

## **Reflection**

### **Successes:**

Our successes as a sub team with respect to project management have improved throughout the duration of the semester. As we've learned how to function as a team, we have become more efficient and have gained a lot of knowledge. Below is a list of what we believe are our greatest successes.

- Working model of the front suspension including brake mounting, knuckles, and suspension linkages.
- Completed all deliverables on time to a good standard for class.
- Excellent progress on design work to streamline manufacturing processes.

### **Room for Improvements:**

Through last semester's class structure, our team has realized the flexibility needed in the beginning stages of FSAE. As the design process and deliverables sped up we got things done, however not always to the full potential as we wanted. Below are specifics on where we need to improve for this upcoming semester.

- Working efficiency
- Timeliness of starting projects before the last minute
- Specific communication between the whole team

### **Action Items:**

Working Efficiency- Communicate more efficiently within the sub team and as a whole team.

Timeliness- Begin assignments and deliverables for sub teams at least 1 week before they are due.

Communication- Create and update our team's meeting minutes more frequently and with more specifications

These action items will improve the sub team's ability to work efficiently as a team, and will help us to achieve our goals in the course and for the vehicle.

### **Remaining Design Efforts:**

- Finalize selected shocks
- Make a complete CAD model
- Finish design/testing on upright
- Determine force estimates on uprights
- Finish design/testing on rocker
- Determine forces that need to be resisted for control arms
- Finish testing on control arms
- Finish testing on dampers
- Complete minor component designs ie. Pedals, steering linkages from wheel to rack & pinion

## Gantt Chart

The project schedule for the suspension, steering, and brakes team is updated to reflect client needs, FSAE competition deliverables, and course submission milestones. The gantt chart below illustrates the work plan from the start of the semester leading up to the first Hardware Status Update and shows the breakdown for each subsystem.

## Gantt Chart

PROJECT TITLE	FSAE	COMPANY NAME	Lumberjack Racing
PROJECT TEAM	Suspension	DATE	1/18/26

TASK TITLE	TASK OWNER	START DATE	DUE DATE	PCT OF TASK COMPLETE	JANUARY													
					WEEK 1					WEEK 2					WEEK 3			
					M	T	W	R	F	M	T	W	R	F	M	T	W	R
<b>Suspension</b>																		
Review Fall Suspension Results & Open Issues	Full Team	1/12/2026	1/15/26	100%	█	█	█	█										
Final Suspension Geometry Refinement	Full Team	1/15/2026	1/28/26	25%						█	█	█	█	█	█	█	█	
Final Damper & Spring Selection	Tanner & Austin	1/22/2026	1/30/26	75%														█
Final Suspension BOM Definition	Chloe & Maeve	1/22/2026	1/30/26	75%														█
Suspension Supplier Selection & Quotes	Tanner	1/26/2026	1/30/26	50%														█
Purchase Bearings, Rod Ends, Bushings	Tanner	1/26/2026	2/2/2026	0%														
Purchase Dampers & Springs	Tanner	1/26/2026	2/2/2026	0%														
<b>Steering</b>																		
Review Fall Steering Design	Reuben	1/12/2026	1/15/26	100%	█	█	█	█										
Final Steering Geometry & Packaging	Reuben	1/15/2026	1/28/26	25%						█	█	█	█	█	█	█	█	
Final Steering BOM	Reuben	1/22/2026	1/30/26	80%														█
Steering Supplier Selection & Ordering	Reuben	1/26/2026	1/30/26	0%														
Purchase Steering Rack, Shafts, Joints	Reuben	2/2/2026	2/13/26	0%														
<b>Brakes</b>																		
Review Fall Brake Design & Open Issues	Reuben	1/12/2026	1/15/26	100%	█	█	█	█										
Final Brake System Design Refinement	Reuben	1/15/2026	1/28/26	25%						█	█	█	█	█	█	█	█	
Brake Supplier Evaluation & Lead-Time Review	Reuben	1/26/2026	1/30/26	0%														
Purchase Rotors, Calipers, Pads	Reuben	2/2/2026	2/13/26	0%														
<b>Class/Competition Deliverables</b>																		
Project Management	Full Team	12/5/26	1/18/26	100%	█	█	█	█	█	█	█	█	█	█	█	█	█	█
CAD Packet Redo	Full Team	1/15/26	1/22/26	75%						█	█	█	█	█	█	█	█	
Engineering Calculations Summary	Full Team		1/23/26	25%														█
Tech 2026 - ETC Review Form	Full Team		2/2/26	0%														
Hardware Status Update 33%	Full Team	1/15/26	2/5/26	10%														█

Figure 1: Gantt Chart

## Important Milestones

- Hardware Status Update 33%
- Purchasing parts within current budget
- Through testing of each design part (FEA)
- Updating current calculations with changed properties
- Fixing current design issues

## Top Level Finances

### Income

Expected Income	
Donor	Amount
Historic Brewing	TBD
Acquired Income 01/18/2026	
Donor	Amount
Gore	\$ 5,000
Flagstaff Chevrolet	\$ 5,000
GoFundMe	\$ 5,770
Seabury Fritz Architects	\$ 2,000
Landscaping Project	\$ 1,000
JGGM Engineering	\$ 1,000
Department	\$ 1,000
<b>Total</b>	<b>\$ 20,770</b>

Figure 2: Income

### Expenses

- Prototype BOM total expenses

Prototype 1			
Item	Cost	# of Parts	Description
Ball Joint	\$0.00	8	From 2024 Car
Wooden Dowels	\$0.00	-	In office
MDF	\$0.00	-	In shop
PVC	\$4.81	1	10' stick
Pushrod	\$0.00	1	From '24 car
Steering Rack	\$0.00	1	From '24 car
Cardboard	\$0.00	-	In shop
Plexiglass	\$0.00	-	In shop
Woodscrews	\$2.00	15	Home Depot 5/8
Brake Caliper	\$0.00	1	From '24 car
<b>Total Cost</b>	<b>\$6.81</b>		

  

Prototype 2			
Item	Cost	# of Parts	Description
Ball Joints	\$0.00	8	From '24 car
Rims	\$0.00	-	3D printed and filament donated
Knuckle (3D Print)	\$0.00	1	3D printed and filament donated
Control Arms (3D Print/PVC)	\$30.00	2	Home Depot 1/2" aluminum tube
Steering Rack	\$0.00	1	From '24 car
Tie Rods	\$0.00	1	From '24 car
Brake Calipers	\$0.00	1	From '24 car
Plywood	\$0.00	-	Previously in shop
<b>Total Cost</b>	<b>\$30.00</b>		

Figure 3: Prototype BOM

## Final Prototype BOM expenses

Subsystem	Item	Purchase/Manufacture/Owned	Individual Cost (\$)	# of Parts	Expected	Actual
Coilover/Pushrod	Damper	Purchase	\$ 249.00	2	\$ 498.00	
Coilover/Pushrod	Bearings	Purchase	\$ 5.89	8	\$ 47.12	
Coilover/Pushrod	Springs	Purchase	\$ 39.00	2	\$ 78.00	
Coilover/Pushrod	Aluminum Round Tube 3/4"	Manufacture	\$ 8.00	6	\$ 48.00	
Coilover/Pushrod	Rod Ends	Purchase	\$ 7.99	6	\$ 47.94	
Coilover/Pushrod	Metal 3D Print Filament	Manufacture	-	2	-	
Coilover/Pushrod	Rocker Spacer	Unsure	-	-	-	
Control Arm	Fasteners	Owned/Purchase	-	-	\$ 50.00	
Control Arm	Rod Ends	Purchase	\$ 3.59	24	\$ 86.16	
Control Arm	Ball Joints	Purchase	\$ 21.55	8	\$ 172.40	
Control Arm	Steel Tubing 5/8"	Manufacture	\$ 10.00	24	\$ 240.00	
Control Arm	Steel Flat Stock	Owned	\$ -	16	\$ -	
Steering	Steering Column Material	Manufacture	\$20.00	1	\$20.00	
Steering	Pillow Bracket Bearing	Purchase	\$58.85	1	\$58.85	
Steering	Steering Rack	Owned	\$0.00	1	\$0.00	
Steering	Steering Rack Mounts	Purchase	\$20.00	1	\$20.00	
Steering	Tie Rod Body Material	Manufacture	\$30.00	1	\$30.00	
Steering	Jam Nuts	Owned	\$0.00	4	\$0.00	
Steering	Tie Rod Ends	Purchase	\$53.99	2	\$107.98	
Steering	Double U-Joint	Owned	\$0.00	1	\$0.00	
Steering	Steering wheel quick connect	Purchase	\$90.00	2	\$180.00	\$228.86
Steering	Steering wheel	Manufacture	\$20.00	1	\$20.00	
Brakes	Brake Pads	Purchase	\$60.00	4	\$240.00	
Brakes	Master Cylinder Kit	Purchase	\$130.00	2	\$260.00	
Brakes	Fluid Reservoir	Purchase	\$0.00	2	\$0.00	
Brakes	Fluid	Purchase	\$5.00	2	\$10.00	
Brakes	Brake Lines	Owned	-	-	-	
Brakes	Rotor Stock	Manufacture	-	-	-	
Brakes	Calipers	Owned	-	-	-	
Brakes	Caliper Inlets	Purchase	\$12.00	4	\$48.00	
Knuckle	Knuckle Stock Aluminum	Manufacture	-	-	-	
Knuckle	Caliper Mount Stock Aluminum	Manufacture	-	-	-	
Knuckle	Pushrod Stock Aluminum	Manufacture	-	-	-	
Knuckle	Wheels	Purchase	\$220.00	8	\$1,760.00	\$1,759.50
Knuckle	Dry Tires	Purchase	\$286.00	4	\$1,144.00	
Knuckle	Wet Tires	Purchase	\$300.00	4	\$1,200.00	
Knuckle	Wheel Studs	Purchase	\$15.00	5	\$75.00	
Knuckle	Hub Stock	Manufacture	\$200.00	1	\$200.00	
Knuckle	Bearings	Purchase	-	-	-	

Figure 4: Final Prototype Expenses

## Travel expenses

The table below shows the possible travel expenses for the entire team. This is based on travel decisions from past years' teams, and was also used to request more funds from Gore. Our plans for travel are currently subject to change due to the copious amount of money necessary.

Itemized Travel Budget	
Item	Amount
Fleet Services NAU	\$5,218.24
Gas	\$2,244.28
Lodging	\$3,621.44
<b>Total</b>	<b>\$11,083.96</b>

Figure 5: Itemized Travel Budget

### Purchasing Plan

The image below shows the parts that we have purchased as of 01/18/2026. This list is much shorter than we would like and we have plans to add to it as soon as possible.

Item	Cost	Make/Buy	Primary Vendor	Manufacturer	Part Status
Wheels	1760	buy	Keizer	Keizer	On hand
Steering Quick Connect	228.86	buy	JEGS	JEGS	On hand

Figure 6: Purchased Item BoM

### Action Items:

- Select & Purchase Shocks
- Purchase Heim Joints
- Purchase Steering Quick Release (done)
- Purchase Aluminum for Knuckle and Steel for Control Arms
- Purchase Rotor Blanks
- Purchase Brake Calipers
- Purchase Tires

### Manufacturing Plan

- Control Arms – Full team, 50 hours, steel, Machine Shop
- Tabs for Mounting arms – Full team, 20 hours, steel, Machine Shop
- Knuckles – Austin (discussions with RedRock), 40 hours, aluminum, RedRock
- Hub-Reuben & Chloé, 30 hours, steel, Machine shop
- Steering Wheel-Reuben&Andrew, 20 hours, carbon fiber, NovaKinetics
- Pedal Assembly-Reuben & Powertrain, 30 hours, Aluminum & Steel, RedRock/Machine Shop

**Bonus Scheduling**

For the FSAE IC competition, final design deadlines are March 30, 2026. The 100% Hardware update being on Mar 23, 2026 works very well for our project.