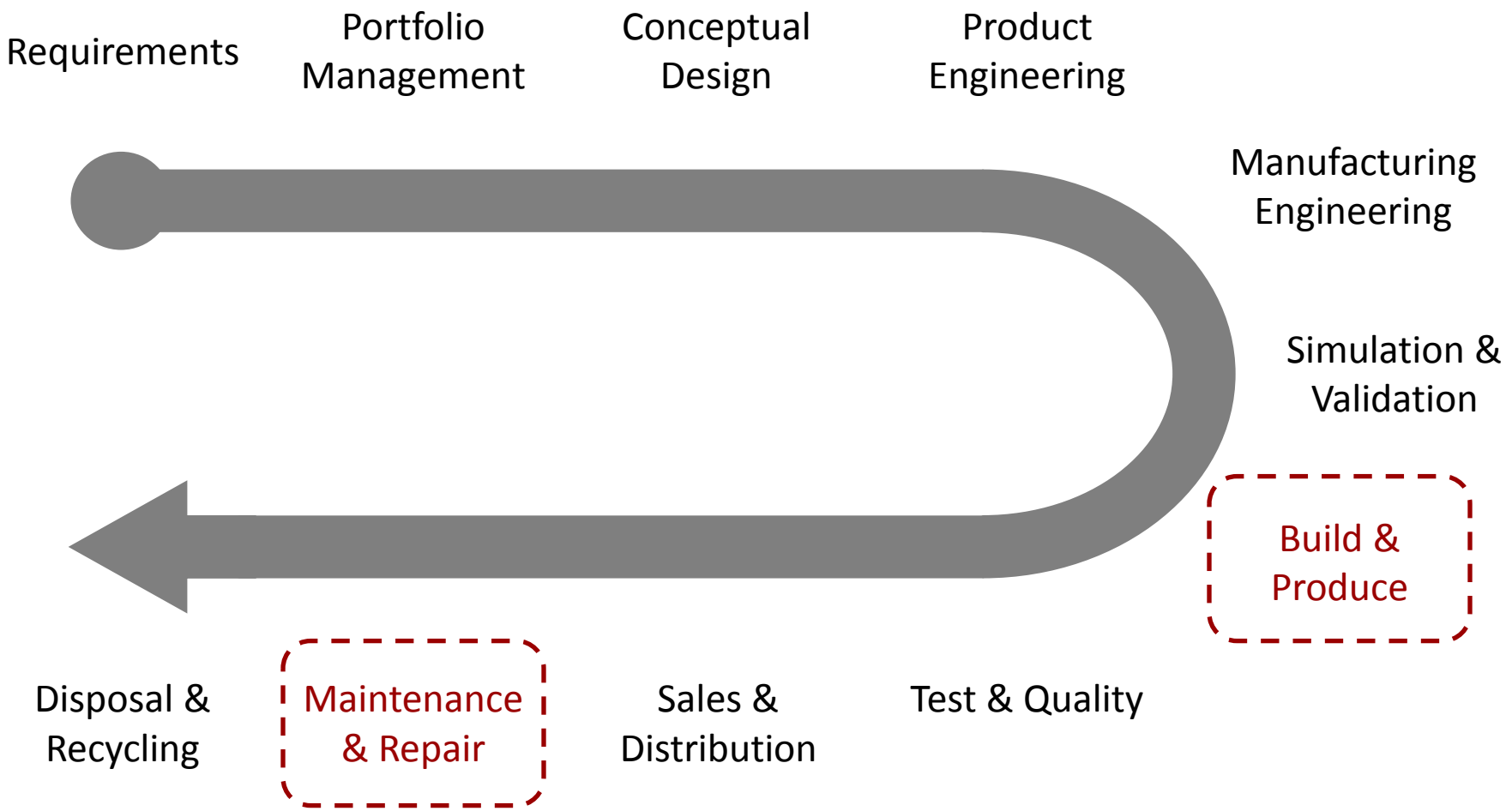
Carnegie Mellon University

Week 15 - Lecture
Manufacturing and Service

Lecture Topics

- CNC Manufacturing
- Product Documentation
- Autodesk Inventor Publisher
- Future of Design Review
- Course Summary

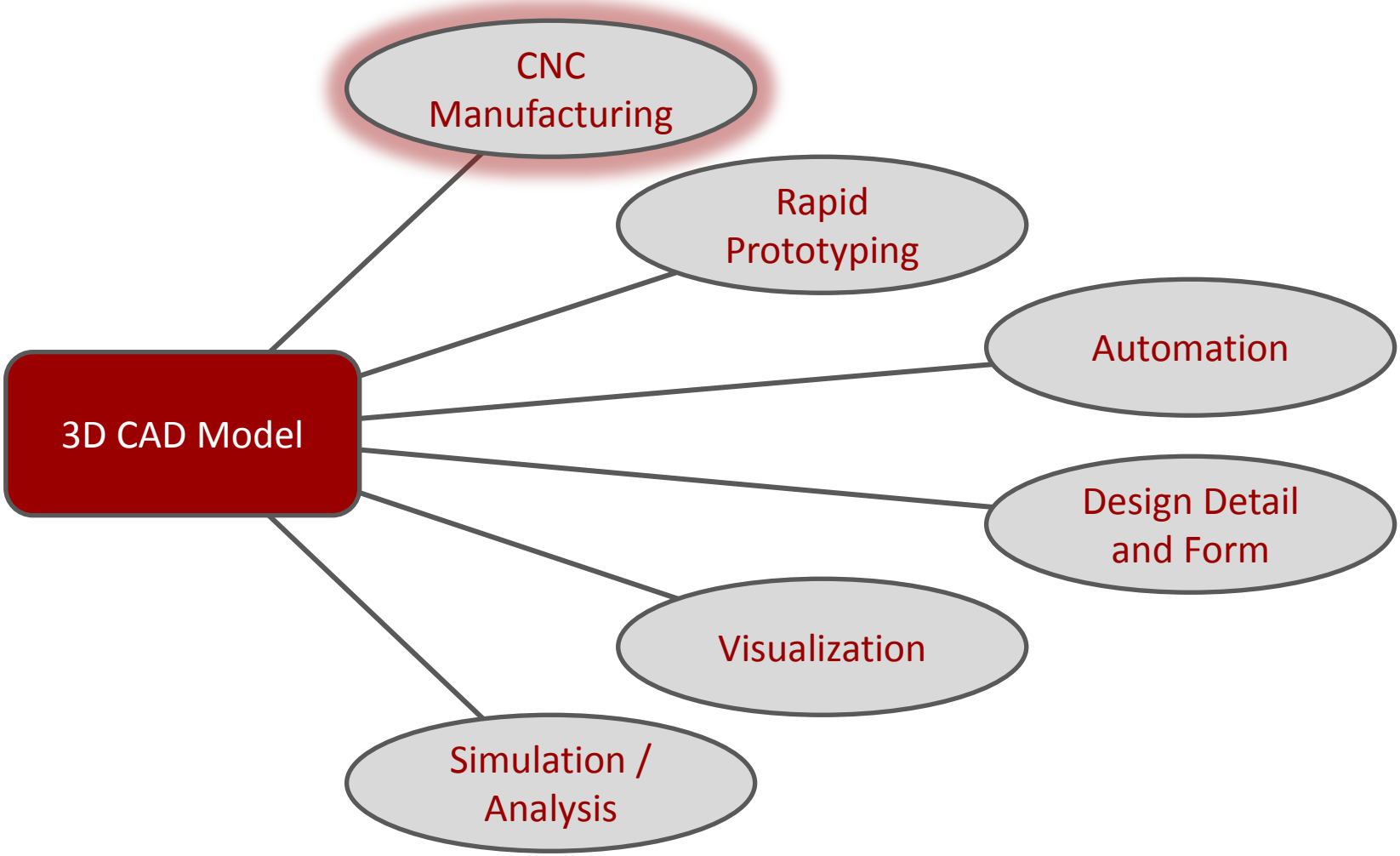
Product Lifecycle – Week 15



3D Product Data

Best in Class companies leverage 3D CAD from engineering throughout the organization.

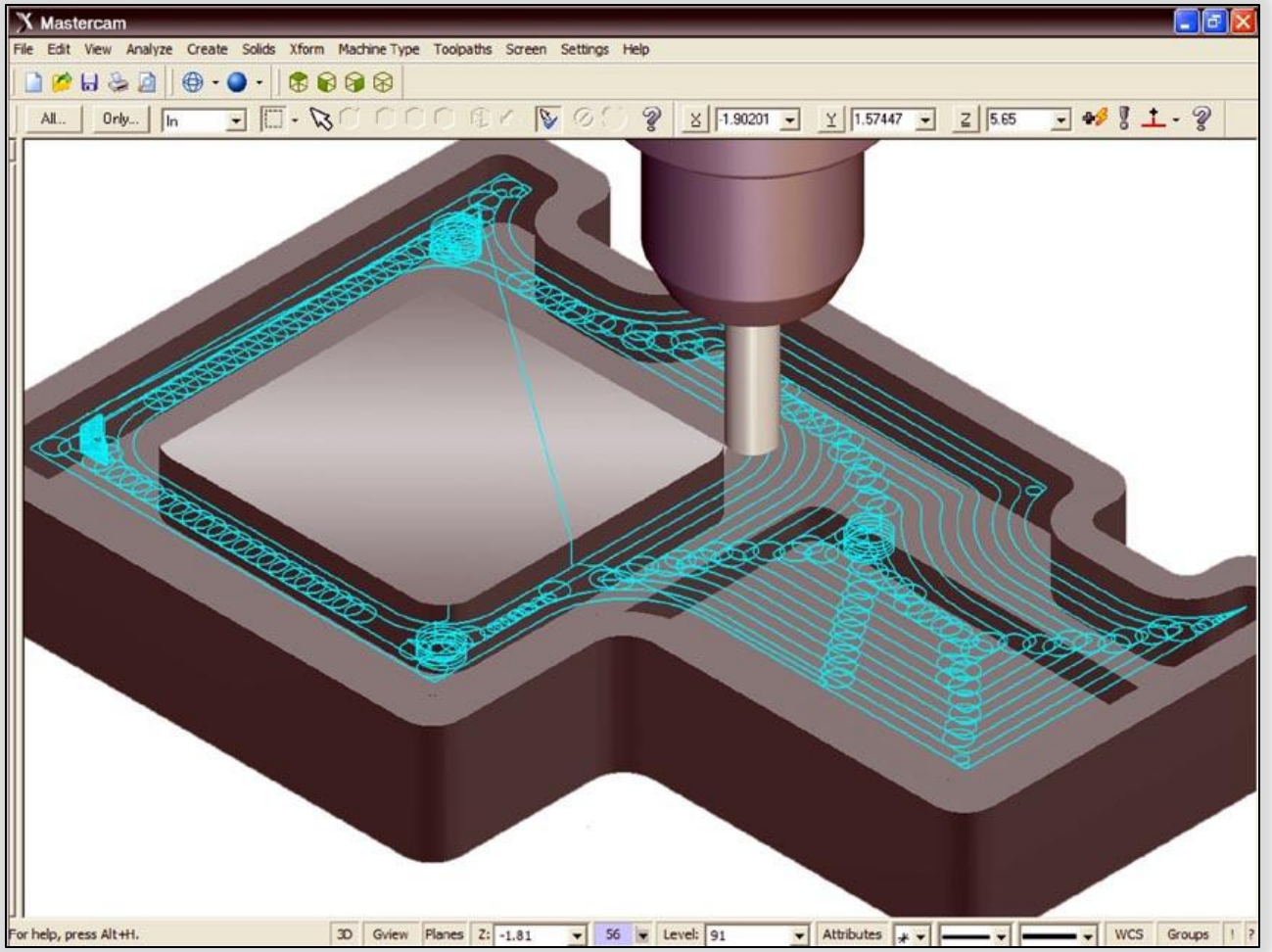
3D Design Use



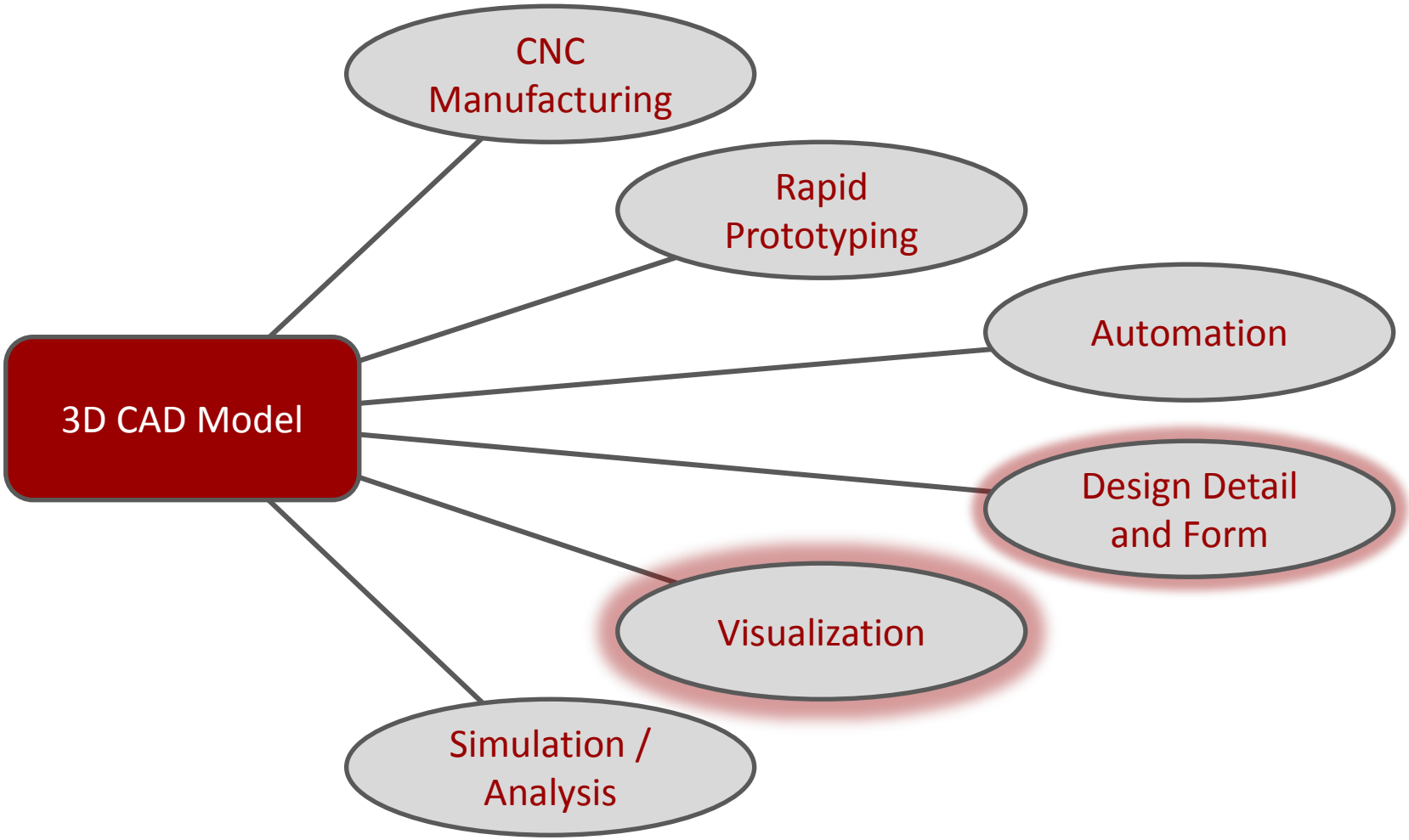
CNC Manufacturing

- Programming of Computer Numerical Control (CNC) manufacturing equipment from 3D model geometry to automate manufacturing of production components.

CNC Cutter Path Example

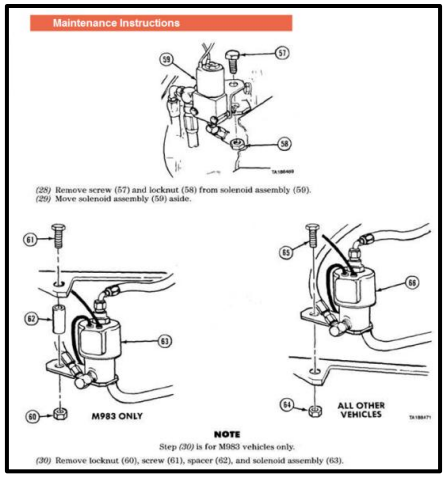


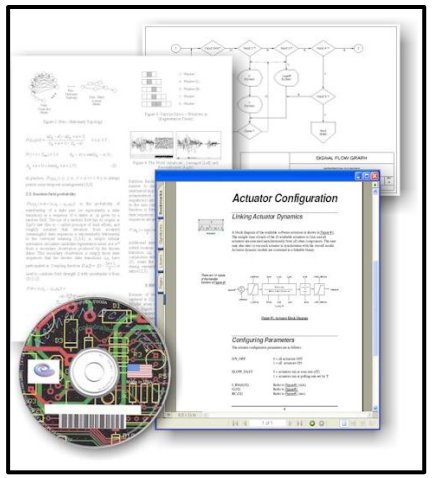
3D Design Use



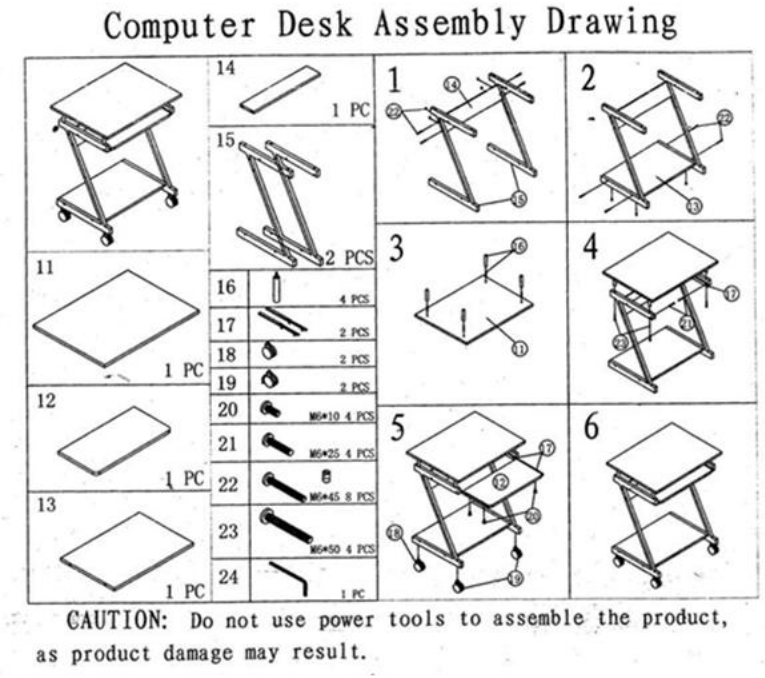
All Products Need to be Explained

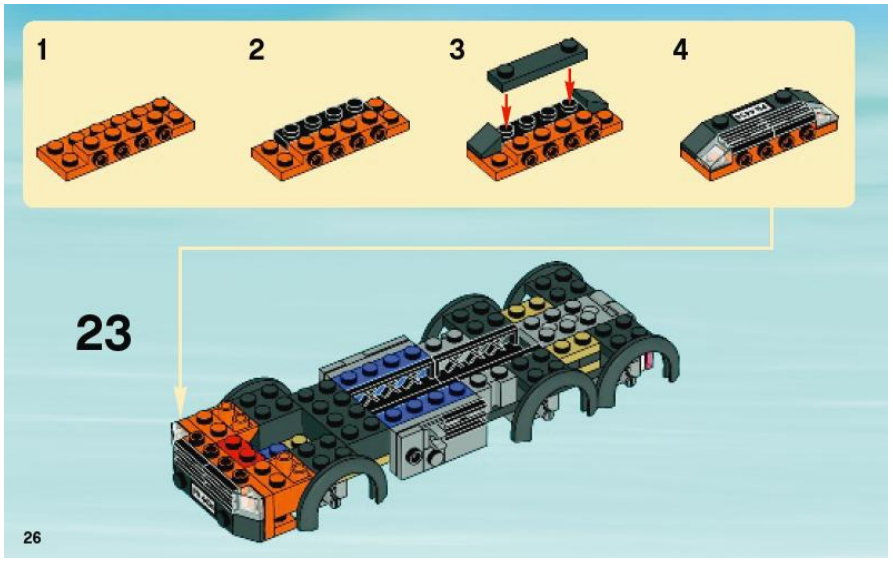
- Assembly Instructions
- Installation Guides
- User Manuals
- Maintenance Instructions
- Process Sheets
- Disassembly Instructions
- Repair Instructions
- Operating Procedures





From Simple Consumer Products



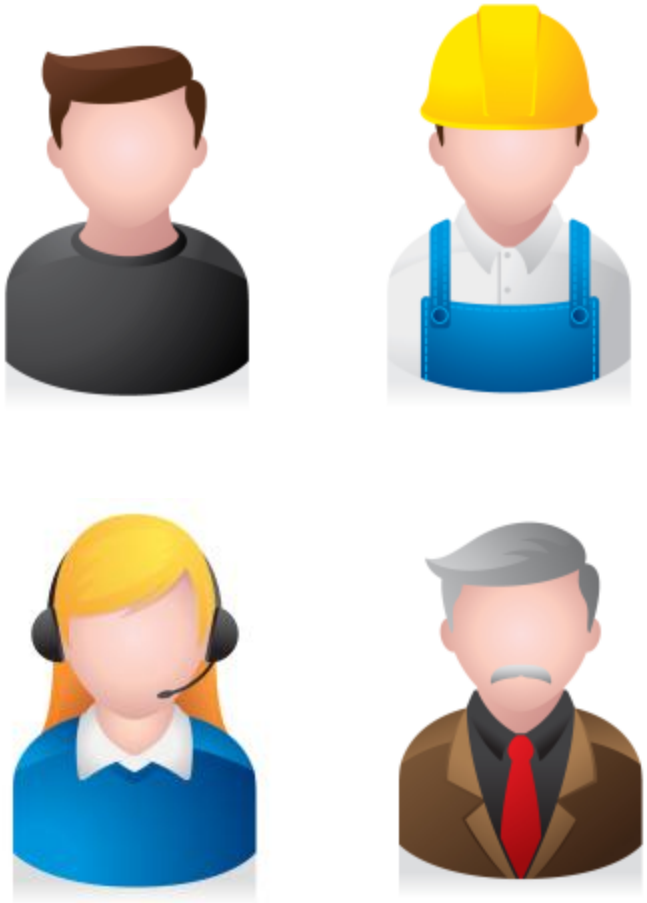


To Complex Industrial Machinery

Seed Runner Unit - *Unverferth Manufacturing Company*

Who Uses Product Documentation

- Manufacturing
- Field Service
- Technical Support
- Customer
- Training Staff
- Reseller / Partners



Today's Documentation Challenges

Inefficient Production Processes	Time to Market Delays	Poor Customer Experience
		
Disconnected documentation processes waste time and drain engineering resources.	Documentation can be a bottleneck in your product launch process and slow time to market.	Unclear and cumbersome text-based documentation can lead to a frustrating customer experience and lack of success with the product.

Legacy Method Examples

- MakerBot Assembly Manual
  - http://wiki.makerbot.com/thingomatic-doc:body-assembly
- Snow Thrower Owners Manual
  - https://icontent.toro.com/smartmanuals/Toro_SingleStage_Snowthrower/Proc10966.htm

Improving Customer Experience

Today's customers expect 3D product information.

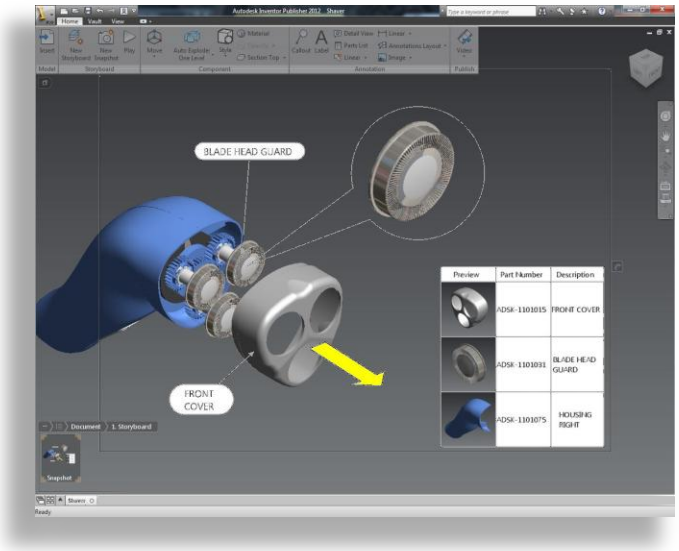
- 80% say 3D images make them more likely to purchase a product
- 60% say they would be more likely to purchase if they had 3D instructions
- 65% say they would be less likely to return a product after viewing it in 3D

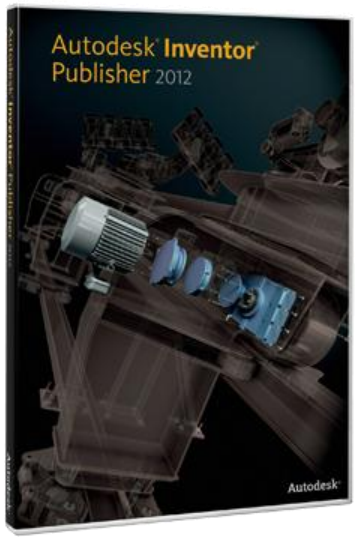
Benefits of Modern Tools

- Mobile Publishing and Viewing
- Integration with PLM Products
- Linked 3D CAD Model Data
- Visualization Quality
- Software Authoring Ease-of Use
- Interactive Documentation

Autodesk Inventor Publisher

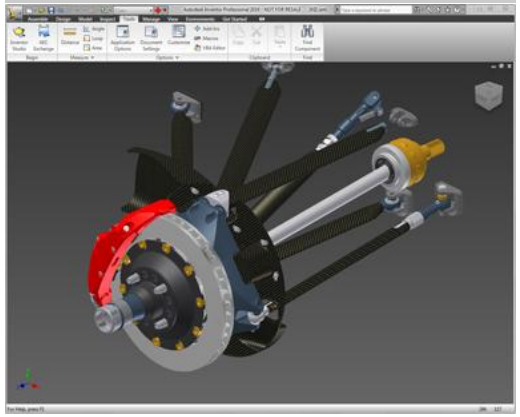
- Autodesk Inventor Publisher is innovative, easy-to-use for creating and sharing interactive 2D and 3D technical documentation of products.





Inventor Publisher Workflow

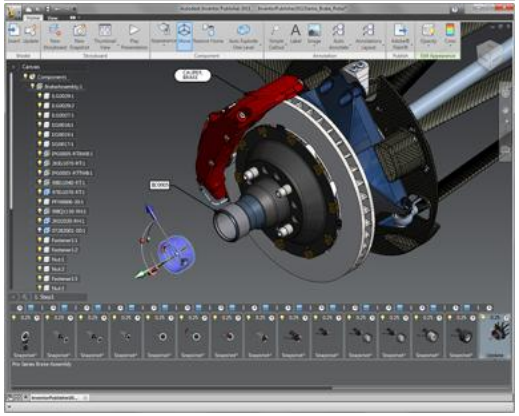
Insert



Extend the value of your 3D CAD data to documentation teams.

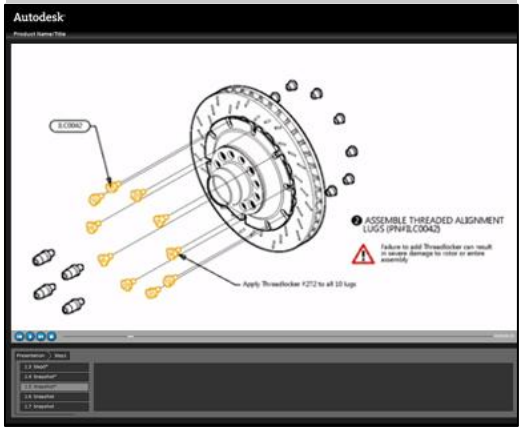
Start docs earlier, work concurrently with Inventor update associativity.

Author



Explain your products visually with exactly the views, appearances, and animation sequences you need.

Publish



Deliver high-impact documentation in the best format for your audience: interactive, animated, or static.

Mobile Viewing

- Viewing and Playing Apps Available

http://www.youtube.com/watch?v=lmIE0ovnTGg

Business Drivers

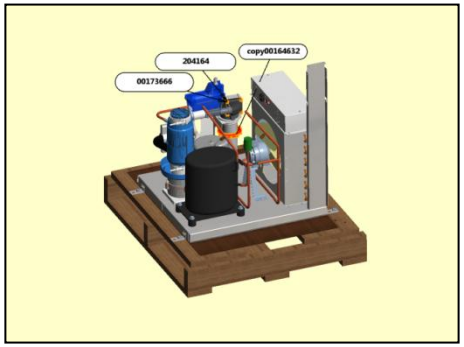
- Increase Customer Satisfaction
- Avoid Assembly Errors
- Keep Documentation Up-to-Date
- Complete Documentation Earlier
- Reduce Photo shoots and Prototypes

Modern Method Examples

- Child Bike Assembly
  - http://www.huffy.com/pdf/ownersmanuals/cf440872-a194-4eb0-b1fb-7c82c4ff8012.pdf
- Playmobile Castle
  - Link to PDF
- IKEA Desk Assembly
  - http://www.ikea.com/assembly_instructions/fredrik--workstation-120x72__735407_PUB.PDF

Follett - Case Study

FOLLETT®
Innovative solutions, inspired by ice



Challenge

Creating manufacturing assembly instructions concurrently with new product design. Current process is to take digital photos of real built prototype machines.

Results

- Our manufacturing / industrial engineering department is now able to create assembly instructions for new product concurrently with new product design.
- Eliminates the need for costly prototypes to take digital photos.
- Eliminates the time it takes to update digital photos after design changes.

"All of our design teams are expected to work concurrently on new product design and up to now that was not possible. Team members from other departments used to have to wait for pilot production prototypes to create assembly instructions and manuals. Now this can be done concurrently saving much time and money."

John Weiss
CAD Administrator
Follett
United States

Open Q&A

- Open Q&A time for discussion on topics

The Future of Design

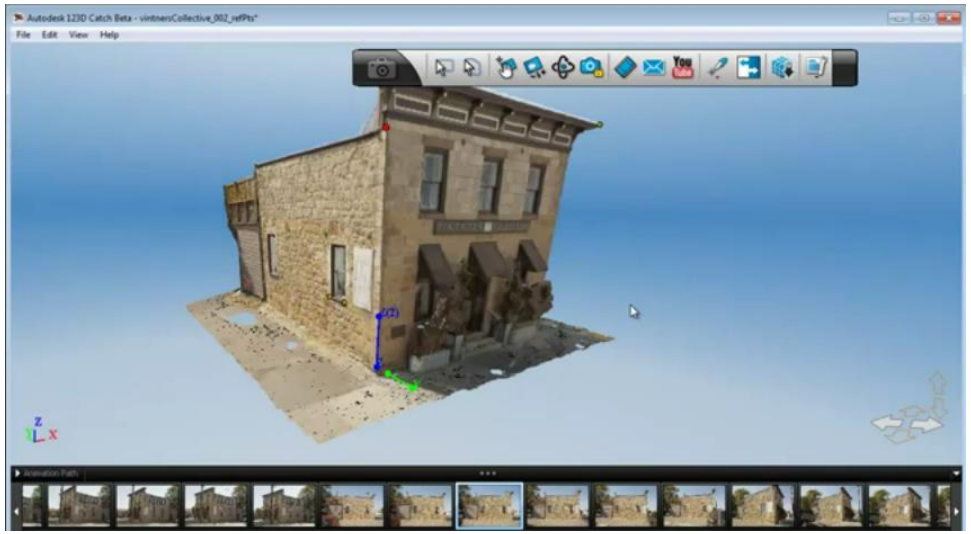
- Infinite Computing
- Reality Digitized
- Everyone is a Designer
- Global Challenges
- Amazing Complexity

Infinite Computing

Access to computing power will spread, and processing power will increase significantly.

Reality Digitized

The speed and ease of capturing reality in the form of a detailed 3D model representing an environment or object.



Example = www.123dapp.com/catch
www.youtube.com/123dcatch

Everyone is a Designer

Low-cost, widely distributed design tools make it easy for non-designers to shape, manipulate, and manufacture objects.

Example = http://www.kickstarter.com/projects

Global Challenges

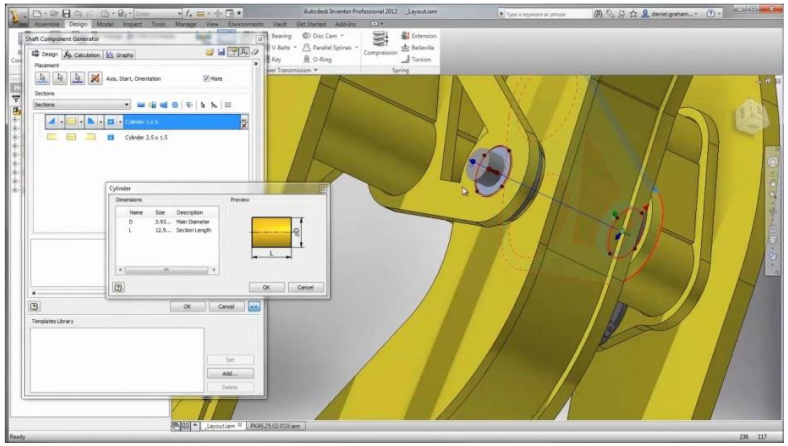
Our increased capacity to create and evaluate design solutions allows us to build resilience and confront the complex challenges ahead.

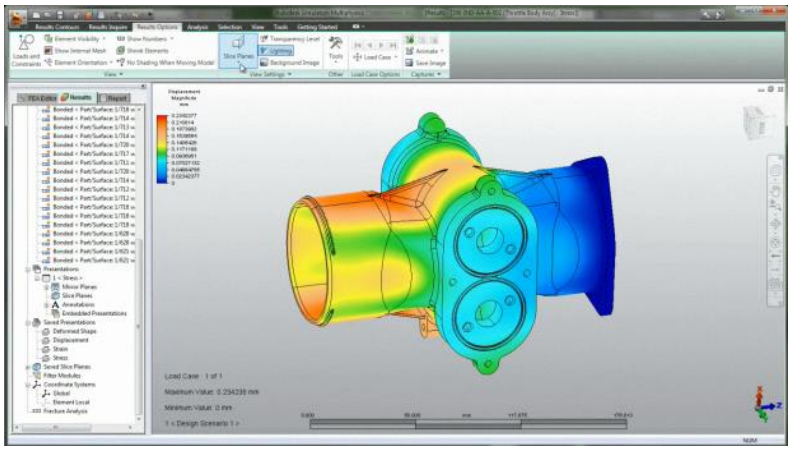
Amazing Complexity

As we create and consume more information we face mass complexity, making it critical to distill clarity.

24-688 Introduction to CAD/CAE Tools

- This course offers hands-on training on how to apply modern CAD and CAE software tools to engineering design, analysis, and manufacturing.



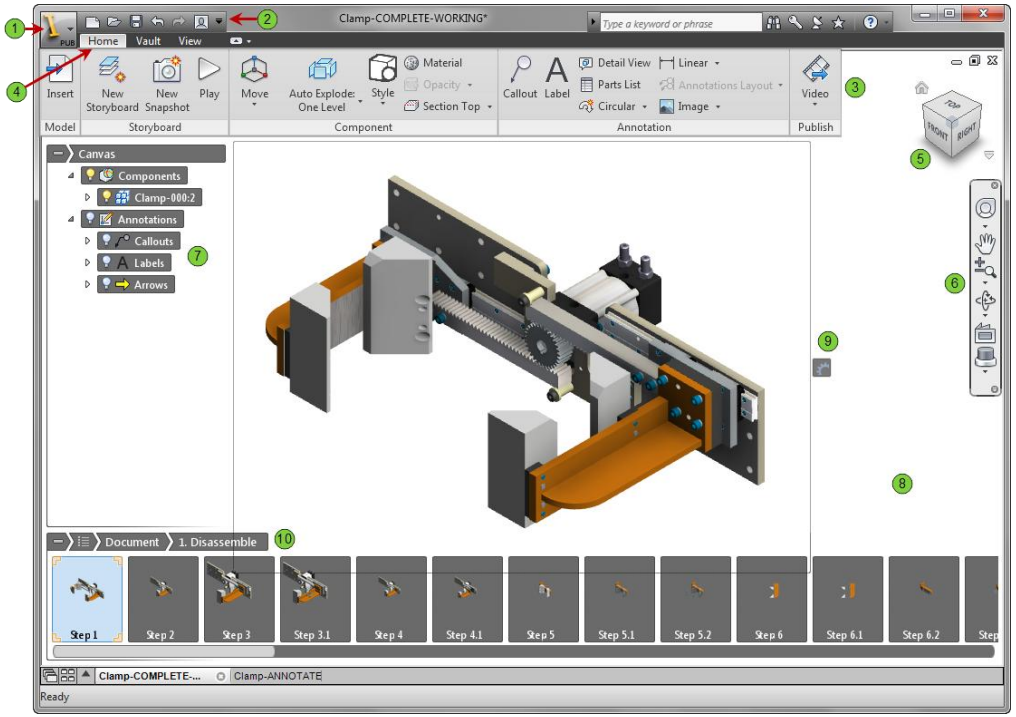


Course Objectives

- CAD
  - Describe the product development process
  - Express product design ideas using 2D digital sketches
  - Model a component with complex shapes
  - Model an assembly of components with kinematic linkages
  - Render and animate the appearance and functionality of a product
- CAE
  - Perform linear structural analysis
  - Perform non-linear structural analysis
  - Perform kinematic motion study analysis
  - Perform Computational Fluid Dynamics analysis
  - Design optimization using simulation

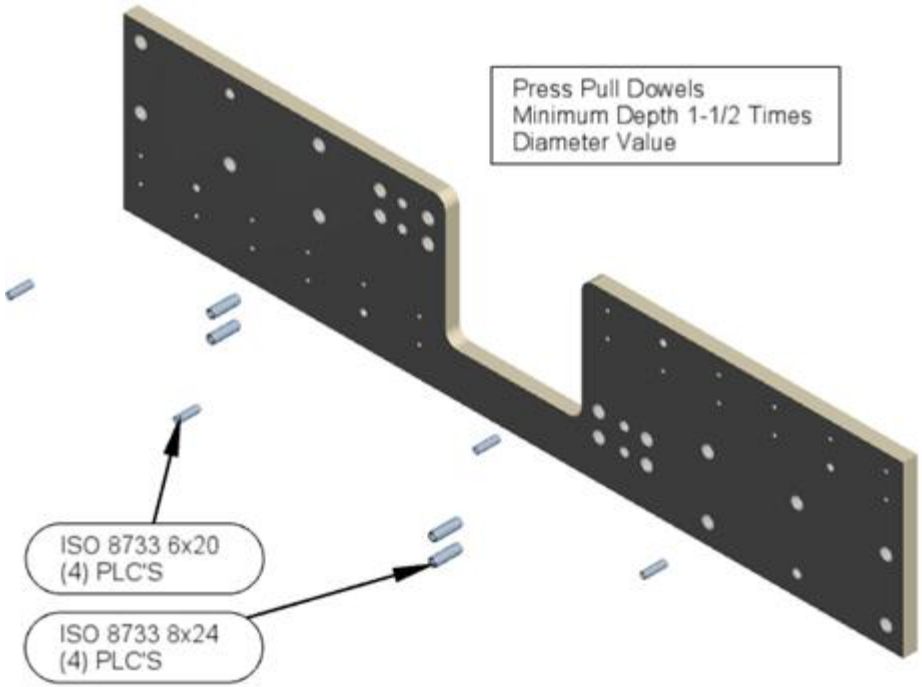
Guided Lab Project 1

- Guides instructions for creating storyboards and snapshots in Inventor Publisher.



Guided Lab Project 2

- Guided instructions for adding annotation and controlling the model appearance.



Guided Lab Project 3

- Guided instructions for playing and publishing Inventor Publisher documents.