RISE Proposal
February 28, 2014
Structurally Sound Sustainable Engineering
Steel Bridge and Concrete Canoe

Abdel Abouhaib, Tripp Collier, Logan Balstad and Martin Gray

Amount requested:
  Option 1: $2375
  Option 2: $9575

Amount matched: $13,000 - $20,000

Total cost of project: $75,000
  Raised: $40,000

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  Logan Balstad
  907-209-5610

  Martin Gray
  907-347-2131

Civil/Mechanical Engineering Freshman, Sophomore, Junior/Senior undergraduates

Sustainability theme – National Engineering Competition, Outreach, Educational experience to produce further solutions for UAF.

Project summary –

UAF has been able to provide engineering students with real world engineering experiences through ASCE sponsored competitions. Students from every branch of engineering at UAF have come together to work as a team to compete in the Steel Bridge and Concrete Canoe competitions. These events encompass past and future progression in the UAF engineering department. For over a decade, UAF engineering students have participated in the steel bridge competition, winning nationals and regional’s multiple times. This is the first year UAF Engineering students are participating in the Concrete Canoe Competition. Taking on this
task for the first time is not an easy feat. We are starting from the ground up, making our mistakes and learning quickly. We hope to be successful in our first year so that we can minimize the learning curve in the future in order to perfect the designs.

Both of these regional competitions are conveniently being held in Portland, Oregon at the same time. The Steel Bridge competition is judged in many factors including: The ability to incorporate sustainable/reused materials, weight, and compressive strength of the bridge. The Concrete Canoe competition is being judged through the practicality of design, team efficiency in racing and three categories of sustainability including Construction, Testing, and Development.

Project description:

Sustainability is at the core of both the concrete canoe and steel bridge projects. Along with the rules of the competition being oriented towards sustainability, our teams have taken extra steps towards preserving earth’s natural resources and our ecosystem. The environment is delicate and care must be taken to ensure the preservation of our ecosystems. The following are some of the efforts we are making towards sustainability in our projects.

The steel bridge is made entirely from recycled steel. The goal of the project is to design and construct a bridge from the least amount of materials while retaining its strength. The result is a very strong, light, and green bridge. What we learn from this competition will be directly used to develop stronger bridges and explore the opportunity of using recycled materials in bridge building. A criterion of the competition is to build the bridge in a set amount of time. The long run the effects of the competition will reduce waste, improve bridge designs, and reduce the impact of construction on the ecosystem.

The concrete canoe competition offers a whole new set of learning opportunities. Again we are using recycled materials on the project. The glass beads that make up the aggregate in the canoe and lead to its flotation are made from recycled glass that has been crushed and compressed into rice crispy-like structures. Innovations learned from this project will have effects other aspects of construction such as making floatable infrastructure that can be used in areas with high flood risk, or floating bridges that can be constructed in one location and transported to the final destination.

Although the two projects differ in their goal and development the benefits to society and the environment are obvious. Sustainability is a crucial aspect of the projects and is prevalent in the short term by our choice of materials and building processes. In the long run the skills and information learned will affect the building techniques and procedures of projects for years to come. Also crucial is the interaction between teams at the competition. This is where we will expand our knowledge based on the successes and mistakes of other teams as well as share our lessons with them.
Project value:

The Steel Bridge and Concrete Canoe teams want to show case there hard earned results and long worked efforts in solving problems while dealing with environmental issues. More importantly we want to show our region and the nation UAF knows “Sustainability.” UAF goes against the status quo, by using its engineering student body to build projects with sustainable values that represent the office of sustainability and the character of the UAF student body; Responsibility, Excellence, and Innovation.

We care about our renewable materials; Responsibility, it is our objective to deal with socially environmental issues, and our natural resources “the use of recycled glass and refurbished steel.” Excellence, we do not compromise with our environment, neither with producing nothing but the finest quality bridge and canoe. Innovation, UAF students will recover a sense of pioneering, and be able to achieve goals with a long term ecological mentality and realistic economical benefits.

Each student in the entire UAF student body is a character in this story, and how this story pans out is based on how we all behave, asses our situations, and most importantly produce results. By reviewing the main goals of the sustainability fee you clearly see how our innovative recycled materials used promote energy efficiency. Secondly our creative, yet realistic, idea of reusing older bridge materials to create new and improved bridges is by definition a renewable energy project. Let’s bring pride to UAF and save money.

In accomplishing our goals, a proper assessment of savings is provided. Steel bridge alone with our proposed plan will save $ 700,000 minimum on any bridge with the nearly the same specs, most bridges around the nation fall into this category. Concrete canoe saves $27 per cubic yard, and on average construction projects use thousands of cubic yard, which results in thousands of dollars saved. Economic benefits are immediate, but it is our design and proper use of materials that effect in long term benefits. Plus all our proposals adhere to LEED objectives.

Short Term Goals for UAF Students:

• Students will be exposed to a tremendous amount of knowledge while travelling in an engineering convention, and will be able to bring back new solutions to problems UAF might have (write many RISE proposals)
• A minimum of three outreach seminars held by CEM professors regarding “Sustainability and Engineering”
• Ability to compete on the national stage showcasing our responsibility to our environment, and win!

Medium Term Goals for UAF Students:

• Ability to continue research and development
• Outreach to UAF students to showcase our success
Long Term Goals for UAF Students:
- Research which can assist in future university infrastructure projects
- Continuing growth on student involvement within CEM
- All projects proposed are designed to be used within Fairbanks and Alaska.

Implementation Plan:

<table>
<thead>
<tr>
<th>Date</th>
<th>Goal</th>
<th>Person in charge</th>
<th>+40 students</th>
<th>Funds</th>
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</thead>
<tbody>
<tr>
<td>Mid March</td>
<td>Order Supplies</td>
<td>Abdel Abouhaib/Dr Hulsey</td>
<td>$2,075.00</td>
<td></td>
</tr>
<tr>
<td>Mid March</td>
<td>Begin Out reach</td>
<td>Tripp Collier</td>
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<td></td>
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<tr>
<td>Mid March</td>
<td>Purchase Flights</td>
<td>Dr Hulsey</td>
<td>$7,200.00</td>
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<td>End March</td>
<td>Begin Canoe Construction</td>
<td>Abdel Abouhaib/Logan Balstad</td>
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<td></td>
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<tr>
<td>End March</td>
<td>Begin Bridge Construction</td>
<td>Tripp Collier</td>
<td>Abdel Abouhaib/Tripp</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>Finish Canoe and Bridge</td>
<td>Collier</td>
<td>Abdel Abouhaib/Tripp</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>Finalize Publications</td>
<td>Collier</td>
<td>Abdel Abouhaib/Tripp</td>
<td></td>
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<tr>
<td>April</td>
<td>Finalize Presentations</td>
<td>Collier</td>
<td>Abdel Abouhaib/Tripp</td>
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<tr>
<td>End April</td>
<td>ASCE ACI competition</td>
<td>Select group members</td>
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<td>May</td>
<td>Submit final report</td>
<td>Collier</td>
<td>Logan Balstad</td>
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<td>May-September</td>
<td>Summer research</td>
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<td>May-September</td>
<td>prepare Major outreach for fall</td>
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<td>September</td>
<td>Submit RISE proposals from selected member</td>
<td>Logan Balstad</td>
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<td>October</td>
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</table>

Budget option 1: Matched by AGC (Alaska general contractors) and ASCE (American Society of Civil Engineers)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total</th>
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<tbody>
<tr>
<td>Expanded recycled Silica Glass Spheres</td>
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<td>$111</td>
<td>$333.00</td>
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<tr>
<td>Basalt Fiber</td>
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<td>$500</td>
<td>$500.00</td>
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<tr>
<td>cement type III</td>
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<td>$42</td>
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<tr>
<td>Alaska steel</td>
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<td>$1,200</td>
<td>$1,200.00</td>
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<tr>
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<tr>
<td>Flyers</td>
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$2,375.00
Budget option 2: Matched by AGC (Alaska general contractors) and CEM (College of Engineering and Mines), plus “materials” ASCE (American Society of Civil Engineers)

<table>
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<td>$100</td>
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<tr>
<td>Flyers</td>
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<td>$0.20</td>
<td>$200.00</td>
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<td>Flight ticket round trip from FAI to Portland</td>
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$9,575.00

Budget Justification:

Supplies:
- Expanded recycled silica glass spheres- are made to produce a high performance mix design, and ultra light weight aggregate.
- Basalt Fiber- With a three times the strength of steel and an eighth of its weight. Our tests have shown and proven that it is a perfect match for our reinforcement on the canoe.
- Cement type III- bonding agent in concrete.
- Alaska steel- local steel, which will be placed as trusts on the upper half of the bridge while allowing the low carbide steel (provided by UAF department UATC) on top to take the burden on major forces.
- RISE board poster- Outreach and presentation. Where ever we mention any of our projects, especially in presentations, the RISE board will be recognized.
- Flyers- Outreach targeting UAF students while they are on campus and also for dormitories and any events hosted by ASCE, AGC, and CEM.
- Airline Tickets-Next to the materials, Transportation to the convention is crucial. Our ability to learn and bring back ideas to UAF heavily relies on getting students there and back safely. Proper recognition of UAF’s sustainability mission will also receive national recognition as we proceed in winning. Yet the most important fact is that AGC (Alaska general contractors), CEM (College of Engineering and Mines), and ASCE (American Society of Civil Engineers) will match the amount provided by the RISE board.

Outreach:

The most important aspect of our proposed project is our outreach program. Upon completion of your convention, all student participants are required to provide one innovative sustainable proposal or base idea to support
engineering program. In addition our two student chapters will host presentations which will focus on the enrichment gained during the convention.

Planned Program:
• Lecture series by advising CEM professors.
• “Student enrichment” presentations.
• Fliers
• As in previous years Sunstar, Newsminer, and ASCE journal publications.
• Posters at conference and hosted events.
• Published final results.

These programs will serve to spread the word about sustainability and engineering opportunities within the UAF community.

**Qualifications and experience:**
My team and I all have extensive experience in research, development, and testing in every aspect of our project. We have dedicated 1500 hours+ in total and have 40 students participating over the last six month. We have a strict discipline to time and completion. We are National Champions! This makes every student in UAF a national champion. We have four complete lab rooms to conduct our research and development, plus two machine shops. As UAF engineering students we are the best at what we do, that is we produce responsible results, and we achieve all our goals. So let’s RISE above together.

**Technical advisers and collaborators**

Dr. Hulsey (Civil Engineering) - Steel Bridge/Concrete Canoe Lead adviser and in charge of finances.

Dr. Jenny Liu (Civil Engineering) – Concrete Canoe Mix design adviser.

Dr Wilhelm (Civil Engineering) – Steel Bridge analysis and fabrication adviser.