Engineering Design
ENGR 13x2

Materials, Manufacturing, & 3d Printing

Look for efficient solutions

Agenda

- Demo of 3d Printing
  - Slicing software
  - G-code
  - Printer setup
  - Print!
- Materials & Fabrication Methods
- Manufacturing & Production Issues

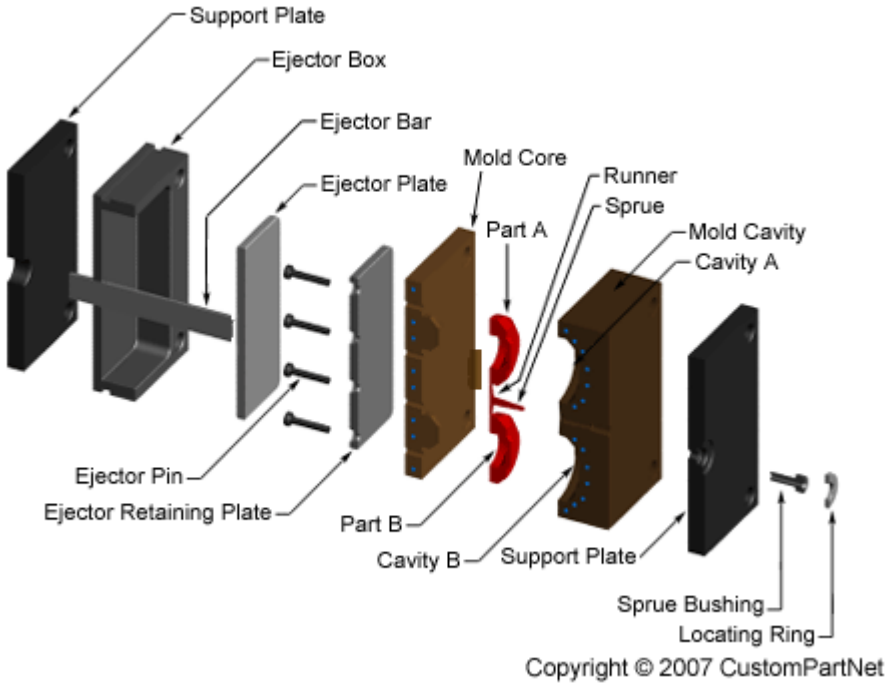
3d Printing demo

STL model

Your 3d Printing Options…

- OSU Bookstore
  - Tech counter at the back.
  - Give them a file, they give you back a part.
  - Free for school projects, otherwise 8 cents per gram.
- Edmon Low Creative Studios (OSU Library)
  - https://info.library.okstate.edu/creativestudios/3dprinting
  - Go through their training, and you can print on your own.
  - Nice printers, can use free of charge!
- CEAT ITS 3d Printers
  - CraftUnique Craftbot printers in ATRC, ES, Parker Hall.
  - Let them help you with your first print, then open-use.

Materials & Fabrication Methods



Structural/Mechanical Materials

What are some commonly-used materials?

- Metals
- Wood
- Plastics
- Concrete
- Ceramics/Glass
- Paints/Coatings
- Composites
- Fluids

Material Properties

- General Properties
  - Availability/Manufacturability
  - Cost
  - Appearance
- Mechanical Properties
  - Density
  - Corrosion Resistance
  - Strength
  - Elasticity
- Thermal Properties
  - Melting Point
  - Conductivity
  - Creep Resistance

Material Selection

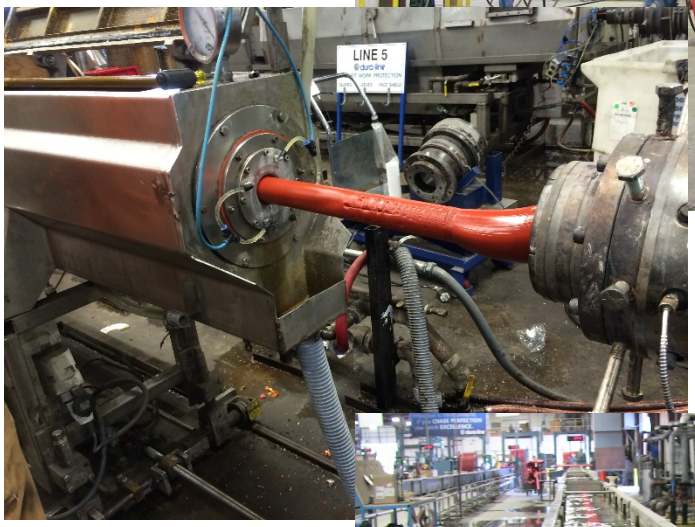
- Size Constraints
- Shape & Geometry
- Technology availability
- Lifetime targets
- Cost/Stock Availability
- Environment
- Force Requirements
- Disposal
- Safety
- Quantity

Fabrication Methods

- Metals
  - Casting (complex geometries, hollow parts, large parts, combinations of parts, high volume) (https://www.youtube.com/watch?v=yXVLbzI3xTE)
  - Wrought Processes (superior mechanical properties)
    - Stamping
    - Forging
    - Extrusion (https://www.youtube.com/watch?v=iiGlq7408ME)
    - Rolling
    - Drawing
  - Machining (subtractive, common, can be complicated (5-axis machines))
  - Joining
    - Welding
    - Assembly

Fabrication Methods

- Plastics
  - Injection Molding
  - Compression Molding
  - Extrusion
  - Blow Molding
  - Thermoforming
  - 3D Printing
  - Machining
  - Joining
    - Welding
    - Adhesives
    - Assembly

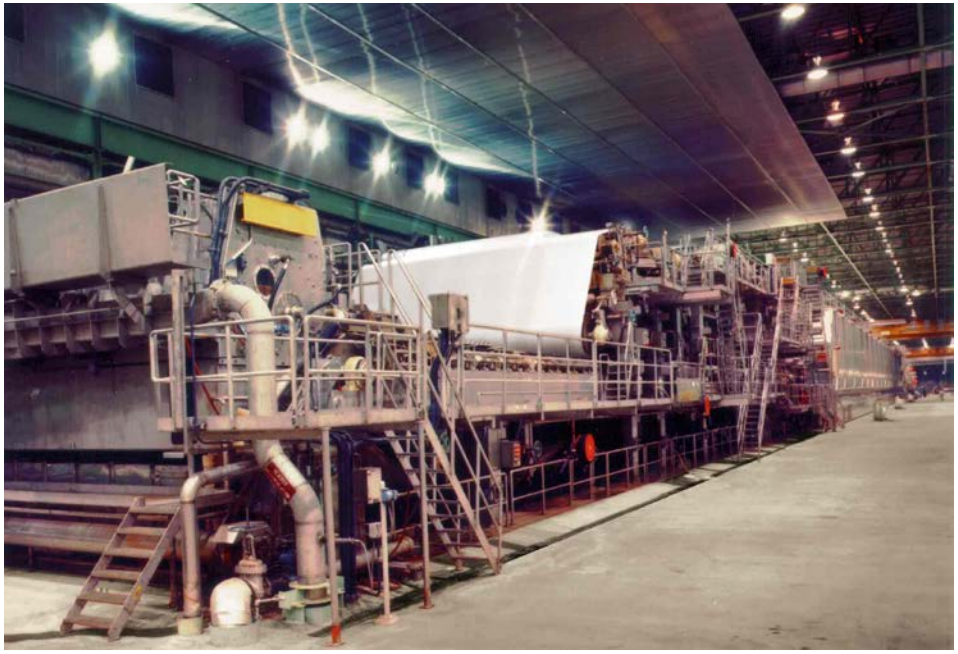


https://www.youtube.com/watch?v=qn16JtE_vLc

Manufacturing & Production Issues

Manufacturing & Production Issues

- Raw Material & Component Quality
- Fits & Tolerances
- Tooling Costs
- Lead-times
- Functionality vs. Manufacturability



Some Recommendations

- Consider taking Materials & Fabrication Courses
- Establish good relationships
  - Make friends with the prototype shop and the manufacturing technicians.
- Maintain your willingness to learn
  - This is practice, not theory.
  - Be willing to get your hands dirty.
- Hone your organizational skills (working on multiple projects)
- Failure is your friend… it is how we learn best.