Work Package: Steering Wheel Design and Fabrication

Team Lead: Miles Petterson

10/25/15

Version 1

**Task Description**

The steering wheel transforms linear/rotational motion of the driver’s arms to rotational motion of the steering column and ultimately movement of the front wheels of BR16. Additionally, the steering wheel acts as a surface to which buttons and/or informational displays can be mounted, allowing the driver easy access and read-ability to electrico-mechanical car features. The Steering Wheel Team will design the steering wheel in accord with FH, FE, and FN rules. The Team will communicate with other relevant teams to determine the location, size, and paraphernalia that will determine the final design. Critical contacts are Yossi Kohrman-Glaser (steering column and system), Jordan Gardner (seat/drivers cell), and Phil Piper (electronics and HUD). While designing, they will consider the method of fabrication and expected loads to create a robust product. If questions arise, they will consult teammates with fabrication experience (Jordan, Dante Archangeli, Taha Zeki, and others). The steering wheel will be positioned 12-18 inches from the driver’s chest and will have a continuous non-concave perimeter. It will be able to withstand a minimum of 135 Nm of torque/force without failing. It will also be able to support at least 660 N of lateral (radial) force. Once the design has been finalized, the Team will fabricate the device(s).

(add something about how we decided just to build one steering wheel now and then do a second one later if there is time)

**Responsible Parties**

Miles Petterson is team lead. As team lead, he is responsible for communication with the project manager and chief engineer, and meeting project deadlines. During design phase, he will work alone. During fabrication, he will work with an additional member.

**Deliverables**

The team will submit a project schedule on 10/25. This schedule will detail the design process with dates:

1. Understanding the project and criteria: 11/1/15
2. Preliminary design review (PDR): 11/1/15
   1. (Add some notes about what you learned from these discussion – E.g. no electronics, any shape of material considerations).
3. Intermediate design review (IDR): 11/7/15
   1. Begin Prototype and Design modification
4. Critical design review (CDR): 11/14/15
   1. Finalize design and begin fabrication of steering wheel
   2. A 2 week process
5. Delivery of the steering wheel: 12/6
6. Delivery of supporting documentation 12/13

**Budget**

|  |  |
| --- | --- |
| Steering Wheel Quick Disconnect | $70 |
| Carbon Fiber | $20 |
| Modeling Clay for Preliminary Molding | $10 |
| Silicon for Molding | $50 |
| Electronics | $30 |

**Resources (human and machine)**

|  |  |
| --- | --- |
| Discuss Materials with Dante | About Strength and Thickness |
| Discuss Electronics with Phil | Which electronics we want, and how to connect them |
| Internet | Learn about fabrication techniques, materials, designs and electronics |
| CNC Router | Making molds for the hand grips and possibly for the carbon fibre |
| New Car time | Test the preliminary steering wheel before the final product is made |

**Time to complete**

2.5 weeks of design, 2.5 weeks of fabrication (Thanksgiving break in between)

|  |  |
| --- | --- |
| Learning about the design, and materials | 10 hours |
| Designing the Wheel | 10 hours |
| Designing a Preliminary Wheel | 5 hours |
| Designing and fabricating grips | 15 hours |
| Fabricating the Wheel | 15 hours |

**Measures of Success**

Can it sustain the required forces without failing?

Can I turn the wheel all the way with just my pinky?

Can I release the quick disconnect from the driving position?

Does it meet all geometric requirements?

Is it lighter than the steering wheel we currently have?

Is the budget an accurate prediction of the cost of the product?

**Required Inputs**

Horizontal distance from the end of the steering column to both the seat and the front roll hoop.

Vertical Distance from the end of the steering column to the top of the front roll hoop.

Rules:

* The top-most surface of the Front Hoop must be no lower than the top of the steering wheel in any angular position.
* The Front Hoop must be no more than 250 mm forward of the steering wheel. This distance shall be measured horizontally, on the vehicle centerline, from the rear surface of the Front Hoop to the forward most surface of the steering wheel rim with the steering in the straight-ahead position.
* All drivers must be able to exit to the side of the vehicle in no more than 5 seconds. Egress time begins with the driver in the fully seated position, hands in driving position on the connected steering wheel and wearing the required driver equipment. Egress time will stop when the driver has both feet on the pavement.
* With their vision obscured, all drivers must be able to operate the cockpit Big Red Button (BRB) in no more than one second. Time begins with the driver in the fully seated position, hands in driving position on the connected steering wheel, and wearing the required driver equipment.
* Covers over suspension and steering components must be removable to allow inspection of the mounting points.
* The steering wheel must be mechanically connected to the wheels, i.e. “steer-by-wire” or electrically actuated steering is prohibited.
* Allowable steering system free play is limited to seven degrees (7°) total measured at the steering wheel.
* The steering wheel must be attached to the column with a quick disconnect. The driver must be able to operate the quick disconnect while in the normal driving position with gloves on.
* The steering wheel must have a continuous perimeter that is near circular or near oval, i.e. the outer perimeter profile can have some straight sections, but no concave sections. “H”, “Figure 8”, or cutout wheels are not allowed.
* In any angular position, the top of the steering wheel must be no higher than the top-most surface of the Front Hoop. See Figure 7.
* Joints between all components attaching the steering wheel to the steering rack must be mechanical and be visible at Technical Inspection. Bonded joints without a mechanical backup are not permitted.
* All threaded fasteners utilized in the driver’s cell structure, and the steering, braking, driver’s harness and suspension systems must meet or exceed, SAE Grade 5, Metric Grade 8.8 and/or AN/MS specifications.
* The use of button head cap, pan head, flat head, round head or countersunk screws or bolts in ANY location in the following systems is prohibited: Steering system
* One shutdown button is mounted in the cockpit and must be easily accessible by the driver with the steering wheel in any position.
* A team member must be sitting in the cockpit and must be able to operate the steering and braking in a normal manner.