AUTODESK UNIVERSITY 2014

The Suite Life of Product Design Suite

Mike Thomas – Prairie Machine & Parts Mfg.

MD4890

Product Design Suite has just arrived and you have cracked the packaging (or finished the download) and are about to install the software—but wait, what are all these options? Why so many? What is all this stuff? You just want Inventor software and AutoCAD software. Take a deep breath. Autodesk, Inc. has packaged not only software but also workflows to provide you with an excellent set of product design tools. AutoCAD Mechanical software for sketching and legacy maintenance, Inventor software for 3D modeling and design, Showcase software for realistic renderings, 3ds Max Design software for animations, and Alias Design software for complex surface design, just to name a few. In this class, we will look at some of Product Design Suite's workflows so you can get up off the ground and running in no time.

Learning Objectives

At the end of this class, you will be able to:

- Learn how to take a 2D drawing convert to a 3D model and perform a stress analysis
- Learn how to create a photorealistic rendering of an Inventor software model with Showcase software
- Learn how to perform an Inventor software assembly review with Navisworks software
- Learn how to import Alias Design software Surfaces for use in an Inventor software assembly and then animate with 3ds Max software

About the Speaker

Mike Thomas *graduated with the honor of Most Distinguished Graduate in CAD/CAM engineering technology from the Saskatchewan Institute of Applied Science and Technology (SIAST). He is a specialist in the manufacturing industry with a strong knowledge of the Autodesk, Inc., mechanical products, and he has a solid understanding of document management, hardware, networking, and other Autodesk technologies.*

He is now the technical services manager for Prairie Machine & Parts Mfg. (PM&P), and he is responsible for overseeing the Engineering department's technical operations and strategic technical growth. His primary duties include providing ongoing support of critical computer systems and programs, facilitating the interactions between the engineering department and other departments, providing the engineering department with effective systems and technology, and working with PM&P's vice president and engineering managers on the development and implementation of a cohesive strategic plan for the technical growth of the department. Mike is an active contributor to Design & Motion (www.designandmotion.net).

The "*Ultimate*" Experience for the "*Premium*" Professional

"*Product Design Suite (PDS) is a comprehensive solution delivering 3D product design, simulation, collaboration, and visualization tools to complete your entire engineering process. The Digital Prototyping capabilities of the suite can help you design better products, reduce development costs, and get to market faster.*"

Autodesk Product Design Suite ships in two versions: Premium and Ultimate.

Premium includes:

1. Inventor
2. AutoCAD, AutoCAD Mechanical, & AutoCAD Electrical
3. AutoCAD Raster Design
4. 3ds Max Design
5. Navisworks Simulate
6. ReCap
7. Vault Basic
8. Showcase
9. Mockup 360

Ultimate includes

1. **Inventor Professional**
2. AutoCAD, AutoCAD Mechanical, & AutoCAD Electrical
3. AutoCAD Raster Design
4. 3ds Max Design
5. **Navisworks Manage**
6. ReCap
7. Vault Basic
8. Showcase
9. **Alias Design**
10. Mockup 360

Contents

What is in the Box?

Although PDS includes AutoCAD, the real benefit is access to AutoCAD Mechanical and AutoCAD Electrical.

Based on AutoCAD, AutoCAD Mechanical (ACM) and AutoCAD Electrical (ACE) do everything you can do in vanilla AutoCAD. You might have to look for it or it may not be in the same location but it is in there, somewhere! Both provide enhanced versions of standard AutoCAD commands, do not be scared, try them, you will grow to love them. You can also continue to use any custom LISP, VBA, or add-ins as you did with your vanilla AutoCAD.

What is so special about AutoCAD Mechanical?

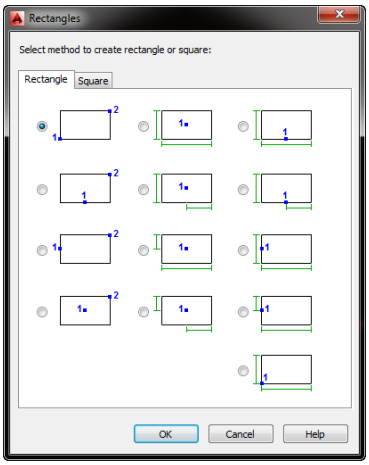


Figure 1: ACM Rectangles

Think about it this way… with AutoCAD you get one option to generate a rectangle (2-corners) where ACM expands this to over 13 different ways to generate a rectangle!

Rectangles just shows how ACM extends standard AutoCAD functionality but also adds tools and features for mechanical engineering documentation, mechanical design productivity, and a set of mechanical drafting standards

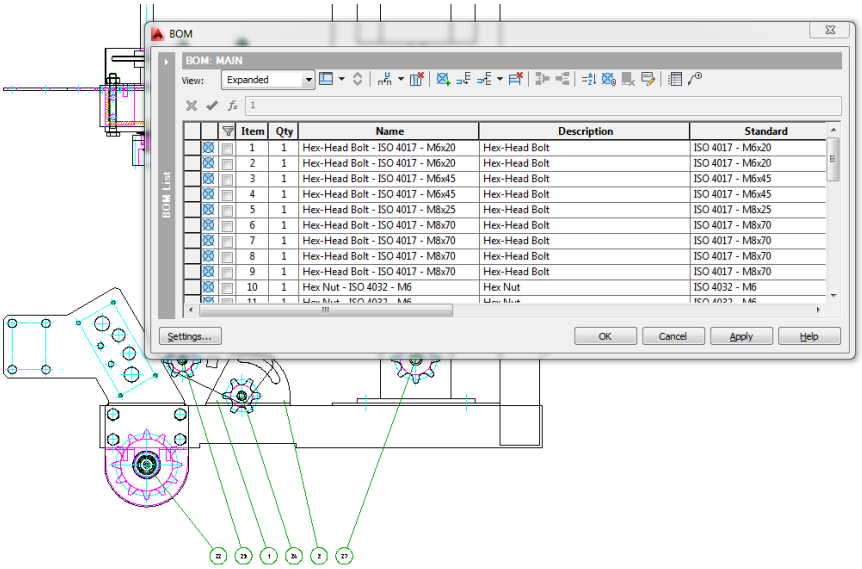


Figure 2: ACM Bill of Materials & Balloons

Mechanical Engineering Documentation

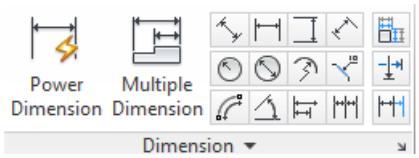


Figure 3: ACM "Power" Dimensioning Tools

- **Bill of Materials, Ballooning, and Parts List**… intelligent, not just some collection of text and blocks
- **Hidden line** and **Centerline** generation
- **Power Dimensioning** to take your mechanical detailing process to a whole new level
- AutoCAD Mechanical takes standard AutoCAD commands and extends their abilities

Mechanical Drafting Standards

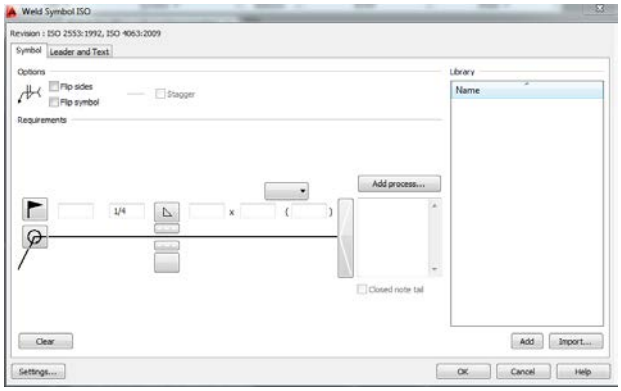


Figure 4: ACM Weld Symbol

- With **ACM's Standards** you can define multiple standards starting with settings based on international standards like ANSI, ISO, and JIS.
- Use the built-in **ACM symbol** tools to quickly create standards-based surface texture symbols, datums, geometric dimensioning and tolerance symbols, targets, weld symbols, and notes.
- With the **ACM Standards** you can configure default settings like layers, dimension styles, text settings, and ACM specific entities like parts lists and balloons.
- Quickly adjust the scale of the drawing updating all annotation objects (dimensions, text, leaders, linetype scale, etc)

Mechanical Design Productivity

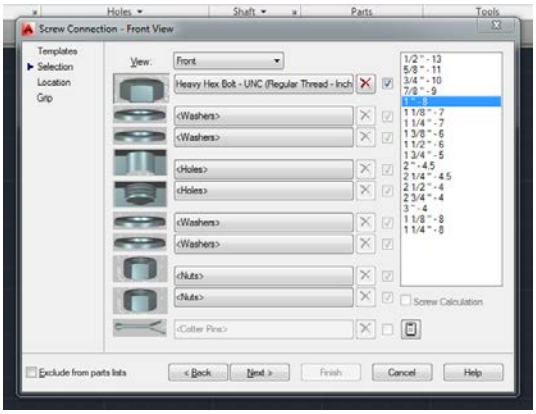


Figure 5: ACM Screw Connection Wizard

- **Finite Element Analysis**… yep, no lies, perform 2D static load FEA for stress and deformation calculations
- **Shaft Generator** to Quickly build-up shafts using different sections which ACM positions automatically one after the other
- Calculations include **Moment of Inertia** and **Deflection Line**
- AutoCAD Mechanical includes over **700,000 standard components**, based on international standards. This includes Features (Holes), Fasteners (Screws, Buts, Washers, etc), Shaft Parts (Bearings, Clips, Retaining Rings), and Steel Shapes (HSS, Tubing, Pipe).
- Use the **screw connection wizard** to quickly create fastener assemblies including generating the holes, fastener, nuts, and washers required to bolt two plates together.
- **Structure** - ACM Structure is like blocks on steroids, a combination of blocks and groups, to define components. Although just 2D geometry the components defined by ACM are both parts and assemblies defining the structure of the assembly you are building. The BOM is automatically built as the structure is defined.

What is so special about AutoCAD Electrical?

"AutoCAD Electrical engineering software automates common design tasks and facilitates drafting productivity. It includes all the functionality of AutoCAD software, plus electrical engineering software features such as symbol libraries, bill of materials (BOM) reporting, and PLC I/O design that make control design faster and more efficient."

Is AutoCAD Electrical (ACE) for me?

- Do you need to produce electrical control schematics, panel layouts, and PLCs quickly?
- What if you could increase your productivity?
- Would you like to create consistent designs using standards-based symbols and components from the catalogs of major manufacturers?

Electrical panel layout

- Terminal Strip Export/Import
- Smart electrical panel layout drawings - Extract a list of schematic components for placement into electrical panel layout drawings.
- Terminal design - Manage and edit terminals and jumpers to help save time and help increase the accuracy of electrical control designs.
- Marking menus for faster edits – faster than traditional right-click menus

Electrical schematic design

- Auto wire numbering and component tagging
- Circuit design and reuse - Dynamically generate rules-based electrical control circuits based on components, wiring, ratings, and catalog data.
- Electrical schematic symbol libraries - AutoCAD Electrical software comes with several hundred thousand standards-based electrical schematic symbols.
- Real-time error checking - Catch and remove costly errors before the build phase begins.

Electrical controls design

- Catalog Browser - Insert components into your schematic with the catalog information assigned | Edit parts in Catalog Browser to easily add or edit catalog items and assign symbols and 3D parts to the catalog database.
- Inventor parts integration - Add the Electrical Catalog Browser to Inventor 3D CAD software 2015 during installation to access 3D electrical parts.
- Real-time coil and contact cross-referencing - Reduce the risk of too many contacts assigned to a relay, and minimize time spent manually tracking assignments.
- PLC I/O drawings from spreadsheets - Define a project's I/O assignments in a spreadsheet program to create a comprehensive set of PLC I/O drawings.
- Standards-based libraries - component libraries from the industry's most popular vendors

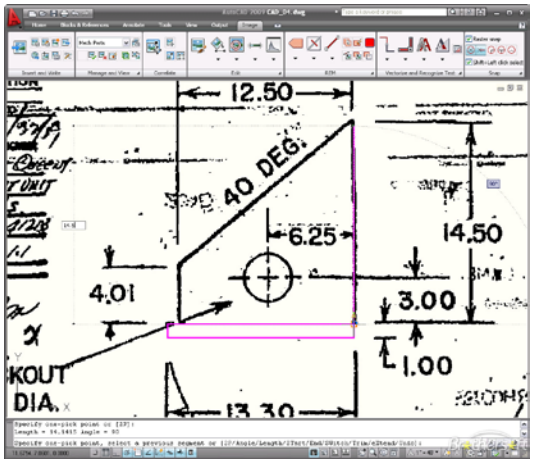
AutoCAD Raster Design

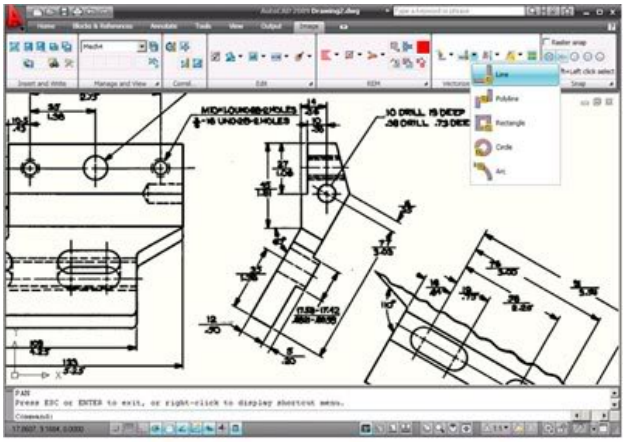
AutoCAD Raster Design provides a set of tools for AutoCAD to convert Raster data (think images) into vector-based drawing objects (think lines, arcs, and circles). This includes:

- **Image editing & cleanup:** despeckle, bias, deskew, mirror, and other tools
- **Raster Entity Manipulation (REM):** using AutoCAD commands on raster image entities
- **Vectorization:** extract AutoCAD objects from raster images
- **Image transformation functionality**

Why would a user of PDS want to use Raster Design?

To take scanned paper drawings, regardless if bitonal, grayscale, or color formatted and correlate, edit, analyze, and convert to working AutoCAD objects. Why redo when you can reuse?





With Raster Design you can:

- Mask → mask areas of the image to hide within the drawing
- Crop → remove unwanted portions of the image using regions of various shapes
- Remove → erase (rub) raster entities like lines, circles, arcs, etc
- Merge → merge vector data into the raster image
- Vectorize → convert raster entities including lines, arcs, circles, and rectangles into AutoCAD vector equivalents
- Text Recognize → converts raster text into AutoCAD text
- Raster Snap → snap, AutoCAD Object Snap like, to raster entities

Inventor

"Autodesk Inventor 3D CAD software offers an easy-to-use set of tools for 3D mechanical design, documentation, and product simulation. Digital Prototyping with Inventor helps you design and validate your products before they are built to deliver better products, reduce development costs, and get to market faster"

Autodesk Inventor is a 3D Parametric, history-based, feature-based, modeler. It provides mechanical, industrial, and manufacturing focused tools for creating both surface and solid models, assembly models, with technical illustration and documentation tools.

Inventor provides tools for sheet metal layout, plastic part design, frames, weldments, along with a database of 1000's of standards based components like hardware, shaft components, and structural steel shapes. Inventor Studio provides an integrated rendering and animation environment.

Inventor Professional extends core Inventor functionality in four areas: Tube & Pipe, Cable & Wire Harness, FEA & Dynamic Simulation, and Mold – Tool & Die design.

Figure 6: Inventor Realistic View

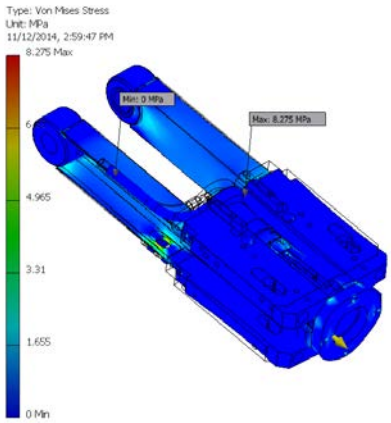


Figure 7: Inventor FEA Simulation

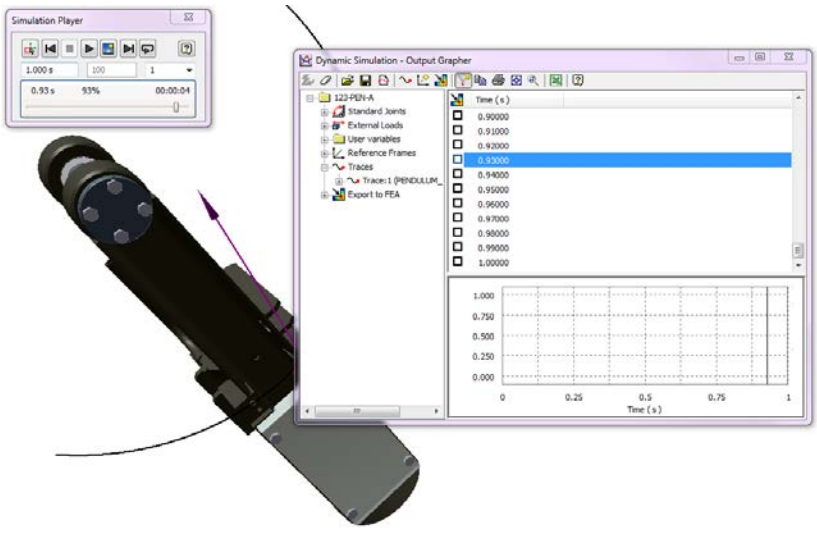


Figure 8: Inventor Dynamic Simulation

Alias Design

"Alias industrial design software powers your creative process with a range of sketching, modeling, surfacing, and visualization tools. Create compelling surface designs with Digital Prototyping tools tailored for industrial design, automotive design, and product design. Get advanced capabilities, from initial concept sketch to development of production-ready Class-A surfaces."

Alias Design provides powerful "technical" surfacing capabilities to digitally create your concept model or design model in an environment with real-time design visualization. Start with a sketched illustration, which moves into a conceptual surface model before being rounded-out to become the final design model.

Figure 9: Alias Design (images courteous of autodesk.com)

Showcase

"Showcase® 3D visualization and 3D presentation software provides easy-to-use presentation and design exploration tools for architects, designers, engineers, and marketing professionals. Quickly transform 3D CAD models into interactive walk-throughs and presentations, so that you can evaluate aesthetic and design alternatives in real time with peers, constituents, and customers."

Showcase's advanced rendering engine provides a system to create "stunning" realistic views of your models, which can be manipulated real-time. As it has no geometry creation tools of its own it is intended to take your AutoCAD and / or Inventor 3D models to create rendered 3D scenes

Figure 10: Autodesk Showcase (images courteous of autodesk.com)

3DS Max

3DS Max is one of the well-known and well-respected programs for creating 3D animations, models, games, and images. With 3DS Max you can add dynamics and effects to your models to create highly realistic 3D Renderings and animations. In conjunction with the general animation, tools 3DS Max includes animated deformers and character animation and rigging tools to quickly build up real-world actions on your models.

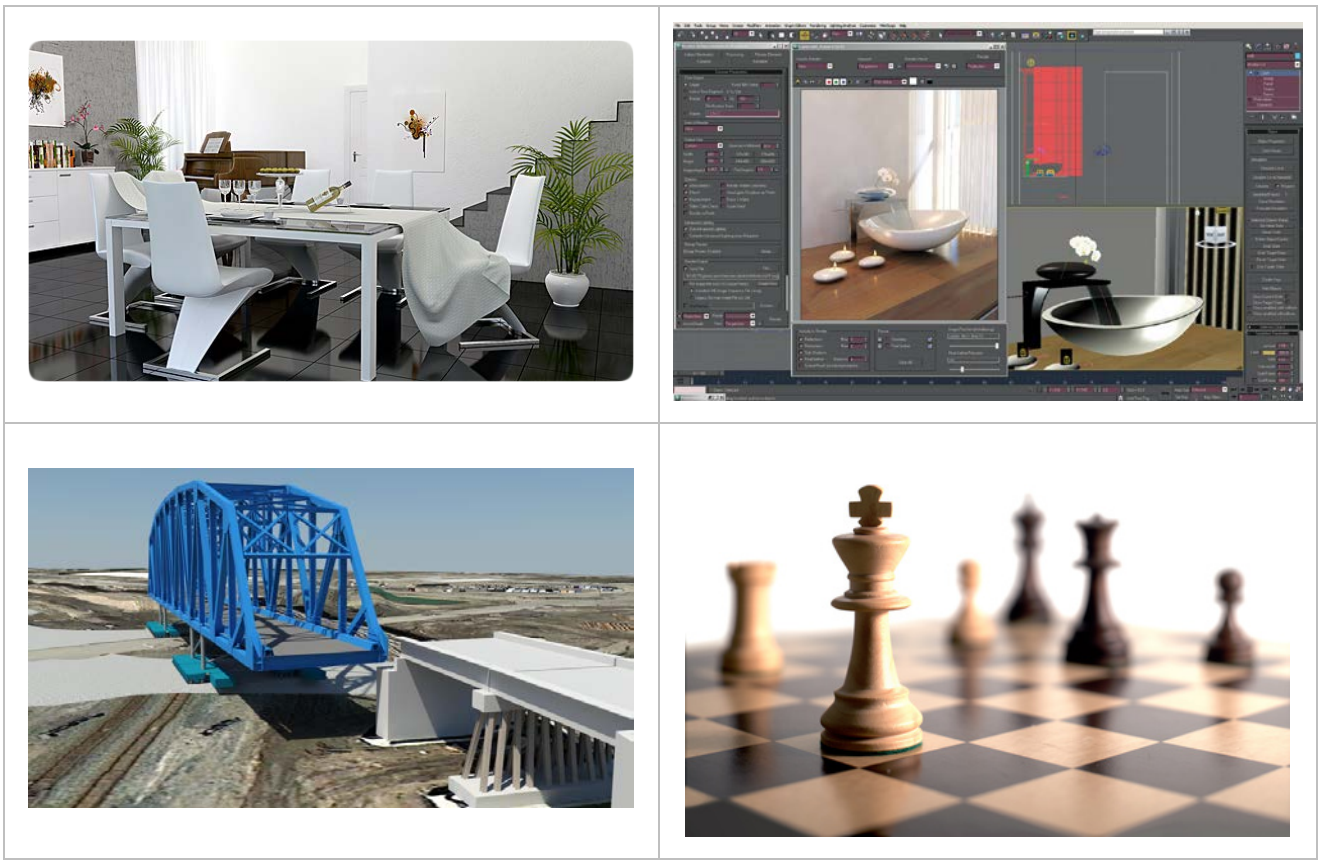


Figure 11: 3DS Max (images courteous of autodesk.com)

Navisworks

Although primarily used in the construction industry Navisworks provides tools to manage large projects and models from various data sources. With Navisworks you can combine the 3D models to navigate, collaborate, markup, and perform collision style interference checks. The purpose of Navisworks is to provide an environment for all project stakeholders to review the models and data to plan projects before they start.

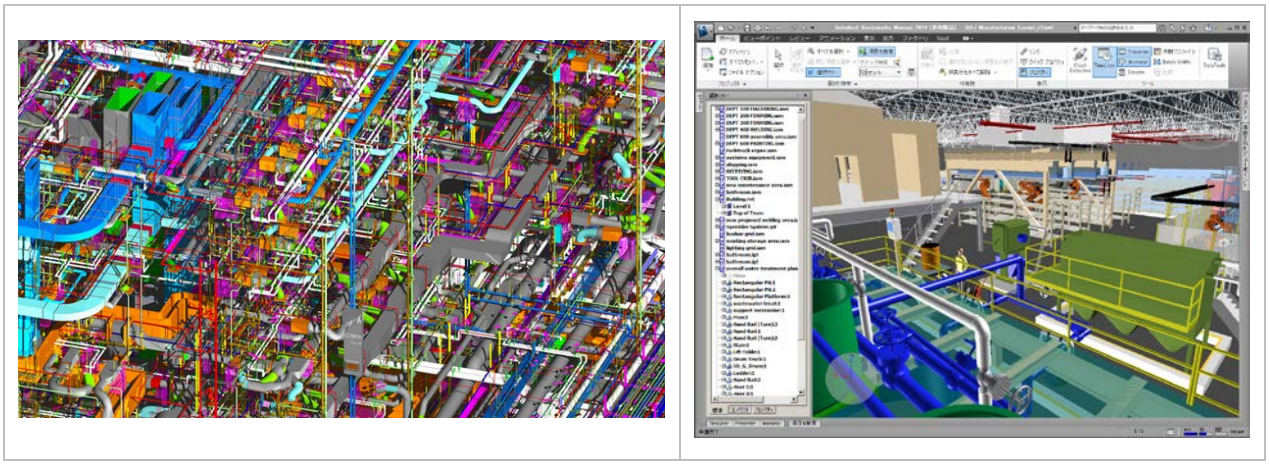


Figure 12: Navisworks (images Courteous of autodesk.com)

Navisworks:

- Coordination: Clash detection and interference checking
- Model Review: insert multi-format models, measure, markup, add comments, and publish to distributable formats
- Model simulation & analysis: integrated 2D & 3D quantification, 5D project scheduling, Photorealistic model rendering, and object animation.
- Project Viewing: Cloud rendering, Reality capture, real-time navigation

Recap

Autodesk Recap is reality capture and 3D scanning software

"Capture and integrate reality data directly into your design process with ReCap™ reality capture software and services. ReCap works with Autodesk design and creation suites, so you can start your design with accurate 3D data and full photo-quality context rather than a blank screen."

With the version of Recap included with PDS you can:

1. Import scans from many vendors and various formats (standards)
2. Prepare the Point Cloud including
    a. Point cloud indexing and segmentation
    b. 3D visualization
    c. Cleanup, clipping, and regioning

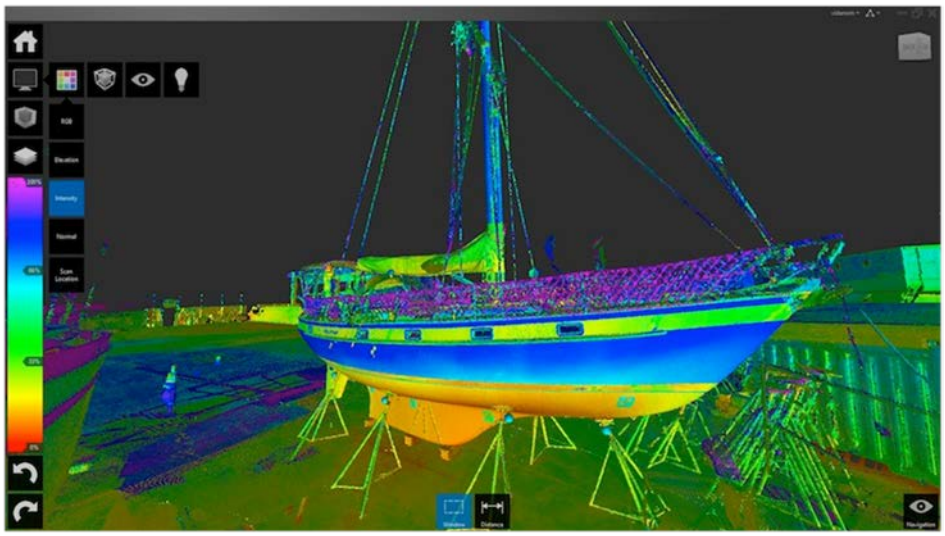


Figure 13: Autodesk Recap (image courteous of revitturkiye.blogspot.com)

Figure 14: Autodesk Recap (image courteous of autodesk.com)

Mockup 360

Mockup 360 is a web-based tool used to collaborate on models. It is **"Open"** for collaboration as you can invite anyone to not only view but markup and comment on your projects. It is **"Built for Large 3D visualization"**, supporting many common 3D CAD file types.

Mockup 360 provides tools for getting information from your data, including a measuring tool and clash type analysis. If you are thinking this sounds like Navisworks, you are right, you will find some similarities especially the navigation tools.

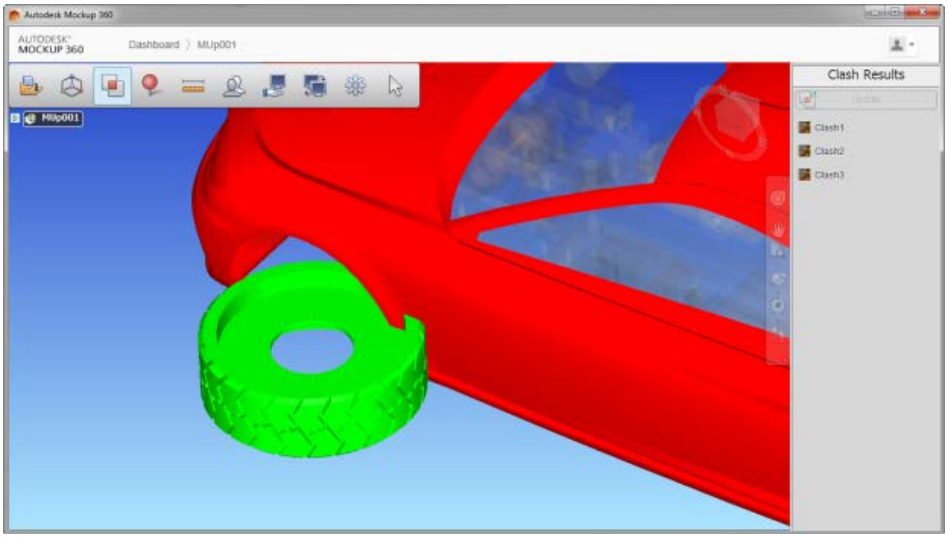


Figure 15: Mockup 360 (image courteous of designandmotion.net)

Now you might be asking, Mockup 360 is not "in-the-box" as it is not an option on the PDS install. However Product Design Suite Subscribers are entitled to Mockup 360 for creating and managing up to five concurrent mockup projects. Check the Subscription site for more details.

Vault Basic

Autodesk Vault is a Product Data Management (PDM) tool integrated with various Autodesk products and Microsoft Office. It helps design teams track work in progress and maintain version control in multi-user environments. It allows them to organize and reuse designs by consolidating product information and reducing the need to re-create designs from scratch. Users can store and search both CAD data (such as Autodesk Inventor, DWG, and DWF files) and non-CAD documents (such as Microsoft Word and Microsoft Excel files).

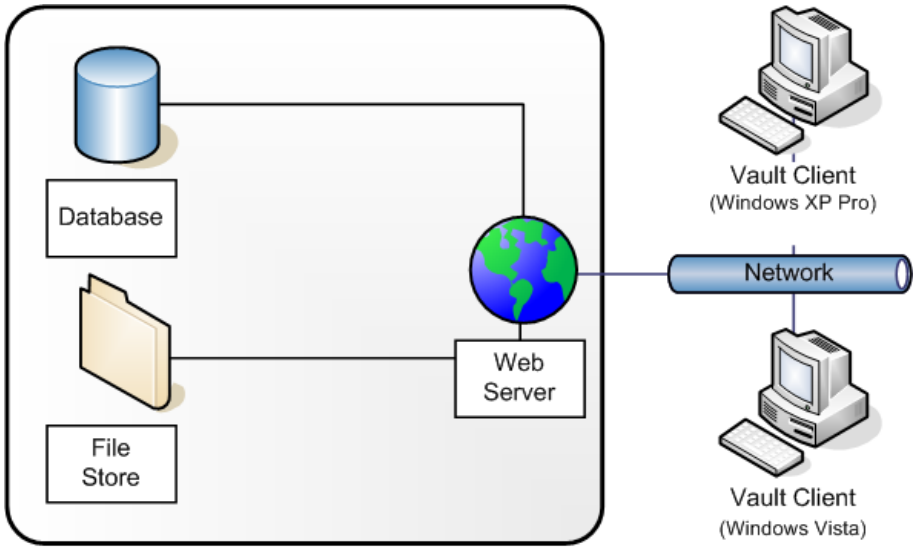


Figure 16: Autodesk Vault Server (courteous of the Autodesk Knowledge Base)

Think of it as a library in which you can only edit the documents by checking the file out, assuming ownership. No one else can make changes until you have checked the file back into Vault. Autodesk Vault maintains a history of all the checked in versions meaning you can see what has changed, when it changed, and who made the changes.

What's the deal with Subscription?

"Autodesk Subscription offers the most convenient and flexible way to access the latest Autodesk software and services to help grow your business"

Maintenance

When part of this yearly maintenance program you receive all upgrades to Suite, including any mid-release Extensions. This means you always have access to the most up-to-date software and features.

Subscription is also the only way to get access to older versions of the software.

Support

Autodesk Subscription includes web-based support directly from Autodesk

Autodesk 360

Subscription customer's Autodesk 360 account limit is 25GB of cloud storage compared to the standard 5GB

Subscription customer's gain "privileged" access to a variety of cloud services, including:

- **Mockup 360** for online project collaboration (5-mockups per subscription)
- **Optimization for Inventor** to perform cloud-based "what-if" design-optimization analysis
- Cloud-based **rendering for AutoCAD**
- **Autodesk Remote** to access your Autodesk software remotely from other systems or from iPads.

Tying It Altogether

Initially PDS might seem like a bundle of disconnected and unrelated software components. However, there are many built-in workflows to transition the data from one solution into another.

Autodesk Product Design Suite Launcher

After installing PDS, regardless of the combination of software installed, the PDS Launcher is installed. Autodesk designed this tool to be the one-stop place for everything PDS. This includes workflows, a listing of installed applications, a list of recent files, and access to the Autodesk Exchange app store.

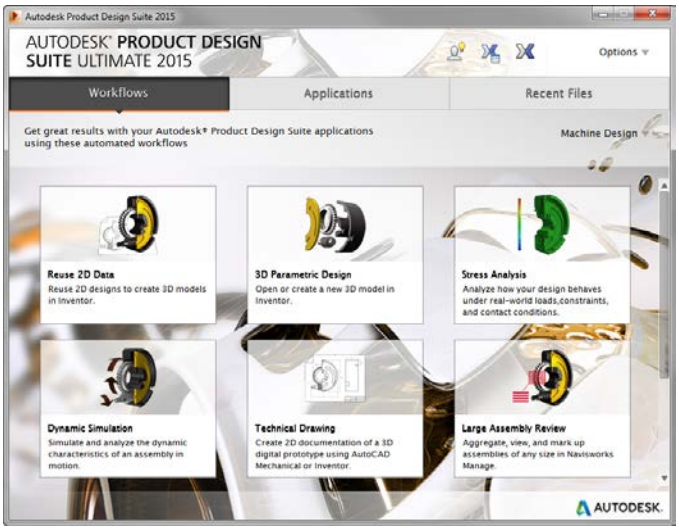


Figure 17: Product Design Suite Launcher

Before using this tool, you should start with the options in the upper right corner with two options in particular. With the Vault option, you can log into your Vault server to extend the PDS Launcher to work with your Vault data (if you are not using Vault then never mind!). Workflow Options sets template options for each type of workflow action

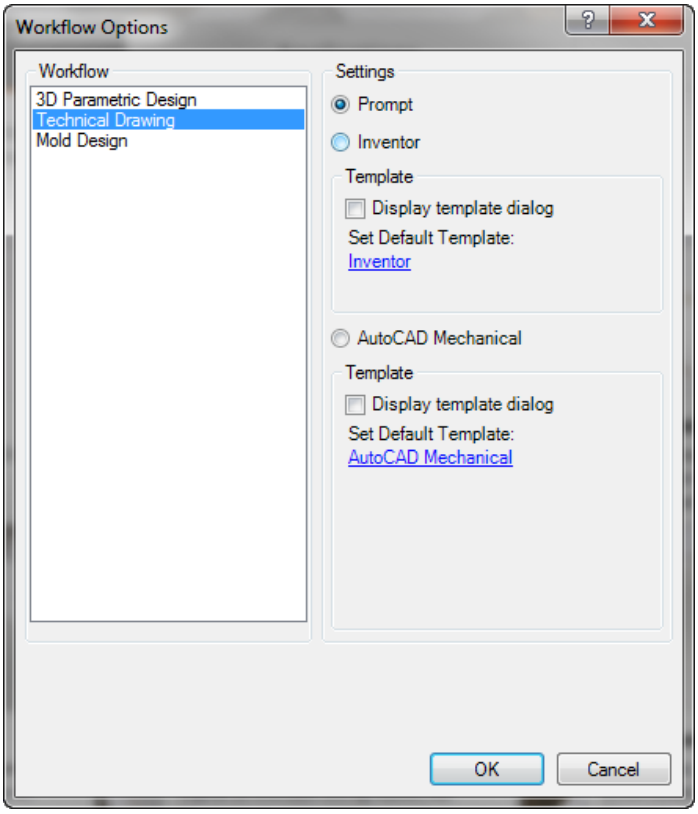


Figure 18: PDS Launcher Workflow Options

More than simply launching the software it steps you through options in selecting templates, creating files, and selecting files so that you are setup and ready to go quicker

For example, by selecting **Reuse 2D Data** you are prompted to first select an AutoCAD drawing and interactively select the layers to import. A new Inventor part is created with the selected 2D geometry inserted as a new sketch.

Two “sets” of Workflows are available: Plastic Part & Machine Design that is toggled from a drop-down in the upper right area of the dialog

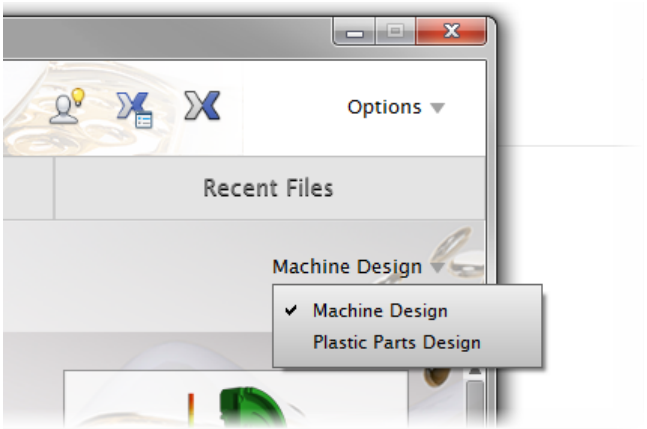


Figure 19: Toggling the Workflow types

Embedded Application Workflows & Features

Many of the PDS Applications have embedded workflows and features to transition the data from one application to another. In many instances, the data is associative so that as it changes in one application it associatively updates in the other

Inventor

1. Launch **Optimization (**from the Environments tab)
2. Attach **ReCap** data (from the Manage tab)
3. **Autodesk 360** tab to add the current component to a **Mockup.**
4. **Suite Workflows** (in the Application Menu) to send the model to Showcase or 3DS Max
5. Open **Alias files** (.wire)

AutoCAD

1. Attach **ReCap** data (from the Insert tab)
2. Attach **Inventor** models to detail with AutoCAD (Mechanical)

3DS Max

1. Link **AutoCAD** DWG (from the Application Menu)

Showcase

1. Import **Inventor** (.ipt, .iam), **AutoCAD** 3D (.dwg), **Alias** (.wire), & **FBX**
2. Export to **FBX** for use in 3DS Max

Alias Design

1. Import **Inventor** (.ipt) and **AutoCAD** (.dwg)
2. **Send to Showcase**

Example Workflow