GEI Brazil Cassava Mill Project

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Global Engineering Innovations
Brazil Cassava Mill Initial Report
12 August 2013

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Executive Summary

This report provides a summary of the progress achieved to date in the development of an improved Brazilian cassava mill. Our team traveled to Brazil in June 2013 and met with the Secretary of Agriculture of the State of Amazonas to share our ideas. The Secretary and his Assistant both liked the ideas that were presented for the mill and invited us to collaborate with them to develop a machine to remove the stem surrounding the fibers in jute and malva plants. We accompanied our hosts to the municipality of Parintins where they presented their project (an epidemiological study of eye diseases) along with our project to the Mayor and Vice-Mayor of the city. The mayor graciously invited us to test prototypes of our mill in the communities that make up the municipality of Parintins. Our group also traveled to the city of Itacoatiara and shared a simple prototype of our modified mill with a local cassava producer who agreed to test the design. He has responded to us that he has used the mill and that it works well.
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Team Composition

The Global Engineering Innovations team consists of three Johns Hopkins University students: Nathan Nicholes, 3rd year PhD student in Chemical and Biomolecular Engineering; Yu-Ja Huang, 4th year PhD student in Material Science and Engineering; and Aaron Chang, Undergraduate Senior in Biomedical Engineering.

Our local hosts are ophthalmologists from the Federal University of Amazonas (Dr. Jacob Cohen and his son Dr. Marcos Cohen) and from the Federal University of the State of São Paulo (Dr. Mauro Campos).

2012 Trip Recap

In the summer of 2012, we went to Brazil to identify potential projects that were both feasible and could be easily adopted by the locals. We first traveled to Manaus, the capital of Amazonas, to meet with our local host, Dr. Jacob Cohen, and presented our objectives for our trip and potential projects at the International Symposium on Ophthalmology and Filariasis.
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We then joined a group of ophthalmologists from Johns Hopkins University, the Federal University of the State of São Paulo (UNIFESP) and the Federal University of Amazonas (UFAM) and traveled down the river to Parintins, where we visited the community of Nazaçu and observed the process of making cassava flour. We recorded some potential issues regarding the current process of making cassava flour and discussed ideas with the locals to explore the feasibility of future projects. One of the major concerns we had regarding the process involved manually feeding the cassava root directly into the blades on the mill wheel. We decided to develop a design to improve the safety of this procedure. We stopped by local hardware stores after we returned to Manaus and acquired the dimensions and cost of cassava mill parts.

After returning to the US, we decided to work on developing a safer feeding system for the cassava mill, since the design can significantly improve process safety and, more importantly, be easily adapted to any existing cassava mill. Using the parts we gathered at the local hardware shop in Manaus, we built a modified version of a cassava mill that has a hopper at the feeding end to facilitate safer feeding. We successfully tested our design using cassava roots and recorded a short video demonstrating the feasibility of our project.

2013 Trip Summary

Our group returned to Amazonas from June 16-23, 2013 to continue our work to develop and spread information about a safer cassava mill. During our first day in Manaus, we purchased materials to build a simplified prototype of the mill with the hopper. Our objective was to show that the prototype could be built using locally available materials and tools with a minimal amount of time. We were able to create a simplified prototype in our hotel room.

On our second day in Manaus, our host arranged a meeting with the Secretary of Rural Agriculture of the State of Amazonas and the Director of Technical Assistance to the Rural Area. In the meeting, we presented our ideas about how to improve the cassava mill and showed them a video of how the cassava mill works. They were very interested in the design and asked if we would leave them with the report and video that we had prepared so that one of their engineers could build and test a similar prototype using the cassava that is grown in Amazonas. They also shared the possibility of working with their office and some students from
the Federal University of Amazonas (Universidade Federal de Amazonas - UFAM) on a project to develop a machine that would remove the stalk from jute and malva plants. We agreed to meet again a few days later with them both to test the prototype. Unfortunately, both the Secretary and the Director of Technical Assistance had to travel to other parts of the state on the day that we had agreed to meet. They asked us instead to prepare a more detailed set of plans for the mill and submit it to them and they would begin the process of testing the mill design. They also agreed to let us know if additional modifications would be necessary or if they would already be able to share information about the mill with local cassava farmers.

We spent most of the next day traveling on the Amazon River to the city of Parintins. We had previously agreed to meet up with our hosts in Parintins to learn more about a project that they were starting in that municipality. This project, named the Projeto BARES, involves an epidemiological study of reasons for vision loss in individuals over the age of 45 in the municipality of Parintins, which includes not only the city itself but several other surrounding rural communities. As part of this project, our hosts had arranged to meet with the Mayor and Vice-Mayor of the municipality of Parintins. While most of the meeting was devoted to discussing the Projeto BARES, our hosts made a point of introducing our group to the city officials as well and gave us an opportunity to explain the objective of our trip. The mayor was interested in the project and invited us to use the city and surrounding communities to test out the new mill. We returned to the community of Nazaçu and learned that the community had loaned their cassava mill to a neighboring community.
After returning from Parintins, we took a bus to the city of Itacoatiara. We had learned from a friend in the city that there was a local cassava producer with whom we could share our ideas. We brought the basic cassava mill prototype that we had built in Manaus. We explained the mill in detail to the cassava flour producer and he took it with him to test. We have heard back from him, and he says that the simplified prototype worked well.

**Future Work**

Following distribution of the mill design, there is the possibility that field use will reveal weaknesses in the initial design. Thus, a possible project would be to visit villages where the modified mills have been used and take note of the most common failure modes. These failure modes would then be ranked as a function of prevalence and significance to create a list of priorities for redesigning the mill. Close collaboration with the office of the Secretary of Rural Agriculture would take place to ensure that the redesigns do not sacrifice ease of production or distribution while addressing the highest items of concern.

During the presentation of the original mill to the Secretary of Rural Agriculture and the Director of Technical Assistance, a future collaboration between the Global Engineering Innovations Team and the Federal University of Amazonas (Universidade Federal de Amazonas - UFAM) was proposed. Jute and malva play a large role in providing revenue for the Amazonian region as they are used to produce ropes and hats and are also being fashioned into increasingly popular eco-friendly grocery bags. However, with the traditional method of harvesting jute facing a high risk of desertion due to the lack of knowledge transfer from the elder generation of river dwellers, process automation is seen as a key step to ensure that the next generation continues the processing of this important crop. Some difficulties have been observed in the mechanical mills which separate raw and dried jute into finer threads and this project would encompass analysis and redesign of new jute and malva mills.

Our host ophthalmologists are planning on engaging in Projeto BARES in Parintins next year. The undertaking will involve eye examinations and door to door interviews of local residents. A Johns Hopkins Biomedical Engineering undergraduate design team has been developing OcuRex - a portable fundus retina imager which is designed as a cost effective and portable solution for examining retinas in rural eye camps in
India. Through conversations with our hosts, it was confirmed that a more portable retina scanner would be desirable for their field surveys. Thus the last possible project would be to collaborate with team OcuRex to accelerate the development of their product and bring it to a point of field testing so that the device could be employed by our hosts in the field.

Local Partners and Contacts

**Eron Bezerra** – Secretary of Rural Agriculture for the State of Amazonas

**Mauro Campos** – ophthalmologist from UNIFESP that serves as our local host

**Alexandre de Carbras** – Mayor of the City of Parintins. Invited our group to test the mill in the communities that make up the Municipality of Parintins.

**Jacob Cohen** – ophthalmologist who conducts trips along the Amazon and its tributaries to perform cataract surgeries. He offered to allow us to accompany his group on a later trip to take our proposed manioc mill to the communities.

**Marcos Cohen** - Son of Jacob Cohen. He is taking over the work of his father as an ophthalmologist in Amazonas.


**Carlos Gustavo Nunes** – professor at the Federal University of Amazonas (Universidade Federal de Amazonas UFAM) in the department of biotechnology.

**Jose Ramonilson** – Director of Technical Assistance to the Rural Area for the state of Amazonas

Proposed Project Completion Schedule

Recruit new team members and team leader (August-September 2013)

Period of Testing/Evaluation by the SEPROR in Amazonas (September – December 2013)

Create a new prototype based on suggestions from the SEPROR or work on the machine to handle jute and malva (January 2014 – April 2014)

Return to Brazil with new team to meet hosts and continue collaboration (June – July 2014)