Overview
The purpose of this project was to design a Universal Testing Rig (UTR) to perform automated static testing on the Jaipur prosthetic foot in order to understand more about its characteristics. All previous testing that has been prone to vast human error and therefore has not provided valuable information. The Jaipur venture is based out of India and each foot is hand crafted by a lone individual. Thus, the team faced the challenge of developing a testing rig that can accommodate numerous variations in each foot including foot size and structural components. The rig needed to be able to perform four different tests (1) heel compression; (2) dorsal flexion; (3) supination (4) pronation.

Objectives
The team built a UTR that the Jaipur foot could be attached to and then loads of 60 kg were applied to the foot with the use of a Material Testing System machine. The stand that the foot was attached to was able to slide providing for one degree of freedom, while the MTS machine’s ability to move allowed for another. This made it easy for the rig to be adjusted for the positions mandated by each test, and additionally enabled the rig to accommodate different types of feet.

Approach
• To understand customer needs, the team discussed with Dr. Pooja, a doctor from India who works directly with the Jaipur project as well as Dr. Kisenwehter and Dr. Winter, both of whom travelled to India to retrieve the original feet and start this project.
• The team decided that the foot would need to able to be moved in order for the different tests to be conducted; therefore they developed the idea of a two-track system to provide two degrees of movement.
• After performing an external search, it was found that the Jaipur foot is very unique in the way it is made and the only similar testing mechanisms available were for fatigue testing, however this project focused on static tests.
• Unfortunately, no previous data was provided for the team, although they were informed that low-tech tests had been done.
• The first model the UTR was unsuccessful because the tracks were made too thin. However, after consultation with Ardell Hostman a bulkier track was created that included a sturdy stand locked into a T-slide.
• The image at left shows the set-up for heel compression testing by the MTS
• One foot was fully tested for pronation, dorsal flexion, supination and heel compression.
• Results generated Force vs. Displacement graphs for each test, however more feet need to be tested in order to better understand the results. Heel compression, supination and pronation followed a linear displacement. Dorsal flexion started linearly until it reached a deformation point where the foot bent to extreme degrees.

Outcomes
• First automated testing system has been developed for the Jaipur foot
• The team has begun to identify characteristics of the foot that could help in understanding of why the foot fails
• Identified the importance of standardizing the manufacturing of the Jaipur feet in order to have collective improvement of the foot.