## **Project Title: Helmet/Vest Design to Reduce Impact**

**Sponsor**

Gavin Boone

Executive Sales Professional

Sanofi Inc.

**Faculty Advisors**

Dr. Kamal Amin (ME)

Dr. David Olawale (IE)

Restated Scope and Project Plan

Due Date:

January 17, 2014

Team 26

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**Summary**

This senior design team has been assigned to work with Mr. Gavin Boone in the development of a prototype vest, which will serve as a protective gear for baseball players when they are batting. In order to accomplish our goal we will take into account the following considerations, safety, player performance, and quality. Currently there is no official protective gear used by baseball players to prevent injuries caused by the pitch when they are batting.

In order to create a vest that will provide the best protection to the baseball player, the senior design team will have to identify the forces related to the baseball impact, as well as the most common injuries caused by the impact when the players are batting. After analyzing the critical areas of the human body that are affected by these injuries, the team will develop a series of vest designs that will attempt to protect those critical parts of the body. The most optimal designs will later undergo a series of tests to measure their effectiveness as protective gear.

**Project Scope**

Design a protective vest that provides protection for the neck, back and rib areas of a baseball player when it’s batting. The vest will provide protection without hindering the range of movement of the players, so their performance is not affected.

The initial focus relies on the study of the forces related to the baseball impact and its relation to the body capability to withstand such forces. In addition, the study of body motions will be related to the batting motion, so there is a better understanding of the mechanics in this type of movements. By gathering quantitative data explaining these subjects, an engineering perspective can be develop of what is going on while a player is batting.

The next step will be to analyze possible materials that could work for the vest prototype. Based on the information previously collected, each possibility will be considered by its unique properties. The vest needs to be closely attached to the body, so it will be preferable a material that is bendable without evidence of breaking or cracking easily. The material selection will ultimately be based on our customer material requirements of impact resistance, transparency, lightweight, flexibility, and durability.

**Work statement:**

The “Wear It” project members will work as a team to design and build the best possible protective vest for the sponsor, within our capabilities and resources. The project will be conducted in an ethical manner that does not harm or break any rules or laws.

**Major goals and objectives:**

* Analyze materials to determine the best choice for the protective vest.
* Determine the ideal material for the vest, and verify it is suitable for prototyping.
* Analyze designs to determine best choice for the protective vest.
* Choose the design for the protective vest which provides the best protection.
* Construct / test / analyze a prototype.
* Ensure that the vest is ergonomically acceptable for the players to wear.
* Determine manufacturing characteristics of production.

**Adjustments & Modifications**

 One thing that our sponsor, Mr. Boone, has adjusted as far as our overall direction is where he wants us to direct our focus. For most of the fall semester, we put more of our attention on to the actual vest and how we were going to protect critical areas like the rib cage and spinal cord. Something that he went over in our last meeting was the area of our vest that is not necessarily covered by other vests that have been produced in the past: the neck. We had always planned to incorporate another part, whether it be an add-on piece or an extension of the vest, that also covers the neck, but we never made it a priority. Much of our research and design work was focused on the actual body and how we could protect it. Mr. Boone said that while that was important, the neck is the part that can actually cover our patent and make our product some money. Other vests have done the torso and back areas, but no vest to date has made something with the neck covered. This could definitely change how we move forward with our project, but it is not going to massively change our direction.

One issue that we have encountered is selection of materials for the protection vest. The team initially decided to pursue the use of a carbon fiber shell with padded backing to absorb and cushion the impact of the baseball. However, it was brought to our attention that the use of carbon fiber was not acceptable due to the characteristic of carbon fibers decreasing strength upon multiple impacts. For this reason, the team has to continue to analyze various types of materials in order to aid in the selection of a material / composite that will be suitable for the intended impact characteristics. Another issue that all teams are likely facing is the duration of the project. As we near the end of the semester, time is of the essence. In order to fully complete the project of constructing a baseball protection vest, many milestones must be reached. Due to the time constraints of the senior design class, the team must prioritize which milestones must absolutely be attained and which are less important for completion of the project/class purposes. For example, on key criteria that the team would like to meet is the production of a prototype vest. However, with the necessary material selection and testing that must still take place; the prototyping stage may not be attained within the allotted timeframe.

Procurement plans have not been a factor yet in the new semester. As the team is still in the material selection stage, procurement issues are prioritized further into the project timeline to the point when material selection has been made and tested. At this point the team will have a better understanding of what materials will need to be acquired, how much of each material will be required, and what tools/outside labor must be attained to make the prototyping of the vest achievable. As stated earlier, one milestone that has changed direction is the portion of the vest of which the team will provide the most focus. The neck region of a batter is currently unprotected by current market offerings, so the team has decided to pursue the development of a portion of the vest that protects this region first. This has changed from the previous semester when the team believed it was necessary to produce a vest that protected a player’s complete torso and neck region. This has affected the project schedule due to the fact that the team has to now devote more time to developing protection to a specific region, and then designing the vest around the former goal. Budget is still largely unaffected because the team is in a position where budget is largely unknown or unnecessary until the point at which we are sure that prototyping will be feasible and the material selection process has been completed.

**Budget**

The team was initially provided no budget for this project. From the beginning it was a goal of the team to complete all project steps possible without the need for spending. This included project goals such as design, material selection, ergonomics, and projected cost. The team has a goal to complete all other portions of the project up to the point of procurement, until the point that prototyping is within reason, and the acquisition of materials becomes necessary. That being said, the team has paid attention to projected cost with the attempt to keep the cost as minimal as possible. With this goal in mind, when the issues of budget and procurement become important to the continuation of our project, the team will likely have a low cost design that will be able to be produced cheaply using materials that are easily attained. This will aid in the ability to work with a likely low budget and short timeframe of production.

**Spring 2014 Semester Gantt Chart**

Gantt chart subject to change once team meets with advisers and sponsor.