Bumper Design Review

Scarlet Galvez
Sako Garoian
Mariam Grigoryan
RFA Changes

- Replace objectives with requirements
  - Quantify
- Move testing section after design details
- Add part to detect center hits
- Separate bracket for switch and spring
- Make back mounting bracket smaller
Objectives

- Redesign and build a bumper system for The Life Of the Party that is mountable, easily accessible for modifications.
- Bumper must also use a spring system to protect sensors against any extreme hits and return whiskers to neutral position.
## Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring energy capacity of at least 10lbs.</td>
<td>Bumper switch sensors</td>
</tr>
<tr>
<td>Spring compression system</td>
<td>Cost efficient</td>
</tr>
<tr>
<td>Needs pivot point</td>
<td>Made of aluminum</td>
</tr>
</tbody>
</table>
Team Organization

Project Manager
Armen Toorian

Systems Engineer
Ricshaun Eliott

Documentation, Design Research, Body Structure
Test Engineer
Scarlet Galvez

Design Research, Bumper Design, CAD Drawings
Sako Garoian
Design Process
RFA Design Changes

- add part to detect center hits
- separate bracket for switch and spring
- make back mounting bracket smaller
Bumper Tests

- Run different tests to make sure bumper works when it needs to
  - Hit at different angles, straight on
  - See what our limitations are
- Come up with short program on VEX to see if bumper switches go off or not when they are supposed to
- Mount onto a table and run more tests
- Mount onto The Life of the Party (TLOP) and run tests to see if bumper gets triggered
<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
<th>Cost</th>
<th>Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface-Mount Hinge with Holes, Polished 304 Stainless Steel, 1-1/2&quot; x 1-3/8&quot; Door Leaf</td>
<td>4</td>
<td>$4.83 each</td>
<td>Need to Order</td>
</tr>
<tr>
<td>Fastener-Mount Compression Spring, 0.97&quot; Overall Length</td>
<td>4</td>
<td>$6.09 each</td>
<td>Need to Order</td>
</tr>
<tr>
<td>Alloy Steel Flat-Head Socket Cap Screw - 8-32 Thread Size, 9/16&quot; Long</td>
<td>50</td>
<td>$11.28 (per pkg of 10)</td>
<td>Need to Order</td>
</tr>
<tr>
<td>Bumper Mount</td>
<td>2</td>
<td></td>
<td>Machined</td>
</tr>
<tr>
<td>Vex Bumper Switch</td>
<td>4</td>
<td>$16.99 (per pkg of 2)</td>
<td>In Stock</td>
</tr>
<tr>
<td>C-Brackets</td>
<td>4</td>
<td></td>
<td>Machined</td>
</tr>
<tr>
<td>Whiskers</td>
<td>4</td>
<td></td>
<td>Machined</td>
</tr>
</tbody>
</table>
## BoM (cont.)

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
<th>Cost</th>
<th>Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme-Strength Steel Hex Nut, Grade 9, Cadmium Yellow-Chromate Plated, 1/4&quot;-20 Thread Size</td>
<td>16</td>
<td>$11.46 (per pkg of 50)</td>
<td>Need to Order</td>
</tr>
<tr>
<td>Stainless Steel Washer - 0.203&quot; ID, 0.438&quot; OD</td>
<td>4</td>
<td>$4.24 (per pkg of 100)</td>
<td>Need to Order</td>
</tr>
<tr>
<td>Square Head Screw - 1/4&quot;-20 Thread, 5/8&quot; Long</td>
<td>16</td>
<td>$6.60 (per pkg of 50)</td>
<td>Need to Order</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$122.38</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Delivery Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finalize &amp; Approve CAD</td>
<td>Nov 14, 2017</td>
</tr>
<tr>
<td>3D Printed Prototypes</td>
<td>Nov 17, 2017</td>
</tr>
<tr>
<td>Order parts</td>
<td>Nov 17, 2017</td>
</tr>
<tr>
<td>Have all parts</td>
<td>Nov 28, 2017</td>
</tr>
<tr>
<td>Test Prototypes</td>
<td>Nov 30, 2017</td>
</tr>
<tr>
<td>Final Assembly</td>
<td>Dec 7, 2017</td>
</tr>
<tr>
<td>Test Final Assembly</td>
<td>Dec 8, 2017</td>
</tr>
</tbody>
</table>
Documentation

Bumper folder on Delta Drive with Preliminary Concepts from Trello and Project Documentation
Questions?
Thank you!
Extra Slides
Second Semester
Second Semester Changes

- Only changes made were to the two brackets and bumper mount.
- Steel was used for all parts except the mount which was made of aluminum.
Preliminary Concepts
Scarlet Caves
Soho Common

1. Pick mount
2. Where go where?
3. Design
4. Sensor value,
   longer 15 - 15A
   9kΩ

Sensor?

- New vs old bumper
- Can we use pull switch, better signal

- Metal parts
- Machining steps / outs
- Use that have
  in fast price.

Camscan

More stuff
4 switches

Phot. rigid

A-A

Bumper
Bumper System

Hinges - machined

Find old files on bumper

- Make Shaft
- Hinges
- Centerpiece
- Fillets, Flat E

Tuesday 19, 2007
- More SolidWorks file done.
- Some cut fillets and not
- Think of springs and where to put.
Other Parts
Delta Bumper Documentation

- Changed previous design to a "Flat C"
  - Got rid of tension on side flaps
  - Easier to machine
- Added fillet to every inner 90 degree angle
  - Much easier to machine
- Chamfer outer corners
  - Safer (gets rid of sharp corners)
- Added hinges instead of planes between mount and whiskers
  - Allows for pivot and flexibility
- Chose to use countersunk, hex drive flatheads
  - Won't have to use nuts and bolts
- Using bumper switches
  - Very sturdy and have a good supply of them
- Using spring w/ bolt going through and L-bracket attached to rover body
  - Using L-bracket instead of C-bracket so that we don't have to go by EXACT height/won't have to machine it
- Hex screws
  - More surface area to tighten down
  - Gives us ability to torque down, won't become loose
- No nuts
  - be threaded whiskers
- Not using a 90 degree bend on the whisker
  - Really hard to bend and it weakens that point
- Totally got rid of L-bracket idea and went with two C-brackets
  - Provides more stability