Multidisciplinary Senior Design
Project Readiness Package

Prepared by Lydia Yeckley on 5/31/18

Project Title	Skreppa – Modular Shoe
Project Number	[Assigned by MSD]
Primary Customer	Engineers for a Sustainable World [RIT Chapter], esustainableworld@gmail.com
Sponsor	Engineers for a Sustainable World, Bri Goold, bng2008@rit.edu, ~$500 based on need
Faculty Champion	[Assigned by MSD]
Other Support	N/A
Project Guide	[Assigned by MSD]
IP Considerations	[Finalized by MSD]

Project Information

Overview

Please provide a brief (2-3 paragraphs) overview of the background on the problem to be solved, the motivation for solving it, the short-term goals for the proposed project, and the long-term goals for any program the project may support.

If this is a follow-on project, please include a link/reference to the prior project(s) here.

The shoe market in today's society is enormous. There is a myriad of shoe types, makes, and models that all encompass a wide range of shoe abilities. With a modular shoe that is able to have outsoles changed on the go, a single pair of shoes can become extremely versatile. We'd want to explore sustainable sole materials that hold up well to wear and tear, while still being flexible enough to contour to the human foot.

The ability to have a versatile shoe will allow the consumer to be able to own a single pair of shoes with a wide range of abilities. Other than the various benefits listed above, another key motivation to forming this product would be to experiment with new sustainable/reusable materials, given the state of pollution that the world faces today.

Short term goals would include 3 swappable outsoles of the most used treads based on a quick market survey, as well as 2-3 swappable insoles/tops to show proof of concept. The outsoles will be made from a sustainable/recycled material that passes wear and use tests, and the insoles will feature easily sourced material based on the design. Long term goals include creating a self sustaining company that produces these shoes while also working on R&D for future add-ons. During the year, members of the team will potentially take the Applied Entrepreneurship and Commercialization class through the Simone Center [unless it does not fit into anyone's schedule] as well as hopefully compete on Tiger Tank.

Preliminary Customer Requirements (CR)

What attributes does the customer seek in the final project? Each CR should map to one or more ER (see below).

- Easily Manufactured
- Comfortable for Consumer
- Easy to use
- Long lifetime
- Low cost

Preliminary Engineering Requirements (ER)

Include both metrics and specifications. Each ER should map to one or more CRs (see above).
Metrics: what quantities will be measured to verify success?
Specifications: what is the target value of the metric that the team should design to?

- Easily Manufactured – Outsole should have a cure time **no longer than 24 hours**. Injection molding should be easy to produce and maintain. Insole creation should be on par for industry standards for hiking boots/shoes.

- Comfortable for Consumer – interactive testing should show across at least 50 subjects find the shoe comfortable to wear on a scale of 1-5. After testing, the shoe should perform with an **average of a 3.5 or more.**
- Easy to Use – To ensure that the product is easy for consumers to use, over 100 tests of swapping the outsole will be conducted. The average time taken should not be longer than **15-30 seconds**.
- Long Lifetime - Outsole material and locking mechanism should hold up **to over 3000 uses for each deliverable.** The materials themselves should be flexable to a point, obviously similar to a market standard outsole on a walking shoe. Non-absorbent material in material [so that the outsole does not break down upon use]. Tests will include varied terrain, water tests, mud tests, etc.
- Low Cost – The raw materials for a single shoe unit [1 pair of insoles, 3 pairs of outsoles] should **not cost more than $80** to produce on a small sample run. This would allow for there to be a decent enough profit margin to move forward.

Constraints

List any external factors that limit the selection of alternatives, e.g., allowable footprint, budget, required use of legacy hardware/software.

- US sizing conventions
- <$1000 budget
- Responsibly sourced materials
- Sustainable materials

Project Deliverables

Minimum requirements:

- *All design documents (e.g., concepts, analysis, detailed drawings/schematics, BOM, test results)*
- *Working prototype*
- *Technical paper*
- *Poster*
- *All teams finishing during the spring term are expected to participate in ImagineRIT*

Additional required deliverables:

- *List here, if applicable*

N/A

Budget Information

Include total budget, any major cost items anticipated, and any special purchasing requirements from the sponsor(s).

- 1”x6”x36” Bar of 6061 Al - $113.83 from McMaster Carr, split into 3 blocks for 3 different molds. May determine that injection molding is not needed for this specific project, but will be utilized upon increased production.
- <$100 for responsibly sourced, cloth materials based on preliminary research on Offset Warehouse, Organic Cotton Plus, and Silk Road Textiles.
- Remainder of the budget will most likely go towards material selection experiments and testing.

Intellectual Property

Describe any IP concerns or limitations. According to RIT policy, students have the right to retain any IP they generate during a course, but some students voluntarily agree to be placed on projects where they will be asked to assign their IP. If a sponsor wishes to have a team assign their IP, we need to know ahead of time so that we can place appropriate students on the team.

To ensure that students can discuss their projects openly during presentations and job interviews, we ask that no more than ~20% of the project be considered confidential.

At the conclusion of this MSD project, it has been openly discussed between Engineers for a Sustainable World and the proposing parties that all IP will belong to the students.

U.S. Citizenship

Describe any U.S. Citizenship concerns or limitations.

N/A

Project Resources

Anticipated Student Staffing by Discipline

Please provide a brief explanation of the expected activities for each required discipline. "Other" includes students from any department on campus besides those explicitly listed. For example, we have done projects with students from Industrial Design, Business, Software Engineering, Civil Engineering Technology, and Information Technology.

Department	**Expected Activities**
Biomedical Engineering	Design consultation, human testing trials to determine comfort, making sure certain aspects of the human foot are supported when needed.
Computer Engineering	-
Electrical Engineering	-
Industrial & Systems Engineering	Manufacturing, reasonable project managing, materials
Mechanical Engineering	CAD, materials selection, design and functionability, fatigue testing.
Other	Industrial Design, design consulation and prototyping guidance.

Required Resources

Describe the resources necessary for successful project completion. When the resource is secured, the responsible person should initial and date to acknowledge that they have agreed to provide this support. We assume that all teams with ME/ISE students will have access to the ME Machine Shop and all teams with EE students will have access to the EE Senior Design Lab, so it is not necessary to list these. Limit this list to specialized expertise, space, equipment, and materials.

Faculty	Any faculty with an advanced knowledge of polymers, probably in the Chemistry Department. Rob Kraynik for machining out a injection mold.
Environment	Material Science Lab [depending on material processing manufacturing]
Equipment	CNC Mill, CNC Router, Vacuum pump.
Materials	Leather, Fabric, plastic, raw/recyclable materials, currently unknown chemicals to breakdown materials to form a polymer [nothing too nasty however].
Other	