

Team 21: Autonomous RoboSub

Final Presentation Fall 2012



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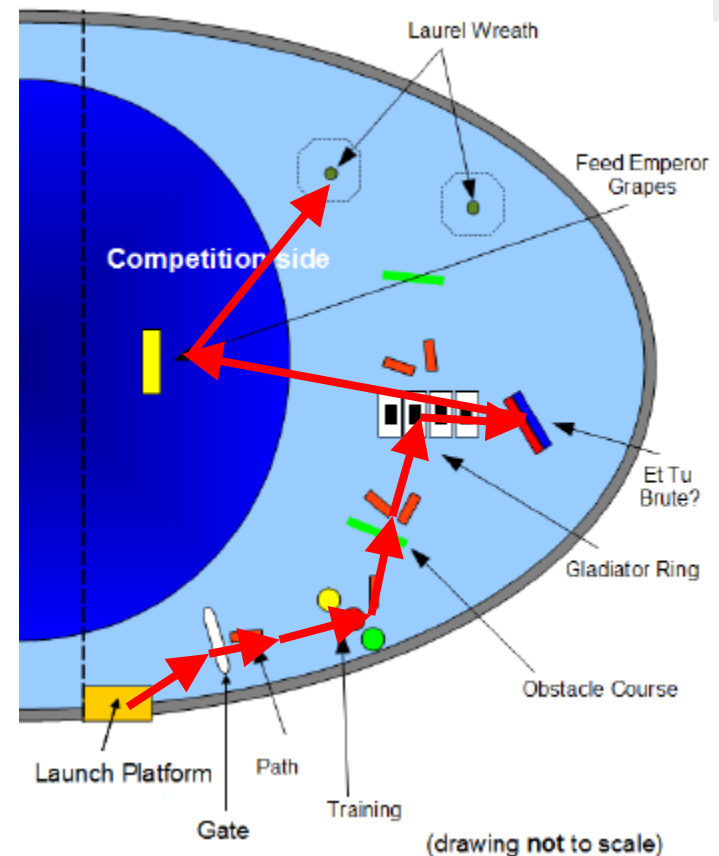
Competition

- 15th Annual AUVSI RoboSub Competition
- Held in San Diego July 22-28, 2013
- 7 tasks making use of camera, depth sensor torpedoes, claw, marker dropper, and hydrophones
- Current rules have not yet been released

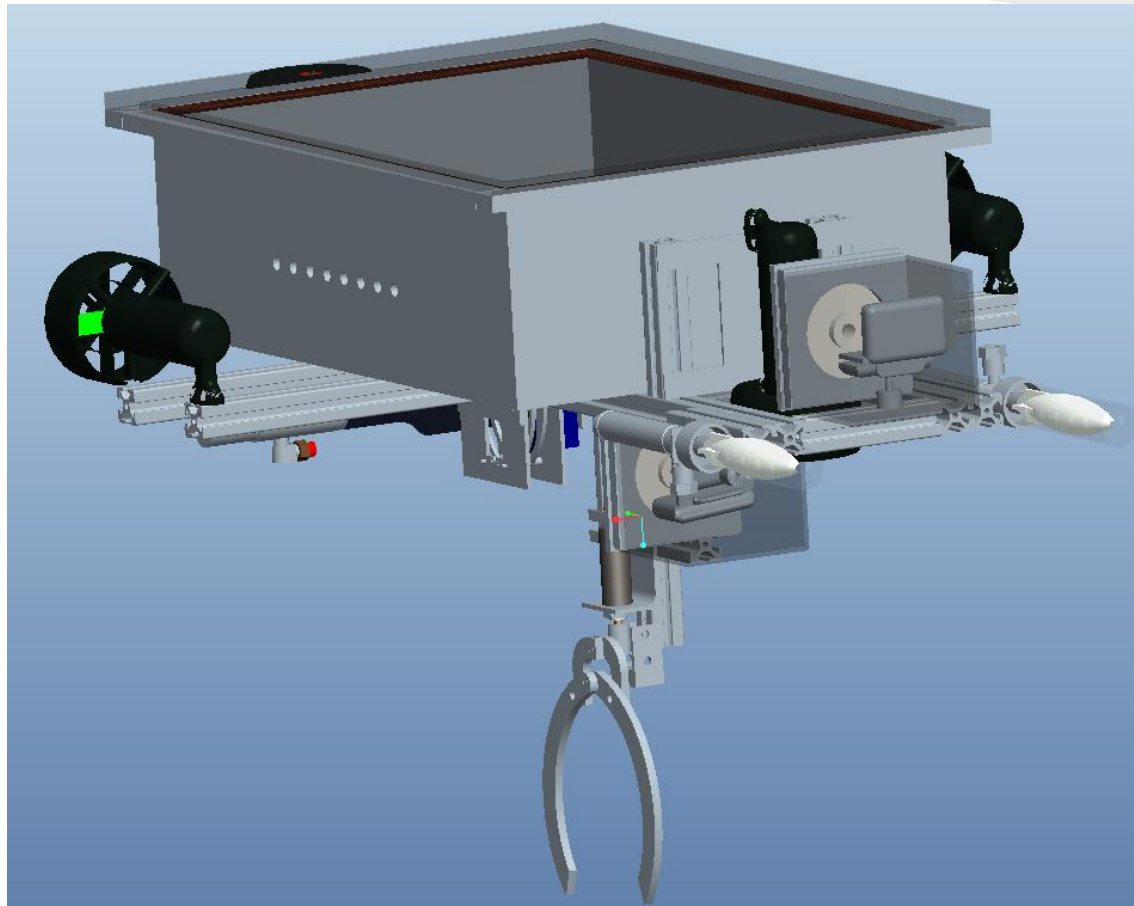


Competition Tasks

- Maneuvering through a gate
- Line following on ground
- Buoy ramming
- Maneuvering around obstacles
- Dropping markers in specific location
- Shooting a target
- Picking up specified objects
- Moving towards a pinger and surfacing



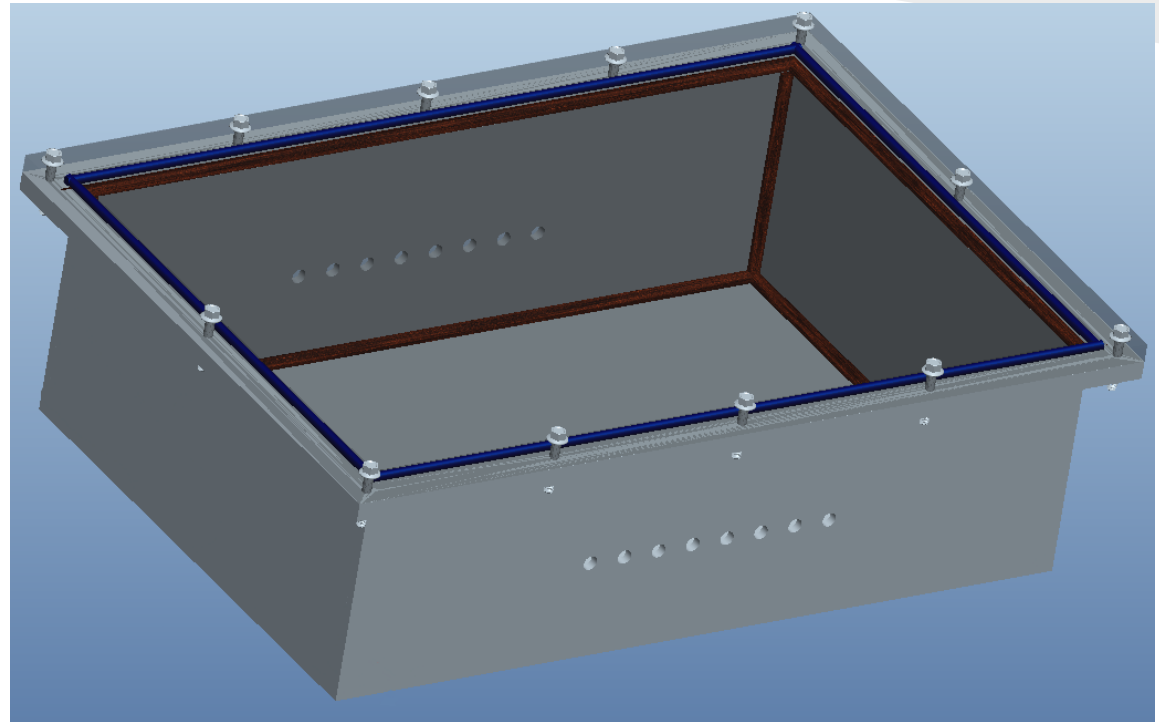
Current Design



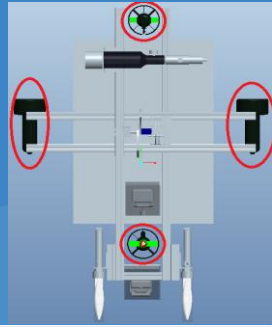
CAD drawing of Assembly

Hull and Frame

- New Hull design
 - Simpler
 - More accessible
 - Better!



Thrusters



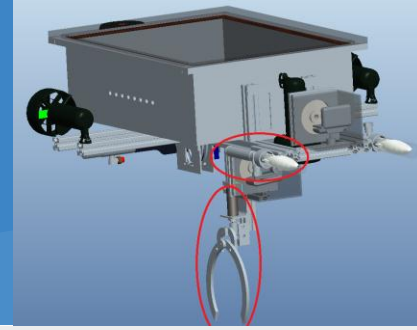
SeaBotix SBT150

- Max Amp.: 5.8A(30 sec duration)
- Max Cont. Amp.: 4.25A
- Max Power: 150W(each motor)
- Total of 4 thrusters



Thruster

Claw and Torpedo Launcher



- Both custom made by last year's team
- Both powered by pneumatic actuators fed by an air tank

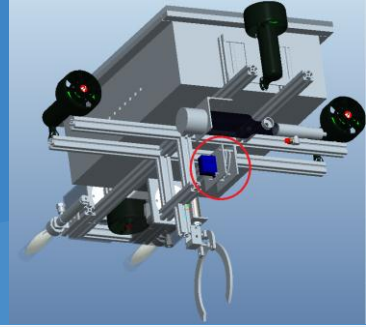


Torpedoes and torpedo launcher

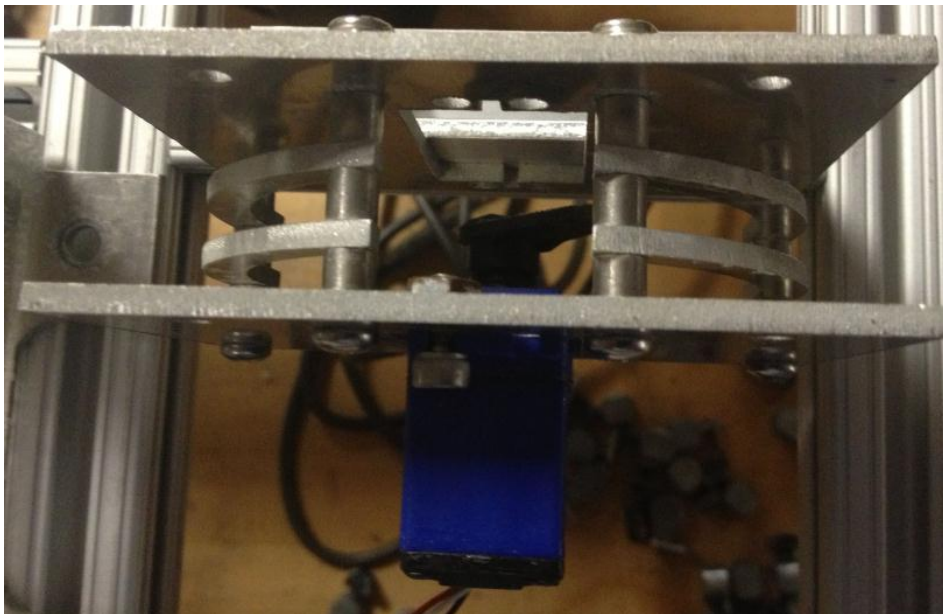


claw mechanism

Beacon Dropper



- Servo motor used to rotate arm to allow beacon to drop out



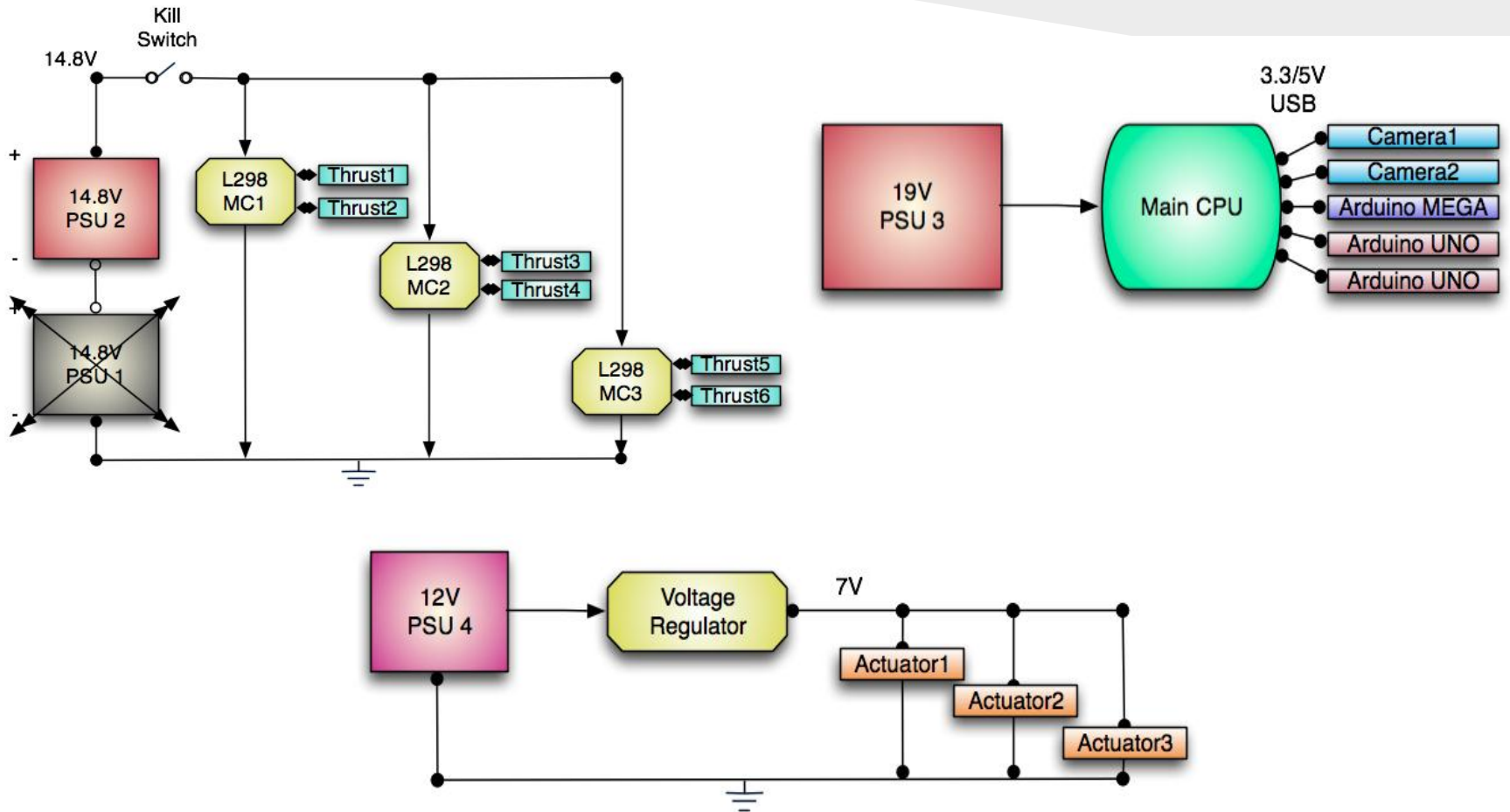
Bottom view of the beacon dropper

Power System



- 2x 14.8V Polymer Li-Ion batteries
 - Only powering thrusters
 - Only using 1 at a time
 - 30A Max Discharge rate
- 1x 19v 4Ah Li-Ion External Laptop Battery
 - Powers main CPU unit
 - Lasts roughly 2-3 hours
 - Essentially powers all USB devices as well
- 1x 12v Li-Ion 18650 Box Battery
 - Regulated to power all other electronics
 - Arduino
 - Actuators
 - 4A Max Discharge Rate

Power Subsystems Outline



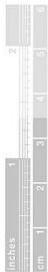
Processing System



- Main System Controller
 - Intel i3 2330M, 8GB Ram, Wifi, 6 USB Ports
 - Controls all subsystems
 - Contains top level controller

- Subsystem Controllers

- Arduino UNO
- Arduino MEGA
 - Controls all 4 thrusters
 - Directly connected to IMU
 - Stabilizes sub movement



- Inertial Measurement Unit
 - Razor 9DOF IMU
 - Acceleration along 3 axes
 - rotation about all 3 axes

Sensors

- Depth sensor
 - IMCL submersible pressure transducer
 - feeds voltages to Arduino



- Hydrophones
 - Sensortech SQ26 hydrophones
 - Passive locating
 - 4 used for 3-dimensional localization

Cameras

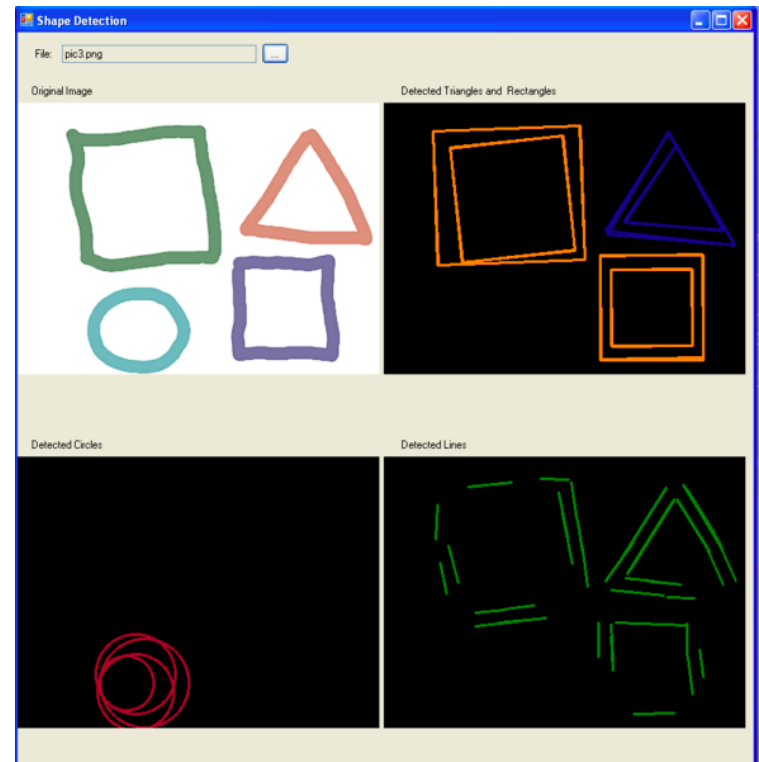
Logitech C615 Webcam

- Using two: one for frontal view, one for ground view
- Will send video for running vision processing

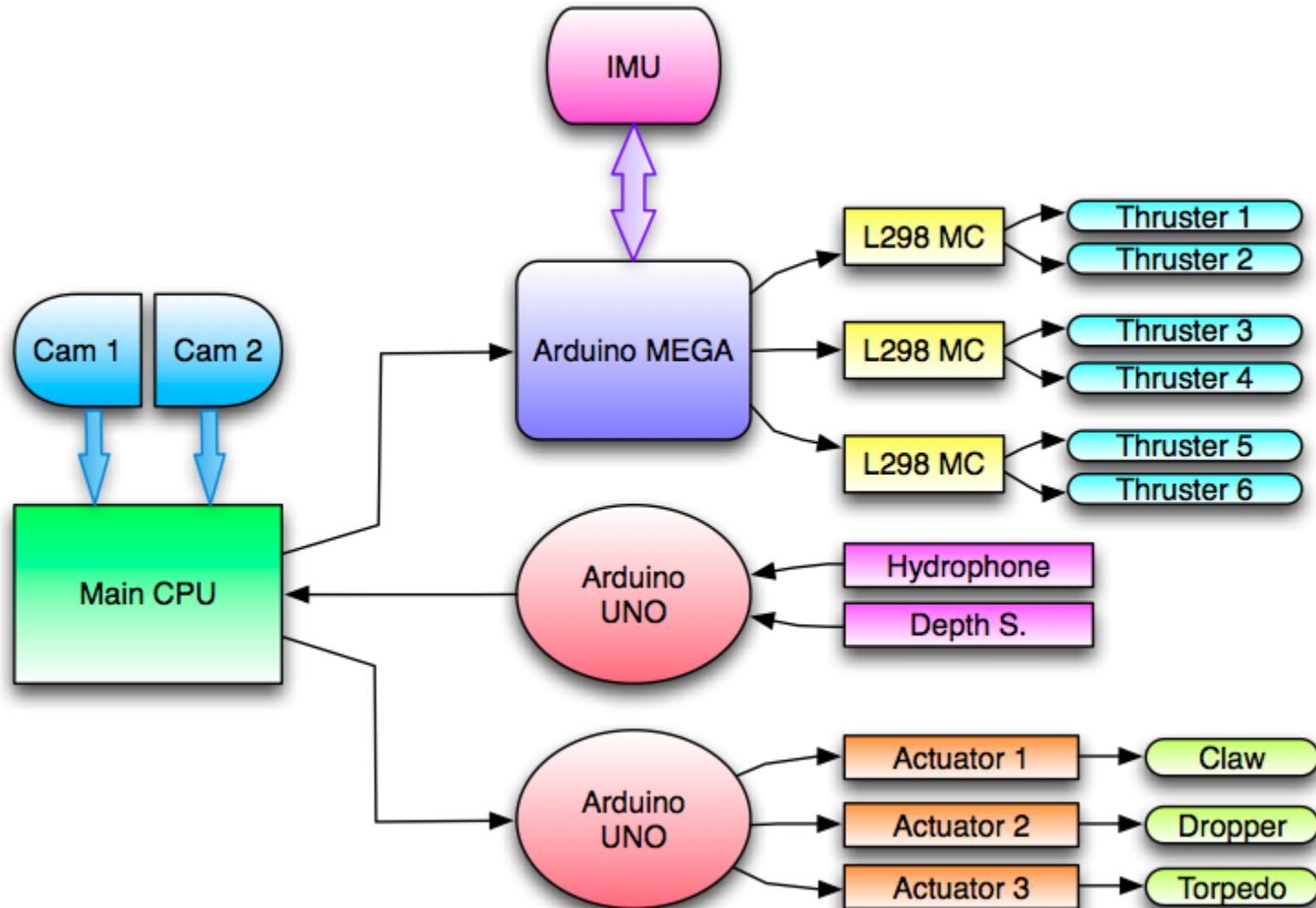


Vision Program

- Running OpenCV software using C++
- Ability to recognize colors and shapes
- Used for location of, direction to, and identification of objectives



Communication Subsystem



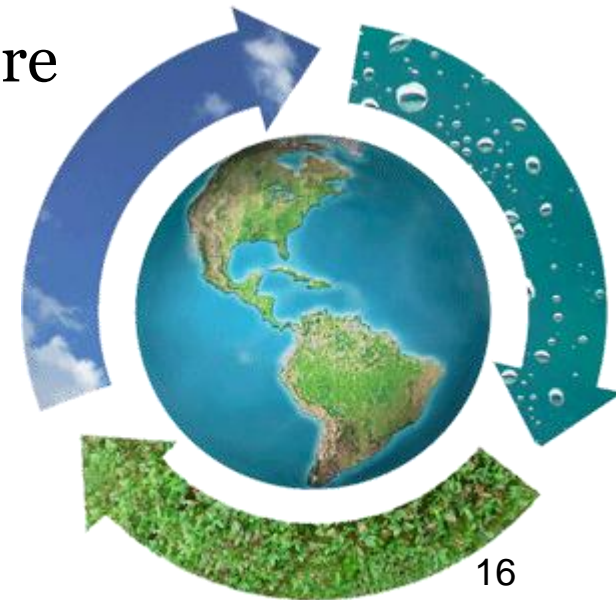
Safety

- Safety of AUVSI divers is a primary concern
 - Low-impact torpedo system
 - Non-toxic sealants
 - Safety shrouds covering blades on all thrusters
 - Exterior kill switch for entire system
- Safety of components
 - Rigid exterior frame
 - Watertight o-ring
 - Separated power systems



Environmental Concerns

- Toxicity of components, sealants, and adhesives
 - standard aluminum
 - non-toxic sealants
- Disposal and recyclability of components
 - Proper disposal of batteries in future years
 - Aluminum hull and frame can be reused or recycled



Future Plans

- Complete the fabrication and testing of the physical design
- Interface with all sensors
- Recognize objects and colors underwater
- Perform trial runs designed to resemble actual competition conditions
- Go To Competition!



Questions



Sources

- [1] OpenCV Shape Recognition. *Image*.
<http://www.emgu.com/wiki/images/thumb/ShapeDetectionExample.png/300px-ShapeDetectionExample.png>

- [2] Recycling. *Image*.
http://www.sunsetscavenger.com/green_cart/images/recycling_logo_eart_h_300x300.gif

- [3] Question Mark. *Image*.
http://upload.wikimedia.org/wikipedia/en/a/af/Question_mark.png

- [4] IMCL Submersible Pressure Transducer. *Image*.
<http://www.sensorson.com/wp-content/uploads/2012/02/IML-500px.jpg>

- [5] Razor 9DOF IMU. *Image*. <http://static3.watterott.com/09510-02-Working.jpg>