



Vandal Hybrid Racing Project Plan for Susan V1.2 2014-15

Objectives:

The primary goal of the project is to design and build a successful hybrid racecar capable of competing in the 2015 Formula Hybrid SAE competition. The secondary goals of the project are first to design, build and test a new accumulator pack to streamline the electrical technical inspection, and improve the overall safety of the tractive system. The next major goal for the year is to reduce the overall weight of the vehicle by attacking several key areas on the vehicle, which include the accumulator pack, the suspension, wiring, and braking systems. After reducing the weight of the vehicle the next goal is to improve the reliability of several key subsystems, primarily the braking system along with the powertrain system. The team goal is to also improve the packaging of the vehicle by moving key components on the vehicle lower to the ground and closer to the center line of the vehicle. The last goal which enables the team to achieve several of the other secondary goals is to dive into research and development of several new technologies for the team. These technologies include the use of exotic materials, along with research into aerodynamics and control systems.

Expected Results:

The expected results from the project are derived from the secondary goals of the project laid out in the previous section. The largest and most important result of this project is to build an accumulator pack that is rule compliant before competition, and holds a higher standard of safety then the previous design and is lighter. The project should also yield the lightest vehicle to date for the program. The team expects to remove a minimum of 20 lbs. from the overall vehicle weight but is attempting to remove 40 lbs. from the overall weight. This goal is to be achieved by the use of exotic materials and lighter designs for several sub systems, which are primarily focused on the un-sprung mass of the vehicle and the accumulator pack. The team is also looking at moving components of the vehicle lower to the ground and closer to the center line of the vehicle to improve the balance and handling characteristics of the vehicle. The movement of components also allows for a lower drag force experienced by the vehicle. To improve the reliability of the vehicle the team is looking at two key subsystems. The first subsystem needing attention is the brake systems which failed during the endurance event in the previous competition. The second system being the engines which had reliability issues with starting and consistent operation all throughout the competition. The last goal of the project is to perform research into new areas that the team has previously shied away from in the past. This research is also to help realize a few of the other goals of the project. The primary topics that are to be researched are carbon fiber, manufacturing concerns with regards to titanium, the design and use of aerodynamic devices and improved control systems. The team also seeks to test a new a method for the storage of past and current research, manufacturing techniques, engine testing methods and vehicle design analysis to be used by future teams. This storage is to allow for the passing of important design and experimentation information to improve future designs.

Team and Project Structure:

The team is organized in a hierarchical structure where the leadership is at the top of the structure and comprised of the team captain and advisors. The leadership sees to the overall direction of work, research and development for the year. The leadership brings these directives to the management level of the structure where the directive is broken up into smaller divisions such as tasks, research, manufacturing, design and testing. The directive is broken down into a manageable amount of work for one to two team members per task. This is done to maximize the limited human resources available to the team this year and minimize the amount of time require for any one task. The quick turnaround time for task set by the





management is done so that small gains can be readily achieved to improve the morale of the team which can be critical during large scale projects. When a task becomes too large or is taking too long to complete it is broken up into smaller task and distributed to other team members so that they can be quickly finished. Due to the large scale of the project and the diverse skills required to understand the tasks and work required to complete a task the team has two different managers for the project. The two managers hold equal but for the most part separate responsibilities. The managers are chosen based upon the background discipline so that a mechanically savvy manager handles the mechanical directives and an electrically competent manager handles the electrical directives. The leadership and management collectively share the responsibility to set forth the overall schedule for the project and sponsorship activities. The team has two different groups of seniors working on the project to increase the time for the design and development phase of the project totaling 14 seniors. The two groups are broken up based upon their senior design class, one group began in the summer term and ended in the fall, where the second group starts in the fall and works through the competition. The team also includes younger members who assist the seniors with tasks until they are ready for a larger responsibility and decrease the learn curve on the project if they continue on to be seniors on the team. The figure below depicts the overall structure of the team.



Change Management Process:

The team although structured in a hierarchical manner also allows for the reverse flow of ideas. This meaning that if an idea is brought forth that may be of benefit to the project it can be brought to one of the managers or leadership. At this point the leadership and management will collaborate on the possibility of investing time and resources into the idea and determine the best course of action to remain compliant to the timeline and goals set forth for the project. This reverse flow of ideas is also the mechanism employed by the team to allow for the dynamic change of goals for the project. When new information arises that simplifies or otherwise changes a goal of the project it is brought to the manager of the respective discipline or leadership's attention. After the leadership and management personal analyze and verify the new information the goal or goals and timeline of the project will be amended to accommodate the new change. The managers at this point will reorganize and restructure affected task groups to ensure that the project can continue smoothly. This system is used for its simplicity as well as it effectiveness, as more often than not the information that arises that changes the direction of work and research comes from the team members actually conducting the work or research.

Time Schedule:





The time schedule is critical to the success of the project. Knowing this the schedule is of the utmost importance, the leadership and management collectively structure a project timeline which is to be rigorously kept. The schedule is designed to have three major deadlines to allow enough time to compete specific tasks and research. The three deadline system is used for its simplicity and easy implementation. The system divides the project time frame into the three distinct phases for the project. The three phases are design, manufacturing and testing. The system is used as a cutoff date, such that if a task or project misses the manufacturing deadline and has a considerable amount of work still need, it will be abandoned. This action is taken to maximize the use of human resources available to the team. However if the tasks in question are critical to the success of key systems the manager will reallocate resources to expedite the completion of the task and minimize the extra time required so that the schedule will not be adversely affected. The overall time line can be seen in the figure below.



The team also employs a Gantt chart to help track and maintain specific tasks, along with the team member responsible for the task and the time taken to complete said task. The Gantt chart helps show which tasks are on schedule and where time can be recovered should a task take longer than allotted. A portion of the Gantt chart currently in use can be seen in the appendix.





Appendix

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Required Items			
Team Surgenzion and Braker			
Upright Design	Monk	Quatermai	
Wheel Speed Sensor Design	Zane	Darren	
Upright jig	Monk	Quatermai	
Upright manufacturing Steel	Monk	Quatermai	
Unight manufacturing Titanium	Luigi	Quatermai	
Titanium outters	Luigi	Teddy Bea	
Titanium CV Cups	Luigi	Teddy Bea	
Inboard Toe Rod Bracket Design	Darren	Quatermai	
Inboard Toe Rod Bracket Steel manufacturing	Quaterm	sin Monk	
Podal Assembly Redecian	Guaterin	Zane	
Pedal Assembly manufasturing	Gilligan	Luigi	
Pedal Assembly Plate	Gilligan	Zane	
Pedal Extension Aluminum	Gilligan		
Brake Hose Install	Gilligan Taam Su	. M	
Carbon Fiber Tensile Test	Zane	Jon	Testing
Ball Joint Carriers Rear and Front Design	Zane	Darren	16-Dec
Ball Joint Carriers Rear and Front Manufacturing	Zane	Darren	
Carbon Suspension manufacturing	Zane	Jon	
Rims for Bains	Team	ar	
Rotor Outers	Zane	Gilligan	
Rotor Centers	Zane	Gilligan	
Rotor Pins	Zane	Meaty	
CarAlignment	Quaterm	ain Monk	
Suspension Tuning According to Univerteedback	Monk	Quatermai Toddu Boa	
Alignment Fixture Design	Quaterm	ain Monk	
Alignment Fixture manufacturing	Quaterm	ain Matt	
Team Powertrain			
Intake Model Design	Nomio	Teddy Bea	
Intake manufacturing	Janicki	Team	
Dyno valve cover manufacturing	Luigi		20-Nov
Dyno Tuning	Teddy Be	ar Nomio/Mea	cold start 22-Dolt, finished tuning on 15-Nov
Rebuild Race Engine	Teddy Be	ar Nomio/Mea	
Order Starter Clutch	Teddy Be	ar	
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Radiator brackets manufacturing	Justin		
Radiatorinstall	Justin		
New Soatter Shield	Meaty		
Motor mount brooket	Jon		
Dog Clutch Docign	Jon		
R6 Exhaust Active baffeling	Teddy Be	ar	Due before thesis
Ship new exhaust for ceramic coating	Teddy Be	ar	
Team Electrical and Battery Design	Manufa	7	
High Voltage Power Limit	Gordon	Trov	
Nev Kely	Meaty	,	
New Motor	Jon		
New Motor Bracket Design	Jon		
New Motor Bracket Hanufacturing	Jon	Monk	
Heat Transfer Model for Battery	Jake	Ben	2-Dec
Battery Cell Test	Troy	Gordon	14-Nov
Gauge Cluster	Meaty	Grant	
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