Unit: Engineering Design Day

Experiment Title: Aeromachine Design

Unit Purpose: To teach students basic engineering principals such as teamwork, planning and budgeting.

Experiment purpose: To teach students basic aeronautical principals and improve teamwork and communication skills.

College Applications: Mechanical Engineering, Aerospace Engineer

Career Applications: Mechanical Engineer, Aerospace Engineer, NASA

Materials:

Per Group:
- $600 SeeS Money
- A large piece of paper (butcher paper works fine, ~2 ft by 2 ft)
- 2 or 3 markers per group
- 4 Styrofoam cups
- 2 or 3 stopwatches

Notes:

The following supplies can be purchased for $100 each to help build the flying machine:

- 5 paper clips
- 10 straws
- 2, 5x7 index cards*
- 4, 1 ft pieces of light-weight string
- 4, balloons (approx. 9" inflated or assorted sizes)
- 2, paper plates (the cheap thin kind)
- 2, 5x7 index cards*
- 5, 1 ft strips of masking tape (3/4 to 1 in. wide)
- 1, ½ stick of handi tack
- 4, balloons
- 2, paper plates
- 2, small binder clips

*a sheet of card stock, cut in half can substitute for 2 index cards

-Also have a stapler and staples available for use (for free) and several pair of safety scissors that can be used at the supply table.

Preparation:

All of the kids will be divided into equal groups, hopefully of 8 or fewer. Each volunteer has their own group.

The supplies should be divided ahead of time into groupings as listed above. This includes cutting string, separating straws, etc. Zippered, snack size bags work well for dividing small pieces. The tape can be pulled off and cut as needed, but we will need a couple of volunteers to handle this.
Event coordinator sets the evaluation criteria depending on facility and background knowledge of participants.

**Procedure:**

1) The “budgeting” and design should take a total of 15 minutes.
2) Have the students begin by looking at the supply list and sketching a few ideas for something that can fly and meet the designated criteria.
3) After they have agreed on a design have them decide what supplies they want.
4) Now send ONE representative to purchase the supplies. Supplies do not have to be purchased all at once, nor do they have to spend all their money (coming in under budget receives points as well).
5) Have them build their design.
6) Make sure ALL group members participate and give input. Don’t allow one person to entirely dominate the group, a group leader is fine, but a group of 1 with 3 spectators is not.
7) Have them test their aeromachine and re-design as time is available.
8) After 45 minutes, we will stop for the demonstration flights.

**Points to make:**

- Your job is to be a guide. DO NOT design the device; just help the kids out in the process, offering suggestions.
- The kids should do most of the work. Your main task is to keep *everyone* excited and involved.
- If the kids are getting stuck ask them what a kite looks like? Is there a way to make a kite from straws and paper? Would these work as wings? Try to incorporate ideas such as lift, drag, air resistance, etc. from the previous aeronautics units.
- Also remind them of airfoils, parachutes, balloon rockets, and helicopters from previous units.

Experiment from: SeeS