

## Project Opportunity – Fall 2009

### Improving Impact Attenuation in Hockey & Lacrosse Helmets

Work to be performed with Cascade Sports of Liverpool, NY

Faculty contact: Alan Zehnder, 5-9181, [atz2@cornell.edu](mailto:atz2@cornell.edu), Kimball 211

Helmets are designed with a hard shell and an impact absorbing layer. When a helmeted head hits a hard surface, the speed of the head is brought to zero over a short time, resulting in large accelerations. The job of the helmet is to spread the impact load in time and space. The ideal impact absorbing layer will provide a constant force, thus minimizing the peak force and hence the deceleration felt by the head. Motorcycle helmets do this with a crushable foam, however such helmets are designed to be replaced after an accident. In contrast, lacrosse and hockey helmets are required to sustain multiple impacts and to continue to perform.

Cascade sports is a local (Syracuse area) company that builds lacrosse and hockey helmets to order for many customers, including the Big Red Lacrosse team. They have developed an impact absorbing system consisting of a group of short, hollow, injection-molded polymer cylinders. Upon impact the cylinders buckle. After buckling, the load required to continue to deform the cylinders is close to constant. Cascade desires to develop novel designs that will reduce the initial load required for the onset of buckling, thus reducing peak loads. Cascade believes that through changing geometry and/or material we can lessen the g forces felt by the head in a direct impact type impact. Cascade has the ability in its test lab in Liverpool to test and rate new ideas with a test rig that includes g force readings along with a graph of the impact and the ability to high speed video the impact. A successful design will not dramatically increase the weight or height of the current product. A decrease in either would be successful while the primary goal would be to decrease the g forces on both low and high impacts at both ambient and cold temperatures with multiple impacts being necessary. The project would include physical samples being designed and tested with the ultimate goal being Cascade would make an injection molded tool of the concept or concepts.

A small team of students (2-3) is sought to work with Cascade Sports and Prof. Zehnder to brainstorm, model, develop and test new concepts as outlined above. Prerequisites would be to have taken or to be enrolled in MAE 4700 (finite element method) or equivalent. This 1 semester project will begin early in the Fall semester and can serve as your M.Eng. project. Interested students are encouraged to contact Prof. Zehnder for further information. Undergraduates interested in satisfying their senior design are also invited to inquire about the project.