The Projects of…



Joe Grand aka KINGPIN

Zoz aka

DEFCON 17

Prototype This!

- Engineering entertainment program on Discovery Channel
- Four guys building prototypes of crazy things
- Try to follow the "true" design process
- Premiered October 2008 (US), ~February 2009 (World)
- Thirteen episodes
- ~1 million households/episode
- **www.discovery.com/prototypethis**





Joe Grand





electrical engineer. hardware hacker. daddy.

KINGPIN

Zoz Brooks









robotics. software programming. mad scientist. mit.

KINGPIN









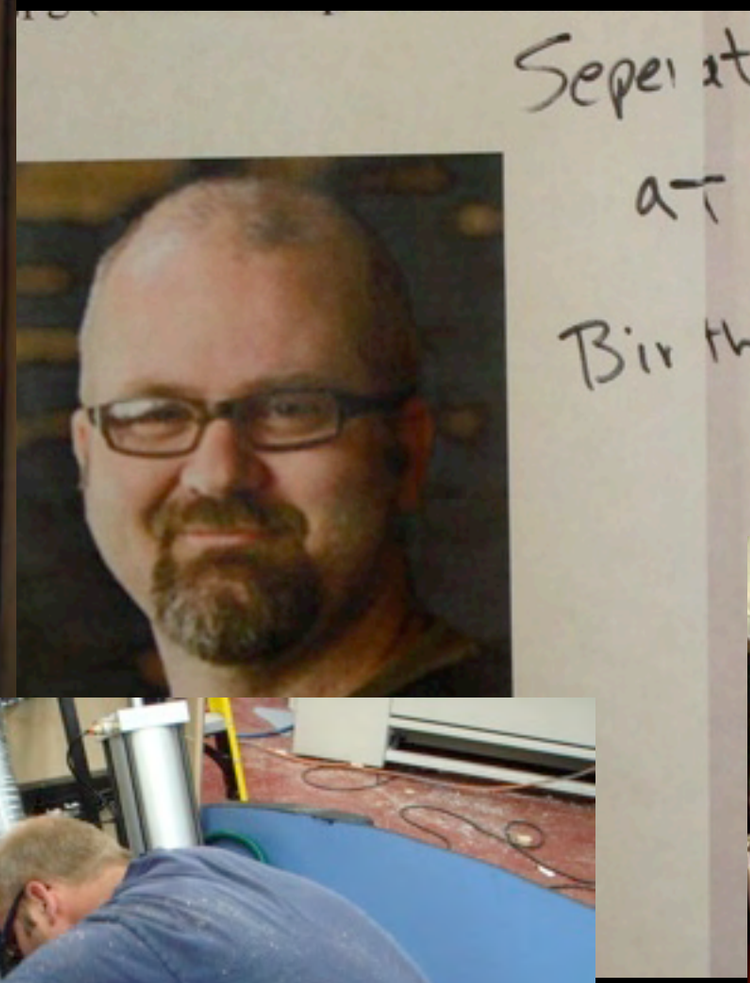
Mike North

materials scientist. mechanical engineer. ucsb.

KINGPIN

Terry Sandin







special effects. machinist. fabricator.

Friends











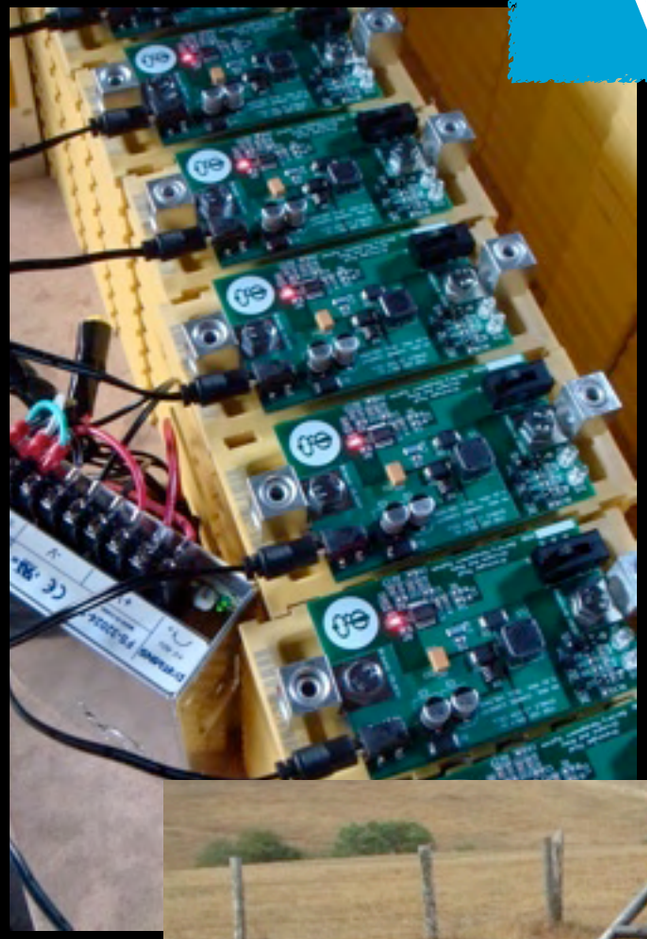
joe andreas. kevin binkert. steve lassovsky. flaming lotus girls. nemo gould. diana coopersmith. many, many more.

KINGPIN

We built stuff like this...



We built stuff like this...







We built stuff like this...









With not a lot of this...





(Contrary to popular belief...)

Challenges

- TV is nothing like how it really happens in real life
  - Don't believe the hype
- Most producers/editors/execs were not technical and didn't care to be
  - Were only interested in the final result
- Did not understand the complexity of the tasks
  - Assumed everything was easy
- Wanted unrealistic projects that had never been done before built in two weeks or less
  - Ex.: X-ray glasses, personal force field
- How to make engineering sexy?

Traffic Busting Truck



- Omnidirectional Wheels
- Autonomous Parking
- Drive/Park Over Traffic
- ~4 weeks

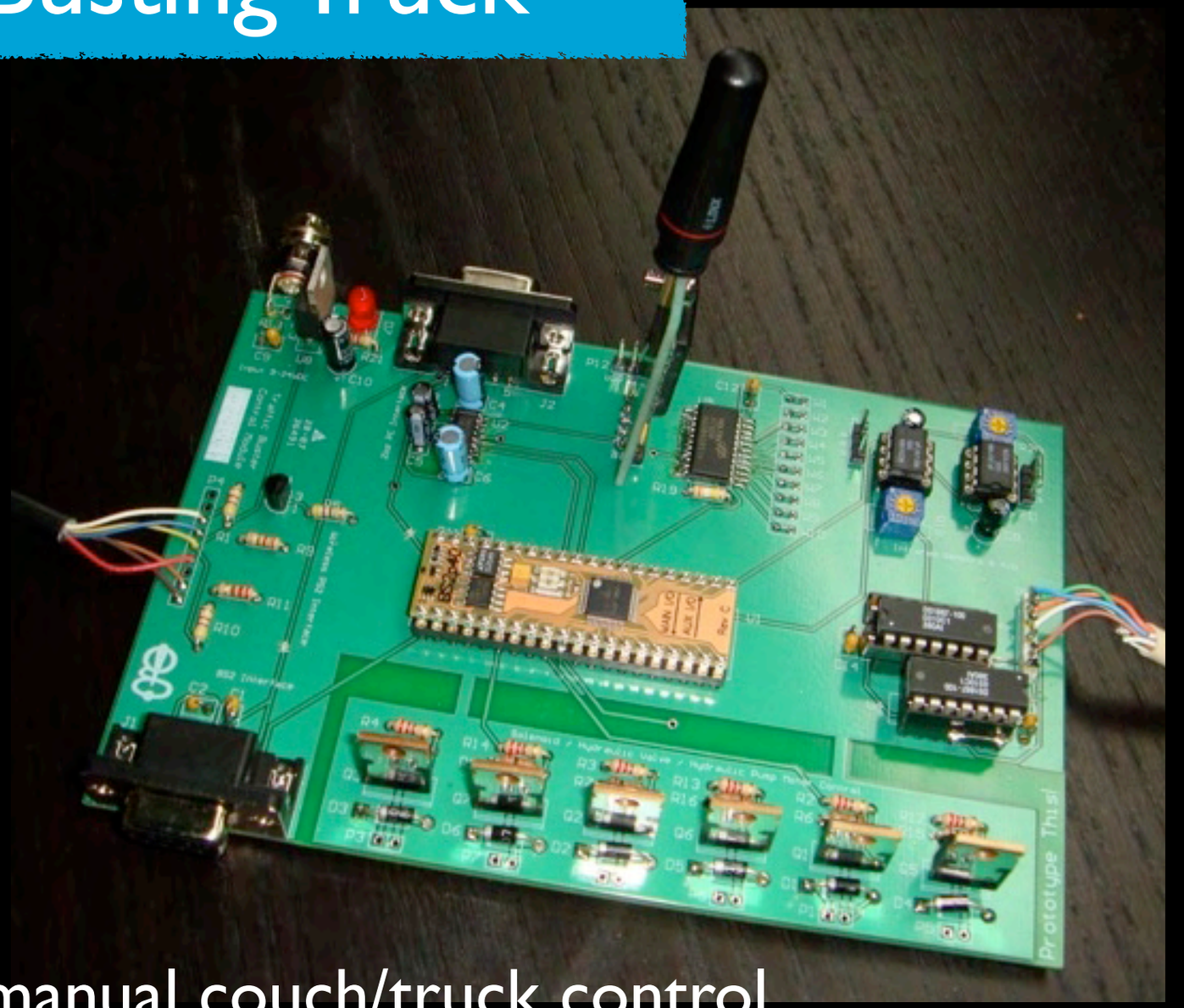


Traffic Busting Truck



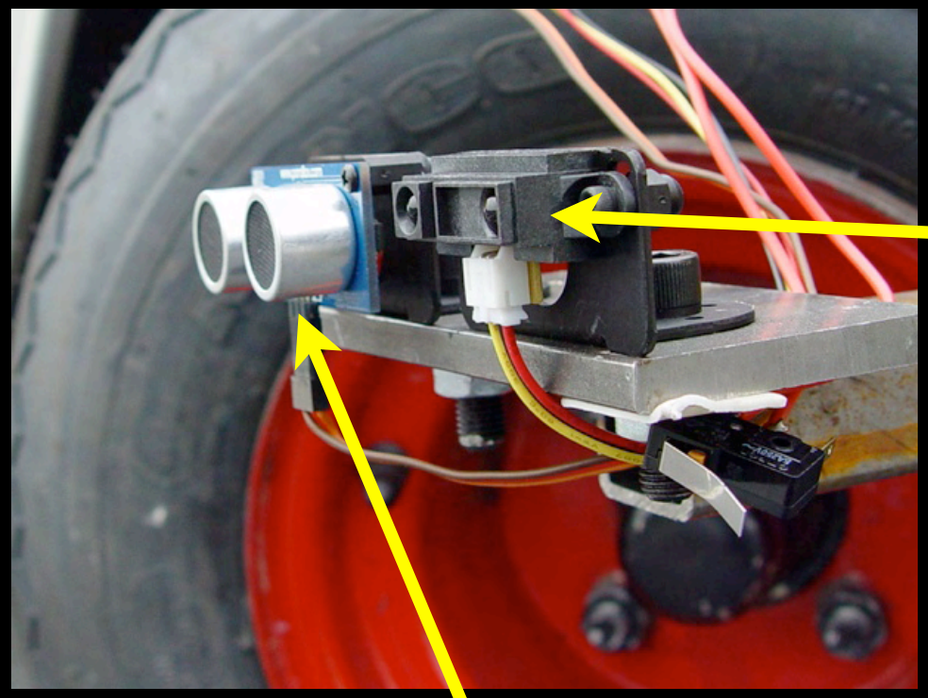
Traffic Busting Truck





- BASIC Stamp 2p40
- RF Keyfob
- Wireless PS2 Controller for manual couch/truck control
- Solenoid/Hydraulic Valve control via MOSFET
- DS1867 Digital Potentiometers for Joystick Emulation for omnidirectional wheel control
- Serial port I/F to communicate w/ Zoz's autonomous control S/W

Traffic Busting Truck Sensors



Sharp GP2 infrared rangefinder

Parallax PING))) ultrasonic rangefinder



Videre Design STOC stereo camera



- IR, US: single range
- Stereo: 640x480 RGBD map
- IR: detect suitable gaps between parked cars
- Stereo: parallel alignment of vehicle at parking distance
- Ultrasonic: curb detection for park slide completion

Fire Fighter PyroPack

- High-tech FF pack & headset
- ~2 weeks





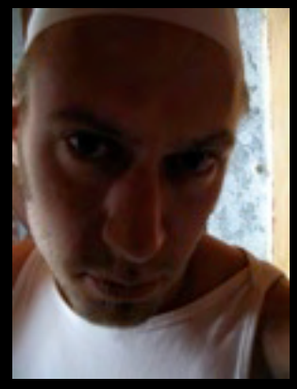


Fire Fighter PyroPack

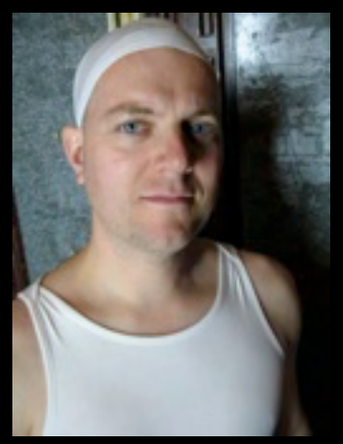


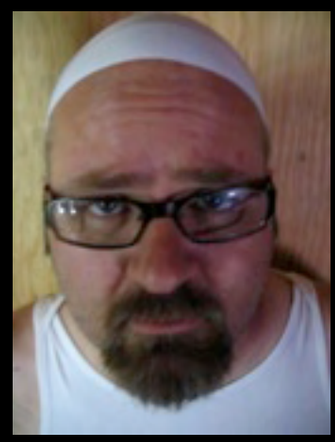
Sexy 3-D Body Scans!@#





Nerds Gone Wild!



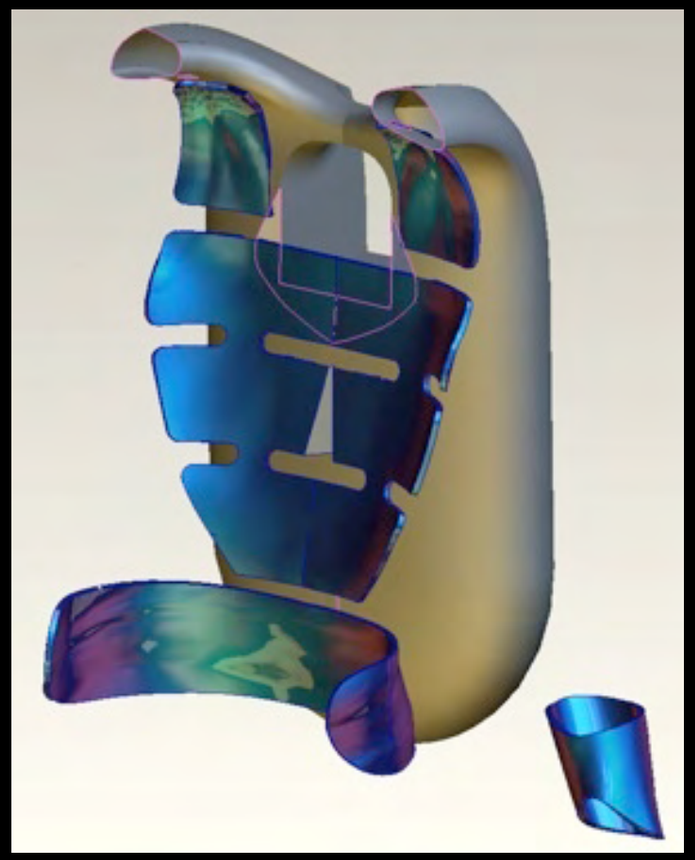


KINGPIN

Fire Fighter PyroPack









- Pack "printed" by Forecast 3D, San Diego

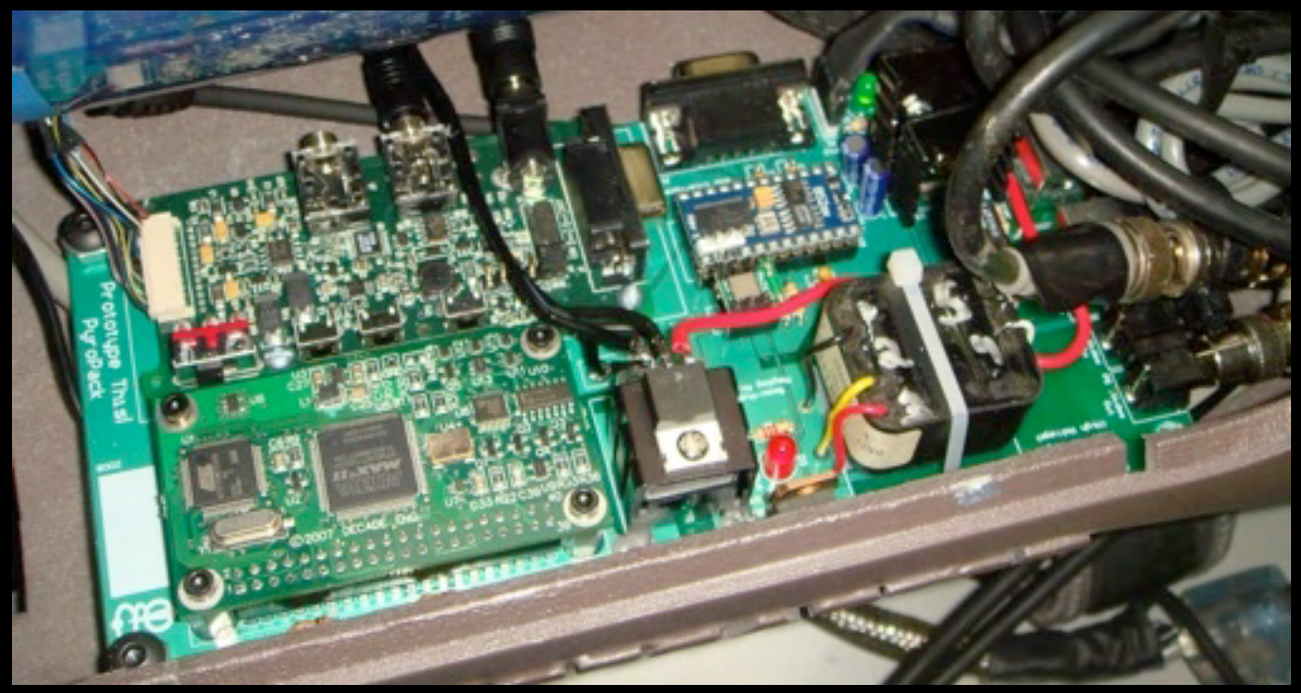
Fire Fighter PyroPack



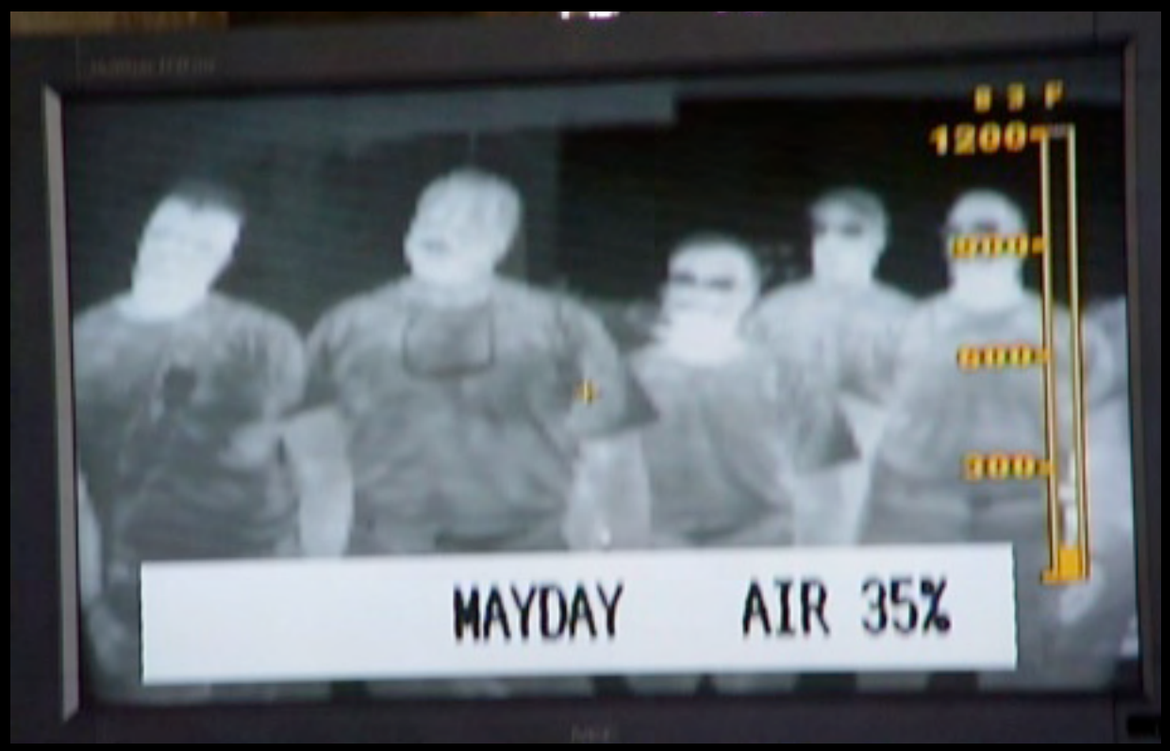
- Breathing air tank
- Primary regulator
- Digital pressure transmitter
- Dry-chem
- Makita 18V drill battery
- Circuit board

- Thermal imaging camera
- Heads-up microdisplay

Fire Fighter PyroPack



- BASIC Stamp 2sx
- Parallax RFID Reader
- Memsic 2125 Accelerometer
- BOB-4-H On-Screen Display Module
- eMagin Reference Board

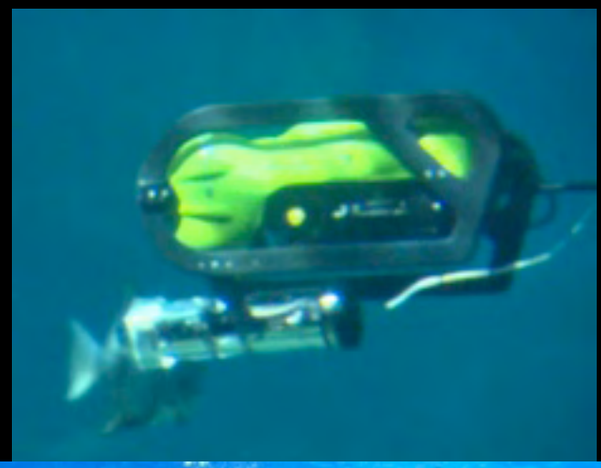


- Thermal image
- Temperature display
- % of remaining air
- Firefighter identification

Virtual Sea Adventure

- Underwater Projection
- Remotely Controlled Seabotix ROV via 1000ft. Ethernet
- Magnetic Thumb Control
- Live HD Video Feed
- ~2 weeks

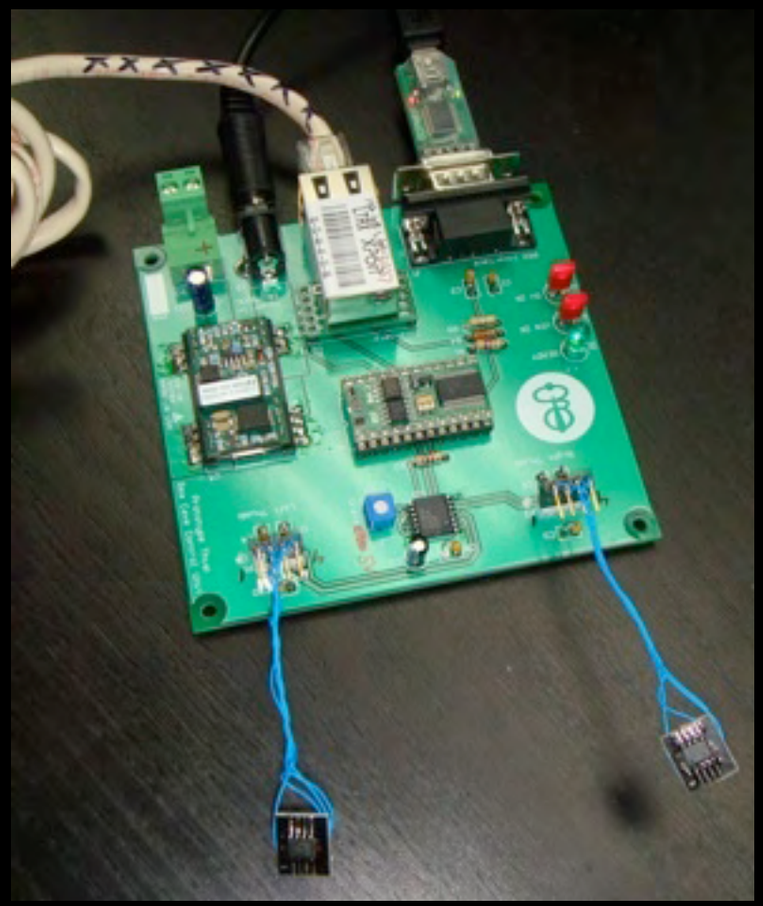






Virtual Sea Adventure

- BASIC Stamp 2
- Melexis MLX90333 3-D Magnetic Position Sensors
- ADC0834 Analog-to-Digital ICs
- Lantronix XPORT Serial-to-Ethernet Interface (sends control data inside UDP Broadcast packet)

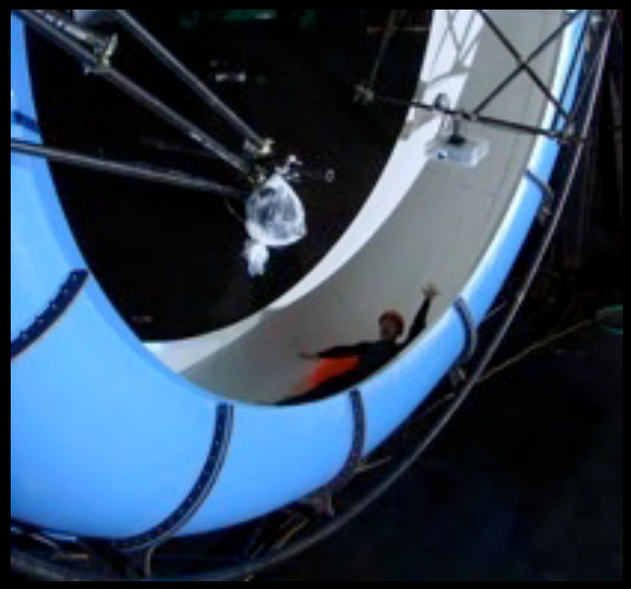




Virtual Sea Adventure

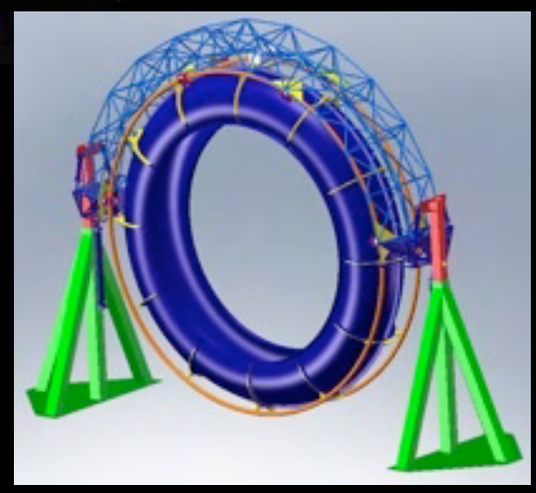


Waterslide Simulator

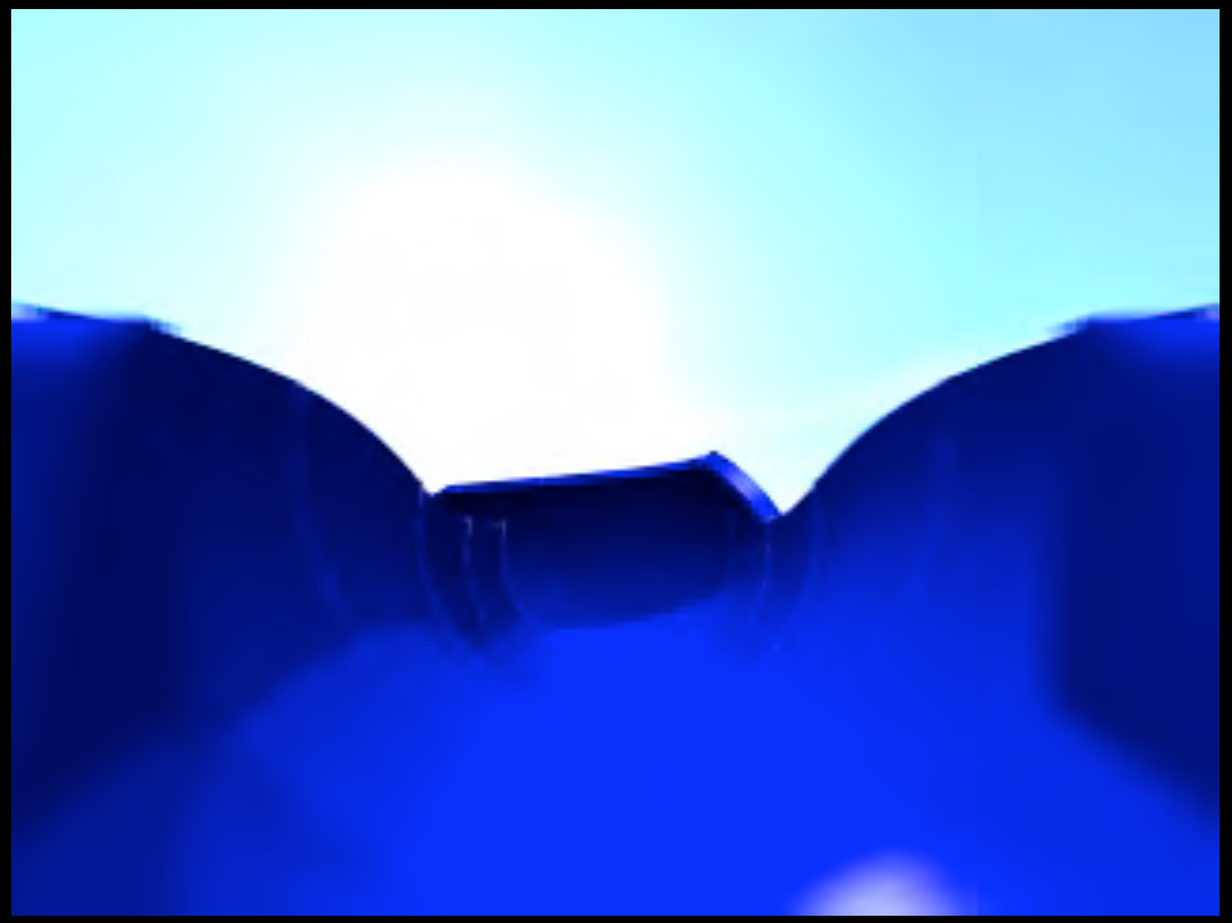


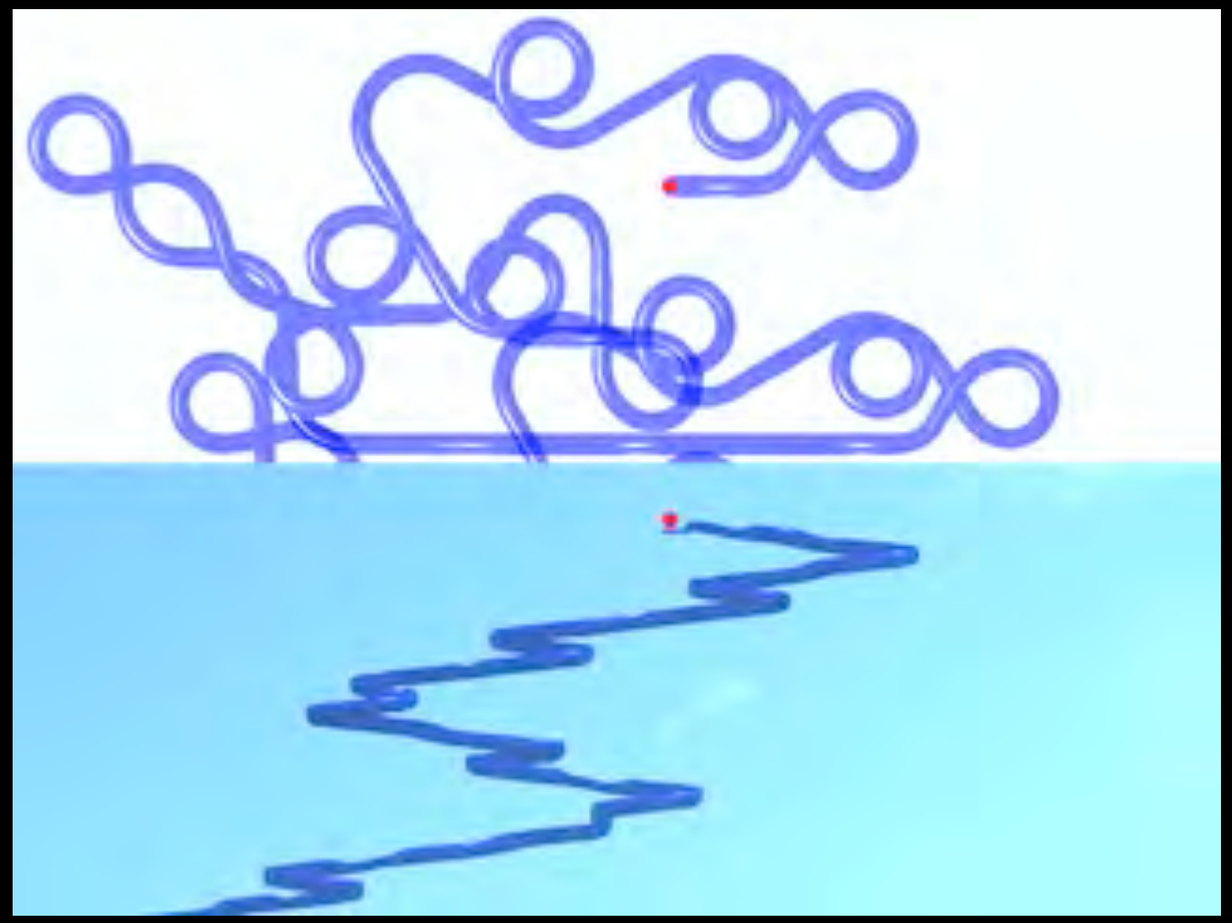


- Fully computer controlled motion simulator
- Real water!@#
- Over 30 feet tall
- 5 weeks (build/program/test)
- CAD/FEA predesign by Acorn



Waterslide Simulator

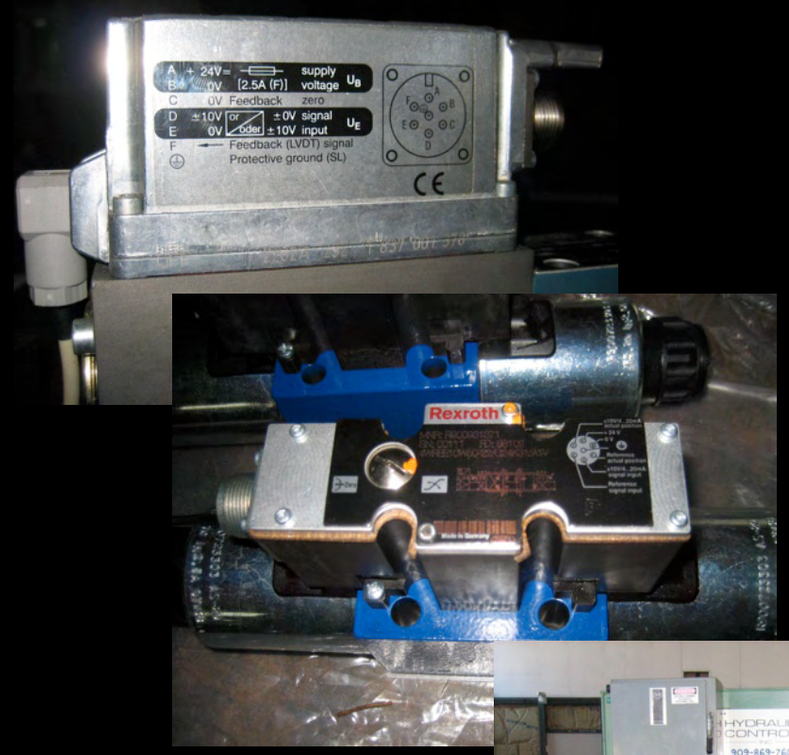




- 3D rendering of waterslide by Splashtacular
- 3600 ft slide – too much for physics sim package!
- 6-axis camera flythrough
- 3DOF output mapping: lift, tilt, rotation

Waterslide Simulator









- Heavy metal!
- RMC150 embedded motion controller
- 6 linear axes (2 lift, 4 tilt), 1 rotary
- UDP direct write access to RMC150 registers

Waterslide Simulator Control





- 3DOF B-Spline interpolated axis data downloaded to RMC
- Controller/visualizer (OS X Java) UDP commands RMC
- RMCTools (Windows in VM) monitors & tweaks control loops
- Secondary visualizers (OS X Java) synced via UDP

Flying Lifeguard

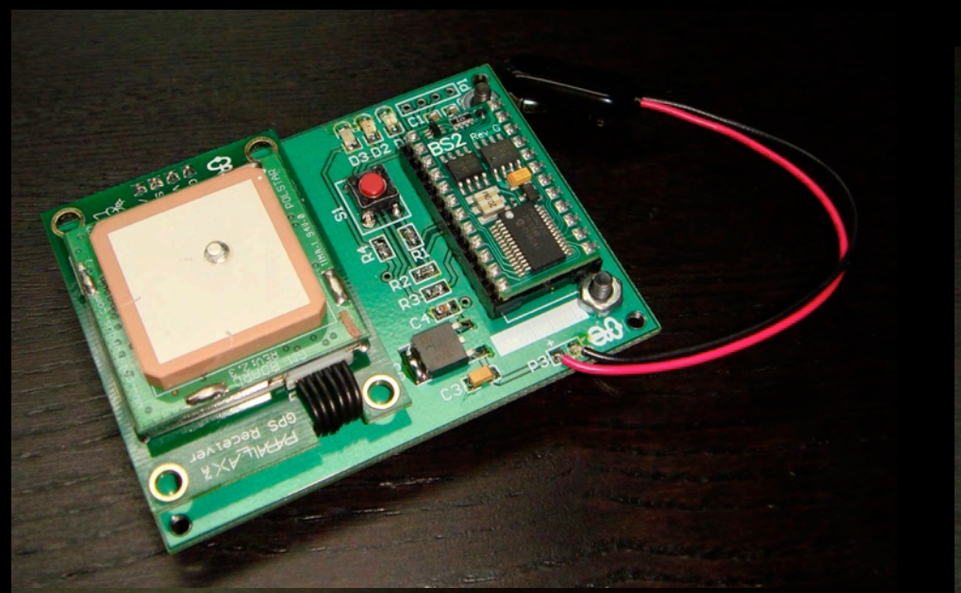
- Lifesaving equipment for the "beach of the future"
- Autonomous airplane with lifejacket delivery
- Short-range auto-positioning pneumatic cannon to shoot lifejacket into surf zone
- Wristband transmitter worn by swimmer sends GPS coordinates

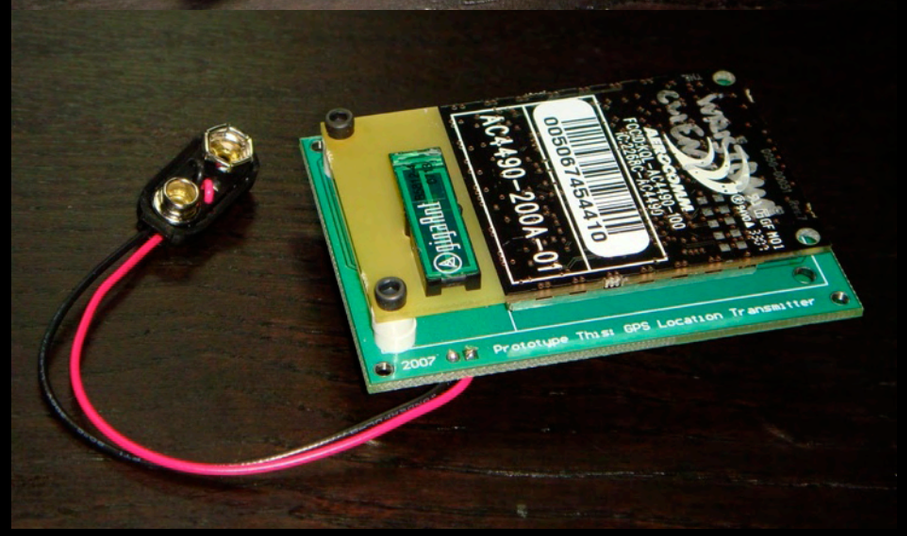




Flying Lifeguard

- BASIC Stamp 2
- Aerocomm AC4490 900MHz RF Transceiver
- Parallax GPS Receiver Module
- Enclosure made with Z-Corp 3D printer

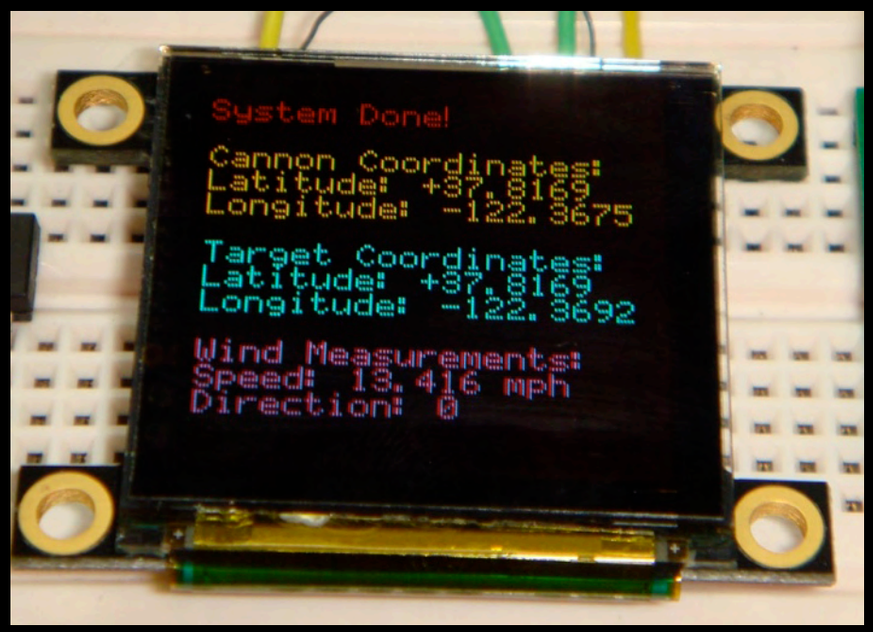


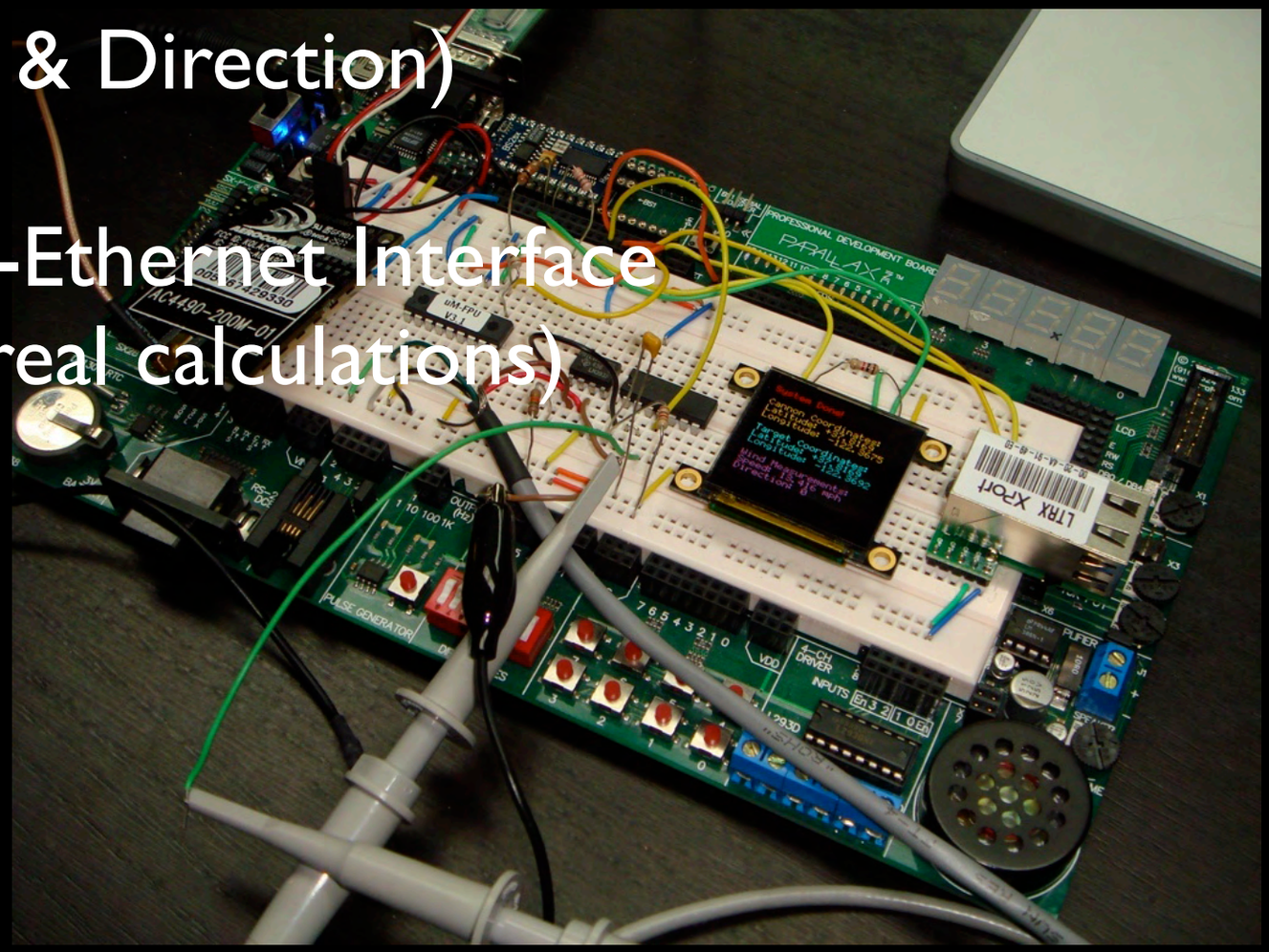




Flying Lifeguard

- BASIC Stamp 2sx
- Micromega uM FPU Floating Point Coprocessor
- Aerocomm AC4490 900MHz RF Transceiver
- Parallax GPS Receiver Module
- Anemometer (Wind Speed & Direction)
- Miniature OLED
- Lantronix XPORT Serial-to-Ethernet Interface (data sent to Zoz's PC for real calculations)

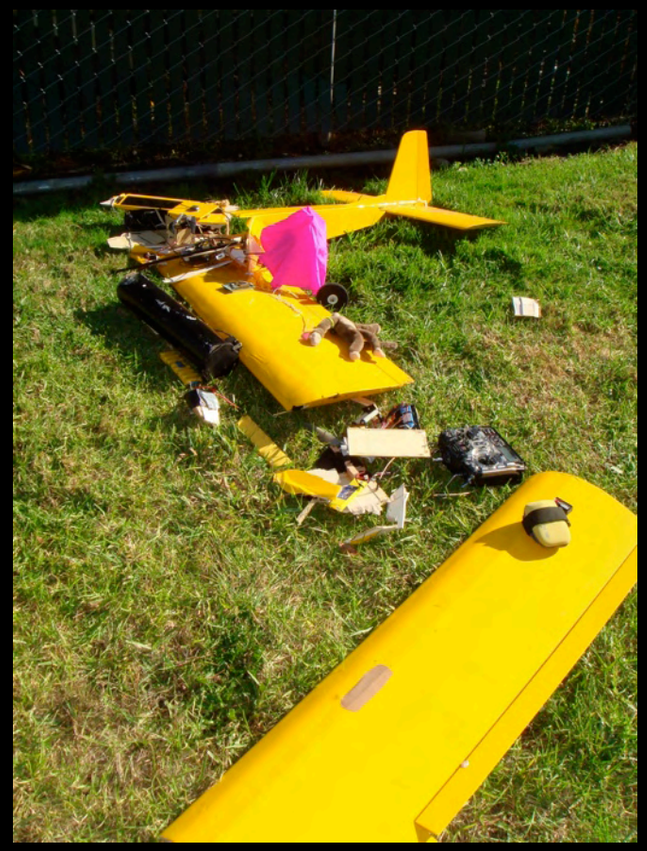




Flying Lifeguard

- Micropilot MP2028 UAV & HORIZON ground control software
- Rocket launch via sled mechanism
- Some custom plug-ins for more accurate GPS tracking
- Servo-controlled payload deployment







Flying Lifeguard





- Cannon firing solution
  - Map lat/longs to WGS-84 ellipsoid
  - Correct for magnetic/true North
  - Compute base chamber pressure for range
  - Anemometer data to correct for wind speed and direction

- UAV launch procedure
  - Load lat/longs into HORIZON
  - Set up approach run with waypoints
  - GPS only samples @ 1 Hz!
  - Trigger drop servo within target range predictor

THANK-U+GOODNITE
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