Danko Arlington
Since 1920

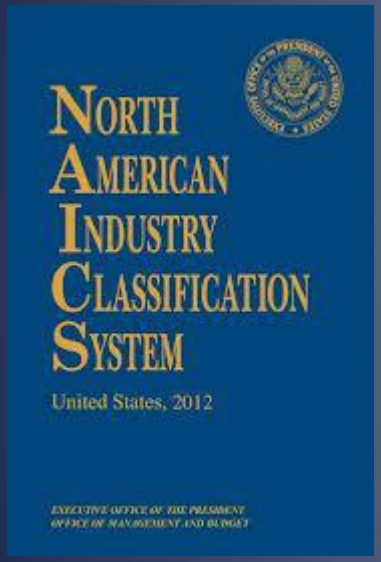
The Use of Additive Manufacturing in Foundry Patternmaking

John D. Danko, President

Danko Arlington, Inc.

2013 Annual Additive Manufacturing Users Group Conference

AMUG

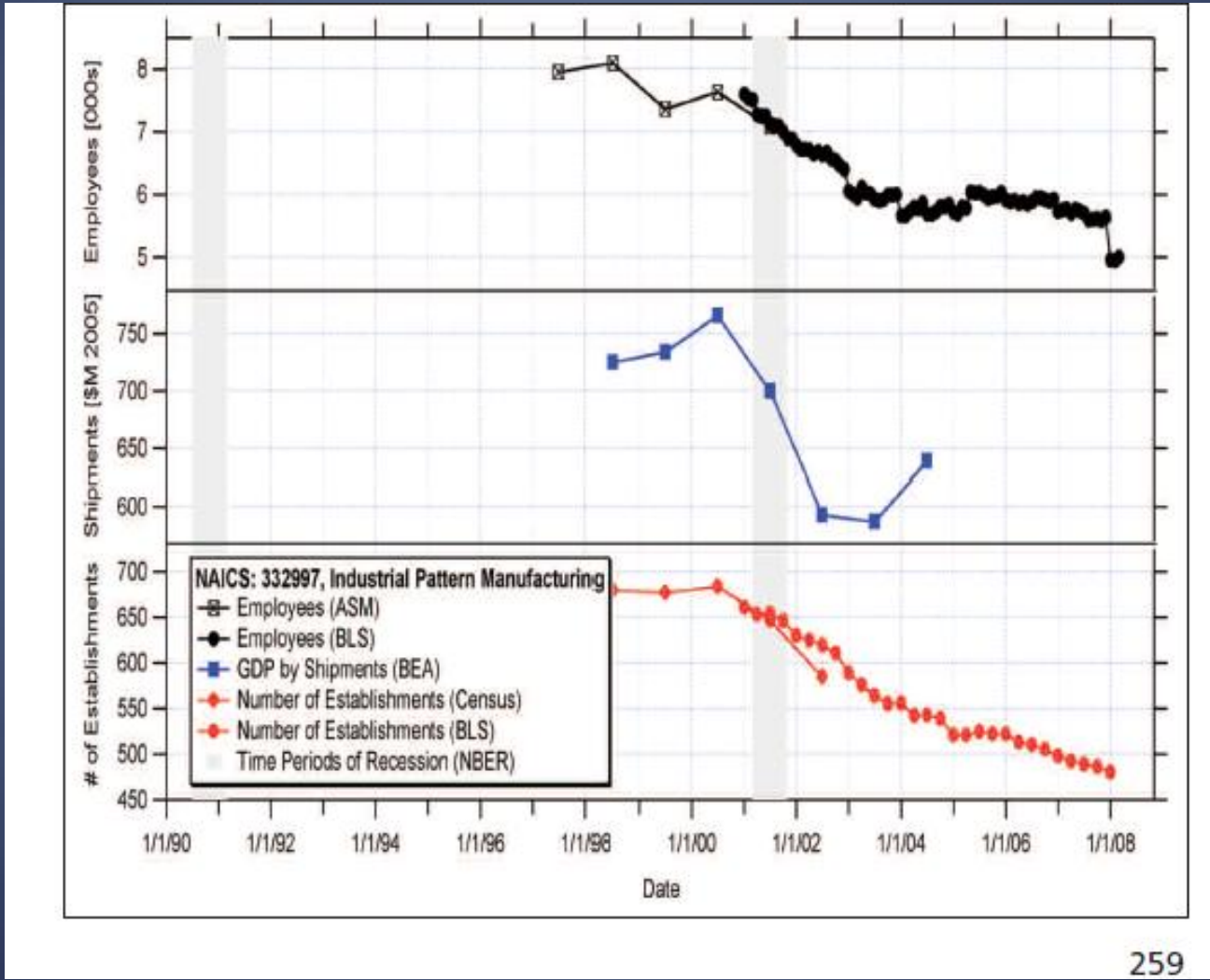


NAICS 332997 Industrial Patternmaking

- Cores, sand foundry, manufacturing
- Foundry cores manufacturing
- Foundry pattern making
- Industrial pattern manufacturing
- Patterns (except shoe), industrial, manufacturing

Industrial Patternmaking has declined…

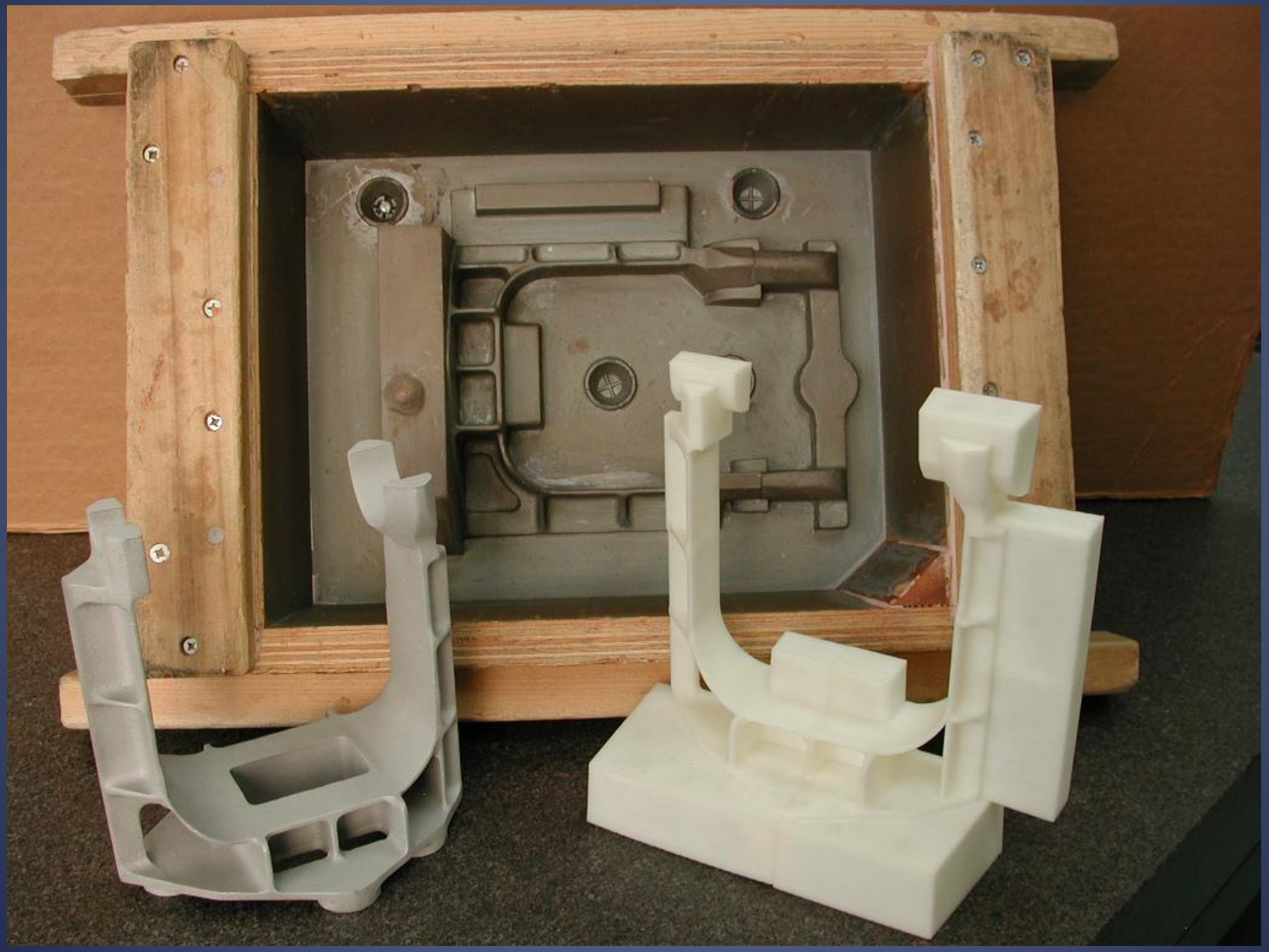
as a result…. NAICS 332997 is now no longer an active trade code.



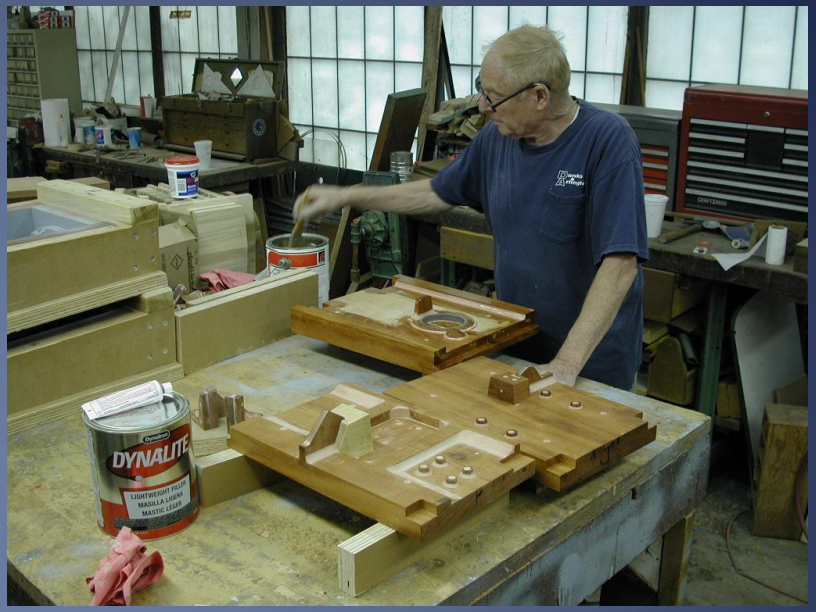
How castings are made at Danko Arlington:

- (Play Video found on home page of D/A website)

Danko Arlington now exclusively uses 3-D printing for new foundry patterns.



Traditional patternmaking is now scarce



Danko Arlington invests in a Stratasys 900MC 3-D printer to construct new patterns

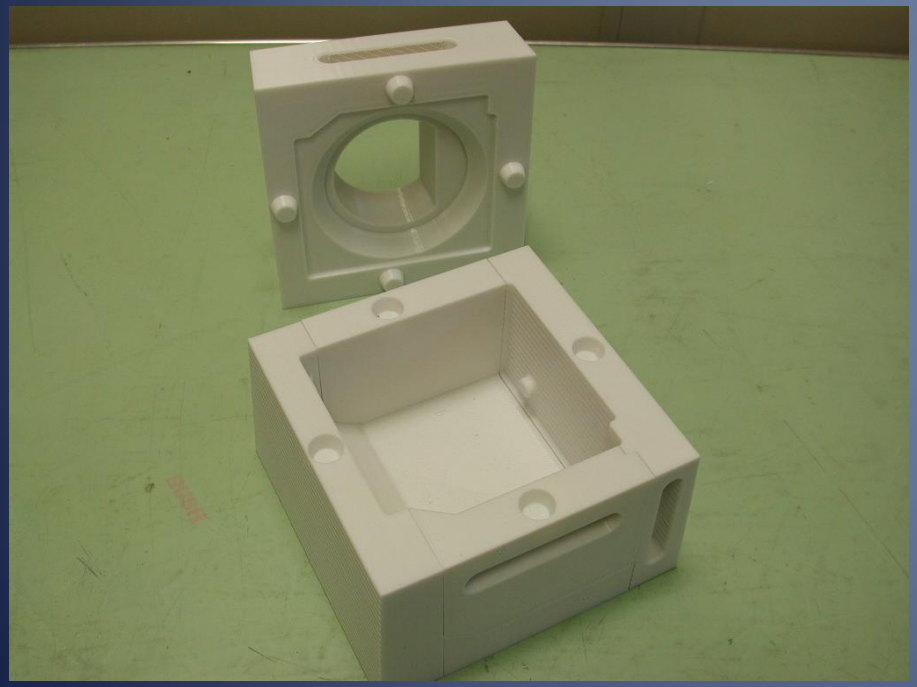
STRATASYS®
3D Printers and Production Systems

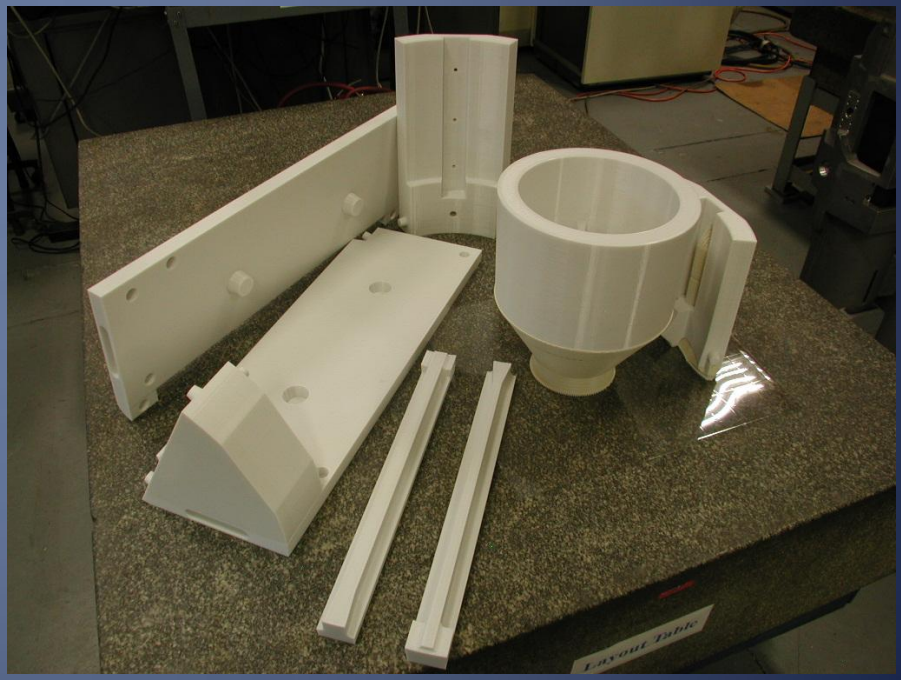
3-D Patternmaking Printing Benefits

- Unlimited New Design Options
- Accuracy
- Incorporating Variable Fillets, Locks, Pins, & Clearance
- Efficient Process
- Less Programming and Operator Setup
- Fast
- Very Reliable
- Great Sales Tool

3-D Patternmaking Printing Benefits

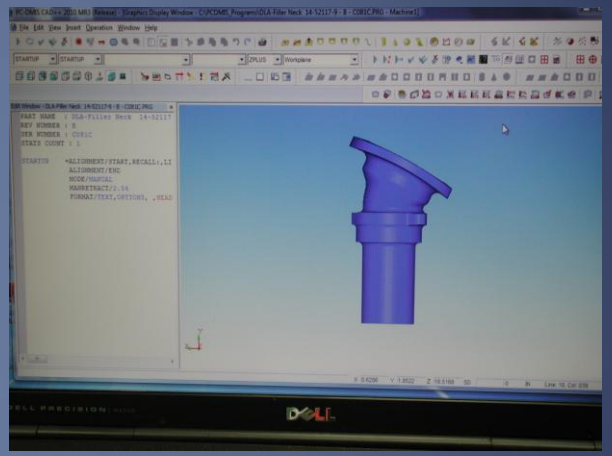
- Unlimited New Design Options

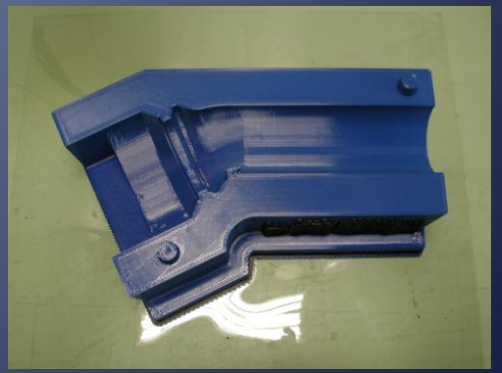




3-D Patternmaking Printing Benefits

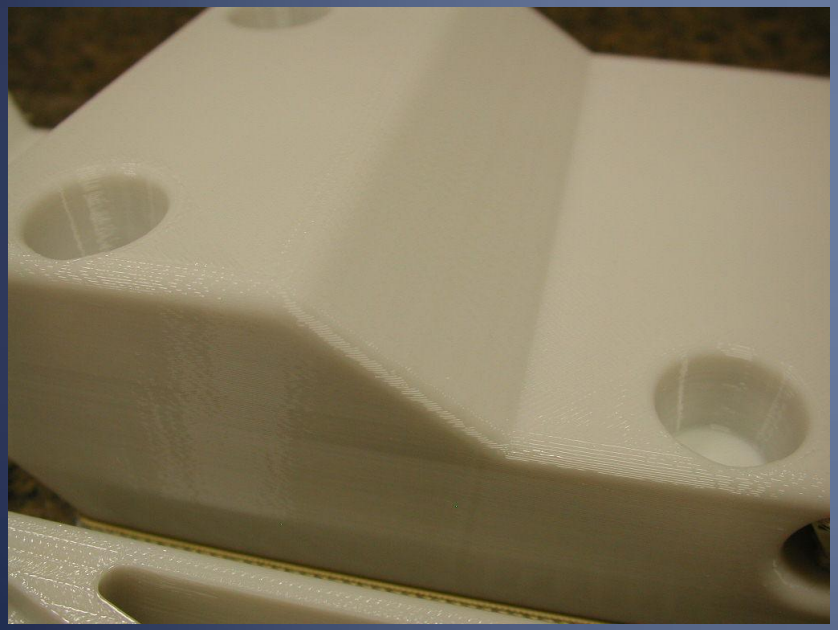
- Accuracy

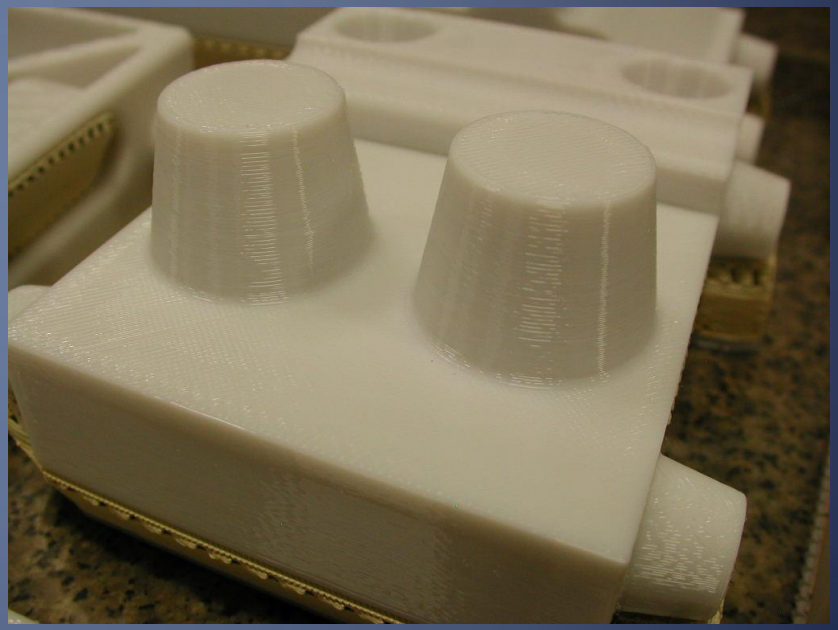




3-D Patternmaking Printing Benefits

- Incorporating Variable Fillets, Locks, Pins, & Clearance.





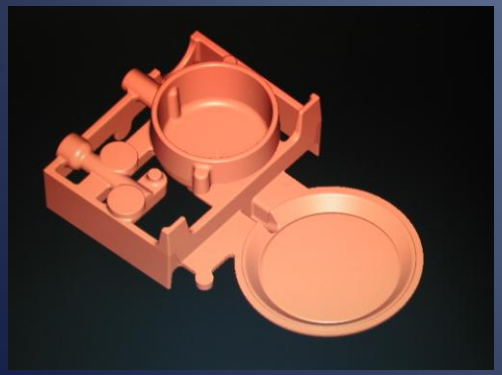
3-D Patternmaking Printing Benefits

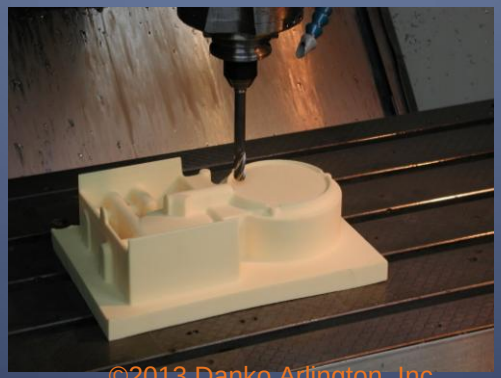
- Efficient Process

Our Conventional Shop vs. 3-D Printing

3-D Patternmaking Printing Benefits

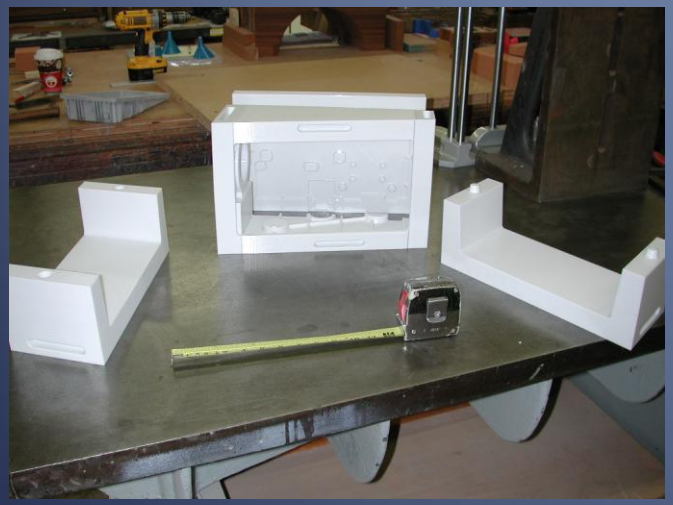
- Less Programming and Operator Setup

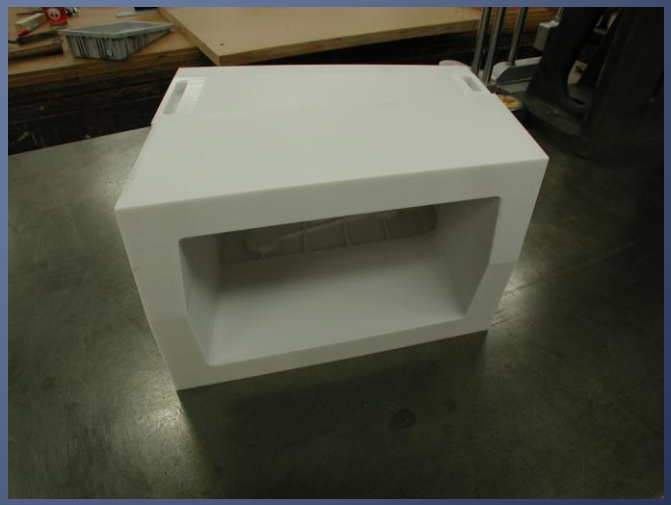




3-D Patternmaking Printing Benefits

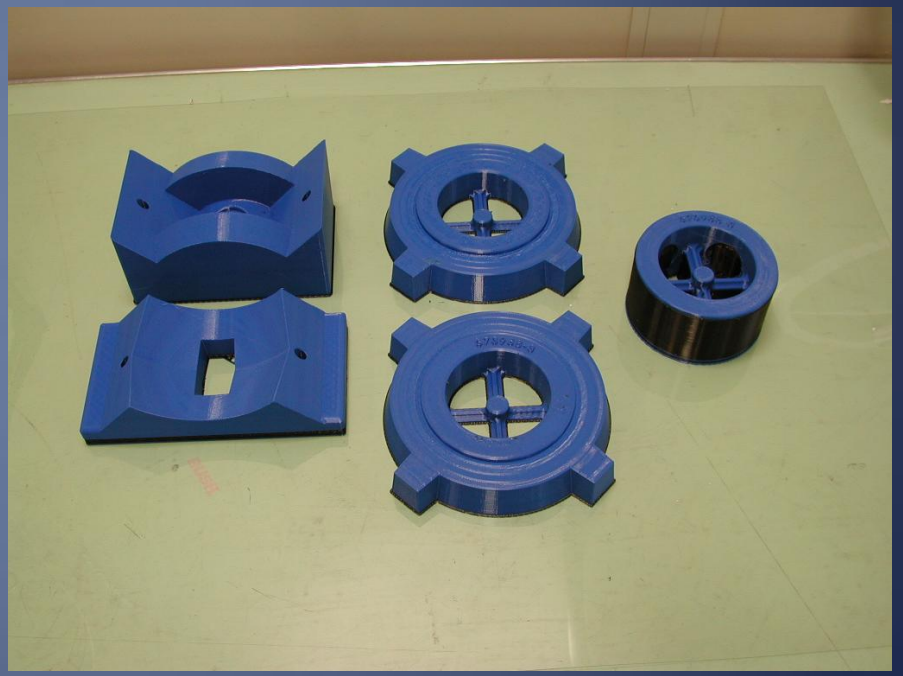
- Fast





3-D Patternmaking Printing Benefits

- Very Reliable



3-D Patternmaking Printing Benefits

- Prototypes from rapid tooling are great sales tools!

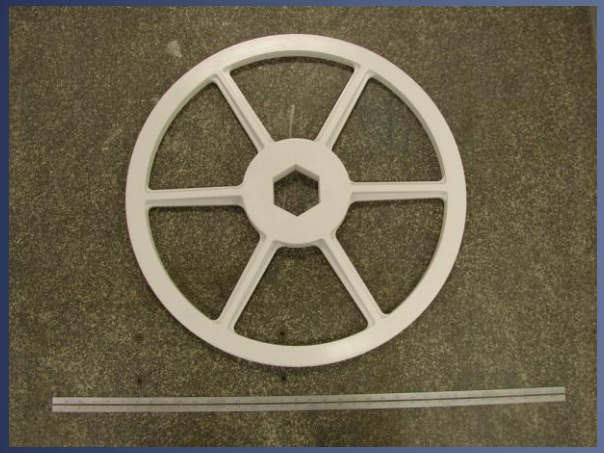
3-D Patternmaking Printing Challenges

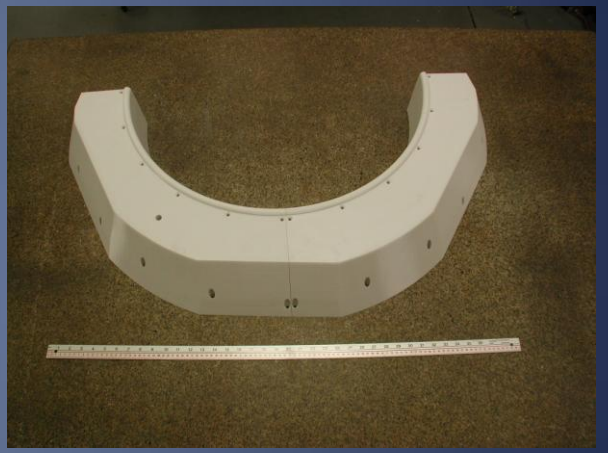
- Equipment Cost
- Material Cost
- Fragile Printed Designs
  - Can Easily Twist
  - Can Crack if mishandled
  - Difficult to Repair or Modify pattern once printed
- Potential Binder Chemical Reaction
- Potential Thermal Distortion in Hot Reclaimed Sand
- Hand Labor & Finish Required

3-D Patternmaking Printing Challenges

- Equipment Cost

24” x 36” x 36” print volume is great for large patterns:





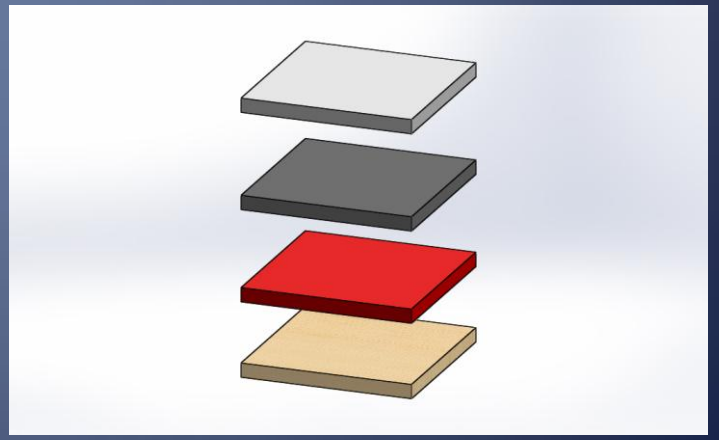
vs.

joined assemblies from smaller printers:

3-D Patternmaking Printing Challenges

- Material Cost$

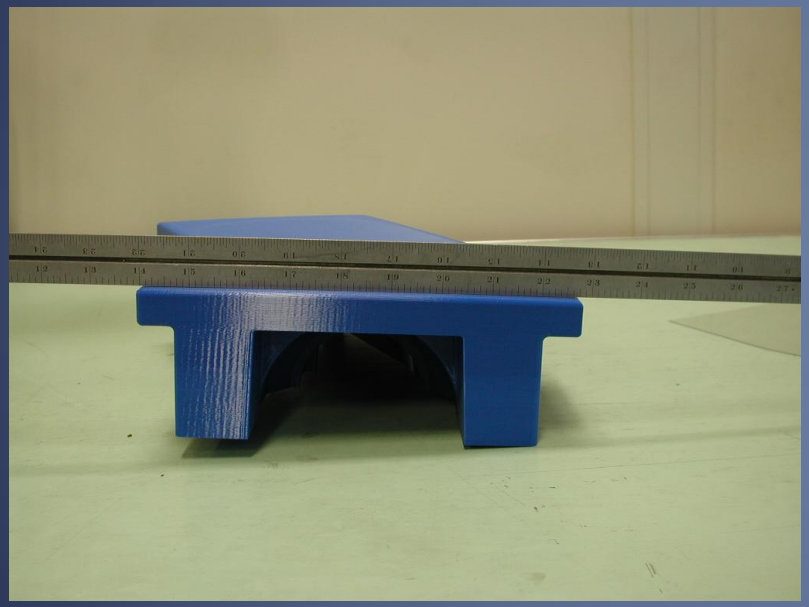
Comparing equal volumes of matl:

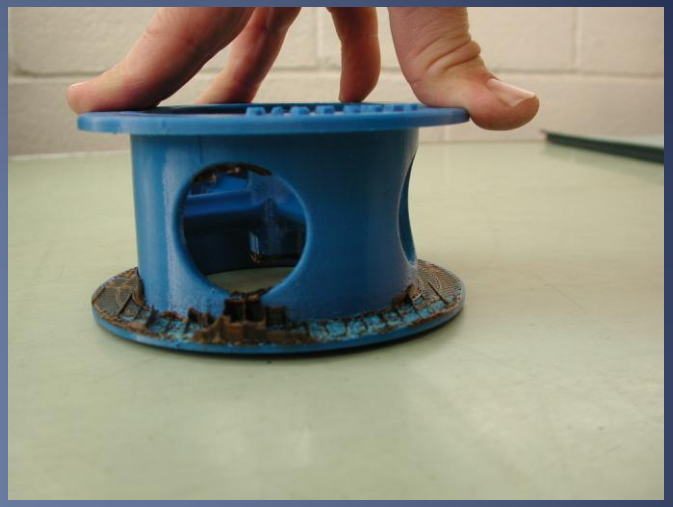


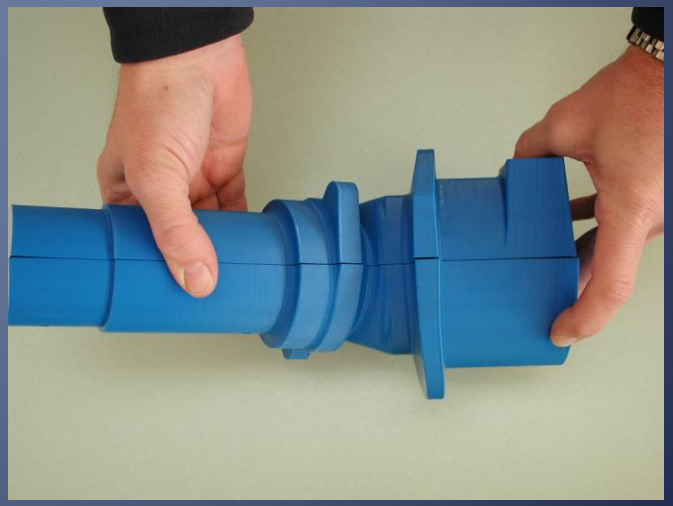
1 Board Foot = 12” x 12” x 1”

3-D Patternmaking Printing Challenges

- Fragile printed tooling can twist.

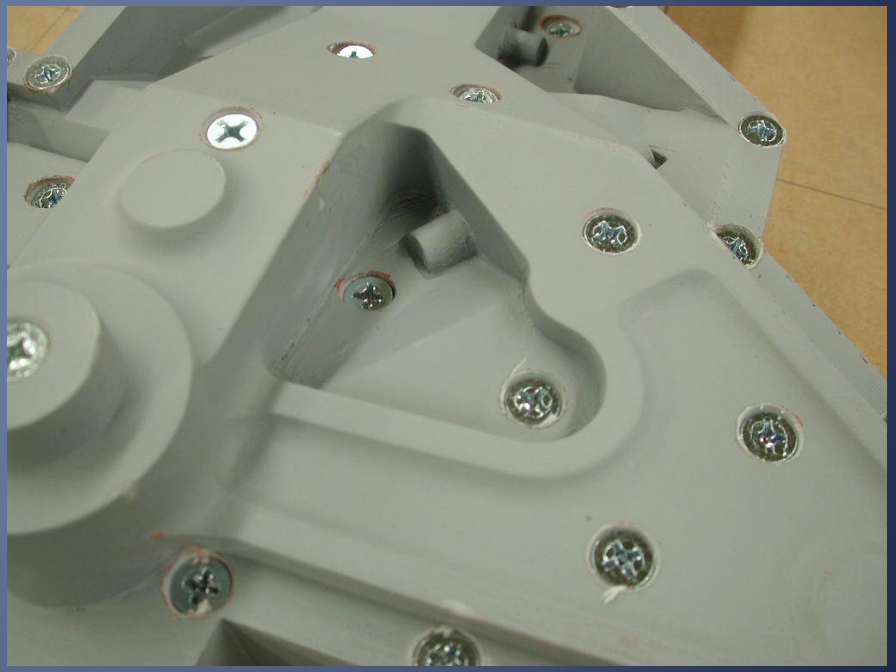






3-D Patternmaking Printing Challenges

- Fragile tooling can crack if mishandled or over stressed.



3-D Patternmaking Printing Challenges

- Printed patterns are difficult to repair or modify.

3-D Patternmaking Printing Challenges

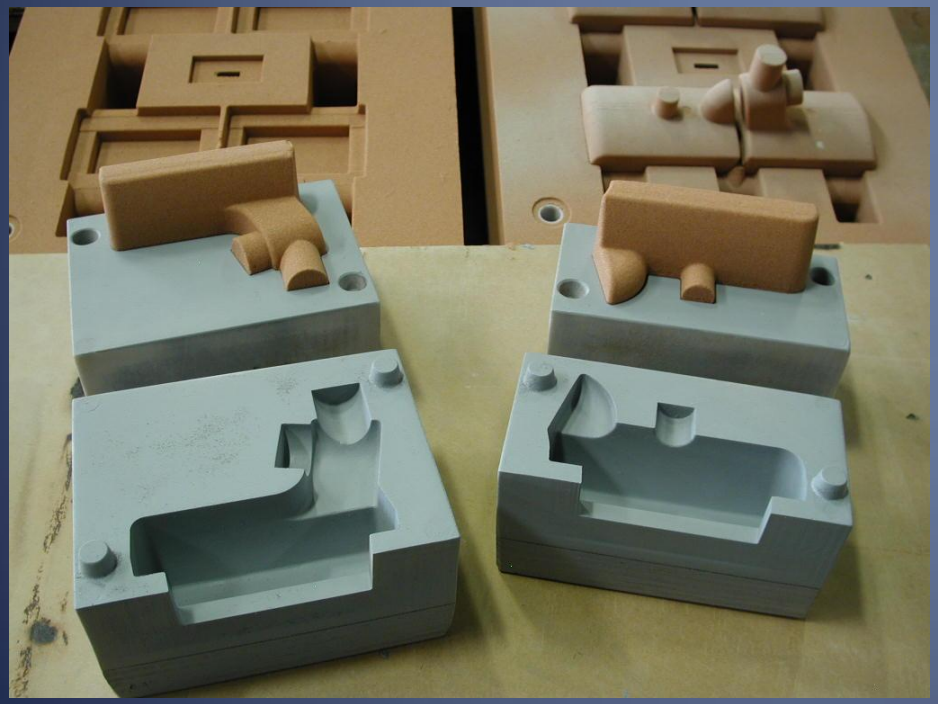
- Chemical sand binders can degrade plastic tooling.

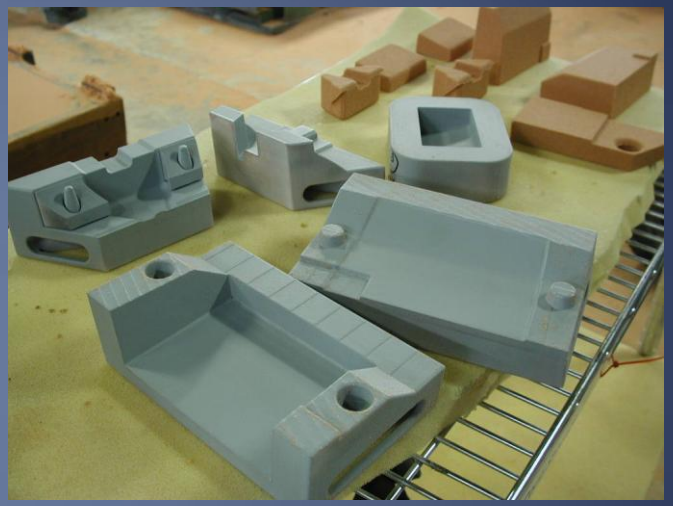
3-D Patternmaking Printing Challenges

- Thermoplastic patterns can distort in hot reclaimed sand.

3-D Patternmaking Printing Challenges

- FDM patterns & core boxes require hand labor to finish.





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