2014-2015 Concrete Canoe

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NORTHERN ARIZONA UNIVERSITY

HIGH ALTITUDE ENGINGEERING

Project Management

- Jeremy DeGeyter – Project Manager
- Matt Snyder – Structural Analysis Lead
- Kristin Van Sciver – Concrete Lead
- Cynthia Alvarez – Reinforcement Lead
- Ramon Aguilar – Quality Control and Safety Officer

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Project Understanding

Introduction

- The Concrete Canoe project provides "hands-on, practical experience and leadership skills by working with concrete mix designs and project management" [6].

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Background

- Last's years Concrete Canoe "Spirit" finished 13th out of 18 at PSWC 2014 held in San Diego, California.
- The wood strip mold that was reused for "Spirit" will not be used for this year's Canoe.
- Concrete included Portland cement, sand, Poraver, and reinforcing fiberglass mesh

Project Understanding

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Client

Mark Lamer, P.E.

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Technical Advisor

Thomas Nelson, P.E.

[6]

Stakeholders

Client- Mark Lamer
Technical Advisor- Thomas Nelson
ASCE-National And Student Chapter
Northern Arizona University

Project Understanding

Project Description

The team is required to design and build a concrete canoe for the PSWC 2015 competition held in Tucson, AZ.

Competition will be scored in 4 categories:

- Final Product-25%
- Oral Presentation-25%
- Design Report-25%
- Canoe Races-25%

Technical Requirements

Concrete Properties:

- Compressive Strength
- Tensile Strength
- Shrinkage

Reinforcement Properties:

- Tensile Strength
- Bond Properties

Hull Design:

- Structural Analysis
- Hydraulic Characteristics

Constraints & Exclusions

Constraints:

- Money
- Time
- Personnel

Exclusions:

- Mold Fabrication
- Staining

Scope of Services – Project Startup

Fundraising

- Companies, family and friends
- Materials
- Technical support
- Paddles and life jackets

Safety Training

- Online safety courses
- Field safety
- Chemical hygiene
- Tool SOP check off

Paddling Practice

- Lake Mary
- NAU Wall Aquatic Center
- Classroom training

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Scope of Services – Project Design

Structural Analysis

- 2-D Beam moment analysis
- Minimum compressive strength, f'c
- Compressive stress
- Hull design
- Prolines, AutoCAD, RISA3D, Excel

Concrete Mix

- Cementitious materials
- CeraTech ekkomaxx™
- Aggregates
- Property enhancing admixtures

Reinforcement

- Percent open area
- Thickness
- Suitability

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Scope of Services – Construction

Mold Fabrication

- Depends on funding
- CNC Machining

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Pour Day

- Trotta's Farm
- Apply layer by layer
- Shotcrete
- Post-tensioning

Curing and Finishing

- Monitored daily
- 28 day strength
- Staining will be done by others

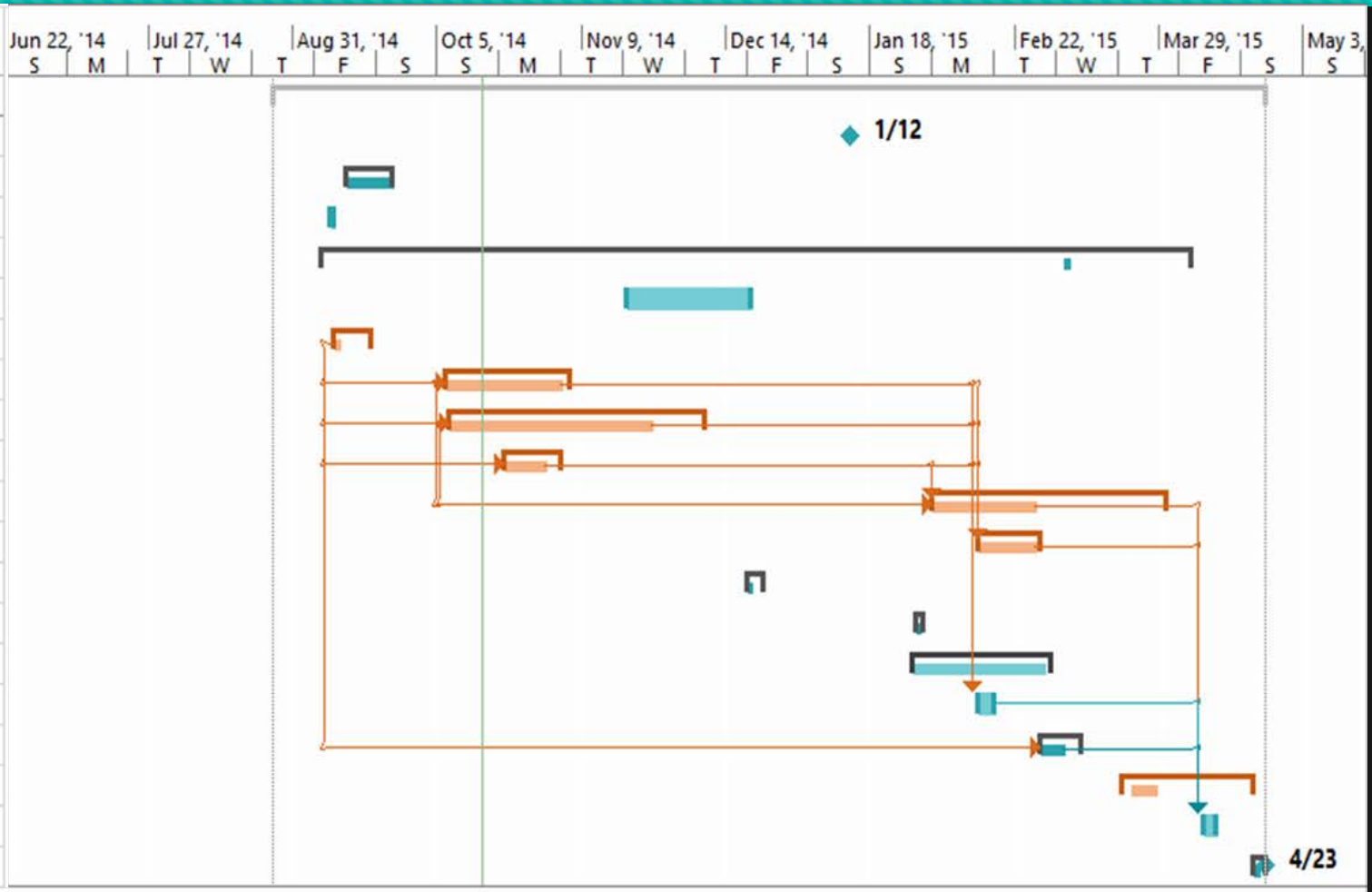
Scope of Services – Project Design

Broader Impacts

- Sustainable material will be used to minimize environmental impacts
- Efforts will be taken to reduce the amount of material waste generated
- Impacts after competition:
  - NAU standings
  - ASCE popularity
  - Precedence for future students
  - Future sponsor support

Project Schedule

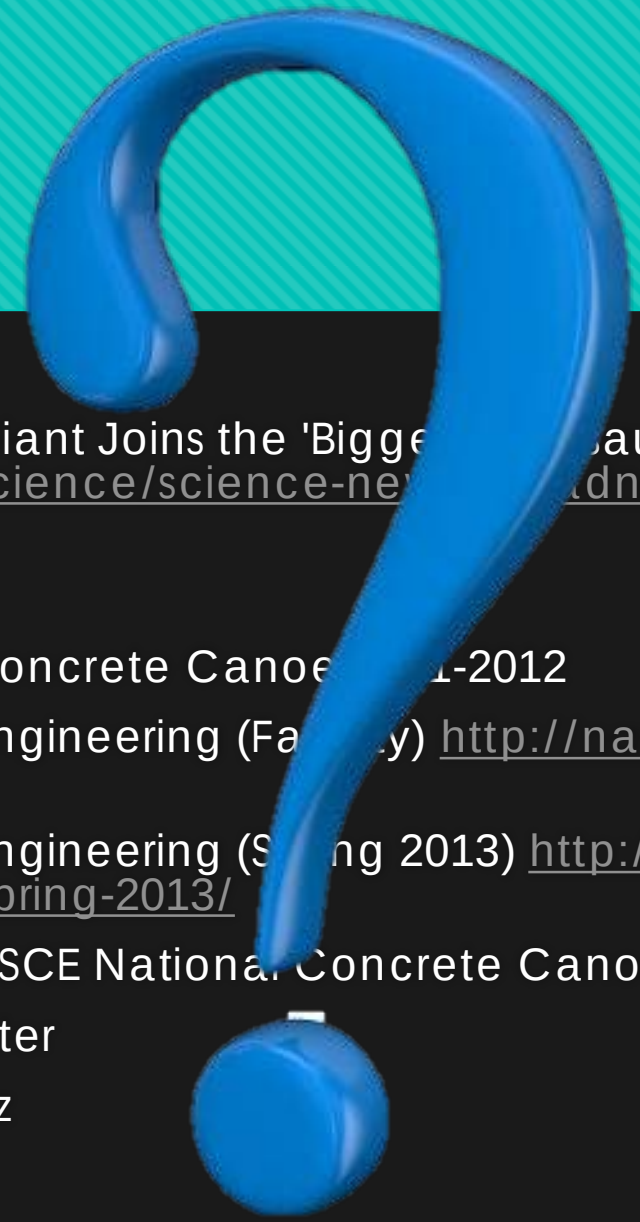
	Task Name	Duration	Start	Finish
0	14-15 Concrete Canoe Schedule2	173 days	Tue 8/26/14	Thu 4/23/15
1	1 90% Project Completion	25 days	Tue 8/26/14	Mon 1/12/15
2	2 Inventory	8 days	Sat 9/13/14	Tue 9/23/14
5	3 Safety Training	1 day	Tue 9/9/14	Tue 9/9/14
6	4 Paddling Practice	152 days	Sun 9/7/14	Sun 4/5/15
8	5 Fundraising	22 days	Thu 11/20/14	Fri 12/19/14
9	6 Rule Review	7 days	Wed 9/10/14	Thu 9/18/14
11	7 Structural Analysis	22 days	Tue 10/7/14	Wed 11/5/14
17	8 Mix Designs	44 days	Wed 10/8/14	Mon 12/8/14
24	9 Reinforcement Design	10 days	Tue 10/21/14	Mon 11/3/14
28	10 Design Paper	41 days	Mon 2/2/15	Mon 3/30/15
38	11 Engineer's Notebook	11 days	Fri 2/13/15	Fri 2/27/15
43	12 Mold Fabrication	2 days	Fri 12/19/14	Mon 12/22/14
45	13 Theme	2 days	Thu 1/29/15	Fri 1/30/15
48	14 Pour Day Preparation/Monitoring	24 days	Wed 1/28/15	Mon 3/2/15
56	15 Conference Oral Presentation	2 days	Fri 2/13/15	Mon 2/16/15
57	16 Product Display	7 days	Sat 2/28/15	Mon 3/9/15
61	17 Canoe Finishing	22 days	Fri 3/20/15	Mon 4/20/15
67	18 ASCE PSWC Conference (Tucson, AZ)	3 days	Thu 4/9/15	Sat 4/11/15
68	19 Final Project Presentation/Deliverable	3 days	Tue 4/21/15	Thu 4/23/15



Cost of Services Break Down

1.0 Personnel	Classification	Hours	Rate, $/hr	Cost
	SENG	282	100	$28,200
	ENG	989	80	$79,120
	LAB	444	62	$27,528
	INT	1032	52	$53,664
	Total Personnel			$188,512
2.0 Travel	Lodging/Food	per person		$250
	Registration	per person		$120
	Mileage	$0.56/mi	520 miles	$291
	Total Travel			$2,141
3.0 Direct Costs	Materials			$4,000
	Total Direct Costs			$4,000
4.0 Total				**$194,653**

References



- [1] Dreadnoughtus: A New Giant Joins the 'Bigge saur' Parade (NBC News) http://www.nbcnews.com/science/science-ne dnoughtus-new-giant-joins-biggest-dinosaur-parade-n195306
- [2] Picture by Noel Cruz
- [3] Picture by “Ponderosa” Concrete Canoe 1-2012
- [4] Civil and Environmental Engineering (Fa y) http://nau.edu/cefns/engineering/civil-environmental/faculty/
- [5] Civil and Environmental Engineering (S ng 2013) http://nau.edu/CEFNS/Engineering/Civil-Environmental/Newsletters/Spring-2013/
- [6] ASCE, and NCCC. 2015 ASCE Nationa Concrete Canoe Competition Rules & Regulations.
- [7] Picture by Jeremy DeGeyter
- [8] Picture by Cynthia Alvarez