



**AUTODESK  
UNIVERSITY  
2005**

November 28 – December 1, 2005 • Orlando, Florida

## **Multidiscipline CAD Usage at an EPC Company**

Jimmy Bergmark – Pharmadule Emtunga AB / JTB World

**PD12-1** This case study will discuss CAD usage at Pharmadule Emtunga. They are aiming for project execution using a mix of CAD applications that best suit their needs. AutoCAD, Autodesk Architectural Desktop, PDMS, third-party applications as well as in-house-developed tools are used. An engineering database application is a hub for the information flow. EDM and ERP are also deployed. A data-centric P&ID application is on its way.

### Topics Covered

- Computer-integrated engineering and project execution
- AutoCAD integration with PDMS
- 2D, 3D, and BIM
- P&ID and engineering databases
- Customization of AutoCAD



### **About the Speaker:**

Jimmy is CAD and database development manager at Pharmadule Emtunga AB in Sweden, where he has been working for 8 years. He has also served the company in the position of AEC engineer. Pharmadule Emtunga, an AEC/EPC company, is the world-leading supplier of high-tech modular facilities to the pharmaceutical and biotech industry, living quarters and technical modules to the oil and gas industry, and modules to the telecom sector. Jimmy started to use AutoCAD in 1989. He also owns and operates JTB World, a company that focuses on application development. He has been published in several magazines and writes for his blog <http://jtbworld.blogspot.com>.



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## Pharmadule Emtunga AB

Pharmadule Emtunga with head quarter in Sweden is the world-leading supplier of high-tech modular facilities to the pharmaceutical and biotech industry (Division Pharmadule), living quarters and technical modules for the oil & gas industry (Division Emtunga) and modules to the telecom sector (Division Flexenclosure). We provide high-tech, top quality facilities with short delivery time, at a fixed price. The business concept is to create value for our customers by designing and producing high-tech facilities with short lead-times, that are complete and predictable of high quality at a favorable cost

Jimmy Bergmark, employed at Pharmadule Emtunga and works as a CAD and Database Development Manager. Organizational location of our group Engineering Management & Tools is within Plant Engineering that is a line organization supporting the three divisions.

Pharmadule Emtunga is an EPC (Engineering, Procurement and Construction) company as well as an ETO (engineering-to-order) company.

Pharmadule Emtunga has in-house personnel specialized in the design and engineering of modules, complete plants and facilities for the different industrial segments we are active in.

The plant engineering department covers all engineering disciplines necessary for a project execution, such as:

- structural
- architectural
- piping
- electrical and telecommunication
- HVAC (Heating Ventilation, Air Conditioning)
- Instrumentation

Our concept of exceptionally fast project delivery, guaranteed quality and cost, demands tight project control. This is achieved by using standardized guidelines for documentation and scheduling. The rational and efficient engineering work is based on computerized tools and work methods. We work with 3D CAD (database) systems for all engineering disciplines.



## A growing company

Jimmy has been working at the company since 1997 when he started working with architectural and structural engineering. At that time the company used AutoCAD r13 even though r14 had recently been released. The company was relatively small at that time and the CAD reseller did the CAD support, management and IT work. Over the time Jimmy started to involve more and more in these areas and 1999 the company upgraded to AutoCAD 2000. Everything was still mostly 2D but Jimmy added minor Lisp customizations when there was need for it. A lot of information was handled in Excel and he started to use VBA to improve the work with these lists.

Attributes were added to blocks to hold information. The Express Tools commands ATTOUT and ATTIN were used as a starter to save data back and forth. The format of the exchange file was tab separated so it could be handled by Excel. After a while the company started to use the dbConnect functionality instead. Since Excel is not a really good place to store a lot of data in a consistent and secure way Jimmy introduced Access. Jimmy used the VBA functionality in Access to build forms for navigating and entering data as well as creating reports based on queries.

During the years since AutoCAD 2000 was released Pharmadule Emtunga have used every released version and now are using AutoCAD 2006. Since year 2000 Jimmy have been involved with Alpha/Beta tests of different Autodesk products. He can really recommend signing up for the Beta and Feedback program at <http://myfeedback.autodesk.com/>. This has helped a lot by being able to influence the shape of products like AutoCAD based on the company's specific needs. It also has been a great help to easy migrate to newer versions.

Pharmadule Emtunga today have two CAD platforms. AutoCAD as one and PDMS is another. On the AutoCAD platform Autodesk Architectural Desktop (ADT) is used for architectural engineering and MagiCAD (from Progan) for HVAC, piping and E/I/T. ProSteel 3D has been used for structural design for some projects. Most projects are engineered fully in 3D as this is more or less required to be able to connect and extract object data to and from our other systems.

Our aim is for 100% object oriented systems to ensure 100% consistent project documentation across all used systems.

## Databases used to handle Information in BIM

One thing that I early started to develop was a MC & Commissioning database application supporting the work with Mechanical Completion and Commissioning, i.e. the procedures to test and verify the functionality and quality of our products. It started to be quite data centric because an object is getting a unique tag number that is showed on AutoCAD drawings using dbConnect. One reason for this is that often a dummy tag is given in an early phase or the tag is renamed based on late customer requirements. This way consistency is ensured. The object is also having data that is used to produce information for purchasing. A status is put on the object depending on different criteria's like if it's purchases, mounted, tested, having failed a test and so on. Reports on what objects that has critical punches that has to be fixed before shipping can be extracted from the database.

The Engineering and MC and Commissioning database application developed during the years as the demands grow as well as the company. In the beginning both the back-end database and the front-end application was in Access. At one point, a few years ago we migrated the back-end database to SQL Server to gain better performance and stability on the data. About a year ago we also started to work on a completely new front-end application developed using VB.NET 2003.

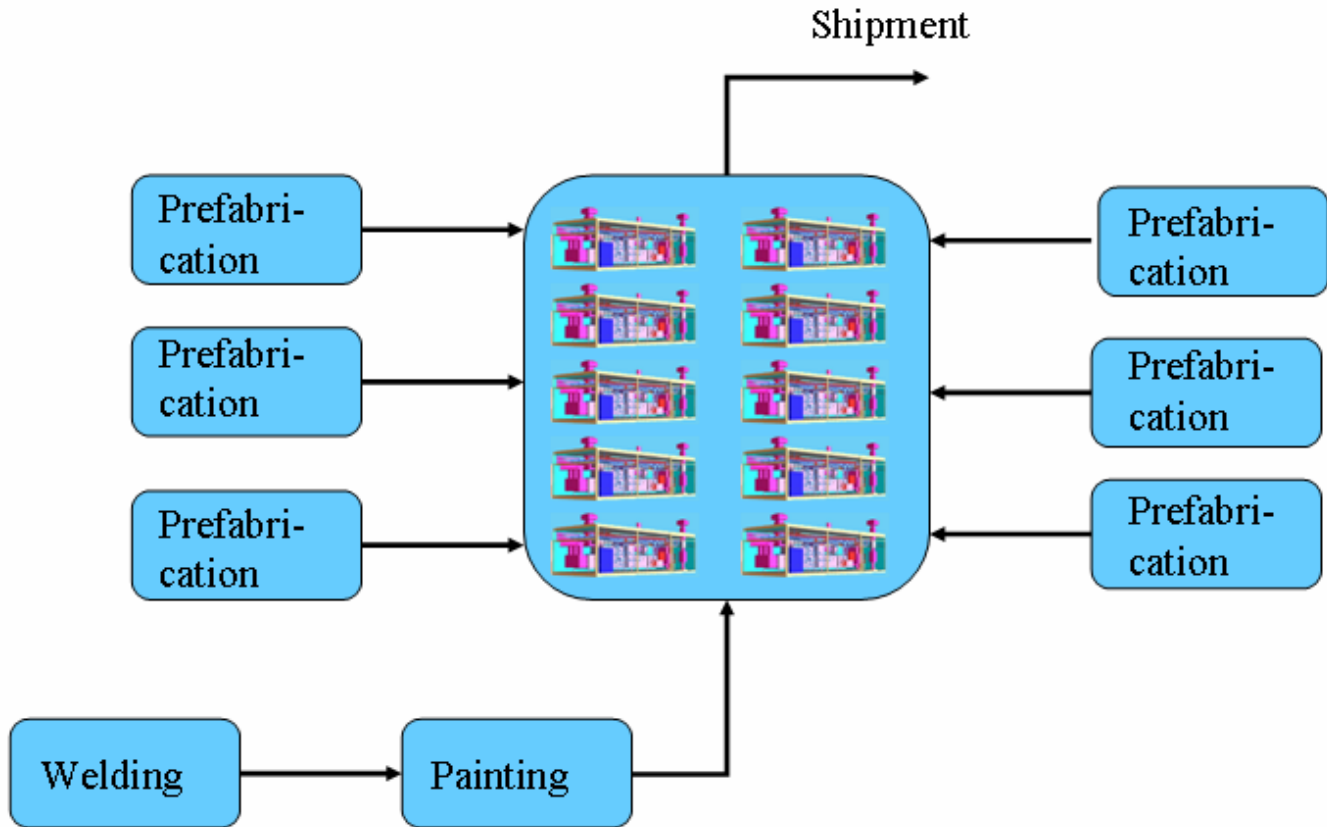
## ETO

As a ETO firm we depend heavily on engineers and designers inside the order cycle because the facility has to be imagined, then designed and detailed, before it can be built. Long lead items like large complex equipment need to be ordered, sometimes even before the design is complete. Often, engineers are reluctant to release partial designs to manufacturing or vendor items to purchasing when quantities and details can still change. Time considerations usually prohibit a complete release at one time, much as engineering prefers doing just that. Instead, releases have to stream out of the department over the course of several days or weeks.



What makes engineers hesitant to release are the inevitable changes that come back from manufacturing and the customer. The engineering department becomes a roadblock. The longer a project languishes in design, the less time for the purchasing department to negotiate prices. The aim here is to move the information from engineering to purchasing quicker and as early as possible.

**Industrialized production**



Design and manufacturing departments work together more closely. In many cases product design continues through production (design in process), incorporating several engineering changes along the way. These changes may be driven by the customer or by the manufacturer, necessitating a seamless flow of data between engineering and production. Therefore it's not surprising that an organizational change has been done at our company recently. The departments for engineering, purchasing and production has now a common manager to be able to make the work between the departments more lean.

This puts higher demands on the software tools to support the work processes and information flow. The CAD (AutoCAD/ADT/MagiCAD and PDMS) and ERP (Movex) software has to be able to exchange data both ways and handle the engineering changes.

As a side note when talking about ETO you might have heard that Autodesk acquired Engineering Intent Corporation in October 2005. Engineering Intent provides "Engineer to Order" (ETO) software and services. Not sure if and how that will affect Pharmadule Emtunga though.





Pharmadule Emtunga is now close to a release of the new Engineering Database application. It's developed using VB.NET, VS 2003 and SQL Server 2000. It meets a lot of the needs that a more industrialized way of running the projects puts on the supporting applications.

One thing that I think makes the work at Pharmadule Emtunga interesting is that it is an EPC company. It makes it also easier as well as a larger challenge when it comes to the IT tools and applications that has to support the company. As the company matures and grows the applications must follow. The understanding and acceptance by everyone in the organization is important. Therefore we that works with the applications must not run away too far and too quick even though we often have the visions and are pushing things ahead. Engineering, purchasing and construction as well as the divisions with marketing and project leaders has to speak the same language and understand each other. If engineering makes drawings that those that construct doesn't need or doesn't use it's a waste of time and money.

### **PD - Pre-Conceptual Design and CD - Conceptual Design**

ADT is used for layout and space studies as well as foundation for 3D presentations.



## BD - Basic Design

Discussions starts with the customer regarding delivery and format of documents, drawings and data. PSP (Project Specific Procedures) is created if there are deviations against our preferred engineering tool manuals. Limited engineering is done using primarily the AutoCAD platform if the BD scope is small. If DD should be done in another system and BD is extensive it's preferred to also do BD in the same system.

## DD - Detail Design

When the contract is signed DD starts. The final decision is taken regarding what CAD tools should be used.

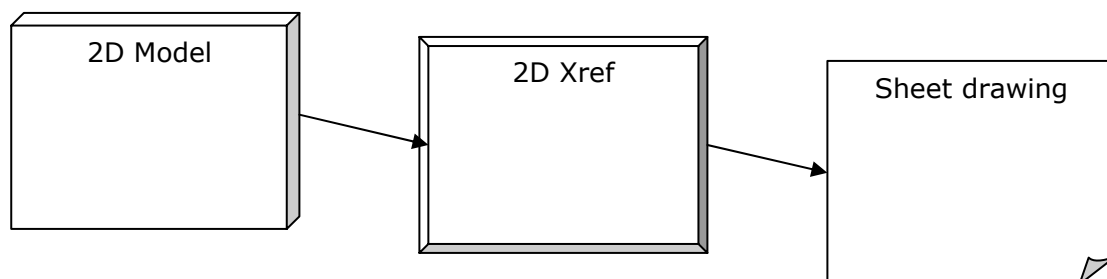
Engineering of the BIM and generation of drawings and lists. The design review process uses NavisWorks as a tool. Continuously documentation is transferred to the EDM system where all documents are stored and revision handled. Data is transferred to the ERP system for generation of purchase orders and for work orders.

The production starts of the steel structure followed by architectural materials and installations. MC and Commissioning for testing and validation to make sure of good quality and that set requirements are followed. Transportation to site. Final installation at the site. IQ (Installation Qualification) is done at site. As Built changes to the model and drawings.

## Multiple disciplines using AutoCAD and PDMS as CAD platforms

For a long time Pharmadule Emtunga used AutoCAD as it's only CAD platform. Engineering was primarily done in 2D. Coordination and usage of each others discipline drawings was all manual work. From time to time there where issues when two or more drawings where compared and the installation engineers noticed that the architectural layout was different. To get around this problem I created a small script file that the architect could use to create xrefs from their model drawing. The script file could be run whenever the architect wanted a layout change to be visible for the other disciplines. A small text with a date and name was also added to the xref in a way that it was always visible on all drawings that used the xref.

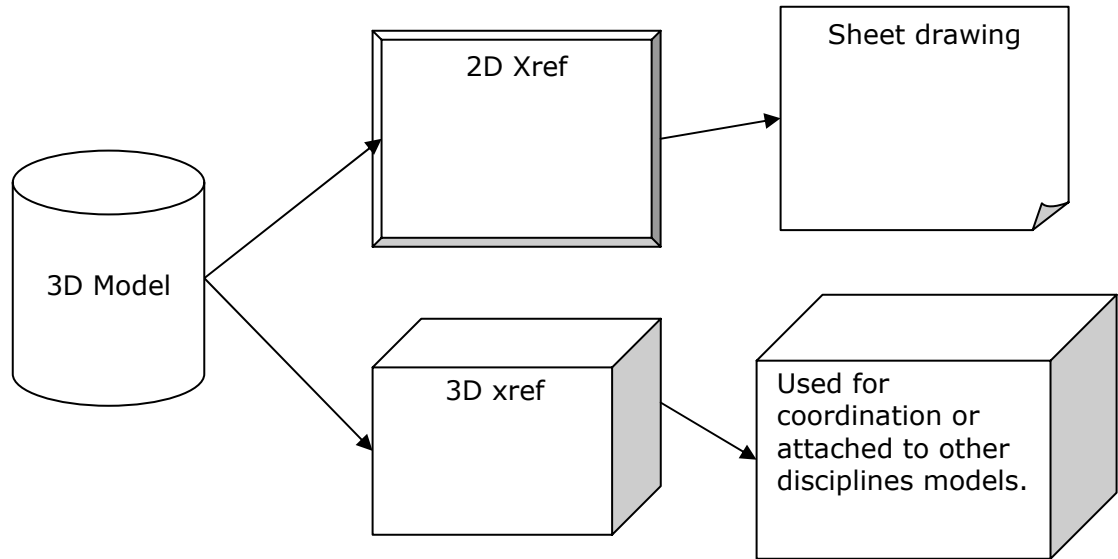
## 2D Environment using AutoCAD



This resulted in more control on the usage of xrefs and it was always possible to track what version of the architectural layout that was used.

After 2D it was time for 3D. We started using it for the installation disciplines using a 3rd party MEP application, MagiCAD. I continued on the previous concept. Now there was a 3D model instead and there was a need for both 3D and 2D xrefs. I created a script that now instead created these and that also could be run on a server scheduled every night if the project members so wanted.

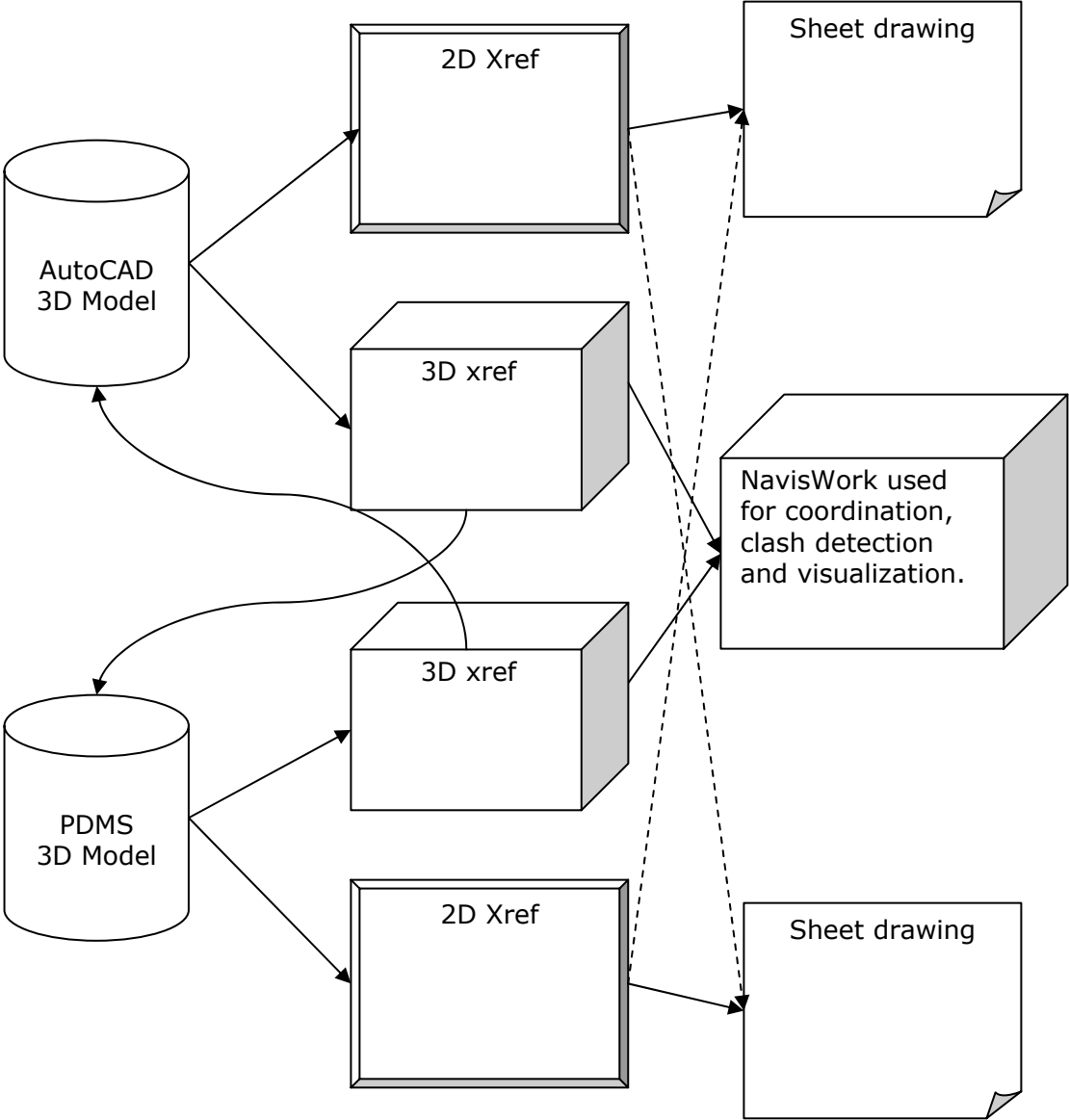
### 3D Environment using AutoCAD



This is still not an optimal way to handle things since it has happened that the engineers forgot to run the script files to update the xrefs resulting in others working with too old data.

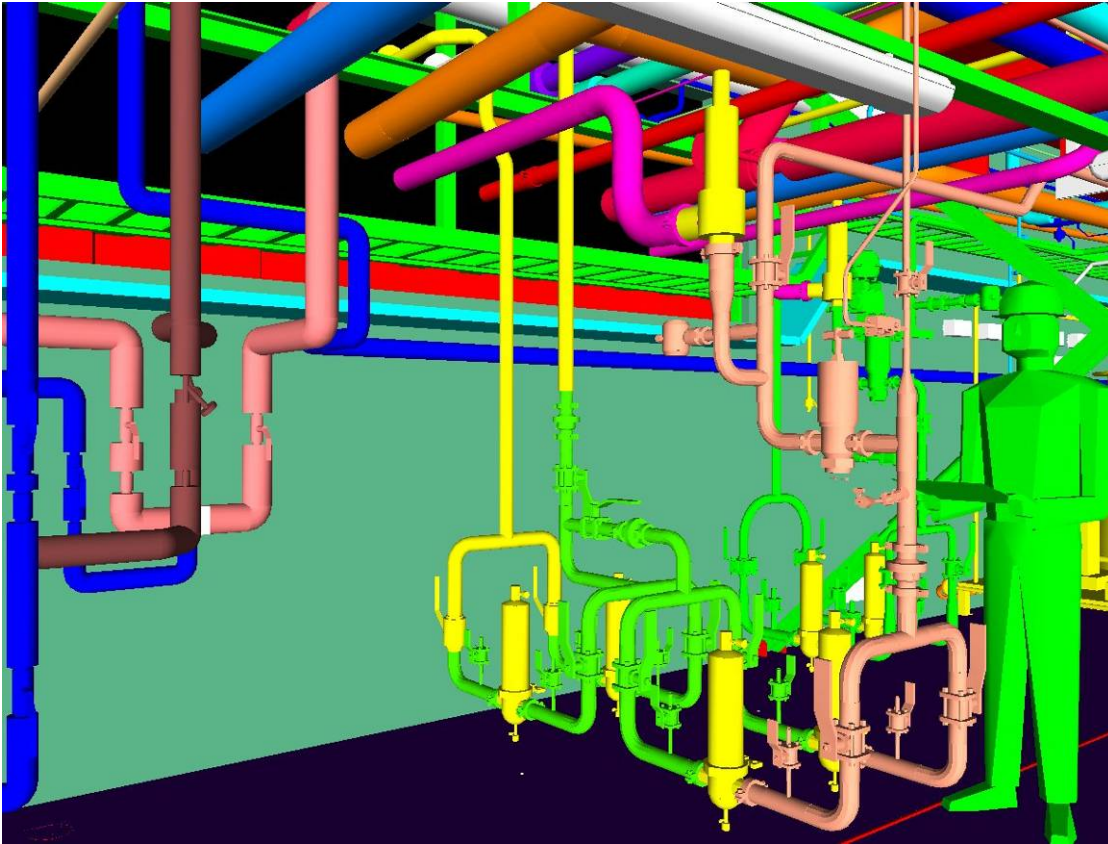


Mixed 3D environment using AutoCAD and PDMS



Since PDMS handles DGN better than DWG we use MicroStation in the middle of the automated conversion. Some intelligence is achieved by naming convention of xrefs, layers and blocks as well as adding hyperlinks to objects that can be seen both in AutoCAD and NavisWorks.

3D reviews using NavisWorks.



## Contact Information

You are welcome to contact me.

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