Eggonaut Water Rocket Design and Launch

First Launch Date:	**November 13, 2012**	**(in Demo Lab Section)**
Second Launch Date:	**November 20 2012**	**(in Demo Lab Section)**
Final Report Due:	**November 27, 2011**	**(in Demo Lab Section)**

Mission:
Your mission is to design and construct a water rocket that will carry an intrepid Eggonaut to 100 ft. into the air and return him or her safely to the Earth. You are strongly encouraged to paint/decorate your rocket.

Teams:
Teams will consist of 3-4 people. Group members MUST be from the same lab section. Each team must come up with a team name, which needs to appear on the rocket.

Rocket Guidelines:
IF YOUR ROCKET DOES NOT MEET THE SAFETY DESIGN CRITERIA, ACCESS TO THE LAUNCH PAD WILL BE DENIED. We reserve the right to deny access to any rocket that is deemed unsafe to launch.

Materials

- Acceptable Materials: cardboard, cloth, rubber, paper, plastic, tape
- Unacceptable Materials: rocks, metal, coins, nails, metal springs, wood
- Pointy objects are forbidden, including forks, springs, skewers, pencils, etc.
- Choose strong but light weight and safe materials for maximum performance.

Rocket Body

- Rocket body will be constructed out of a 2-liter *soda pop bottle* (used for carbonated beverages), with a standard neck that is compatible with the launch pad. Please use a Coke, Pepsi or Dr. Pepper bottle and not a generic brand. Do NOT use green bottles; they do not fit the launch pad. Do NOT use water bottles or tonic water bottles; they are not strong enough to be pressurized.
- The rocket body will be pressurized. Do NOT modify the pressurized bottle.
- Nothing may be added to the interior of the bottle.
- Weakening the bottle in any way may cause a fatal failure of the system. For example: do not use hot glue or other epoxies (glues) that might damage the integrity of the bottle.
- Decorating the exterior of the bottle is encouraged.
- Glues may be used in the construction of fins or nose cone, but not for attaching those items to the bottle. Tape must be used instead.

Stabilizers:

- Your rocket needs some mechanism for stabilizing its flight (e.g.: fins).
- Any stabilizers should meet the material restrictions.
- The rocket must fit on the launch pad, which has hardware that gets in the way if you have too many fins. You will see the launch pad prior to the launch.

Nose Cone:

- You must improve the aerodynamic shape of the bottle with a nose cone.
- You nose cone cannot be rigid and pointy.

Eggonaut Protection:

- Eggonaut can only be a raw chicken egg
- You must design some mechanism for keeping your Eggonaut safe.
- Extra credit will be given to any team that successfully deploys a parachute that returns the Eggonaut's capsule safely to the Earth.

Fuel:

- Only room temperature, clean water will be used as the fuel.
- You must bring water on the day of the launch in a *separate* bottle.
- You must decide what fraction of the 2-liter bottle you will fill with fuel.
- You must either measure your fuel before the launch, or be able to see inside your bottle as it sits on the launch pad.

Since we have not yet discussed rockets in lecture, you are encouraged to do research on the web. NASA's website is a good place to start:
http://exploration.grc.nasa.gov/education/rocket/rktbot.html

Day of the Launch:
Each team member must be present and participate in the launch of the rocket. The following tasks need to be assigned: Fueler, Pumper, Launcher, Height Estimator

Each team must bring the following to the launch: Rocket, Water (bring extra), Eggonaut (raw chicken egg), Paper Towels (just in case), paper for marking height and performance.

It is your team's responsibility to record your rocket's height at the time of launch. Your TA will not provide you with this information in the days following your launch.

Your rocket will be inspected to ensure that it meets the safety criteria listed above.

NOTE: Points will be deducted from any team that does not clean up after their Eggonaut if the worst should occur.

Final Report:
Each team member must type and submit a final report (3 pages not including sketches, 12 pt font, and 1.5 spacing). The report must include your name, team name and the names of your team members. The report should have the following sections:

- *Initial Rocket Design* section should include who did what, why you chose your design for each of the following: fins, nose cone and egg protection. This section should include a diagram of your rocket with the different features pointed out.
- *First Launch Results* should describe who did what at the launch, your estimated height for each launch, how much fuel you used for each launch, and whether or not your egg survived.
- *Analysis One* section, you should state what you learned about the amount of fuel needed for maximum height, why your egg protection succeeded or failed, and any changes you would make for a second design.
- *Changes to Rocket Design* section should describe any and all changes to your rocket. Note that changes must be made to attempt to improve the rocket's height and/or Eggonaut protection. Diagrams should be included here.
- *Second Launch Results* should describe who did what at the launch, your estimated height for each launch, how much fuel you used for each launch, and whether or not your egg survived.
- *Analysis Two* section, you should state what you learned about the amount of fuel needed for maximum height, why your egg protection succeeded or failed, where your changes successful in producing the desired effect? Why or why not?

Grading:
Besides the final report, you will be graded on **both** launches. Full credit for launch #1 requires a rocket that does not violate any of the above restrictions, and launches without any structural failures or major mishaps (e.g. parachute deploying on launch, ejection of eggonaut). Full credit for launch #2 requires improvement from launch #1 (i.e. increase in height reached, straighter flight, safer re-entry) and meeting the launch criteria of reaching 100 feet and safely returning your eggonaut. Extra credit will be awarded during either launch for parachute deployment or a second stage.