SAE Toolbox

Project Management – 486C

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Summer 2025 - Fall 2025

Project Sponsor: NAU SAE
Faculty Advisor: David Willy
Instructor: Armin Eilaghi

1. Reflection

1.1 Project Management – Successes

Last semester, our team successfully navigated the planning and initial design phases of the SAE Toolbox project. Several aspects of our project management and communication efforts stood out:

- Held weekly staff meetings with clearly assigned agendas and follow-up action items
- Created a preliminary BOM early, allowing us to start contacting sponsors before the 486C start
- Established communication with local Flagstaff fabrication labs early to check manufacturability
- Used Microsoft Teams and WhatsApp for fast and effective team communication
- Created a shared Teams folder structure with clear file naming conventions

1.2 Project Management – Room for Improvement

Despite the successes, we identified several areas that require improvement moving into Capstone II:

- Delays in Gantt chart updates caused uncertainty about real timelines
- Some parts of the BOM lacked supplier research or lead time estimates
- Decision-making sometimes lagged due to lack of clear delegation

1.3 Project Management – Action Items

To address the above, we've developed a set of targeted action items:

1. Enforce weekly meeting
    - We will implement a meeting attendance log and assign weekly roles (note-taker, timekeeper, task lead) to increase responsibility.
    - Improvements: Team reliability and on-time deliverables.
2. Assign Gantt chart ownership
    - One team member will own and update the Gantt chart weekly.
    - Improvements: Clarity of timelines and team task alignment.
3. Finalize full BOM with vendor research
    - Each subsystem lead will complete BOM sections with cost, vendor, manufacturer, and lead times.
    - Improvements: Faster part ordering and prevents last-minute delays.
4. Assign subsystem leaders
    - Each major section of the cart (frame, brakes, power supply, cabinets/drawers) will have a designated leader.
    - Improvements: Decision-making speed and accountability.

1.4 Remaining Design Efforts

Here are the remaining major design tasks to be finalized before fabrication begins:

- Finalization of locking mechanism for drawer system
- Electrical layout and integration of charging system
- Braking handle mount adjustments for reliability
- Material thickness and fastener selection for structural members
- CAD model cleanup and final drawing package generation

2. Gantt Chart

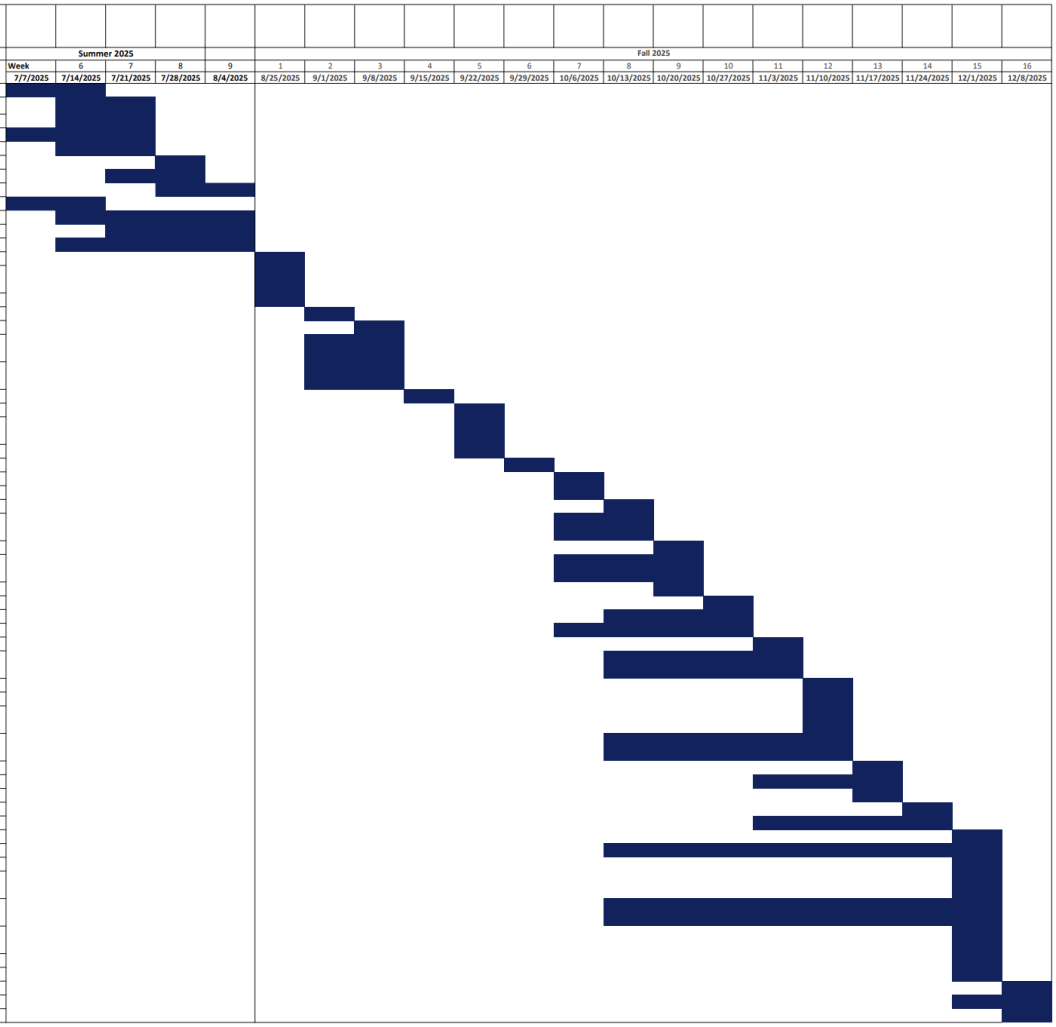
The Gantt Chart provides a tentative layout of key assignments and deadlines for the 2025 Fall semester. The columns on the left provide due dates, project start dates, and owners of each task. This helps the team distribute the workload and continue to exceed deadlines. Major milestones include the three hardware status updates that lead to our final poster compilation per the UGrad specifications.

Figure 1: Tentative ME 486C Schedule

Gantt Chart SAE Toolbox

7/17 - 12/11/2025 Schedule

Owner	ACTIVITY	PLAN START	PLAN DURATION	DUE DATE	ACTUAL DURATION	PERCENT COMPLETE
All	Peer Eval 2	17-Jul	1	16-Jul	1	100%
Derek	Brake System Prototype	17-Jul	7	24-Jul	5	100%
Hailey	VR CAD Prototype	17-Jun	7	24-Jul	8	100%
Yanbo	Website Check #1	8-Jul	2	24-Jul	3	90%
All	Peer Eval 3	19-Jun	1	24-Jul	1	100%
Haoran	2nd Prototype	18-Jul	10	30-Jul	7	25%
All	Presentation 3	18-Jul	20	31-Jul	8	25%
All	Final BOM	24-Jun	15	1-Aug	12	75%
Yanbo	Website Check #2	8-Jul	1	1-Aug	1	50%
All	Report #2	18-Jul	20	1-Aug	12	50%
All	Peer Eval 4	25-Jul	1	1-Aug	1	0%
Hailey	Final CAD	17-Jul	20	5-Aug	15	40%
All	486C Kickoff	26-Aug	2	26-Aug		0%
All	Academic Integrity Assignment	25-Aug	1	29-Aug		0%
Hailey	Project Management	25-Aug	6	30-Aug		0%
Hailey	Timecard Wk1	2-Sep	0.5	2-Sep		0%
Hailey	Timecard Wk2	8-Sep	0.5	8-Sep		0%
All	Engineering Calculations Summary	1-Sep	5	10-Sep		0%
All	Self-Learning or Individual Analysis	1-Sep	8	12-Sep		0%
Hailey	Timecard Wk3	15-Sep	0.5	15-Sep		0%
Hailey	Timecard Wk4	22-Sep	0.5	22-Sep		0%
All	Hardware Status Update - 33+% build	20-Sep	5	25-Sep		0%
All	Peer Eval 1	26-Sep	1	26-Sep		0%
Hailey	Timecard Wk5	29-Sep	0.5	29-Sep		0%
Hailey	Timecard Wk6	6-Oct	0.5	6-Oct		0%
Yanbo	Website Check #1	10-Oct	6	10-Oct		0%
Hailey	Timecard Wk7	13-Oct	0.5	13-Oct		0%
All	Hardware Status Update - 67+% build	1-Oct	5	16-Oct		0%
Hailey	Timecard Wk8	20-Oct	0.5	20-Oct		0%
Derek	UGRADs/Efest Registration	1-Oct	2	23-Oct		0%
All	Peer Eval 2	24-Oct	1	24-Oct		0%
Hailey	Timecard Wk9	27-Oct	0.5	27-Oct		0%
All	Draft of Poster	15-Sep	8	30-Oct		0%
Haoran	Finalized Testing Plan	5-Oct	4	31-Oct		0%
Hailey	Timecard Wk10	3-Nov	0.5	3-Nov		0%
All	Hardware Status Update - 100% build	15-Oct	8	6-Nov		0%
Hailey	Timecard Wk11	11-Nov	0.5	11-Nov		0%
All	Peer Eval 3	14-Nov	1	14-Nov		0%
All	DAC Meeting Extra Credit	14-Nov	2	14-Nov		0%
All	Final Poster and Final PPT	15-Oct	6	16-Nov		0%
Hailey	Timecard Wk12	17-Nov	0.5	17-Nov		0%
Derek	Initial Testing Results	5-Nov	8	20-Nov		0%
Hailey	Final CAD Packet	15-Nov	15	21-Nov		0%
Hailey	Timecard Wk13	24-Nov	0.5	24-Nov		0%
Derek	Final Testing Results	5-Nov	8	26-Nov		0%
Hailey	Timecard Wk14	1-Dec	0.5	1-Dec		0%
All	Final Report	10-Nov	20	2-Dec		0%
Yanbo	Final Website Check	3-Dec	5	3-Dec		0%
Haoran	Final Product Demo Multiplier	4-Dec	8	4-Dec		0%
Derek	Operation/Assembly Manual	10-Nov	6	4-Dec		0%
All	Poster Presentation Delivery Results	5-Dec	3	5-Dec		0%
All	Capstone Exit Survey	6-Dec	2	6-Dec		0%
All	Course Eval Extra Credit	7-Dec	1	7-Dec		0%
Hailey	Timecard Wk15	8-Dec	0.5	8-Dec		0%
All	Client Handoff	1-Dec	4	10-Dec		0%
All	(FINAL) Peer Eval 4	11-Dec	1	11-Dec		0%



3. Top-Level Finances

The SAE Toolbox project has been allocated a budget of $2,000 through the NAU SAE program. Additional fundraising activities are still under consideration and have partially contributed to the budget. As of this report, estimated expenses total $1,387.35, leaving a projected margin for unforeseen costs. A large parts sponsorship from Miller Fabrication of a $1,150.00 value allows us to save our raised cash funds for further parts purchases.

Table 1. Top-Level Finances Breakdown

Category	Income / Expense	Notes
Income		
NAU SAE Allocation	$2,000.00	Provided through client funding
Monetary Sponsorship	$501.00 (planned)	Funds deposited to FNAU
In-Kind Part Sponsorship	$1,150.00	Frame & wheel components sponsored
Total Income	$3,651.00	
Expenses		
Prototype BoM Purchases	$650.00 (est.)	Initial build hardware, casters, tubing
Final Prototype BoM	$637.35 (est.)	Drawer system, brakes, electrical modules
Fabrication (welding/CNC)	$75.00 (est.)	May vary with shop scheduling
Coatings/Paint	$25.00 (est.)	Powder coat or paint TBD
Travel Expenses	$0.00 (N/A)	No team travel anticipated
Total Expenses (Necessary)	$1,387.35	
Remaining Budget	$612.65	Reserve for unforeseen costs, replacements, or sponsor-requested changes
Total Expenses (Extra)	$2,206.29	Allowable extra spending
Remaining Budget	$294.71	Reserve for unforeseen costs

This top-level financial summary indicates that the project remains comfortably under budget, with ~30% of the allocation available as contingency. The primary risks to this financial outlook include changes in vendor lead times (requiring expedited shipping), unexpected fabrication costs, or adjustments to the electrical subsystem.

4. Purchasing Plan

The team is working to ensure that all components for the SAE Toolbox project are purchased within the allotted $2,000 budget. As of now, the total estimated cost stands at $1,387.35, leaving a comfortable margin for any unforeseen expenses or additional hardware needs. We have included a sub-section underneath the main BOM to show additional parts that are allowable for purchase due to our budgeting efforts. These additional parts bring the overall spendable total to $2,206.29, leaving us with $294.71 for emergency purchases. The status column allows us to identify which parts have been ordered, and what parts are still needed. The right-most column (not pictured) includes the links for each product for fast purchasing efforts. The tentative BOM is pictured below.

Subassembly	Part #	Description	Qty	Price	Total	Manufacturer	Status
Necessary Parts:							
Frame		Roller pit cart frame with casters	1	$ -	$ -	Miller Custom Fab	In Transit
		Tie-down anchors 4 pcs	1	$ 14.99	$ 14.99	Pamazy	
		1x1" Steel Tubing	6 ft	$ 50.80	$ 101.60	Home Depot	
		36x36x0.02" Aluminum paneling	6	$ 34.47	$ 206.82	Home Depot	
Toolbox		13"Dx24.25"Wx29.33"H Box with 238 tools	1	$ 209.99	$ 249.98	Powanli	
Tools		4in table top swivel vice	1	$ 34.99	$ 34.99	Central Machinery	
		Fire extinguisher mount for 2.5lb extinguisher	1	$ 18.99	$ 18.99	MANNIFEN	
		9" Safety wire plier kit	1	$ 17.98	$ 17.98	Gunpla	
		Brake bleed kit	1	$ 19.99	$ 19.99	Wenzhon	
Storage Cabinets		2 pack stainless steell flush latches w/key	3	$ 19.97	$ 59.91	Qwork	
Brakes		Brake kit for miller fab frame	1	$ 100.00	$ 120.00	Miller Custom Fab	
Power Supply		2500W Inverter Generator	1	$ 319.99	$ 319.99	PowerSmart	
		120 V Power strip	1	$ 29.98	$ 29.98	Trond	
		25 ft Extension cord	1	$ 12.74	$ 12.74	Amazon	
Shade		4.6x6.6ft Pullout sun shade with legs (55" L)	1	$ 89.99	$ 89.99	SKYSHALO	
Trailer ramp		Hinged aluminum trailer ramp extension	1	$ 74.11	$ 74.11	Justsail	
					$ 1,372.06		
Extra Parts:							
Workspace		Fold down aluminum table tray to mount	1	$ 59.00	$ 59.00	Holzoffer	
Ancillary		Formula rear swivel lift jack	1	$ 265.88	$ 265.88	Summit Racing	
Jacks		Race Ramps 10" Wheel lifts	2	$ 212.19	$ 424.38	Race Ramps	
Casters		Spare toolcart bolt on tire	1	$ 64.99	$ 64.99	Miller Custom Fab	
Sound system		Bluetooth speaker	1	$ 19.98	$ 19.98	Chifenchy	
					$ 2,206.29		

Figure 2: Tentative Fall 2025 BOM

Areas Needing More Planning:

- Some items (sheet metal and tubing) still need vendor confirmation for lead time
- Inverter generator or lead acid battery alternative needs final sourcing and safety checks
- Electrical components like charging modules lack specific vendor and backup options
- Some sponsor-requested items are awaiting donation confirmation

Action Items:

5. Confirm vendor lead times for frame and caster wheels
    - Assigned to: [Hailey Hein]
    - Improvement: Prevents delays in mechanical subsystem build
6. Finalize decision and supplier for battery and charging system
    - Assigned to: [Haoran Li]
    - Improves: Critical for functionality testing and safety review

5. Manufacturing Plan

At this stage of the SAE Toolbox project, a formal manufacturing plan has not been developed because all major components are commercially available and can be purchased online. Our design intentionally prioritizes off-the-shelf parts to streamline the build process and reduce reliance on custom fabrication. As a result, our current focus is on finalizing vendor selection, lead time verification, and order scheduling, rather than coordinating in-house manufacturing tasks.

Areas Needing More Planning:

- The welding schedule still needs confirmation with machine shop tech availability (or alternative i.e. Hailey's personal welder in Phoenix)
- CNC cut panel files need to be finalized and submitted to machine shop
- No backup plan if plasma cutter is unavailable for side panel cuts
- Powder coating vs painting still undecided based on budget

Action Items:

7. Schedule welding session with machine shop fabrication lab
    - Assigned to: [Derek Griffith]
    - Improvements: Ensures timely start of assembly
8. Submit panel cut files for CNC processing (If applicable)
    - Assigned to: [Hailey Hein]
    - Improves: Prevents delay in enclosure and drawer fitment
9. Finalize the finish method (paint vs powder coat)
    - Assigned to: [Yanbo Wang]
    - Improves: Cost and timeline accuracy