

Design it. Print it.

Launch it. Twice.

Team Rocket

Meet our team



Frank Fomby
~ our crazy engineer
grandpa ~



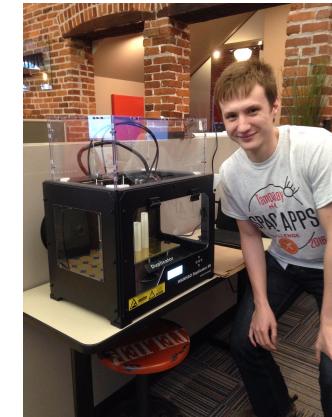
J Kent
~ our 3D printing expert ~



Amber Howard
~ our computer scientist ~



Christian Stanley
~ our resident architect ~



Riya Fukui
~ our medical student ~



↑
Resemblance?
↓

Why 3D print a rocket?

\$500,000,000

In 2012, SLS deputy project manager Jody Singer estimated that SLS will cost \$500M per launch.

Print My Rocket

Stronger

Faster

Lighter

Cheaper



NASA has too much “space”

- NASA ships more air than product (fuselage, fairing)
- Eliminate transport, transport logistics and its cost and risks

Efficient custom
fairing to
accommodate
secondary
payloads

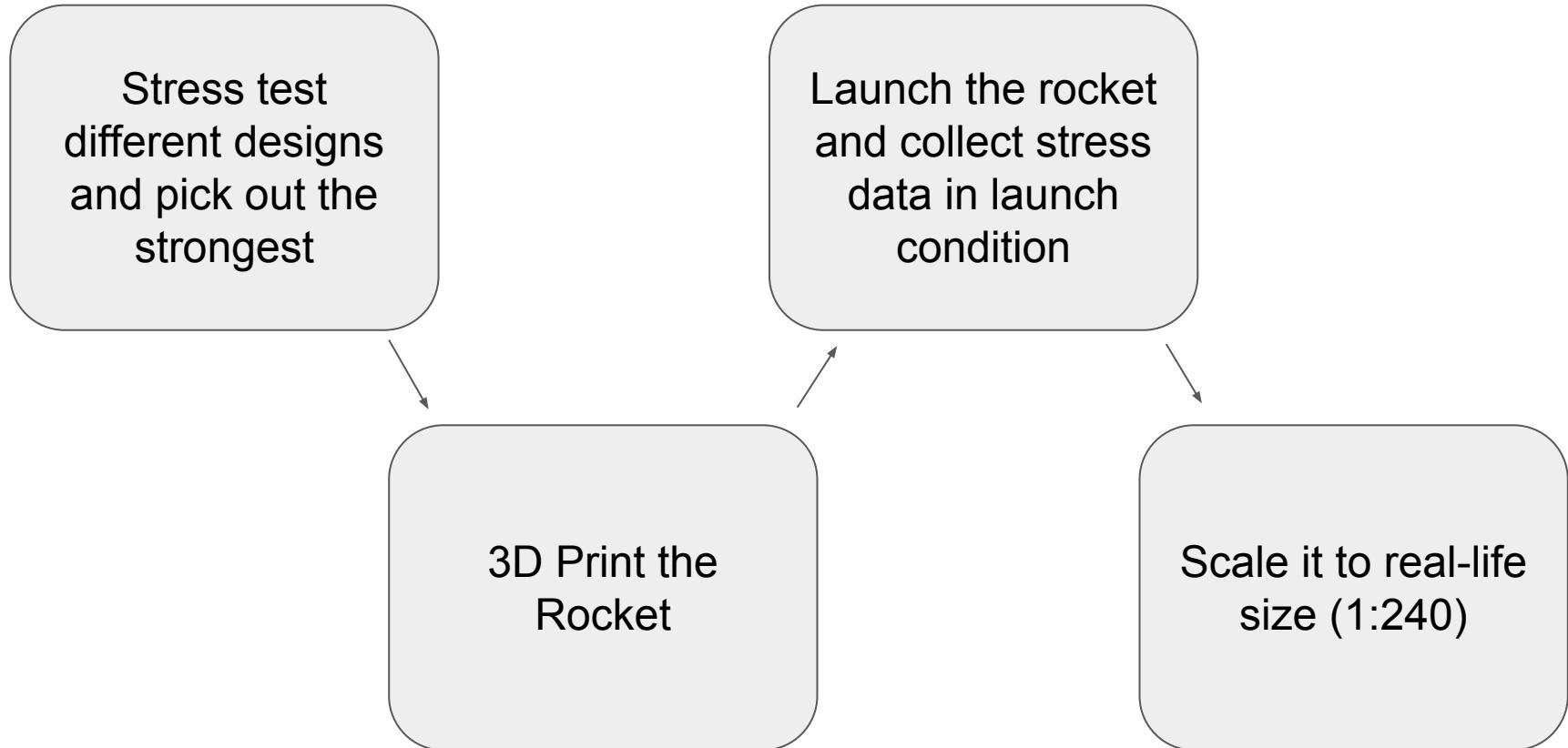


Reduced
manufacture/assembly
time by less need for
nuts and bolts

Estes Rocket of comparable size cost \$18. We can print it for half a dollar. A rocket for everyone.

- STEM / STEAM
- Boy and Girl Scouts
- Youth groups

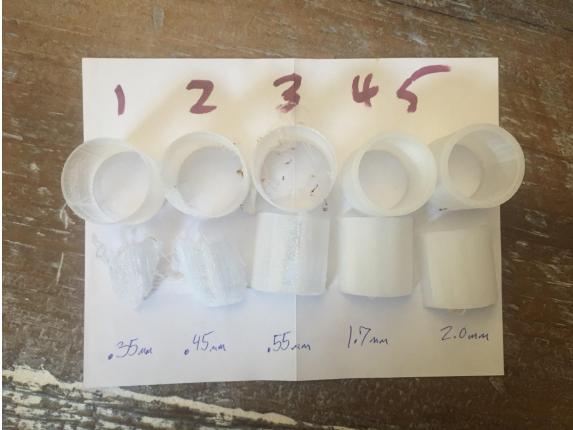
Our process



25mm by 25mm cylinders with wall thickness of .
35mm, .45mm, .55mm, 1.70mm and 2.00mm.

We stress tested by stacking 8.4 fl oz Red Bull cans.

The thinnest (.50mm) withstood >4 cans.
We even sat on it. Strong enough!



Stress test

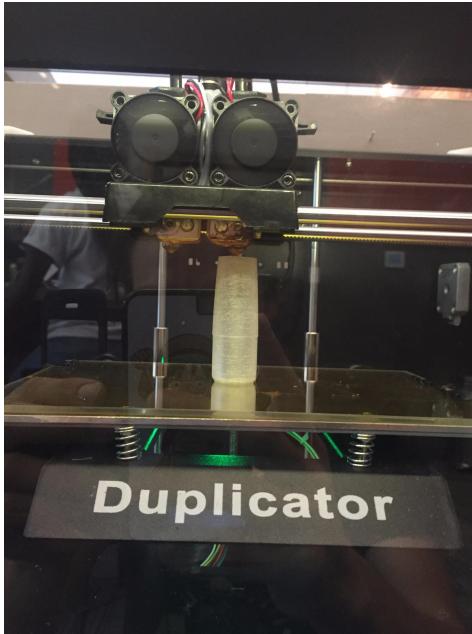
3D Modeling Software: Rhinosaurus
3D Printer: WANHAO Duplicator 4S
Material: ABS

Pieces:

- Fuselage: 2x 97mm+25mm lip and 1x 97mm
- Fairing/nose cone
- Engine bay and fins
- Engine screw cap
- Launch guidance



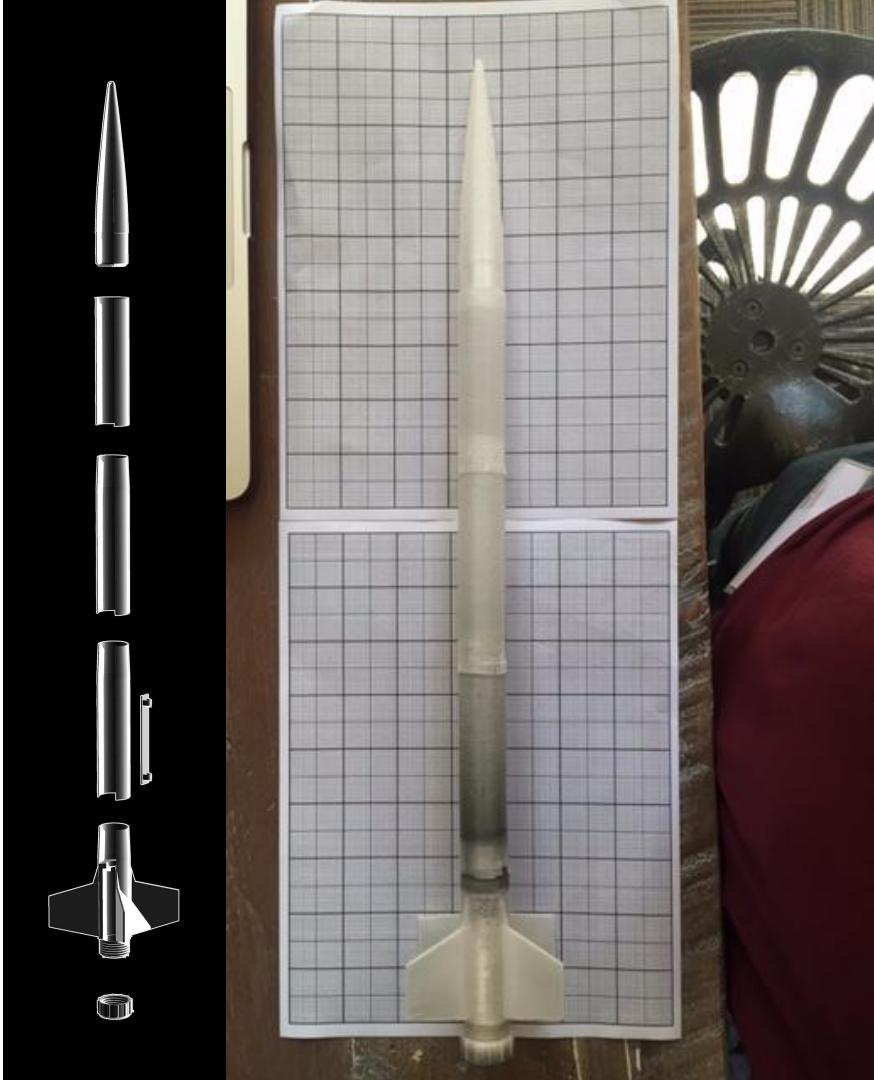
3D print the rocket

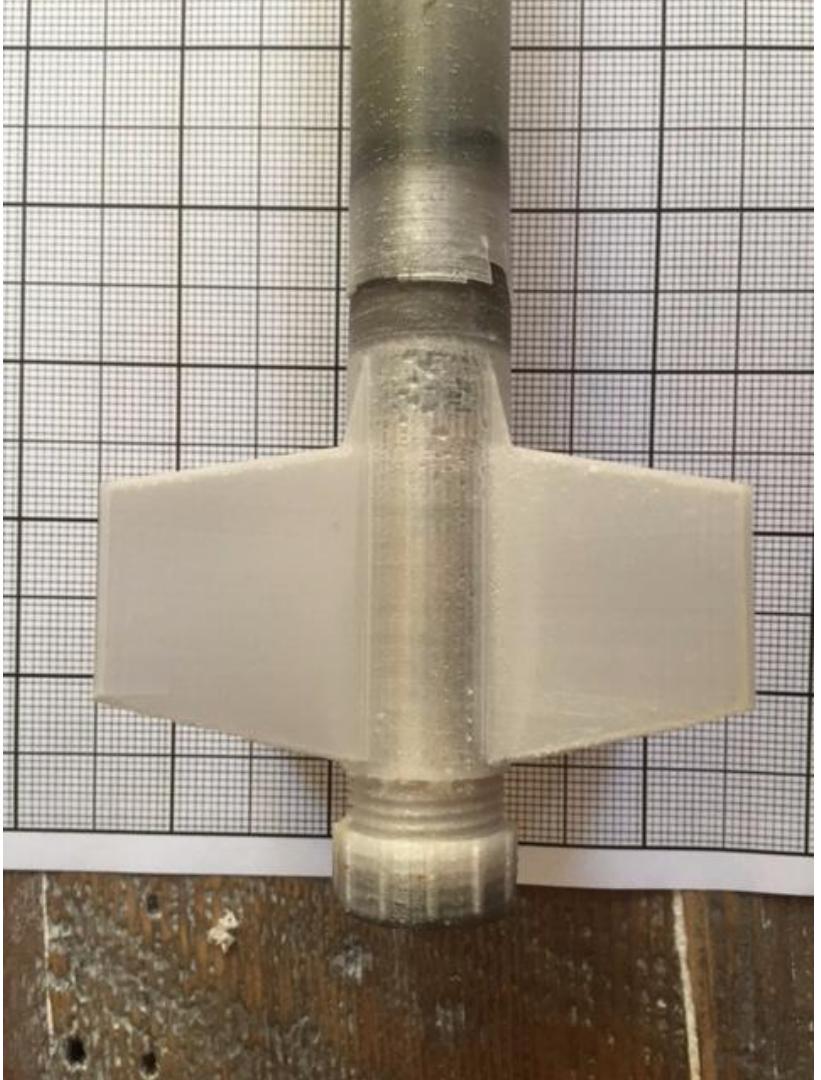


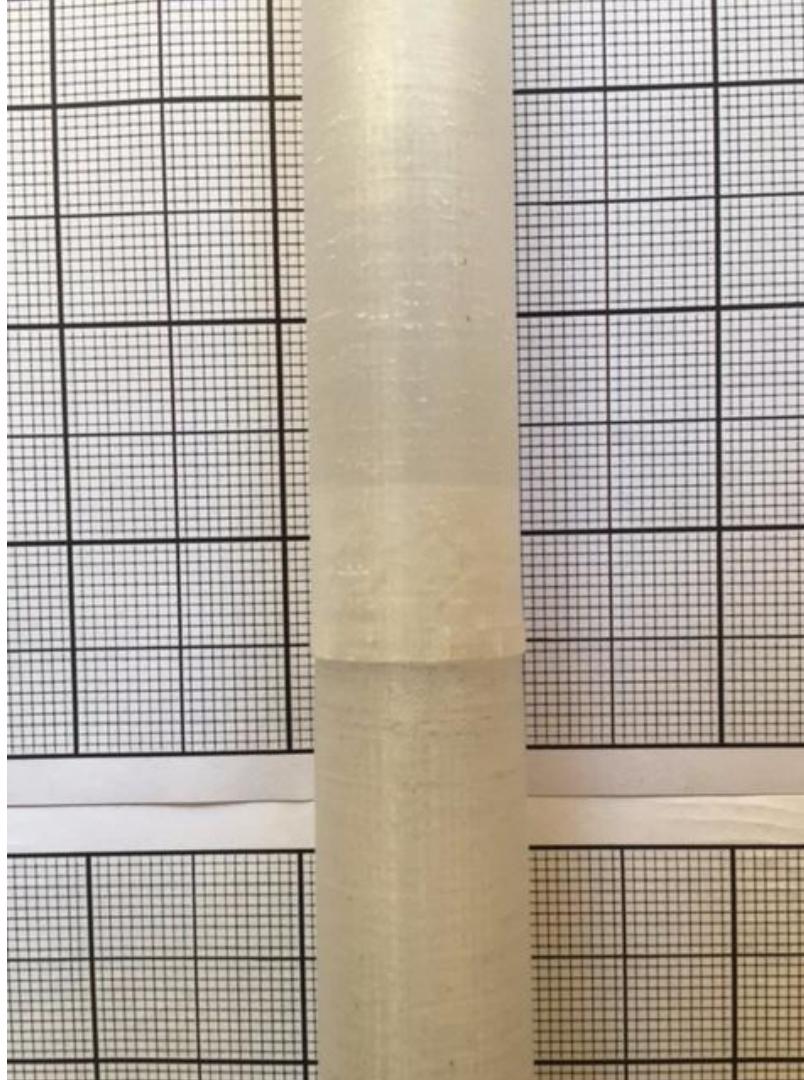
3D printed rocket:

- Height: 493mm
- Printed Weight: 44.9g
- Engine: 25.8g of Initial weight, 12.48g of propellant
- Wet weight = 70.7g
- Dry weight = 58.2g
- Fuselage wall thickness: 0.50mm
- Theoretical delta V = 1530 m/s
- Print time 5h
- Cost: 50 cents

Launch the rocket and stress analysis







Design Analysis

- Center and axis of thrust was consistent and stable throughout the burn
 - First launch: A8-3 engine (max thrust-10N, burn time-0.73s, total impulse-2.5 N-s)
 - Second launch: C6-5 engine (max thrust-15.3N, burn time-1.6s, total impulse-10.0 N-s)
 - Estimated >300m altitude, recovered within 50m radius after wind drift
- Structural integrity
 - Brittle but wedged type fitting allows tighter fit
 - Successful separation to multiple pieces
 - No parachute needed - light enough. Even on hard road impact
 - Eliminates parachute related complications
- No unnecessary connection: reduce weight, complexity, cost
 - Most damaged part can be easily replaced

Changes we would make

- Not use acetone
- Add support structures inside the fuselage
 - We had zero internal support. A worst case scenario
- Add guide through to keep the modular pieces together

3D printed rocket scaled to 240:1 assuming Aluminum 2219 use

- Height: 118m
- Printed Weight: 1,690,000kg
- Engine: 357,000kg of Initial weight, 173,000kg of propellant
- Wet weight = 2,050,000kg
- Dry weight = 1,880,000kg
- Fuselage wall thickness: 0.12m
- Theoretical delta V = 1530 m/s

Compare with

SLS heavy lift

- Height: 117m
- Dry weight: 2,950,000kg

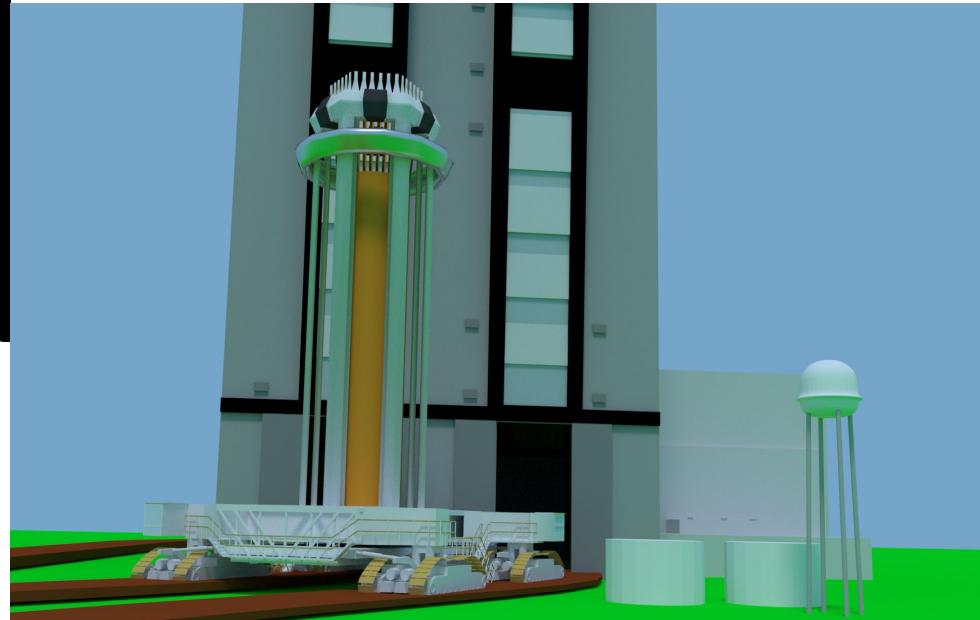
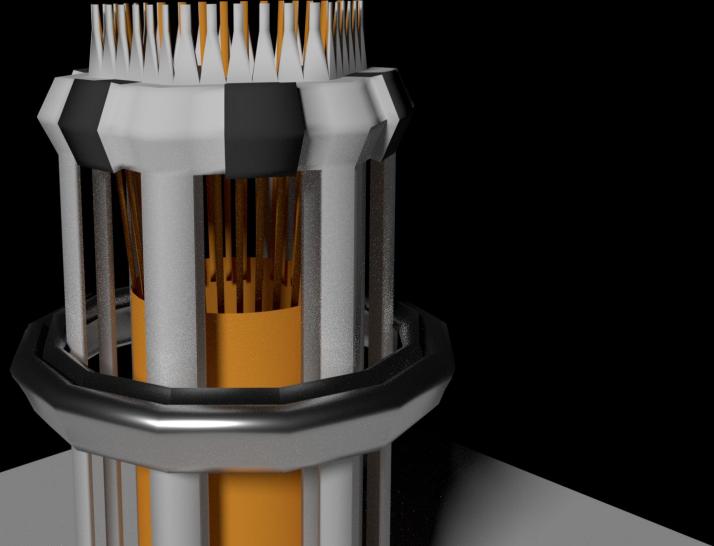
Scale up

We have more ideas!



Alternative 3D printing method: Sock Loom





Alternative 3D printing method: Sock Loom

Sock Loom 3D printing technology

- Using a loom-like technology, modern materials like fiberglass, carbon fiber or even graphene, a rocket can be woven, on site, to any scale necessary and any thickness necessary.
- Use a set of scaffolding and existing technology used in weaving tube socks

Looking into the future...

- We will become to 3D print more and more material
- Fast, customizable, cheap
- Print the whole rocket **and** the fuel
 - Gummy worm glue gun!
- 3D printing with drones

<https://github.com/team-rocket-tampa/3DPrintedRocket>

