

# Portland State Remote Operated Vehicle

Spencer Krum, Patrick Bledsoe, Gregory Haynes

March 15, 2013

# ROV Team

2010 Team at regionals



2011 Team at a meeting



# ROV 2009 and 2010

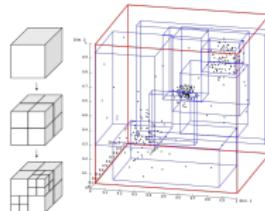
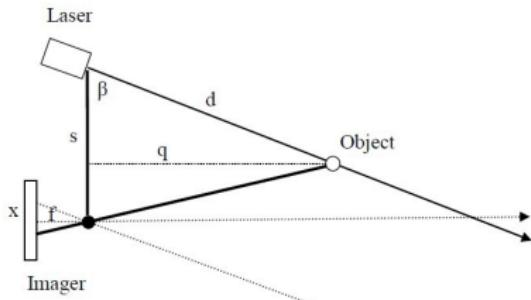
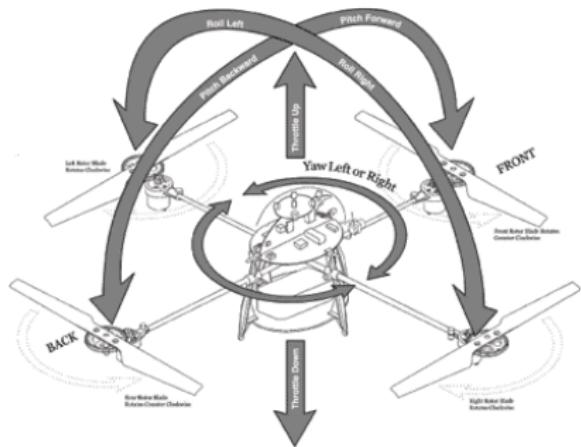
- ▶ 2009 and 2010
- ▶ Underwater Remote Operated Vehicle
- ▶ Marine Advancement for Technology Education (MATE) Center
- ▶ 2009 - Boston, Mass. - 28th
- ▶ 2010 - Hilo, Hawaii - 18th
- ▶ No members of the 2009 team remain, the torch has been passed
- ▶ Switched away from MATE in 2011, seeking new challenges

# International Aerial Robotics Competition

- ▶ Mission
  - ▶ Covertly infiltrate a secret installation
  - ▶ Recover and replace USB stick without being detected
- ▶ Rules
  - ▶ 10 Minutes
  - ▶ Cannot Land
  - ▶ Completely Autonomous
- ▶ IARC
  - ▶ 6th IARC Misson in about 20 years
  - ▶ 1k entry fee(hopefully get waived), 20k grand prize
  - ▶ Mission went uncompleted last year
  - ▶ Designed so that “No currently existing craft can complete the mission”
  - ▶ AUVSI, Association for Unmanned Vehicle Systems International

# The very basics of the plan

- ▶ Quadrotor
- ▶ Mapping and Octrees
- ▶ Perform SLAM
- ▶ AI



# Using school and internet resources to increase efficiency

The collage includes the following screenshots:

- Portland State IARC Robot:** A screenshot of a Google Groups discussion board titled "PSU ROV". It shows a list of messages, including one from "gphaynes" about "Robot handles trash receptacle?" and another from "gregory.haynes" about "Robot handles trash receptacle?".
- github:** A screenshot of the GitHub interface for the "PSU-ROV" repository. It shows several pull requests, including ones from "gphaynes" and "gregory.haynes". One pull request from "gphaynes" is labeled "merged" and has a comment from "gregory.haynes" asking for a review.
- IARC:** A screenshot of the IARC website, showing the "Issues" section. It lists various items such as "Robot handles trash receptacle?", "Robot handles trash receptacle?", "Robot handles trash receptacle?", and "Robot handles trash receptacle?".
- Google Sheets:** A screenshot of a Google Sheets document titled "PSU-ROV-Budget". It contains a table with columns for Part Name, Quantity, Price Per Unit, Order #, and Total Funds. Items listed include Meas, ECU, Pressure, Battery, Power Supply, Pressure Sensor, Microcontroller, Multiplexer, Relay, and Solenoid.

# Close, but not there yet

- ▶ Quadrotor mechanical done
- ▶ Capable of brief flights
- ▶ Closed loop stabilization in 'tweaking' phase
- ▶ Craft takes off, hovers for a few seconds, 'lands'
- ▶ Need floating point unit
  - ▶ Complexity bump
- ▶ 3 PCBs are in the works
  - ▶ Sensor/control board has been prototyped and built once already
  - ▶ Power board has been prototyped
  - ▶ ESC board has been whiteboarded

# Pieces have moved forward, much remains to be done

- ▶ Hokuyo conversation demonstrated
- ▶ Pandaboard/Beagleboard flashed, configured
- ▶ Messaging code(0mq) has been written, but needs to be fleshed out
- ▶ SLAM(Tinyslam) has been investigated, but needs to be worked on a lot
- ▶ AI(A\*?) Hasn't been touched, needs a ton of work

# Things that have tripped us up

- ▶ Noise
- ▶ Sensor drift
- ▶ The accelerometer conspiracy
- ▶ The super-tool problem
- ▶ The leaf problem
- ▶ Cosine function

## Really cool things that happened

- ▶ Greg wrote an RTOS
  - ▶ Bribed mechanical engineers
  - ▶ Kept the number of ‘black boxes’ to an absolute minimum
  - ▶ Set up foodbot

**Flight Components:**

<i>Carbon Fiber Frame</i>	\$100.00
<i>2 Motors</i>	\$89.98
<i>PCB ESCs</i>	\$100.00
<i>Battery Charger</i>	\$119.99
	<b>\$410.97</b>

**Navigation Components:**

<i>PandaBoard Minicomputer</i>	\$174.00
<i>Printed PCB and components (control)</i>	\$200.00
<i>Printed PCB and components (power)</i>	\$100.00
<i>Digital inertial measurement unit</i>	\$64.95
<i>Protoboard and components</i>	\$100.00
	<b>\$638.95</b>

**Miscellaneous:**

<i>Testing Equipment</i>	\$100.00
<i>Unplanned Expenditures(S&amp;H)</i>	\$200.00
	<b>\$300.00</b>

---

Total: **\$1316.84**

# Thank You very much

- ▶ Once again, we're the PSU Remote Operated Vehicle Team
- ▶ I, and my teammates as well, strongly support this pilot program because our experience last year with getting involved in student engineering was the highlight of my college experience to date.
- ▶ Thanks Again!

# We want you

- ▶ Google Group - psu-rov@googlegroups.com
- ▶ Redmine - rov.cs.pdx.edu
- ▶ Weekly Meetings - FABC 86-04 - 1:00pm Saturdays
- ▶ IRC #rov, irc.cat.pdx.edu