

# NAU SAE



# TOOLBOX

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Engineering 218

# Project Description

## Department of Mechanical Engineering

- NAU Baja SAE Capstone
- NAU Formula SAE Capstone
- Professor David Willy

## Why?

- Yearly SAE collegiate competitions
- Need for mobile tools and equipment and storage at competitions
- Incremental increase from the current wagon storage/transport system



Figure 1: 2025 Baja SAE Pit Setup



Figure 2: Benchmark/Projected End Goal

# Design Description

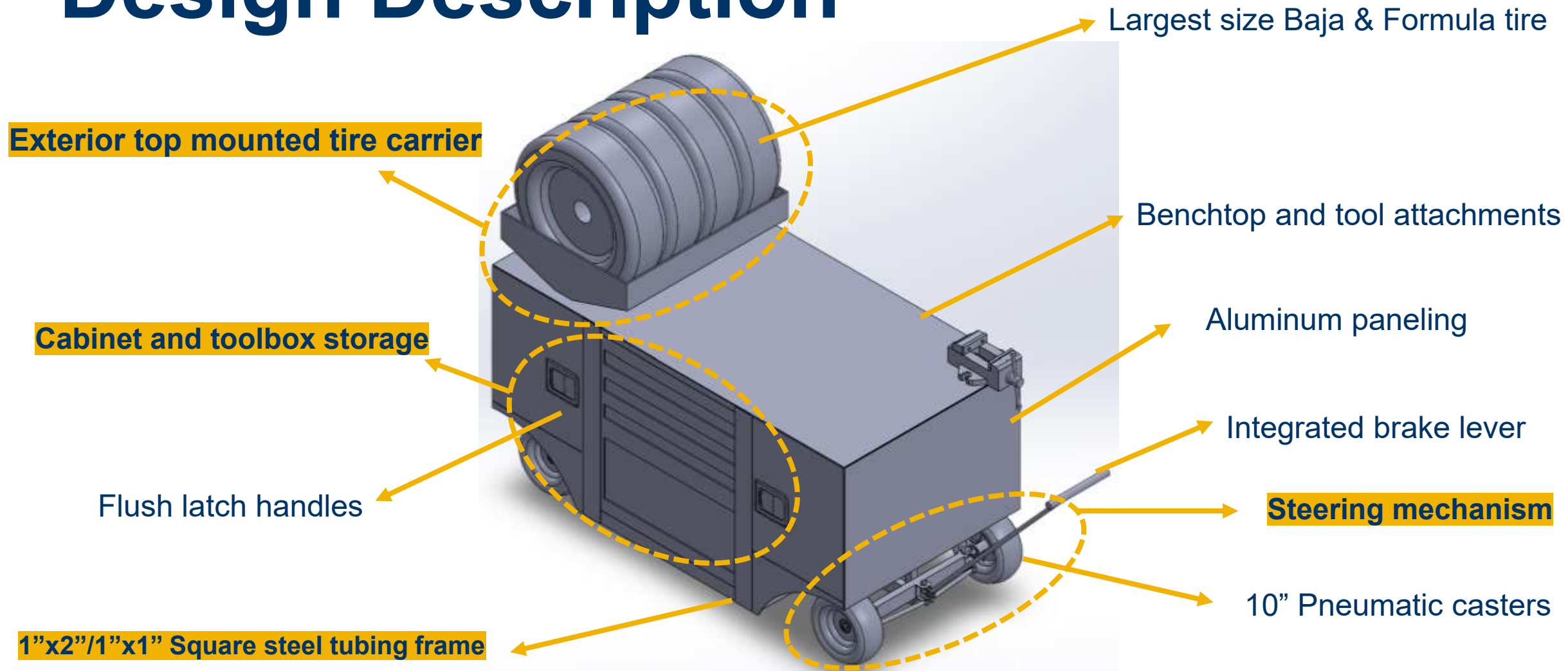


Figure 3: Top Model View

# Design Efforts

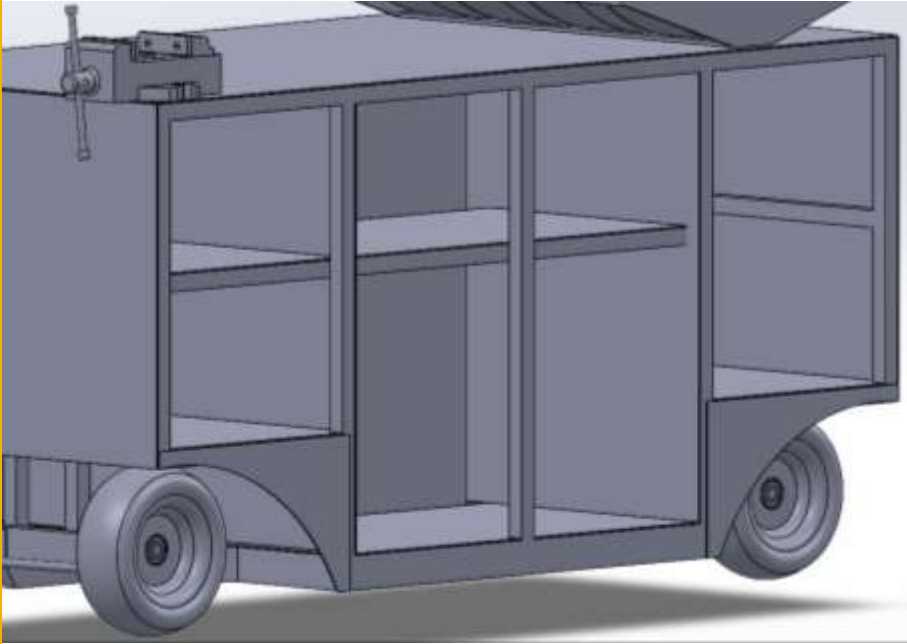


Figure 4: Modeled Cabinet Storage



Figure 5: Modeled Steering Mechanism

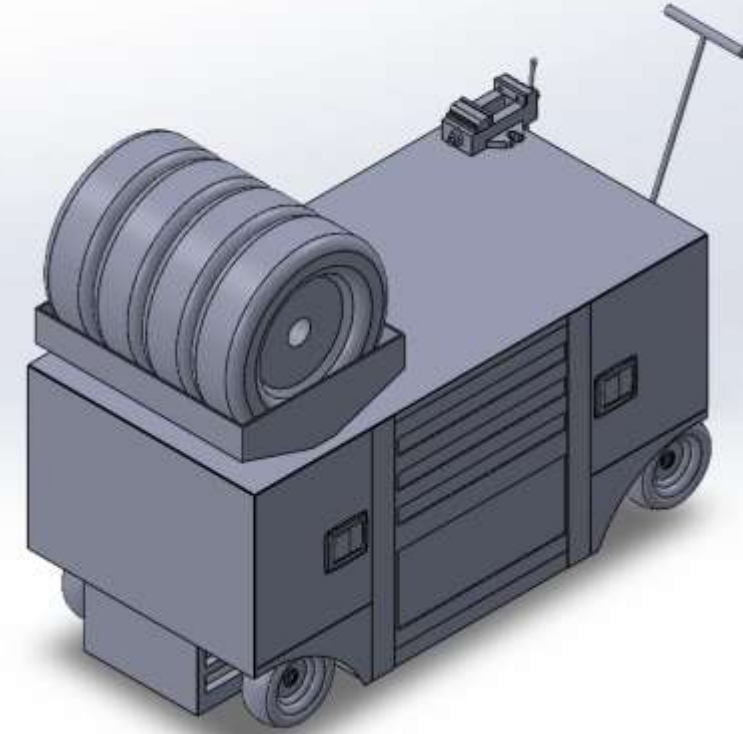


Figure 6: Tire Holder Schematic

# Progress Chart

\*Complete\*



Figure 7: Raw Frame CAD

\*In Transit\*



Figure 8: Miller Custom Fab Sponsored Frame

\*Projected\*



Figure 9: Benchmarked Frame Construction

\*Projected\*



Figure 10: Benchmarked Completed Pit-cart

## Initial:

Completed CAD  
Completed calculations  
Completed BOM

## 33% Build:

Parts 100% Ordered  
Base frame constructed  
Attached wheels  
Attached handle

## 67% Build:

Working brakes  
Integrated toolbox  
1x1" Framing around toolbox  
Cardboard mock-panels

## 100% Build:

Full aluminum siding  
Tools/equipment in place  
Completed assembly manual  
Tests completed



# Purchasing Plan

- 70% Purchased
- 55% On Hand
- \$2,000 Starting budget from NAU SAE
- All major parts ordered/delivered
- Waiting on sponsored frame component for next steps
- Leftover budget for in-person hardware needs
- Staying below allocated budget

Part	Price	Status
<b>Order Form 1:</b>		
13"Dx24.25"Wx29.33"H Box with 238 tools	\$ 284.39	Delivered
Fire extinguisher mount for 2.5lb extinguisher	\$ 14.82	Delivered
9" Safety wire plier kit	\$ 26.62	Delivered
Brake bleed kit	\$ 23.38	Delivered
2500W Inverter Generator	\$ 294.90	Delivered
120 V Power strip	\$ 31.87	Delivered
25 ft Extension cord	\$ 12.75	Delivered
Hinged aluminum trailer ramp extension	\$ 85.65	Ordered
Formula rear swivel lift jack	\$ 284.87	Delivered
	\$ 1,059.25	
<b>Order Form 2:</b>		
0.065" 1x1 Square Tubing 6' Qty 18	\$ 306.90	Delivered
0.020" 36x96" Aluminum Paneling Qty 4	\$ 520.84	Delivered
Tax+Shipping	\$ 228.55	
	\$ 1,056.29	
<b>Card/Check Order:</b>		
Miller Custom Fab Brake Addition		Invoiced
<b>In Person:</b>		
Door Latches/magnets? Handles		
Long Hinges		
Hardware		
Rivets		
Dzus nuts and mounts		
Tie-down Anchors		
Spray Paint		
<b>Donated/Sponsored:</b>		
Miller Fab Base Frame	\$ 1,150.00	In Transit
Monetary	\$ 501.00	Deposited
	\$ 1,651.00	
<b>Total Spent:</b>	\$ 2,115.54	
<b>Total Left:</b>	\$ 385.46	

Invoices	Price
<b>Order Form 1:</b>	
Amazon	\$ 103.47
UTV Nut	\$ 85.65
Summit	\$ 290.84
Amazon	\$ 284.39
Amazon	\$ 294.90
<b>Order Form 2:</b>	
McMaster Carr	\$ 1,056.29
<b>Order Form 3:</b>	
Miller Custom Fab	
<b>Order Form 4:</b>	
In Person	
Spent	\$ 2,115.54
Leftover	\$ 385.46

Figure 11: In Progress Purchase Plan

# Manufacturing Plan

\*Rows From BOM\*

Part	Manufacture Status	Location	Comment
Base Frame	100% Built	Sponsor Shop	In Transit
Frame shell	Upcoming Build	98C Machine Shop	Requires Base Frame
Aluminum Panels	Upcoming Build	98C Machine Shop	Requires Base Frame
Aluminum Tire Holder	Upcoming Build	98C Machine Shop	Requires Base Frame
Brake Rotors	100% Built	Sponsor Shop	In Transit
Brake Calipers	100% Built	Sponsor Shop	In Transit
Wheel Hubs	100% Built	Sponsor Shop	In Transit
Steering Handle	100% Built	Sponsor Shop	In Transit
Extinguisher mounting	Upcoming Build	98C Machine Shop	Requires Base Frame

Figure 12: In Progress Manufacturing Plan

# Hardware Demonstration



Figure 13: Toolbox and Tools Hardware



Figure 14, 15: Additional Parts Hardware



Figure 16: Material Hardware



# Gantt Chart Update

- On-time
- Ordering complete
- Build in progress
- Documenting in progress
- Testing in progress
- Website updates regularly
- Gantt chart kept up-to-date with progress

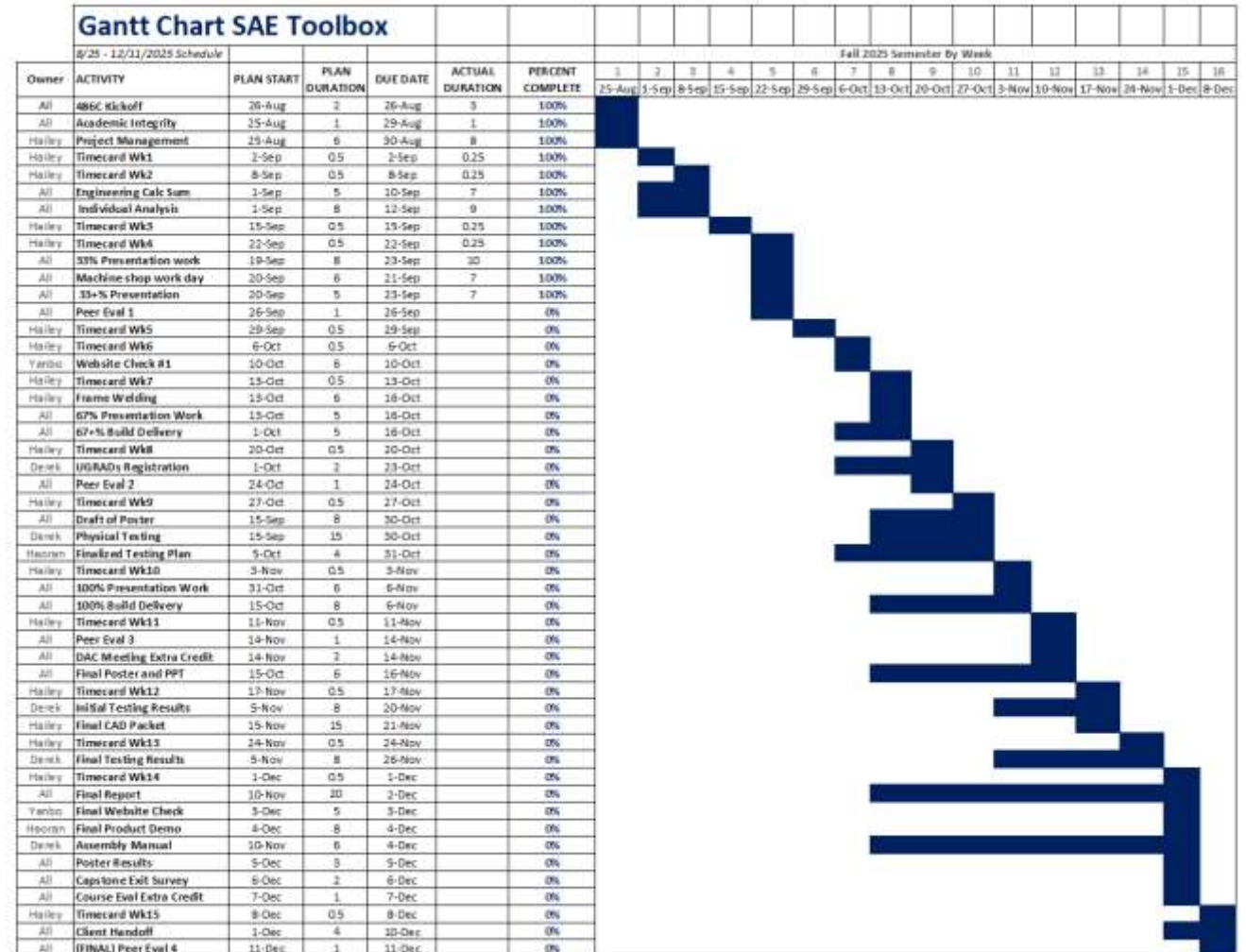


Figure 17: SAE Toolbox Fall 2025 Gantt Chart

# References

- [1] R. G. Budynas and J. K. Nisbett, *Shigley's Mechanical Engineering Design*, 11th ed. New York, NY, USA: McGraw-Hill, 2020.
- [2] SAE International, "Baja SAE Rules 2025," SAE International, Warrendale, PA, USA, 2025.
- [3] Extreme Tools Inc., "Extreme Portable Tool Storage Systems," 2025
- [4] McMaster-Carr, "Product Catalog," 2025
- [5] ASME, *ASME Code of Ethics of Engineers*, American Society of Mechanical Engineers, 2023
- [6] ASM International, *Properties and Selection of Aluminum Alloys*, Materials Park, OH, USA: ASM International, 2019.
- [7] American Welding Society (AWS), *Welding Handbook: Welding Processes*, 10th ed. Miami, FL, USA: AWS, 2018.
- [8] H. Kerzner, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 13th ed. Hoboken, NJ, USA: Wiley, 2022.

# Thank You

# Questions?