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**IMPLEMENTATION OF A RECORDS SYSTEM FOR TECHNICAL DOCUMENTS
AND DRAWINGS - CASE OY NAUTOR AB**

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Imagine a factory inside whose walls is everything necessary to make a product - machines component parts, other raw materials, safety glasses and hard hats, testing equipment, forklifts, the works. But suppose this stuff is heaped and scattered about the building without rhyme or reason. Parts are never counted or sorted; every time a worker has to bolt the gearbox onto the product, he must leave his post and search for ten minutes before he finds the box of bolts and three minutes more before he finds the right one. Bins overflow with random jumbles of spare parts and components, the testing equipment is a city block from where the finished product comes off the line - if "line" is the word, for the plant's arrangement seems more like a plate of linguine than a line. Half-finished examples of discontinued products lie all over the building, and navigating a forklift through the mess is like driving in Manhattan on the last shopping day before Christmas. Trash is never collected. Instead, every few months a bulldozer drives through the plant, pushing out the door whatever lies in its path. I have described your teenager's bedroom, I know, but I have also described your company's management of knowledge, and mine.

Thomas A Stewart, Intellectual capital, 1997

ABSTRACT

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DOCUMENTS AND DRAWINGS – CASE OY NAUTOR AB

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The background of the thesis was a wide scale IT systems renewing project conducted by Oy Nautor Ab between mid 2005 and end of 2007. Different ERP systems, among other things, were being assessed and the chosen ERP system was accompanied by a 3rd party document management system, PDMWorks Enterprise, as a complement to the ERP system.

This thesis describe the implementation of the document handling system, how the requirements of this new system were defined, how the system was configured and finally deployed for production use in a pilot project. The new document handling system was to manage all technical documentation including 2D drawings and 3D CAD data related to the company's products, i.e. luxury offshore sailing yachts between 50 and 130 foot in length, as well as other documentation of a more administrative type. The scope of the thesis was limited to the technical documentation and more specific to the handling of 2D drawings and 3D CAD data.

The requirements for the new system were found via multi-disciplinary project meetings and workshops together with representatives from the Finnish PDMWorks Enterprise reseller, CadON Oy. These requirements were then configured into the system by defining the document metadata model, folder structures, workflows and user access rights. The configured system was then tested for production use in the new Swan 60 development project and after six months a survey was conducted amongst the designers working in the system.

The results from the pilot project survey showed that although many of the Oy Nautor Ab specific adoptions and configurations seemed to work well the PDMWorks Enterprise environment as a whole seemed to be too unstable for production use at Oy Nautor Ab.

ABSTRAKT

KYMMENEDALENS YRKESHÖGSKOLA

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Bakgrunden till examensarbetet var att Oy Nautor Ab bedrev ett omfattande förnyelseprojekt av företagets IT system mellan mitten av 2005 till slutet av 2007 där bland annat ERP systemet var under utredning. Med det valda ERP systemet följde ett tredje parts dokument hanteringssystem, PDMWorks Enterprise, vars uppgift var att komplettera det valda ERP systemet.

Examensarbetet beskriver hur kravställningen för det nya dokumenthanteringssystemet söktes, konfigurerades samt lanserades och testades. Det nya dokumenthanteringssystemet var tänkt att kunna hantera hela företagets dokumentation inklusive produkternas, havsgående lyx segelbåtar mellan 50 och 130 fot i längd, tekniska dokumentation. Examensarbetet begränsades till att gälla enbart teknisk dokumentation och specifikt hanteringen av 2D ritningar och 3D CAD filer.

Kravställningen på det nya systemet söktes via projektmöten mellan olika discipliner och funktioner inom företaget samt arbetsmöten tillsammans med representanter från den finska återförsäljaren av PDMWorks Enterprise, CadON Oy. Kravställningen användes sedan vid konfigureringen av systemets metadata, mapp strukturer, processflöden och styrningen av användarrättigheterna. När systemet konfigurerats klart testades det i produktionsmiljö i ett pilotprojekt, utvecklingen av den nya Swan 60 båtmodellen, och efter ca 6 månaders användande skickades en utvärderingsblankett ut till användarna i pilot projektet.

Resultatet av utvärderingsblanketten visade att även om konfigureringen av nya systemet verkade fungera väl visade sig PDMWorks Enterprise systemet som helhet vara för ostabilt för att kunna användas i produktionssyfte vid Oy Nautor Ab.

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1 INTRODUCTION

1.1 Thesis background

The company Oy Nautor Ab has invested heavily into upgrading its IT Systems, including the ERP system (Enterprise Resource Planning system), during 2006-2010 with the goal of streamlining the building process of large oceangoing sailing yachts. When a project-team, appointed by the company management, systematically reviewed different ERP systems one of the selection criteria's was that it should include document handling capabilities for the handling digital records such as product specifications, drawings, reports etc.. For reasons outside the scope of this thesis the choice of ERP system fell on upgrading the previously implemented system from IBS. IBS software had served the company well for over 10 years and was now to be upgraded to the latest version, ASW Enterprise 6, which also included a project planning module called APM (Advanced Project Management). ASW Enterprise 6 together with the APM module, however, does not include any sophisticated document handling capabilities. IBS had previously implemented a third party document handling system, PDMWorks Enterprise (a.k.a. Conisio at the time of purchase), together with its own ASW/APM software modules for another client and was therefore in the position to also offer this solution to Nautor. PDMWorks Enterprise as a software has its history in CAD (Computer Aided Design) add-on applications but has expanded its capabilities towards document handling in general, i.e. towards EDM software capabilities (electronic document management).

In parallel to the renewing Nautor IT systems project, Nautor has initiated a program for reviewing and improving its quality management system, today based on ISO-9001. Nautor has started the process of implementing 5S by Lean manufacturing. Lean manufacturing is a generic process management philosophy derived mostly from the Toyota Production System (TPS) and it's philosophy comprise a way of organizing and managing the workspace and work flow with the intent to improve efficiency by eliminating waste, improving flow and reducing process unreasonableness. Therefore, even from Lean manufacturing point of view there was a need for reviewing and upgrading the document handling process of technical documentation and drawings. Although the procedures and tools for creating drawing has changed a great deal during the last 10 years the quality management systems and routines for handling of drawings hasn't been updated. A good example of this is the current identification system for drawings, i.e. drawing numbering, which can be traced back to the days when drawings were made by hand on drawing tables and archived on plastic film. At that time it was important that the size of the drawing, e.g. A2, was part of the identification code, i.e. drawing number, and was easily recognized so that the original copy could physically be archived in a drawer for size A2 drawings. Today, when all drawings are being made with CAD-software on computers and stored as digital files on server disks these drawings can easily be retrieved regardless of paper size.

Rather than to identify and evaluate different software's for electronic document handling this thesis describes the process of implementing PDMWorks Enterprise for handling of drawings at Oy Nautor Ab. By identifying both internal and external requirements on a records system for drawings this thesis will make a proposal on how to best fulfill these requirements through the PDMWorks Enterprise document management software.

1.2 Methodology

This thesis describes the implementation of a records system for technical documents and drawings within the chosen software, PDMWorks Enterprise. This document is split into separate chapters:

1. Chapter 2 – KNOWLEDGE MANAGEMENT
 - a) What is knowledge and knowledge management
 - b) What is Intellectual capital and how to preserve it
 - c) Different requirements on Document management systems
2. Chapter 3 - CASE OY NAUTOR AB
 - a) Describing the company, its products and the existing records system
 - b) Analyzing the existing records system and identifying the pros and cons.
 - c) Identifying the internal requirements set on a new records system
 - d) Identifying the external requirements set on a records system
 - e) Describing the PDMWorks Enterprise software
 - f) Describing how PDMWorks Enterprise was setup to work
3. Chapter 4 – SUMMARY
 - a) Analyzing how well the requirements was met
 - b) Areas of interest for future work

1.3 Limitations

This thesis will focus on the implementation of a records system for technical documents and drawings and to prevent this subject from getting too wide the scope of the work need to be limited. Although very much related to the subject of this thesis the following subjects will only be mentioned briefly:

1. the quality of drawings, meaning the checking and approval routines for drawings
2. looks and design of drawings, meaning drawing templates etc...
3. links to other software's like ERP etc...

2 KNOWLEDGE MANAGEMENT

A company's assets can, according to Stewart (Stewart 1997), be divided into *current assets*, *long-term investments*, *fixed assets* and *intangible assets*. With *current assets* we mean cash and other assets (inventory etc...) expected to be converted to cash, sold, or consumed either in a year or in the operating cycle. *Long-term investments* are assets to be held for many years and are not intended to be disposed in the near future. *Fixed assets* refers to as PPE (property, plant, and equipment), or *tangible assets*, these are purchased for continued and long-term use in earning profit in a business. *Intangible assets*, on the other hand, lack physical substance and usually are very hard to evaluate. They include patents, copyrights, franchises, goodwill, trademarks, trade names and knowledge assets among other things.

The four different forms of assets described above aren't enough to explain why some companies have a market value ten times higher than what can be found in their book values says Stewart, (Stewart 1997, 55). A lot of value that should belong to the intangible assets cannot be accounted for because of their indeterminate nature says Stewart. The talents, knowledge and know-how of the employees, relations and networks with customers and suppliers among others are assets that are not normally accounted for in book values but should according to Stewart be defined as the company's *intellectual capital*.

Documents are an important part of a company's knowledge assets. As the number of documents raise the challenge to access and retrieve them effectively grows as well. Ineffective access implies mismanagement of the authors' expertise, poor document management and hence poor knowledge management (KM).

The definition of knowledge management according to NASA is:

Knowledge management is getting the right information to the right people at the right time, and helping people create knowledge and share and act upon information in ways that will measurably improve the performance of an organization and its partners.

(<http://km.nasa.gov/home/index.html>)

2.1 Intellectual capital

Stewart, (Stewart 1997, 67-68), also says one should distinguish *intellectual capital* from *intellectual material*. Intellectual capital, according to Professor David Klein and Laurence Prusak, says Stewart, is packaged useful knowledge whereas intellectual material, however vital this information may be, is not packaged in a way to allow it to be useful, e.g. a telephone number to a potential client written on a yellow post-it note that has fallen behind the desk.

Stewart continues describing the difficulties involved with packaging intellectual material. The idea of formalized, captured, and leveraged knowledge is easy to understand when the intellectual material in question is a patentable invention or provide obvious boundaries for knowledge. However, when the package or the intellectual materials in question are hard to specify, two problems emerge; classification and recognition. The classification problem concerns: "what kinds of material qualify to be included in your knowledge handling system, and what should be left out? What's an asset, and what's noise? The recognition problem on the other hand deals with the question of finding the valuable information for example lots of intellectual capital is unexpressed, tacit knowledge such as, for example, the background expertise and relationships a salesman builds up over many years covering a territory. How does one find that?

Knowledge is usually divided into explicit and implicit knowledge where:

Explicit knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. The most common forms of explicit knowledge are manuals, documents, procedures and designs, e.g. drawings, pictures etc... . Knowledge also can be audio-visual. Works of art and product design can be seen as other forms of explicit knowledge where human skills, motives and knowledge are externalized

Implicit knowledge is the knowledge that people carry in their heads. Compared with explicit knowledge, implicit knowledge is more difficult to articulate or write down and so it tends to be shared between people through discussion, stories and personal interactions. It includes skills, experiences, insight, intuition and judgment.

According to Stewart (Stewart 1997, 108) intellectual capital may be divided into three categories; human capital, structural capital and customer capital (also known as relational capital).

2.1.1 Human capital

Simply saying that employees' brainpower is an intangible asset is meaningless according to Stewart (Stewart 1997, 76), rather should the human capital be defined as the capabilities of the individuals required to provide solutions to customers. Human capital is so important because it is the source of innovation and renewal. However, the organization will not automatically become intelligent by employing intelligent people. It is only when the employees work together in the context of the organization and its strategy that the human capital is put to work.

2.1.2 Structural capital

Sharing and leveraging knowledge requires structural intellectual assets, such as information systems, market intelligence and management focus, which turn individual know-how into the property of the company. Simply put, structural capital is the know-how that does not go home in the evening after the workday is finished.

Like human capital, structural capital exists only in the context of a point of view, a strategy, a destination, a purpose. Structural capital packages human capital and permits it to be used again and again to create value, just as a die can stamp out part after part.

Stewart (Stewart 1997, 108) boldly states that structural capital in some cases is even more important than human capital; at least as far as the company management is concerned. It is the job of the management to build corporate assets. Systematic management of intellectual capital creates growth in shareholder value. The goal for this systematic management is to continuously recycle and take advantage of the knowledge and experience, which exist inside the organization, for creative purposes. Knowledge needs to be structured and packed with the help of technology, operational procedures, manuals and networks, and so on, to ensure that the competence will remain with the company when the employees go home. Once packaged, these become a part of the company's structural capital or more precisely, its organizational capital. This creates the conditions for the rapid sharing of knowledge and sustained, collective knowledge growth. Lead times between learning and knowledge sharing are shortened systematically. Human capital will also become more productive through structured, easily accessible and intelligent work processes.

2.1.3 Customer capital

Customer capital, or more correct "relationship capital" according to Stewart (Stewart 1997, 77), is the value of an organization's relationships with the people with whom it does business, both customers and suppliers. Customer capital can also be described as the probability that our customers will keep doing business with us. When an airline chooses between General Electric, Pratt & Whitney, and Rolls-Royce for engines to power a new plane, its decision is based on the quality of its relationship with each company as well as on price and technical specifications. The better that relationship between the two, the more likely the buyer is to share its plans and expertise with the seller which in turns means the more likely a company can learn with and from its customers and its suppliers. Shared knowledge is the ultimate form of customer capital.

As this thesis is about implementing a records management system, i.e. information system for handling of structural capital, from here on it will be focusing on the structural capital part.

2.2 Records management systems

ISO 15489-1:2001 (International Standard 2001) defines records management in organizations as setting policies and standards, assigning responsibilities and authorities, establishing and formalizing procedures and guidelines, providing a range of services relating to the management and use of records, designing, implementing and administering specialized systems for managing records and integrating records management into business systems and processes.

According to ISO 15489-1: 2001 (International Standard 2001) records contain information that is a valuable resource and an important business asset. A systematic approach to the management of records is essential for organizations and society to protect and to preserve records as evidence of actions. A records management system results in a source of information about business activities that can support subsequent activities and business decisions, as well as ensuring accountability to present and future stakeholders.

ISO 15489-1:2001 (International Standard 2001) also emphasize the need for all organizations to identify the regulatory environment that affects their activities and requirements to document their activities. The policies and procedures should reflect the application of the regulatory environment to their business processes. An organization should provide adequate evidence of its compliance with the regulatory environment in the sectors of its activities.

ISO 15489-1:2001 (International Standard 2001) applies to management of records, in all formats or media. However, the ever increasing use of computers in organizations for creating and using records has led to a whole new discipline in records management, called *electronic document management (EDM)*. When such a system is used for defining and structuring product information it's called *product data management (PDM)*.

2.2.1 Electronic document management systems (EDMS)

The introduction to the European standard SFS-EN 82045-1 “Document management – Part 1 Principles and methods” (European Committee for Standardization 2001) summarize the situation in many companies today:

“During the last decade, industry has undergone a thorough transition from manual practice to computer support for the creation and exchange of information. However, the manual practices and standards for handling documentation have not undergone a corresponding process. The situation is that the well-documented manual methods for design co-operation and co-ordination – a system for process quality assurance common to the industry – is being replaced by procedures specific to projects and companies. The result is that, although every single actor strives to assure the quality of his own products and services, the process may fail in achieving overall product and process quality. The information interfaces and networking become industry key factors.”

The key to an efficient electronic document handling is according to this European standard (European Committee for Standardization 2001) computer-based information, i.e. electronic document, that is identified, structured, processed, controlled and interchanged & communicated as a unit (a closed container of information) with its associated metadata.

Further the standard (European Committee for Standardization 2001) defines *Management data* as the data describing the content of a document, necessary to manage it in an Electronic Document Management System (EDMS) or Product Data Management System (PDMS). This definition is quite similar to the definition of *metadata* as described later in this text.

The same European standard (European Committee for Standardization 2001) continues by stating that electronic document handling is well-suited for handling the ever increasing amount of electronic documents occurring in today’s engineering, manufacturing, operation and maintenance processes together with the connected metadata. Potential benefits of electronic document handling include

- Efficient search and retrieval of specific documents
- Quick and direct propagation of changes
- Automatic workflow procedures
- Providing document collections about related information
- Reduced administration through integration of document production and management
- Retrieval of information from previous projects and common industry sources
- Supporting the exchange and sharing of data
- Supporting collaborative engineering

2.2.2 Metadata

The European standard for document management, SFS-EN 82045-1 “Document management – Part 1 Principles and methods” (European Committee for Standardization 2001), defines *metadata* as data (or information) needed for managing documents during their life cycle and for their exchange between partners, i.e. data identifying and describing the document. Such metadata may appear as a visible part of a document presentation, in a document file transferred between document management systems, be associated to a document in a document management system or as a separate set of data managed independently from the documents for search and retrieval purposes.

The recommendations in SFS-EN 82045-1 (European Committee for Standardization 2001) regarding metadata in an Electronic Document Management System (EDMS) is that one should clearly separate the document metadata from the content. If separated from the content the metadata provides an added value to the document, as they allow managing, searching, and retrieving etc. within a repository of metadata, e.g. within a database.

A document’s metadata might have different sources. Metadata can be associated with “the life cycle of the document”, with the business process producing the document, i.e. “the life cycle of the product”, with the described product and its structure or with the business process producing the considered document.

Document lifecycle

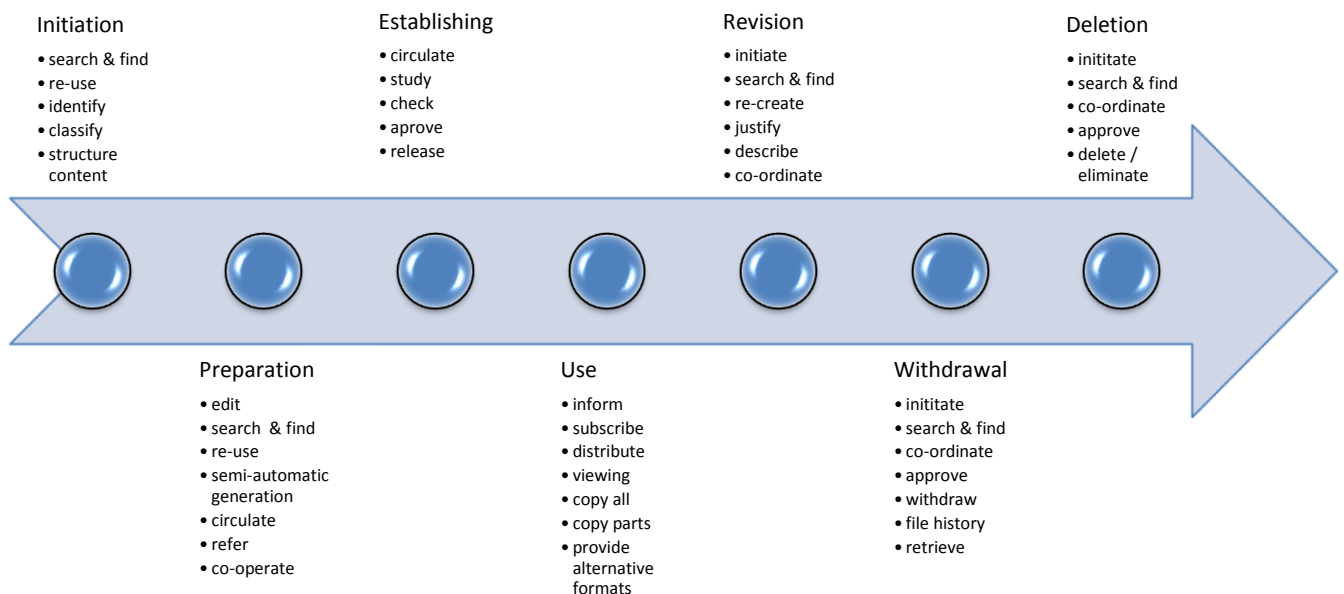


Figure 1 – Different phases in a document’s life cycle

The figure above illustrates the different activities linked to a document, according to SFS-EN 82045-1 (European Committee for Standardization 2001), during its life cycle. Some document characteristics in the different phases are highlighted below with reference to the documents metadata:

Initiation phase

This phase is important because at this stage the document should get its identification, unique within the documents management system or context so that the document can be referred to unambiguously. At this stage the document will usually also get a classification as appropriate to the content of the document. The classification provides input about the characteristics of the document. It eases search and retrieval of documents dealing with similar issues. Typical classification with respect to metadata may be:

- associated contract identifier
- associated work order identifier
- ownership, author, and related organizational data
- document identification system
- intended document function
- title of document providing the description of the intended document content
- languages used in the document
- reference to the described object, for example to an identified product
- initiation date, due date
- association to a specified node in the work break-down structure
- association to a specified node in the documentation structure
- references to a list of international, regional and national standards or other contractual documents servings as specifications to be used for the production of the document
- document version history relationship (based on, supersedes, replaces)
- security grading, may change with time without the change of the document version
- rights of persons and organizations to access the metadata and the related document content (e.g. read, write, delete, modify, establish etc...)
- identification of electronic templates and source used in the preparation of the document

Preparation phase

This phase starts after the initiation of a document and includes the production of a document until the document is forwarded to the establishing activity. To a considerable extent, new documents are based on other documents or parts thereof. The identity of the source document shall be preserved, in particular for copyright, history management and legacy reasons.

Establishing phase

The document should undergo check and approval routines within the responsible organization, and if required also external approval may be needed. Once entered into the approval process all the changes in the document shall be traceable. The establishing phase ends when the document is released, which means the document may be used for the intended purpose.

Using phase

After release, the documents and their metadata are made available for their use. They need to be kept into a safe on-line repository and be controlled, i.e. distributed for viewing.

An important part of the using phase is the distribution of the documents to the specified persons and/or organizations. Typically the released document versions are made available either by actively forwarding the document versions or by providing the information that the referred documents are made available and can be accessed.

Revision and withdrawal phase

Each document version is released for one or more defined purposes. Several document versions may be in use simultaneously as long as they fulfill their intended release purposes.

Each document version with its release purpose is considered to be valid until it is actively withdrawn. Withdrawing a document version reflects the situation that the former release purpose for that document version has changed.

Archiving phase

Archiving is considered as the activity of storing a variable selection of document versions including their metadata from the active use into a more compact physical and normally non-revisable form. The primary aspects of archiving documents are to fulfill legal and/or contractual requirements by long term storage of the documents.

Deletion phase

When the legal requirements on the archiving have expired, the document content, their metadata and the configuration data may be deleted. However, as long as any other document version refers to it, metadata should be saved.

2.2.3 Product data

The Product Record, or Product Data Record, is an information technology management concept used to refer to data associated with the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. It includes all the information used to develop, describe, manage and communicate information about products and critical linkage between relevant data elements. According to Sääksvuori & Immonen (Sääksvuori and Immonen 2002) product data can be divided into three sub-groups *product definition data*, *product lifecycle data* and *metadata*. *Product definition data* is the data that unambiguously defines the physical and functional characteristics of the product. *Product lifecycle data* is the data describing the phase the product is in, e.g. technology research, product design, production, usage, maintenance and destruction. Product data is a key concept Product Data Management (PDM) because it represents all the data that PDM processes and PDM software can manage and allow access to.

2.2.4 Items

The effective use of a product data management system is, according to Sääksvuori & Immonen (Sääksvuori and Immonen 2002) , to a large extent dependent on functional items. Items are a systematic and standard way of identifying, codifying and naming physical products, components, material and services. Dependent on line of business the company is in sometimes even documents, software, packaging, assembly tools, CNC programs can be seen as items. An item often contains technical, economical (cost and pricing), logistical and production information about a product. If items are organized hierarchically according to the way the product is to be built it is called a product structure.

2.2.5 Product data management systems (PDMS)

Sääksvuori & Immonen (Sääksvuori and Immonen 2002) states that the definition of Product Data Management is *a systematic way of planning, managing, controlling and checking all the information needed to document a product during its concept, design, production, testing and usage phase*. They continue by saying that typical features of product data management systems are:

- a) *Item management* – manage item information during its life cycle
- b) *Create and maintain product structure* – maintain a hierarchical items structure
- c) *User rights management* – manage the rights of groups and individuals within PDM
- d) *Document workflow* – manage the status (e.g. draft, checked, approved etc...) of items, documents and drawings.
- e) *Search* – manage effective search to; find out how items and data relate, find and reuse of existing items, documents and drawings.
- f) *Change management* – tool to implement and track changes in items, documents and drawings.
- g) *Configuration management* –manage variants and customizations from a generic product structure
- h) *Messaging* – enable quicker communication between team members
- i) *Metadata and indexing* – manage document content information
- j) *Backup functionality* – manage automatic backup of data
- k) *Logs* – traceability in all actions performed on items, documents and drawings.
- l) *File vault* – physical storage location for data (items, files etc...)

3 CASE OY NAUTOR AB

3.1 The Company

3.1.1 History

In 1966, when Pekka Koskenkylä founded Oy Nautor Ab, fiber reinforced plastic was considered a new material in boatbuilding. Pekka had a vision of building a series of 100 large sailing yachts in fiber reinforced plastic for racing and cruising. Yachts around 36 feet in length were considered large at that time and to build a yacht in this size out of fiber reinforced plastic was an ambitious project to say the least.

Right from the start Pekka's business idea was to focus on quality and he recognized that if the yachts were to be successful on race tracks they needed a fast design. He contacted the most prestigious naval architect bureau at the time, Sparkman & Stephens and after some convincing he managed to buy a set of plans from them with the requirement that at least three yachts were to be sold before he could start building. Pekka, educated in USA and working as a paper sack salesman for the local paper industry, was a skillful salesman and managed to sell three yachts based only on the drawings from Sparkman & Stephens.



Figure 2 - Pekka Koskenkylä founded Nautor's Swan in 1966

The Swan 36 turned out to be very successful on the race tracks and there are several reasons to this success. One of them is claimed to be the fact that the Swan 36 had fin keel and rudder unlike the yachts at that time which had a long keel with rudder at the trailing edge. Another reason may be the fact that it was built according to Sparkman & Stephens standards, meaning it was built to be strong and could be sailed in rough weather without reefing, i.e. decreasing sail area. As a result of these racing triumphs owners soon demanded upgrades to their existing Swan 36 models; in response Nautor's Swan produced the Swan 37. As the market trend moved towards bigger models the company also diversified range into a 43 ft model.



Figure 3 – S36-001 “Tarantella” was the first Swan to be built and is still sailing.

In contrast to this overwhelming success, fate was soon to deal a serious blow to the uprising boatyard. Shortly before Christmas in 1969 the Assembly hall of the Nautor’s Swan boatyard burnt to the ground destroying a dozen hulls in various stages of production. As a result Koskenkylä was forced to sell stakes in Nautor to the company Oy Wilhelm Schauman Ab among others to finance rebuilding.

The Swan 55 (introduced in 1970) saw Nautor enter the market sector, safe, fast, live-able cruising yachts capable of high speed under sail, in which they are now dominant. It is, however, the Swan 65 for which Nautor's early history is best remembered. This classic S&S design was, for almost a decade, the largest production fiberglass yacht built worldwide. The yacht gained its popularity as the Swan 65 (Sayula II) effortlessly won the first Whitbread Race in 1973/4. The second Whitbread in 77/78 saw the Swan 65 take 2nd, 4th and 5th. During the first 12 years of the company, Sparkman & Stephens went on to design 15 Swan models for Nautor. Of the first 1000 Swans, 800 were of their design.

Nautor’s Swan entered a new era in 1979 with the appointment of German Frers as designer, who continued to demonstrate a good balance of competent racers and comfort in his design. To this day, the Frers design office continues to push the boundaries, whilst maintaining the hallmark of Swan.

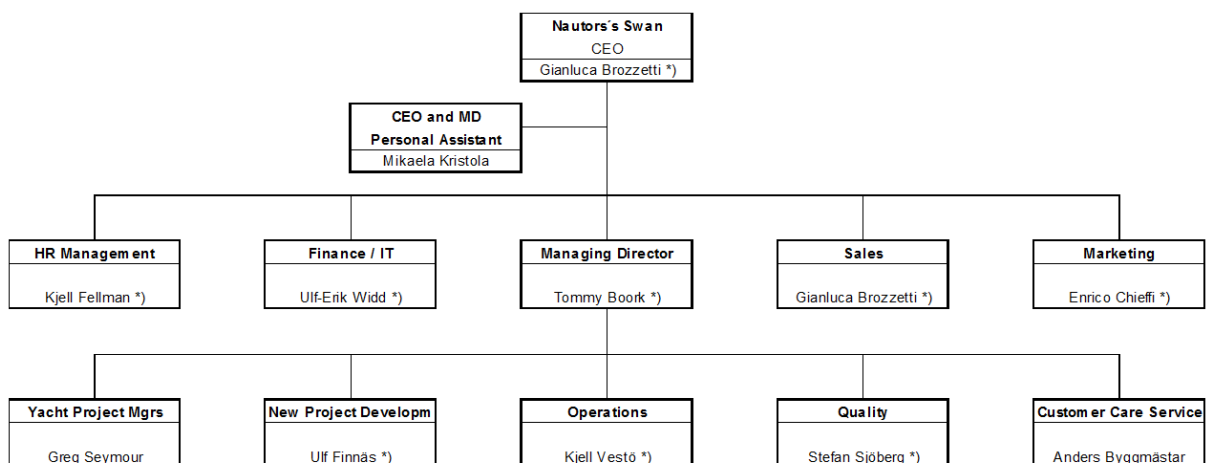
In 1998 Leonardo Ferragamo and a group of investors saw the potential in this brand. This initiated a time of change which have firmly placed Nautor at the forefront of the international sailing world. Nautor’s Swan yachts are considered the ultimate ocean-going, performance, luxury sailing yacht of unrivalled build quality. Since 1966, over 1900 Swans have been built and nearly all are still sailing.



Figure 4 – Leonardo Ferragamo, owner and president of Nautor's Swan

3.1.2 Organization & resources

Today Nautor's management team is led by CEO Gianluca Brozzetti out of London (UK), with the Nautor marketing department seated in Florence (Italy) which is headed by Marketing Director Enrico Chieffi. The rest of the management team headed by MD Tommy Boork is located in Pietarsaari, Finland.



*) = Oy Nautor Ab Management Team

Figure 5 – Nautor's organization in July, 2009



Figure 6 – Locations of Nautor's production facilities

Historically, Nautor's main facility was located in Kolppi, where the manufacturing of plugs and moulds as well as the lamination work is still being done today. Since 2001, there have been some heavy investments in modern, high tech, production methods at the Kolppi factory which today is the home for the Nautor's new FlexMill CNC milling machine, occupying almost half of the mold shop it has an impressive work area (Length 30 m x Beam 6 m x Height 3 m), and a high tech curing oven for polymerization of large pre-pregs for hulls and decks, occupying also some 260 m².



Figure 7 – The Kolppi factory is today the home of the FlexMill CNC milling machine

The production facilities in Kruunupyy, today a total of 7 000 m² floor area, is where all the joinery work is done. This is where the handpicked teak, and nowadays other exotic woods, of world class quality is refined into lightweight, foam cored, sandwich panels of which the interior modules are made. These interior modules are then transported to the assembly line at BTC in a Just-In-Time manner. Nautor has also invested a great deal in the joinery production methods. To increase productivity and dimensional accuracy a CNC router has been installed to numerically cut interior components such as panels and foam cores. Based only on the 2 dimensional and 3 dimensional digital data files prepared by the designers at the BTC - Technical Office this production method gives remarkable improvements in terms of both speed and accuracy.

When the Boat Technology Center, in short BTC, facility was built in year 2000 and extended in 2006 the head office, the technical office, customer care and the main assembly lines where moved from Kolppi to the new location which today comprises an impressive 13 000 m² floor area in total. The Boat Technology Center also facilitates a large marina for launching and testing of the whole product line.



Figure 8 – Boat Technology Center, the main assembly facility today with its own marina

Today Nautor's human resources include some 400 employees of which roughly 2/3 are blue collar and 1/3 white collar. Today some 40 employees, roughly 1/3 of the white collars, are working in the Technical office with project management and product design. Another 30 is working as production plant managers, department managers and production foremen. The last 1/3 is working with support functions such as sales, purchase and economics.

During the last 5 years Nautor has undergone a generational change meaning that the skilled craftsmen that was employed by Koskenkylä and helped him build the company to what it is today, have all more or less reached an honorable age and been retired. The new generation boat builders are often sons and daughters of these retired craftsmen and have grown up with and studied boat building in the Pietarsaari vocational school.

3.1.3 Products

The Swan product line today extends from the smallest Club Swan 42, an almost 13-meter-long “club racer” designed especially for the New York Yacht Club, to the largest model the Swan 130, a 40-meter super yacht.

Today the “Swan Line” consists of no less than 13 different models of which several models have different deck housings and deck and interior layout versions.



Figure 9 – Swan Line 2009

Continuing on the historical success of models like Swan 36 and Swan 65, many of the models today are focused on performance cruising, meaning they are built to perform on the race tracks but also to provide the comfort needed for relaxed cruising with family and friends. Almost half of the models in today’s product line are performance focused starting from the smallest CS42, S50, S60, S80, S82 and the true maxi performance cruising yacht, the S90. In the construction of these performance-oriented yachts a lot of effort is put into designing and building as light weight as possible without sacrificing comfort, safety and style. For the rest of the product line, the word *comfort* gets more prioritized, meaning both the naval architecture, design and building of these yachts are focused on ease of handling and ease of living, safety and styling.

To further nourish the racing spirit of Nautor’s Swan and Swan owners Nautor, developed the *Swan Maxi Class Circuit*, for Swan yachts over 60 feet, which is made up of a selection of the most prestigious regattas in the Mediterranean. The Class Circuit was established by Nautor's Swan in 2008 to bring together a network of Swan Maxi yachts from across the globe to enjoy a structured, active racing circuit. Over the course of the initiative's inaugural year the Swan Maxi Class rapidly expanded in stature. In September 2008, we saw the Class at its peak with a dramatic fleet of 36 Swan Maxis racing on the waters of Porto Cervo in the most prominent event in the Swan sailing calendar, the Rolex Swan Cup. The Swan Maxi Class adopts the ‘owner-driver’ rule, and allows Class members to compete at all official circuit events with separate race starts dedicated to the Class.

Through the years, Nautor has also built a number of custom built one-offs, based purely on the requirements of the customer and the customer chosen naval architect. Choosing Nautor as the production yard for even the wildest one-off projects is not so far fetch after all when taking into account all the high tech production equipments, like CNC cut plugs & moulds and interior-panels as well as a curing oven for pre-preg laminates and skilled craftsmen continuing to live up to Nautor’s impeccable reputation on build quality.



Figure 10 – CS42, the smallest in today's Swan line.



Figure 11 – Swan 131, the largest yacht built today by Nautor.

3.2 Existing records system

In the early days when Pekka Koskenkylä started Nautor, the boat builders used drawings drawn by hand, or rather the carbon copies of these drawings, from the Sparkman & Stephen's office to build according to. It was not unusual that the first yachts in a series were built using only three different drawings, one showing the hull shape, also called *Lines Plan*, which included an offset table for lofting and fairing of the hull, one showing the *Deck layout* and *Profile* of the yacht with the hull and deck joined together and finally one showing the *General Arrangement* which meant to show the room disposal of the interior of the yacht and the location of main components like the engine. With only these three drawings and a good deal of craftsmanship the boat builders were able to put together classics like the Swan 36 and Swan 43.

Later on, Nautor began producing its own production drawings, first by hand and later with computers, when they realized that to effectively build larger series of yachts in a similar manner they needed to document and describe more in detail the way to build the yachts. The naval architect still provided with all the exterior drawings like the hull, keel and rudder shapes as well as the deck and the rig design but from there Nautor's in-house designers took over and produced all the necessary detail drawings needed to build the yachts effectively.

3.2.1 2D CAD

Design with computers at Nautor started in the late 80's when computers and licenses of AutoCAD, a two dimensional computer aided design software from Autodesk Inc, were obtained. As the personal computers gained in popularity and came down in price, more and more designers at Nautor began adopting this new tool for designing its products. The main advantage of computer aided design tools like AutoCAD, compared to hand drawn designs, is that once you've drawn a view of a component this design can easily be incorporated into other designs making it possible to build oneself a library of designs. Another big advantage of 2D CAD software's is that they often allow the user to draw their designs on different layers. In their simplest form layers can be used like sheets of transparent paper making it possible to for example draw the dinner table on one sheet of transparent paper and the chairs on another sheet. By simply allowing the objects on one sheet to be visible or not, this is analog to add or remove a sheet of transparent paper from the stack of sheets, one can easily master a lot more information in a drawing than traditionally with pen and paper.

The major drawback of 2D CAD is that one is still drawing the same way as by hand on paper, meaning one is drawing on one plane only, like on a sheet of paper it is only in two dimensions, and you have to make different views of the designs to be able to show an object's width, height and depth. In yacht design, the often curvy shapes of the hull and deck, makes it difficult to draw objects only in one projection. The designer often needs to check what the cross section of the yacht looks like at the particular place where he for example is designing a hanging locker. Producing and checking these cross sections are often very time consuming tasks and therefore tends to be kept to a minimum, often resulting in designs that has not been thoroughly checked.

3.2.2 3D CAD

In 2001, Nautor invested in a number of seats of relatively new design software on the market, a three dimensional computer aided design software called Solidworks. The purpose for this investment was to start designing components in 3D CAD, often more complex shapes like fiber reinforced plastic, FRP components, for the hull and deck to enable the moulds for these objects to be produced by modern productions methods, like CNC milling. The investment in 3D CAD software can clearly be seen as the first step towards the planned larger investments in the FlexMill, CNC machining centre in Kolppi.

Very soon, however, the designers at Nautor found that the 3D CAD was a very effective tool when trying to fit the ever increasing number of functions and components into small spaces. In the years 2004-2006, this 3D CAD tool was used extensively to model the engine room of the Swan 131 “super yacht” and thereby omitted the need to build a physical mock-up of the engine room on the shop floor, saving time, resources and shop floor area.

The main advantage of the 3D CAD tool over the 2D CAD tool is that you are working with your design in all 3 dimensions at the same time, meaning you can have control of the width, height and depth of the components all at once without needing to produce “extra” cross sections to check things for collisions and assembly tolerances. The 3D CAD tools seems to be especially useful in yacht design where the ever increasing number of functions and components requires more space and at the same time the trends in naval architecture, like lighter displacements boats leads to more shallow hull shapes, which in turn means less space available for these components.

Another advantage of modern 3D CAD software compared to 2D CAD software’s is that they force the designers to think more in terms of production as the software usually require the designer to build the design as a hierarchy in such a way that it reflects the way the design is supposed to be built. In other words, it requires the designer to group the design into assemblies and sub-assemblies that reflects the way it’s meant to be assembled, for example like hull, deck, interior and systems assemblies with different sub-assemblies such as a hanging locker in the forward cabin with all its different components. This often means the designers have to make decisions on how to join together different parts with each other rather than to just draw the final shape and leave it to the production to solve how it should be built.

3.2.3 Product breakdown structure

A sailing yacht consists of tens of thousands of components of which a large part is custom built to fit just this particular yacht or yacht model. Psychologists say man is normally able to comprehend between 7-9 items simultaneously and to manage the planning and designing of such a complex structures one need to divide it into smaller, more comprehensible units. This divided result is often presented in a hierarchical form called the *Product Breakdown Structure (or a PBS)* and when talking about the tasks involved in planning, designing and building the product it is called a *Work Breakdown Structure (or a WBS)*.

At Nautor the Product Breakdown Structure, i.e. the “DNA” of a Nautor’s Swan sailing yacht, is used extensively throughout the organization as the backbone in the yacht’s technical specifications, weight calculations and customer contracts.

A sailing yacht, nowadays more than ever, is a highly technical, multidisciplinary product comprised of advanced hydro- and aerodynamics exterior design, high tech composites structures like the hull and deck, lightweight woodwork interior details, sophisticated engine, plumbing and HVAC systems, hydraulics system, electrical systems and the latest entertainment and electronics systems on the market. No single designer is able to manage all these different disciplines all alone which means designing and specifying a sailing yacht is done by designers and specialists from each different discipline which is also reflected on Nautor’s organization as the designers are divided into four different sections, each with its own Chief Designer acting as the specialist and foreman for the designers. The different sections and their areas of responsibility are consequently:

- **Mechanical:** hull, appendages, deck and deck hardware, rig and sail handling
- **Interior:** all interior components, furniture, floorboards, ceilings etc...
- **Plumbing:** Engine & propulsion systems, hydraulics, plumbing and HVAC
- **Electrical:** electrical (AC, DC), navigation, communication and entertainment systems

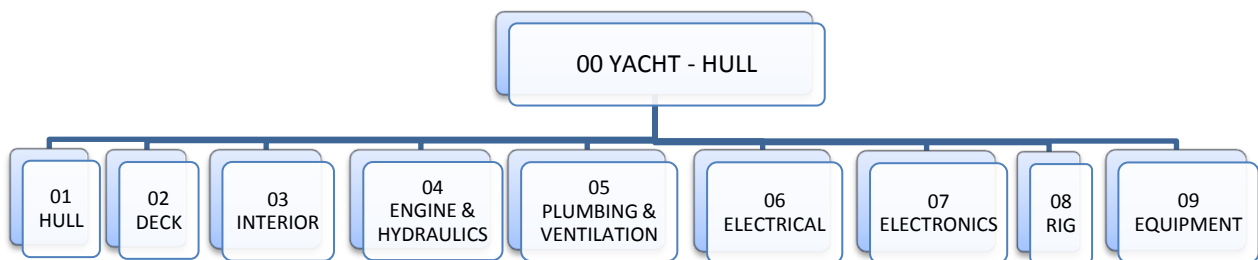


Figure 12 – First level of a Product Breakdown Structure of sailing yacht

01 HULL 01.00 Hull General 01.01 Hull Laminate 01.02 Hull Stiffening 01.03 Hull Finish 01.04 Keel 01.05 Steering System 01.06 Mast step 01.07 Through Hull Fittings 01.08 Transom 01.09 Hull Windows 01.10 Boarding Ladders 01.11 Focsl 01.12 Lazarette 01.13 Dinghy Garage	02 DECK 02.00 Deck General 02.01 Deck Laminate 02.02 Deck Finish 02.03 Teak Woodwork 02.04 Winches & Windlasses 02.05 Bow Fitting & Anchoring 02.06 Sail Handling System 02.07 Deck Fittings 02.08 GRP Mouldings & Vents 02.09 Hatches & Windows 02.10 Cockpits 02.11 Canvas Work	03 INTERIOR 03.00 Interior General 03.01 Bulkheads 03.02 Forward Cabins 03.03 Forward Midship Cabins 03.04 Aft Midship Cabins 03.05 Aft Cabins 03.06 Saloon 03.07 Raised Saloon 03.08 Galley 03.09 Crew Mess 03.10 Navigation Area 03.11 Toilet, Showers General 03.12 Forward Toilets, Showers 03.13 Forward Midship Toilets, Showers 03.14 Aft Midship Toilets, Showers 03.15 Aft Toilets, Showers 03.16 Engine Room 03.17 Control Room 03.18 Noise and Vibration Control 03.19 Corridors
04 ENGINE AND HYDRAULICS 04.00 Eng. & Hydr. General 04.01 Main Engine 04.02 Propulsion System 04.03 Cooling System 04.04 Fuel System 04.05 Exhaust System 04.06 Diesel Generator 04.07 Oil Handling System 04.08 Engine Controls 04.09 Thrusters 04.10 Fire Fighting System 04.11 Engine Room Other 04.20 Hydraulics 04.21 Central Hydr. System 04.22 Power pack 04.30 Pneumatics	05 PLUMBING AND VENTILATION 05.00 Plumb. & Vent. General 05.01 Fresh Water System 05.02 Sea Water System 05.03 Grey Water System 05.04 Black Water System 05.05 Drainage System 05.06 LPG System 05.07 Ventilation 05.08 Climate Control 05.09 Refrigeration System 05.10 Domestic Appliances 05.11 Centr. Vacuum Cleaning	06 ELECTRICAL 06.00 Electrical General 06.01 AC-System 06.02 Earthing System 06.03 Powered Hydraulics 06.04 DC-System 06.05 Plumb. & Monitoring Systems 06.06 Engine and Generator Systems 06.07 Instrument Power Supply 06.08 Ventilation and Heaters 06.09 Electrical Panels 06.10 Domestic Appliances 06.11 Lights
07 ELECTRONICS 07.00 Electronics General 07.01 Compasses, clocks and Barometers 07.02 Sailing Instruments 07.03 Navigation Systems 07.04 Communication Systems 07.05 Entertainment Systems 07.06 Autopilot Systems 07.07 Aerials 07.08 Computer Systems 07.09 Security Systems 07.10 Safety Systems	08 RIG 08.00 Rig General 08.01 Mast 08.02 Booms and Poles 08.03 Standing Rigging 08.04 Running Rigging 08.05 Furlers 08.06 Rig Hydraulics	09 EQUIPMENT 09.00 Equipment General 09.01 Manuals & Warranty Card 09.02 Anchoring & Mooring 09.03 Sailing Gear 09.04 Fire Fighting Equipment 09.05 Safety Equipment 09.06 Spare Parts 09.07 Tools 09.99 Equipment Other

Figure 13 – Second level of a Product Breakdown Structure of a sailing yacht.

3.2.4 Handling of drawings and documents

Back in the days when Nautor's designers made drawings by hand with ink pens on transparent sheets, copies were made of the drawings for distribution to functions such as the production and supply. The original drawings were stored for reference in the archive. The original drawings were stored in a numerical order in drawers of matching sizes which meant that the size A1 drawings could be found in one drawer and other sizes in other drawers. To find a specific drawing later on one needed to know the size of the drawing as well as the drawing number.

As 2D CAD became more widely used at Nautor, the same archiving system was used also for the plotted original computer drawings. Until early 2005 all computer generated drawings were to be plotted on a transparent film and stored in the same archive with the old hand drawn drawings. This transparent film was considered the original drawing and the computer file was saved on a centralized server disk for further re-use and reference.

As the number of people involved in design and production grew as well as the number of projects grew, i.e. delivered yachts, the need for a drawing handling system that would keep track of which drawings were used to build which yachts, emerged. For this reason a database application called RITREG was developed by the company Pivota Kb, based in Pietarsaari. RITREG was a stand-alone database application integrated with Autocad so that the next free drawing number could be fetched from the database from within Autocad and the storage path for the CAD files could be saved to this database for later reference. The RITREG interface inside Autocad required the designers to fill in attributes like yacht model, hull number, Product Breakdown Structure Code and designer initials. These attributes made it possible to later search & filter out drawings for a specific system like, e.g. the steering system, for different yacht sizes or even for a specific hull number. Once you filtered out the drawing you were looking for you could open it in the CAD application with the help of the storage path or go the archive and find the original transparent film based on the drawing size and drawing number.

Historically Nautor has handled revisions by replacing the existing original (= transparent film) in the archive with a new revised version and the previous version was removed and destroyed. RITREG was implemented in the same way and therefore none of the older versions of the CAD files were saved. This method, of course, required that the new revision of the drawing was 100 % compatible with the previous revision, i.e. backward compatibility, as replacement parts, for warranty or after-sales reasons, would be built according to the latest archived revision.

When 3D CAD was first introduced its first priority was to deliver three dimensional manufacturing data, i.e. 3D CAD files for the milling machine, of different fiberglass components to the plug and mould workshop in Kållby. At that time the 3D file was often only seen a complement to the "real" manufacturing drawing, an Autocad 2D drawing, describing the fiberglass component with dimensions and notes on the different fiber plies of laminates and resin to be used and with references to which yacht model, hull number and system this component belong. For this reason 3D CAD files were stored on their own server disk and referenced to from the 2D manufacturing drawings when needed. It was also common for the more experienced 3D designers to design different systems in the 3D application and export the needed 2D views to Autocad to finalize the manufacturing drawing there.

There are some major drawbacks with this way of working. The need to convert the 3D CAD designs into 2D views and export it to Autocad, in order to get an official drawing number, means a loss in productivity as these are clearly “extra steps”. The 3D application do have the necessary 2D drafting tools to allow the designer to produce a manufacturing drawing inside the 3D CAD application but it lacks the integration with the RITREG database to make the drawing official. This also affects the data integrity as there is no easy update functionality between the two different systems making it possible to make changes just in the 2D manufacturing drawings (Autocad drawings) without necessarily updating the 3D model, which in worst case leads to that the 3D CAD data cannot be trusted.

3.2.5 IT environment

The IT environment of any company often reflects the history of the company and this is also the case at Nautor. At the time when the IT systems and Enterprise Resource Planning systems was being adopted at Nautor the company was owned by Oy Wilhelm Schauman Ab, which later became UPM Kymmene Oy. The heritage of UPM Kymmene Oy was very much visible in Nautor’s IT systems even 5-8 years ago although today it’s starting to fade away as the IT systems are being renewed.

When Nautor started using personal computers for design the files were stored locally on the PC’s hard disks and after project completion back-ups were taken on diskettes. Later Nautor started using a centralized place, i.e. a hard disk on a network server, for storing project design information. The design information, i.e. the CAD files, were then stored in different directories on a file server in a hierarchical directory structure, that reflected the project and its disciplines like hull, deck and interior design, which was adopted from the Sparkman & Stephens’ office way of working. As the number of people involved in design and production grew, and the number of simultaneous projects grew, Nautor implemented a database application called RITREG to keep track of the project drawings and their revisions and where their files were stored on the network server.

For other technical and commercial project documentation, other than manufacturing drawings, a number of network disks were created to allow for detailed user access rights management to different type of documentation.

As the Boat Technology Center was built in Pietarsaari and a large number of functions, such as design, project management and purchase, were shared by these two factories. As a result of low bandwidth in the data communications between the Kolppi and BTC factory, the IT system was also duplicated meaning almost every network disk found at the Kolppi plant got its counterpart at the BTC plant. This included network disks for CAD drawings, project technical and commercial documentation. The situation became worse and at one point the IT-administrator started to worry that the number of letters in the alphabet, ranging from A to Z, would not be enough to identify all the mapped resources, i.e. network disks, which were being used in the Nautor IT-environment. Below is a “simplified picture” of what it could look like:

Mapped resources on a typical Nautor workstation (Designer)			
A ...D	PC's physical drives	E , F	Card readers & USB drives (HP Workstation)
G	Technical project documents (Kolppi)	H	Technical project documents (BTC)
I, J	IT-administrator (software and apps)	K, L	Economy department
N	Solidworks 3D CAD files	O, P	IT-administrator (software and apps)
Q	Quality department	R	Not in use
S	Sales & Commercial files	T	AutoCAD 2D CAD files (BTC)
U	AutoCAD 2D CAD files (Kolppi)	V	After sales (mostly pictures)
W	Common temporary files	X	New Product Development department
Y	User specific network drives	Z	Not in use

Table 1 – Mapped resources on a typical Nautor workstation

The problem with this IT environment is that nobody really knows where to find the information they are looking for and normal windows search functions doesn't work properly over large mapped network drives. On the manufacturing drawing side Nautor luckily had RITREG, a stand-alone database application, which kept track of the storage paths of the drawings.

As there is no company specific standard on how to handle document versions the problem is not only to find the specific location where the information you are looking for is stored but also to know which of the version that is the current one, often as many as three to five versions can be found of a technical documentation or project time schedule. The most common used version identifiers seem to be to include the last modification date in the filename. This method, however, never informs the user if the last modified file is officially approved for use or if it is still another "under work" draft version.

3.3 Implementing a new records system

The decision to implement a new records system at Oy Nautor Ab is very much dependent on a larger investment decision of the company management to renew Nautor's IT system. The background to this investment decision is according to "Renewing Nautor's IT System" project plan (Kaj Westerlund 2005, 2-3) as following:

"Nautor's ERP-system consists of the ASW-program family from IBS, version 3.51, and it was taken into use 1998 -1999. The version in use is old fashioned, inflexible and not user friendly.

In addition, during the last years, Nautor as a company has dramatically changed; our production range is completely new, the industrial processes and the organization have changed.

To improve the efficiency, the demands for a new system are therefore considerable. November 4th 2005, Nautor and IBS signed a contract consisting of both renewing the ERP system and implementing a project handling module, APM (Advanced Project Management) Furthermore, Nautor has signed a contract on a document handling system, Conisio, which will be implemented parallel to the other systems"

(Kaj Westerlund 2005, 2-3)

Figure 14 – Background to the "Renewing Nautor's IT System" project

The appointed project manager for the "Renewing Nautor's IT System" stated, together with the company management, stated the goals for the project as following:

"Improve profitability and discipline by fast and easy access to accurate information for planning, daily operations and analysis throughout the company's all business processes. The integrated system shall fully support Nautor's multi-project environment and new industrial processes."

(Kaj Westerlund 2005, 2-3)

Figure 15 – Goals for the "Renewing Nautor's IT System" project

The implementation of a new records system for technical documents and drawings is clearly a sub-project to the “Renewing Nautor’s IT Systems” project and therefore the background to and goals for this project are the same as for the mother project. However, as will be described in the “work methodology” section later the implementation team set up new, more tangible goals for the implementation project.

3.3.1 Project organization and resources

As shown above, the document handling implementation project is very much a sub-project of the larger “Renewing Nautor’s IT Systems” project. Below is an illustration to highlight where the “Document Handling - Technical Documents and Drawings” implementation project fits into the organization of the “Renewing Nautor’s IT Systems” project. In other words, how it all fits together.

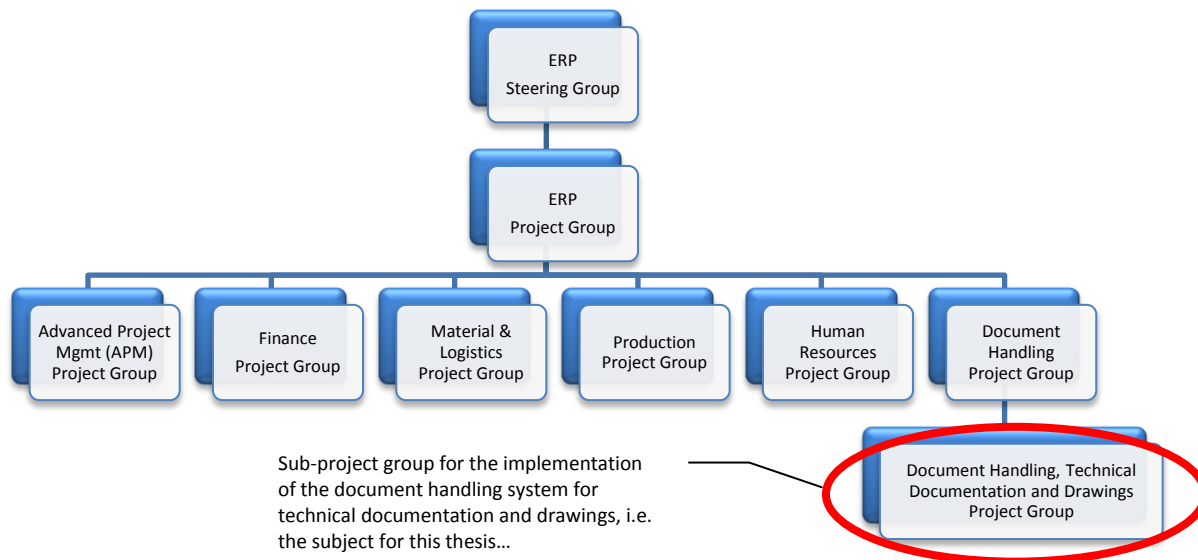


Figure 16 – Project organization of the “Renewing Nautor’s IT Systems” project

As illustrated in Figure 16, the project group for the Technical Documentation and Drawings was only considered a sub-project to the Document Handling Project Group, which was formed to deal with document handling in a more wider sense, not only technical documentation and drawings but also documents from Finance and Human Resources. As the chairman of the Technical Documentation and Drawings project group I was also part of Document Handling Project Group. The resources of the Document Handling Project Group consisted of persons from the following functions:

Team role	Representative for business process & function
Chairman	Corporate Document Handling Responsible
Team member 1	IT technician
Team member 2	Project Manager
Team member 3	Finance
Team member 4	Purchase department
Team member 5	Customer Care department
Team member 6	Designer, Engine & Plumbing – Kim Sundkvist (me)

Table 2 – Resources of the Document Handling Project Group

Technical documentations and drawings were considered important and needed extra attention in the ERP renewal project and therefore a sub-project group was formed with the following resources:

Team role	Representative business process & function
Chairman	Designer, Engine & Plumbing – Kim Sundkvist (me)
Team member 1	Designer, Mechanical
Team member 2	Designer, Interior
Team member 3	Assembly foreman
Team member 4	Project Manager
Team member 5	Design Office Manager
Team member 6	Designer, Interior
Team member 7	Designer, Interior
Team member 8	Designer, Mechanical

Table 3 – Resources of the Technical Documentation and Drawings Sub-project group

3.3.2 Project Scope

The scope of the “Renewing Nautor’s IT Systems” project according to the project plan (Kaj Westerlund 2005, 2-3) is to implement in parallel both the Enterprise 6.0 and Conisio IT environment:

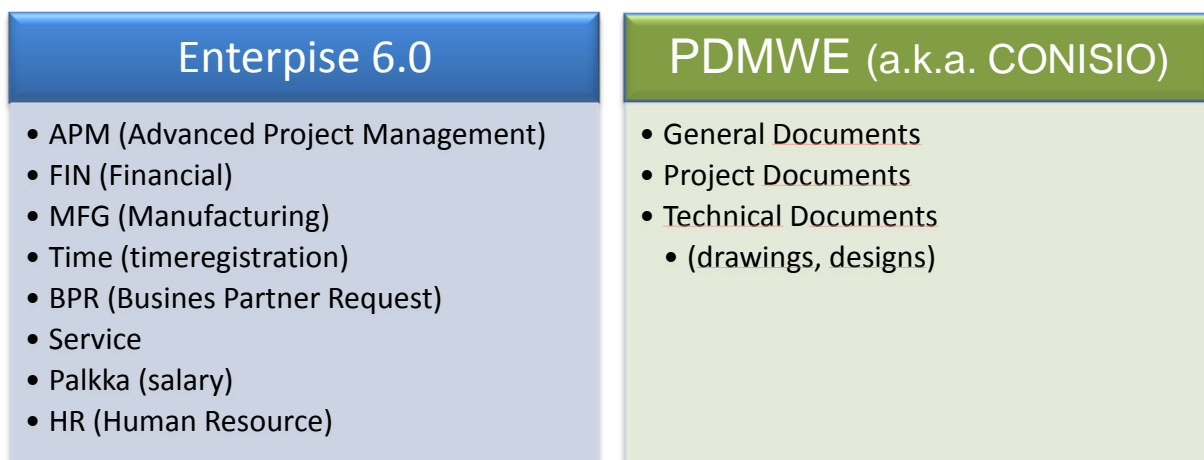


Figure 17 – Scope of the “Renewing Nautor’s IT Systems” project

This next illustration, Figure 18, intends to show how the two IT environments; IBS ASW Enterprise 6.0 and Conisio (later PDMWorks Enterprise) are meant to work together. Enterprise 6.0 is the common name of the complete suite of smaller modules that handles specific tasks in the ERP environment such as:

- APM (Advanced Project Management Module) which role is to function as a real-time resource and material scheduling environment for all on-going project
- MFG (Manufacturing Module) which role is to be the home of all product data, i.e. items, which are used by the other modules
- FIN, Time, Salary & HR are the modules that handles finance, time reporting per project, salaries and human resource planning.

The role of Conisio, later PDMWorks Enterprise, on the other hand is to bring structure into the knowledge that resides outside the ERP environment, in other words, to create a home for the structural capital that Stewart (Stewart 1997) refers to. In this setup, Conisio is intended to create structure and be the home for information such as:

- 2D and 3D CAD data and drawings
- Technical specifications of yachts, sourced components
- Work & quality assurance instructions and reports
- Technical & project correspondence both internally and externally (i.e. with customer)

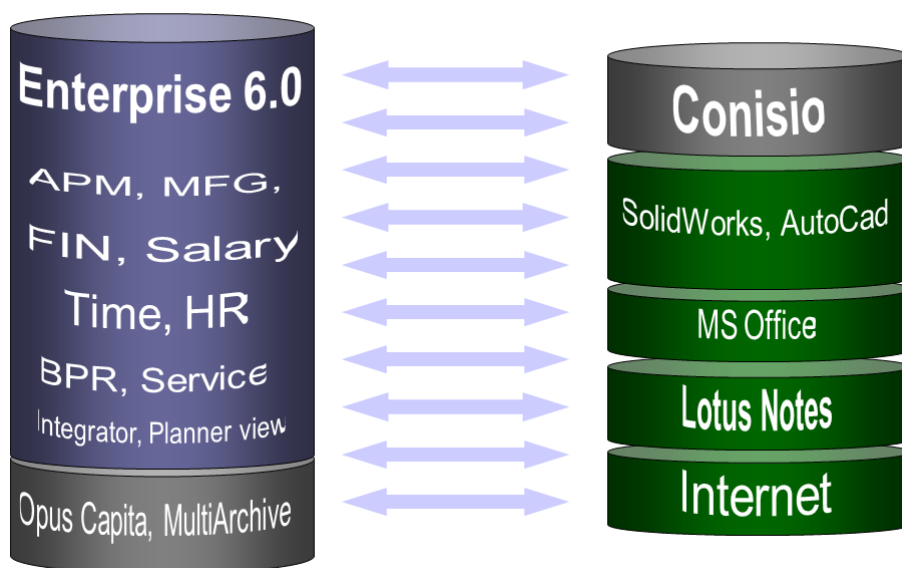


Figure 18 – The different roles of Enterprise 6.0 and PDMWorks Enterprise

The arrows in between the two systems indicate some interaction between the systems which is planned for the future. One requirement on the different ERP systems Nautor evaluated was that they would include some sort of document handling capabilities. As IBS Enterprise 6.0 did not include this by default, IBS made promises that there would be interaction between the two systems. Although this is clearly outside the scope of this thesis this interaction, e.g. possibility to access project documentation from within the APM module, is vital if these systems are to work together in the future and not to “grow apart”.

3.3.3 Project Time Schedule

The original time schedule for the overall “Renewing Nautor’s IT System” project dictated that once the acquisition decision was made by November 4, 2005, the configuration work was to start by installing the different environments. Workshops, meetings with both the reseller’s project manager and Nautor internal resources were held in order to work out the detailed requirements before implementation. Both the ERP and Conisio environment was planned to be “up and running” before September 1st 2006.

The project plan, (Kaj Westerlund 2005, 4, 23-25), for the “Renewing Nautor’s IT System” project included an overall time schedule, Figure 19, as well as detailed time schedules per each sub-project that can be found in APPENDIX 1.

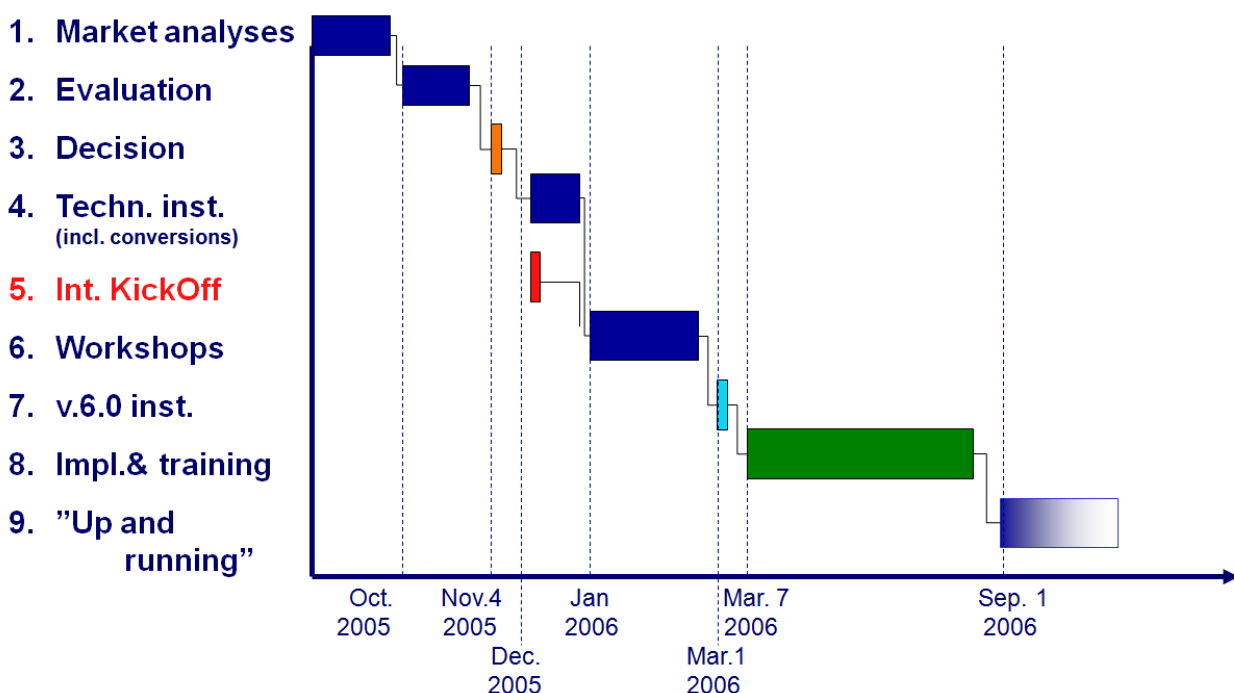


Figure 19 – Overall time schedule for the Renewing Nautor’s IT system project

According to the detailed time schedule, APPENDIX 1, the work in the sub-project group, Document Handling - Technical documentation and drawings, was to start December 8, 2005 and continue with trainings, workshops and internal meetings.

As soon as a project manager was assigned from the Finnish Conisio reseller, CadON Oy, the project started to make a more detailed time schedule together that aimed to comply with both the standard Conisio implementation process and the detailed implementation time schedule of the “Renewing Nautor’s IT System” project. This was no easy task and many compromises needed to be done in order for this to come together, especially as the project faced some serious issues two months into the project when the CadON’s project manager stepped aside and left the company, and a new project manager was to be phased in. Although internal meetings continued as planned the project made slow progress together with the reseller until end of February 2006 when the new project manager was up to speed. The Conisio implementation time schedule in whole can be found in APPENDIX 2.

3.3.4 Project work methodology

The work to find out the requirements of the new records system was done both within the project group for document handling and the sub-project group for technical documentation and drawings but with a different focus on documentation types, as the project group names imply. The project group for document handling focused at first on a general restructuring and overhaul of the existing documents on the different network disks. Later it began focusing on how to best organize this information into folders in one single place. This work was led by the chairman of this project group who coordinated and called together different workgroups, consisting of resources from different departments such as IT, Purchase and Technical Office, to perform these tasks as needed.

The project group for technical documentation and drawings focused at first mostly on drawings because of its tight integration with CAD and other technical software's and applications. The work was mostly teamwork in different workgroups which were coordinated by the author of this study.

Part of the work in both project groups followed the instructions of the CadON's project manager. Following a Conisio documented implementation process he coordinated different workshops where Nautor and CadON representatives decided upon how to configure Conisio to best fit the needs of Nautor's business processes. In practice, the CadON's project manager set up goals for us what issues to prepare and which work processes we needed to define, e.g. the drawing approval process, before the next workshop where we together analyzed how to best implement this in Conisio.

3.4 Requirements on new records system

Based on the shortcomings of the existing records system and the results from the work performed in the different project groups, the high-level requirements on the new records system could be summarized as:

The requirements for the new records system is to create **one single system** for safe storing and unambiguous retrieval of both Nautor internal project specific, standard product and supplier delivered drawings and technical documentation. This new system must be easy to use for both creators and viewers and because several different CAD/CAM systems (AutoCAD, SolidWorks, Rhinoceros, MaxSurf, MasterCAM etc...) exist side by side, complementing each other, it is important that the new records system supports all these and is open for future software's as well.

Figure 20 – High-level requirements for new records system

This thesis describes the more detailed requirements on the new records system in the same way that PDMWorks Enterprise, a.k.a. Conisio, is configured, namely:

1. Folder structure
2. Workflow
3. User rights management
4. Metadata (data cards)
5. Search functions

This is perhaps the easiest way to present in a structured way the result of the work done in the different workgroups and workshops. Before going into these details though, a short introduction to the basics of the PDMWorks Enterprise, a.k.a. Conisio, as an application is in order.

3.4.1 PDMWorks Enterprise

To the end user the PDMWorks Enterprise application is the user interface to a server based database application that keeps track of digital records (a.k.a. documents), their file names and storage paths, their versions, their metadata and their access rights. This is illustrated in its easiest form in Figure 21. This figure illustrates how the end user's workstations that are connected via one or several switches in a LAN (Local Area Network) to the PDMWorks Enterprise Database and Archive server. According to the Solidworks PDMWorks Enterprise Installation Guide (Solidworks Corporation 2008, 1-3) the function of the PDMWorks Enterprise Database Server, as the name implies, is to be the host of the database application, usually Microsoft SQL Server. The function of the PDMWorks Enterprise Archive Server is to provide enough disk space for the files that are managed by the database.

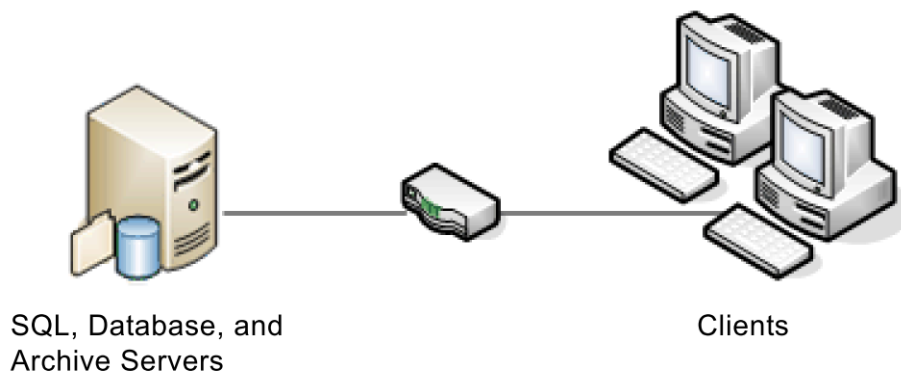


Figure 21 – Medium office PDMWorks Enterprise system layout

In the simplest configuration, as can be seen from Figure 21, the PDMWorks Enterprise Database Server and the PDMWorks Enterprise Archive Server can be located on one single server. For better performance one should have one server hosting the database server and another one hosting the archive server as presented in Figure 22.

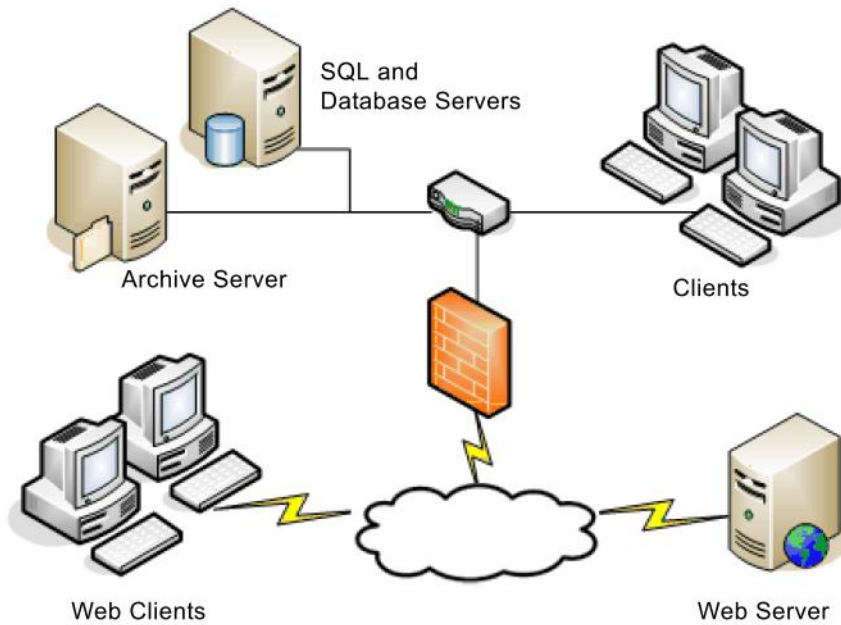


Figure 22 – Large office PDMWorks Enterprise system layout

3.4.2 Folder structure

Anyone who has worked with computers regardless of operating system is familiar with the term *folders*. Although arguably most people think of computers today when we hear this word it is not a computer specific term rather it's a heritage from the time when people sorted and stored paper copies in physical binders, or folders, in some logical way so that it could be easily found later when needed. The definition of a folder in computer technology today would be:

Folder is a virtual container within a digital file system, in which groups of files and other folders can be kept and organized. (<http://en.wikipedia.org/wiki/Folder>)

Figure 23 – Definition of a folder

To fully understand the two words; *virtual* and *container* in this definition one need to remember that data stored in a binary mode, “zeroes and ones” e.g. 001001011010, on our storage media of choice. Every type of hierarchical folder structure that we create on our hard disks, USB memories is not physically there, it is just binary data virtually organized for us to find it more easily.

PDMWorks Enterprise is a database application and one could argue that the documents, data and files, would not need to be organized in folders, i.e. *virtual containers*, to be easily found rather one could execute database queries on different metadata, i.e. document attributes, which would list possible hits from which you can select the one you where actually looking for. This is true in the sense that the database keeps track of where the documents are stored and therefore it is more a question of how to accurately query the database what results you will get, i.e. what documents you find.

The architects of PDMWorks Enterprise have found that it is possible to have the “best of both worlds”, meaning they have implemented a database with fast search functionality, based on database queries on document metadata, and they have implemented means for the user to create a folder structure of their own choice which everyone is accustomed to use and find their ways in.

For this reason, it was important in the implementation project to both find out what the searchable metadata would be and what type of folder structure should be in place for more a traditional way of storing information. The result from the work in different workgroups and workshops was a folder structure that is divided into two main branches: one branch that repeats itself per each project, i.e. a project specific folder structure, and another branch for the more generic type of information which is used for non project specific information.

Beside these two main branches, there was a third for standard yacht information, grouped per yacht model, which is used in marketing and on tradeshow and some folders for document templates and other data for the implementation and testing of the system.

For information on what information goes where see Figure 23 below. APPENDIX 3 contains a detailed list of the folder structure implemented into the PDMWorks Enterprise environment.

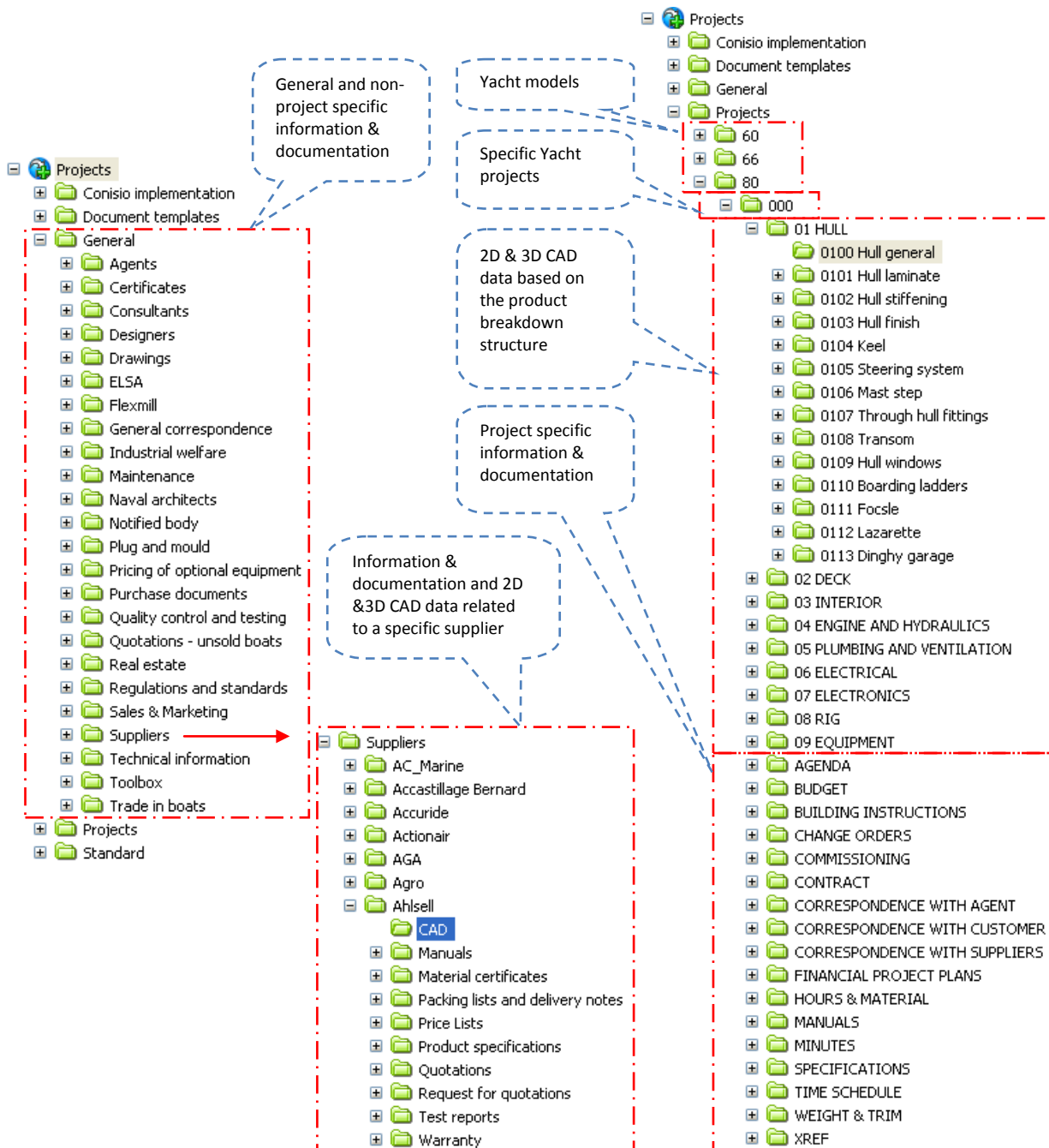


Figure 24 –Folder structure for general and project specific information

3.4.3 Workflow

With the PDMWorks Enterprise administration tools, the administrator can define different workflows to automate or control different tasks related to the documents. The definition of a workflow according to the PDMWorks Enterprise Administration Guide (Solidworks Corporation 2008, 222) is:

Workflows in PDMWorks Enterprise are intended to represent the internal workflow structure practiced in the company. A workflow can control the lifecycle of a document, project, or process by defining what a user or group can access.

Figure 25 –Definition of a workflow within the PDMWorks Enterprise

To fully understand the usage of workflows for controlling document related task one need to understand the different *Lifecycle States* of documents. In the workgroups and workshops we decided that we'd like to use the lifecycle state functionality within PDMWorks Enterprise but we want to "keep it simple", meaning we only want to have a few different lifecycle states per document type. Following the recommendations of the SFS-EN 82045-1, (European Committee for Standardization 2001) on document lifecycle states would have been too difficult and only added bureaucracy. The project also realized that 2D&3D CAD documents needed perhaps a different lifecycle state configuration than rest of the documents. For CAD related documents it was decided to have three different lifecycle states:

- **WORKING**, this is the first state (or status) a document receives when created. It means the document is still *preliminary*, i.e. "under work". WORKING status permits editing (i.e. checking in/out). The edited version gets a new version number.
- **APPROVED**, when a drawing or 3D model is checked by a colleague designer and approved by a Chief Designer it is ready for production and receives the APPROVED status. An APPROVED drawing is "locked" in the sense that it CAN NOT be modified without creating a new revision, this means that check in/out is not allowed for documents with the APPROVED status.
- **REV IN PROGRESS**, the only way to revise an APPROVED drawing is therefore to change the state from APPROVED back to WORKING to allow for editing (check in/out). In order for the production foremen and other designer to get the information that a specific drawing is being revised we needed to implement a third state, namely REV IN PROGRESS, which basically has the same functionality as the APPROVED status but gives the document user the information that a new revision is pending.

These different lifecycle states can be seen in Figure 26 below. In this figure, the blue boxes illustrate the different actions that the user may perform, depending on the user rights settings.

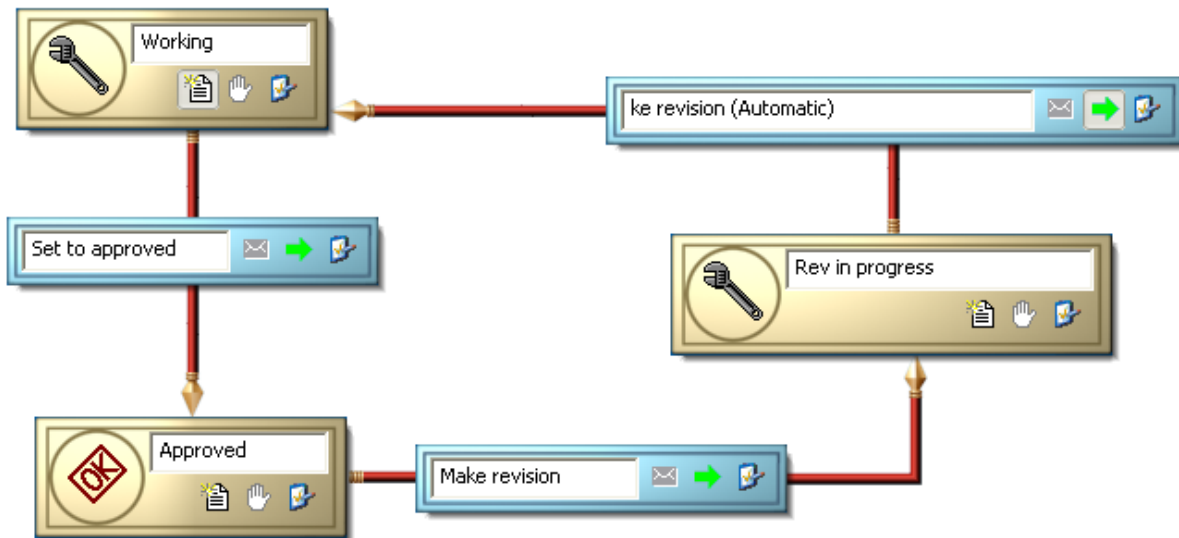


Figure 26 –Workflow for 2D&3D document approval and revision

For non-technical documents, the workgroup decided to first try with only the first two lifecycle states, namely WORKING and APPROVED. There even was a resistance to implementing lifecycle states at all to non-technical documentation as many thought it only adds bureaucracy and no added value. However, reflecting on the many issues experienced with our existing system with ambiguous document versions among other things it was decided to at least try it out. The different lifecycle states for non-technical documentation can be seen in Figure 27.

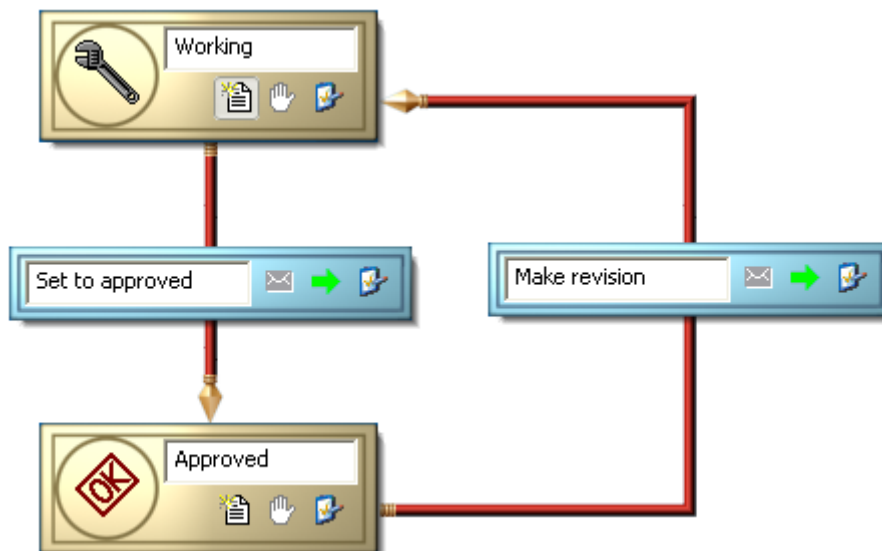


Figure 27 –Workflow for document approval and revision

3.4.4 User rights management

One big shortcoming in Nautor's existing IT environment, based on Microsoft server technology with partitioned and mapped network disks, with the many different mapped network resources described earlier in the IT environment section is that there is no good way to manage the individual user and user group access rights. PDMWorks Enterprise offers a complete new set of tools to manage user rights compared to the traditional Microsoft Server technology.

First of all, the access to the documents inside the PDMWorks Enterprise file vault requires the user to login with a username and password. PDMWorks Enterprise also offers the possibility to link this login to the normal windows login via a technology called LDAP which means PDMWorks Enterprise can sense which user is currently logged in on the workstation and automatically logs in as this same user when he or she tries to access the documents inside the PDMWorks Enterprise file vault.

With the administration tool the administrator can control the access rights of different individual users or user groups. This makes it possible to allow a variety of users, even external users if one like, inside a single PDMWorks Enterprise file vault as they will only have access to and see the documents that they are supposed to. The document access may be controlled per folder and/or document lifecycle state. For example this makes it possible to assign individual user or user group access rights per project, per supplier folder or per folder e.g. sales and marketing and finance.

Based on the work done in the workgroups and workshops it was decided upon the following user groups:

Group Name	Functions
Material management	Purchasers, Purchase manager, material & production planners
Technical Office	Designers, Chief Designers, Technical Office manager
New Product Development	Designers, NPD Manager
Yacht Management	Project Managers, project assistants,
Production Foremen	Assembly foremen, Plant foremen, Joinery foreman, Plug and lamination foreman
Management Team	Managers included in management team
Finance	Finance
Customer Care	After Sales personnel
Document Distribution	Drawing copies and distribution personnel
Flexmill	CAM designers and operators
Quality Management	Quality assurance personnel
Human Resources	Human Resources
Facilities	Facility planning

Table 4 – User groups in PDMWorks Enterprise

The individual user and user group settings are easily manage with the Administration Tool, see Figure 28.

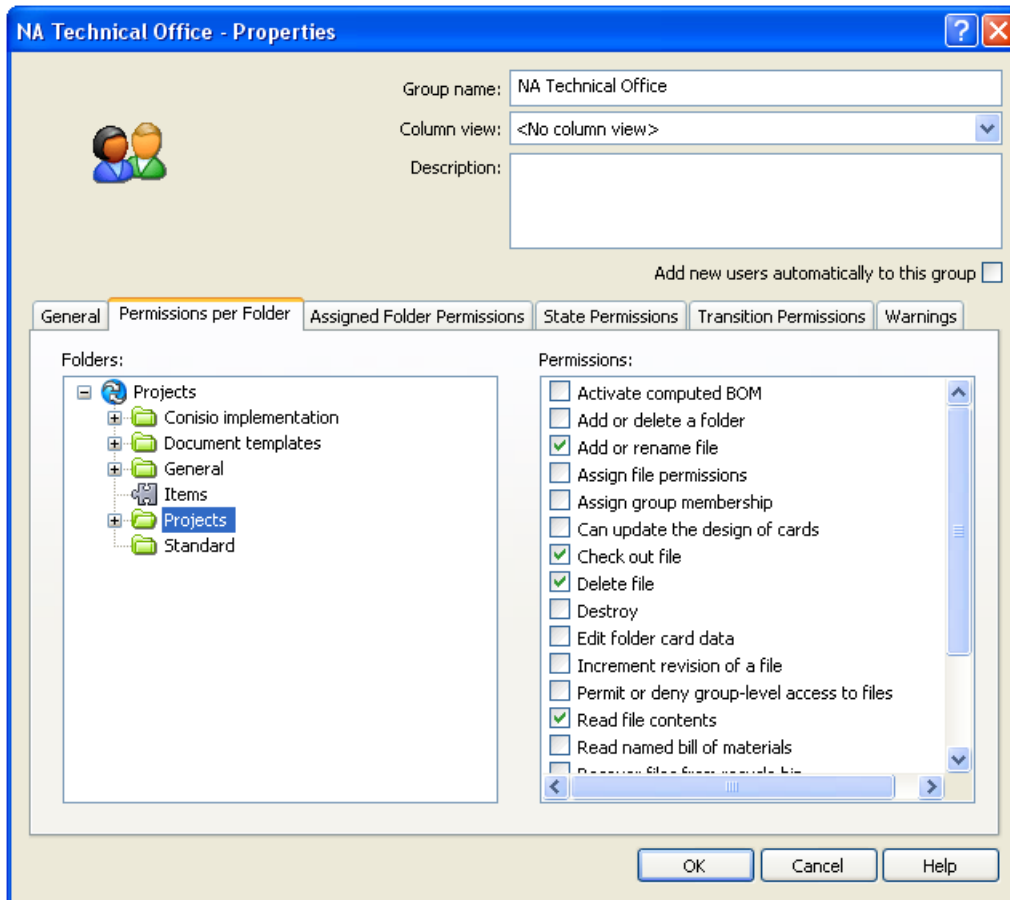


Figure 28 – User groups' settings in PDMWorks Enterprise Administration Tools

The access rights for these different user groups can be viewed in detail together with the folder structure in APPENDIX 3.

In the different workgroups and workshops, lengthy discussions was held on how to secure that production is only working on the latest, correct information. On the advice from CadON's project manager it was chosen to set the access rights on drawings and technical documents based on their lifecycle states, meaning a production foreman cannot access, or even see, documents that are in a *WORKING* state rather he can only work with documents that have matured to the *APPROVED* state.

3.4.5 Metadata (Data cards)

There are two ways of finding information stored inside PDMWorks Enterprise as described in the previous chapter on *Folder structure*. The more traditional way of finding documents is to look in the hierarchical folder structure, i.e. following the built in logic, and the other way is running a query in the database for the location of the document you search for based on document attributes, i.e. document metadata.

An example on the more traditional way would be if one is looking for a project specific drawing showing the forward cabin assembly in the new 60 footer one would look in this folder *C:\Projects\Projects\60\901\03\0302 Forward cabin\...* However, sometime if one is unsure of where the document creator might have stored the document one is looking for you may find the traditional way to browse the hierarchical folder structure somewhat slow.

In the example described above, the user may also have used the advanced search functions inside PDMWorks Enterprise to run a database query based on document metadata, e.g. *Yacht="60", Hull="901", Section="03", Group="02"* and the query would have resulted in a document list that would have been more or less identical with the content of the folder described in the example above. The user might also have added more conditions to this query, e.g. *Description="Forward cabin assembly"* to further narrow down the number of listed documents returned by the query. The database queries are particular powerful if the user is unsure of where the information is stored or if the user wants to get an overview of all the possible documents that match a certain set of conditions, i.e. metadata.

A prerequisite for the database query function to work properly is that every document creator thoroughly classifies and adds the correct metadata, i.e. document attributes, to the documents. If a document lacks the correct metadata it will not show up in a database query "hit list", i.e. it will not show up in the list of documents which metadata matches the given conditions in the query.

SFS-EN 82045-1 "Document management – Part 1 Principles and methods" (European Committee for Standardization 2001), recommends that one should clearly separate the document metadata from the document content. PDMWorks Enterprise does this by letting the *PDMWorks Enterprise Database Server* handle the document metadata and the storage locations of the documents and by letting the *PDMWorks Enterprise Archive Server* handle the storage function. However, to the end user the document and its metadata are managed as one single unit. If the user chooses to the metadata can be displayed in the document's *Data Card* immediately as the user selects a document. The user accesses the document's *Data Card* simply by selecting the document from the document list and selects the *Data Card* tab as shown in Figure 29 below.

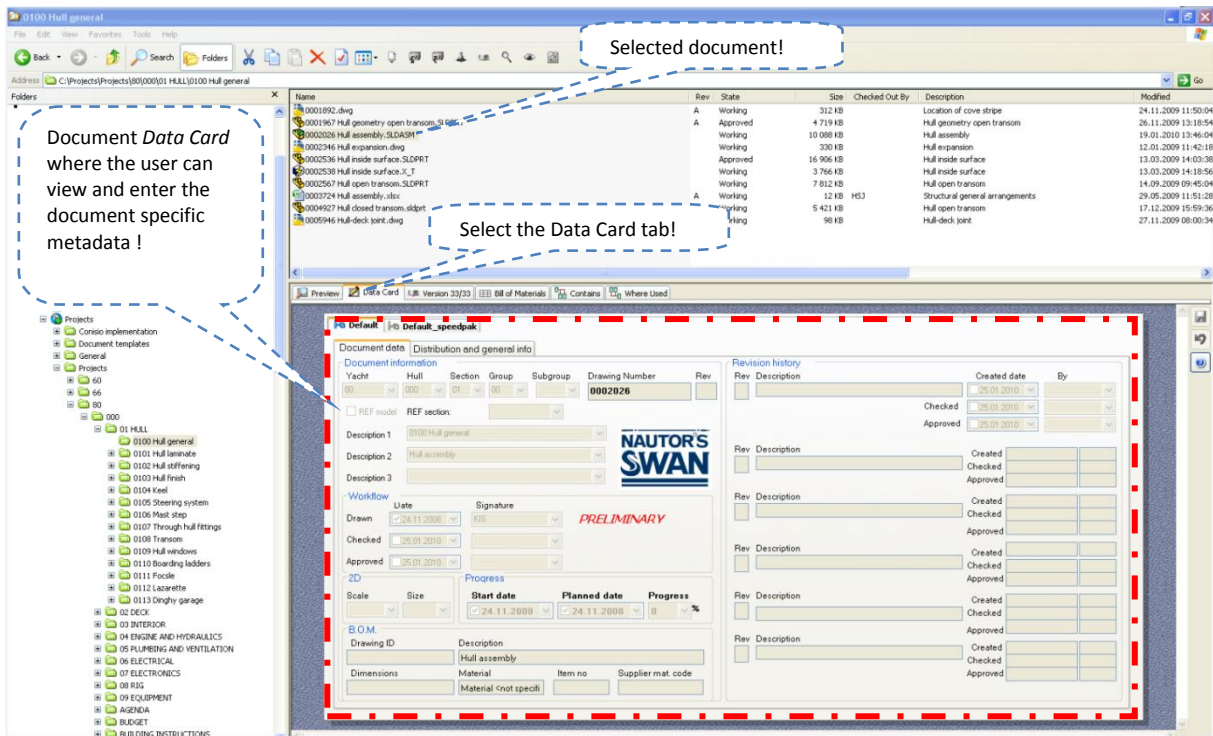


Figure 29 – Document data cards in PDMWorks Enterprise

When the document is selected the user may, besides accessing the *Data Card*, also access the following functions:

1. Get a preview of the selected document with the PDMWorks Enterprise in built viewer.
2. view the *Data Card* tab, see Figure 29 – Document data cards in PDMWorks Enterprise
3. View and select which document version to work with
4. View and work with a assembly *Bill of Material*, a.k.a. BOM
5. Perform a *Contains* analysis, which lists all the documents that is referenced by the selected document, e.g. what components an assembly is made up of
6. Perform a *Where Used* analysis, which lists all the documents that references the selected document, e.g. is the selected document used as a reference by a 2D drawing

A more detailed view of the user interface when accessing these functions can be found in APPENDIX 5.

During the different workgroup meetings and workshops with CadON's project manager it was discussed which attribute fields, i.e. metadata, that were to be entered for the different document types. It was realized that if the number of fields that needed to be prompted the document creator, grew too much it would reduce the productivity of a designer as the time needed to enter data into these attribute fields on the *Data Card* would also grow. This productivity issue became a subject of a lengthy debate in the workgroups and it was agreed upon to tackle the problem in two different ways:

1. Trying to keep the number of attribute fields that prompts the creator for information at a bare minimum
2. Trying to automate the entering of metadata as much as possible

The documents metadata is displayed in the document data card with two tabs. Most of the fields on the first tab, which also is the default tab that is displayed to the user, are actually information that is required in the drawing header. In this case there is actually no time added to the design process as this information now linked to the drawing header instead of the designer entering this information inside the CAD application.

The fields in the “folder and product structure” section, in the Figure 29 below, are automatically inherited from the folder structure where it is created and saved the first time. In this way, much of the information that is usually repeatable can be automated which saves the document creator a lot of time and automatically entered metadata is usually most correct, have the least typing errors.

The revision information is prompted and entered through the workflow process and is displayed more as read-only information on the *Data Card*.

The screenshot displays the first tab of the document data card, titled "Default". It contains several sections and fields:

- Document data:** Includes fields for Yacht (80), Hull (000), Section (01), Group (00), Subgroup, Drawing Number (0002026), and Rev.
- Folder & product structure:** A section at the top right, outlined with a dashed blue box, containing fields for Yacht, Hull, Section, Group, Subgroup, Drawing Number, and Rev.
- Revision information:** A section at the top right, outlined with a dashed blue box, containing fields for Rev, Description, Created date, Checked, and Approved.
- Workflow info:** A section in the middle, outlined with a dashed blue box, containing fields for Drawn (24.11.2008), Date, Signature (KIS), Checked (25.01.2010), Approved (25.01.2010), and a "PRELIMINARY" stamp.
- Drawing header & BOM info:** A section at the bottom, outlined with a dashed blue box, containing fields for Drawing ID, Description (Hull assembly), Dimensions, Material, Item no, and Supplier mat. code.
- Revision history:** A table on the right side of the card, listing revisions with columns for Rev, Description, Created, Checked, and Approved.

Figure 30 – First tab on document data card

On the second tab on the data card, *Distribution and general information*, it was chosen to put attribute fields that are more “optional” in their nature. Here the document creator may enter supplier information if it is a supplier related document and the different drawing distribution codes required for the document to be distributed correctly once approved. Many of these fields, such as the supplier name and document type, are also inherited automatically.

3.4.6 Search functionality

The search functionality inside PDMWorks Enterprise is closely related to the metadata issue. It is therefore necessary to select and define the metadata, i.e. document attributes fields, with the search functionality in mind. When designing the *Search Data Cards* and the pre-defined search variables we could copy the *Data Card* and start from there. However, in order to free more space for the search result list and preview window it was decided to organize the search variables on more tabs as can be seen from Figure 31 below. More detailed information on the design of the *Search Data Cards* can be found in APPENDIX 6.

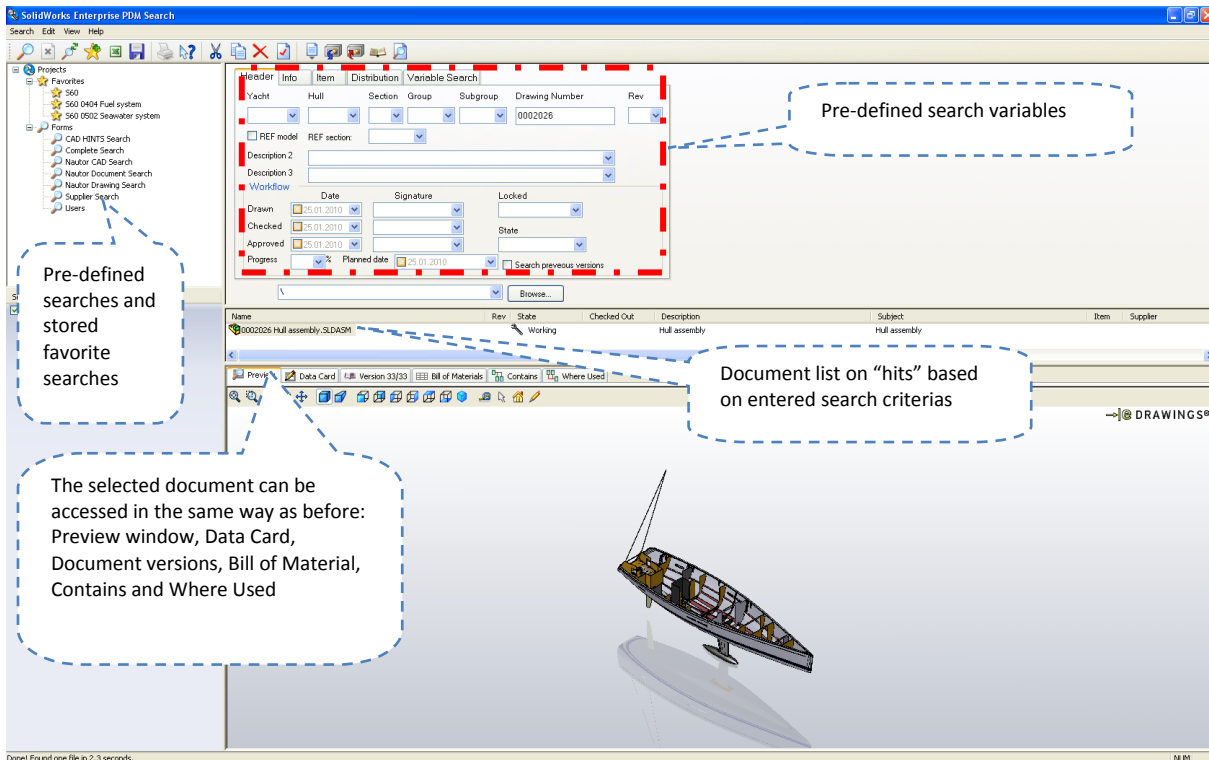


Figure 31 – Performing searches and evaluating the results

A very useful feature in PDMWorks Enterprise search tool is that once a user have entered his search criteria and performed the search he may store these search criteria as a favorite search for later us. In this way, the user may create an own set of searches in order to avoid repetitive tasks when performing searches.

It was also found that we could create a different *Search Data Cards* for other non-technical documents as they also have a more simplified *Data Card* design. For example we've excluded some search variables concerning the Bill of Material from *Search Data Cards* for the non-technical documents.

3.5 Deployment and testing

According to the original time schedule for the Renewing Nautor's IT system project, APPENDIX 1, the system was planned to be up and running by 1st September 2006. Due to delays and technical issues in the configuration work it was not possible to start user training and install final software versions on the servers and clients, i.e. user workstations, until mid August 2006.

Prior to the user training sessions and installations begun the decision was made, together with CadON's team, to start with deploying the PDMWorks Enterprise environment in a pilot project to avoid risking ongoing projects. Corporate management team accepted that the project could use the then just started project for a new yacht model, the Swan 66, as the pilot project. The advantages with having a pilot project testing the environment was that it would be good from a risk management point of view and that the installations and user trainings could be focused on a smaller group of people, namely the team members in the Swan 66 development team.

3.5.1 Software installation

Although Solidworks Corporation claims, according to the PDMWorks Installation Guide, (Solidworks Corporation 2008, 5), that the PDMWorks Enterprise environment components may be installed in any order the recommended assembly sequence is the following:

1. Install SQL Server on the system that will host the PDMWorks Enterprise file vault database.
2. Install the database server component on the system where you in step 1 installed the SQL Server.
3. Install the archive server on the system running the SQL Server installed in step 1 & 2 OR on a separate system.
4. Install the PDMWorks Enterprise clients on all workstations that will work in the file vault.
5. Create a new file vault using the PDMWorks Enterprise administration tool on a system where the PDMWorks Enterprise client is installed.
6. Optionally set up the PDMWorks Enterprise index server for content search support.
7. Attach the remaining clients to the archive server and create local file vault views using the View Setup wizard.

On the advice from the Conisio reseller CadON Oy, Nautor choose to install both the PDMWorks Enterprise Database Server and the PDMWorks Enterprise Archive Server on the same physical hardware, i.e. server machine. This installation is illustrated best in Figure 21. This is not an optimal solution for best performance but should according to the reseller be most cost efficient and sufficient for a company of Nautor's size and number of concurrent users.

The installation of the "go live versions", Conisio version 6.4 for the server and client software was originally planned to be done by week 22, just before the summer holidays in July 2006, but was postponed to week 34, 22 August 2006. Since May 2006, there was a more intermediate version, Conisio 6.3, installed for testing and development of the Nautor customized environment. In August 2006, the software was upgraded to the latest "go live" versions of this software.

3.5.2 User training

Once the PDMWorks Environment was configured, i.e. workflows, processes, document types and their metadata and search cards defined, it was time to start the end user training. According to the original time schedule for the Renewing Nautor's IT system project (see APPENDIX 1) this was planned for May 2006. Early in the Conisio implementation project, the scheduled end user training in May 2006 was recognized as being too early and was therefore rescheduled to August 2006 with the approval from the Renewing Nautor's IT system steering group.

The end user training was planned more in detail according to the table below.

Week	Date	Group
W33-06	16.08.2006	PDMWorks Enterprise environment demonstration for Corporate Management Team and invited people
W33-06	17-18.08.2006	Administrator training
W34-06	24.08.2006	Designers group -1 (5 persons)
W34-06	25.08.2006	Designers group -2 (5 persons)
W35-06	29.08.2006	MS Office users (10 persons), mostly purchasers and material planners

Table 5 – Detailed time schedule for PDMWorks Enterprise end user training

3.5.3 Pilot project

During the deployment phase, i.e. software installation and end user training, there were many technical problems with the PDMWorks Environment which also became evident in the start-up phase of the pilot project, the new Swan 66. By the end of 2006 it was decided that the Swan 66 project would continue as a normal project and not as a pilot project for the PDMWorks Enterprise implementation. This was a pure risk management decision and in truth the implementation project needed to re-group and fix the technical problems before further deployment.

These technical problems were to a large extent a result from trying to customize the system to match the perceived needs of the Nautor's business processes. However, Nautor is a constantly evolving and changing company and its business processes and organization models are often changed and therefore there is a risk in extensive customizations.

The time it took for the PDMWorks Enterprise implementation project to re-group turned out to be longer than predicted as it took almost one year to find a new suitable pilot project, the new Swan 60 model, whose development was planned to start in the beginning of 2008. During this year of re-grouping there had not been much activity in the implementation project as the workgroup had been scattered across different development projects and the author of this thesis was also fully booked for the Swan 66 development.

With a new pilot project in target, however, the necessary simplifications and improvements to the PDMWorks Environment was made together with a team from CadON. In March 2008, a new set of end user training was arranged, this time in house and held in Swedish by myself, for the team of designer that were to work on the new Swan 60 model development.

Still there were massive technical problems with the PDMWorks Enterprise environment during the Swan 60 development and the upgrading to Solidworks version 2009 and PDMWorks Enterprise version 2009 in beginning of February 2009 led to that the problems escalated to a new level and would there have been a good way on returning to the previous version, version 2008, it would have been an easy decision. Unfortunately, once the Solidworks files are upgraded to a newer version it is difficult to return to the previous version. Restoring backed-up files of version 2008 would have meant too much loss of development work and time and was therefore not a real option.

3.5.4 Feedback on pilot project

To gain some feedback from the designers working with in the PDMWorks Enterprise environment a survey was conducted in mid November 2008, approximately six months into the Swan 60 development project. I asked the following questions:

1. Write down the things you think is **BETTER** with the PDMWorks Enterprise environment in the Swan 60 project and rate it according to 5-10, where 5 means “no real improvement” and 10 means “significant improvements”
2. Write down the things you think is **WORSE** with the PDMWorks Enterprise environment in the Swan 60 project and rate it according to 1-5, where 1 means “totally wrong” and 5 means “no difference from before”
3. Write down a list of **IMPROVEMENTS** that you think must be addressed before we can deploy PDMWorks Enterprise as a corporate PDM system, i.e. for all projects.

The answers received through this survey were naturally from designers in different disciplines within the pilot project. The different disciplines represented in the answers can be viewed in Table 6 below.

Designation	Discipline	Function
Designer 1	Mechanical, i.e. hull, deck, rig and sail functions	Chief Designer
Designer 2	Mechanical, i.e. hull, deck, rig and sail functions	Designer
Designer 3	Interior design	Chief Designer
Designer 4	Mechanical, i.e. hull, deck, rig and sail functions	Designer
Designer 5	Mechanical, i.e. hull, deck, rig and sail functions	Designer
Designer 6	Mechanical, i.e. hull, deck, rig and sail functions	Designer
Designer 7	Engine and Plumbing Systems	Chief Designer
Foreman 1	Plug, mould & lamination	Foreman in production

Table 6 – Survey answers from different disciplines

Tables 7,8 and 9 below show a translated conclusion of the answers received in this survey. In all honesty, it must be said that approximately 30% of the answers in Table 8, refers to many of the technical problems with the software, especially with version 2009. Arguably 30% of the answers are a result of the users not being properly informed or trained enough in the ways of working with the PDMWorks Enterprise system.

Answer by	Question no. 1 – Write down the things you think is BETTER with the PDMWorks Enterprise environment in the Swan 60 project	Rating
Designer 1	File data cards gives a clear overview of the information.	7
	2D & 3D preview of models is a nice feature.	7
Designer 2	Drawings and model changes update are visible to all users once the models are checked back into the vault.	6
	Sequential drawing numbers are generated directly for new projects.	5
	You can make 2D drawings directly from the Solidworks 3D models without going via Autocad.	10
	Easier to find existing drawings compared to the old system (RITREG)	8
Designer 3	PDMWE enables the use of drawing no. for Solidworks parts and assembly files.	10
	Solidworks drawing files are not needed to be exported to Autocad to get drawing no.	10
	Easier update paths.	8
Designer 4	Drawing number creation for Solidworks files works relatively good.	8
	All drawings regardless of file type can be found in one place, no need to switch between network disks U:\, T:\, N:\, etc....	9
	Solidworks files are now searchable thanks to this system.	10
	It is more clear now when a drawing is ready or still under work (if the users remember to update the file data cards)	7
Designer 5	Filling the file data cards seems relatively easy (if the update would work).	8
	Easy to check both 2D drawings and 3D models through the preview window even without starting Solidworks.	
Designer 6	It's very easy to start a new drawing from a part or assembly. It saves time that the drawing number is automatically generated from the part.	7
	The previews in windows explorer are very nice. It was first a little slow, but after changing the setting to "show bitmaps for solid work files" it's great.	9
	To change versions and go back in history is a nice feature.	7
	The search function is good.	8
Designer 7	Every discipline now works in Solidworks (3D).	10
	Now also possible to create 2D drawings within Solidworks.	8
	Nice search functionality.	10
	Easy to log in and out, the system feels relatively stable.	9
	Easy to add new models and drawings into the system.	8
Foreman 1	Big advantage to be able to view the files (preview window) before opening them.	8
	Search function is good but feels a little bit complicated.	

Table 7 – Answers to question no. 1 in PDMWorks Enterprise end user survey

Answer by	Question no. 2 – Write down the things you thing is <u>WORSE</u> with the PDMWorks Enterprise environment in the Swan 60 project	Rating
Designer 1	Does not seem to work together with Autocad LT, update of file data cars doesn't work but you have to manually edit each attribute field for them to be shown on drawing.	3
	Personally I think it's no point spending time checking in/out files.	1
	Should be possible to make sketches etc... on T: disk and save them to PDMWE later when more ready without creating new file numbers.	3
Designer 2	It is not possible to work with files directly in PDMWE as they disappear.	3
	There must be a way to break referencing files to prevent others or yourself from messing up the drawings later on.	1
	Working with Bill of Materials and their balloons feels difficult.	2
	Drawing distribution fields need to be sheet dependent and not drawing dependent as different sheets may have different distribution needs.	2
	Large assembly creation is very slow.	1
	Files remains checked out as people don't remember to check them in after use.	3
Designer 3	Files with virtual parts don't work in PDMWE especially with 2D drawings.	1
	Information field sometimes disappears from drawing.	3
	Check in of a 10MB file takes 1 min which I think is too long.	4
Designer 4	Search function doesn't find Solidworks drawings as the metadata for the drawings is in their 3D models.	2
	Check in/out feels rather difficult. There is a big risk one forgets to check in the modified files and the rest of the designers etc... will only see the old versions.	3
	There is a big risk of using old versions if you don't remember to check version and "Get Latest".	3
	If the preview window is enabled the browsing of files in a folder will become slow.	2
	Many sub-folders together with unclear directives make it difficult to find information where you'd think it would be.	4
Designer 5	If you double click a file a new session of Solidworks or Autocad will be launched even if you have one open already.	2
	You need to close all parts and even sub-assemblies where these parts occur for the database to update correctly.	3
	It's a risk you forget "Get Latest" version, this should be automatic.	3
	Difficult to get an overview of the drawings in a folder when the filename starts with the drawing number.	4
	Copying files to PDMWE very unpredictable (works/doesn't work).	2
	Updating of drawings unpredictable.	2
Designer 6	Every time you send out a drawing it's necessary to check the drawing schedule and set the drawing to "approved" as soon as it is sent out.	5
	The previews of assemblies are showing all the hidden parts in the assembly as well.	3
	Opening a file directly from windows explorer is opening a new session of solid works.	2
Designer 7	Sometimes data entered into data card isn't saved in PDMWE.	1
	The workflow of setting a file to "APPROVED" is sometimes too complicated.	3
	Long file paths inside PDMWE.	3
	Autocad lacks functionality inside PDMWE compared to Solidworks.	3
Foreman 1	Standardization will be difficult if a new drawing number is required per each new yacht even if the component stays the same.	2

Table 8 – Answers to question no. 2 in PDMWorks Enterprise end user survey

Answer by	Question no. 3 – Write down a list of <u>IMPROVEMENTS</u> that you think must be addressed before we can deploy PDMWorks Enterprise as a corporate PDM system	Rating
Designer 1	Bill of Material functionality and linking information to the drawing header must work 100%.	
Designer 2	There should be a way to lock/unlock referencing files from preventing un-accidental updates in drawings.	
Designer 3	Get the virtual parts working with Solidworks and PDMWE Faster workflows, check in/out, set to approved, make revision in PDMWE Link between file data cards and drawing header must work 100%	
Designer 4	-	
Designer 5	Updates between data card and drawings must work No new session of Solidworks if one is already running Possibility to change text fields without making revision More training in search functionality	
Designer 6	It's not possible to change the data card with the part or assembly open. You need to close the part, assembly and drawing before you can change it in the data card. It should not interfere with the toolbox.	
Designer 7	More training in Solidworks 2D drawing creation Instructions on how to add different type of documents to PDMWE Needs to much more faster	
Foreman 1	-	

Table 9 – Answers to question no. 3 in PDMWorks Enterprise end user survey

4 DISCUSSION

Offshore sailing yacht design and building is truly multidisciplinary to its nature as it requires the designer and builder to constantly take into consideration the interaction between the yacht itself and the two media's it travels through, namely air and water. Besides optimizing the performance of the yacht structure's interaction with air and water an offshore sailing yacht often also needs to be designed and built for comfortable living in both warm and cold climates. Today, with the help of modern CAD tools and analyzing software's, we are able to better understand the different aspects of the sailing yachts interaction with the two medias but still yacht design and building is very much a question of making compromises, e.g. usually one have to choose between cruising comfort and speed. As the boundary conditions, air and water, stays the same also for our competitors it is more a question of which compromises the designer and builder makes when developing the product if it is a success or not. In other words the designer and builder needs to have a clear vision of what the end result should look like and make well informed decisions, based on prior experience and knowledge, when making those compromises during the development phase and always check that the end results meets the vision set by the customer.

With over forty years of experience in building offshore sailing yachts, Nautor has gained unique knowledge in how to design and build these yachts so that the products fulfill the visions set by the specific customer and the market in general. Much of this knowledge has traditionally been implicit, i.e. skills, experiences, insight, intuition and judgment, by some key persons involved in product development and production. With an imminent generation shift, however, there is a risk that the important implicit knowledge is lost when these key persons retire or otherwise leave the company. When this occurs, it is important that as much as possible of this otherwise implicit knowledge has been formalized and documented so that it remains within the company, and turned into structural capital. One might argue that Thomas A. Stewart (Stewart 1997, 108) (see chapter 2), is even somewhat provocative when he states that Structural capital would be even more important than Human capital. In a way, however, one can understand his point of view on how important it is for a company that as much implicit knowledge as possible within product development is documented so that it remains the intellectual property of the company. On the other hand one needs to remember that without a company's human resources, i.e. its employees, a company may not even possess any implicit knowledge worth owning. Therefore, human capital is a company's most valuable asset closely followed by structural capital and customer capital.

This thesis focused on the implementation of a records system for the handling of structural capital at Oy Nautor Ab. When the project group started working with implementing PDMWorks Enterprise as the company wide records management systems it was clear that it would need to be easy to create documents in and safe to retrieve documents from the new system. Otherwise it would not stand a chance to succeed. Historically, there have been a series of less successful IT system implementations in the last 5 – 10 years and therefore the threshold for the end users to embrace new IT systems is somewhat raised.

Ease of creation means that the "extra" time it would take for the author to *initiate, prepare* and *establish* a new document (see Figure 1) into PDMWorks Enterprise must not be longer than it can be justified by the added value it provides, e.g. new search functionality. We succeeded in creating

a compact yet functional user interface through the different file and folder data cards and that we managed to utilize many of the unique functionalities within PDMWorks Enterprise to automate the entering of metadata, i.e. document attributes, into these data cards as a function of the locations where the user was creating the document. The feedback from the pilot project survey verifies this as there are several comments on the ease of use and creation of new documents into the new system.

Safe retrieval of documents from the new system means that the new system must give unambiguous information to the end user on which version of a document the user is currently viewing and what is currently the latest version in the system. Due to a confusing user interface there have been mistakes during the pilot project where designers have not been clearly enough informed by the system that they are not working with the latest version of a document, i.e. 3D model document. The risk of viewing or working with the wrong document version is also verified by the pilot project survey. For the production foremen we set up the system to always show the latest approved version but for the designers this setting was not possible to use in the same way. This is more a shortcoming of the PDMWorks Enterprise user interface as I see it and could not have been affected by the implementation project.

Ease of use is important but along the road we found that there are also other important aspects of the new system that needed our attention like user access rights and document approval workflows. In terms of access rights the solution to limit the access rights to documents based on document life cycle state, i.e. working versus approved, solved a problem that existed in the old system, namely that the production foremen tended to be impatient and use drawings that had not yet been approved.

Taking part in such a large IT project was very interesting and being a project manager, although for a small sub-project to the larger IT project, gave new insights into the dynamics of project team work. Besides learning to configure and administer a new document handling application, i.e. PDMWorks Enterprise environment, there was a great deal to be learned on how to lead a project, although small, by delegating tasks, and following up these tasks, to team members and trying to both create and maintain project time schedules but perhaps even more valuable are the insights in what can go wrong in a project.

Many aspects of the sub-project for “Document Handling - Technical Documents and Drawings” did not go as planned. To start with the resources that were allocated to this project were not diversified enough and approximately one thirds of the project team was too busy or double booked in such a way that prevented them from attending project meetings and workshops. Regarding the diversity of the project resources, the project team had too many designers with similar functions and background and too few representatives from “process customer” functions like purchase department and production.

Another lesson learned is that when it comes to IT projects one should always strive for simplicity and therefore a keyword in all IT projects should be K-I-S-S (Keep It Simple Stupid). We were aiming too high with regards to try to adopt the system to our somewhat old business processes and asked the reseller to try to add custom functionality to the PDMWorks Enterprise environment by coding customized add-in applications. This not only took a lot of extra time and effort but the add-ins also turned out to be highly unstable and was later removed because of

their instability before we started the pilot project. In other words, one should always try to implement *Out Of The Box* functionality (OOTB) and if possible adopt the work processes to match this rather than the other way around. This may sound strange and awkward at first but by adopting OOTB functionality and if possible changing some of the old business processes a lot can be won in implementation time & costs. A little bonus is a more robust environment as the new, slightly modified, business processes will most probably follow industry best practice. However, even an OOTB system needs to be adapted to in some degree to the needs of your organization and business processes.

Before the “go live” decision is taken, i.e. start deploying and training the end users, one should be sure that to have covered most of the functionality needed and at least laid the ground work for further implementations and improvements without having to start making changes to the foundation of the system, e.g. changing the data model like document attributes. Also verify that the software is stable and performing under normal production conditions, not only in a test lab which usually is the case when configuring and developing a new system. PDMWorks Enterprise had many technical problems and performance issues, not caused by the Nautor specific configurations that required extra work in the deployment phase. In other words the software was not stable enough for a production environment and therefore we had massive problems in the pilot project, the development of the new Swan 60, and this can clearly be seen in the feedback on the pilot project survey.

One should also not underestimate the language barrier when it comes to deploying, training and testing new and highly sophisticated software. To learn how to use a new software and perhaps even new working routines and business processes is difficult enough in ones mother tongue and should therefore not be forced on to the end users in a second or third language if not absolutely unavoidable.

Finally it was the responsibility of the corporate management, as the owner of the project, to ensure that the allocated resources were allowed to work undisturbed with the project. The implementation project was badly timed to be carried out in parallel with the finalizing, launching and testing period of the biggest Swan built today, the Swan 131 S/Y Aristarchos. For a large part of the project team the Swan 131 project was prioritized and they were therefore not allowed to attend project meetings and workshops as intended. This meant that the research, definition and configuration work had to be carried out by only a few persons, including the author of this thesis.

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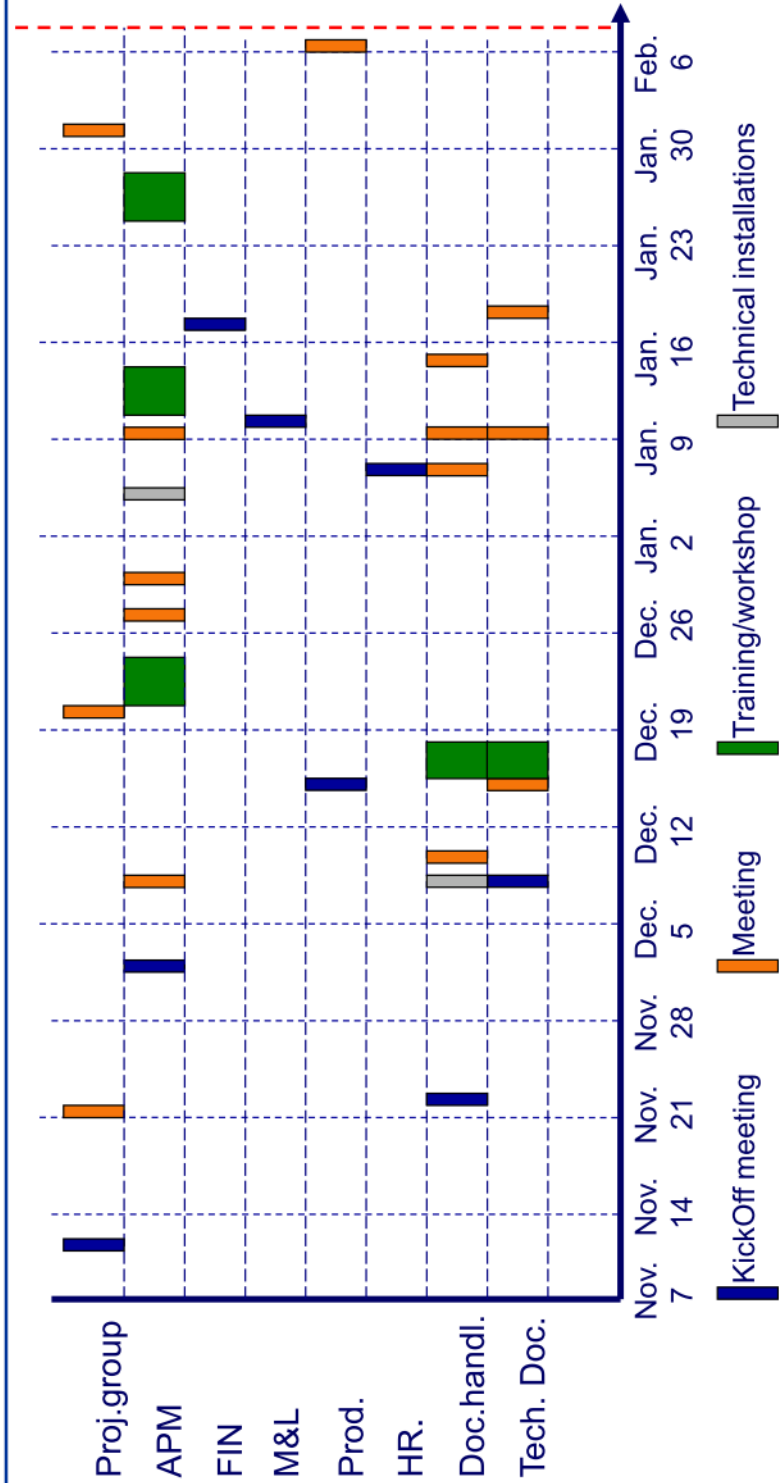
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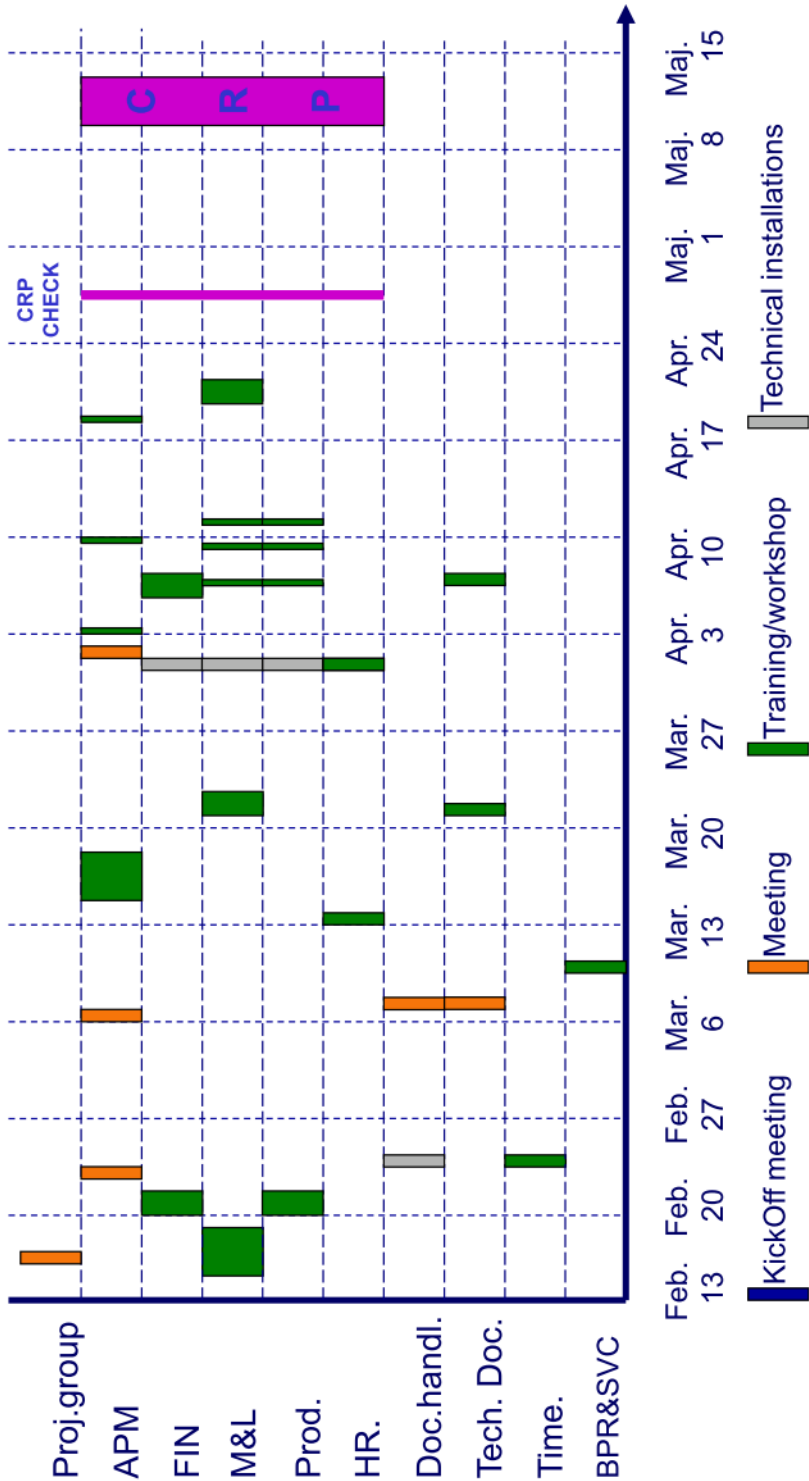
6 APPENDICES

APPENDIX 1 – Detailed time schedule for the “Renewing Nautor’s IT System” project

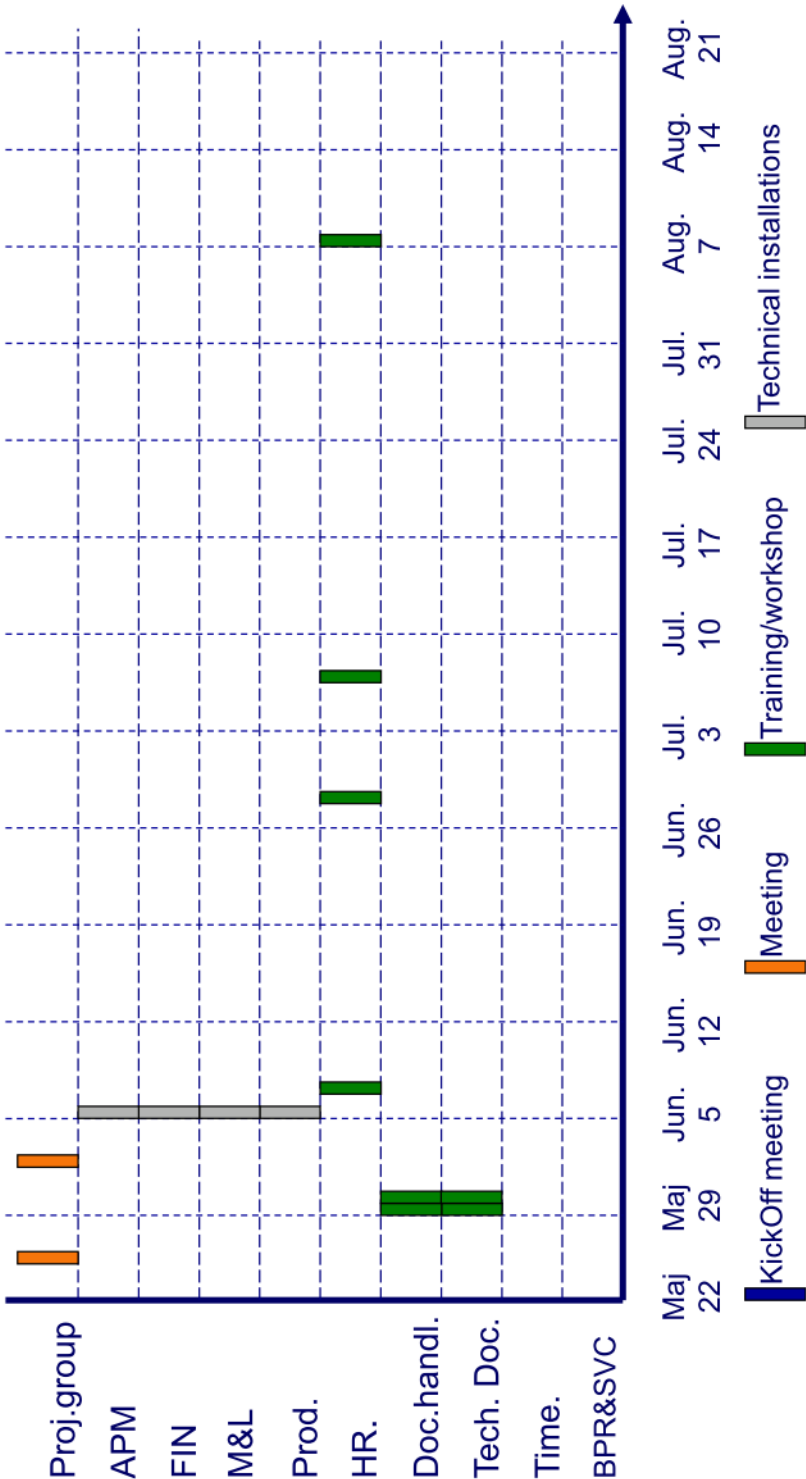
DETAILED PLANNING



DETAILED PLANNING

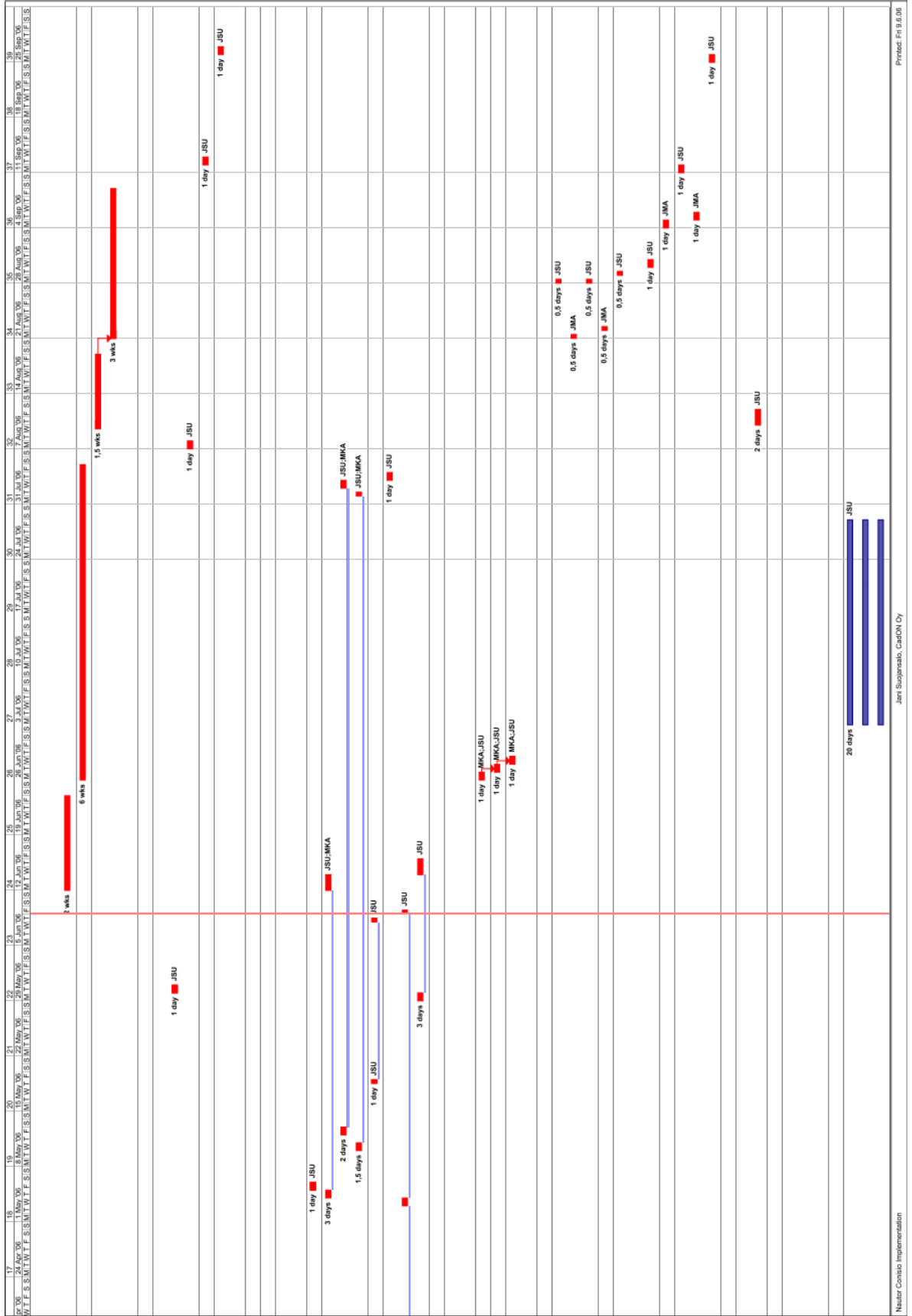


DETAILED PLANNING



APPENDIX 2 – Time schedule for Conisio implementation project

ID	Task Name	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Dec 18	Dec 19	Dec 20	Jan 01	Jan 02	Jan 03	Jan 04	Jan 05	Jan 06	Jan 07	Jan 08	Jan 09	Jan 10	Jan 11	Jan 12	Jan 13	Jan 14	Jan 15	Jan 16
1	Conisio environment (CAD and Office users)																			
2	Milestones																			
3	Testing environment																			
4	Testing weeks (CAD and Office)																			
5	Final environments installation week																			
6	Training weeks																			
7	Workshops & Follow up days																			
8	1. Workshop																			
9	2. Workshop																			
10	3. Workshop																			
11	4. Workshop																			
12	1. Follow up day																			
13	2. Follow up day																			
14	Other																			
15	Add-ins for Conisio																			
16	APR add-in??																			
17	Conisio ja SolidWorksin konfigurointi																			
18	Initial Structure																			
19	Users/ Groups																			
20	4x2 FielddataCards																			
21	2 WorkFlow																			
22	Serial Numbers																			
23	2 Search Forms																			
24	Notifications																			
25	Templates																			
26	3 reports																			
27	Installations (2x3 pv)																			
28	Server Installation																			
29	Client Install (50)																			
30	Install Office Users (50)																			
31	Install Light Users (20)																			
32	Setup WebServer and Clients																			
33	Trainings (max. 10 persons/group)																			
34	A. Conisio Training 1/2 day x 5 groups																			
35	1. Conisio training (Finnish)																			
36	2. Conisio training (Swedish)																			
37	3. Conisio training (Finnish)																			
38	4. Conisio training (Swedish)																			
39	5. Conisio training (Finnish)																			
40	B. Designer Training 1 day x 5 groups																			
41	1. Designer training (Finnish)																			
42	2. Designer training (Swedish)																			
43	3. Designer training (Finnish)																			
44	4. Designer training (Swedish)																			
45	5. Designer training (Finnish)																			
46	C. Administrators training 2 days x 2 groups																			
47	1. Admin Training (Finnish) (1-10 persons)																			
48	2. Admin Training (Finnish) (max. 6 persons)																			
49	Holidays																			
50	Winter																			
51	Jari Suojanen																			
52	Kim Sundbust																			
53	Summer																			
54	Jari Suojanen																			
55	Marko Karinen																			
56	Kim Sundbust																			



APPENDIX 3 – Folder structure in PDMWorks Enterprise

Nautor Workshop #2 6.4.2006

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5			NA Material Management	NA Technical Office	NA Yacht Management	NA Foreman Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1	1	Conisio root (NAUTOR)																			
2	2		DOCUMENT TEMPLATES																		
3	3		AUTOCAD																		
4	4		OFFICE																		
5	5		SOLIDWORKS																		
6	6	GENERAL																			
7	7		AGENTS																		
8	8		CONTRACTS																		
9	9		MARKET REPORTS, GENERAL SALES AFFAIRS																		
10	10		MARKETS																		
11	11		CERTIFICATES																		
12	12		CE CERTIFICATES																		
13	13		CERTIFICATES FOR OLD BOATS																		
14	14		INSURANCES																		
15	15		TRADE REGISTER																		
16	16		CONSULTANTS																		
17	17		BV																		
18	18		DICK YOUNG																		
19	19		GL																		
20	20		RINA																		
21	21		SP																		
22	22		VAN CAPELLEN																		
23	23		DESIGNERS																		
24	24		ROYALTY																		
25	25		DRAWINGS																		
26	26		01 HULL																		
27	27		00 Hull general																		
28	28		01 Hull laminate																		
29	29		02 Hull stiffening																		
30	30		03 Hull colour and antifouling																		
31	31		04 Keel																		
32	32		05 Steering system																		
33	33		06 Mast step																		
34	34		07 Through hull fittings																		
35	35		08 Transom																		
36	36		09 Hull windows																		
37	37		10 Boarding ladders																		
38	38		11 Focsls																		
39	39		12 Lazarette																		
40	40		13 Dinghy garage																		
41	41		02 DECK																		
42	42		00 Deck general																		
43	43		01 Deck laminate																		
44	44		02 Deck colour																		
45	45		03 Teak woodwork																		
46	46		04 Winches & windlasses																		
47	47		05 Stemhead fitting and chainplates																		
48	48		06 Sail handling systems																		
49	49		07 Deck fittings																		
50	50		08 GRP mouldings and vents																		
51	51		09 Hatches and windows																		
52	52		10 Cockpits																		
53	53		11 Canvas work																		
54	54		03 INTERIOR																		
55	55		00 Interior general																		
56	56		01 Bulkheads																		
57	57		02 Forward cabins																		
58	58		03 Forward midship cabins																		
59	59		04 Aft midship cabins																		
60	60		05 Aft cabins																		
61	61		06 Saloon																		
62	62		07 Raised saloon																		
63	63		08 Galley																		
64	64		09 Crew mess																		
65	65		10 Navigation area																		
66	66		11 Toilets, showers general																		
67	67		12 Forward toilets, showers																		
68	68		13 Forward midship toilets, showers																		
69	69		14 Aft midship toilets, showers																		
70	70		15 Aft toilets, showers																		
71	71		16 Engine room																		
72	72		17 Control room																		
73	73		18 Noise and vibration control																		
74	74		04 ENGINE AND HYDRAULICS																		
75	75		00 Engine and hydraulics general																		
76	76		01 Main engine																		
77	77		02 Propulsion systems																		
78	78		03 Engine cooling system																		
79	79		04 Fuel system																		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5		NA Material Management	NA Technical Office	NA Yacht Management	NA Foremen Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1																					
81	80							05 Exhaust system													
82	81							06 Diesel generator													
83	82							07 Lub oil system													
84	83							08 Engine controls													
85	84							09 Thrusters													
86	85							10 Fire fighting systems													
87	86							11 Engine room other													
88	87							20 Hydraulics													
89	88							21 Central hydraulic system													
90	89							22 Power pack													
91	90							30 Pneumatics													
92	91							05 PLUMBING AND VENTILATION													
93	92							00 Plumbing and ventilation general													
94	93							01 Fresh water system													
95	94							02 Sea water system													
96	95							03 Grey water system													
97	96							04 Black water system													
98	97							05 Drainage system													
99	98							06 LPG system													
100	99							07 Ventilation													
101	100							08 Heating systems													
102	101							09 Refrigeration systems													
103	102							10 Domestic appliances													
104	103							11 Central vacuum cleaning systems													
105	104							06 ELECTRICAL													
106	105							00 Electrical general													
107	106							01 AC-system													
108	107							02 Earthing system													
109	108							03 Powered hydraulics													
110	109							04 DC-system													
111	110							05 Plumbing and monitoring systems													
112	111							06 Engine and generator DC													
113	112							07 Instrument power supply													
114	113							08 Ventilation and heaters													
115	114							09 Electrical panels													
116	115							10 Domestic appliances													
117	116							11 Lights													
118	117							07 ELECTRONICS													
119	118							00 Electronics general													
120	119							01 Compasses, clocks and barometers													
121	120							02 Sailing instruments													
122	121							03 Navigation systems													
123	122							04 Communication systems													
124	123							05 Entertainment systems													
125	124							06 Autopilot systems													
126	125							07 Aerials													
127	126							08 Computer systems													
128	127							09 Security systems													
129	128							10 Safety systems													
130	129							08 RIG													
131	130							00 Rig general													
132	131							01 Mast													
133	132							02 Booms and poles													
134	133							03 Standing rigging													
135	134							04 Running rigging													
136	135							05 Furlers													
137	136							06 Rig hydraulics													
138	137							09 EQUIPMENT													
139	138							00 Equipment general													
140	139							01 Manuals and warranty cards													
141	140							02 Anchoring and mooring													
142	141							03 Sailing gear													
143	142							04 Fire fighting equipment													
144	143							05 Safety equipment													
145	144							06 Spare parts													
146	145							07 Tools													
147	146							99 Other													
148	147							ELSA													
149	148							+%boat size% - %serial number% (ex. 82-701)													
150	149							SLUT													
151	150							SYSTEM													
152	151							FLEXMILL													
153	152																				
154	153							GENERAL CORRESPONDENCE													
155	154							FINANCING COMPANIES, BANKS													
156	155							LAWYERS AND LEGAL MATTERS													
157	156							LOCAL AUTHORITIES													
158	157							OLD CUSTOMERS													
159	158							PARENT COMPANY													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5		NA Material Management	NA Technical Office	NA Yacht Management	NA Foreman Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1																					
160	159				PR																
161	160				SUBSIDIARIES																
162	161				INDUSTRIAL WELFARE																
163	162				MAINTENANCE																
164	163				MEDIA																
165	164				NAVAL ARCHITECTS																
166	165				BRENTA																
167	166				FRERS																
168	167				TRIPP																
169	168				NOTIFIED BODY																
170	169				CE																
171	170				LLOYD																
172	171				VTT																
173	172				PRICING OF OPTIONAL EQUIPMENT																
174	173				PURCHASE DOCUMENTS																
175	174				QUALITY CONTROL AND TESTING																
176	175				INSTRUCTIONS																
177	176				TEST DOCUMENTS FOR PRODUCTION																
178	177				TEST PROTOCOLS																
179	178				QUOTATIONS – UNSOLD BOATS																
180	179				SWAN 45																
181	180				01 HULL																
182	181				02 DECK																
183	182				03 INTERIOR																
184	183				04 ENGINE AND HYDRAULICS																
185	184				05 PLUMBING																
186	185				06 ELECTRICAL																
187	186				07 ELECTRONICS																
188	187				08 RIG																
189	188				09 EQUIPMENT																
190	189				STANDARD SPECIFICATIONS																
191	190				DRAWINGS PDF-FILES																
192	191				OPTIONAL LISTS																
193	192				SWAN 46																
194	193				SWAN 53																
195	194				SWAN 56																
196	195				SWAN 601																
197	196				SWAN 62 FD																
198	197				SWAN 62 RS																
199	198				SWAN 66																
200	199				etc.																
201	200				REAL ESTATE																
202	201				REGULATIONS AND STANDARDS																
203	202				SUPPLIERS																
204	203				HALL SPARS																
205	204				Drawings																
206	205				Manuals																
207	206				Material certificates																
208	207				Packing lists and delivery notes																
209	208				Price Lists																
210	209				Product specifications																
211	210				Test reports																
212	211				Warranty																
213	212				HARKEN																
214	213				Drawings																
215	214				Manuals																
216	215				Material certificates																
217	216				Packing lists and delivery notes																
218	217				Price Lists																
219	218				Product specifications																
220	219				Test reports																
221	220				Warranty																
222	221				LEWMAR																
223	222				Drawings																
224	223				Manuals																
225	224				Material certificates																
226	225				Packing lists and delivery notes																
227	226				Price Lists																
228	227				Product specifications																
229	228				Test reports																
230	229				Warranty																
231	230				OFFSHORE SPARS																
232	231				Drawings																
233	232				Manuals																
234	233				Material certificates																
235	234				Packing lists and delivery notes																
236	235				Price Lists																
237	236				Product specifications																
238	237				Test reports																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5		NA Material Management	NA Technical Office	NA Yacht Management	NA Foremen Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1																					
239	238						Warranty														
240	239						TECHNICAL INFORMATION														
241	240						CONDENSED SWAN DATABOOK														
242	241						IMPROVEMENTS														
243	242						TRADE IN BOATS														
244	243						AGENTS														
245	244						BROKERS														
246	245						CONTRACTS														
247	246						CUSTOMERS														
248	247						EXTRAS SPECIFICATIONS														
249	248						SURVEY REPORTS														
250	249						+PROJECTS														
251	250						+%boat size%														
252	251						%serial number%														
253	252						01 HULL														
254	253						00 Hull general														
255	254						01 Hull laminate														
256	255						02 Hull stiffening														
257	256						03 Hull colour and antifouling														
258	257						04 Keel														
259	258						05 Steering system														
260	259						06 Mast step														
261	260						07 Through hull fittings														
262	261						08 Transom														
263	262						09 Hull windows														
264	263						10 Boarding ladders														
265	264						11 Focslie														
266	265						12 Lazarette														
267	266						13 Dinghy garage														
268	267						02 DECK														
269	268						00 Deck general														
270	269						01 Deck laminate														
271	270						02 Deck colour														
272	271						03 Teak woodwork														
273	272						04 Winches & windlasses														
274	273						05 Stemhead fitting and chainplates														
275	274						06 Sail handling systems														
276	275						07 Deck fittings														
277	276						08 GRP mouldings and vents														
278	277						09 Hatches and windows														
279	278						10 Cockpits														
280	279						11 Canvas work														
281	280						03 INTERIOR														
282	281						00 Interior general														
283	282						01 Bulkheads														
284	283						02 Forward cabins														
285	284						03 Forward midship cabins														
286	285						04 Aft midship cabins														
287	286						05 Aft cabins														
288	287						06 Saloon														
289	288						07 Raised saloon														
290	289						08 Galley														
291	290						09 Crew mess														
292	291						10 Navigation area														
293	292						11 Toilets, showers general														
294	293						12 Forward toilets, showers														
295	294						13 Forward midship toilets, showers														
296	295						14 Aft midship toilets, showers														
297	296						15 Aft toilets, showers														
298	297						16 Engine room														
299	298						17 Control room														
300	299						18 Noise and vibration control														
301	300						04 ENGINE AND HYDRAULICS														
302	301						00 Engine and hydraulics general														
303	302						01 Main engine														
304	303						02 Propulsion systems														
305	304						03 Engine cooling system														
306	305						04 Fuel system														
307	306						05 Exhaust system														
308	307						06 Diesel generator														
309	308						07 Lub oil system														
310	309						08 Engine controls														
311	310						09 Thrusters														
312	311						10 Fire fighting systems														
313	312						11 Engine room other														
314	313						20 Hydraulics														
315	314						21 Central hydraulic system														
316	315						22 Power pack														
317	316						30 Pneumatics														

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5		NA Material Management	NA Technical Office	NA Yacht Management	NA Foreman Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1																					
318	317							05 PLUMBING AND VENTILATION													
319	318							00 Plumbing and ventilation general													
320	319							01 Fresh water system													
321	320							02 Sea water system													
322	321							03 Grey water system													
323	322							04 Black water system													
324	323							05 Drainage system													
325	324							06 LPG system													
326	325							07 Ventilation													
327	326							08 Heating systems													
328	327							09 Refrigeration systems													
329	328							10 Domestic appliances													
330	329							11 Central vacuum cleaning systems													
331	330							06 ELECTRICAL													
332	331							00 Electrical general													
333	332							01 AC-system													
334	333							02 Earthing system													
335	334							03 Powered hydraulics													
336	335							04 DC-system													
337	336							05 Plumbing and monitoring systems													
338	337							06 Engine and generator DC													
339	338							07 Instrument power supply													
340	339							08 Ventilation and heaters													
341	340							09 Electrical panels													
342	341							10 Domestic appliances													
343	342							11 Lights													
344	343							07 ELECTRONICS													
345	344							00 Electronics general													
346	345							01 Compasses, clocks and barometers													
347	346							02 Sailing instruments													
348	347							03 Navigation systems													
349	348							04 Communication systems													
350	349							05 Entertainment systems													
351	350							06 Autopilot systems													
352	351							07 Aerials													
353	352							08 Computer systems													
354	353							09 Security systems													
355	354							10 Safety systems													
356	355							08 RIG													
357	356							00 Rig general													
358	357							01 Mast													
359	358							02 Booms and poles													
360	359							03 Standing rigging													
361	360							04 Running rigging													
362	361							05 Furlers													
363	362							06 Rig hydraulics													
364	363							09 EQUIPMENT													
365	364							00 Equipment general													
366	365							01 Manuals and warranty cards													
367	366							02 Anchoring and mooring													
368	367							03 Sailing gear													
369	368							04 Fire fighting equipment													
370	369							05 Safety equipment													
371	370							06 Spare parts													
372	371							07 Tools													
373	372							99 Other													
374	373							AGENDA													
375	374							BUDGET													
376	375							BUILDING INSTRUCTIONS													
377	376							+CHANGE ORDERS													
378	377							53-507 CO 03.01.06													
379	378							53-507 SPEC 03.01.06													
380	379							etc													
381	380							COMMISSIONING													
382	381							Damage report													
383	382							Familiarisation													
384	383							Overseas delivery													
385	384							Rig check													
386	385							Safety check													
387	386							Test sail log													
388	387							CONTRACT													
389	388							CORRESPONDENCE WITH AGENT													
390	389							CORRESPONDENCE WITH CUSTOMER													
391	390							CORRESPONDENCE WITH SUPPLIERS													
392	391							FINANCIAL PROJECT PLANS													
393	392							HOURS & MATERIAL													
394	393							MANUALS													
395	394							MINUTES													
396	395							Kick-off meeting													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	No.	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5		NA Material Management	NA Technical Office	NA Yacht Management	NA Foreman Production	NA Management Team	NA Finance	NA Customer Care	NA Document distribution	NA Flexmill	NA Quality Management	NA Human Resource	NA Facility	OBS
1																					
397	396							Meeting with customer													
398	397							Progress meeting													
399	398							Test protocols													
400	399							+SPECIFICATIONS													
401	400							53-507 CO 03.01.06													
402	401							53-507 SPEC 03.01.06													
403	402							etc													
404	403							TIME SCHEDULE													
405	404							WEIGHT & TRIM													
406	405							+STANDARD													
407	406							%boat size%													
408	407							01 HULL													
409	408							02 DECK													
410	409							03 INTERIOR													
411	410							04 ENGINE AND HYDRAULICS													
412	411							05 PLUMBING AND VENTILATION													
413	412							06 ELECTRICAL													
414	413							07 ELECTRONICS													
415	414							08 RIG													
416	415							09 EQUIPMENT													
417	416							DRAWINGS PDF-FILES													
418	417							OPTIONAL LISTS													
419	418							STANDARD SPECIFICATIONS													
420																					
421	Folder Permission list:																				
422	1. Add or delete a folder																				Admin
423	2. Add or rename file																				User rights
424	3. Can update the design of cards																				Admin
425	4. Delete file																				User rights
426	5. Destroy files in recycle bin																				Admin
427	6. Increment revision of a file																				(workflow)
428	7. Lock/unlock file																				User rights
429	8. Read file contents&Show working versions of files																				User rights&read only
430	9. Recover files from recycle bin																				User rights
431	10. Share file to another folder																				nobody
432	12. Rollback																				Admin
433																					
434	Colors:																				
435	Read only																				
436	User Rights																				
437																					

APPENDIX 4 – List of document types

Lista över dokument

03.01.2006 / KiS

AVTAL / SPECIFIKATIONER

- * Båtspecifikation
- * Båtkontrakt
- * Change orders
- * Tidplan/milestones

TIDPLANER

- * Tidplaner (Budget, prognos, aktuell)
- * Personlig task-lista

RITNINGAR

- * Nautor projekt ritningar
- * Nautor standard ritningar
- * Externa ritningar (Brenta, D.Y.D m.m.)
- * Leverantörers ritningar (se leverantörsinfo)
- * Certifieringsritningar (CE)
- * Klassificeringsritningar (RINA, GL, BV m.m.)

KALKYLER & BERÄKNINGAR

- * Nautor beräkningar
- * Externa beräkningar

PROTOKOLL

- * Interna mötesprotokoll
- * Externa mötesprotokoll
- * Progressmötesprotokoll

KORRESPONDENS

- * Kundkorrespondens (e-mail, fax, m.m.)
- * Leverantörskorrespondens (e-mail, fax, m.m.)

INSTRUKTIONER

- * Bygginstruktioner
- * Testinstruktioner
- * Arbetsinstruktioner

RAPPORTER

- * Testrapporter
- * VTT's testrapporter

INKÖP

- * Inköpsanmodan
- * Inköpsordrar

LEVERANTÖRSINFORMATION

- * Leverantörsmanualer
- * Leverantörers produkt specifikationer
- * Leverantörers prislistor
- * Leverantörers ritningar
- * Leverantörers materialcertifikat
- * Leverantörers testrapporter
- * Leverantörers packlistor & forsedlar

BÅT DOKUMENTATION

- * Båtmanualer

PRODUKTIONS DOKUMENT

- * "Gula häftet"
- * Förbättringsförslag ~"100 000-nummer"
- * Viktuppföljning
- * Foton ur båtarna (i olika skeden)

LAGER INFORMATION

- * Lagerlistor

LAGAR & STANDARDER

- * ISO standarder

APPENDIX 5 – User interface of PDMWorks Enterprise

The screenshot displays the PDMWorks Enterprise software interface. The top menu bar includes File, Edit, View, Favorites, Tools, and Help. Below the menu is a toolbar with various icons for file operations and viewing. The main window is divided into several panes:

- Left Pane (Folders):** Shows a hierarchical tree of project folders. The selected folder is '01000 Hull general'. Other visible folders include 'Projects', 'Conio Implementation', 'Document Templates', 'General', 'Projects', '60', '66', '80', '000', '01 HULL', '0100 Hull general', '0101 Hull laminate', '0102 Hull stiffening', '0103 Hull finish', '0104 Keel', '0105 Steering system', '0106 Mast step', '0107 Through hull fittings', '0108 Transom', '0109 Hull windows', '0110 Boarding ladders', '0111 Foode', '0112 Lasareta', '0113 Dmity garage', '02 DECK', '03 INTERIOR', '04 ENGINE AND HYDRAULICS', '05 PLUMBING AND VENTILATION', '06 ELECTRICAL', '07 ELECTRONICS', '08 RIG', '09 EQUIPMENT', 'AGENDA', 'BUDGET', 'BUILDING INSTRUCTIONS', 'CHANGE ORDERS', 'COMMISSIONING', 'CONTRACT', 'CORRESPONDENCE WITH AGENT', 'CORRESPONDENCE WITH CUSTOMER', 'CORRESPONDENCE WITH SUPPLIERS', 'FINANCIAL PROJECT PLANS', 'HOURS & MATERIAL', 'MANUALS', 'MINUTES', 'SPECIFICATIONS', 'TIME SCHEDULE', 'WEIGHT & TRIM', 'XREF', '101', '62', and 'Standard'.
- Top Pane (Revision Table):** A table listing revisions with columns for Name, Rev, State, Size, Checked Out By, Description, and Modified.

Name	Rev	State	Size	Checked Out By	Description	Modified
0001892.dwg	A	Working	312 KB		Location of core ship	24.11.2009 11:50:04
0002026 Hull geometry open transom.sldprt	A	Approved	4 719 KB		Hull geometry open transom	26.11.2009 13:18:54
0002026 Hull assembly.sldasm		Working	10 088 KB		Hull assembly	19.01.2010 13:46:04
0002346 Hull expansion.dwg		Working	330 KB		Hull expansion	12.01.2009 11:42:18
0002536 Hull inside surface.sldprt		Approved	16 906 KB		Hull inside surface	13.03.2009 14:03:38
0002538 Hull inside surface.X_T		Working	3 766 KB		Hull inside surface	13.03.2009 14:18:56
0003724 Hull open transom.sldprt		Working	7 812 KB		Hull open transom	14.09.2009 09:45:04
0003724 Hull assembly.xlsx	A	Working	12 KB	HSJ	Structural general arrangements	29.05.2009 11:51:28
0004927 Hull closed transom.sldprt		Working	5 421 KB		Hull closed transom	17.12.2009 15:59:36
0005946 Hull-deck joint.dwg		Working	98 KB		Hull-deck joint	27.11.2009 08:00:34
- Right Pane (3D Model):** Displays a 3D isometric view of a ship hull assembly. The hull is shown in a light blue color, with internal structural components like the transom and deck joint highlighted in yellow and orange. The model is oriented vertically, showing the hull's profile and internal structure.
- Bottom Pane (Properties):** Shows the properties of the selected item, including 'Preview', 'Data Card', 'Version 33/33', 'Bill of Materials', 'Contains', and 'Where Used'.

The status bar at the bottom indicates 'Type: SolidWorks Assembly Document' and 'Checked Out By:'. The file size is shown as 9.05 MB.

0100 Hull general

File Edit View Favorites Tools Help

Address: C:\Projects\Projects\801000101 HULL\0100 Hull general

Folders

- Projects
 - Consolid Implementation
 - Document Templates
 - General
 - Projects
 - 60
 - 66
 - 80
 - 01 HULL
 - 0100 Hull general
 - 0101 Hull frame
 - 0102 Hull stiffening
 - 0103 Hull finish
 - 0104 Keel
 - 0105 Steering system
 - 0106 Mast step
 - 0107 Through hull fittings
 - 0108 Transom
 - 0109 Hull windows
 - 0110 Boarding ladders
 - 0111 Focle
 - 0112 Laserette
 - 0113 Dringly garage
 - 02 DECK
 - 03 INTERIOR
 - 04 ENGINE AND HYDRAULICS
 - 05 PLUMBING AND VENTILATION
 - 06 ELECTRICAL
 - 07 ELECTRONICS
 - 08 RIG
 - 09 EQUIPMENT
 - AGENDA
 - BUDGET
 - BUILDING INSTRUCTIONS
 - CHANGE ORDERS
 - COMMISSIONING
 - CONTRACT
 - CORRESPONDENCE WITH AGENT
 - CORRESPONDENCE WITH CUSTOMER
 - CORRESPONDENCE WITH SUPPLIERS
 - FINANCIAL PROJECT PLANS
 - HOURS & MATERIAL
 - MANUALS
 - MINUTES
 - SPECIFICATIONS
 - TIME SCHEDULE
 - WEIGHT & TRIM
 - XREF
 - 101
 - 62
 - Standard

Name

Name	Rev	State	Size	Checked Out By	Description	Modified
0001892.dwg						24.11.2009 11:50:04
0002026 Hull geometry open transom.SLDPRG	A	Working	312 KB		Location of cove stripe	26.11.2009 13:18:54
0002026 Hull assembly.SLDASM	A	Approved	4 719 KB		Hull geometry open transom	19.01.2010 13:46:04
0002346 Hull expansion.dwg		Working	10 088 KB		Hull assembly	12.01.2009 11:42:18
0002536 Hull inside surface.SLDPRG		Working	330 KB		Hull expansion	13.03.2009 14:03:38
0002538 Hull inside surface.X_T		Approved	16 906 KB		Hull inside surface	13.03.2009 14:03:38
0002567 Hull open transom.SLDPRG		Working	3 766 KB		Hull inside surface	14.09.2009 09:45:04
0003724 Hull assembly.xlsx		Working	7 812 KB		Hull open transom	29.05.2009 11:51:28
0004927 Hull closed transom.sldprt	A	Working	12 KB	H53	Structural general arrangements	17.12.2009 15:59:36
0005946 Hull-deck joint.dwg		Working	5 421 KB		Hull open transom	27.11.2009 08:00:34
		Working	98 KB		Hull-deck joint	

Revision history

Rev	Description	Created date	By
1	Checked	21.01.2010	
2	Approved	21.01.2010	

Document data

Yacht: 800 Hull: 001 Section: 001 Group: 000 Subgroup: 000 Drawing Number: 0002026

Workflow

Drawn: 24.11.2008 Signature: KIS Date: 24.11.2008

Checked: 21.01.2010

Approved: 21.01.2010

2D

Scale: Size: Start date: 24.11.2008 Planned date: 24.11.2008 Progress: 0 %

B.O.M.

Drawing ID: Description: Hull assembly

Dimensions: Material: Material <not speci

Item no: Supplier mat. code

Type: SolidWorks Assembly Document Checked Out By: 9.05 MB

0100 Hull general

File Edit View Favorites Tools Help

Back Forward Search Folders

Address: C:\Projects\Projects\801000101 HULL\0100 Hull general

Folders:

- Projects
 - Condo Implementation
 - Document Templates
 - General
 - Projects
 - 60
 - 66
 - 80
 - 000
 - 01 HULL
 - 0100 Hull general
 - 0101 Hull laminate
 - 0102 Hull stiffening
 - 0103 Hull finish
 - 0104 Keel
 - 0105 Steering system
 - 0106 Mast step
 - 0107 Through hull fittings
 - 0108 Transom
 - 0109 Hull windows
 - 0110 Boarding ladders
 - 0111 Focle
 - 0112 Lascette
 - 0113 Dinghy garage
 - 02 DECK
 - 03 INTERIOR
 - 04 ENGINE AND HYDRAULICS
 - 05 PLUMBING AND VENTILATION
 - 06 ELECTRICAL
 - 07 ELECTRONICS
 - 08 RIG
 - 09 EQUIPMENT
 - AGENDA
 - BUDGET
 - BUILDING INSTRUCTIONS
 - CHANGE ORDERS
 - COMMISSIONING
 - CONTRACT
 - CORRESPONDENCE WITH AGENT
 - CORRESPONDENCE WITH CUSTOMER
 - CORRESPONDENCE WITH SUPPLIERS
 - FINANCIAL PROJECT PLANS
 - HOURS & MATERIAL
 - MANUALS
 - MINUTES
 - SPECIFICATIONS
 - TIME SCHEDULE
 - WEIGHT & TRIM
 - XREF

Name: 0001892.dwg

Rev: A

State: Working

Size: 312 KB

Description: Location of core ships

Modified: 24.11.2009 11:50:04

0001967 Hull geometry open transom.SLDPRT

0002026 Hull assembly.SLDASM

0002346 Hull expansion.dwg

0002536 Hull inside surface.SLDPRT

0002538 Hull inside surface.X_T

0002567 Hull open transom.SLDPRT

0003724 Hull assembly.xlsx

0004927 Hull closed transom.sldprt

0005946 Hull-deck joint.dwg

0100 Hull general

0101 Hull laminate

0102 Hull stiffening

0103 Hull finish

0104 Keel

0105 Steering system

0106 Mast step

0107 Through hull fittings

0108 Transom

0109 Hull windows

0110 Boarding ladders

0111 Focle

0112 Lascette

0113 Dinghy garage

02 DECK

03 INTERIOR

04 ENGINE AND HYDRAULICS

05 PLUMBING AND VENTILATION

06 ELECTRICAL

07 ELECTRONICS

08 RIG

09 EQUIPMENT

AGENDA

BUDGET

BUILDING INSTRUCTIONS

CHANGE ORDERS

COMMISSIONING

CONTRACT

CORRESPONDENCE WITH AGENT

CORRESPONDENCE WITH CUSTOMER

CORRESPONDENCE WITH SUPPLIERS

FINANCIAL PROJECT PLANS

HOURS & MATERIAL

MANUALS

MINUTES

SPECIFICATIONS

TIME SCHEDULE

WEIGHT & TRIM

XREF

101

62

Standard

0002026 Hull assembly.SLDASM

Source: 0002026 Hull assembly.SLDASM

Configuration: Default <Active Configuration>

Source version: 33

BOM Properties

☐ Activated

☐ Show Selected

☒ As Built

QTY	Description	Material	Dimension	Item nr	Dwg no	Sec
1	Keel mold inlay	Material <not specified>				01
1	Keel bulb - standard version	Material <not specified>				06
1	Keel fin - standard version	Material <not specified>				01
1	Keel floor 3	Material <not specified>				01
1	Keel floor 2	Material <not specified>				01
1	Keel floor 1	Material <not specified>				01
1	Outboard hull girder	Material <not specified>				01
1	Inboard hull girder	Material <not specified>				01
1	Max Power R300 hydraulic bow thruster	Material <not specified>				04
1	Structural general arrangements	Material <not specified>				01
1	Structural general arrangements	Material <not specified>				01
1	Keel floor 3	Material <not specified>				01
1	Keel floor 2	Material <not specified>				01
1	Keel floor 1	Material <not specified>				01
1	Outboard hull girder	Material <not specified>				01
1	Inboard hull girder	Material <not specified>				01

Edited Value (Unsaved) Edited Value (Saved)

Type: SolidWorks Assembly Document Checked Out By:

9.05 MB

SolidWorks Enterprise PDM View

0100 Hull general

File Edit View Favorites Tools Help

Back Search Folders

Address: C:\Projects\Projects\801000101 HULL\0100 Hull general

01 HULL

- 0100 Hull general
- 0101 Hull laminate
- 0102 Hull stiffening
- 0103 Hull finish
- 0104 Keel
- 0105 Steering system
- 0106 Mast step
- 0107 Through hull fittings
- 0108 Transom
- 0109 Hull windows
- 0110 Boarding ladders
- 0111 Focle
- 0112 Lascette
- 0113 Dmgly garage
- 02 DECK
- 03 INTERIOR
- 04 ENGINE AND HYDRAULICS
- 05 PLUMBING AND VENTILATION
- 06 ELECTRICAL
- 07 ELECTRONICS
- 08 RIG
- 09 EQUIPMENT
- AGENDA
- BUDGET
- BUILDING INSTRUCTIONS
- CHANGE ORDERS
- COMMISSIONING
- CONTRACT
- CORRESPONDENCE WITH AGENT
- CORRESPONDENCE WITH CUSTOMER
- CORRESPONDENCE WITH SUPPLIERS
- FINANCIAL PROJECT PLANS
- HOURS & MATERIAL
- MANUALS
- MINUTES
- SPECIFICATIONS
- TIME SCHEDULE
- WEIGHT & TRIM
- XREF
- 101
- 62
- Standard

0001892.dwg

0001967 Hull geometry open transom.SLDprt

0002026 Hull assembly.SLDasm

0002346 Hull expansion.dwg

0002536 Hull inside surface.SLDprt

0002538 Hull inside surface.X_T

0002567 Hull open transom.SLDprt

0003724 Hull assembly.xlsx

0004927 Hull closed transom.sldprt

0005946 Hull-deck joint.dwg

Name	Rev	State	Size	Checked Out By	Description	Modified
0001892.dwg	A	Working	312 KB		Location of core ships	24.11.2009 11:50:04
0001967 Hull geometry open transom.SLDprt	A	Approved	4 719 KB		Hull geometry open transom	26.11.2009 13:18:54
0002026 Hull assembly.SLDasm		Working	10 088 KB		Hull assembly	19.01.2010 13:46:04
0002346 Hull expansion.dwg		Working	330 KB		Hull expansion	12.01.2009 11:42:18
0002536 Hull inside surface.SLDprt		Approved	16 906 KB		Hull inside surface	13.03.2009 14:03:38
0002538 Hull inside surface.X_T		Working	3 766 KB		Hull inside surface	13.03.2009 14:18:56
0002567 Hull open transom.SLDprt		Working	7 812 KB		Hull open transom	14.09.2009 09:45:04
0003724 Hull assembly.xlsx	A	Working	12 KB	HSD	Structural general arrangements	29.05.2009 11:51:28
0004927 Hull closed transom.sldprt		Working	5 421 KB		Hull open transom	17.12.2009 15:59:36
0005946 Hull-deck joint.dwg		Working	98 KB		Hull-deck joint	27.11.2009 08:00:34

Version: 33. <No comment>

Default: <Active Configuration>

File Name	Result	Quantity	Version	Checked Out By	Checked Out In	Found In
0002026 Hull assembly.SLDasm	OK	1	33/33			C:\Projects\Projects\80100
0002012 Structural general arrangements.SLDasm	OK	1	30/30			C:\Projects\Projects\80100
0001962 Structural bulkhead A.SLDasm	OK	1	19/19			C:\Projects\Projects\80100
0001984 Structural bulkhead B.SLDasm	OK	1	12/12			C:\Projects\Projects\80100
0001985 Structural bulkhead C.SLDprt	OK	1	13/13			C:\Projects\Projects\80100
0001986 Structural bulkhead C.SLDasm	OK	1	17/17			C:\Projects\Projects\80100
0001987 Structural bulkhead D.SLDprt	OK	1	14/14			C:\Projects\Projects\80100
0001988 Structural bulkhead D.SLDasm	OK	1	17/17			C:\Projects\Projects\80100
0001991 Structural bulkhead E.SLDprt	OK	1	15/15			C:\Projects\Projects\80100
0001992 Structural bulkhead E.SLDasm	OK	1	21/21			C:\Projects\Projects\80100
0001993 Structural bulkhead F.SLDprt	OK	1	18/18			C:\Projects\Projects\80100
0001994 Structural bulkhead F.SLDasm	OK	1	23/23			C:\Projects\Projects\80100
0001995 Structural bulkhead G.SLDprt	OK	1	19/19			C:\Projects\Projects\80100
0001996 Structural bulkhead G.SLDasm	OK	1	26/26			C:\Projects\Projects\80100
0001997 Structural bulkhead H.SLDprt	OK	1	21/21			C:\Projects\Projects\80100
0001998 Structural bulkhead H.SLDasm	OK	1	24/24			C:\Projects\Projects\80100
0001999 Structural bulkhead I.SLDprt	OK	1	22/22			C:\Projects\Projects\80100
0002000 Structural bulkhead I.SLDasm	OK	1	20/20			C:\Projects\Projects\80100
0002001 Structural bulkhead J.SLDprt	OK	1	8/8			C:\Projects\Projects\80100
0002002 Structural bulkhead J.SLDasm	OK	1	7/12			C:\Projects\Projects\80100
0002003 Structural bulkhead K.SLDprt	OK	1	11/11			C:\Projects\Projects\80100
0002004 Structural bulkhead K.SLDasm	OK	1	10/10			C:\Projects\Projects\80100
0002005 Structural bulkhead L.SLDprt	OK	1	11/11			C:\Projects\Projects\80100
0002006 Structural bulkhead L.SLDasm	OK	1	17/17			C:\Projects\Projects\80100
0002007 Tender bay sole.SLDprt	OK	1	17/17			C:\Projects\Projects\80100
0002008 Tender bay sole.SLDasm	OK	2	2/2			C:\Projects\Projects\80100
0005007 Steering System Autopilot Fitting.SLDprt	OK	1	3/3			C:\Projects\Projects\80100
0005008 Tender Bay Sole Autopilot Reinforcement.SLDprt	OK	1				C:\Projects\Projects\80100

Type: SolidWorks Assembly Document. Checked Out By: 9.05 MB

0100 Hull general

File Edit View Favorites Tools Help

Back Search Folders

Address: C:\Projects\Projects\801000101 HULL\0100 Hull general

Folders

- Projects
 - Condo Implementation
 - Document Templates
 - General
 - Projects
 - 60
 - 66
 - 80
 - 000
 - 01 HULL
 - 0100 Hull general
 - 0101 Hull laminate
 - 0102 Hull stiffening
 - 0103 Hull finish
 - 0104 Keel
 - 0105 Steering system
 - 0106 Mast step
 - 0107 Through hull fittings
 - 0108 Transom
 - 0109 Hull windows
 - 0110 Boarding ladders
 - 0111 Focle
 - 0112 Lascette
 - 0113 Dinghy garage
 - 02 DECK
 - 03 INTERIOR
 - 04 ENGINE AND HYDRAULICS
 - 05 PLUMBING AND VENTILATION
 - 06 ELECTRICAL
 - 07 ELECTRONICS
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 - AGENDA
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 - CHANGE ORDERS
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 - CONTRACT
 - CORRESPONDENCE WITH AGENT
 - CORRESPONDENCE WITH CUSTOMER
 - CORRESPONDENCE WITH SUPPLIERS
 - FINANCIAL PROJECT PLANS
 - HOURS & MATERIAL
 - MANUALS
 - MINUTES
 - SPECIFICATIONS
 - TIME SCHEDULE
 - WEIGHT & TRIM
 - XREF
 - 101
 - 62
 - Standard

Name **Rev** **State** **Size** **Checked Out By** **Description** **Modified**

0001892.dwg	A	Working	312 KB		Location of cove ships	24.11.2009 11:50:04
0002026 Hull geometry open transom.SLDPRT	A	Approved	4 719 KB		Hull geometry open transom	26.11.2009 13:18:54
0002026 Hull assembly.SLDASM		Working	10 088 KB		Hull assembly	19.01.2010 13:46:04
0002346 Hull expansion.dwg		Working	330 KB		Hull expansion	12.01.2009 11:42:18
0002536 Hull inside surface.SLDPRT		Approved	16 906 KB		Hull inside surface	13.03.2009 14:03:38
0002538 Hull inside surface.X_T		Working	3 766 KB		Hull inside surface	13.03.2009 14:18:56
0002567 Hull open transom.SLDPRT		Working	7 812 KB		Hull open transom	14.09.2009 09:45:04
0003724 Hull assembly.xlsx		Working	12 KB	HSJ	Structural general arrangements	29.05.2009 11:51:28
0004927 Hull closed transom.sldprt	A	Working	5 421 KB		Hull open transom	17.12.2009 15:59:36
0005946 Hull-deck-joint.dwg		Working	98 KB		Hull-deck joint	27.11.2009 08:00:34

Preview **Data Card** **Version 33/33** **Bill of Materials** **Contains** **Where Used**

Version: 33. <No comment>

Default: <Active Configuration>

File Name	Configuration Name	Quantity	Version	Checked Out By	Checked Out In	Found In
0002026 Hull assembly.SLDASM	Default	1	33/33			C:\Projects\Projects\801000101 HULL\0100 Hull general
0006061 Fresh water system tank ventilation assembly.SLDASM	Fresh water tank ventilation	1	7/7			C:\Projects\Projects\801000101 HULL\0100 Hull general
0006061 Fresh water system tank ventilation assembly.SLDRAW	Model	1	3/3			C:\Projects\Projects\801000101 HULL\0100 Hull general

Type: SolidWorks Assembly Document Checked Out By: 9.85 MB

APPENDIX 6 – Search card design

Nautor CAD Search

Header Info Item Distribution Variable Search

Yacht: Boat Hull Section: Sect Group: Group_ Subgroup: Subgroi Drawing Number: Name Rev: Rev_

☐ REF model REF section: REFSection

Description 2: Desc2_and_Subject

Description 3: Description_3

Workflow

Drawn: 25. 1. 2010 Author: Author Locked: Checked Out by Us

Checked: 25. 1. 2010 Checked By: Checked_By State: State

Approved: 25. 1. 2010 Approved by: Approved by Workflow - State Nai

Progress: Progi % Planned date: 25. 1. 2010 ☐ Search previous versions

Search Folder Path Browse...

Nautor CAD Search

Header Info Item Distribution Variable Search

Notice text: Notice_text

Customer: Material

Quotation nr: Quotation_nr

Supplier name: Supplier_Name

External Source: External_Source

Source File Name: Source_File_Name

Comment: Comment

Search Folder Path Browse...

Nautor CAD Search

Header Info Item Distribution Variable Search

Bill Of Material Info

Description: Desc2_Desc3

Dimensions: Dimension Material: Material (SW) MFG-nr: MFG_nr Supplier mat. Code: Supplier_code

Search Folder Path Browse...

Nautor CAD Search

Header | Info | Item | **Distribution** | Variable Search

Distribution

<input type="checkbox"/> (Y) Yacht Manager	<input type="checkbox"/> (E) Electrical	<input type="checkbox"/> (L) Lamination	<input type="checkbox"/> (F) Finish
<input type="checkbox"/> (A) Assembly	<input type="checkbox"/> (Q) Owners Manual	<input type="checkbox"/> (J) Joinery	<input type="checkbox"/> (M) Mechanical
<input type="checkbox"/> (I) Installations	<input type="checkbox"/> (P) Plugs, Molds	<input type="checkbox"/> (S) Supply	<input type="checkbox"/> (R) Rig
<input type="checkbox"/> (D) Deck	<input type="checkbox"/> (C) Cust. care	Other: <input type="text" value="Distribution free"/>	

Search Folder Path

Nautor CAD Search

Header | Info | Item | **Distribution** | **Variable Search**

Variable Search Control

Search Folder Path

APPENDIX 7 – How to create documents in PDMWorks Enterprise

How to create documents in PDMWorks Enterprise

1(13)



PDMWorks® Enterprise

at Nautor's Swan

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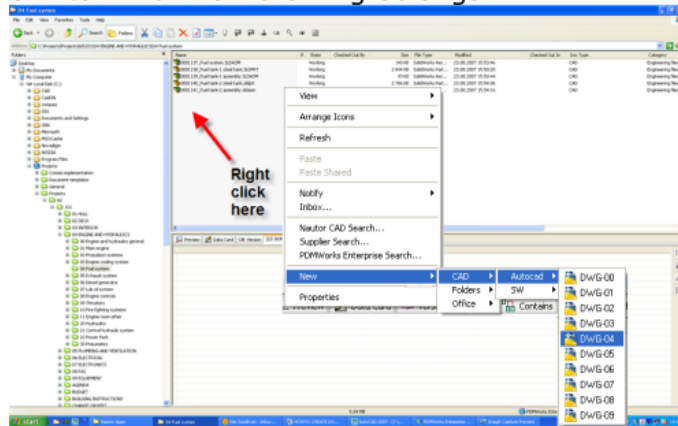
A. CREATE A NEW AUTOCAD DRAWING IN PDMWE.....	2
B. ADD AN EXISTING AUTOCAD DRAWING TO PDMWE.....	4
C. INSERT AUTOCAD DRAWING BORDER, HEADER AND REVISION BLOCK	6
D. CREATE A NEW SOLIDWORKS MODEL (SLDPRT, SLDASM) IN PDMWE	7
E. ADD A SW-MODEL (SLDPRT, SLDASM) TO PDMWE WITHIN SOLIDWORKS	9
F. ADD AN EXISTING SOLIDWORKS MODEL TO PDMWE	11

How to create documents in PDMWorks Enterprise

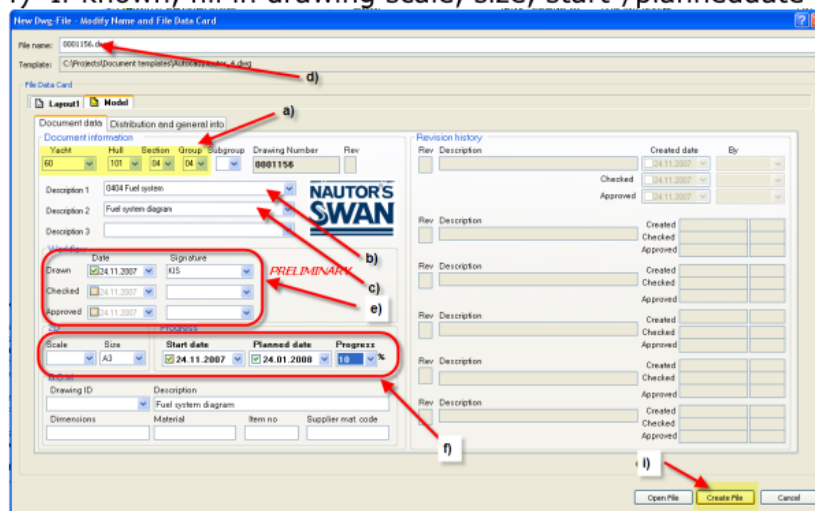
2(13)

A. CREATE A NEW AUTOCAD DRAWING IN PDMWE

- 1) Go to the folder in which you wish to add a drawing and right click in empty area below existing file list. Choose an Autocad template, e.g. "New/CAD/Autocad/DWG-04" to which new drawing belongs.



- 2) In "Document data tab" of the "New Dwg file" dialog:
 - a) check that Yacht, Hull, Section and group is correct
 - b) Check/choose correct "group" for Description 1 from drop down list
 - c) Fill in drawing descriptions for Description 2 & 3, free text but try to use from drop down list (standard texts).
 - d) Add "_Description2" to filename, e.g. 0001156_Fuel system diagram.dwg
 - e) If known, fill in Checked by and Approved by with dates
 - f) If known, fill in drawing scale, size, start-/planned date and progress.



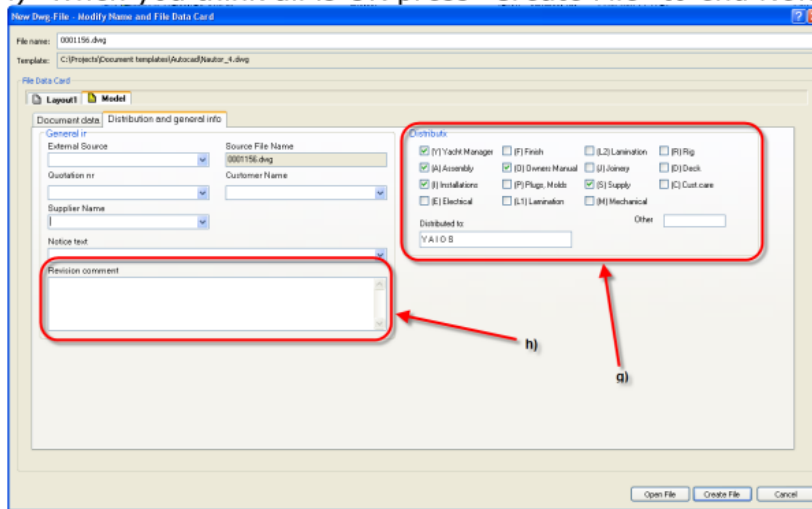
by Kim Sundkvist, 03.12.2007

How to create documents in PDMWorks Enterprise

3(13)

In the "Distribution and general info" tab:

- g) Fill in drawing distribution
- h) If needed fill in special revision comments (detailed information of revision etc...)
- i) When you think all is OK press "Create File" to end New Dwg File dialog.



- 3) You have now created an empty Autocad drawing file which should be named acc. to 0001156_Fuel system diagram.dwg where
 0001156 = 7 digit ID-code
 Fuel system diagram = Description 2 field in data card

!!! If you forgot to add _Description2 text in filename you can now rename file to include this.

Name	R	State	Checked Out By	Size
0001137_Fuel system.SLDASM		Working		140 KB
0001138_Fuel tank-1 steel tank.SLDPRT		Working		2 844 KB
0001139_Fuel tank-1 assembly.SLDASM		Working		93 KB
0001140_Fuel tank-2 steel tank.sldprt		Working		2 786 KB
0001141_Fuel tank-2 assembly.sldasm		Working		114 KB
0001156_Fuel system diagram.dwg			KIS	33 KB

- 4) Open up newly created drawing and insert drawing title block, revision block and drawing borders according to separate instructions.
- 5) When OK, close and check in drawing to file vault. Now it's accessible for others as well (user rights dependent).

by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

4(13)

B. ADD AN EXISTING AUTOCAD DRAWING TO PDMWE

- 1) Open existing drawing in Autocad.
- 2) In Autocad drawing remove any old "RITREG" drawing blocks and insert new drawing title block, revision block and drawing borders according to separate instructions.
- 3) When OK, "Save As" the drawing to the PDMWE folder it belongs (C:\Projects\...) with a filename like "_Fuel system plumbing.dwg" so that you can add drawing number later by renaming file.
- 4) Close file in Autocad and switch to Windows Explorer and go to folder and select the file you just saved
- 5) Check-in file so that a drawing number is generated.
- 6) Check-out file and complete data card as follows.
 - a) check that Yacht, Hull, Section and group is correct
 - b) Check/choose correct "group" for Description 1 from drop down list
 - c) Fill in drawing descriptions for Description 2 & 3, free text but try to use from drop down list (standard texts).
 - d) ***This step is not applicable*** (only when creating new drawing file)
 - e) If known, fill in Checked by and Approved by with dates
 - f) If known, fill in drawing scale, size, start- and planned date. Check progress.

File name: 0001156.dwg

Template: C:\Projects\Document templates\Autocad\... 4.dwg

File Data Card

Layout1 | Model

Document data | Distribution and general info

Document information

Yacht	Hull	Section	Group	Subgroup	Drawing Number	Rev
00	TOT	04	04		0001156	

Description 1: 0404 Fuel system

Description 2: Fuel system diagram

Description 3:

Revision history

Rev	Description	Created date	By
		24.11.2007	
		24.11.2007	
		24.11.2007	

Drawing ID

Scale	Size	Start date	Planned date	Progress
A3		24.11.2007	24.01.2008	100%

Drawing ID

Drawing ID	Description	Dimensions	Material	Item no	Supplier mat code
	Fuel system diagram				

Open File | Create File | Cancel

by Kim Sundkvist. 03.12.20007

How to create documents in PDMWorks Enterprise

5(13)

In the "Distribution and general info" tab:

- g) Fill in drawing distribution
- h) If needed fill in special revision comments (detailed information of revision etc...)
- i) When you think all is OK press "Create File" to end New Dwg File dialog.

7) Rename file to include drawing number, e.g. "0001157_Plumbing sea water.dwg".

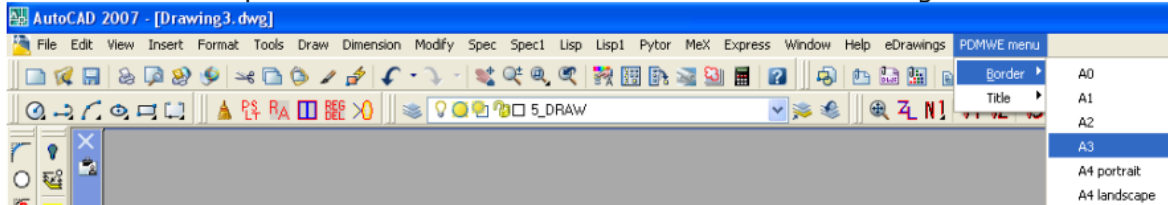
8) Check-in file when finished.

How to create documents in PDMWorks Enterprise

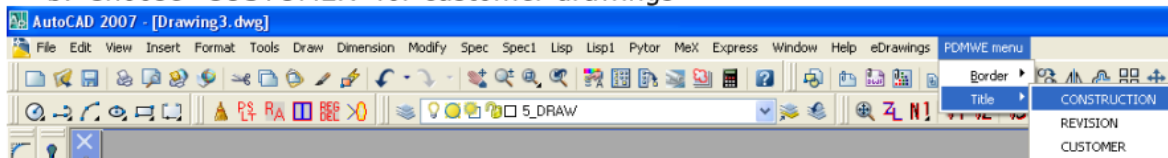
6(13)


C. INSERT AUTOCAD DRAWING BORDER, HEADER AND REVISION BLOCK

- 1) Open Autocad drawing in which you wish to add PDMWE border, title & revision block
- 2) Choose drawing border size from "PDMWE menu/Border".
 - a. Preferably make drawings in paperspace (=layout mode) then specify origin and scale of border block (0,0 and 1:1).
 - b. If in modelspace choose enter other scale factor when inserting border block



- 3) Insert title block "PDMWE menu/Title" and place in lower/right corner of border
 - a. Choose "CONSTRUCTION" block for production drawings
 - b. Choose "CUSTOMER" for customer drawings

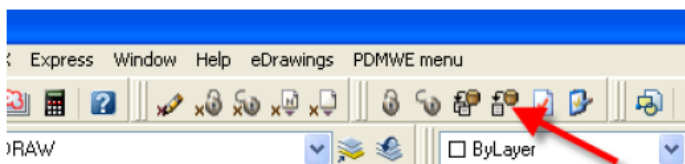


	Scale	Drawn	Distribution					
		Checked						
	Size	Approved						
ALL RIGHTS RESERVED. THIS DRAWING IS THE PROPERTY OF OY NAUTOR AB. USE, MANUFACTURE OR PRODUCTION IN WHOLE OR IN PART IS PROHIBITED WITHOUT WRITTEN APPROVAL GIVEN BY OY NAUTOR AB.		Yacht	Hull	Section	Group	Subgroup	Drawing Number	Rev
NAUTOR COMPUTER DRAFTING								

- 4) Insert revision block "PDMWE menu/Title" and place in upper/right corner of border

Revisions								
Symbol	Description	Changed	Sign	Checked	Sign	Approved	Sign	

- 5) Press "Update title block" to import attributes from PDMWE to title block.



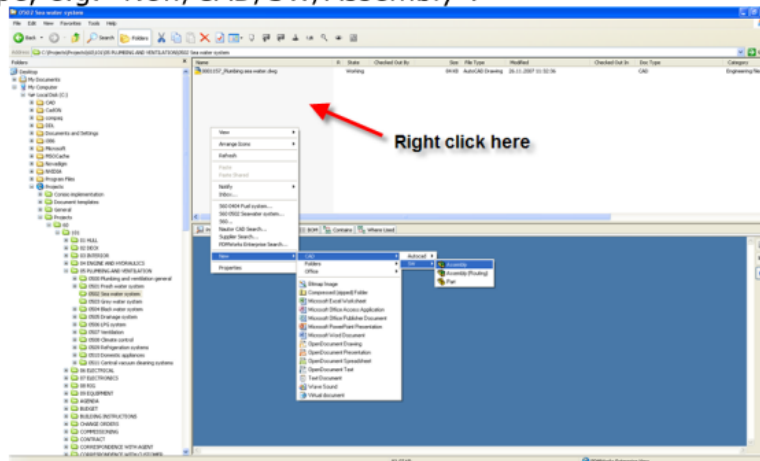
by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

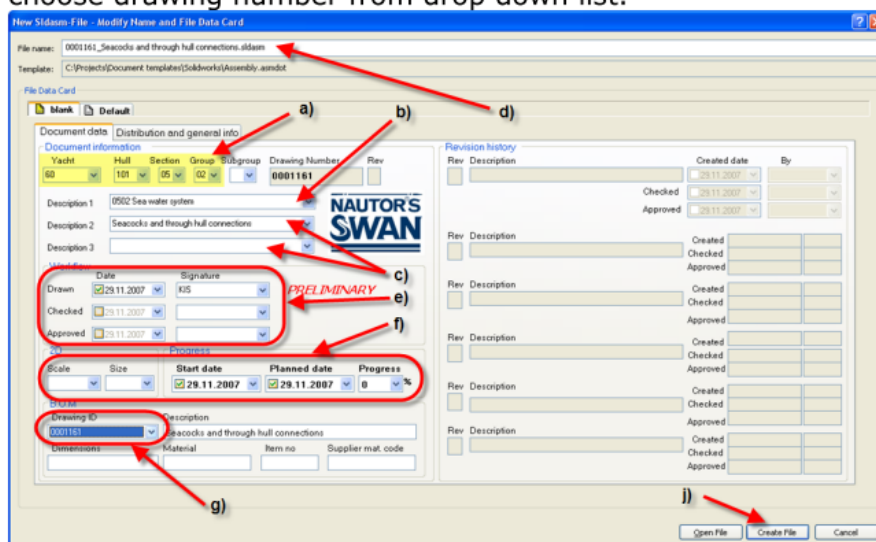
7(13)

CREATE A NEW SOLIDWORKS MODEL (SLDPRT, SLDASM) IN PDMWE

- 1) Go to the folder in which you wish to add a drawing and right click in empty area below existing file list. Choose an Solidworks template for correct Assembly or part type, e.g. "New/CAD/SW/Assembly".



- 2) In "Document data tab" of the "New Sldasm / Sldprt file" dialog:
 - a) Check that Yacht, Hull, Section and group is correct
 - b) Check/choose correct "group" for Description 1 from drop down list
 - c) Fill in drawing descriptions for Description 2 & 3, free text but try to use from drop down list (standard texts).
 - d) Add "_Description2" to filename, e.g. 0001161_Seacocks and through hull connections.sldasm
 - e) If known, fill in Checked by and Approved by with dates
 - f) If known, fill in drawing scale, size, start- / planned date and progress.
 - g) If known at this stage if a Solidworks drawing will be made of this model, choose drawing number from drop down list.



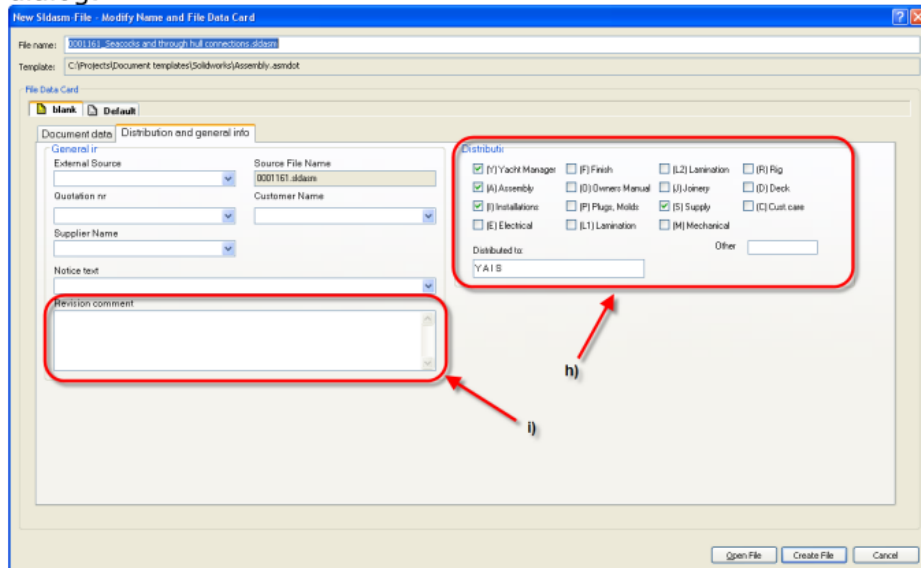
by Kim Sundkvist, 03.12.2007

How to create documents in PDMWorks Enterprise

8(13)

In the "Distribution and general info" tab:

- h) Fill in drawing distribution
- i) If needed fill in special revision comments (detailed information of revision etc...)
- j) When you think all is OK press "Create File" to end New Sldasm/Sldprt File dialog.



- 3) You have now created an empty Solidworks model file which should be named acc. to 0001161_Seacocks and through hull connections.sldasm where
 0001161 = 7 digit ID-code
 Fuel system diagram = Description 2 field in data card

!!! If you forgot to add _Description2 text in filename you can now rename file to include this.

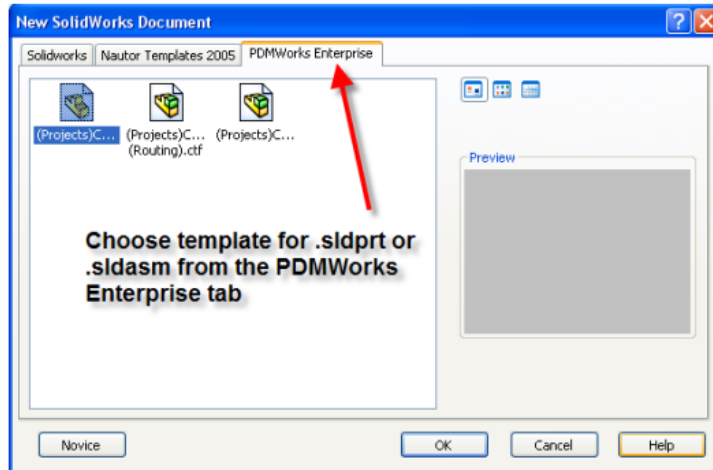
- 4) You can now check out file, save it once and start modeling...

How to create documents in PDMWorks Enterprise

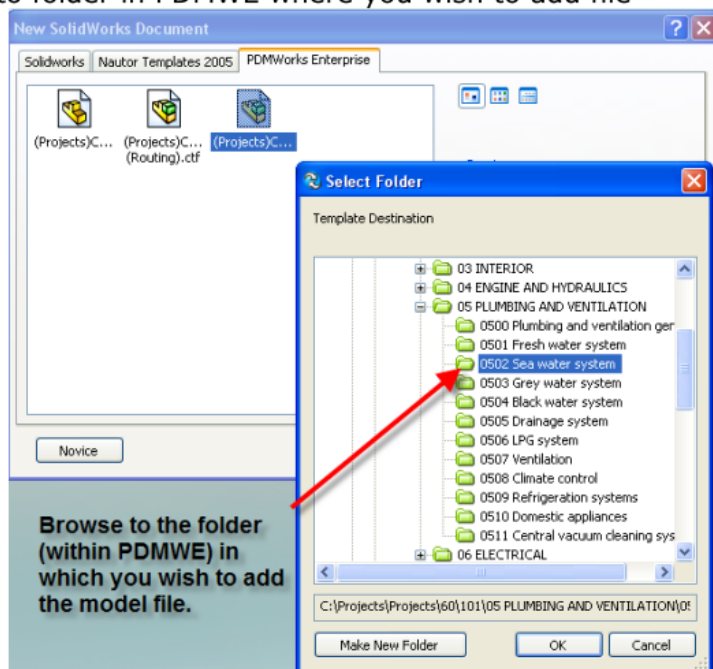
9(13)

D. ADD A SW-MODEL (SLDPRT, SLDASM) TO PDMWE WITHIN SOLIDWORKS

- 1) Within Solidworks choose "File/New..." to view the "New SolidWorks Document" dialog.



- 2) Browse to folder in PDMWE where you wish to add file



- 3) In "Document data tab" of the "New Sldasm / Sldprt file" dialog:
 - a) Check that Yacht, Hull, Section and group is correct
 - b) Check/choose correct "group" for Description 1 from drop down list
 - c) Fill in drawing descriptions for Description 2 & 3, free text but try to use from drop down list (standard texts).

by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

10(13)

- d) Add "_Description2" to filename, e.g. 0001161_Seacocks and through hull connections.sldasm
- e) If known, fill in Checked by and Approved by with dates
- f) If known, fill in drawing scale, size, start- / planned date and progress.
- g) If known at this stage if a Solidworks drawing will be made of this model, choose drawing number from drop down list.

In the "Distribution and general info" tab:

- h) Fill in drawing distribution
- i) If needed fill in special revision comments (detailed information of revision etc...)
- j) When you think all is OK press "Open File" to end New Sldasm/Sldprt File dialog.

by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

11(13)

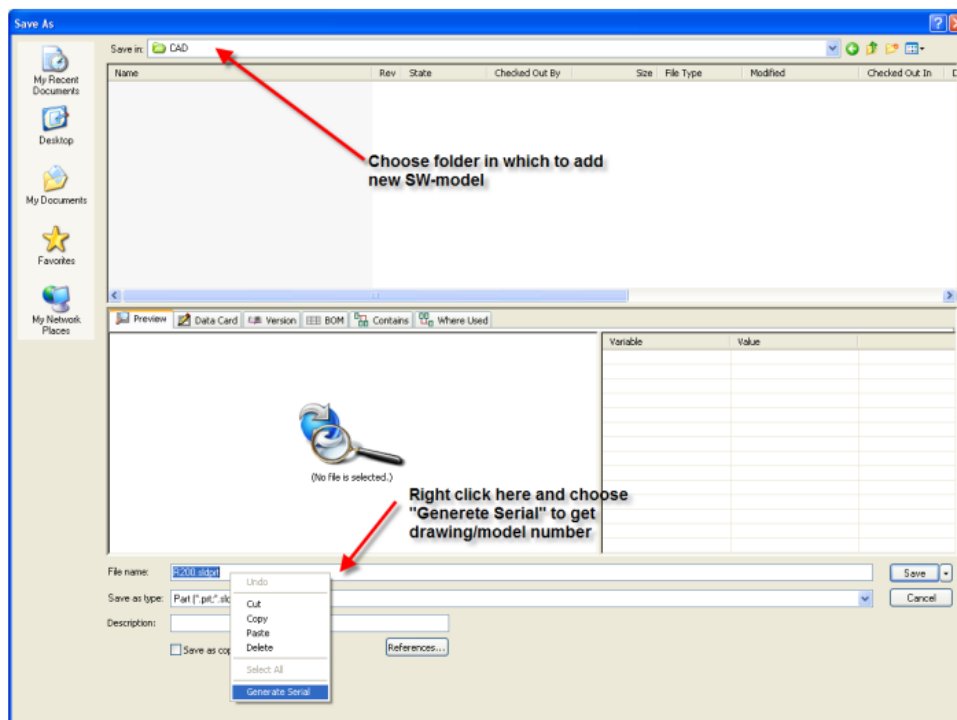
- 4) You have now created an empty Solidworks model file which should be named acc. to 0001161_Seacocks and through hull connections.sldasm where
 0001161 = 7 digit ID-code
 Fuel system diagram = Description 2 field in data card

!!! If you forgot to add _Description2 text in filename you can now rename file to include this.

- 5) You can now check out file, save it once and start modeling...

E. ADD AN EXISTING SOLIDWORKS MODEL TO PDMWE

- 1) Open existing model in Solidworks.
- 2) Choose "File/Save As..." to get Save as dialog
- 3) Browse to correct Project- or Supplier folder
- 4) Right click in "File name" field and choose "Generate Serial"

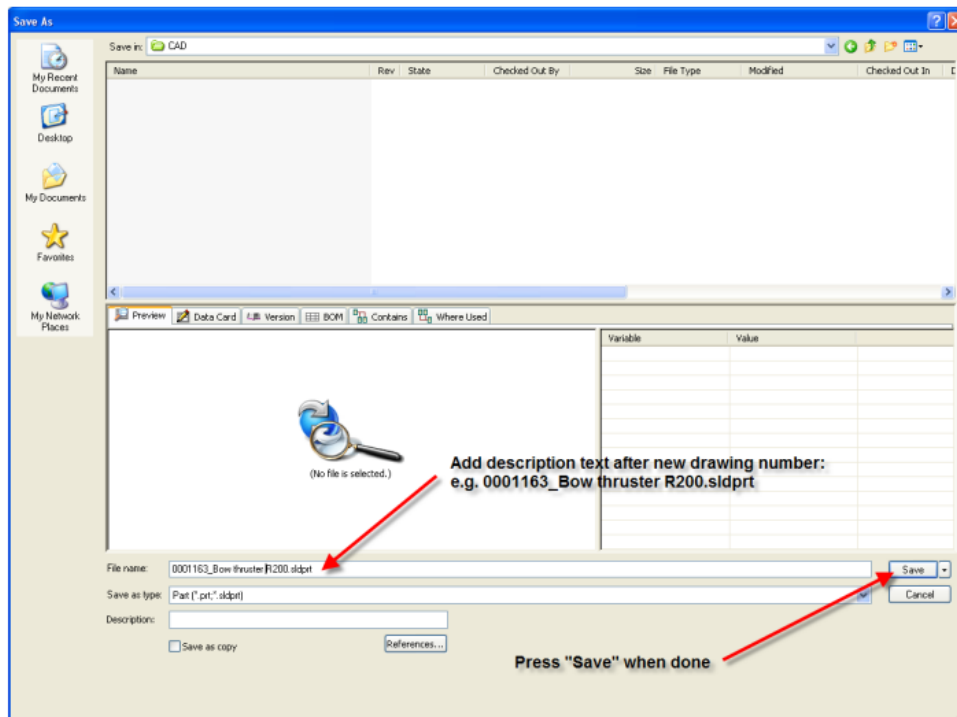


by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

12(13)

5) Add description text after new drawing number: 0001163_Bow thruster R200.sldprt



- 6) In "Document data tab" of the "Properties" dialog
- Check that Yacht, Hull, Section and group is correct
 - Check/choose correct "group" for Description 1 from drop down list
 - Fill in drawing descriptions for Description 2 & 3, free text but try to use from drop down list (standard texts).
 - If known, fill in Checked by and Approved by with dates
 - If known, fill in drawing scale, size, start- / planned date and progress.
 - If known at this stage if a Solidworks drawing will be made of this model, choose drawing number from drop down list and add Item no if known.

by Kim Sundkvist, 03.12.20007

How to create documents in PDMWorks Enterprise

13(13)

Properties - 0001163_Bow thruster R200.sldprt

Document data | Distribution and general info

Document information

Yacht Hull Section Group Subgroup Drawing Number Rev

04 09 0001163

Description 1 0409 Thrusters

Description 2 Bow thruster R200

Description 3

Drawn Date Signature

30.11.2007 KJS

Checked 30.11.2007

Approved 30.11.2007

Scale Size Start date Planned date Progress

1:1 A4 30.11.2007 30.11.2007 0 %

Drawing ID Description

Bow thruster R200

Dimensions Material Item no Supplier mat. code

Revision history

Rev Description Created date By

Checked 30.11.2007

Approved 30.11.2007

PRELIMINARY

OK Cancel

Check the information on the "Distribution and general info" tab!

!!! If it's a "supplier model" please check that correct supplier name information is correct !!!

Properties - 0001163_Bow thruster R200.sldprt

Document data | Distribution and general info

General info

External Source

Source File Name

0001163_Bow thruster R200.sldprt

Quotation nr

Customer Name

Supplier Name

Max Power

Notice text

Revision comment

Distributable

☐ (Y) Yacht Manager ☐ (F) Finish ☐ (L2) Lamination ☐ (R) Rig

☐ (A) Assembly ☐ (O) Owners Manual ☐ (J) Joinery ☐ (D) Deck

☐ (I) Installations ☐ (P) Plugs, Molds ☐ (S) Supply ☐ (C) Cust care

☐ (E) Electrical ☐ (L1) Lamination ☐ (M) Mechanical

Distributed to:

Other

If it's a "supplier model" then check this field

OK Cancel

by Kim Sundkvist, 03.12.20007