NORTH STAR ENGINEERING

POLARIS

Northern Arizona University ASCE Concrete Canoe Team North Star Engineering 2015-2016

Project Management

- Chelsie Kekaula Project Manager
- Evan Kaichi Concrete Lead
- Brent Lipar Structural Analysis Lead
- Colton McConnell Construction Manager
- Emily Melkesian Reinforcement Lead
 Conference Manager



Figure 1: 2015-16 Concrete Canoe Team [1]

Project Purpose

- Hands on Experience
- Practical Experience
- Leadership Skills
- Project Managment



Figure 2: NAU Star Logo [3]

Project Background

- Last's year's Concrete Canoe "Dreadnoughtus" finished 3rd at PSWC 2015
- Sacrificed stability to optimize speed
 - Lengthened the canoe and made
 it narrower



Figure 3: Dreadnoughtus [8]

Potential Challenges

- Resources
 - Finances
 - Equipment
 - Materials
- Time
 - Curing Time
 - Conference
- Weather
 - Paddling



Figure 4: Snowy San Francisco Peaks [5]

Stakeholders

- Client: Mark Lamer P.E.
- Tech Advisor: Thomas Nelson P.E
- ASCE National Board
- NAU
- NAU ASCE Student Chapter
- Sponsors



Figure 5: Mark Lamer [6]



Figure 6: Thomas Nelson [7]

ASCE Conference

- The team is required to design and build a concrete canoe for the 2016 ASCE Pacific Southwest Conference in Long Beach, California
- Overall team score is based on four categories
 - Final Product (25%)
 - Design Report (25%)
 - Oral Presentation (25%)
 - Canoe Races (25%)



Figure 7: Dreadnoughtus [8]

Exclusions

Canoe Mold

- Will not construct a new mold
 - Renovate by filling in the depressions and seams
 - Place new shrink wrap

Canoe Coffin

- Will not construct a new coffin
 - Renovate by adding padding to the coffin cross-sections



Figure 8: Male Foam Mold [9]

Project Design and Technical Consideration

- Structural
 - Shear and Moment Analysis
 - Hull Analysis
 - Minimum Compressive Strength
 - Excel, RISA 3D, Prolines 7, AutoCAD
- Concrete
 - Ekkomaxx™
 - Aggregate
 - Admixtures
 - Testing Strength of Concrete Mixes
- Reinforcement
 - Percent of Open Area
 - Flexibility
 - Strength
 - Post-Tensioning



Figure 9: Reinforcement Mesh [10]

Construction

- Pour Day
 - Civil and Environmental Engineering Field Station
 - Shotcrete
 - Reinforcement
 - Complete Aesthetics
- Mold and Coffin Renovation
- Curing System
 - Create a Reusable "incubator"
- Finishing
 - Sanding
 - Sealing



Figure 10: 2015 Curing System [11]

Schedule – Gantt Chart

	Task Name 👻	Aug 16, '1 T W	5 Sep 6, T F	15 Sep 27, S S N	15 Oct 18, '15 T W T	Nov 8, '15 F S S	Nov 29, '15 De M T W	ec 20, '15 Jai T F S	n 10, '16 Jan 31, '1 S M T W	6 Feb 21, '16 / T F S	Mar 13, '16 Ap S M T	r 3, '16 Apr 24, W T F S
1	• NAU ASCE 2015-16 Concrete Canoe: Polaris											
2	1.0 Project Management		1									
3	1.1 Concrete Canoe Team Set		9/4									
4	1.2 Safety Training/ Farm Clean-Up											
5	1.3 ASCE Conference Rule Review - Design			10	/2							
6	1.4 Fundraising			L.								
7	2.0 Paddling											
8	3.0 Analysis and Testing											
9	3.1 Hull and Structural Analysis						-					
10	3.2 Concrete Mix Designs											
11	3.3 Reinforcement/ Post-Tensioning Design								-			
12	3.4 Composite Concrete/ Reinforcement Testing											
13	3.5 Structural Verification											
14	4.0 Construction											
15	4.1 Mold, Coffin, Incubator Construction											
16	4.2 Canoe Pour											
17	4.3 Canoe Sanding and Sealing									1 and		
18	5.0 ASCE PSWC											
19	6.0 CENE 486 Capstone										1	

Figure 11: Gantt Chart

Schedule – Critical Path

	Task Name 🔹	Aug 16, '15 T W	Sep 6, T F	15 Sep 27 S S	7, 15 Oct M T V	18, 15 N V T F	lov 8, '15 I S S	Nov 29, 15 M T	Dec 20, '15 W T F	Jan 10, '16 S S M	Jan 31, '16 I T W	Feb 21, '16 T F S	Mar 13, '16 S M	Apr 3, '16 T W T	Apr 24, '1 F S
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2	1.0 Project Management					-									
3	1.1 Concrete Canoe Team Set		9/4												
4	1.2 Safety Training/ Farm Clean-Up														
5	1.3 ASCE Conference Rule Review - Design			1	10/2										
6	1.4 Fundraising			Ĭ		-									
7	2.0 Paddling														
8	4 3.0 Analysis and Testing						21								
9	3.1 Hull and Structural Analysis								1						
10	3.2 Concrete Mix Designs					Ì									
11	3.3 Reinforcement/ Post-Tensioning Design					1		0							
12	3.4 Composite Concrete/ Reinforcement Testing									in the second second	1				
13	3.5 Structural Verification									j	1				
14	4.0 Construction							1					-		
15	4.1 Mold, Coffin, Incubator Construction										•				
16	4.2 Canoe Pour											1			
17	4.3 Canoe Sanding and Sealing														
18	5.0 ASCE PSWC														
19	6.0 CENE 486 Capstone													•	

Figure 11: Gantt Chart

Staffing & Cost

1.0 Personnel:

- SENG: Senior Engineer
- ENG: Engineer
- LAB: Lab Technician
- INT: Intern
- AA: Administrative Associate

2.0 Travel:

- Conference Registration
- Lodging/Food
- Mileage

3.0 Expenditures:

- Materials
- Equipment

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1.0 Personnel			
Classification:	Hours	Billing Rate	Cost
SENG	267	\$93.77 /hr	\$25,036
ENG	228	\$64.03 /hr	\$14,598
LAB	224	\$34.49 /hr	\$7,726
INT	212	\$12.68 /hr	\$2,688
AA	458	\$32.76 /hr	\$15,006
			\$65,054
2.0 Travel			
Conference Registra	tion:	\$150.00 /person	\$1,500
Lodging/Food:		\$250.00 /person	\$2,500
Mileage (miles roun	dtrip):	\$0.56 /mi	\$535
			\$4,535
3.0 Expenditures			
Materials:		\$5,250.00 /person	\$6,750
Equipment:		\$1,500.00 /person	
		Total Project Cost:	\$76,340
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Table 1: Cost Breakdown

Broader Impacts

- Future NAU Concrete Canoe Teams
- NAU Civil Engineering Department



Figure 12: 2015-16 Concrete Canoe Team [1]



Figure 13: 2014-15 Concrete Canoe Team [12]



Figure 14: 2013-14 Concrete Canoe Team [13]

References

[1] Photo taken by Gerjen Slim

[2] ASCE, and NCCC. 2015 ASCE National Concrete Canoe Competition Rules & Regulations.

[3] NAU Student Affairs, Northern Arizona University Logo. https://www.youtube.com/watch?v=ng3C1GUcg4Q

[4] Dreadnoughtus: A New Giant Joins the 'Biggest Dinosaur' Parade (NBC News) http://www.nbcnews.

com/science/science-news/dreadnoughtus-new-giant-joins-biggest-dinosaur-parade-n195306

- [5] KNAU, Snow Storm. URL: http://knau.org/post/knau-meteorologist-lee-born-weekends-big-snow-storm#stream/0
- [6] Civil and Environmental Engineering (Faculty) http://nau.edu/cefns/engineering/civil-environmental/ faculty/
- [7] Civil and Environmental Engineering (Spring 2013). http://nau.edu/CEFNS/Engineering/Civil-Environmental/ Newsletters/Spring-2013/
- [8] Photo taken by Emily Melkesian
- [9] Photo taken by Charlie Wilson
- [10] Photo taken by Charlie Wilson
- [11] Photo taken by Charlie Wilson
- [12] Photo taken by Noel Cruz
- [13] Photo taken by Gerardo Gonzalez