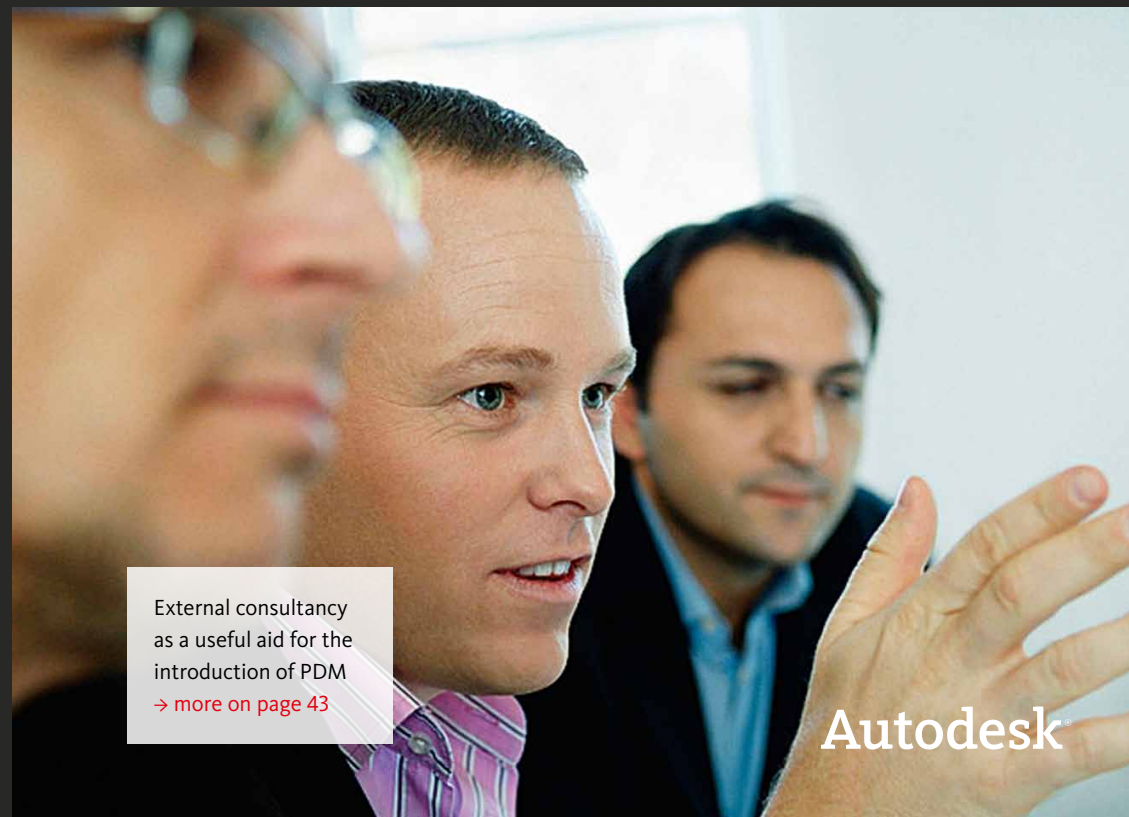
PDM Adviser

What is PDM and what is it used for?



External consultancy as a useful aid for the introduction of PDM
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Contents

Dear Reader,

This brochure contains all you need to know about PDM: from the basic concepts, special requirements and user experiences with the system, through to the current products.

There have been great changes in the work of the design office. The role of paper as a medium has practically disappeared, giving way to digital models, drawings and documents. Searching large-scale archives for the digital documents which have been created over the many years of CAD design is quicker, and switching between a variety of locations and project partners and applying changes is easier.

However, the necessary prerequisite for ensuring that these advantages of digital product data are fully exploited is sophisticated product data management which does more than simply organise filing. It also manages clearance processes and the access rights assigned to the various internal and external users. At the same time, modern PDM solutions are becoming ever more cost-effective and simple to use. They are closely integrated into CAD systems and use the graphic facilities these offer for viewing data, so that the designer is not obliged to work with abstract numbers and text attributes, but always has a clear idea of the parts and assemblies he is dealing with.

This brochure is designed to help you identify the correct solution for your company in order to enhance profitability and innovative capacity and ensure that you always remain a step ahead of the global competition. That's what it's all about for us as well.

Christian Lang
Sr. Director Manufacturing Sales
Autodesk EMEA

PDM solutions from Autodesk are essential, but still affordable.

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What is PDM?

Key Features – Overview

Worksharing in assembly design, the proliferation of files and the increasing distribution of work across various sites, stakeholders and suppliers all underline the need for systematic working procedures and secure data management.

AFTER NEARLY 3 DECADES OF CAD DESIGN, PAPER-BASED ARCHIVES HAVE DISAPPEARED FROM ENGINEERING DEPARTMENTS.

Today, all relevant design data is stored on digital storage media. A designer may occasionally use a working copy on paper just to get a quick overall picture of the design, and production departments still generally receive production drawings on paper. However, every search through the archive, every change, every distribution is undertaken by accessing digital data.

Using a systematic approach to filing and well-defined workflows, product data management systems provide the high level of organisation and reliability required to stay competitive in today's product development environment.

The ever-increasing amount of data can no longer be controlled without a management system.

Who is authorised to make changes? Who is entitled to make a copy? How is a release rule for digital data implemented? Which version did we send to our client three weeks ago? How can I demonstrate to the client that a particular release is the correct one? These are burning issues for the design manager and are even more important if many people at different sites or even external stakeholders access a networked development and production environment.

PDM or PLM

The term Product Data Management (PDM) is commonly used to designate technical data and process management.
In marketing copy, it is sometimes confused with PLM (Product Lifecycle Management). PLM is a strategic approach applied with the intention of providing maximum support throughout the product lifecycle, from the initial product idea to end-of-life disposal. PLM therefore has more comprehensive objectives, while PDM may be regarded as the essential core of a PLM strategy.

Several different PDM systems are available on the market today, developed from three distinct starting points. Some originate from document management and are aimed at covering requirements in technical fields through the application of design-related enhancements. Others have approached product development from the point of view of Enterprise Resource Planning (ERP), with the aim of co-managing product development data in a commercial software package by means of the corresponding add-on modules.

The most comprehensive PDM systems, however, have their roots in CAD development. They are fully acquainted with the requirements of product development, the specific aspects of product data and the workflows in development departments. Design managers will feel most at ease with these kinds of systems as they provide the best response to the needs of CAD design and make the most of the specific properties of CAD systems, their graphic capabilities and data. They promise solid integration, maximum ease of use and the greatest benefits for users in the field of product development.

Basic Features and Functions

A PDM system manages related data as so-called objects. These objects are, for example, items (or parts), documents and projects.

Items

An item or part can represent a physical or virtual component, an assembly, sub-assembly or a complete product; it can be a manufactured or purchased part and always has a unique name or number. The key information relating to an item, e.g. item number, name, version number, is stored in its master record. In order to display complex item structures, the master data for the items are simply metadata referencing other documents, files and information.

Documents

Documents contain information related by content, which may describe other objects but may also be self-contained. Typical documents in a PDM system are, for example, CAD models and drawings, calculations and NC data, as well as texts such as specifications or descriptions. The ability of a PDM system to manage Office documents like any standard Data Management system is of great value in engineering-oriented operations as any document in administration, sales, manufacturing or development can be accessed through one standardised interface. However, in product development, PDM systems have to manage documents with considerably more complex requirements in terms of format, structure, versioning, change management and processes. This extends far beyond the requirements of sales correspondence or personnel records, for example.

Projects

A PDM system uses the 'Project' object to collate items, assemblies, parts and documents for a customer order or a development project. In this case, the PDM system is not taking on the role of a comprehensive project management system, but is providing an overview of all of the relevant data related to a project as a whole. Items or documents can be assigned to multiple projects without being duplicated, therefore facilitating changes: a change to one instance will be applied automatically to all projects containing the relevant document. One of the great benefits of project-oriented management is that all information belonging to a project is connected. 'Knowledge is linked information', i.e. all related items of information can be retrieved from a single location, eliminating redundant storage.

Being able to compare Bills of Materials (BOMs) from different versions or variants quickly and easily is another very useful feature for gaining a rapid insight into any differences.

Version – Revision – Variant
The version designates the current change status of a PDM object by means of a system of internal serial numbering, including the date of creation. The current and relevant version is clearly demarcated from older versions and the user may return to a previous version at any time. The term 'revision' denotes a version after it has been assessed and released in the course of a review and release process. In addition to a sequential series of versions, a parallel sequence of one or more product variants may exist, e.g. a 30 or 40-roll conveyor belt, one for each length.

During product development, a design passes through many iterative modifications and adaptations until it reaches a stable state shortly before being transferred over to production, at least temporarily. Versioning ensures reliable management of all statuses to guarantee that it is possible to return safely to the starting point or to reproduce approaches and intermediate statuses in cases where a design phase has led to a dead end.

Bills of Materials (BOMs)
Generally, PDM systems visualise the hierarchical product structure by graphical means within a structure browser. For further modification or for use within the purchasing department or in production or assembly, data must be output in lists. This calls for different kinds of Bills of Materials (BOMs). The PDM system derives BOMs in all common forms, from structure and unit to quantities or for variants. Being able to compare BOMs from different versions or variants quickly and easily is another very useful feature for gaining a rapid insight into any differences.

Classification
Even small-scale engineering offices find that they cannot survive without applying a systematic approach to managing design data. They need quick and efficient access to parts and assemblies which have already been used. Collecting any parts and relevant data related to an assembly without a methodical filing system is a tedious procedure. PDM helps companies to organise and classify products and the relevant parts in a systematic manner, by assigning objects to default or company-specific classes distinguished by specific characteristics. Characteristics lists are a defined collection of characteristics which can be organised within a hierarchical structure of any desired depth. Classification speeds up the search and retrieval process for existing parts and assemblies. It facilitates the reuse of existing designs, eliminates duplication of design work and reduces manufacturing costs considerably. The minimal additional outlay for systematic data management applied from the outset is soon recouped.

'Where Used' Parts List
Unlike a BOM, the 'where used' parts list in the PDM system specifies in which products or assemblies parts or sub-assemblies have been used. This is a very important feature for reviewing the consequences of changes.

A PDM system contains a high proportion of the knowledge within a company. It is therefore vital that only authorised persons are able to access the information.

Integrating Legacy Data
When introducing PDM, managers are often faced with the task of integrating legacy data from an old CAD system or even the contents of a paper-based archive. In order to achieve a reliable and comprehensive implementation, all relevant data should be imported into the PDM system. Paper documents are of practically no use in a digitised world which calls for electronic communication between different sites and countries. Some companies take this opportunity to dispose of legacy data they no longer need while converting as much of the rest as possible. Drawings on paper are scanned and transferred to the system. Companies want to prevent original CAD data from circulating beyond the design process and thus create copies of these documents in neutral formats such as PDF, DWF or TIF for viewing purposes only.

User Administration
A PDM system contains a high proportion of the knowledge within a company. It is therefore vital that only authorised persons are able to access the information. Who is authorised to view, edit and release which documents is defined by means of user privileges set up for a single user or user group. It must also remain possible to trace who is responsible for which specific change or release. At the same time, the current status of a document is always identifiable and shared access to documents possible. Situations that could give rise to conflicts, such as two people attempting to edit a part or overwrite an assembly at the same time, are prevented by the check-in/check-out features of the data management system. Any file checked out for editing is temporarily locked.

ACCESSING THE WEB

STATE-OF-THE-ART PDM SYSTEMS SUPPORT SECURE WEB-BASED COLLABORATION.

Field personnel and assembly staff are no longer isolated from the company's centralised information portal. When undertaking maintenance work on site, they are still able to browse through the required drawings.

Access to relevant technical information can also be provided for suppliers and customers (within the limits imposed by the company's security policy).

The system sends change orders to all relevant people within the company automatically, meaning that team members are informed about actions directly and can react immediately.

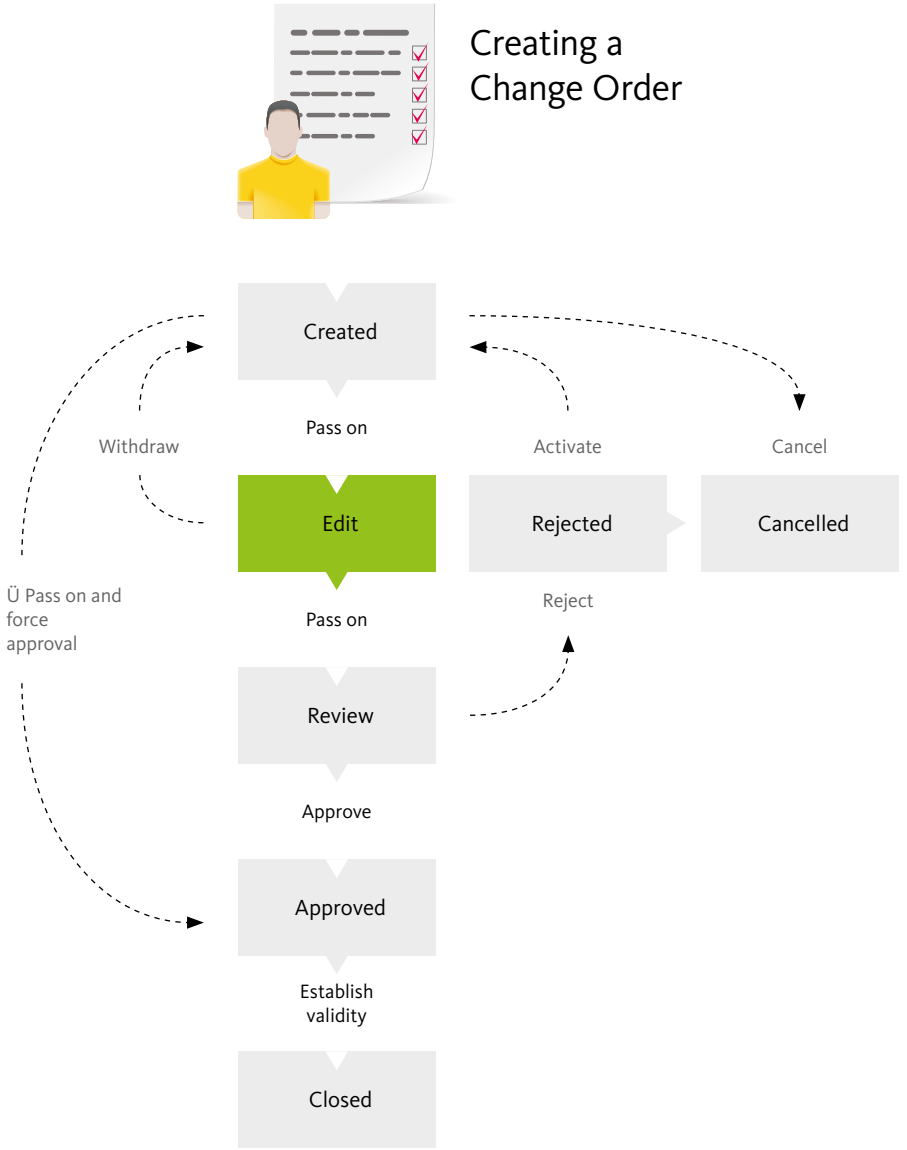
Status and Workflow
Status is an essential attribute of every PDM object. It denotes whether an object is 'work-in-progress' or 'released', for example. The workflow automates and documents a defined sequence of individual activities which have to be performed in order to achieve a change in status. The system sends change orders to all relevant people within the company automatically, meaning that team members are informed about actions directly and can react immediately. Processes flow smoothly and quickly and can be reproduced easily. No product will be released until all relevant changes have been signed off.

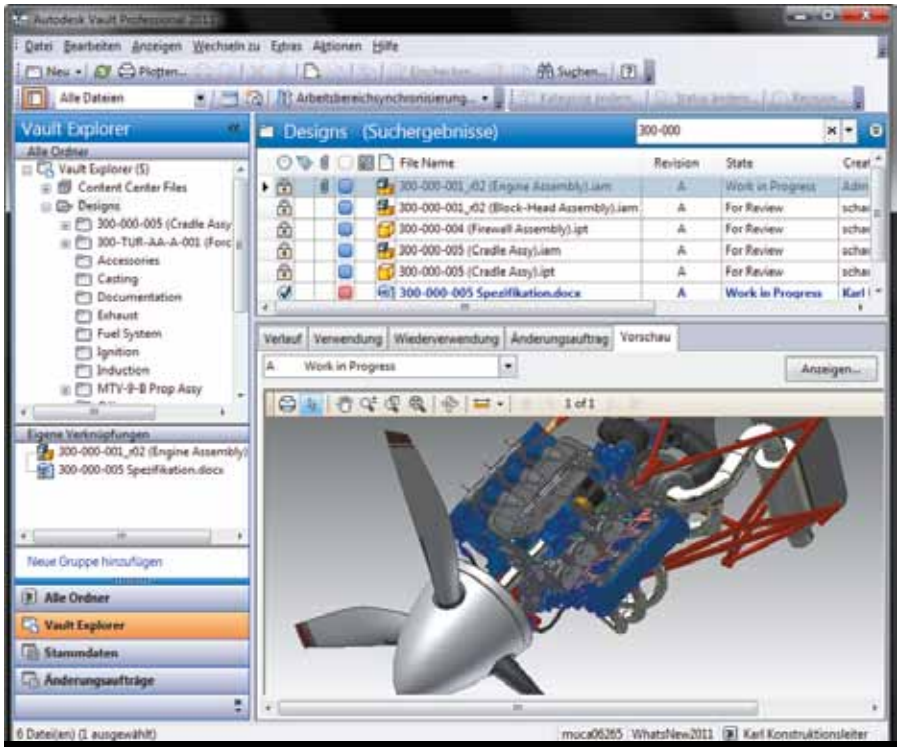
Completed designs are usually released by the design manager in a simple one-step process. However, in some cases the design manager might wish to discuss some aspects, for example with purchasing or production, to clarify whether a certain product can be manufactured or purchased. This involves a two-step release process, first by the purchasing department and then by the design manager. Releases can therefore be company-specific or product-specific processes. By using a flexible PDM system, these kinds of processes can be mapped very easily.

Internal communication within a company can benefit from electronic data management. Corrections and change notes can be entered easily in digital drawings and 3D designs (redlining). This can accelerate the communications process as comments are sent directly by email – significantly faster and cheaper than the old-style paper and postal method – with no information going missing in the process. Everything is well documented and traceable (an important requirement for ISO 9000).

Configuration Management and Changes
The process of configuration management is defined in ISO 10007. It is designed to ensure the compatibility of the functional and physical properties of a product with the relevant requirements, product design and operational information throughout the entire lifecycle of the product. As used here, configuration denotes the description of the product. Due to legal constraints on product liability, the configuration of a product has to be traceable for several years. The management of changes and responsibilities therefore constitutes an essential element of configuration management. PDM helps to ensure compliance with such guidelines and at the same time fulfils the requirements of additional quality and industry standards.

A PDM release process makes changes quick, easy and traceable, an essential requirement for ISO certification.





The output of product data in DWF or PDF format enables colleagues in external departments to review and print documents or to add comments without changing the original data. As part properties are not dependent on the type of file, precise and quick search results are delivered.

Viewing formats play an important role for PDM users from outside the design department or external to the company as they allow them to visualise released data for products, assemblies and components without being able to make changes to them.

Replication of design data allows for distributed product development at multiple sites and ensures the reconciliation of data.

Data Management in Distributed Organisations

Larger organisations present even greater challenges for a PDM solution. They require the best possible level of support over a number of sites, countries and even continents, and integration into a variety of CAD systems and the specific ERP system in use. Routine tasks like data exchange (including converting different data formats), the generation of viewing formats such as DWF or PDF, plotting and archiving have to be largely automated in order to lighten the workload for designers and administrators.

Replication of design data allows for distributed product development at multiple sites and ensures the reconciliation of data. Therefore, access to engineering data – and 3D models – is accelerated and data consistency is ensured at every site, a prerequisite for 'simultaneous engineering'. For security reasons, access to data can be restricted at certain sites so it is crucial that replication be selectively limited to the required data. There should be no data relating to assemblies and products stored on the servers at the subsidiary in China that they do not absolutely need for their manufacturing orders.

Adaptability

The larger a company grows, the more difficult it is to change established processes. The PDM system therefore has to adapt itself to the existing situation. This applies to the user interface, approval and change processes, basic features and the data model. On the one hand, the use and implementation of a default configuration has to be as simple as possible; on the other it must offer maximum flexibility in terms of modifications and enhancements. The ideal PDM system has to manage these conflicting demands by offering comprehensive standardisation combined with a flexible layout, providing configurable parameters and a modular approach. In addition, it must be efficient and easy to use, as the engineers' productivity is always top priority.

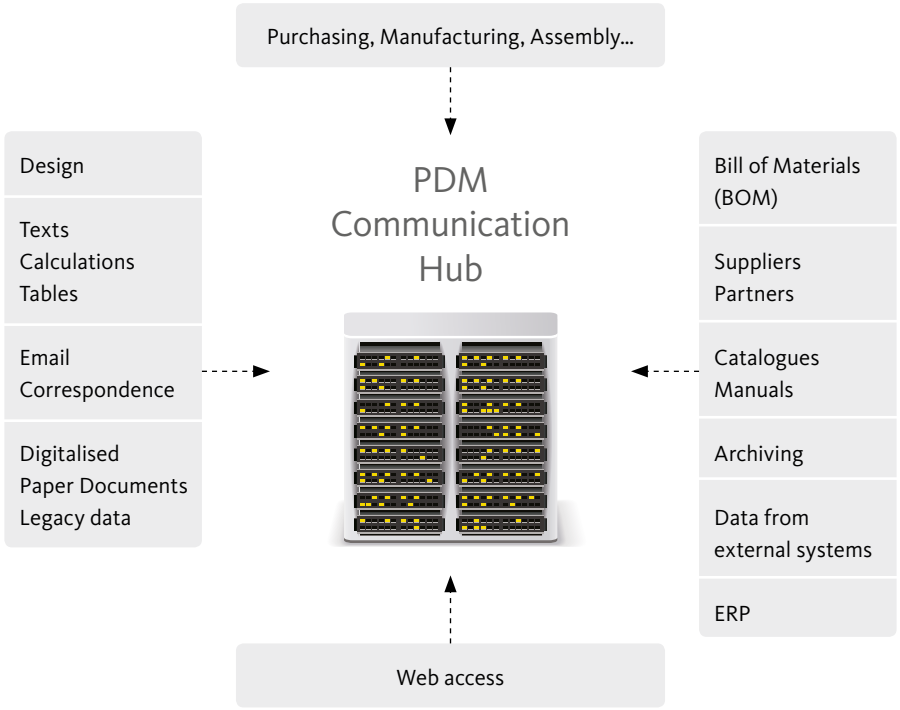
PDM is Affordable

A PDM solution is the communication hub for the product data and a source of knowledge for the whole company. As a vital interface between design engineers and their colleagues in other disciplines, PDM enhances product-related communication, helping to avoid errors and speed up projects. As an organisational and control tool, PDM increases the productivity of designers.

In the past, high software costs, organisational set-up and implementation often caused small offices and small and medium-sized enterprises (SMEs) to shy away from rolling out a PDM solution. Indeed, some CAD systems today include basic PDM features at no extra cost, making them accessible to companies of all sizes.

There are also systems which can be used 'out of the box', as such providing an immediate and direct benefit for designers. Solutions offering flexibility and adaptability are also available today at a reasonable cost and can be implemented for a moderate outlay on consulting.

A PDM solution is the communication hub for the product data and a source of knowledge for the whole company. As a vital interface, PDM enhances product-related communication, helping to avoid errors and speed up projects.



What is PDM used for?

Can you afford to work without PDM?

Some companies allow their designers to set about their work like freestyle mountaineers, climbing with neither ropes nor pitons, relying on agreements reached verbally and painstakingly searching out the correct drawing only to emerge with an outdated version at the end of the day. The risk of error here is great and things can get expensive if the wrong version of a drawing accidentally finds its way into the hands of production or a supplier.

Today, product descriptions exist almost exclusively in the form of digital CAD data.

Machines, appliances and systems are designed exclusively with CAD, predominantly using 3D systems.

The 3D view is more comprehensive and easier to understand for everyone involved in any way with the product, including non-technical sales staff and decision makers. It is the prerequisite for many process enhancements, both in development and associated fields.

During the design and development process, CAD models and drawings are in a permanent state of flux: designers are looking for solutions, customers are changing their requirements, suppliers are modifying their products and specifications, and production is calling for simplifications. This sees many groups of users accessing data, often at the same time, while designers are making frequent changes to their drafts and drawings. Other departments such as purchasing, marketing and sales are involved, and likewise retrieve information. They require clarity in respect of what information is provisional and what is definitive.

A growing volume of data in various file formats needs to be interlinked to ensure that the connection with the product described is always reliable. This accentuates the necessity for systematic organisation. Digital data is the optimal form for efficient communication, both within a company and with external stakeholders, as it simplifies collaboration over large distances and improves productivity. However, it also involves risks.

These revolutionary changes in product development call for appropriate tools and rules to guarantee secure procedures for handling digital product data, just as those employed previously for paper documents did.

So what are the other great challenges facing companies who have been working with CAD systems for years or even decades, but have not yet started working within a data management system? And why are more and more companies coming to the conclusion that they need a PDM solution?

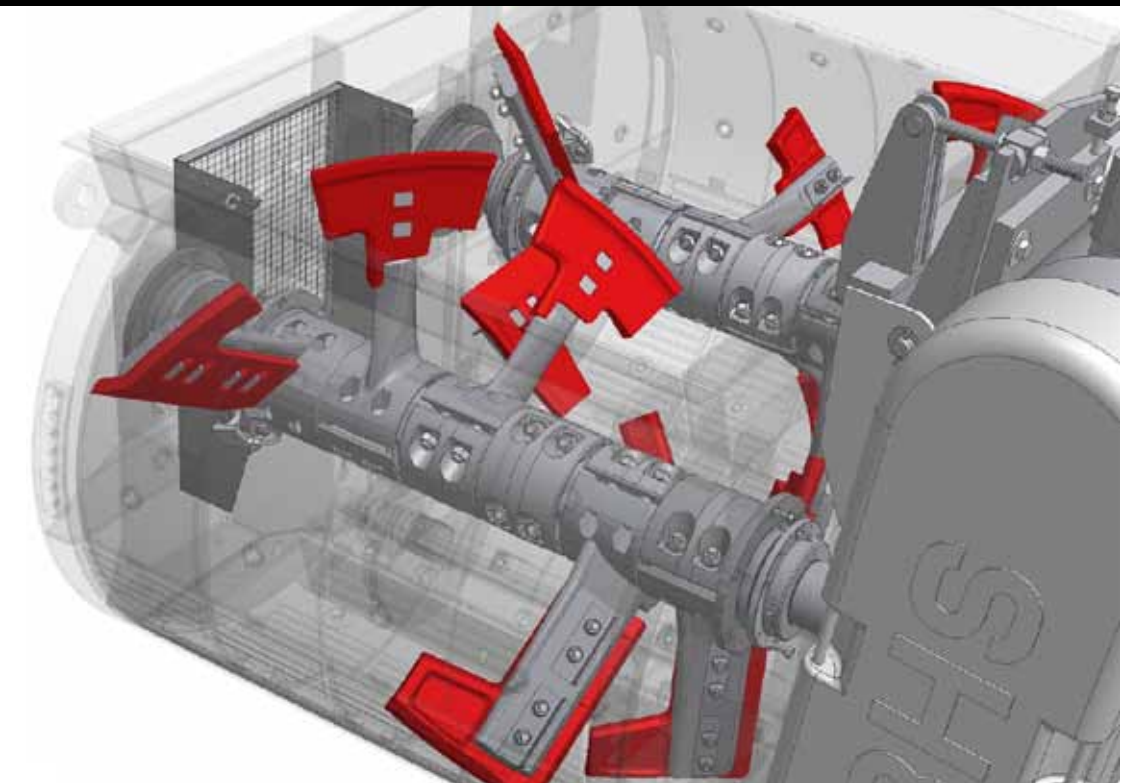
Digital data is the optimal form for efficient communication, both within a company and with external stakeholders as it simplifies collaboration over large distances and improves productivity. However, it also involves risks.

PDM is an aid to standardisation and speeds up searching.
Designers spend 30 to 40 percent of their time on research before even embarking on a design or on locating available components and assemblies. The PDM system simplifies searching and recognises all files belonging to a design.

It makes it easier to reuse existing components and, in the best cases, saves the entire expenditure involved in redesigning as well as a large part of the production costs. In this way, PDM helps with standardisation and reduces the number of existing parts.

„As the PDM system takes account of duplicate parts and streamlines modular structures, it is possible to develop and produce machines at affordable market prices and to achieve time savings of over 50 percent in new developments."

Dr. Angelo Schmandra, Managing Director of BHS Sonthofen, Germany



Exact Definition of Each Version
The main problems and risks associated with CAD design include the matter of the correct version. Which is the current version? Which version did we send to the customer three weeks ago? Which version are we currently working on? What parts and assemblies belong to this design? A PDM system can answer all of these questions by providing a clear and unambiguous picture of the progress of the design and all of its versions, making it absolutely clear which is the current version. In practical terms this means that the risk of people working on an old version can be eliminated. Previous versions are also retained and can be accessed at any time. This is particularly useful when a design concept has led to a dead end and the designer is forced to go back to an earlier version.

A PDM system makes it absolutely clear which is the current version. In practical terms this means that the risk of people working on an old version can be eliminated.

Documenting Changes
Drawings often contain many external references or blocks and 3D assemblies generally consist of numerous sub-assemblies and individual parts. Windows Explorer is not much use for someone looking to maintain an overview within these complex structures, especially when changes are required or assemblies exist in a variety of version statuses. This is when a PDM system alone can provide the required overview. It recognises all of the relevant assemblies and parts and automatically keeps track of which versions of the individual parts belong to which version of an assembly.

'Where Used' Information
There is a part to be changed in an assembly. What will the consequences be? Has that part been used in other assemblies or products? The PDM system can answer these questions at the press of a button. The 'where used' information shows the relationships between parts and assemblies and provides the basis for the decision as to whether the change is useful or might possibly give rise to problems elsewhere. This knowledge can avoid serious errors and therefore save a lot of money.

Who is Responsible?
Design teams usually comprise a number of colleagues working together on a project, often individually over great distances and across different time zones, and perhaps even in a number of shifts. It is not always possible to answer questions quickly across a desk or with a telephone call and it is often the case that the required colleague is away on a business trip or on holiday when urgent problems arise. Where the areas of responsibility of two colleagues overlap, clarification is required. Employees have mutual access to colleagues' data, not only on a read-only basis but also to write as well, as even in the absence of one colleague, the project must go on.

HOW MANY ACTIVE DRAWINGS DO YOU HAVE?

5,000
10,000
50,000

And for each designer an average of 100 new or modified drawings can be added every year.

Does designer Tom know what designer James has just been working on? What if designer James leaves the company? Does that herald the beginning of a great data search? Wouldn't it be better if all drawings were managed by the PDM system so that they could be located easily at any time, even when James is off enjoying his well-earned holiday in Spain?

Let's take a typical mid-size manufacturing company, an operation handling a large number of individual orders, as an example. Its order documents are reused at various intervals and in some cases repeated with alterations. With some PDM systems, the project-oriented organisation of data simplifies the location of documents to quite a considerable degree. Models, drawings, specifications and calculations as well as contacts, emails, offers, etc. can be filed in a clear and logical manner within a project and easily relocated, without any data redundancy.

Who is Monitoring the Valuable Data?
By means of a check-in/check-out function, the PDM system ensures that the possibility of files being edited by different team members at the same time or being accidentally overwritten is eliminated.

The PDM system files all design data in a central location. Access to this data is restricted to users identified within the system and authorised to access specific areas. In this way, the system also establishes who has modified what data, meaning that the question of responsibility can be clarified in the event of a problem. The software also ensures that staff in other departments, for example production or purchasing, only have access to the released data and cannot, for example, access any data currently being edited.

"We must always be able to go back to file data and guarantee its availability in the event of tool failure. This is why data management is so important for us. Therefore, the main tasks for our PDM solution were systematic filing and rapid location. These two functions alone have made the system an essential tool for us."

Jens Pröger, Managing Director of Modellbau Chemnitz GmbH

The status display for each component shows the status of the project, for example ‘in progress’ or ‘released’.

Rapid Electronic Release Process

Um To reduce development times it is not sufficient to manage data systematically just within the design department. Data must still be controlled when it is passed on to production, where it is all about working from the released drawings with constant access to the most up-to-date data. This is the role taken on by PDM: it automates the release process and the management of both design changes and bills of materials, meaning that the design department retains control of all design data passed over to production. Production or purchasing staff also have access to the data. They can check it and add to it without actually overwriting the design data itself. The status display for each component shows the status of the project, for example ‘work-in-progress‘ or ‘released’.

Controlling status changes, rules and access to data: the PDM system ensures the secure management of product data, from initial design through to archiving.

The PDM Bill of Materials features are the prerequisite for ensuring that products and the full set of system parts arrive on the customer‘s premises or at the assembly site.

Reliable Bill of Materials Management

On its own, the automatic generation of a Bill of Materials in a 3D CAD system saves a lot of time and helps to avoid errors. However, PDM software provides other facilities as well, for example, adding to the Bill of Materials purchased parts such as seals and lubricants not explicitly modelled within the CAD design, or packaging or parts required during the assembly phase. The PDM Bill of Materials features are the prerequisite for ensuring that products and the full set of system parts arrive on the customer‘s premises or at the assembly site.

Here, too, a PDM system saves serious money as it can become expensive if the assembly team has to go back and look for missing items because important parts have not been provided.

Fulfilling Documentation Obligations

Many companies have to document their processes to fulfil the requirements for ISO certification or to fulfil their statutory obligations in terms of documentation for reasons of product liability. This also includes documenting the release and modification of design documents, along with the point in time at which these changes come into force. The intention here is that it is possible to see at any time which revision of a bought-in part has been ordered from a supplier, which version has been supplied to which customer, and which changes were applied during production from which point in time. Responsibility for decisions is also clearly documented – a necessity for certification – with this being the case in an increasing number of industries. Changes become traceable and therefore transparent.
As certification becomes an ever more urgent requirement, a PDM system becomes essential.

Speeding Up Development Cycles
In the competition for customers and orders, speed is always the trump card. Where the requirement for a product exists, the advantage always lies with the supplier who is in a position to deliver a comparable product quicker. With a nod to the Olympic motto of 'citius, altius, fortius', the equivalent in terms of product development is 'faster, better, cheaper'. And in the same way as in the heats at the Olympics, the competitors occupying the last places are eliminated. A PDM system not only helps to relocate an old design, but also supports the automated monitoring of processes and changes. Production and purchasing are provided with more reliable data, and sources of error are eliminated. At the same time there is a more accurate basis provided for calculating offers, and calculations take less time and cost less, resulting in a better chance of winning the order. So it is clear that PDM not only provides support for the design department, but has a positive effect throughout the entire company.

A PDM system does not just manage information. Knowledge is created through the interlinking and networking of information. This knowledge is then made available to more staff throughout the organisation.

The company becomes less dependent on individuals and less affected by the vagaries of personnel turnover or even simply non-availability due to leave or business trips. James's holiday in Spain will no longer hold up a project.

Industry-specific Requirements for PDM

Different Priorities

The requirements for a PDM system differ not only between small and medium-sized enterprises and large-scale companies, but also across various sectors of the industry.

A PDM system is designed to cover specific working processes within the company and to offer integration with ERP systems.

Serial production: optimisation to the last detail

Serial production is characterised by high unit numbers, production based to a large degree on division of labour, products related in terms of quality and a high degree of outlay in preparing for production with high tooling times and costs. Examples can be found in the automotive industry, in the production of consumer goods and in standard mechanical engineering.

Serial production is all about ensuring that the product has been optimised and tested through to the very last detail before production starts. Correcting errors once serial production has begun can be very expensive and is to be avoided as much as possible. Therefore, particular importance is attached to release and modifications, which can be extremely complex procedures involving many phases. For the purposes of product optimisation, receiving and analysing feedback – from prototype construction, for example – is very important, while working together with purchasing is essential for minimising costs within a company. A PDM system should fulfil these requirements by supporting company-specific working processes and facilitating smooth co-operation between various departments through the integration of, for example, material handling (ERP) systems.

However, even in serial production, development does not stand still following release. The PDM system must support further development in parallel, including the possibility of having a partial improvement fed into serial production in a controlled process.

The production processes in many industries display individual characteristics and these shape what is expected from PDM software.

Serial production is all about ensuring that the product has been optimised and tested through to the very last detail before production starts.

In the case of order-based production, a product is ideally only developed once a concrete order is in place.

A PDM system supports the standardisation and reuse of components.

Order-based production: time is money

The priorities for order-based production, also known as individual and small-series production, are quite different. This situation is most commonly found in the capital goods sector, for example in large-scale mechanical engineering or the construction of works equipment and special production machinery. In an ideal world a product is only manufactured once a concrete order from a customer is in place. It's not that long ago that, for some companies, almost every product was unique. The fulfilment of individual customer wishes is regarded as one of the strengths of mechanical engineering in Europe. However, these days, companies are increasingly relying on making their systems modular, standardising components and using platform technologies to keep high unit costs, long project turnaround times and ever more stringent quality requirements under control.

A PDM system that provides support for the standardisation and reuse of components by means of an intelligent parts management system is essential for this. The system's detailed and comprehensive data also provides the basis for the production of realistic offers, as it is possible to call on similar past projects for relevant data, costs and calculations. In the final analysis, the data drawn from the PDM and ERP systems make it possible to keep the costs for the entire planning and design phase under control.

The fulfilment of individual customer wishes is regarded as one of the strengths of mechanical engineering in Europe.

With its scalable structure, the PDM solution provides the opportunity to select just the right components for the relevant requirements.

Accelerated handling

The most important aid for speeding up project handling, apart from modularisation and standardising assemblies, is optimal control and monitoring of the development process.

Here it is a matter, on the one hand, of automating specific processes such as the provision of drawing sets and error-free Bills of Materials, as well as ensuring the constant availability of information for other departments – fully up to date and clearly indicating whether something is released or still in progress – without the design department being required to deliver this information manually. The extent of the advantages of this can be seen from a study carried out in the summer of 2006 on behalf of Autodesk: according to the design, purchasing, sales and work scheduling managers surveyed, a good solution for this task alone would be of such benefit that the implementation of a PDM solution would pay for itself in less than 12 months.

On the other hand, project organisation tools can also help in terms of ensuring an overview and specifically intervening as required. Therefore, the integration of project management systems can provide support for time schedules, and with the aid of project-oriented structuring it is possible to manage both communication with the customer and any change requirements arising in the project.

A flexible and adaptable product data management system is suitable for use in serial production and order-based production alike. With it's modular structure, the PDM solution provides the opportunity to select just the right components for the relevant requirements.

PDM Selection Criteria

Ties that stand the test of time!

The implementation of a PDM system represents an important change of direction with an enormous influence on the innovative capacity of a company.

Selecting the appropriate software and the right partner is a decision that will lead to a long-term relationship.

As a rule, control of a PDM project is in the hands of design and development, as it is here that around 75 percent of all product data is determined. And it is here that the loose ends are tied together when changes are required. So it is only logical that these departments should be in charge of product data.

The introduction of a PDM system affects many divisions and departments within a company and as such has far-reaching consequences on the company's processes, productivity and data security.

Everyone who needs access to product data for their daily work should be able to access the PDM system; this is the only way to guarantee that all of the people involved in the product process are working with the same standardised database. Therefore, as soon as the choice has been made, a PDM project should be made available to all relevant users. In this way, as many employees as possible gain immediate benefits and the investment rapidly recoups the outlay involved for the company.

In a smaller enterprise, it may be sufficient if just one person from each of development, production and order handling is involved. In larger organisations it may be the case that a number of implementation teams for the various divisions are in place alongside a central planning team.

The task for PDM planners is to take the requirements of all departments into consideration. It is not just about replicating the existing processes and structures within a PDM system on a one-to-one basis, but also questioning them in order to arrive at better and quicker processes through renewal or simplification.

The ideal would be to manage for the most part with standard software; the fewer adaptations made to the PDM system, the lower the maintenance and upgrade costs. Software adaptations also carry with them risks in respect of the reliability of the installation. However, where company-specific processes are absolutely essential, it is crucial that the PDM software has the required adaptability to ensure that their introduction does not hamper the necessary processes. Therefore, one of the first steps for planners is to undertake a comprehensive inventory and analysis of requirements leading on to a target concept, which provides the basis for the selection of the solution.

Autodesk's PDM systems control compliance with works directives and regulations with regards to drawing numbering, part designations, categories and processes.

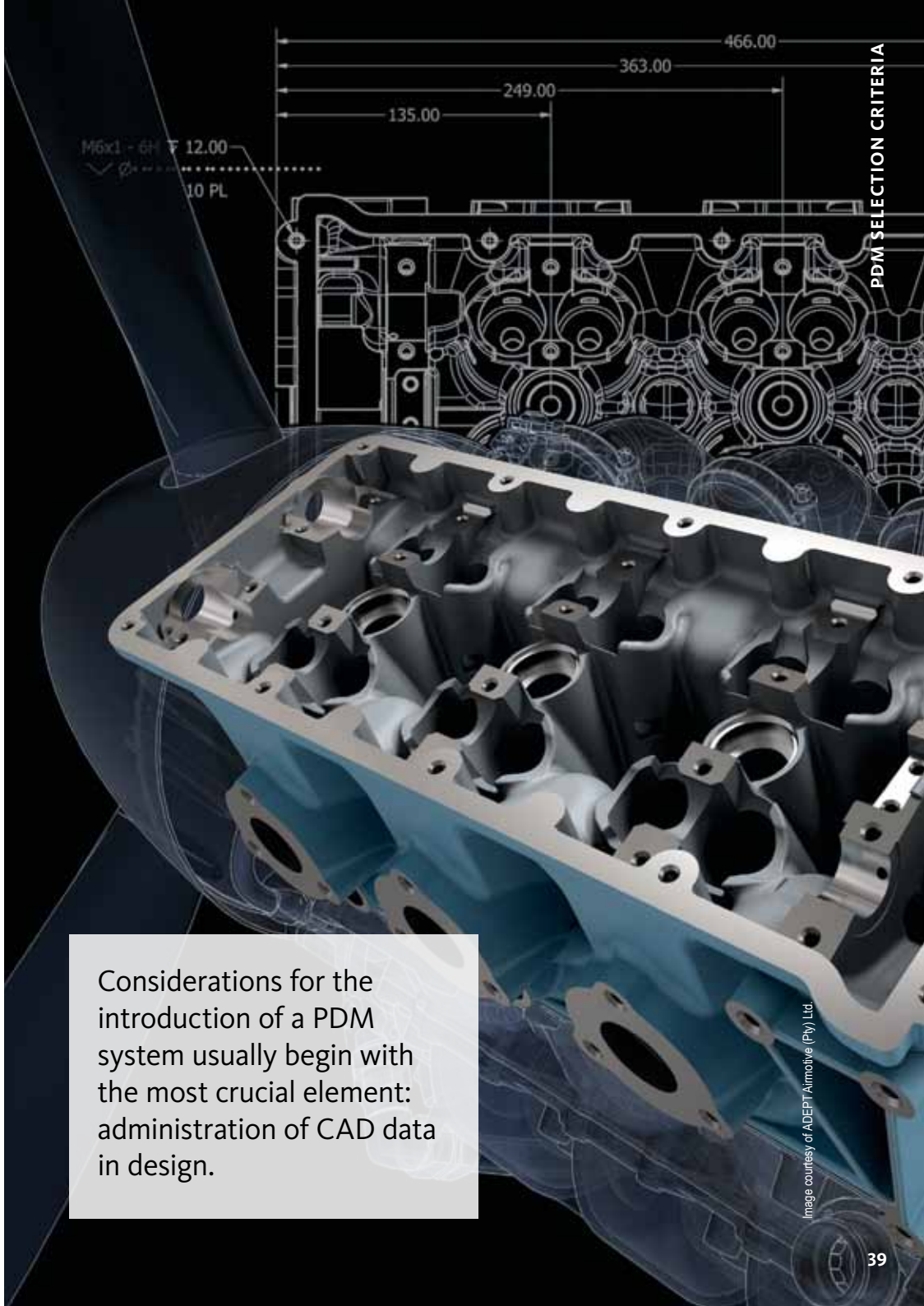
Selection Criteria

Comprehensive lists of requirements and catalogues of questions can be used to aid the process of selecting a PDM system. We concentrate on a number of selected and important topics and questions which always have a role to play in current PDM projects.

Focal Point: Design
Considerations for the introduction of a PDM system usually begin with the most crucial element: administration of CAD data in the design.
The initial step, therefore, is frequently a system of file management. Correspondence and other important documents relating to a project should not be filed 'privately' at the workstation of a specific employee. They represent an important element of overall project documentation and must be managed accordingly. Under no circumstances must they be lost.

Attention is then quickly turned to the associated data which also has to be managed, such as:

- → Office documents (texts, spreadsheets, presentations, images)
- → CE declarations
- → Minutes and protocols
- → Specifications
- → Tools for materials and semi-finished parts
- → Digitalised paper drawings
- → Correspondence
- → Internal and external communications



Considerations for the introduction of a PDM system usually begin with the most crucial element: administration of CAD data in design.

Image courtesy of ADEPT Airmotive (Pty) Ltd.

With the right tools, e.g. a bulk loader, it is possible for models, drawings and other documents to be transferred to the PDM system along with their attributes.

Transferring Legacy Data
In most cases, a great deal of redundant data and files are in place and it is not usually possible for file structures to be carried over on a one-to-one basis. This calls for the use of checking tools which, for example, scan assemblies to see if they are complete and eliminate duplicate files or file names. In the interest of simplifying migration, a data management system should be implemented as early as possible. Once the data are organised within a data management system, it is much easier for them to be transferred to another PDM solution.

Integrated Administration of Mechatronic Data
he topic of mechatronics is becoming ever more important, with its constituent aspects of mechanics, electronics and IT. In many mechanical engineering operations, the outlay for electronics and software development is already outstripping that for mechanical design. This gives rise to the question of whether the PDM solution should not be managing all three areas.

When it comes to transferring legacy data there are a number of questions which require clarification:

- → Can you do without transferring such legacy data, partially or entirely?
- → Do you want to transfer just your CAD data?
- → Might it be necessary for CAD data to be converted during the transfer process?
- → In addition to the native CAD data, will it be necessary to transfer neutral formats such as PDF, TIF or DWF?
- → Or do you even want to scan in your paper drawings so as to have a standardised system for the electronic management of all documents?
- → Is long-term document archiving necessary?

Don't Put the Cart Before the Horse
High priority is always given to integration into any existing ERP (Enterprise Resource Planning) system. ERP and PDM systems overlap, primarily in the areas of Bills of Materials and master data management. Many important PDM system functions such as configuration management, classification and parts management are, however, hardly covered by ERP systems at all. The integration of CAD/CAM/CAE systems is, for the most part, similarly inadequately dealt with. In the meantime, ERP manufacturers are also looking to come up with solutions for the management of design data. However, the question is whether the solution from your ERP manufacturer is flexible and user-friendly enough for your design requirements.

Particularly when it comes to taking the requirements of design and development departments into account, ERP systems frequently display striking weaknesses:

- → To check documents in and out it is necessary to switch between CAD and ERP views.
- → The direct interface with the ERP system is slow, resulting in wasted time.
- → The ERP interface has to be accessible at every workstation (licence costs).
- → 3D models can be accessed from outside the design department (security).
- → The ERP solution only partially supports structured data filing, if at all.
- → Upgrading to new releases of the CAD or ERP systems at different times can cause problems.

Conversely, for a PDM solution optimally integrated into the CAD system, experienced users put forward arguments such as:

- → 3D data remains under the control of the design department and there is less risk of it falling into the wrong hands.
- → The transfer of data to the ERP system does not take place until later on or upon release.
- → The ERP interface is only required at a few workstations.
- → Designers can work more quickly, efficiently and largely independently of the ERP system.
- → Better support is provided for CAD-specific information and structures as well as graphic views.

Efficient searching makes it easier to locate existing designs and parts, thus reducing costs.

Search facilities and an intelligent system of data organisation based on part properties, irrespective of file type, allow for accurate and quick search results.

Reducing Costs in the Process of Searching and Locating

An efficient search and the quick location of existing designs and components can be of enormous help in reducing costs.

→ Are your products to be classified and provided with characteristics (characteristics lists)?

→ Or is the rudimentary solution of a naming catalogue sufficient for finding existing parts and assemblies quickly?

→ Do you expect your data to be connected to an information network via links?

Central Management of Templates and Contact Data

The value of a centralised system for managing templates and forms only becomes clear when there are changes in the company's name or logo.

→ What templates and forms are required?

→ Would centralisation be useful?

For order-based production in particular, centralised management of project data is useful to ensure that all of the data associated with the project is available to the parties involved. This includes customer and partner contact details, meaning that if a customer relocates, for example, all of their relevant contact details can be updated automatically.

In selecting a PDM system, small and medium-sized enterprises are looking for quick and practical solutions. A simple entry level is a sound basis for this.

Comprehensive checklists help to cover as many conceivable situations as possible. Within the actual project, a planner has to set his own priorities and come up with weightings suitable for his own company or organisation. When selecting a PDM system for small and medium-sized enterprises (SMEs), weightings may be allocated completely differently. For example, for a small operation, purchasing costs, time required for introduction or even simply the firmly-established business relationship with a partner may represent the crucial factors. Small companies have neither the time nor the resources for extravagant projects.

However, it is getting easier for SMEs as the investment barrier is being continuously lowered. These days, a basic but powerful PDM solution is included in some CAD systems, for example, all of Autodesk's mechanics systems, at no extra cost. This means that functions such as secure multi-user management, design version management, component and assembly location and 'where used' information are an integral part of modern CAD systems. This simple entry level provides a sound basis for the further extension of PDM functionality, allowing for the management of Bills of Materials, item families, Office documents and workflows, along with geometry data. Autodesk's graduated Vault solutions offer the possibility of extending over a number of phases.

When it comes to migrating to a larger and more comprehensive PDM solution, anyone who has failed to keep design data under control right from the start will have great difficulties at a later date once the volume of data has grown.

Where will this leave 2D users?

Data management is by no means a topic solely for 3D CAD users; quite the contrary. It makes a lot of sense to apply data management systematically at an early stage – ideally right from the start – even for 2D design. After all, while the volume of archived design data is still manageable, the barriers to introduction remain lowest. One of the strongest arguments for data management for 2D design is frequently overlooked: when it comes to migrating to a larger and more comprehensive PDM solution, anyone who has failed to keep design data under control right from the start will have great difficulties at a later date once the volume of data has grown. Once the uncontrolled proliferation of temporary files and redundant copies on hard disks and backups have gained the upper hand, then it will be difficult to separate valid drawings from the dross. If then, at some point, the technology is changed, the PDM system will ideally guide the user seamlessly from 2D to 3D.

Collaboration Across Different Sites

The trend for globalisation of companies, or even simply the opportunities offered by modern data networks, sees engineering and manufacturing geographically separated ever more frequently. The task for the PDM system is to ensure that the physical distance is felt as little as possible across different sites, continents and time zones. At the same time, greater importance is being attached to what is termed 'lean production' and flexible collaboration with service providers, stakeholders and suppliers. This goes hand in hand with a greater need for controlled access to data, the administration of a variety of versions and assignment of responsibility as well as support for check-in/check-out, version management, complete or selective replication of data at each site, sequential or simultaneous engineering and collaboration functions.

Only in rare cases is a PDM specialist with experience of PDM, or even of the introduction of a PDM system, available internally. It is therefore logical to work with an external partner with the appropriate knowledge.

Selecting a Partner

As the decision to adopt a PDM system represents a long-term commitment, selecting the right supplier is of crucial importance. Therefore, it is entirely justified to ask questions about the future prospects of the supplier:

- → What is the supplier‘s position in the market?
- → What is the supplier’s financial situation?
- → How big is the development team?
- → How big is its customer base?
- → Is the supplier represented in all of the significant countries?
- → Can they provide local support?

External assistance can be useful during both the planning and implementation stages.

External Consultancy
Only in rare cases is a PDM specialist with experience of PDM, or even of the introduction of a PDM system, available internally. It is therefore logical to work with an external partner with the appropriate knowledge. You can benefit from the experience gained through the implementation of many previous projects and avoid making the same mistakes that others have already made. External assistance can be useful during both the planning and implementation stages. In the planning phase, you may prefer to call on the services of an independent specialist, while for implementation the supplier‘s experts may prove to be the better choice.

Higher productivity, greater security, better organisation

Designers are no longer prepared to do without it: PDM reduces project times, improves product quality and provides support for routine tasks.

The Barriers are Falling

In many companies, management has come to view the topic of PDM in a different light. The highly ambitious PLM (Product Lifecycle Management), with its expensive long-term projects, has given way to the more pragmatic PDM approach.

PDM solutions are practical and cost-effective. They quickly pay for themselves, the barriers to adopting them are lower and there is a wealth of positive experience to draw on. For the most part, paper archives have disappeared from companies while CAD archives are growing rapidly and, without a management system, will soon become unmanageable. The investment is worthwhile even for small-scale engineering offices. Add to this the broad-based switchover to 3D design which can be seen across the board and which gives rise to a greater variety of file formats to be managed for each part or assembly: model files, drawing files, Bills of Materials, neutral files for exchanging data such as STEP and DXF files, viewing formats such as DWF or PDF, calculations, descriptions, images, renderings and animations for marketing and sales purposes, and many more. This is further complicated by the management of the more complex relationships between these files.

CAD archives are growing rapidly and, without a management system, will soon become unmanageable. The investment is worthwhile even for small-scale engineering offices.

A-dec, Inc.
Easier Collaboration with Autodesk Vault

A-dec Inc.'s award-winning dental equipment can be found in the White House, ships at sea, more than 100 countries, and 90 percent of dental schools throughout the United States and Canada. Founded in 1964, the family-owned, Oregon-based company is one of the world's leading dental equipment providers and a one-stop shop for cutting-edge, configured-to-order dental equipment systems.

When developing a new product, as many as 25 A-dec engineers work concurrently, designing parts that must ultimately interconnect. In the past, the lack of version control was a huge issue, resulting in wasted time and effort. Now, A-dec relies on Autodesk® Vault software to manage all data related to the digital prototype—letting engineers know they're always designing and building interfaces around the most up-to-date parts.

Autodesk Vault software also makes it possible for stakeholders in different departments and locations to leverage the digital prototype and its built-in information. External vendors use the digital model to create tools and cast parts. Manufacturing relies on the geometry in the digital prototype to produce and assemble the product. And the marketing department uses the digital prototype to create advertising materials, installation instructions, and service guides. Beyond its direct design use, the information contained in Autodesk® Vault helps a long list of others do their jobs more efficiently.

"Life before Vault was cumbersome," says Patrick Berry, Product Development Engineer at A-dec. "Thanks to Vault, engineers know they're not working with something that was obsolete months ago. The team can collaborate with confidence."

Joy Mining Machinery
Autodesk Vault Helps Joy Manage Its Development Engineering Data

A leading manufacturer of mining equipment in a tough global market, Joy Mining Machinery faced a critical challenge: to create an engineering environment with enough process efficiency to integrate multiple design teams worldwide and accelerate its time to market.

With four distinct engineering teams in as many countries, Joy needed an efficient way to manage development engineering data. They found it in Autodesk Vault. Autodesk Vault offered easy installation, without complex deployment, and scalability for workgroups. And with an intuitive interface that's easy to use, Joy gained immediate data management efficiency.

Today Joy is using Autodesk Vault to organize its multi-team, multi-location development engineering data into local repositories. The application gives engineering team members access to up-to-date data without spending time on data organization, extensive searches, and individual file sharing efforts. Working outside of the enterprise PDM system for development accelerates design cycles, improves reuse and repurposing of data, and enables better version control with fewer errors.

Tim Morris, Director of Global Engineering Systems, Joy Mining Machinery: "The key to this entire process was the selection of Autodesk as both our technology and global implementation partner. I don't know of another company that can provide the technology strengths, sophisticated software, and world-wide implementation services that make up this comprehensive solution."

Soil Machine Dynamics
Dynamic Data for Deep Sea Discovery

How a subsea robotics specialist is combining Autodesk Inventor with Vault Professional to facilitate cutting-edge, multi-site design engineering.

Soil Machine Dynamics Ltd (SMD) designs and manufactures cutting-edge subsea and remote intervention systems. Examples include an extensive range of remotely operated vehicles (ROVs), equipment for nuclear decommissioning, the world's first deepwater mining equipment and marine renewable energy devices. Established in 1971, SMD has worldwide reach and over 300 staff, including 80 design engineers. Its head office is based near Newcastle, with other operations in Malton, Houston, Singapore and Macaé in Brazil.

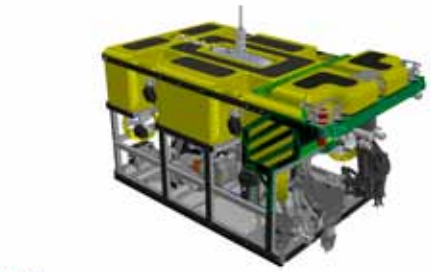
Autodesk Inventor is used by the specialist manufacturer to design its innovative vehicles. It has developed its own control software to operate the vehicles, similar to flight simulator software, which is operated from the deck of a ship. The operator controls a vehicle 5,000 feet below them, which is attached by a cord. At offshore oil assets, the vehicles provide vital images from the seabed to support a range of operations. The machines are also used when telecoms lines are buried at sea.

High-tech design and visualisation

SMD has a long history of using Autodesk software in the design and manufacture of its machines, which has taken it from 2D drafting and design engineers on the shop-floor to near-perfect first-time manufacture. "We started using Autodesk software around 1997, as our engineers moved from 2D drawings to 3D CAD," explains SMD chief engineer, Jason Riby.

With Autodesk solutions for manufacturing, changes can be made and tested with a digital prototype far more rapidly than physical redesigns in the real world, something that SMD experienced first-hand when it began using Autodesk Inventor for design simulation and analysis. "One of the major benefits that we have seen in terms of 3D deployment is the standard and accuracy of the drawings has increased dramatically, which in turn has had a positive impact on design and assembly," says Riby.

The fact that Autodesk solutions enable companies to digitally test performance of a product before it is manufactured is also of great benefit to the organisation."Where, fifteen years ago, engineers would spend a lot of time in production and supervising the weld and grind on the shop floor, now we have separated design engineers and production staff that have enough detailed and accurate information to make the machines," says Riby. "It has also enabled us to go into final assembly straight away, rather than pre-assembly."



A strong player

In recent years, its strong heritage in the market, combined with successful acquisitions and growth strategy has helped SMD achieve substantial growth. In 2010, the firm won the industry's largest ever single work class ROV order for twenty vehicles and was chosen to manufacture the world's largest free-stream tidal turbine. It also increased its engineering design work on the development of the world's first deep-water mining equipment.

To support the increased demand for its operations, SMD expanded beyond its head office and manufacturing facility in Wallsend, near Newcastle to include other operations in the UK and overseas. The expansion has seen the firm's workforce double in size.

Rapid growth and expansion inevitably present operational challenges. For Soil Machine Dynamics, one of the main technical challenges faced was concerned with sharing data, as engineers at each of the different sites needed access to the same files. Taking local copies was not a viable option for the firm because they would quickly have become

out of date. What was needed was fast access to real-time data which was where SMD recognised that Autodesk Vault Professional would prove essential in helping it to replicate data across its different sites.

Unlocking the Vault

Autodesk Vault was first introduced at SMD in 2007, predominantly for file management. As his engineering team increased to almost 100 split across four sites, Riby recognised that implementing Vault Professional controls – including data security, work-flow and change control, would help him to properly enforce Soil Machine Dynamic's existing tried-and-tested operational procedures; "We realised that the work-flow and change order control that can be done in Vault would enable us to do what we needed plus a whole lot more," he says.

Vault Professional was implemented in August 2010 to create a centralised data repository that could be synchronised across the various SMD sites. "Users don't have to worry about whether or not they are working on the latest version because they have complete visibility of the main data centre at the HQ in Wallsend and the other three sites have replicated servers," says Jason Riby. "Now that the system is established, it will support further expansion of the business across more sites."

Uniting users and technology

The other main benefits of Vault Professional for Soil Machine Dynamics, over and above data replication, are the fact that the system facilitates automatic engineering change control and the ability to export the data from Vault into an Enterprise Resource Planning (ERP) system. So far, chief engineer Jason Riby reports that the file management system has been deployed slowly, but successfully, with training information coming from existing staff mentoring new staff.

Soon, Riby hopes to roll-out the data management aspect of the implementation, at which point significant user training will be given: "The deployment is so integral to the success of the company that we are testing it in stages before we roll-it out across the firm," he explains.

On track for success

Now that SMD is successfully on course to achieve seamless multi-site data management, chief engineer Jason Riby is determined to have the right systems in place to give all of Soil Machine Dynamics' expanding workforce visibility of essential systems and real-time data.

"Having tackled the issue if data management, our current focus as a firm is implementing a new ERP system that fully integrates with our CAD system," he says. "The overall aim is to automate management planning feedback, which is currently done manually but is fast becoming unsustainable as the company grows. Ultimately, the engineers will be using Autodesk systems and the rest of the company ERP, but, crucially, all our users will have access to engineering data."

Does it Pay Off?

PDM offers both quantitative and qualitative benefits

There are many strong arguments in favour of a PDM solution. But does PDM actually pay off? These are the areas that stand to gain the most.

As a rule, taking the first steps into design data management today is an extremely simple process which is possible at quite a low cost.

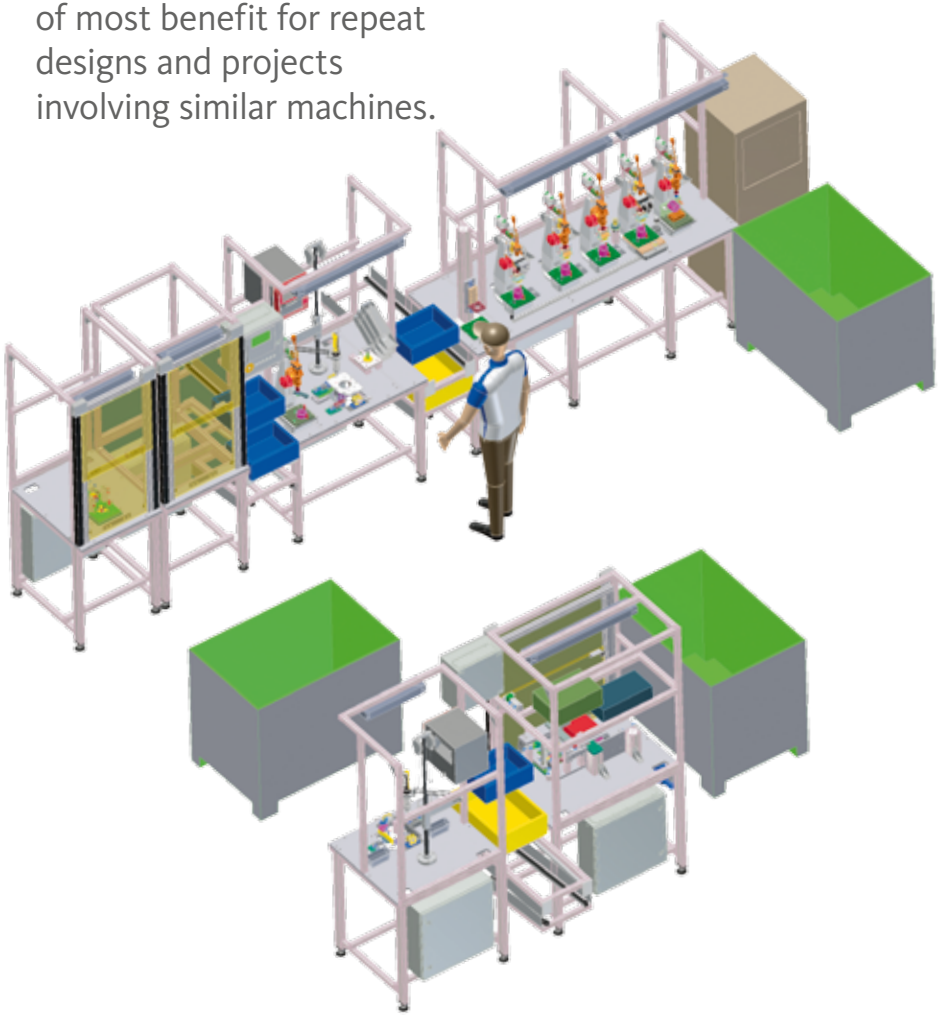
Only when company-specific aspects and processes have to be incorporated are higher costs to be anticipated.

The costs involved in the acquisition of hardware and software and for operation can usually be calculated relatively simply. It is significantly more difficult to assess the benefits of a PDM system in quantitative terms. There are no formulae, factors or tables from which a company's ROI (Return On Investment) can be easily calculated. This applies both to assessment prior to and after acquisition. While many of the benefits are clear to see, others cannot be simply quantified. In a small design office it may be possible to come close to the real figure on the basis of simple estimates, but this is more difficult in larger organisations. All of the affected divisions and departments must be analysed, involving many tasks and processes. In fact, some experts even see the greatest advantages occurring in the downstream divisions. For this reason, we will restrict ourselves here to a number of qualitative statements and indications of potential benefits acknowledged in the professional sector or frequently reported by users. It would be possible to evaluate these potentials quantitatively on a case-by-case basis in order to achieve useful results for calculating a return on investment.

Design as the Focal Point

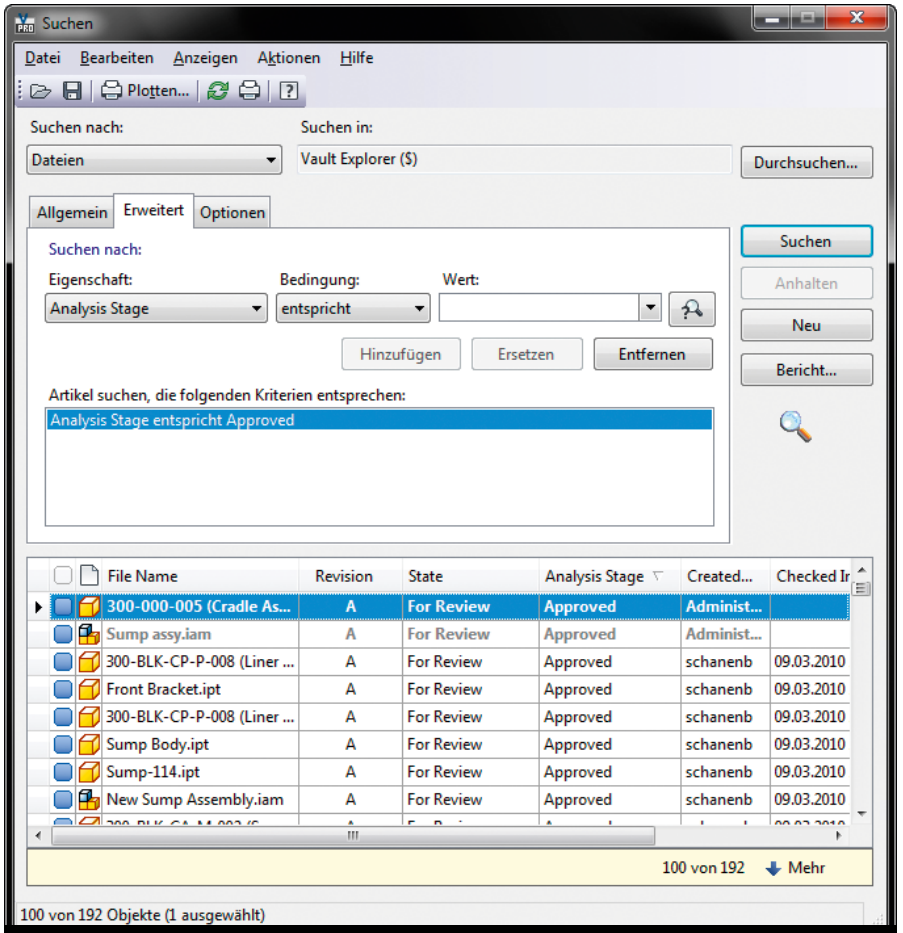
Around three quarters of a product's costs are determined at the design stage so it is here that the impact of a PDM system is greatest. The starting point here is that experienced users are unanimous in reporting the time savings they make when searching for design data and other information. They quote figures in the magnitude of 25 to 80 percent time savings during searches for product data, drawings or calculation documents. As a designer usually spends around one third of his project time gathering information prior to starting the actual design work, there is a concrete benefit to be derived here.

3D design and PDM are of most benefit for repeat designs and projects involving similar machines.



Efficient Searching – More Frequent Reuse

More efficient searching has the direct result that existing parts and assemblies are reused more frequently, making it possible to save almost 100 percent of design costs and a large part of production costs. In this way, PDM provides support for standardisation. Various studies and analyses show that €500 to €2000 is spent every year solely on the maintenance of data records pertaining to a part saved in a company's systems. Add to this an estimated sum of up to €1000 for the creation of a new item, and on top of this there are the development and production costs.



Various methods such as saved search criteria or links assist in the organisation of product data and the ability to locate it quickly.

If designers do not have the appropriate tools to establish which parts are already present in the system or are provided with inadequate access to parts already entered, numerous parts are duplicated and entered a number of times, and the costs are multiplied accordingly.

It is estimated that with the use of PDM it is possible to increase the rate of reuse of existing parts by some 50 percent. The use of parts requiring only slight modification is also increased under PDM, contributing towards lower costs.

Improved Collaboration
The electronic communication of product data within modern computer networks is considerably faster than the old system of forwarding paper drawings. Data replication means that even sites separated by great distances always have the most up-to-date version of a design. Time delays caused by sending items through the post are a thing of the past. Of course, a PDM system must safely control and manage access to the data it contains. The time saving here in comparison with paper communication is up to 100 percent; it is impossible to overestimate the resulting benefit in terms of a reduced time to market.

The Slow Lose Out
In recent years, many companies have been forced to cut their project times significantly simply to remain competitive. Apart from 3D design, they have found PDM to be the key to reducing their time to market. PDM eliminates a great deal of manual work, making the processing of customer-specific variants simpler and faster.

Higher Quality
The automation of processes in design and the associated divisions helps to avoid mistakes, saves the cost of expensive follow-up work and reduces time-consuming discussion meetings. Even the 'where used' information for parts serves to avoid expensive mistakes. The designer can check where a part is installed and what effect modifying it will have on other assemblies. Overall, experienced PDM users report a significant improvement in quality in terms of design and general organisation.

Additional benefits from coupling PDM and ERP

Additional benefits can be achieved by integrating the PDM system into other company IT applications, especially into the ERP system, but also its knowledge management systems and other solutions.

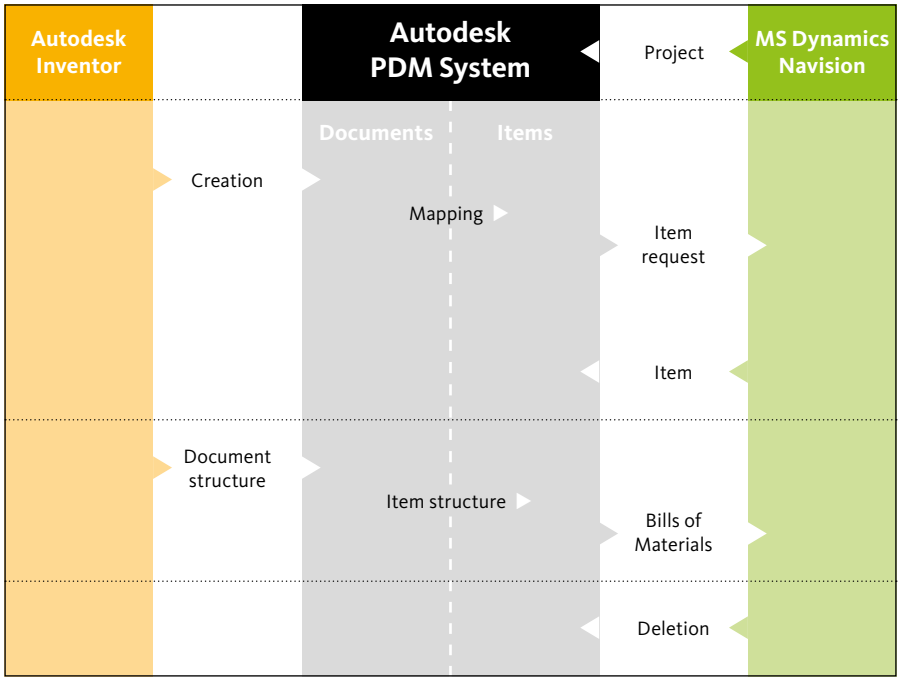
The Glatt Group, with its workforce of over 1,500, produces systems for the pharmaceuticals industry. The company increased the benefit gained from its PDM solution by coupling it to its ERP system, and the profitability of this measure has been clearly demonstrated.
Glatt set up an Autodesk PDM solution and initially operated the two systems, PDM and ERP (Microsoft Dynamics Navision), in parallel without linking them. The duplicate entering of items in both the ERP and PDM systems and the constant switching between ERP and PDM required to view a drawing in a deeper bill of materials structure took up valuable time and resulted in an increased error rate.

„The interface paid for itself in around three months simply through the time saved by employees when entering and maintaining item data and when searching for information. Furthermore, the quality of our data today is considerably better.“

Martina Edelmann, Project Manager, Glatt Group

Some companies may be more impressed by the stricter legal requirements and use these to justify their PDM investments.

As indicated above, there are numerous regulations associated with product liability with which it would be difficult to comply without a PDM system.



Functional diagram: PDM-ERP coupling at Glatt Group

PDM Solutions from Autodesk

Essential, but still affordable

Autodesk‘s scalable PDM products are deeply embedded within the CAD environment, providing support for the specific aspects of Autodesk‘s CAD systems. This integration makes it easier to manage product data throughout all phases of digital product development, helping to save time and avoid errors.

Six years ago, Autodesk provided its MCAD customers with a PDM system at no extra cost:

Autodesk Vault became an integral component of all Autodesk CAD mechanical CAD systems.

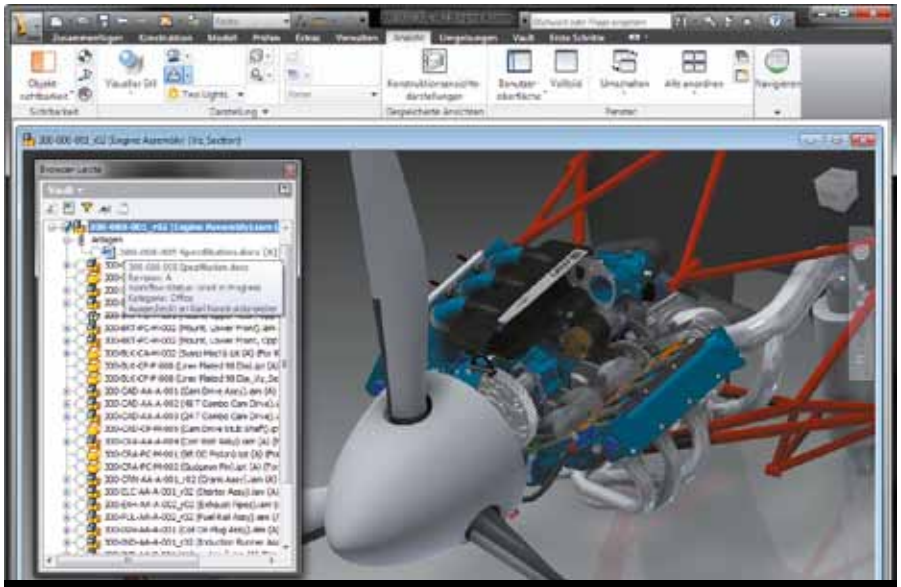
In the meantime, this has given rise to a portfolio of graduated solutions: at entry-level these are viable for small companies, while at the upper end of the scale they meet the high demands imposed by large-scale, globally active enterprises. Today, the Vault product family for these varying PDM requirements represents the essential infrastructure behind Autodesk's Digital Prototyping solutions.

Autodesk Vault
With its version management features, locking of files currently being worked on, referencing of the assembly hierarchy, 'where used' information for parts, efficient searching and intelligent file management (which, for example, helps with the copying of designs with all associated files), Autodesk Vault provides Inventor users with the basic functions necessary for data management. Secure data management, structuring and tracking over a central storage location optimises the creation, filing and common use of data in digital product development.
This basic software is included in AutoCAD, AutoCAD Mechanical and AutoCAD Inventor Suite at no extra cost.

The Autodesk Vault basic software is included in AutoCAD, AutoCAD Mechanical and AutoCAD Inventor Suite at no extra cost.

Autodesk Vault Workgroup

Autodesk Vault Workgroup software offers even more extensive functions. It represents a simple step for the user currently faced with the decision of introducing a PDM solution for the first time, replacing an obsolete drawing administration system or switching from the Autodesk Vault system previously in use to a document-based, team-oriented and more productive data management system for their digital product development. Vault Workgroup lightens the designer's workload by helping with the automatic allocation of file names and numbers and change indices, in accordance with company-specific rules. The package contains the entire range of Vault functions and manages file status attribution. In this way, it supports the facility for releasing a document and protecting it from further changes.

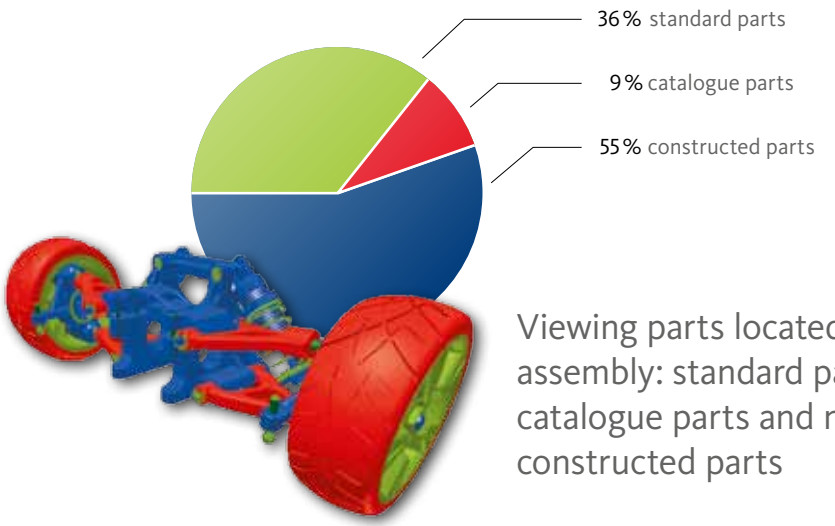


Autodesk's PDM products are deeply embedded within Autodesk CAD systems. This integration makes it easier to manage product data throughout all phases of digital product development, helping to save time and avoid errors. The image shows Autodesk's Vault functions integrated within Autodesk Inventor.

Vault Workgroup makes a release on the basis of a document, which means that it can release a drawing, for example. This is the standard way of working in many companies so.installing Vault Workgroup is an easy matter, requiring no changes to existing company procedures. Modifications (revisions) and all statuses of a design throughout its development are therefore established.
Additional security functions regulate, among other aspects, user access rights, depending on the group to which they belong or their role within the company.

CAD Integration by Means of Visual Functions
The high degree of integration in Inventor makes it possible, for example, to view PDM functions or attributes such as the colour in which parts are displayed during a search, or the different colours assigned to all parts that are released, currently in progress or still awaiting release. This provides a clear, visual and quick overview of the status of a project. CAD characteristics (attributes, properties) and PDM status details are provided in the data cards at a single point for direct processing within Inventor, without the need for a separate PDM client. The CAD administrator can determine compulsory data fields in the data cards to ensure that no short cuts are taken.

Integrated Management of Microsoft Office Documents
Integration with Microsoft Office, including Office 2007, permits simple management of non-CAD data such as specifications, calculations and presentations. A preview function for Office files such as Word documents, Excel spreadsheets and PowerPoint presentations makes it possible to view the content of files quickly without being required to open the application in question.



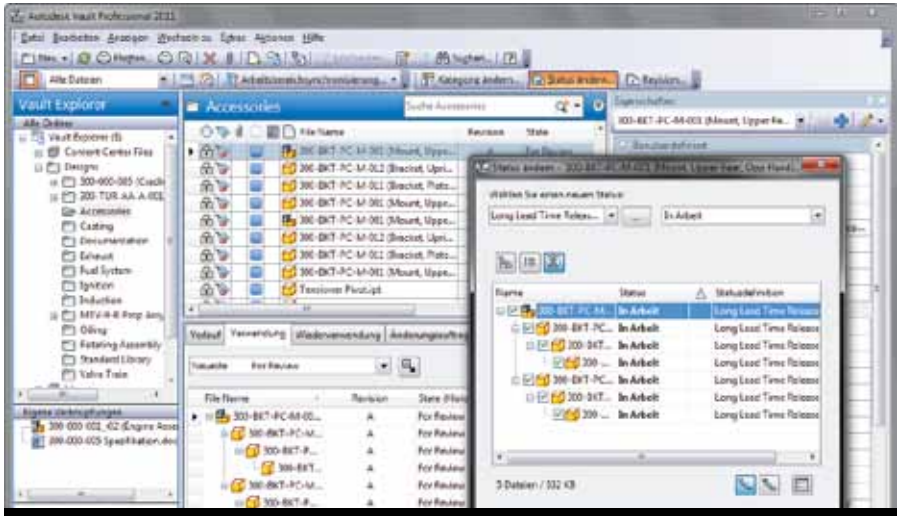
Viewing parts located in the assembly: standard parts, catalogue parts and newly constructed parts

All members of the team work on the digital prototype without overwriting each other's data. To enable this, a design is checked out before being edited and then checked back in.

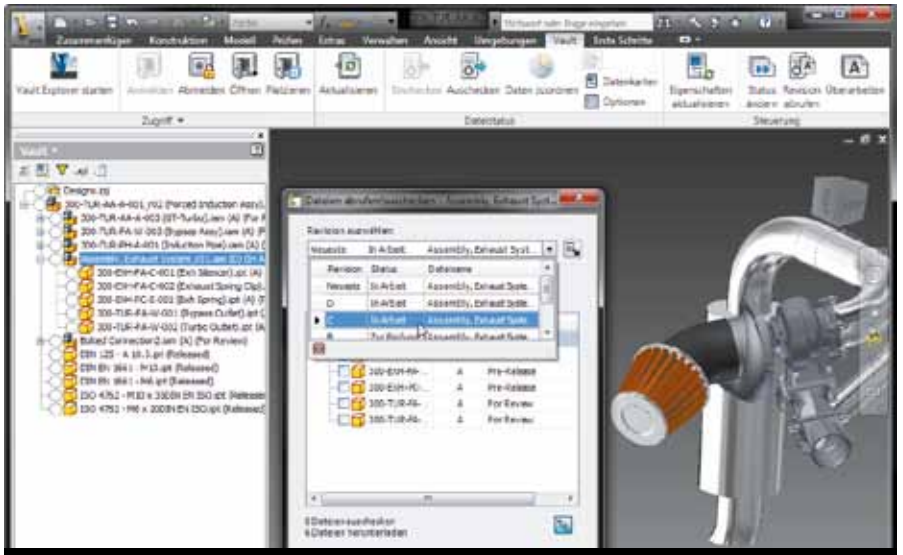
The time, the reasons for and the initiator of changes are recorded. On the basis of team-oriented and controlled collaboration, companies achieve noticeable increases in productivity without any detrimental effect on their existing design processes. Vault Workgroup can be integrated seamlessly into Autodesk Inventor, AutoCAD Electrical, AutoCAD Mechanical or AutoCAD. This guarantees straightforward workflows, facilitates data management and helps to save time.

Vault Workgroup is easy to install, use and manage. Its uncomplicated implementation guarantees a quick ROI.

More Efficient Searching and Reuse of Data
Intelligent search functions based on saved, frequently used search criteria, for example, guarantee quick and effective access to data. Designers require less time to locate digital information, saving unnecessary duplication of work in the process.
Outlay and costs are reduced through the efficient tools for copying and reusing existing assemblies with all the associated data. This is the most efficient method of design: reusing an existing design or part instead of creating from scratch and incurring the storage costs associated with additional parts. The 'where used' function helps with evaluating the effects of any change.



Controlling status changes, rules and access to data: the PDM system guarantees secure management of product data, from initial draft right through to archiving.



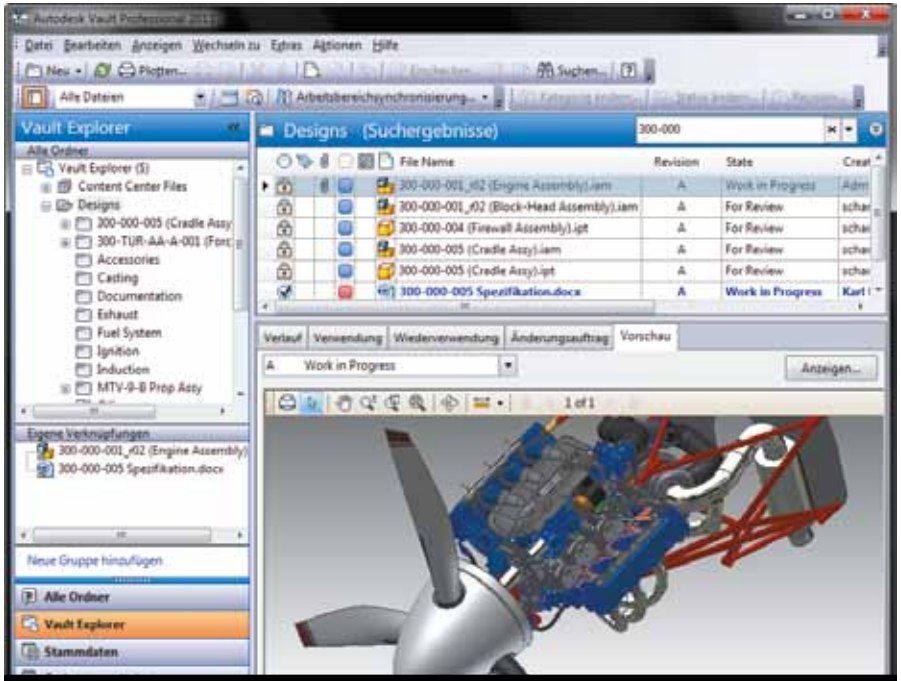
Autodesk PDM systems offer intuitive revision management and provide for the secure tracking and release of all components throughout the entire design process. They help to avoid errors such as the accidental reuse of an old version.

Integrated Change Management
PDM software speeds up design cycles and provides higher quality data. Vault Workgroup enables the control of change and release processes directly from within the design applications in use. The designer can run a complete change history, manage variants and has the option of returning to an earlier draft at any time.

Simple Management and Configuration
Vault Workgroup is easy to install, use and manage. Its easy implementation guarantees a quick ROI. The software offers the administrator the required scalability for managing even large workgroups. He can set up various restrictions for data access, for example at folder or file level, and can also define the level of authority required for completing status changes or restricting access to files of a specified status. A client extension SDK (Software Development Kit) allows adaptations to be applied to the user interface for customer-specific client functions and modifications. Functions for batch processing plot orders simplify the process of plotting complete orders or projects.

Autodesk
Vault Collaboration

Autodesk Vault Collaboration supplements Vault Workgroup with a web client and the facility to replicate across a number of sites. This means that data management can extend to cover various locations, with the inclusion of external or mobile users. Design data can be replicated in full or selectively. Selective replication is a good security measure as data is only available where it is required and is thus not unnecessarily exposed to the risk of theft. A web client, which is a component part of this package, allows for the use of PDM functions and read-only access, including a visual preview within a web browser, with no need for a CAD licence. This enables users in manufacturing or at the assembly site to access and display drawings, or even print them out.



Product data output in DWF format can be checked, printed or annotated by colleagues outside of the design department without changes being applied to the original data.

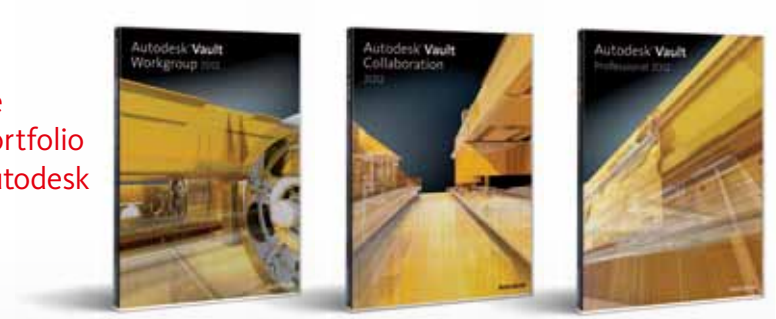
Autodesk Vault Collaboration supplements Vault Workgroup with a web client and the facility to replicate across a number of sites. This means that data management can extend to cover various locations, with the inclusion of external or mobile users.

Autodesk
Vault Professional

Autodesk Vault Professional provides support (over and above the scope of Vault Collaboration) for the management of design changes and Bills of Materials, facilitating handover to production and collaboration at various sites. The package supports the integration of goods handling systems (ERP systems) and early collaboration with departments outside of design, so as to avoid any delays due to inadequate communication in the process of product development.

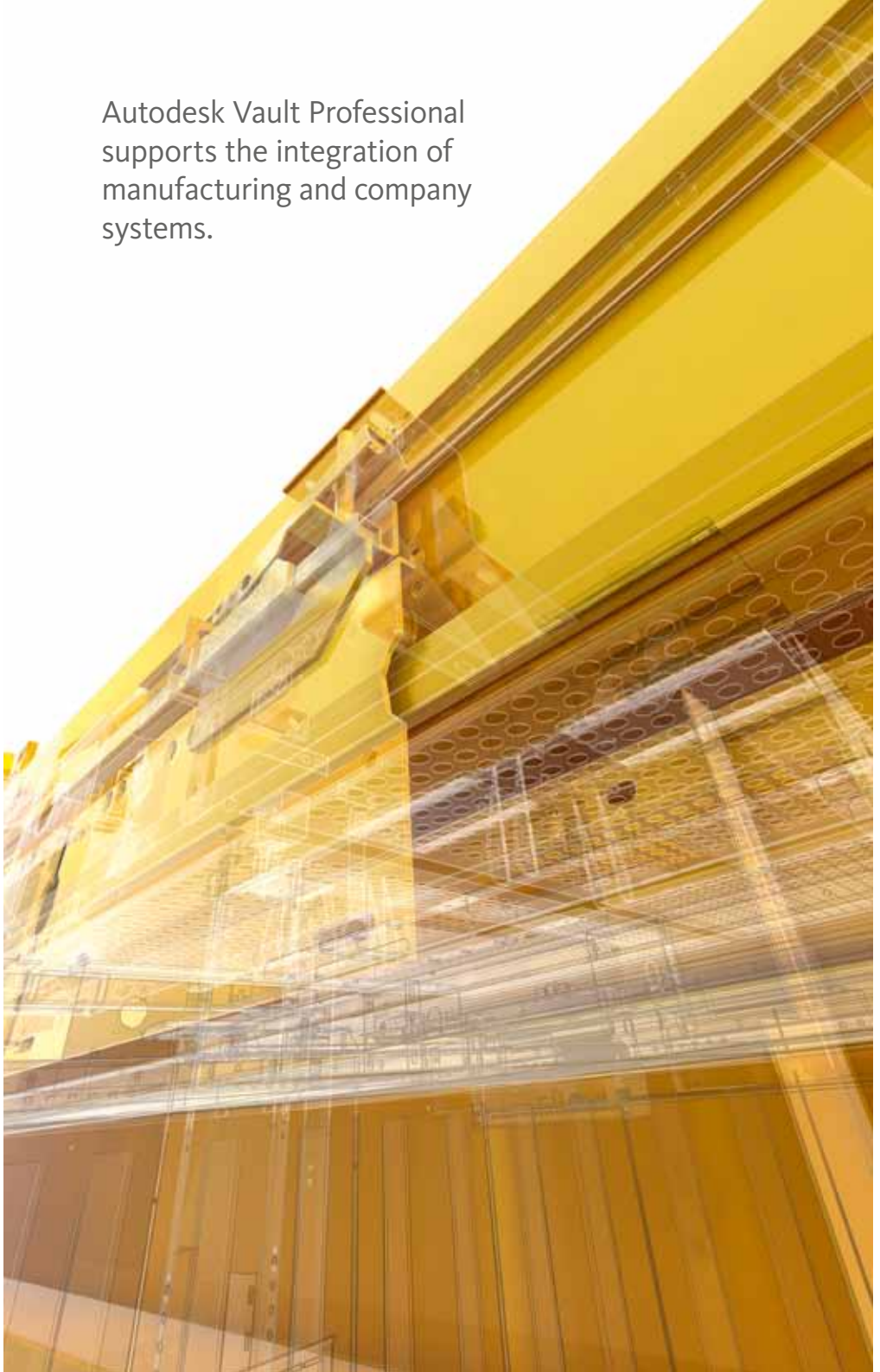
CAD and PDM from a Single Source
Autodesk supplies CAD and PDM solutions from a single source. This means optimal integration of data management into the design environment and synchronous release cycles. Autodesk customers do not have to worry about the compatibility of a new PDM version with their existing CAD system.

Scalable PDM portfolio from Autodesk



Autodesk Vault	Autodesk Vault Workgroup	Autodesk Vault Collaboration	Autodesk Vault Professional
data management for ongoing projects	revision management and security	scalability for large workgroups and across a number of sites	integration with production and company systems

Autodesk Vault Professional supports the integration of manufacturing and company systems.



PDM solutions from Autodesk:
from the basic Vault software through to Vault Professional

Features	Autodesk Vault	Autodesk Vault Workgroup	Autodesk Vault Collaboration	Autodesk Vault Professional
File management tools	✔	✔	✔	✔
Individual workgroup	✔	✔	✔	✔
Quick search procedures	✔	✔	✔	✔
Integration with Autodesk CAD applications	✔	✔	✔	✔
Reuse of designs	✔	✔	✔	✔
Revision and status management for files		✔	✔	✔
Batch processing plot orders		✔	✔	✔
Automatic file naming and numbering		✔	✔	✔
Stand-alone client for users with no CAD software		✔	✔	✔
File and folder security		✔	✔	✔
List and report generation		✔	✔	✔
Server-based DWF file publication		✔	✔	✔
Replication across a number of sites			✔	✔
Web client for printing/display in production			✔	✔
Bill of materials management				✔
Change order management				✔
Coupling with company systems				✔

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