SUMMER INSTITUTE FOR ENGINEERING AND TECHNOLOGY EDUCATION

ENGINEERING DESIGN - STUDENT MODULE 1

SPACE STATION PLATFORM

INTRODUCTION

Engineers design and direct the construction of structures, products, and devices. They need to apply principles of science in their design, yet consider the cost of manufacturing or constructing their design.

Engineers will start with a set of requirements and specifications of their structure/product, and create a detailed design of the end result. Often they need to build a *prototype*, or practice structure/product, to examine and test their design. This exercise is an example of the design and prototype steps in engineering.

THE PROBLEM

You are part of an engineering design team that has been assigned to build a platform for a space station on the moon. It is your task to make the framework as strong and as light as possible. It must be wide enough to support the weight chosen at least **19 cm** above its resting surface. It must be as inexpensive as possible. Use the following steps to help make a successful design.

Do Design on Paper

You will be given about 15 minutes to come up with a design (detailed drawing). First, determine the specifications of your Space Station. What does it have to do? Support the chosen weight a minimum distance above the surface, and be relatively inexpensive.

Get your design approved before you purchase materials or begin construction.

Purchase Materials

Once you have a design, you will purchase the materials you need (straws and tape) from the warehouse. Each long straw represents a cost of $10,000,000 and each short straw represents a cost of $5,000,000 in materials and labor. Each centimeter of tape represents an investment of $100,000. If you discover that you need more straws than your original design called for after you have made your initial purchase of straws, then the cost goes up 50% (that is, each long straw is $15,000,000 and each short straw is $7,500,000.)

Build Your Design

Construct a model of your framework to be used for testing its strength. For the test, the framework should stand on one end. The frame should be at least 19 **cm** tall and must be wide enough at the top to balance a weight selected for the test. You may have to make modifications to your design as you build.

Calculate Your Bid

As you construct your framework, keep track of the materials you use. Total the cost of the materials when your model is complete. Remember that straws purchased late will be 1.5 times more expensive. If your framework is able to support the weight, the cost of your materials will be your bid. The successful team with the lowest bid will win the competition.

COST:

Number of long straws x $10,000,000	= _____
Number of long straws purchased late x $15,000,000	= _____
Number of short straws x $5,000,000	= _____
Number of short straws purchased late x $7,500,000	= _____
Number of centimeters of tape x $100,000	= _____
TOTAL COST	= _____

Demonstration and Testing Phase

When your team is happy with the model bring it to the testing area to demonstrate to the class. Disclose the amount of your bid and present your initial paper design. Demonstrate that the structure meets the specifications. Does your design differ from your final model? If so, why?

KEY QUESTIONS

1. What are the benefits of having a thorough design beforehand?

2. Is it more cost effective to over-purchase straws and have wasted money on unnecessary supplies, or to pay an increased cost if you need to purchase more straws than your original design called for? Explain.

3. What was more important in your design: simplicity of construction, cost of construction, overall performance of structure, or out-bidding your competitors? Why?

4. How does the cost of the design influence how the structure performs its job?