Questions for the Spacecraft Engineers

1. What did you find most surprising or interesting?

2. What problems did you encounter as you built and/or tested your probe? What changes did you make, and why?

3. Based on your trials, and observations of your classmates' designs and tests, what changes, if any, would you make to your design?

4. What questions do you have now?

5. What questions would you like to ask of the Huygens Design Team?

6. What would you like to try next? Why?

Parachuting Probe Packet

The _____ Probe

Design Team/Spacecraft Engineers

_____

_____

Date_____

Engineering and Design Team Challenge:

Design a parachuting probe that will land upright on both solid and liquid surfaces, remain intact (not break apart), weigh as little as possible (while still meeting the other criteria), and meet the requirements for time of descent (how long it takes the parachute to land after being dropped).

Background information for Design Team:

Spacecraft engineers face many challenges. They design machines that survive the forces of being launched into outer space and operate there with little assistance from Earth.

Once in space, the spacecraft must protect its delicate instruments throughout the journey. We are counting on Cassini to protect Huygens on its seven-year journey from Earth to Saturn.

Any heat absorbed or produced by the spacecraft must be managed to prevent the instruments from overheating or getting too cold. The probe must be strongly anchored to the spacecraft, yet able to separate in a controlled fashion at the right time. Both spacecraft and probe must be protected from dangerous radiation and from high-speed dust particles.

The probe must remain able to operate after many months or even years of inactivity. It must also be able to respond to commands and to radio its data back to Earth as accurately as possible.

Testing the _____Probe

Trial Number	Condition Upon Landing	Time of Descent	Notes, Observations, Questions
1			
2			
3			

Idea 3 — Final Plan (draw and write):

Weight of Probe:

Your Task:

You will design and build a parachuting probe. Given an assortment of materials commonly found at home or in the classroom, you will construct a parachuting structure that will:

1. Land upright on a solid or liquid surface. (To simulate the requirement for the Huygens instruments — camera and other instruments — to be able to take pictures and measurements)

2. Land undamaged. (To simulate the requirement for the instruments to be able to work — they must not break on impact.)

3. Take as long as possible to land, but land within in a designated area. (Huygens' parachute size will control its descent time. Huygens will be collecting data as it descends.)

4. Weigh as little as possible. (A fourth property to consider is weight. The more a spacecraft weighs, the more it costs to launch it and maneuver it in space. So, you want your probe to be as light as possible.)

Imagine the possibilities! Wonder! Create!

Helpful Science Hints

Scientists use the word "impulse" to describe an impact.

Impulse is the force of impact multiplied by the amount of time the force is exerted. There are two types of impulse: hard and fast, and soft and slow. Hard and fast is usually not the way you would like to experience a change in speed. That's when you run into a brick wall at full speed, going from fast to stopped in a fraction of a second. The great amount of force you experience over the short amount of time can result in broken bones, or worse. So, soft and slow is the way to go.

If the wall you run into is padded like a mattress, you will enjoy the result more than if you run into bricks. To give your probe the best chance for survival, you need to think about how to give it the soft and slow type of impulse. Anything you can do to increase the amount of time the probe spends slowing down before hitting the ground will increase its chances of landing intact.

Your parachute will be central in this endeavor. You may want to do some initial experimenting with parachutes. Think about these questions:

• What happens if you change the size of the parachute?

• What happens if you change the length of the strings that attach the parachute to its load?

• What happens if the parachute is attached in different places?

Idea 1 (draw and write):

Idea 2 (draw and write):