# Gorilla Racing

A division of SAE Baja



# Purpose

- > All-terrain vehicle for the outdoor enthusiast
  - Design
  - Manufacture
  - ➤ Test
  - Promote
- Competing for shares in a large market against:
  - Polaris
  - > Honda
  - Kawasaki

## SAE BAJA Requirements

- Material strength ≥ 1018 Mild Steel
- Briggs and Stratton 10-hp engine
- > Max width 64"
- ➣ 5 point safety harness
- ➤ 6 inch head clearance
- > 3 inch shoulder clearance
- ≻ Full firewall
- ≻ Fuel drip pan

## Budget

- Beginning Baja Account Balance: <u>\$24,000</u>
- Total spending to date: \$6,125.10
- Travel expenses: \$7,961.10
- Fundraising goal per member: \$1000
- > Total amount fundraised to date: \$7,680
- ✓ Total car cost: <u>\$14,086.20</u>

### Manufacturing Schedule

0	Task Mode 🔻	Task Name 👻	Duration 👻	Start 👻	Finish	18
<ul> <li>Image: A start of the start of</li></ul>	*	Front Frame	8 days	Tue 1/9/18	Thu 1/18/18	E
<ul> <li>Image: A second s</li></ul>	*	Rear Frame	8 days	Thu 1/18/18	Mon 1/29/18	
<ul> <li>Image: A second s</li></ul>	*	Weld Frame	3 days	Mon 1/29/18	Wed 1/31/18	
<ul> <li>Image: A second s</li></ul>	*	Front Suspension	9 days	Mon 1/29/18	Thu 2/8/18	
<ul> <li>Image: A second s</li></ul>	*	Rear Suspension	12 days	Thu 2/8/18	Fri 2/23/18	
<ul> <li>Image: A second s</li></ul>	*	Frame Primary Member Rework	15 days	Tue 2/13/18	Mon 3/5/18	
<ul> <li>Image: A second s</li></ul>	*	Weld Suspension Arms	2 days	Tue 3/6/18	Wed 3/7/18	
<ul> <li>Image: A second s</li></ul>	*	Steering	9 days	Thu 3/8/18	Tue 3/20/18	
<ul> <li>Image: A second s</li></ul>	*	Sheet metal members	30 days	Mon 3/12/18	Fri 4/20/18	
<ul> <li>Image: A second s</li></ul>	*	Miscellaneous Paneling	7 days	Mon 4/16/18	Tue 4/24/18	
<ul> <li>Image: A second s</li></ul>	*	Functional Assembly	5 days	Mon 3/12/18	Fri 3/16/18	
<ul> <li>Image: A second s</li></ul>	*	Race Spec. Assembly	22 days	Mon 3/26/18	Tue 4/24/18	
<ul> <li>Image: A second s</li></ul>	*	Functional Testing	13 days	Mon 4/9/18	Wed 4/25/18	
	*	Update Drawings	16 days	Mon 4/9/18	Mon 4/30/18	
	*	IAC Presentation	0 days	Fri 4/27/18	Fri 4/27/18	
	*	Paint	7 days	Sat 4/28/18	Sat 5/5/18	
	*	Final Project Report	6 days	Mon 4/30/18	Mon 5/7/18	
	*	Final Project Report Due	0 days	Mon 5/7/18	Mon 5/7/18	
	*	Race Ready Testing	7 days	Mon 5/7/18	Tue 5/15/18	



### Material Selection

Material	Cost (\$/ft)	Weight of Frame (Ibs)	Bending Stiffness (Ibs/in)	Bending Strength (Ibs/in^2)
A513 (1'' OD x 0.120'')	1.33	357	11,606,098.6	421,281.86
4130 Chromoly (1.25'' OD x 0.065'')	2.77	320	11,845,399.6	643,625.05

#### Individual Members

- Cut all pieces to length using a chop saw
- Bend all pieces with a pipe bender and a 3" die
- Coped all ends with a 1" end mill



### Frame Manufacturing

Jig to locate critical membersTack welded once fit



### Drivetrain

- CVT (Gaged Engineering)
  - Composite Belt Drive
  - Primary (Min: 2.05 in diameter, Max: 6.0 in diameter)
  - Secondary (Min: 5.4 in diameter, Max: 8.0 in diameter)
- > Starting Gear Ratio  $\rightarrow$  3.90:1
- > Ending Gear Ratio  $\rightarrow$  0.90:1



### Drivetrain

- ➢ Gearbox (Spicer H-12 FNR)
   ➢ Forward gear ratio → 10.15:1
   ➢ Neutral Equipped
   ➢ Reverse gear ratio → 11.15:1
- Overall Velocity Ratio
   Starting: 3.90 x 10.15 = 39.585
   Ending: 0.90 x 10.15 = 9.135
   => Top Speed of 28.475 w/ 23 inch tall tires



## Suspension

Plate and tube jigs
 Quick jig modifications
 Heim joints and inserts
 Ready to weld in and go





## Steering

Purchased components: Rack and pinion > Heim Joints Steering Wheel Manufactured Components:  $\succ$  Tire rods Steering shaft Steering shaft mount Rack mount





#### Tie Rods & Steering Shaft

 $\succ$  1/2 in. 1020 cold rolled rod stock

 $\succ$  Tie rods

Cut to length

> 5 % in. sleeve

C-shaped bracket

Steering Shaft

Cut to length

Splined end

Quick disconnect end



### Miscellaneous

Lathe working Heim caps Heim misalignments  $\succ$  Tie rod thread sleeves Plasma cutting Paneling > Water Jet Mounting tabs and gussets Cut by KMT





## Performance Testing Plan

► Acceleration/velocity

≻Torque

▶ Suspension

➤Maneuverability

► Possible through a strain gage

#### Lessons Learned

Don't take previous Baja projects words as valid reasoning

- Consider all systems of a design during the process
- Always document adjustments made when building the car

Questions?

Didn't think so

#### Thank You!