UAF Ice Arch 2014
Conceptual Design

Designers:

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Central Concept: Dome with Flying Buttresses

- Four columns supporting a **dome**
- To counteract the tendency of the dome to spread, **flying buttresses** will be used to channel horizontal forces from the dome down to the ground
- Dome will contain a **hoop reinforcement** in its lowest points
Arch Diagram (3D Views)
*All dimensions are in feet.*
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Conservative Force Calculations

RESULTANT FORCE

FORCE RESOLUTION INTO SUPPORTS

FLYING BUTTRESS REACTION FORCE

COLUMN REACTION FORCE

950
Construction Challenges

Tedious? Perhaps. But the concept of constructing domes is ancient. We ought to be able to rise to this challenge.

A number of construction options exist for this particular design. For instance......
Construction Method One

- Use free-standing, ribbed falsework to create the final dome shape, and apply water by spraying layers to form dome
- Incorporate a rebar hoop reinforcement
- Construct columns and flying buttresses using molds and successive layers of frozen water
- Obtain ice blocks from Ice Alaska for the four large supporting blocks
Construction Method Two

- Freeze and construct columns and flying buttresses
- Construct a large outside mold in which to freeze the dome itself
- Incorporate a rebar hoop reinforcement
- After dome is complete, sandwich it between large wooden "bowls" and lift it into place
Tentative Material List and Cost Analysis

- 460 cubic feet (~13 tons) of ice
- $800 for plywood, 4x8, 4x4, 2x6, 1x4 and visqueen
- $400 for Ice from Ice Alaska for the large supporting blocks
- $300 for rebar and other reinforcing materials as necessary
Thank you for the opportunity to present a design for the UAF 2014 Ice Arch!!

Your comments, questions, and suggestions are now invited. This input will be vital to the success of our project.