# **Rockets and Robotics**

What's up Also robots

### First off, NEW LOGO!!



## **Open House Project Day**

- Pacman Bot demo
- Drone guts
- Social and academic exchanges.



## **Tinker Days**

- Open to everyone
- Social Environment
- Active Mentorship and Skill building
- Regular progress made towards

each of out project goals





## Bumble BEE

• Aerosubmersable

• Bicopter for the challenge

• First major project



## Other notable projects

- Humanoid camera interface
- Handy Hand
- Solar cockroach
- ESC developments



## **PSAS** and **OreSAT**





## Launch Vehicle No. 3

- Composite airframe demonstrator
- Estimated 8 km (24,000 ft) apogee
- Tested in Spring 2018





## Liquid Fuel Engine

- Regeneratively cooled 2.2 kN prototype engine
- LOX + Isopropyl alcohol (IPA)
- DMLS 3D-printed Aluminum
  - Thank you i3D MFG!





## **Electric Nose Cone Separation (eNSR)**

- Better than pyrotechnics -- for us anyway
  - it's testable for reliability
  - gives us staging heritage
- Marmon ring / Lightband-inspired design





### **Reaction Control System (RCS)**

- Aerodynamic control surfaces don't work very well above 30-40 km.
- Cold-gas rocket propulsion
  - 8 N (roll), 11 N (pitch x, y)
  - 8x 3D-printed bell nozzles
  - PWM throttling
  - "Robust" control





## LV4: Composite Tanks

- Extremely lightweight
  - Cryogenic LOX tank
  - Isopropyl alcohol tank
- Low pressure (~ 45 psi)
- PTFE inner liner + gaskets
- Composite + AI + Cryo = hard
- 2016-2017 ME capstone!



## **Electric Feed System**

- Replace heavy high pressure tanks with lightweight low pressure tanks
- Pump low pressure propellants into motor with electric feed system
- 2.5kW RC boat motor! 30V LiPo batteries! Totally not crazy.
- 2016-2017 ME capstone



## **Encouraging Self Motivation**

- Long list of suggested skills to develop
- Open atmosphere and open organizational style
- Mentorship
  - Eagle Cad
  - $\circ$  Soldering
  - Git Workshops

#### Moment to talk about about the EPL









## **Prototype Helical and Turnstile Antennas**

- OSGC UTEAP supported!
- Directional +16 dBi RHCP helical
  - O S band (2.4 GHz) TX OreSat Live connection
- Omni RHCP turnstyle antenna
  - 70 cm (470 MHz) TX/RX Control radio
  - L band (1.2 GHz) RX Backup RX
  - L1 band (1.575 GHz) RX GPS
  - S band (2.4 GHz) TX/RX OreSat live backup









#### **Reaction Wheels!**





### Attitude Determination System: Star tracker

- More "Cell phone cameras", but for stars!
- Open source **Tetra** star tracker program
  - $\circ$  Crappy local star field image  $\rightarrow$  Tetra algorithm  $\rightarrow$  Right Ascension, Declination, and Roll.
  - http://tetra.rocks/ 300 MB database, one *single* database lookup using hashes





## Open SDR GPS receiver

- Yep, GPS works in space.
- Position + Velocity = Keps!





### SatNOGS: Satellite Networked Open Ground Station

• LibreSpace Foundation's open source receive-only ground stations



## University Class Open Ground Station (UniClOGS)

- Worst Name Ever
- Expensive (\$10k each)
- Fully SDR design based on the Lime SDR
- Transmission enabled
  - Danger danger: regulatory red flags
- 2m, 70cm, and S-band
- Fully open sourced on top of SatNOGS network
  - Prototype going up on PSU Engineering Building roof
  - Soon at Pine Mountain Observatory in central Oregon (University of Oregon site)



## Oh yes we did.

