



National Aeronautics and
Space Administration



Low Cost 3D Desktop Fabrication for Manufacturing

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Low Cost 3-D Manufacturing



- NASA Langley is standing up a Low Cost 3-D Desktop Fabrication Lab for Manufacturing**
- Foster Creativity and Innovation**
 - Allow Innovators to Test Out Early Concepts for Form, Fit and Function**



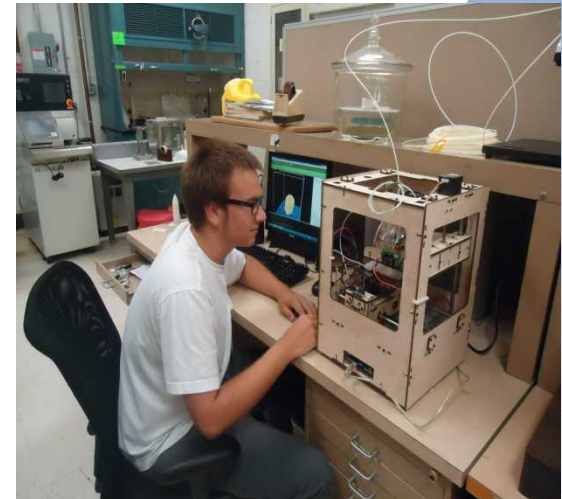
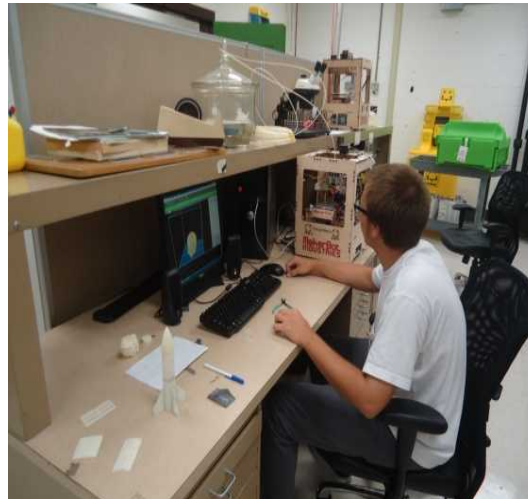
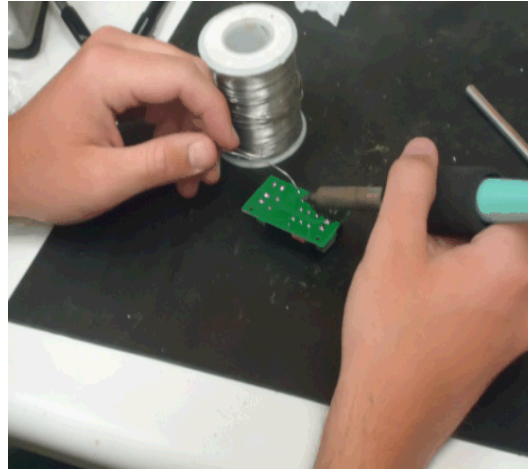
3-D Desktop Printing

3-D Desktop Printers

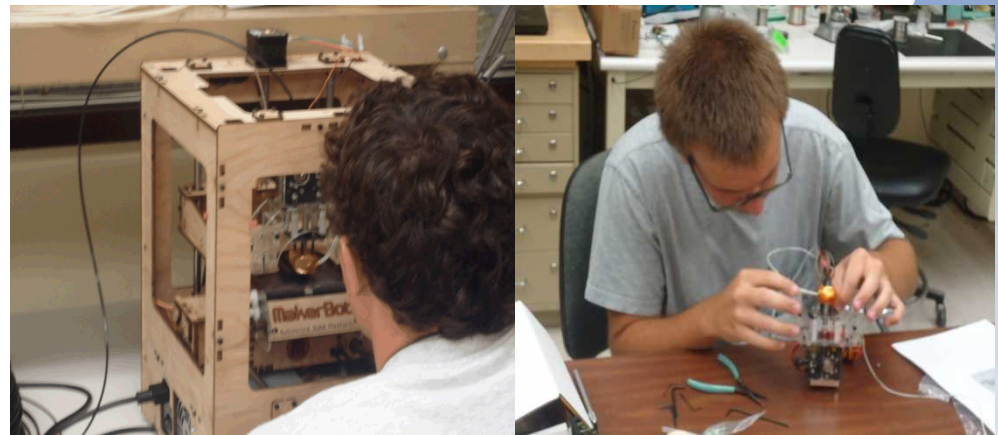
- Makerbot
- Botmill
- Prusa Mendel

Assembly ~2 days

Download files (STL)
from *Thingiverse*
a cache of *free*
drawing files

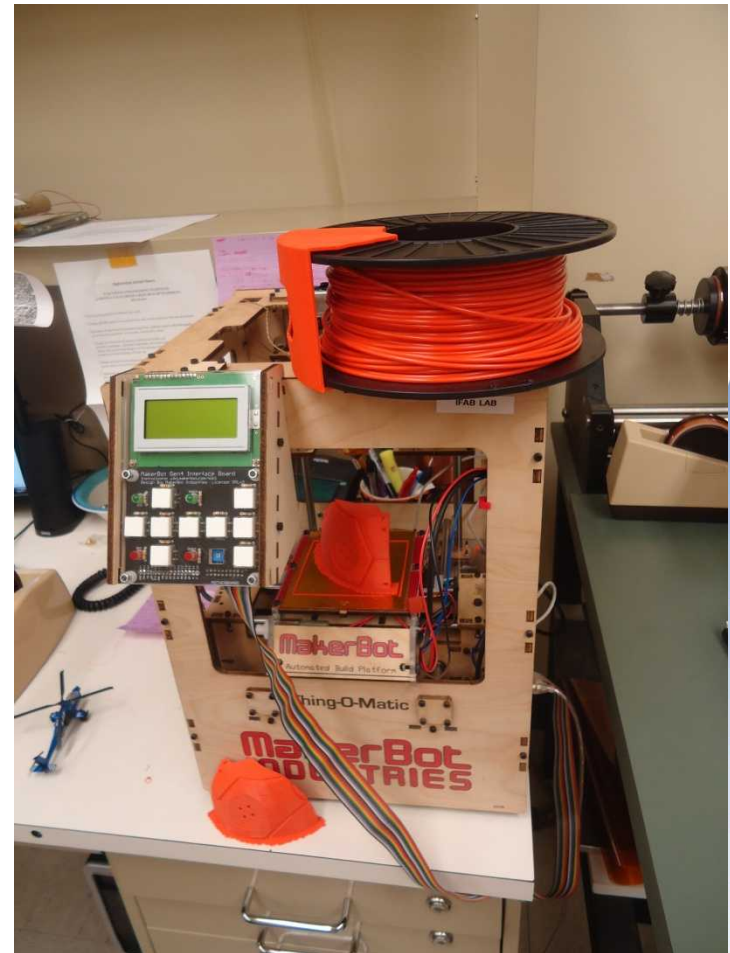


- Kinks in build material interrupting feed during build process
- Parts not sticking to the build plate
- Firewall – not allowing software downloads
- Drives crashing
- Long lead times on delivery (13+ weeks for the Botmill)



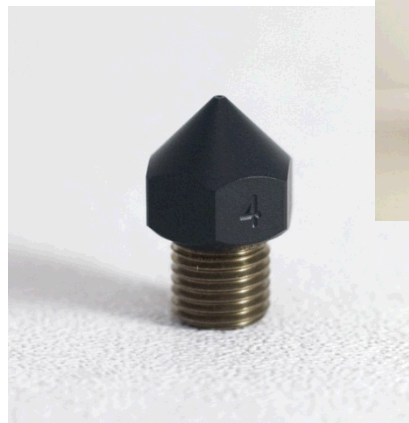
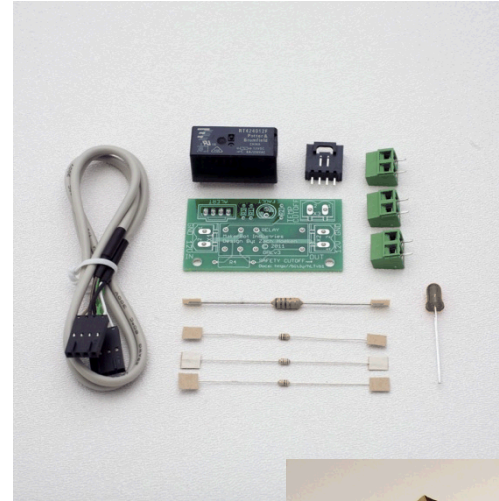
Improvements

Printed and installed a spool holder to prevent kinks from forming while the build material is fed to the extruder



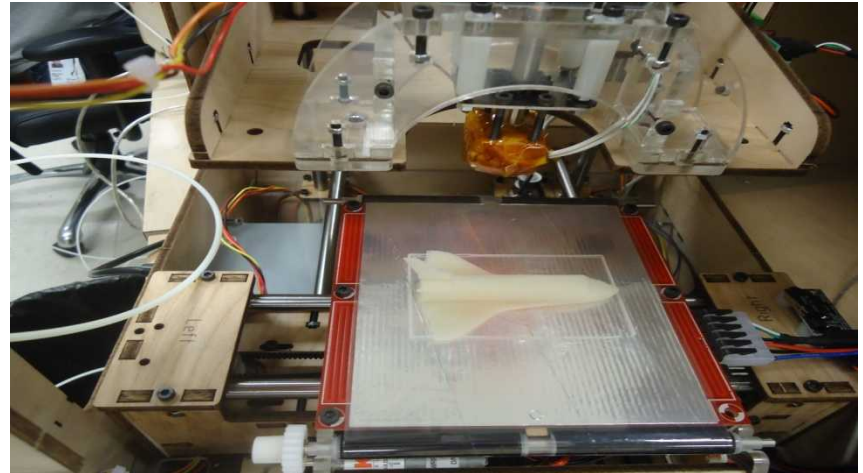
Improvements

- Safety Cutoff Switch Kit
 - Prevent overheating by turning off the heater circuit if it gets too hot
- Interface Board
 - Operate the machine (Makerbot) independently without the use of a computer through a smart card
- Teflon coated nozzles:
 - 0.3mm
 - 0.4mm
 - 0.5 mm



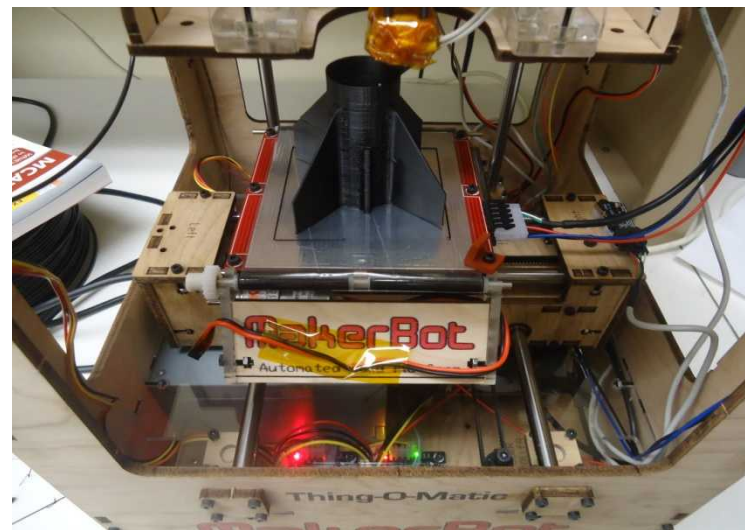
Improvements

- Automated heated build platform
- Multiple objects can be printed in succession without the need for human intervention



Build Material

- Build material is pushed out of the heated extruder to create the part
- Parts are built in a layer by layer process
- Build material comes in a wide variety of colors including “glow in the dark”
- ABS plastic is the most common build material



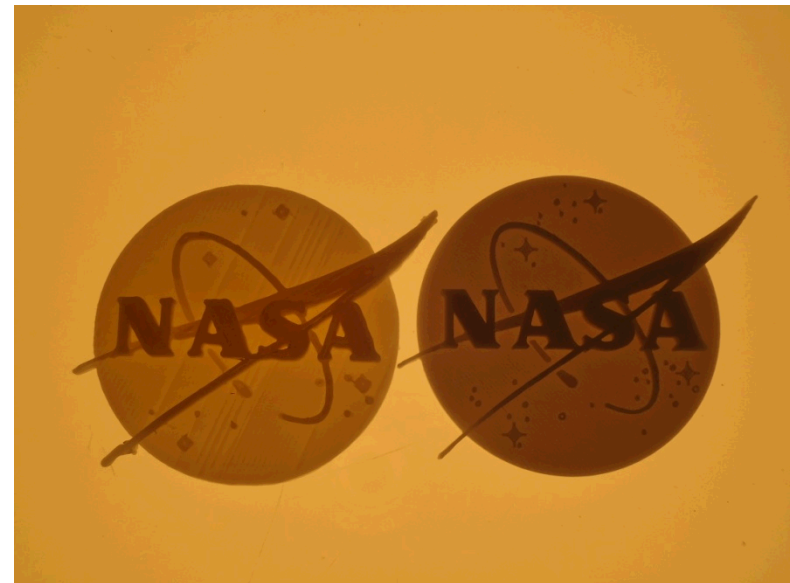
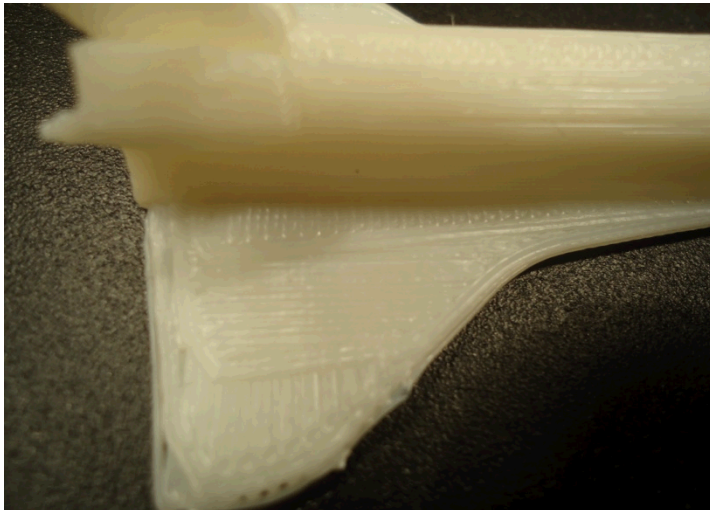
Printing Parts

- Build supports are needed for parts with overhangs
- Build support is pulled off to create the finished model



Printing

- Surface finish is poor compared to parts produced on high end systems
- Layers of build material are visible



Printing

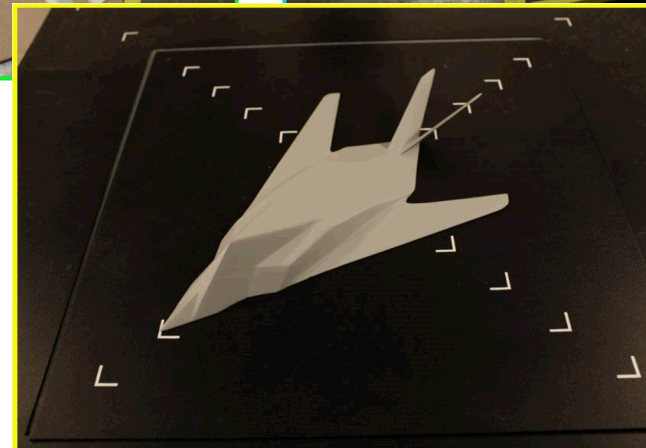
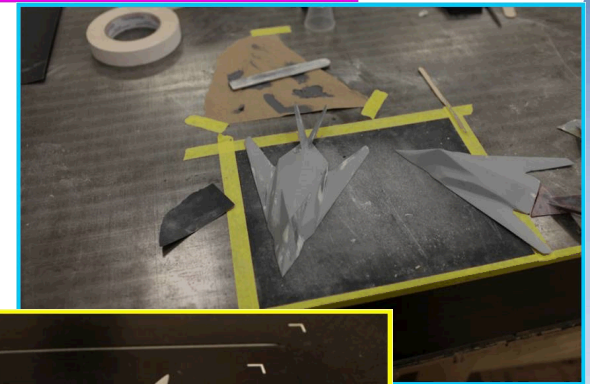
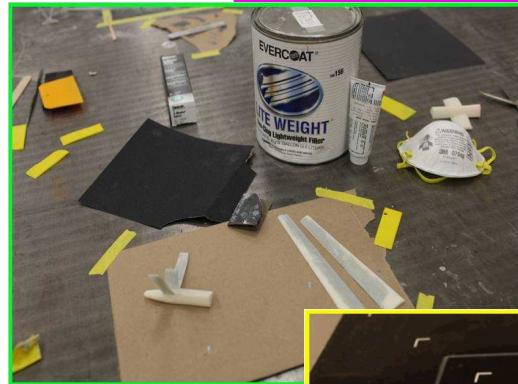
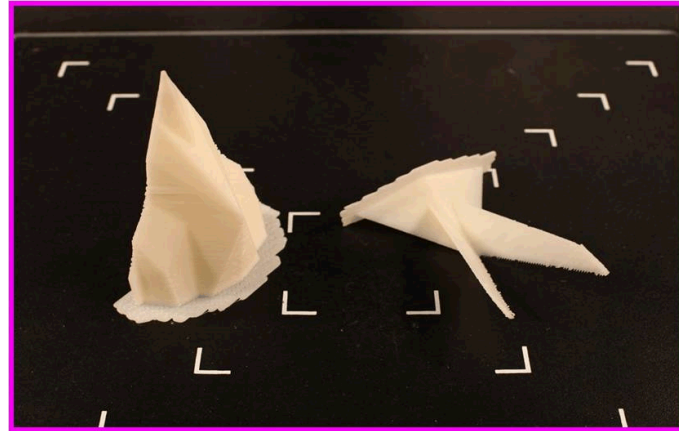
Surface quality can
be improved with
post processing

Hand work

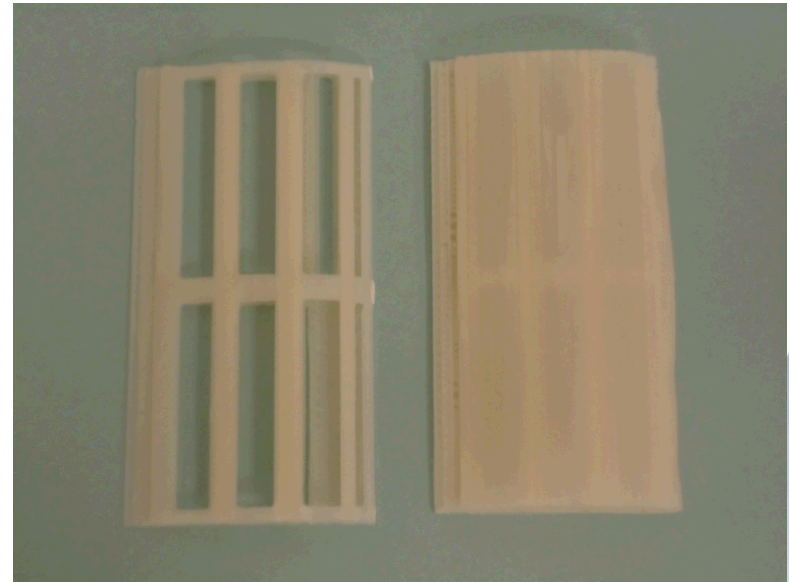
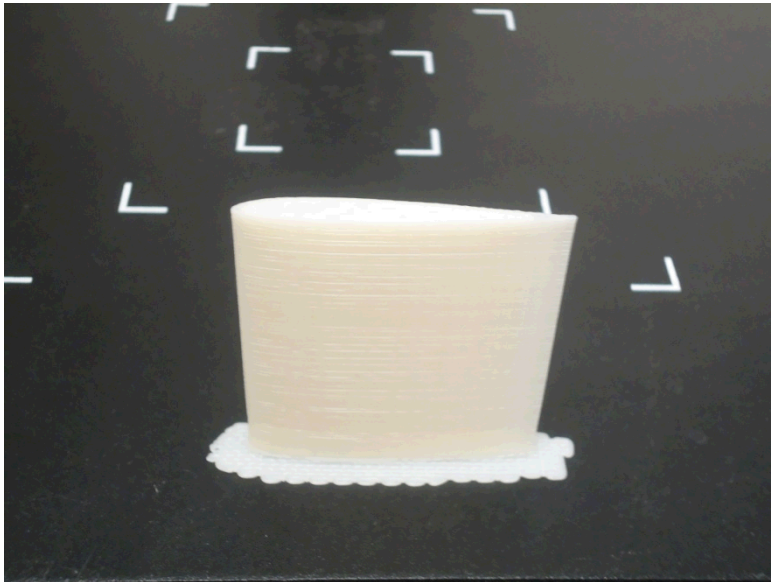
Sanding

Body putty

Consume multiple
days to produce
good results



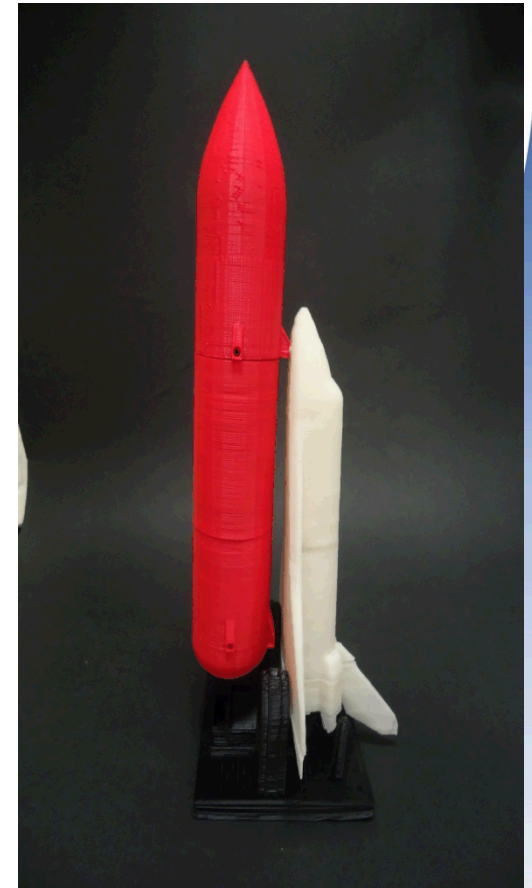
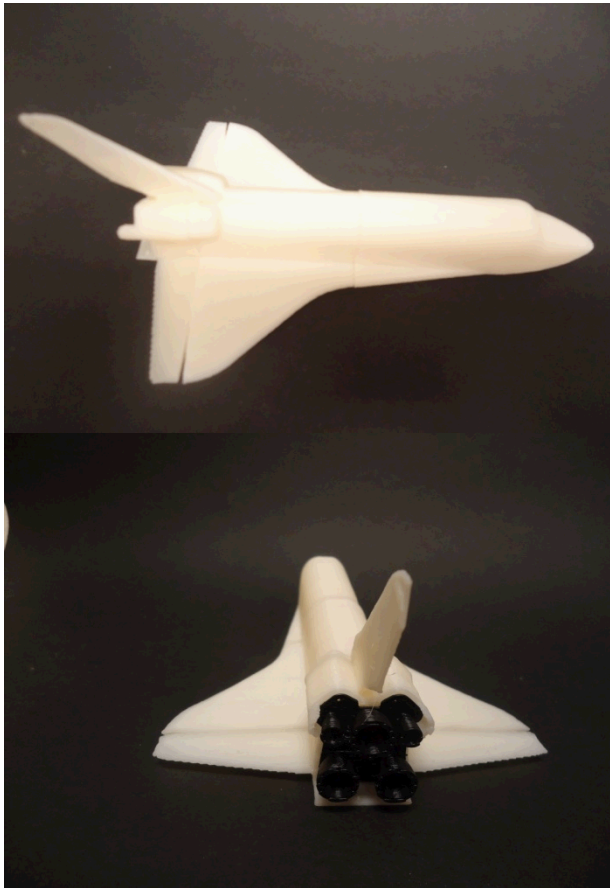
➤ Printed Airfoils



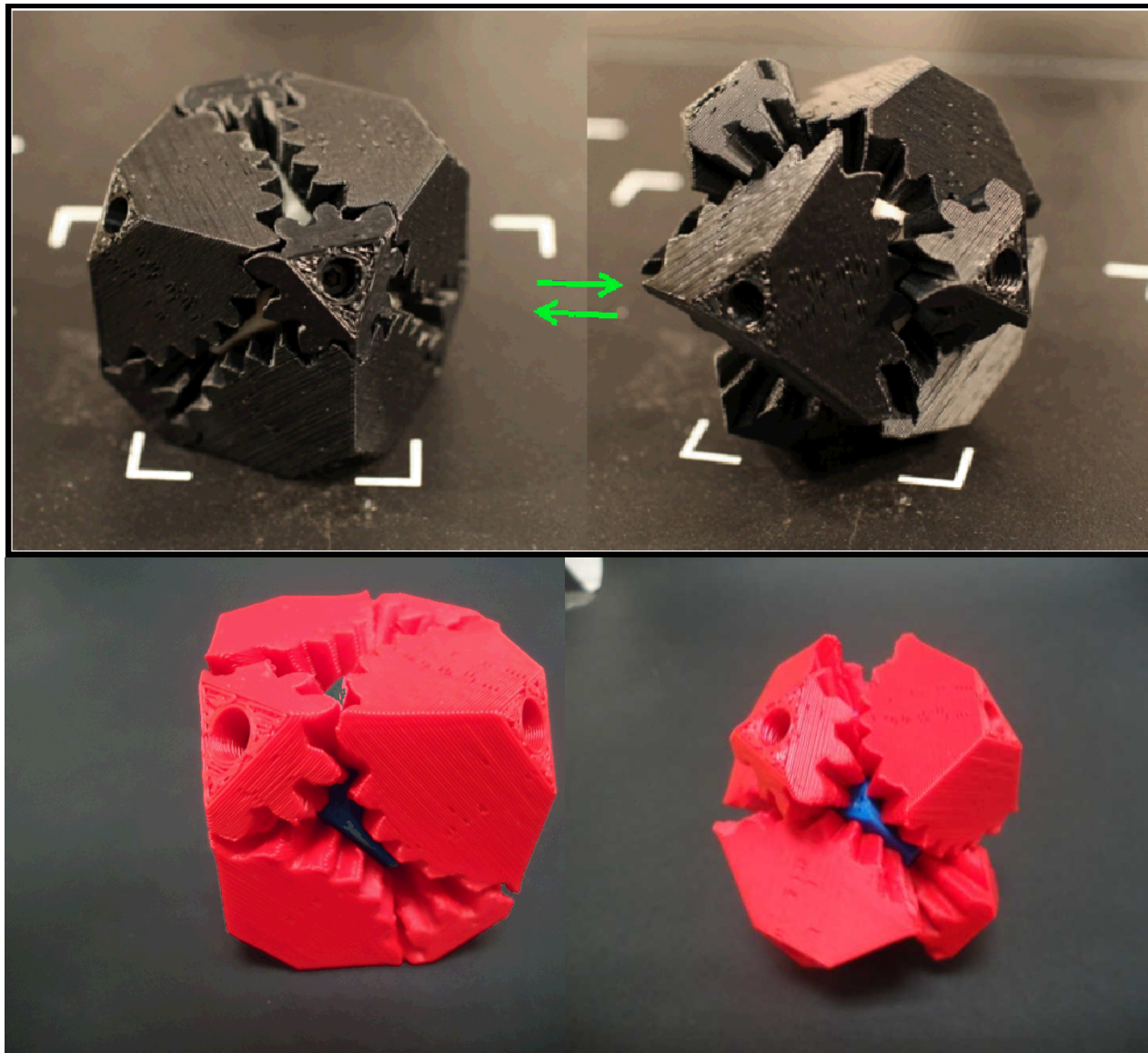
➤ Rockets



➤ Space Shuttles



Gears



Colored parts

**Summer student,
Branden Deyerle, fed
small colored pieces of
the ABS plastic build
material to produce a
unique multi-colored
part**

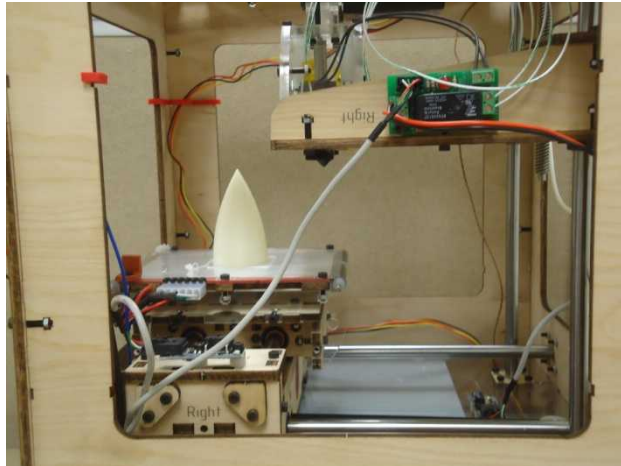


Partial mock up of Predator drone type vehicle

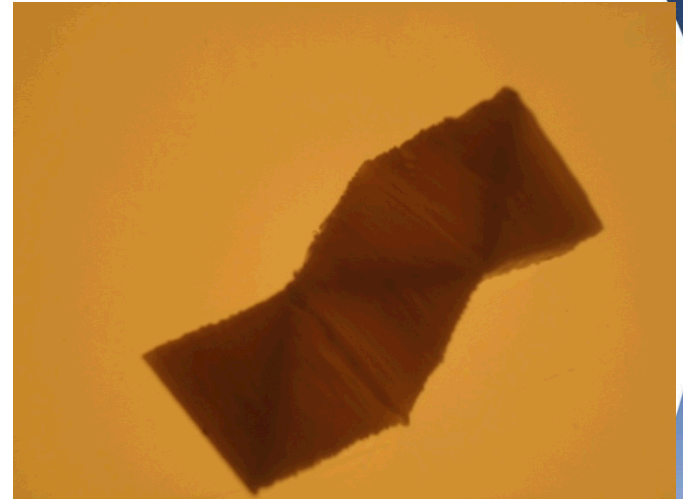




3-D Printing



Questions



Thank you

