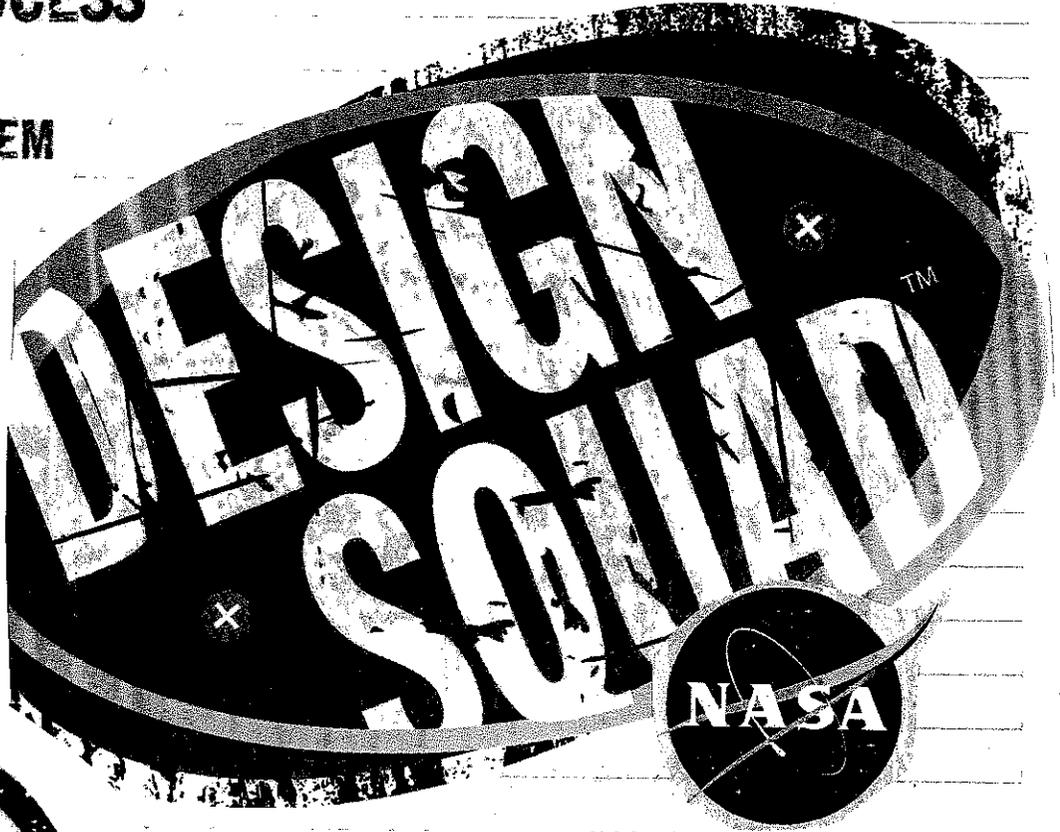
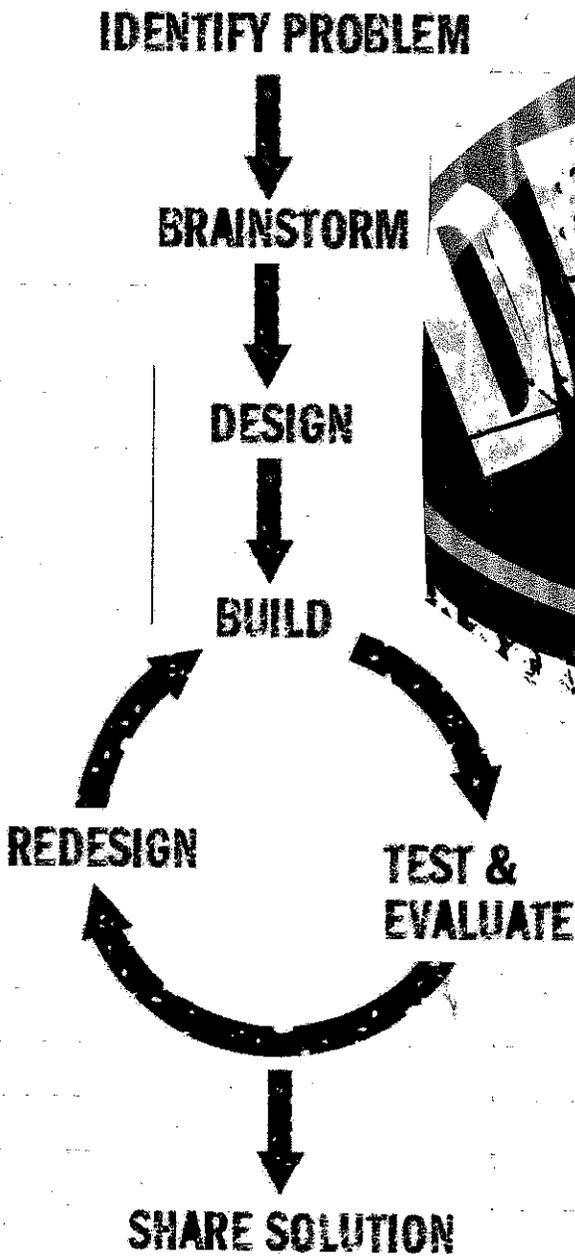


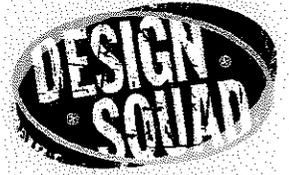
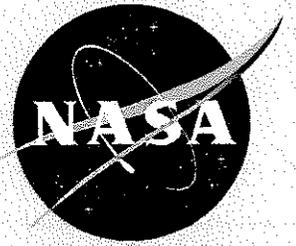
Engineering Notebook

THE DESIGN PROCESS



Team Members:
Carver Magnet School
4th grade
Charlotte Cook

TOUCHDOWN



as built on TV.

Landing on the moon is tricky. First, since a spacecraft can go as fast as 18,000 miles per hour (29,000 km/hour) on its way to the moon, it needs to slow way down. Then it needs to land gently. That lander has astronauts inside, not crash-test dummies. Easy does it!



WE CHALLENGE YOU TO...

...design and build a shock-absorbing system that will protect two "astronauts" when they land.

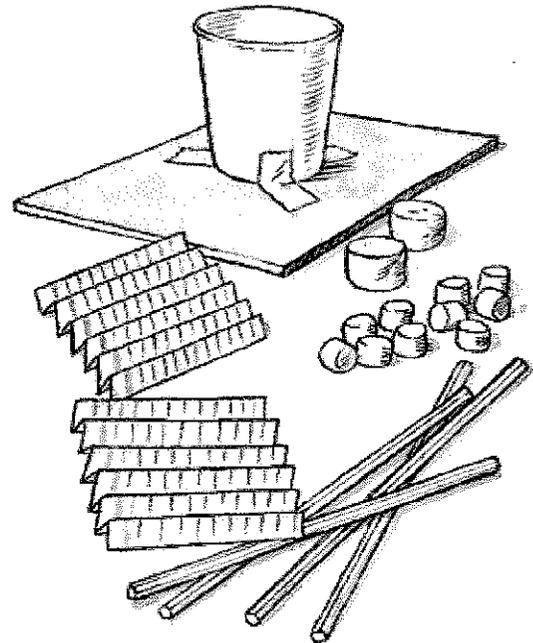
BRAINSTORM AND DESIGN

Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn't tip over as it falls through the air?

BUILD

- 1. First, design a shock-absorbing system.**
Think springs and cushions.
- 2. Then, put your spacecraft together.**
Attach the shock absorbers to the cardboard platform.
- 3. Finally, add a cabin for the astronauts.**
Tape the cup to the platform. Put two astronauts (the large marshmallows) in it.
(NOTE: The cup has to stay open—no lids!)



A lander under construction

MATERIALS (per lander)

- 1 piece of stiff paper or cardboard (approximately 4 x 5 in/10 x 13 cm)
- 1 small paper or plastic cup
- 3 index cards (3 x 5 in/8 x 13 cm)
- 2 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 8 plastic straws
- scissors
- tape

TEST, EVALUATE, AND REDESIGN

Ready to test? Drop your lander from a height of one foot (30 cm). If the “astronauts” bounce out, figure out ways to improve your design. Study any problems and redesign. For example, if your spacecraft:

- **tips over as it falls through the air**—Make sure it’s level when you release it. Also check that the cup is centered on the cardboard. Finally, check that the weight is evenly distributed.
- **bounces the astronauts out of the cup**—Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don’t bounce the astronauts out.



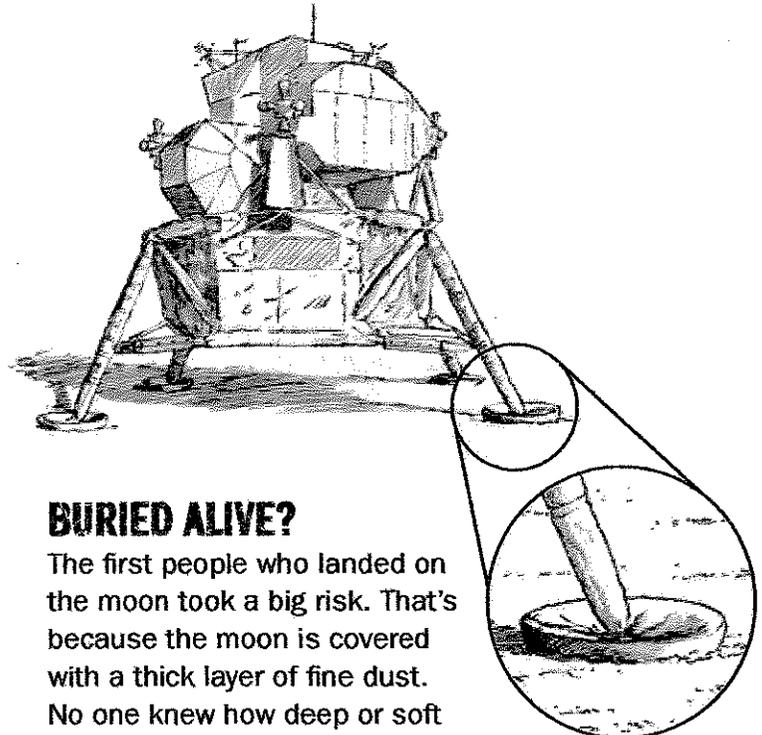
Check out NASA’s moon missions at moon.msfc.nasa.gov.



THE COOLEST JOB AT NASA

When people asked Cathy Peddie what she wanted to do when she grew up, she would point at

the sky and say, “I want to work up there!” Now an engineer at NASA, she manages the Lunar Reconnaissance Orbiter (LRO) project. She calls it “the coolest job at NASA.” LRO will orbit the moon for at least a year and collect information to help NASA prepare for having people live and work there. Hear her describe the mission at: learners.gsfc.nasa.gov/mediaviewer/LRO.



BURIED ALIVE?

The first people who landed on the moon took a big risk. That’s because the moon is covered with a thick layer of fine dust. No one knew how deep or soft this layer was. Would a spacecraft sink out of sight when it landed? Now we know—the layer is firm. In the picture, you can see that Apollo 11’s lander pads sank only about 2 inches (5 cm) into the dust. What a relief! This helped NASA figure out the kinds of shock absorbers and landing systems its spacecraft need.

Only 12 people have ever visited the moon. But someday soon NASA plans to have teams of astronauts living there for six months at a time.



Watch **DESIGN SQUAD** on PBS or online at pbs.org/designsquad.



Major funding for Design Squad provided by



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Education

Additional funding for Design Squad provided by



National Council of Examiners for Engineering and Surveying



NOYCE FOUNDATION

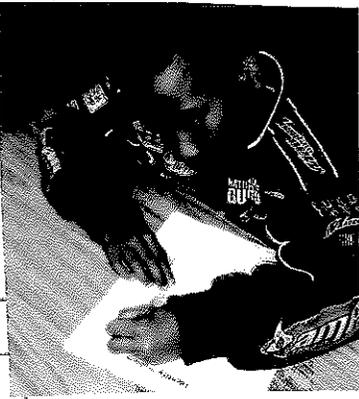
NORTHROP GRUMMAN

IEEE

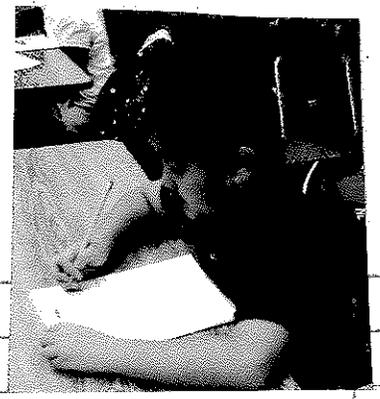
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For more information about NASA missions and educational programs, visit nasa.gov.



Identify Problem



NASA wants to make a space craft that will land safely on the moon to not harm the Astronauts

The problem is the space craft need to land on the moon with out doing up the space ships.

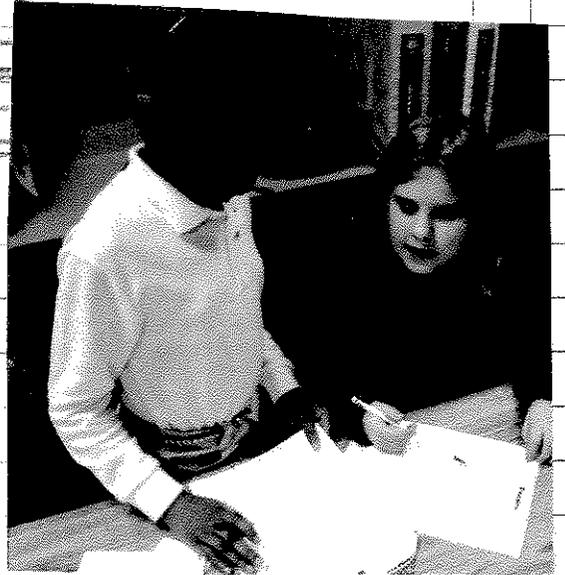
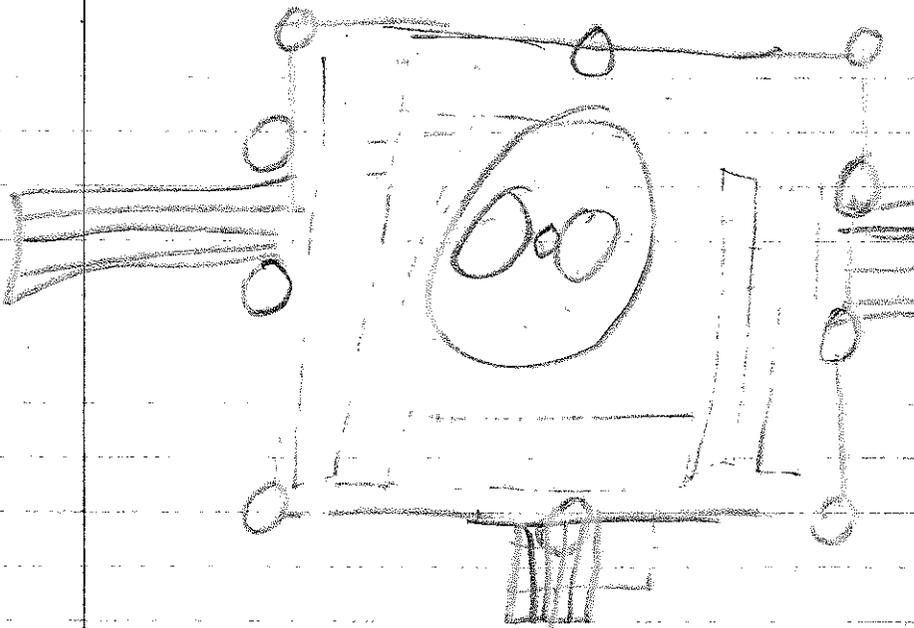
The Identify Problem is that you have to build something.

The problem is the spaceship dosn't have a safe place to land.

I think we need to make a space craft that will be able to land on the moon without killing or breaking any of the astronaut or the rocket and stronger materials also we need to have a material that reduces the power of impact on the rocket when landing.

Brainstorm

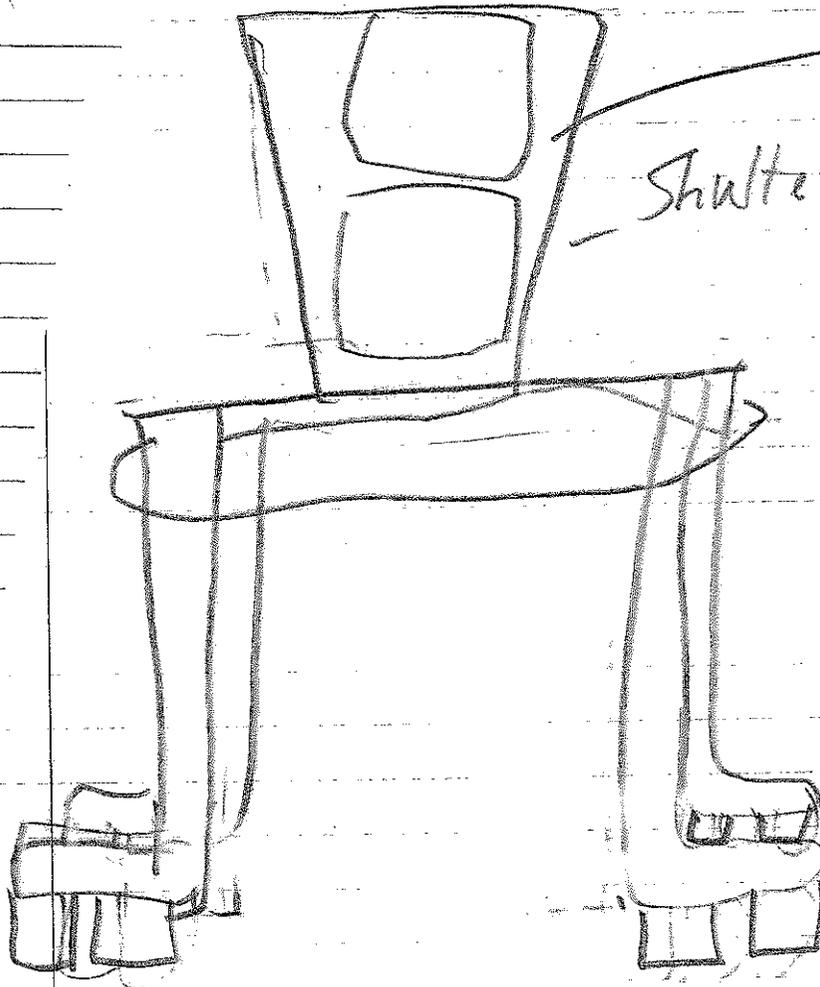
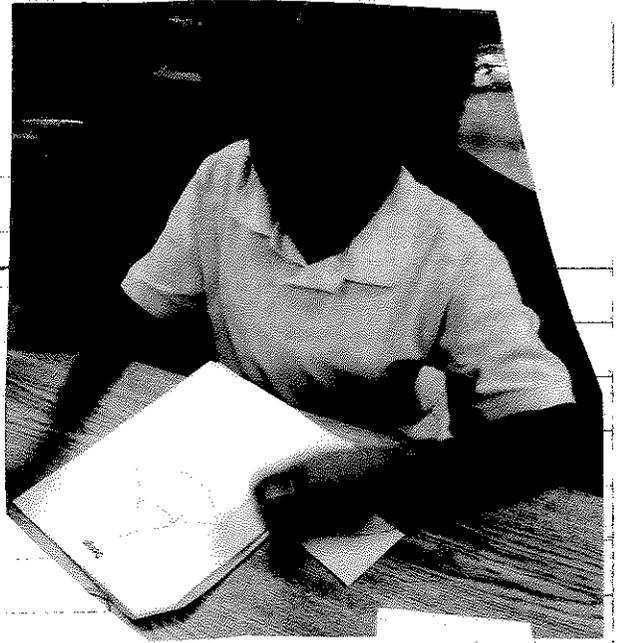
put them all in the middle
then stick all the straws in
all the corners & sides so they
won't fall out. put the little
marshmallows on the bottom.



1. We could have the straws with marshmallows
on the straws so they land softly &
to make them the airplane. The marshmallows
but we could put the marshmallows
where they are so they don't die or get
hurt

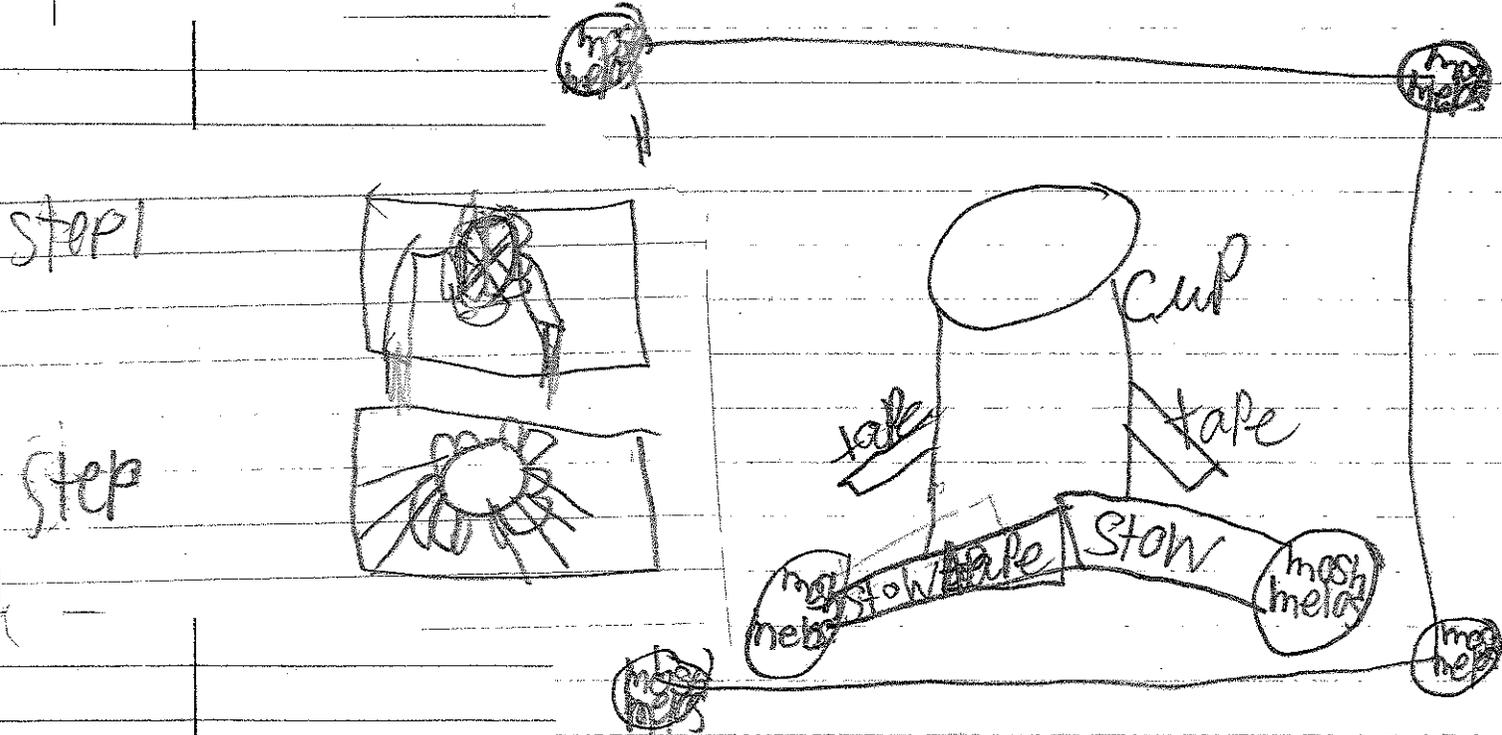
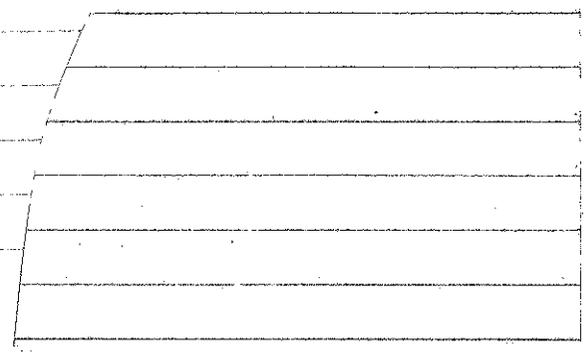
2. We could have the space at the top or
bottom of the airplane so the
astronauts would be in the top of the airplane
so they will have a place to be
and they could get out of the airplane

Design



Shulte

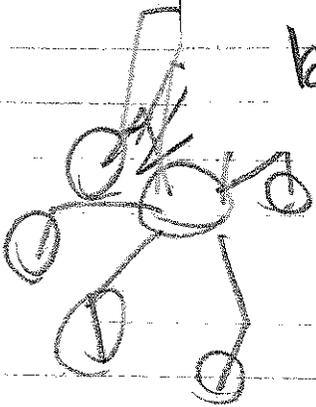
Landing platform



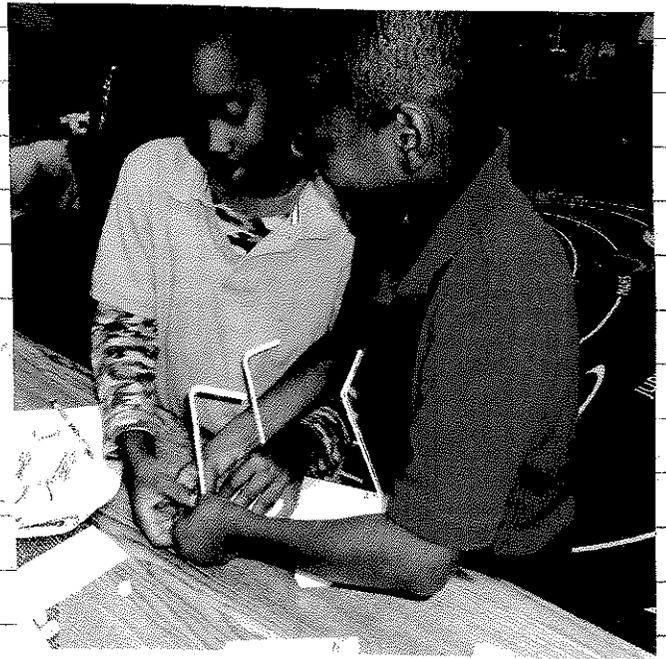
Build

The Building was fun and easy. After putting the price together it got even fun-er.

• We changed a few things when we start building we made a roof and marshmallows at the bottoms to let it land properly.



We could not get the wings. We had trouble with straws.



We change arcs because it was kinda hard to Build it the other way.

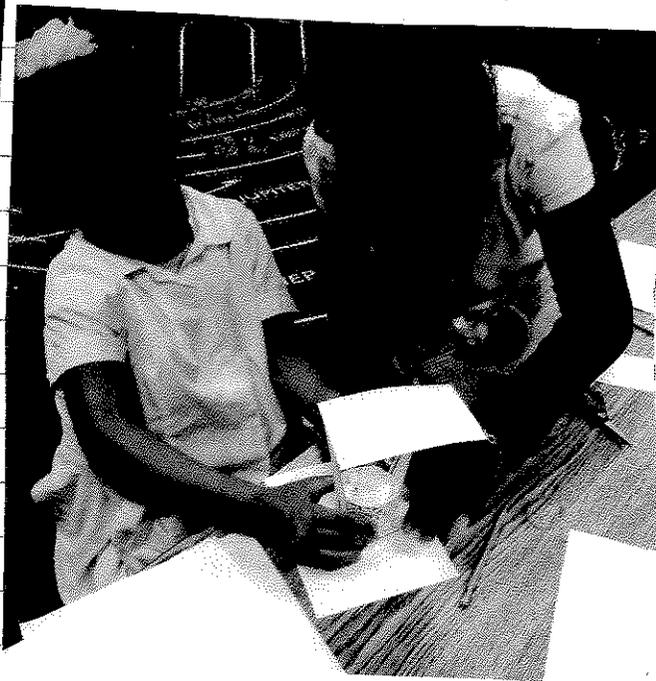
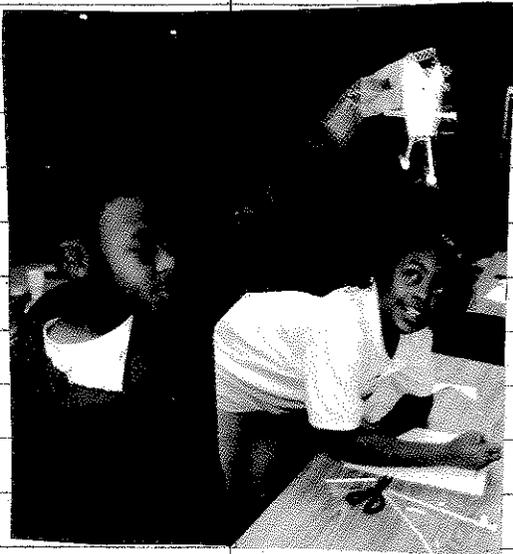
Test and Evaluate

1st test

On the first test
was great.

2nd test

On the second
test it was not
great one



it fell just right the
astronauts didn't fall out.

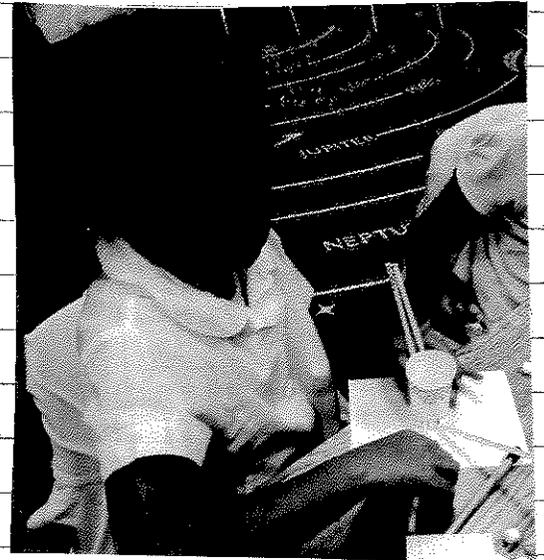
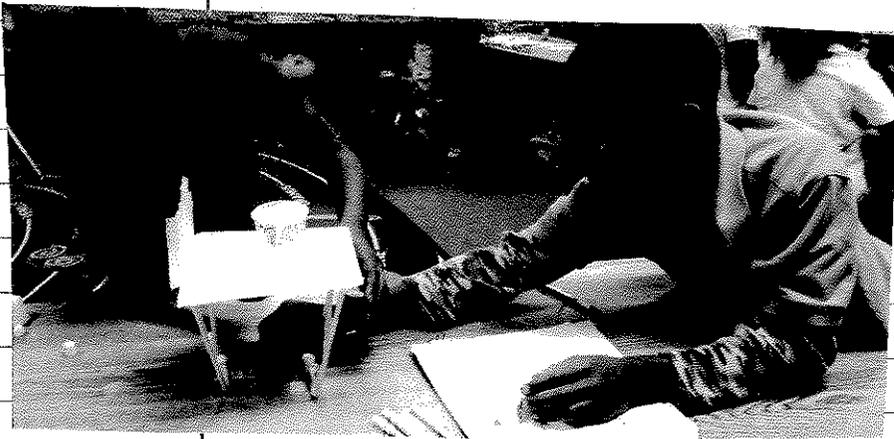
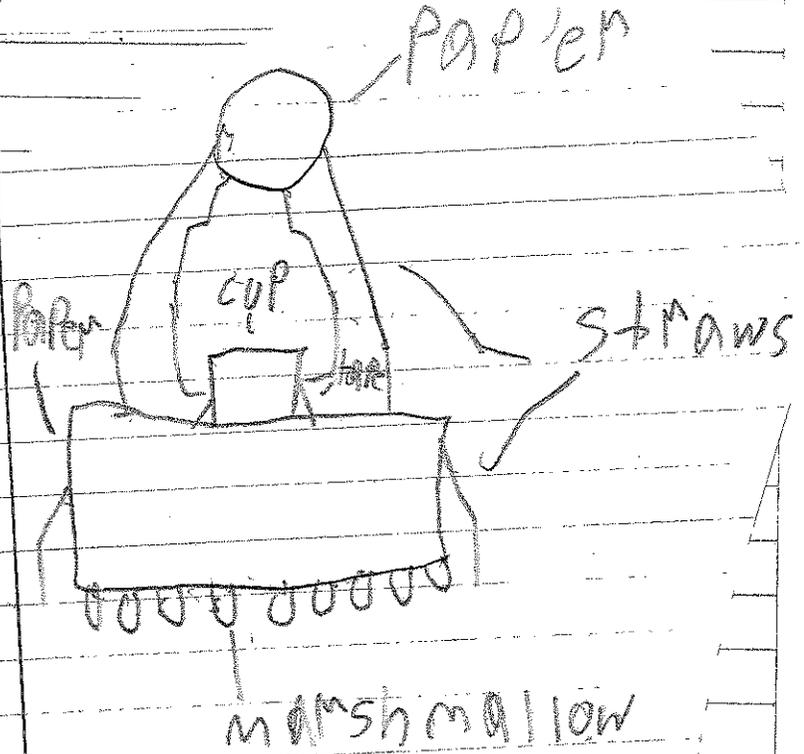
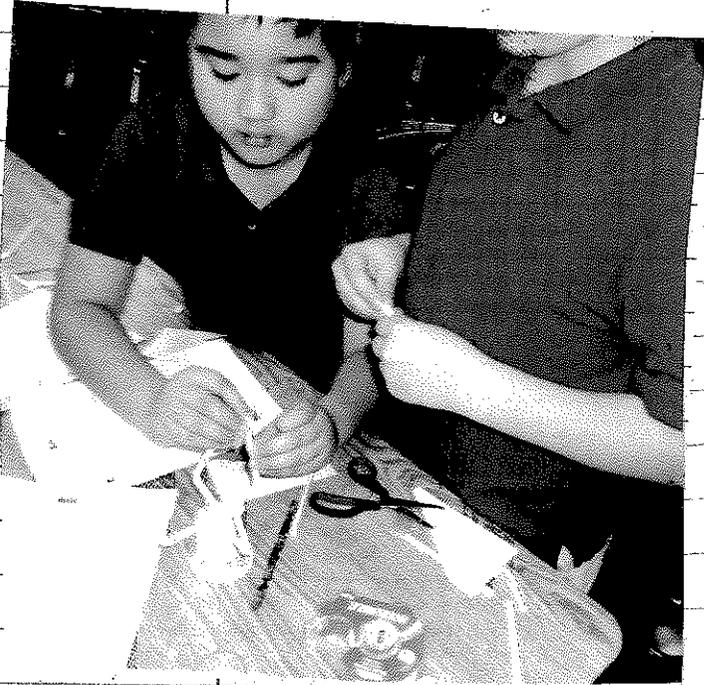
the spacecraft fell on the
table

Test A good

Test B fail one fell out.

Redesign

We had to change design

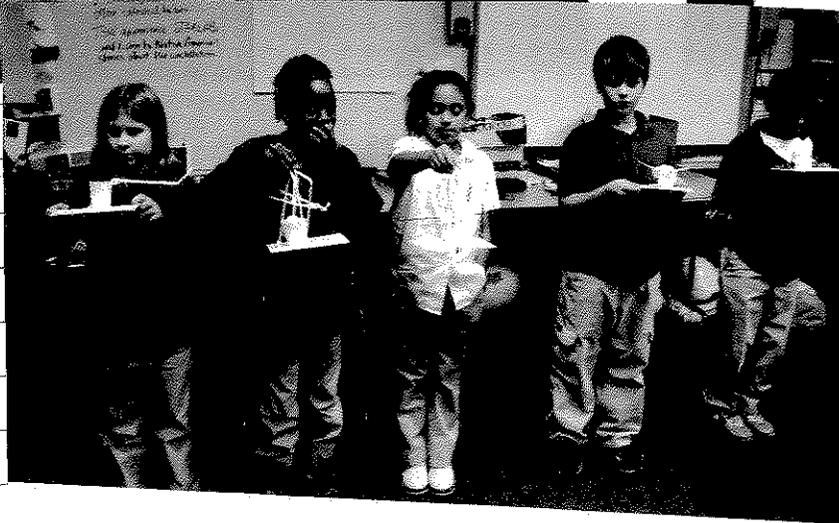
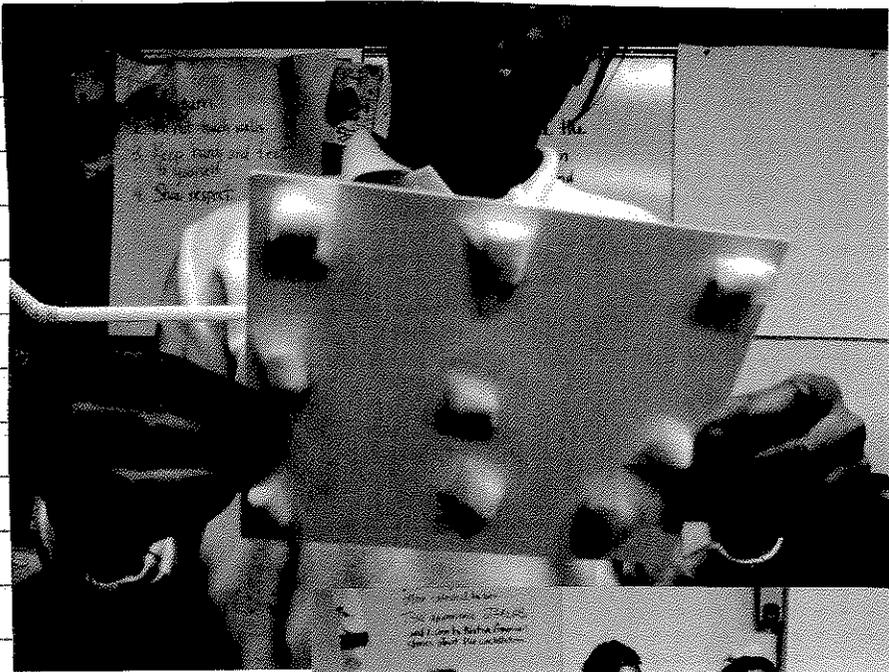


it worked to land Be where Changerg
I little thing not a Bou the landing
Just the Cover

Share Solution

I think that the solution was the marshmallows at the bottom of the aircraft.

We won the competition because ours didn't come out of the cup.



On the first round we was winning.

On the second a marshmallow fell