Overview

● How to breakdown the competition
● Choosing the right parts
● Custom vs off-the-shelf solutions
● Closing
How to Breakdown the Competition

- Types of tasks
  - Vision
    - Pipe tracking, Buoy
  - Fine manipulation and actuation
    - Forward Manipulator, Recovery
    - Bins, Torpedoes
  - Vehicle control
    - Circumnavigation
  - Hydrophones
Choosing the Tasks to Attempt

- How do I decide which tasks to attempt?
- What components do I need to fulfill the task?
What type of motor is right for me?

There are many motors out there

- Brushless DC
- Brushed DC
- Stepper Motor
- Servo Motor
CCD vs CMOS

- Global Shutter vs Rolling Shutter
  - Skew, wobble, smear
To DVL or not to DVL

Pro: Accurate position information, less susceptible to drift

Con: Cost

Seek sponsorship
  Discounts provided on used components or rentals
Interfacing with Other Subteams

Cabling and Wire Interconnects
  How many external connections do I need?
  Where will my parts be located?
  Where should I route connections?

Communication with Software
## Custom vs Off-the-Shelf Controllers

<table>
<thead>
<tr>
<th>Custom</th>
<th>Off-the-Shelf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunability</td>
<td>Reliability</td>
</tr>
<tr>
<td>More complex design</td>
<td>Less complex design</td>
</tr>
<tr>
<td></td>
<td>More complex integration</td>
</tr>
<tr>
<td>Note: either solution may be difficult to integrate into an already functional system</td>
<td></td>
</tr>
<tr>
<td>Meets all (designed for) requirements</td>
<td>May have to make compromises</td>
</tr>
</tbody>
</table>

Cost!
Our Team

Subsystem breakdown
● Power
● Mechatronics
● Sensors
● Acoustics

Check out our upcoming webinars for more information
PCB Board Design and Layout -- 11/22/14 @ 11AM
Hydrophones (How To) -- 11/29/14 @ 1PM
Power System

Batteries
- LiPo
  - Sponsors: Advance Energy Inc. (Custom battery solutions), Maxamps (High quality and capacity for reduced cost)

Battery Management Board
- Monitor individual cell voltage and charge capacity over time
- Off-the-shelf solutions: Fuel gauge IC, Battery Management Chip

Power Distribution Board
- DCDC converters for voltage rails
- Ability to power cycle each channel to reset sensors, protect from overcurrent
Mechatronics

**Thruster Controller (Brushed vs Brushless) Board**
- Custom H-bridges, isolation, current monitoring
- Off-the-shelf solution: Motor controllers or packages H-bridges

**Stepper Motor Controller Board**
- Control and timing logic implemented on board
- Absolute position encoder
- Alternative: servomotor

**Actuator Board**
- Solenoid and DC motor driver
- Relays killswitch information to other mechatronics boards
Sensors

Sensor Suite
- IMU (6 axis)
- Magnetometer and Compass
- DVL
- Cameras

Note: interfacing will be challenging as each sensor may have its own protocol/method of communication

Serial Board
- Sensor interfacing

HIM Board (Heading and Inertial Measurement)
- Accelerometer, magnetometer

GPIO Board
- Pressure and depth sensing

SPONSORSHIP is your best friend!
Acoustics

Hydrophones System
- On board signal processing solutions (DSP vs FPGA vs MCU)

Custom Pinger
- Allow for transmitting pings as well as receiving commands to adjust frequency output

Hydrophones (How To) -- 11/29/14 @ 1PM
My team is brand new, where do I start?

1. Determine which tasks to attempt
   a. Sensor limitations and requirements
   b. Manpower
   c. Integration time and debugging
2. Breakdown each task into specific implementation goals (How To)
   a. Keep in mind that a lot of time must be saved for software and testing
3. Are custom solutions right for me?

Again, catch our other electrical webinars for more information!
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Questions?