Sweet Dreams Are Made Of These

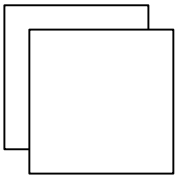
Hands-on Activity for Understanding Radiation Shielding

Time
30-40 minutes

Materials and Preparation
- 6- 4'x8' sheets of insulating styrofoam (These can be found at your local home center for $3-$5 a piece and are often applied under vinyl siding.)
- 4 rolls of heavy masking tape (1-1/2"-2")
- Paper
- Pens or pencils
- Silicon glue
- Box-cutter type knife to cut the Styrofoam

Teacher Preparation

1. Using a sharp knife, cut the styrofoam into 1' x 1' squares. You should end up with 192 squares.
2. Take 2 squares and place one on top of the other, leaving a lapjoint of 1-1/4"-1-1/2" on 2 sides.



3. Carefully glue the 2 squares together to form a "brick". Be as neat as possible!
4. Continue to make these "bricks" until all styrofoam is used. You should have 96 "bricks" when you are finished.
5. Divide the class into four teams.

Key Question
How might NASA engineers use the fewest resources to maximize human protection against radiation?

Background
On Earth, the layers of our atmosphere help protect us from the sun's most lethal forms of radiation. Outside the atmosphere, dangerous forms of ionizing radiation constantly bombard the space station, especially during the violent solar storms called solar proton events. The space station's hull can deflect or absorb some low-energy forms of radiation. High-energy radiation, however, pierces the space station's protective layers.

Effective radiation shielding depends on the material used and its thickness. Different types of radiation require different shielding materials. Finding a shielding material that protects the astronauts from the specific ionizing radiation found in space was a challenge. Another challenge of working with radiation shielding was to determine exactly the right amount. Excess shielding took up too much space and was too difficult to transport to the space station. Too little shielding did not provide adequate protection.

Researchers found that any material rich in hydrogen, such as polyethylene, makes very good radiation shielding material. Polyethylene bricks measuring 1"x14"x14" can be transported easily into space in a rack on the shuttle. They are then transferred to the space station. Once at the space station, the bricks are strapped together.

Part One – Designing a Sleep Station

PROCEDURE FOR PART ONE

1 Each team needs to sketch a sleep station.
Criteria:
   1. Two sides need to be open for ventilation and access of personnel.
   2. One person from your team will need to fit inside. Try to pick someone who would represent the typical astronaut—5'4"to 5'7" and 120-140 lbs
   3. There should be no holes or cracks in your design.

2 Build the sleep station according to your sketch. Use masking tape to connect the panels together. NO DUCT TAPE!

3 Each team will demonstrate their sleep station to the rest of the class. Remember, there must be a member of your team inside of your sleep station when you demonstrate it.

CLOSURE QUESTIONS FOR PART ONE

1. Do you think that your team's design would be useful to the astronauts on the space station? Why?
2. How could your team improve your model?
3. Why is it important that a shielding material such as polyethylene is used? Why not another hydrogen-rich compound such as cement?
4. There should have been no holes or cracks in your model. Why is this an important design factor?