

The Joy of High-Altitude Ballooning

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Naperville North High School
QuarkNet Teacher Workshop
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High-Altitude Ballooning

- sending a small payload to the edge of space by means of a sounding balloon ... and hopefully getting it back
- also known as: space ballooning, near-space ballooning

Why Would You Do This?

- fantastic STEM project
- incorporates various disciplines (physics, earth science, weather, engineering, electronics, photography)
- great opportunity to inspire younger students
- did you see the photos?

Space Ballooning for All Ages Grant

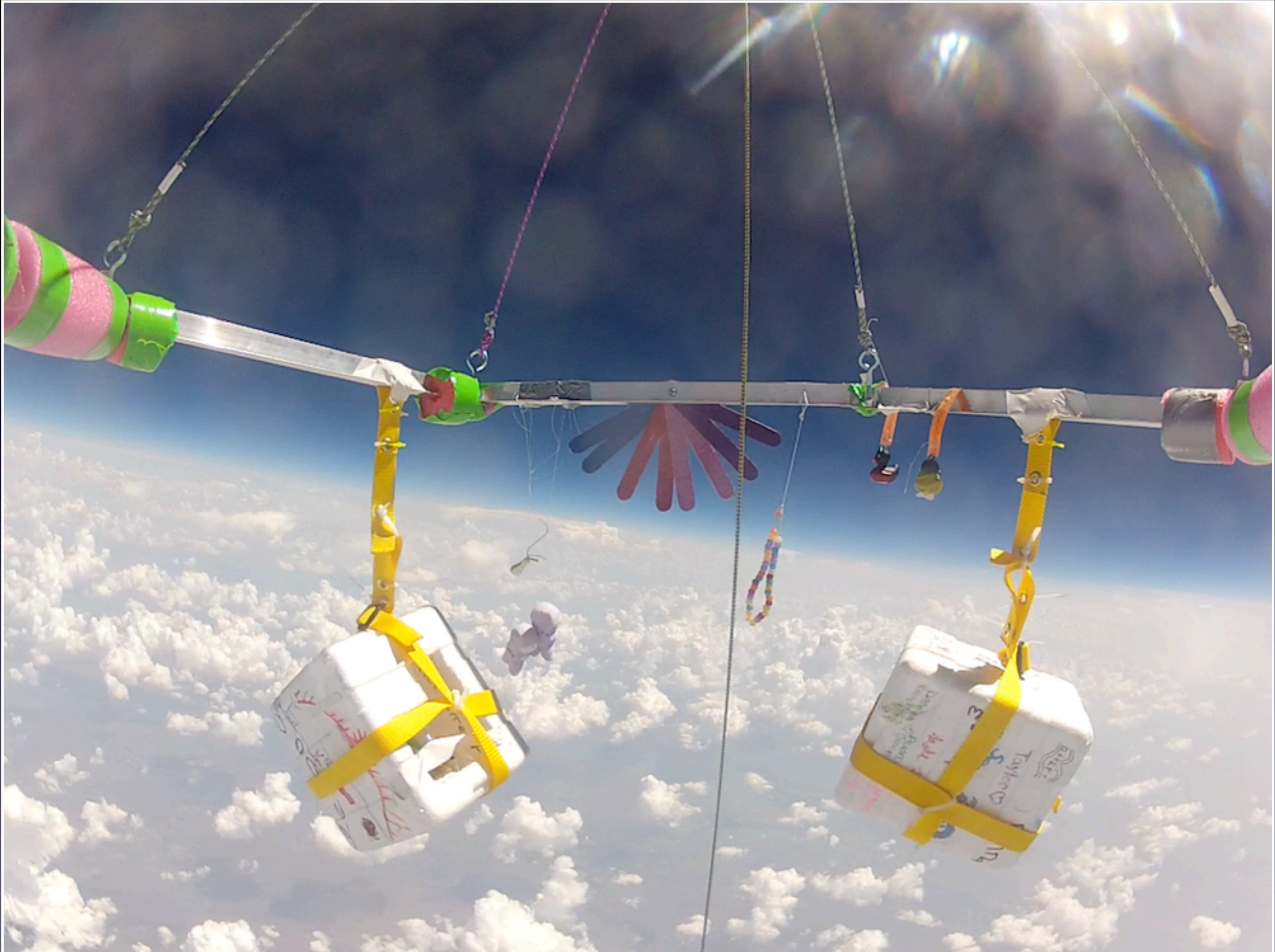
- 4 elementary/middle schools classes
- experiments were defined, designed, and built by elementary/middle school students
- high school Physics Club students were the mentors and executed the design, launch, and recovery



Friday, 2 August 13



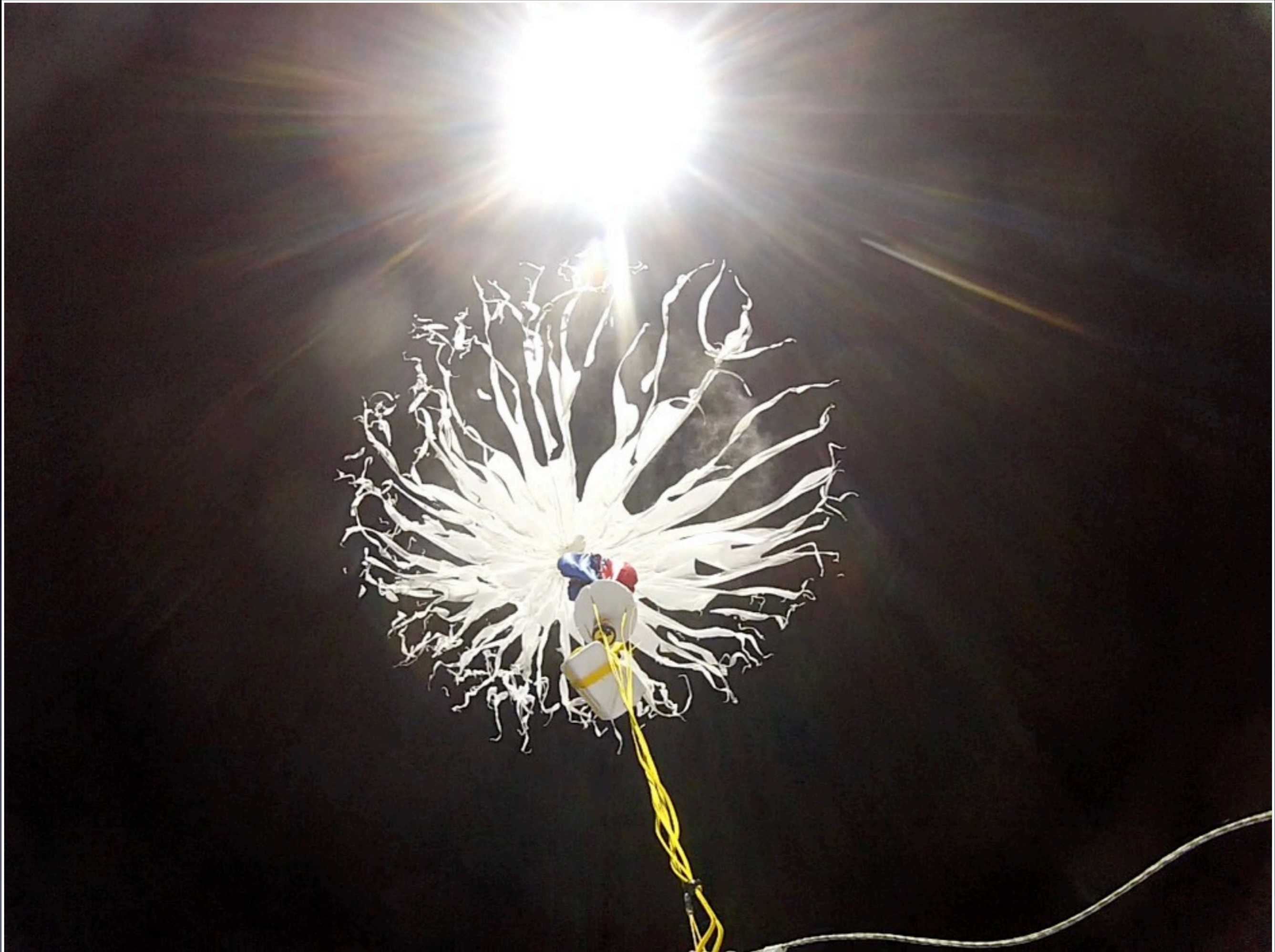
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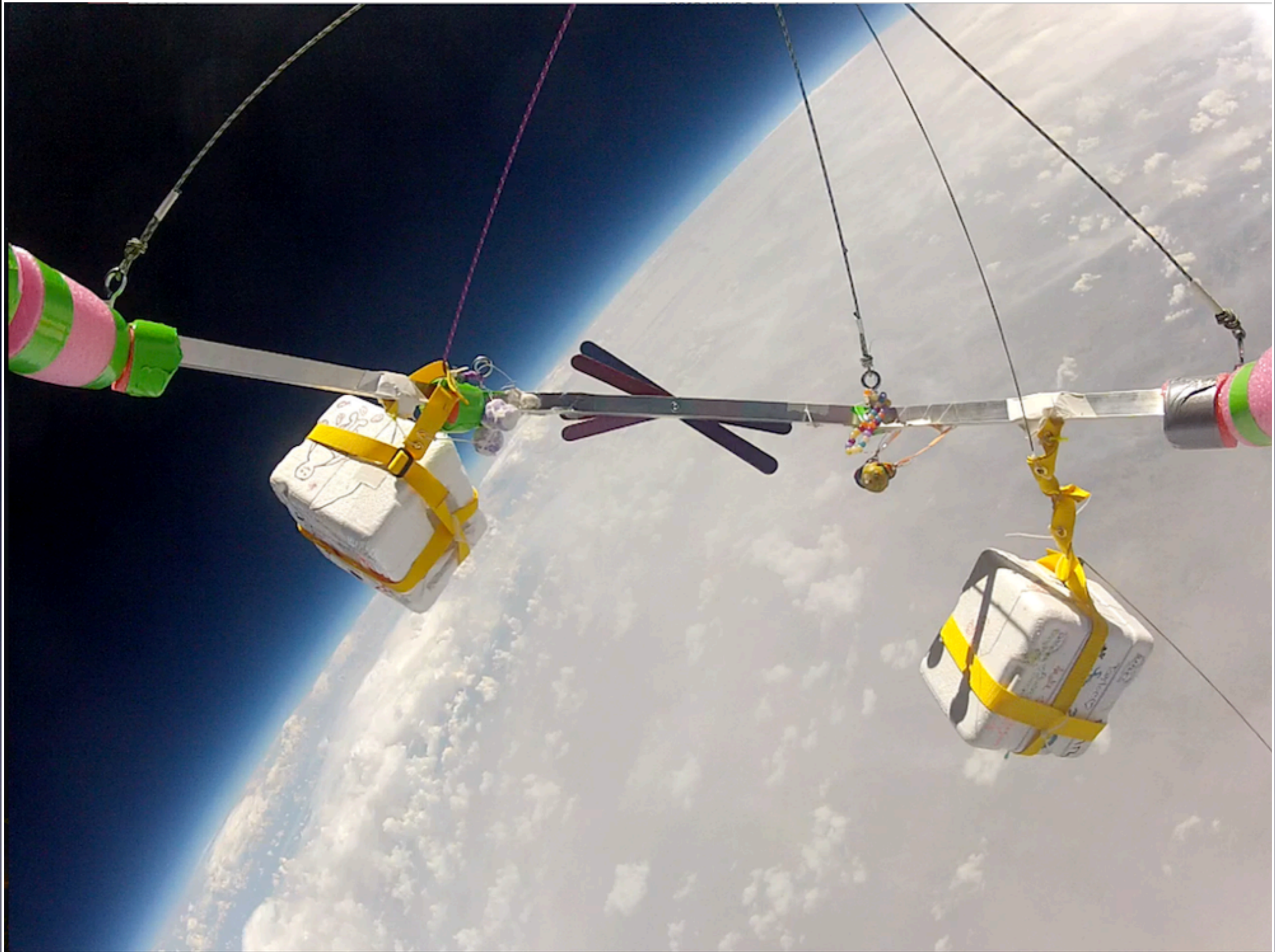


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Minimum Equipment

- sounding balloon and helium
- payload
- camera
- cut down mechanism
- parachute
- tracker

Sounding Balloon

- most expensive part
- 500 g – 3000 g
(\$40 – \$400)
- we used 3000 g last year
- 12 ft diameter at release
- 35 ft diameter at burst
- purchase from Kaymont
or Scientific Sales



Payload

- insulates and protects electronics
- low cost: take the one sitting in the back of your classroom or borrow an insulated lunch bag
- high-end: ripstop nylon sewn shell with tie loops around insulation structure



Camera

- still or video or both!
- low cost: Canon PowerShot (replace firmware), old Flip cam
- high-end: GoPro HD HERO (still and video)



Cut-Down Mechanism

- FAA requires two cut-down mechanisms
- #1: balloon bursts
- #2: nicrome wire melts through cord between payload and balloon
- controlled with timed relay



Parachute

- low cost: “borrow” a kindergarten teacher’s
- design challenge: keep parachute from getting tangled



Tracker

- communicates payload location
- low-cost: SPOT Satellite GPS messenger
- high-end: GPS receiver and APRS radio transmitter & ground-based radio receiver



Extra Goodies

- sensors
- experiments
- lithium batteries
- hand warmers

Sensors

- data loggers for temperature, pressure, radiation
- Arduino microcontroller with data logging shield (stores data on SD card) and sensors



Elementary / Middle School Experiments

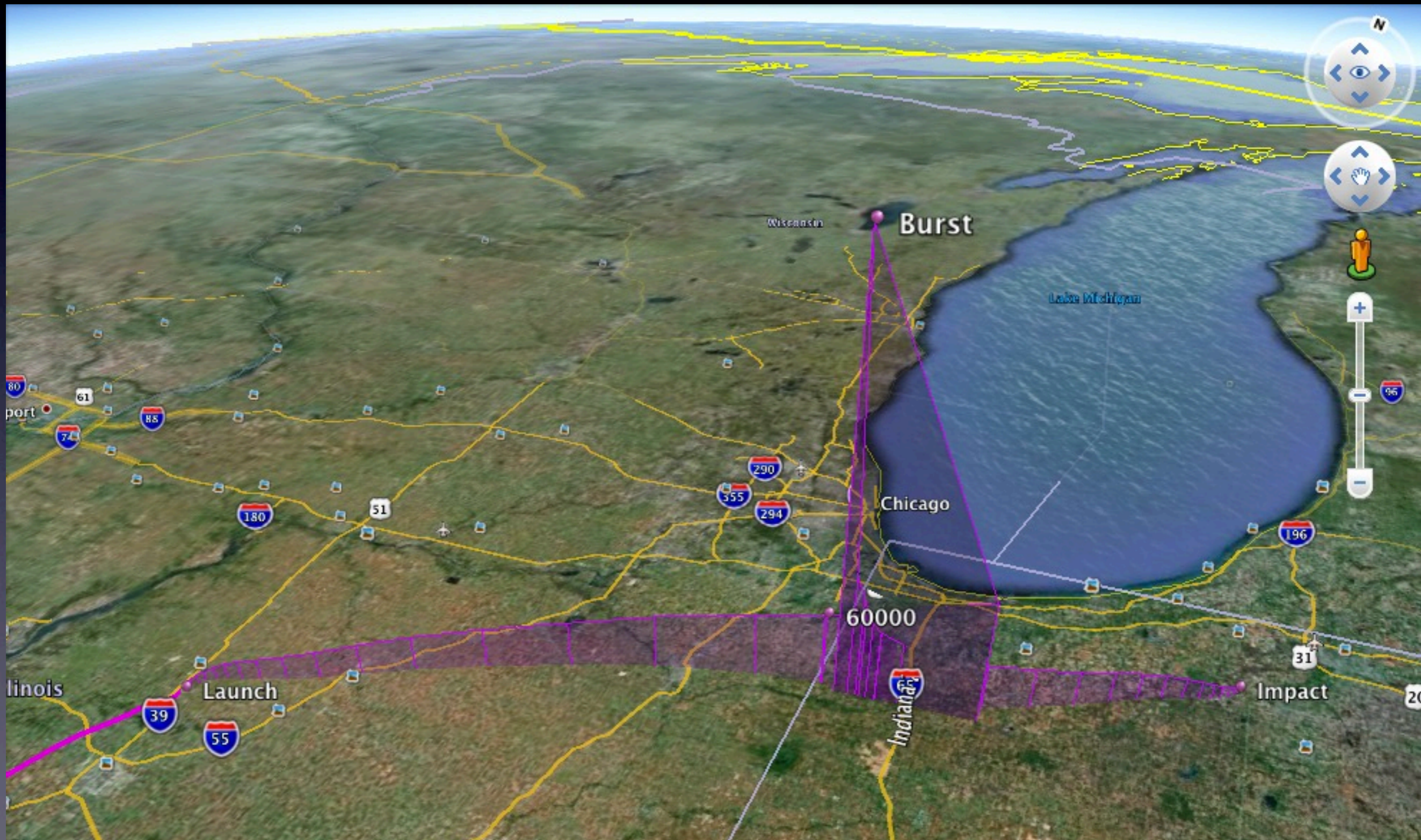
- creativity runs wild!
- UV-sensitive nail polish
- Peeps
- catsup packets
- Jello and popcorn



Other Stuff You Need

- flight path prediction
- weather report
- launch site
- launch procedure
- recovery plan
- luck

Flight Path Prediction



Weather

Earlier in the day is best chance to avoid bad weather. In the lower levels it still is consistently a southwest wind. As you go higher it turns a little more from the west and a little less south, but still a general West/Southwest flow most all the way up so I would guess somewhere in North Central Indiana as your landing point depending on how long it is in the air (winds are pretty strong in the lower levels, so it might take off pretty quickly). Let me know if you have any questions. – Zach Horn

Launch Site

- steer clear of the lake
- El Paso, Illinois (2 hours southwest)
- pavilion, powered outlets, restrooms, open field, few power lines



Launch Procedure

- plan out what everyone is going to do
- takes us a long time to get ready to release



Recovery Plan

- sometimes you get the GPS data and you find it here
- ... and sometimes with APRS receivers you can catch the payload as it float to the ground



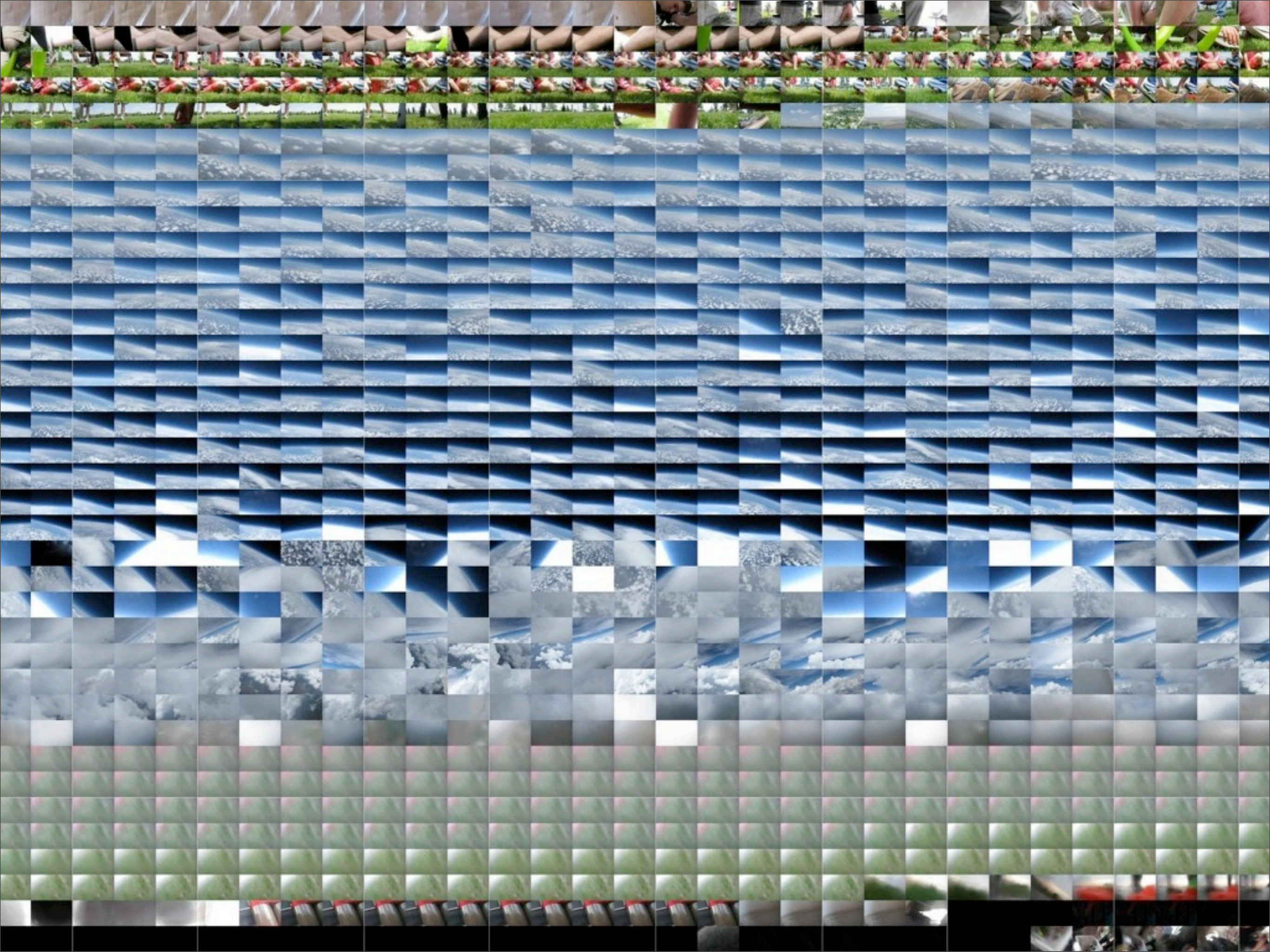
Recovery Plan

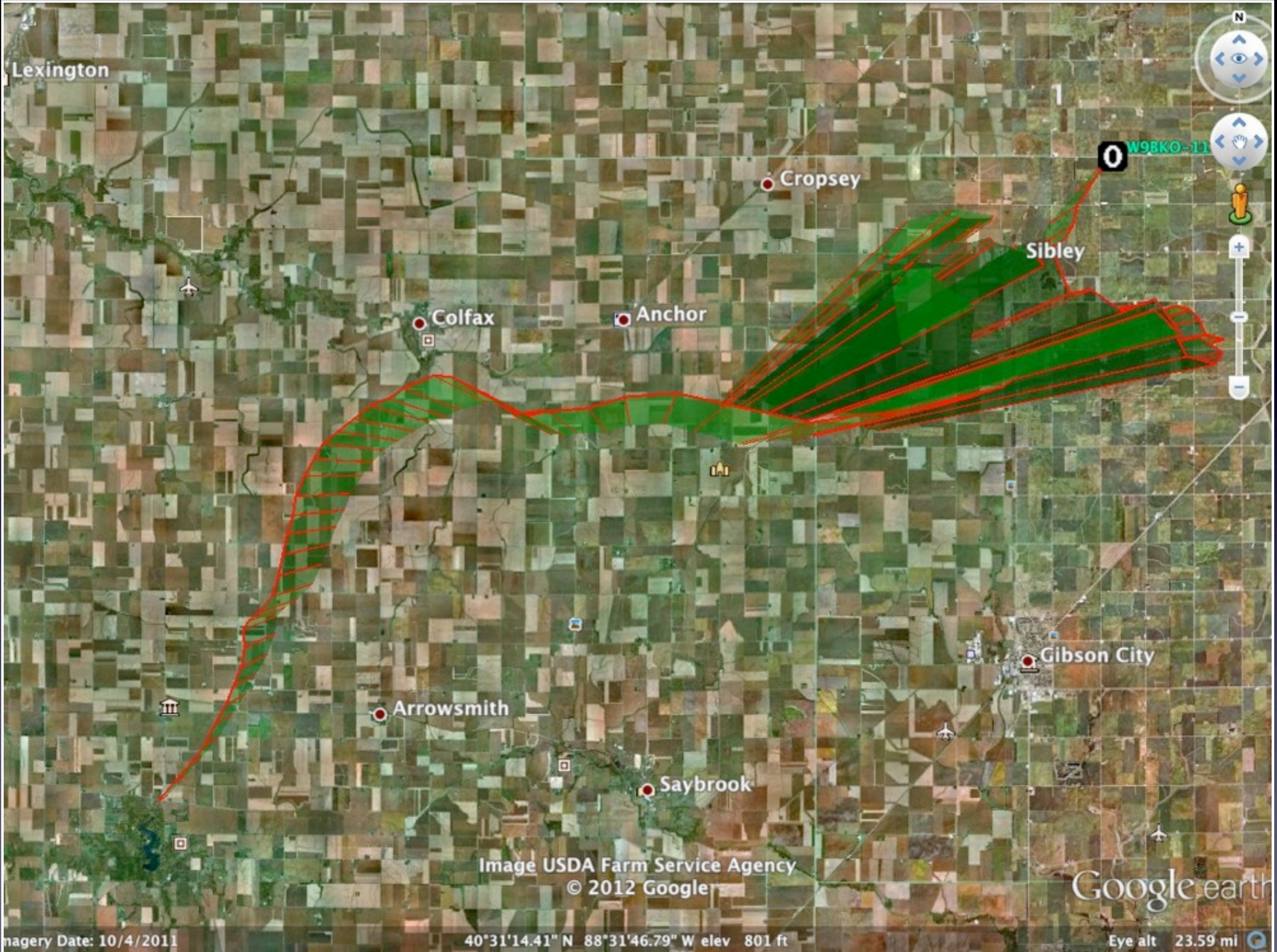
- ... and sometimes you find it here
- it took 3 weeks to get it down
- everything survived (except for the top of the tree)

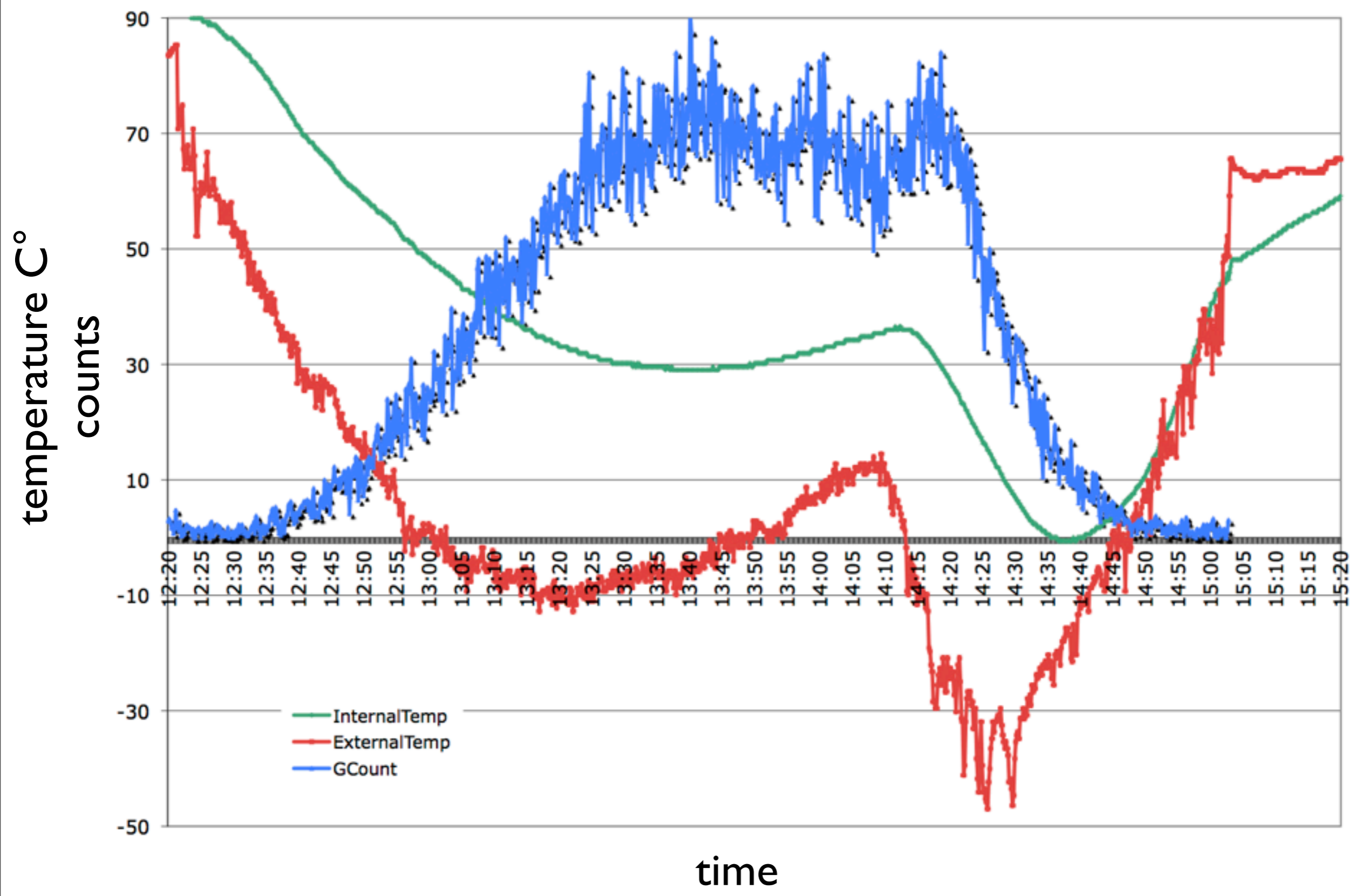


What You Get Back!

- photos
- videos
- data
- excited kids









Testimonial

“Thank you so much for including us in the amazing experience. I would also like to acknowledge student Sean Van Dril for his participation with my fifth graders. He put in countless hours on this project collaborating with my class and opening my student’s minds to the wonders of science. It was one of the highlights of our year.”

– Jeni Rogers, Prairie Elementary teacher



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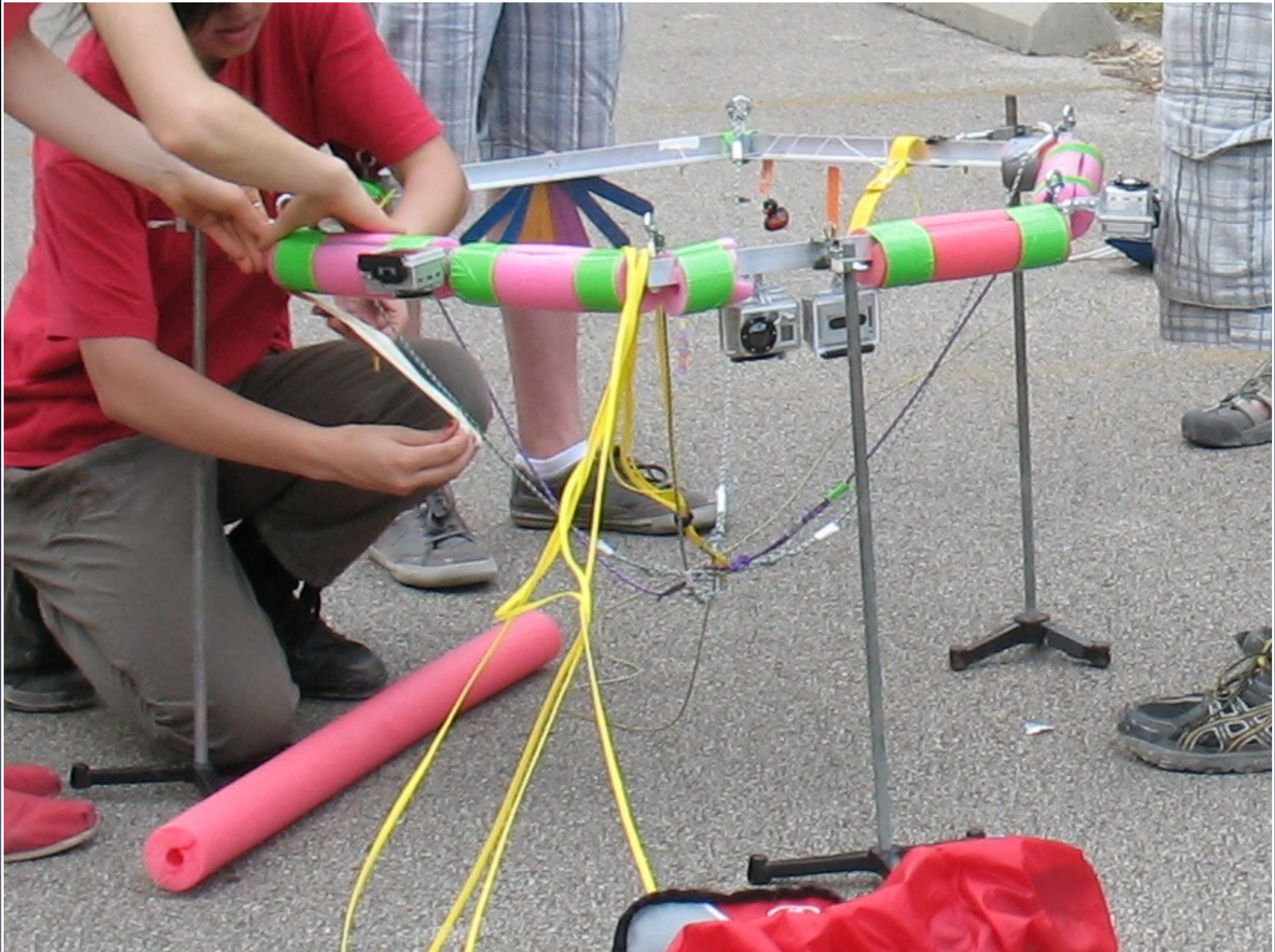
Postscript

- One student has started his own nonprofit, Space for All, to share his passion for space exploration
- A few other students have been interns at Adler Planetarium's Far Horizons project assisting with their launches
- We're still waiting on the elementary students...

Fall 2013 Launch

- How high can we go?
- Field trip for middle school students participating in the Underwater Robotics activity

Questions?
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