



5...4...3...2...1...

SPACE LAUNCH SYSTEM

Light But Strong: Materials in
NASA's Space Launch System

Kat Balch
Tracie Prater



About me



Living and working
on the new frontier of space

Young Astronauts Club, 1994



About me

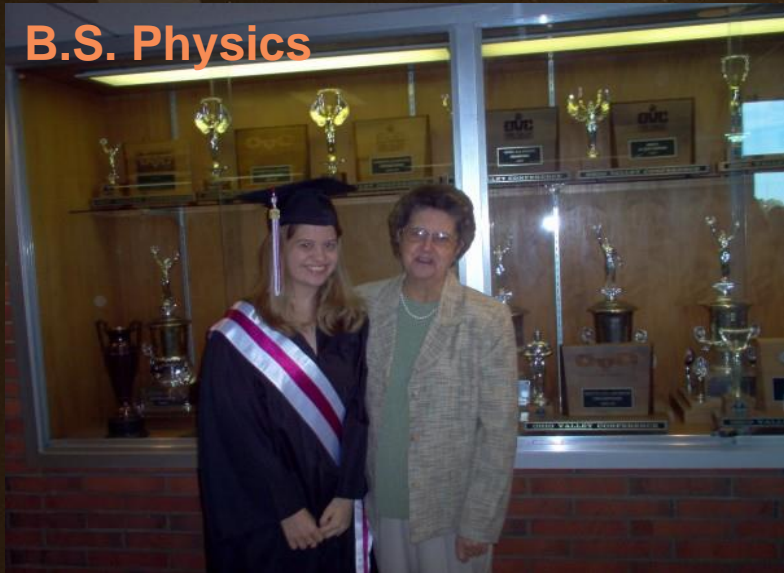
Engineering summer camp!
2001



M.S., Mechanical Engineering
Ph.D., Mechanical Engineering



B.S. Physics



My NASA experiences (2007-present)

RS-25 (space shuttle main engine) at NASA Marshall



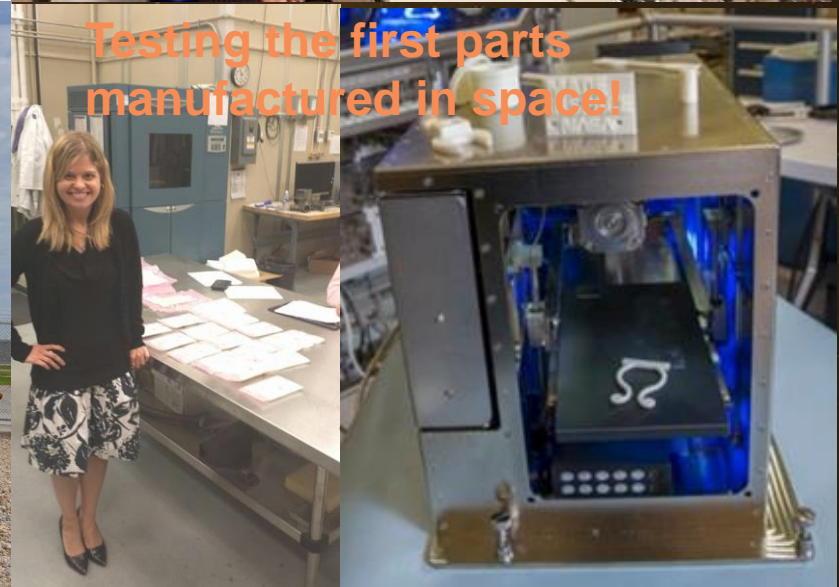
Apollo-era mission control room at Johnson Space Center



Final space shuttle launch



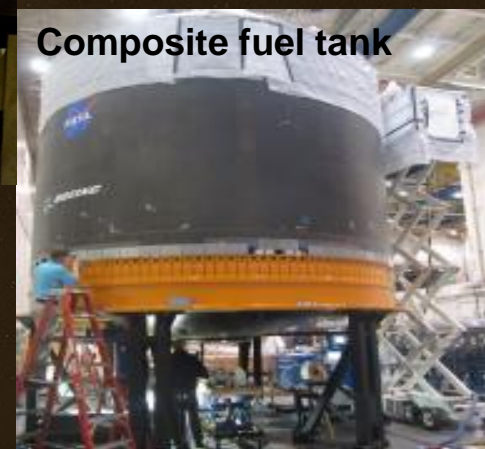
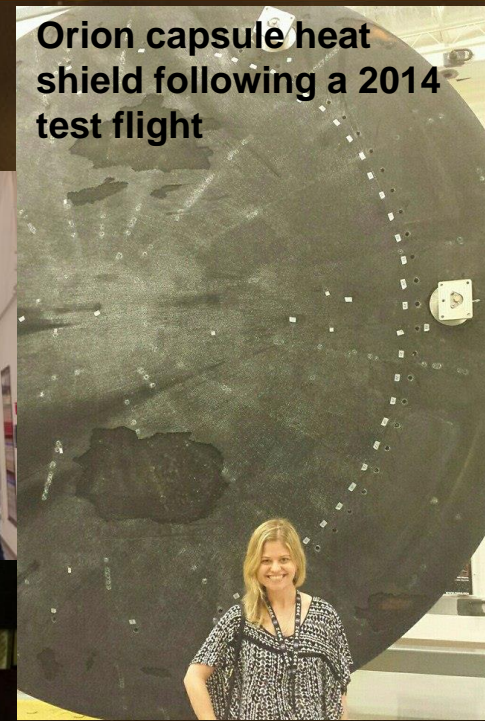
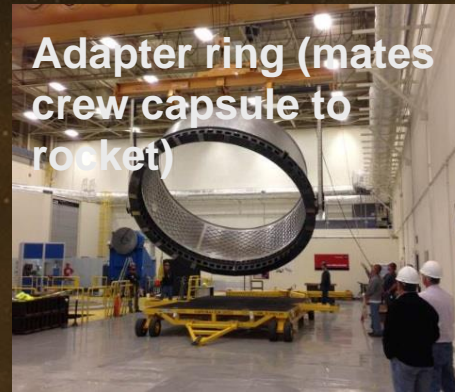
Testing the first parts manufactured in space!



What do Materials Engineers Do?

Materials engineers answer the questions:

- What should it be made of?
- What material is strong enough to withstand a particular environment?
- What material choice is the lightest weight?
- How do we manufacture it?
- How do we weld it?
- How do we develop new manufacturing processes?
- How do we develop new, better-performing materials?

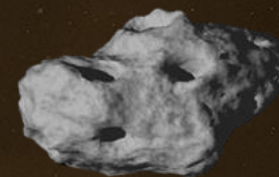


SLS . . .

- Will be the most powerful rocket ever built
- Will launch the Orion spacecraft
- Will carry astronauts, cargo, and science instruments
- Will be the backbone of America's human space exploration
- Will allow us to visit new places where no one has ever gone before



Mars



Near-Earth Asteroid



POWER



Thrust =



Saturn V:

7,610,000
pounds
or

123*
jet engines



Space Shuttle:

7,800,000
pounds
or

126*
jet engines



SLS Crew
70 Metric Tons:

8,400,000
pounds
or

135*
jet engines



SLS Cargo
130 Metric Tons:

9,200,000
pounds
or

148*
jet engines

* Boeing 747

World's Most Powerful Rocket

Interim Cryogenic Propulsion Stage:

The upper stage for the first SLS launch will push Orion beyond the moon.

Orion:

Carries explorers safely into space & back.

Stage Adapter:

Provides space for sending several small spacecraft to the moon and beyond.

Core Stage:

Larger than any other rocket stage, the SLS core stage holds fuel for launch.

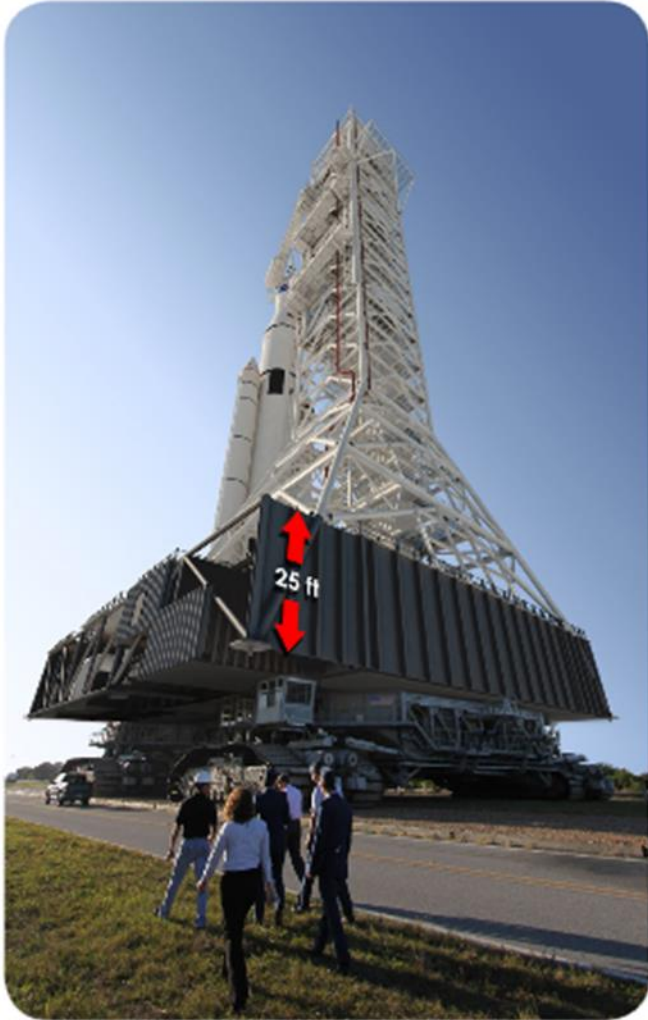
Solid Rocket Boosters:

The largest boosters to ever fly will provide most of the power for the first two minutes of flight.

RS-25 Engines:

The most reliable engines of their kind; upgraded with new technology.

What type of materials were used to make these structures?



Challenge

You have been challenged by a NASA materials engineer to use a lightweight material to design and build a mobile launch platform. This platform must be light enough to move, but strong enough to hold the weight of the rocket.

Restrictions:

- The platform must be 15 cm tall.
- It can't weigh more than 15 grams.
- It must hold at least 50 grams.



Material per Group



Rocket must hold at least 50 g





ENGINEERING DESIGN PROCESS



CAREERS AT NASA



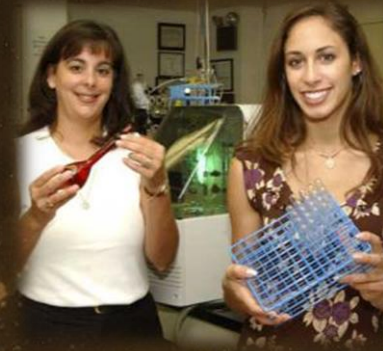
Space Chef



Space Farmer



Astronaut



Microbiologist



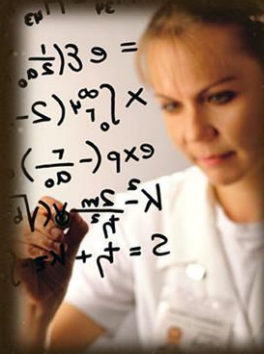
Spacesuit Designer



Geologist



Robotics Designer



Mathematician



Graphic Artist/
Designer



Writer

