

## Advanced Manufacturing Lesson Plan – Design and Modeling

**Title:** Careers in Advanced Manufacturing      **Subject/Course:** Engineering & Robotics

**Topic:** 3D-Modeling      **Grade:** 9th      **Designers:** Clark Sarge/Brian Soars

### Stage 1 – Desired Results (PLAN)

**Established Goals:**

**Students will be exposed to careers in Advanced Manufacturing**

Students will understand the basic design process to produce a new system or part in manufacturing  
Students will learn to use parametric modeling software to produce a model of a prototype  
Students will be introduced to different manufacturing processes, including molding, machining, and additive manufacturing.

**Understandings:**

*Students will understand that manufacturing requires technical skills and knowledge*  
*The will understand that advanced manufacturing offers several career paths.*

**Essential Question/Big Idea:**

How do engineers go from idea to prototype?  
What tools do manufacturers use to produce products?

*Students will know....*

The six steps of the design process.

The different processes involved in advanced manufacturing

*Students will be able to....*

Create a 3D-model in Autodesk Inventor CAD software

## Stage 2 – Assessment Evidence (STUDY)

### Performance Task

**Goal(s):**

Create and 3D print a part for a Robotic Arm

**Role:**

Engineer/Designer

**Audience:**

**Teacher/Class**

**Situation:**

Students will be given a 2D sketch of a part and will convert the design to 3D using CAD

**Performance:**

Create a 3D model in Inventor and send the part to Fablicator for production

**Standards:**

Final Design meets all dimensional and mass requirements.

**Key Criteria:** to reflect Performance Tasks: *Examples: Rubric, Checklist, etc.*

By what criteria will performances and products be judged?

Designed part will be within 2% of specified dimensions.

### Other Evidence

Summarized (tests, essays, work sample(s), etc.

**Discussion response on careers in advanced manufacturing**

**Quiz on the design process**

**Design sketches of part**

## Stage 3 – Learning Plan (DO)

### Learning Activities

*Show video on careers in Advanced Manufacturing*

**Students complete discussion activity:** *What skills and knowledge does a manufacturing engineer need to be successful?*

PowerPoint Presentation on Engineering Design Process (Use Six-step process from Project Lead the Way)  
Students take notes and discuss

Give student sample part to model in Autodesk Inventor

Lead students through the process of designing and extruding a 3-D model in Inventor

Give students Robotic Arm bracket in 2D (orthographic sketch) form. Students will make a model in Inventor and submit for manufacture.

Students take quiz on Design Process.

### Resources

*Video – THE TRUTH ABOUT MANUFACTURING CAREERS:* [https://www.youtube.com/watch?v=kZI\\_36-fFTo](https://www.youtube.com/watch?v=kZI_36-fFTo)

*Possible field trip tour (virtual or in person?) to local manufacturing facility (Lycoming Engines?)*

## Reflection (ACT)

Were the lessons successful? How do you know? What would you do differently next time?

**Intervention** (What will we do if students don't learn it?)

**Enrichment** (What will we do if students don't learn it?)

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**Understandings:**

*Students will understand the design process that engineers use to take a product from design to reality*  
*The will understand how to use 3D parametric modeling software to create a part model.*  
*They will understand how additive and subtractive manufacturing processes are used to create parts and prototypes.*

**Essential Question/Big Idea:**

How do engineers go from idea to prototype?  
 What tools do manufacturers use to produce products?

*Students will know....*

The six steps of the design process.  
 The different processes involved in advanced manufacturing

*Students will be able to....*

Create a 3D-model in Autodesk Inventor CAD software  
 Enter a basic numerical problem in a CNC lathe to manufacture a part



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### Other Evidence

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**Discussion response additive manufacturing video**

**Quiz on the design process**

**Final prints and machined parts**

## Stage 3 – Learning Plan (DO)

### Learning Activities

*Show video on 3D printing/additive manufacturing*

**Students complete discussion activity:** What is another name for 3D printing? What are some applications of 3D printing? What do you think about the future of 3D printing?

Split students into two groups. Engineering students will go to Precision machining with Mr. Soars to complete basic lathe operation hands-on activity. Precision machining students will go to Mr. Sarge to complete lesson on Engineering Design process and 3D modeling in Autodesk inventor.

Give student sample part to model in Autodesk Inventor.

Lead students through designing and 3D printing part for CO2 Car launcher project.

### Resources

*Video – 3D Printing: Revolution or Just a Trend?:* <https://www.youtube.com/watch?v=NRUbaAPbmVA>

*AUTODESK Inventor Professional Software*

*Possible field trip tour (virtual or in person?) to local manufacturing facility (Lycoming Engines?)*

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