Central PA SCI Support Group: Safe Snowboard Project

Overview
Zach Sherman has been trying to get back into snowboarding, a favourite pastime of his before his accident that left him as a bilateral above the knee and right arm amputee. With these limitations, it is critical to make a system that first and foremost provides safety to prevent further injury to his body.

Objectives
To design a safe snowboard system for Zach Sherman, a bi-lateral above the knee and right-arm amputee. The primary deliverables are: 1) to build a suspension system that will absorb the forces produced during snowboarding by replacing the normal function of the knees, and 2) to build a binding system that binds Zach securely to the board.

Approach
- Initial meeting with sponsor and patient to become familiar with the objectives and the project team
- Preliminary specifications for the system were set in order to guide brainstorming
- Brainstorming sessions with the team to generate as many ideas as possible
- Reviewing ideas with sponsor and patient to get feedback and make design modifications
- Concept selection based on safety and functionality of the system
- Detailed measurements of the patients range of motion and stance
- Accurate 3D modelling of the proposed system
- Final design review in person with 3D printed mock-up parts
- Purchasing of major components
- Verification of design based on hard measurements of purchased parts
- Detailed engineering drawings created in order to facilitate machining
- Manufacture of all parts using resources at the Learning Factory
- Assembly of the system
- Travelled to the Physical Medicine and Rehabilitation research lab at the Hershey Center for Applied Research to conduct testing
- Utilized a hoist to suspend the patient in order to properly orient and align the manufactured system
- Made numerous adjustments in order to fit the system to the patient’s body
- Took video of the testing process so that the results could be reviewed and communicated

Outcomes
The overall outcome of this project was a successful proof of concept that a design of this nature could feasibly allow for the safe snowboarding of the patient. The system illustrated adequate damping potential with enough adjustability to allow for personalization and a variety of riding styles. Improvements that will be needed are: material selection, overall size reduction, reduced weight, re-engineered binding system.