SAE Mini Baja 2014-2015

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Team 11

Midpoint Review
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Introduction

Society of Automotive Engineers (SAE) is a world known association for setting standards in the automotive industry around the world. SAE is also interested in collegiate opportunities and participation to help educate and stimulate future engineers. For many years SAE has helped students of all ages to develop their skills and knowledge of mechanical operations and properties. For NAU, the senior capstone mechanical engineering students are participating in competitions held by SAE in the fields of the regular class aero, the micro aero, the moon buggy and the mini Baja.

The mini Baja project is a compilation of design, from the ground up, of suspension, steering, drivetrain, frame, wheels, and overall presentation with respect to cost. The vehicle needs to be built to handle off road conditions and be competitive in different dynamic events against other schools teams. The events at the competition that the Baja vehicle will have to go through are acceleration, hill climb/traction event, maneuverability, endurance, and the sales presentation event. Each event is worth a certain amount of points, adding up to a total of 750 allowable points. Based on how the vehicle does in each event, the team will be ranked accordingly out of 100 positions. The closer you are to being rank 1, the better your vehicle overall is. This 2014-2015 competitions rules and locations have been released by SAE, as every year there are changes made to requirements and locations.

This report provides an update on the fabrication of the frame. It will also discuss what changes have been made to the design of the frame, specifically how the seat will be mounted. This report will also touch base on what needs to be done to finalize the fabrication of the frame along with all other materials and safety equipment that need to be purchased.

Frame Progression

The fabrication of the frame didn't begin until February 2, 2015. The team decided make the bottom supporting members (BSM) and the fire wall the backbone of the frame due to all the other members connecting to one of those parts. To help with the cutting and bending, the team was allowed access to the plotter in the NAU Engineering building to print full scale drawings of the frame. These drawings allowed the team to check dimensions and placement to ensure accuracy when TIG welding everything together. On Feb. 7th, the BSM were welded together.

The following weekend, Feb. 14th, the firewall was welded to the BSM Pictures of the BSM and the firewall are below in Figures 1 and 2.

Figure 1: Bottom Supporting Members

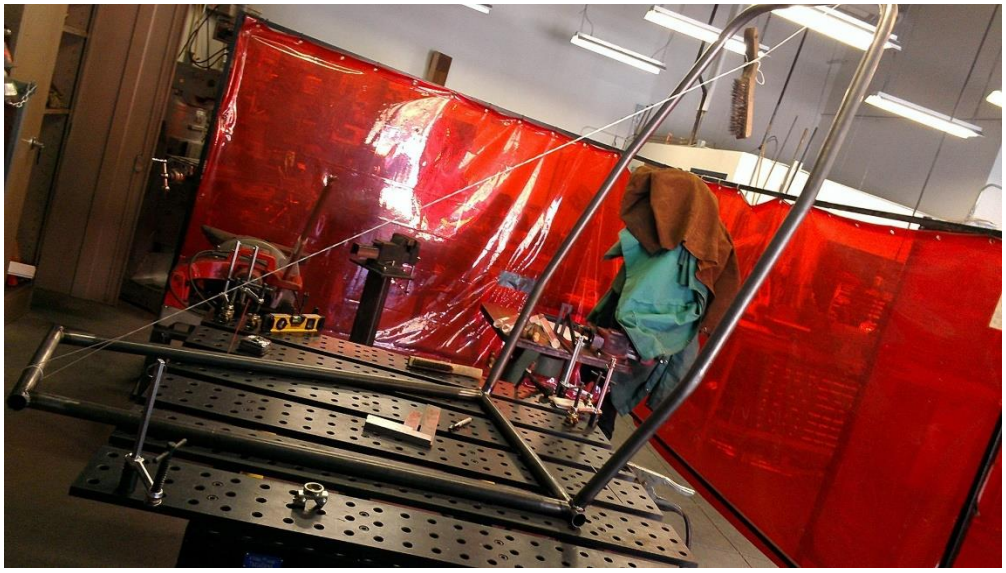


Figure 2: Firewall about to be TIG welded to the bottom Supporting Members

Following the sections being TIG together, the side impact member (SIM) were added next, along with some of the supports. The diagonal support for the firewall was added with another supporting secondary member for the SIM. This was all was all welded together Feb. 15th. The images can be viewed below.

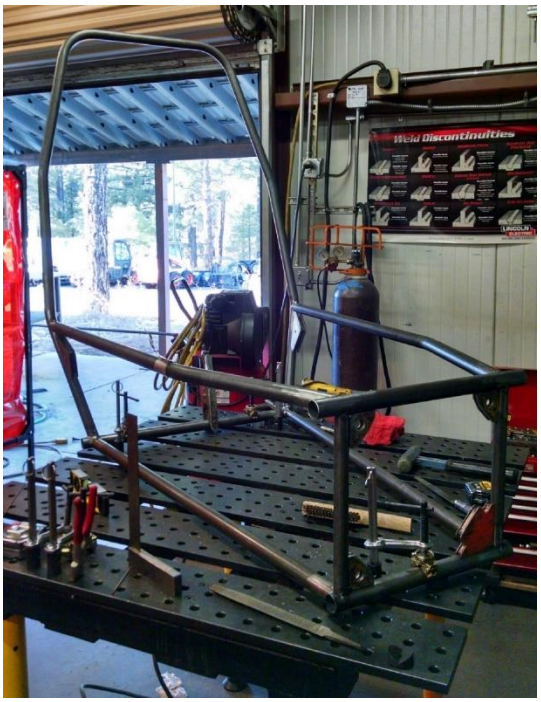


Figure 3: Side Impact Members being welded.

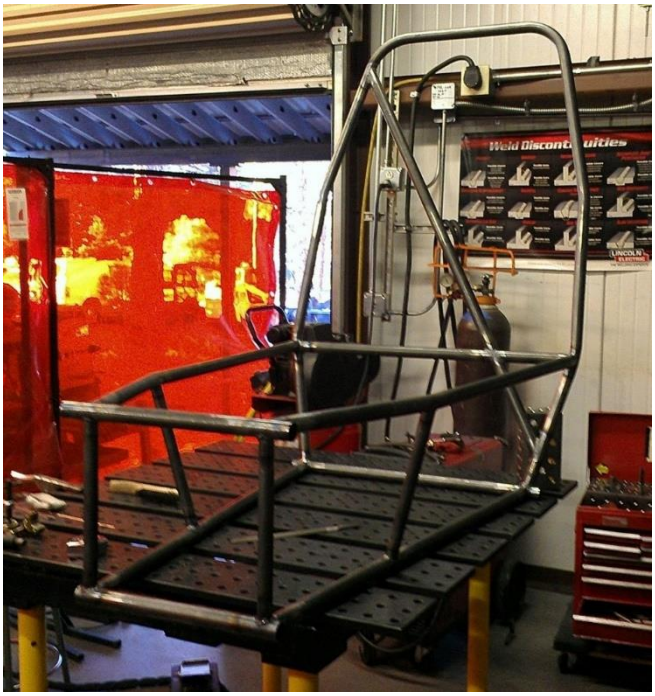


Figure 4: Diagonal Supports and SIM support added to the Frame.

The next members to be added to the frame were the roll hoops along with spacing members. The space members were welded to the roll hoops prior to be welding to the frame, allowing the welding to the frame to be easier. Next the rest of the supporting members for the SIM's were added to the frame as well. This all was done on Feb. 21st and 22nd. Unfortunately no photos were taken of the frame during this progress.

The last members to be added to the frame were the secondary supports for the roll hoops, primary members being added from the SIM to the roll hoop, making the SIM continuous to the roll hoop, and added supports from the fire wall to the roll hoops. This all was welded onto the frame on Feb. 28th, which is the current state of the frame today. The current images can be seen below of the frame in Figures 5 and 6.

Figure 5: Current Frame Progress.

Figure 6: Front View of the Current Frame.

Changes Made to the Frame

The team decided to make one modification toward the frame. The modification was applied to the mounting members of the seat. Due to certain advantages, the team decided to use a 1" 1018 steel square tubing with a thickness of 0.065" instead of 4130 Chromoly round tubing. Figure 7 Modified Seat Mount. Changing the member dimension from rounded tubing to square tubing allows for simple seat mounting and cuts weight due to no added tabs for mounting the seat. The reason for changing the steel from 4130 Chromoly to 1018 steel was due the fact that no manufactures produce square or rectangular 4130 Chromoly tubing.

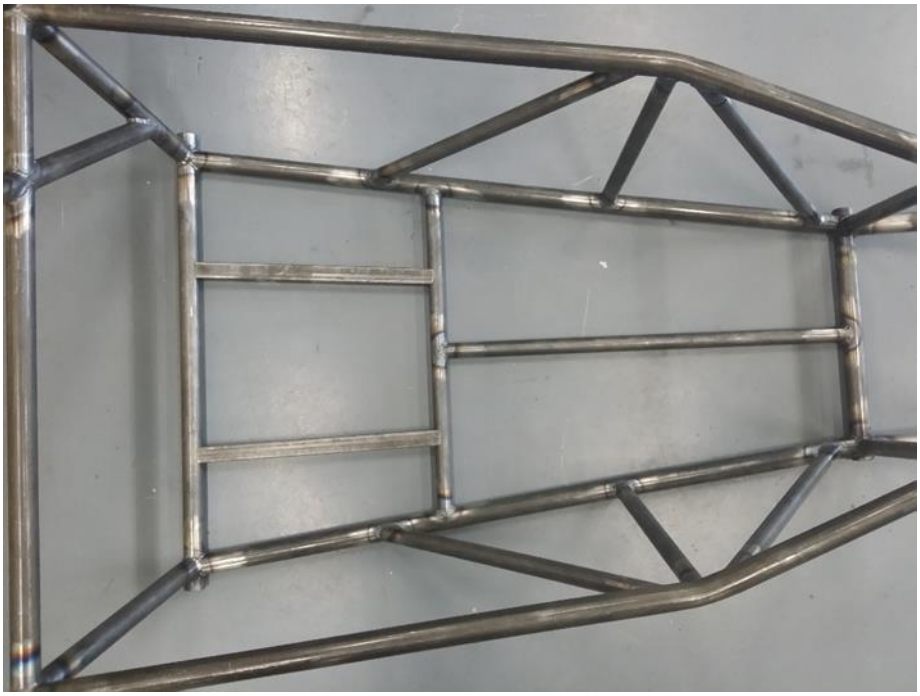


Figure 7 Modified Seat Mount

Finalized Order List

The frame team for the baja is almost done except for a few more things that are needed. The main two things that still need to be ordered to finish the frame and body are: Aluminum sheeting material for the firewall and body panels, and steel plating for body tabs. Information on the material can be seen below in Table 1. Other equipment that needs to be ordered has to do with the safety of the drivers in the vehicle. The safety equipment can be seen in

Table 2: Safety Equipment Ordering Listwhich lists in detail the items needed so that the team is ready for competition.

Table 1: Material Ordering List

Material/Item	Part Number	Dimensions	Quantity	Cost Per
Firewall and Panels	Aluminum Bare Sheet 5052 H32	3ft x4ft x0.025in	5	$23.05
Body Tabs	1018 weldable steel	9ft x1in x0.0625in	1	$19.95
			Total:	$135.20

Table 2: Safety Equipment Ordering List

Material/Item	Vendor	Part Number	Quantity	Cost Per
Fire Extinguisher	First Alert Store	UL Rated 5-B:C (White)	2	$24.99
Goggles	Summit Racing	SOT-2918	2	$18.95
Tear-off lenses	Summit Racing	SOT-12-6621	4	$6.50
Seat	Summit Racing	SUM-G2100	1	$39.97
Fire resistant jacket	Summit Racing	VMS-111005	1	$59.95
Helmet	Summit Racing	HJC-738-954	1	$83.50
Helmet	Summit Racing	HJC-738-923	1	$83.50
Seat Harness	Simpson Racing	29064 Blue	1	$129.95
Arm Restraint	Simpson Racing	36000 Blue	1	$39.99
Wedge Neck Collar	Deist safety	Model: 80215	1	$71.09
			Total	$621.83

Final Fabrication

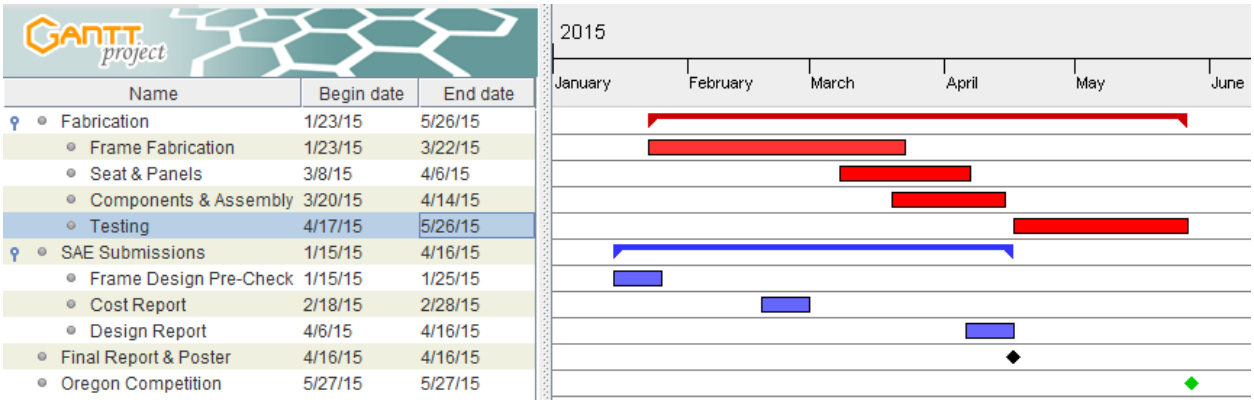
Once we have the needed material ordered and delivered we will be able to finish with fabrication. The rear end will be finished by March 22nd and once the seat is placed into position, we will be able to weld in our last support member into the firewall for the seat belt mounting. The tabs will be able to be cut and installed so that body panels can be cut and installed as well. The firewall will be able to finished, fire extinguisher mounted and kill switches installed.

All that is left is small and non-time consuming things to do for the vehicle such as break lights and sensors. It should take us no more than 2 weeks to get the rest of our needed parts installed into the vehicle. After that we will start helping the other sub teams as much as possible.

Updated Schedule

The schedule for the frame has been modified due to some delays on a finalized rear end along with waiting for the frame to be approved by SAE. Due to this, the fabrication of the frame

won't be finished till March 22nd. Along with that testing has been pushed back to allow time for all the other components to be added to the frame. The updated timeline can be seen below in Figure 8.



Name	Begin date	End date
Fabrication	1/23/15	5/26/15
Frame Fabrication	1/23/15	3/22/15
Seat & Panels	3/8/15	4/6/15
Components & Assembly	3/20/15	4/14/15
Testing	4/17/15	5/26/15
SAE Submissions	1/15/15	4/16/15
Frame Design Pre-Check	1/15/15	1/25/15
Cost Report	2/18/15	2/28/15
Design Report	4/6/15	4/16/15
Final Report & Poster	4/16/15	4/16/15
Oregon Competition	5/27/15	5/27/15

Figure 8: Updated Timeline

Conclusion

In conclusion, the frame has progressed well and is nearly complete. Although, there have been changes made to frame for the seat mounting. This change has reduced weight and simplified the design for mounting the seat. The remaining material and safety equipment that is needed for the completion of the frame are going to be delivered over spring break and be ready to use by Feb 19th for when the machine shop opens back up. With that, the rear end will be finished by the end of spring break, March 22, 2015. The schedule has been pushed which has extending the final fabricated date to April 6th, for body panels, and testing time back to April 17th.