

### **Team Challenge Brief – The ultimate Egg Head!**

Crash! Crack! American athletes suffer 3.8 million sports-related concussions each year. We need YOU to help design an amazing helmet to protect an athlete's head (a raw egg) from falls and while rolling across the ground. Those helmets that successfully protect their egg will be put on display for Makers to vote on which designs best allow for visibility, breathability, freedom of motion, and general, all around cool-ness.

### **Materials**

For each design team can choose any combination of these available materials:

Cardboard, Masking tape, Duct Tape, Bubble wrap, other Wraps (plastic, aluminum foil; wax paper), Paper (various thicknesses), Tissue paper, Straws (small and large), Rubber bands, Paper cups, Styrofoam cups, packing peanuts

Along with One Raw Egg

### **Helmet Construction**

The students design a helmet to protect the head of an athlete, modeled by a raw egg. This fresh look at the classic egg drop introduces much deeper thinking in terms of designing a sports helmet that both protects the head and allows for visibility and mobility. The testing procedure is also unique and may be student-designed.

### **Constraints and Testing Parameters**

Students design and build a helmet for an athlete within the limits of materials that:

- Protects the head (egg) from falls from any direction.
  - Tested with a one meter drop onto a hard surface.
- Protects the head (egg) from a roll on the ground.
  - Tested with a "bowling ball" type roll at a distance of two meters.

In the initial design stages, students can choose how to test their helmet. They might start with a tiny drop of a few inches or a short roll on the floor. They can build up to the final tests.

Every helmet that passes the first two tests without breaking the egg, will then be put on display at the Faire. Each helmet will be assigned a number and all attendees will be voting on which designs best meet the following constraints.

- Allows for excellent visibility in all directions
- Allows for breathing (hole where the mouth is)
- Allows for easy movement (not too big or too heavy)

The challenge categories for voting are:

- Drop test
- Roll test
- Lightness/ maneuverability
- Maximizing visibility
- Appearance - cool factor
- Flexibility

There are two submission categories.

- One for pre-constructed helmets made of anything
- The other using provided materials designed and built on-site



### **“Expect the Unexpected” Hints for the Engineering Design Process**

Older students may have experienced egg drops. This is NOT an egg drop. They need to design functional helmets that model collisions in sports, which includes dropping, rolling, and spinning while dropping. Keep them focused on visibility and comfort/lightness.

Eggs will break unexpectedly. It can help to not give out the egg until the team is ready. It also helps to give them their egg in a protective container, like in a bowl padded with paper towels. Remind the students that they only get two eggs, so they need to be very careful or not only will the egg break, but the materials will get very gooey.

A testing area covered in plastic (cut open trash bags work) makes clean-up easier. You could also have them do all work with raw eggs outside.

Students may have a difficult time imagining their head being like the egg. Sometimes helmets have very poor visibility or are quite large. You may decide this is OK or you may need to help them relate. Having a cardboard box that they can wear might help with imagination.

### **Guiding Questions**

- “Do you think the head is protected from all collisions, from any direction?”
- “Tell me how easy it would be to see while running if the egg was your head.”
- “Could you design it with less protection so the athlete could see better?”
- “Tell me about what it would feel like to wear this helmet if the egg was your head.”

### **About the Challenge**

Here at the Shasta County Mini-Maker Faire, there are no winners and losers. Anything that’s cool is fair game, though sometimes it’s especially cool to try to meet a tough design challenge with a team. The goal is to push yourself and your team to be the best you can be, not compete against others. Thanks to the generosity of our many sponsors there will be many many awards given out for students that enter the challenge.

Teams should expect to bring their team (and helmets if built in advance) to the Maker Faire between 10 am and 2 pm on Saturday, November 12th. When you come to the Shasta County Mini-Maker Faire, check in at the Egg Head booth. After testing your own helmet, please stick around to see what other fabulous designs others created and vote for your favorites. Specific information will be sent to each team that registers in advance via e-mail by November 1, 2016.

### **Team composition**

1. Teams should be comprised of 2-6 members. Mixed age teams are welcome.
2. The oldest team member should be no older than 8th grade. For high schoolers, consider the “You Shall Not Pasta!” challenge.
3. Adults are encouraged to provide materials and space to work, facilitate conversations, teach basic skills (such as how to work with duct tape) and design principles (such as examining real helmets of different kinds), and give lots of moral support. BUT please give teams the chance to try and fail and try again on their own.

### **Standards**

#### **Next Generation Science Standards Disciplinary Core Ideas**

##### **PS2.A: Forces and Motion**

Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.

For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). The motion of an object is determined by the sum of the forces acting on it.

#### **Next Generation Science Standards**

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS-LS4-4: Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

#### **Common Core Math Standards**

2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

#### **Standards for Technological Literacy (ITEEA)**

##### **The Nature of Technology**

Standard 1: Students will develop an understanding of the characteristics and scope of technology.

Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

#### **Design**

Standard 8: Students will develop an understanding of the attributes of design.

Standard 9: Students will develop an understanding of engineering design.

Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

#### **Abilities for a Technological World**

Standard 11: Students will develop abilities to apply the design process.



*Providing assistance and leadership to the districts in Shasta County and ensuring all students have equal access to a quality education*

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## 2016 Grades PreK-8 Team Challenge

Standard 12: Students will develop abilities to use and maintain technological products and systems.

Standard 13: Students will develop abilities to assess the impact of products and systems.

### **The Designed World**

Standard 14: Students will develop an understanding of and be able to select and use medical technologies.

Standard 19: Students will develop an understanding of and be able to select and use manufacturing technologies.