The Joy of High-Altitude Ballooning

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Naperville North High School
DuPage County Science Institute Day 2012

Tuesday, 21 May 13

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)
- did you see the photos?

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Minimum Equipment

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

Sounding Balloon

- most expensive part
- 500 g – 3000 g
- we used 1000 g last year
- 2-m diameter at release
- 8-m diameter at burst
- purchase from Kaymont

Parachute

- low cost: "borrow" a kindergarten teacher's

- design challenge: keep parachute from getting tangled

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

Payload

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

Camera

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

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

- Arudino microcontroller with data logging shield (stores data on SD card) and sensors

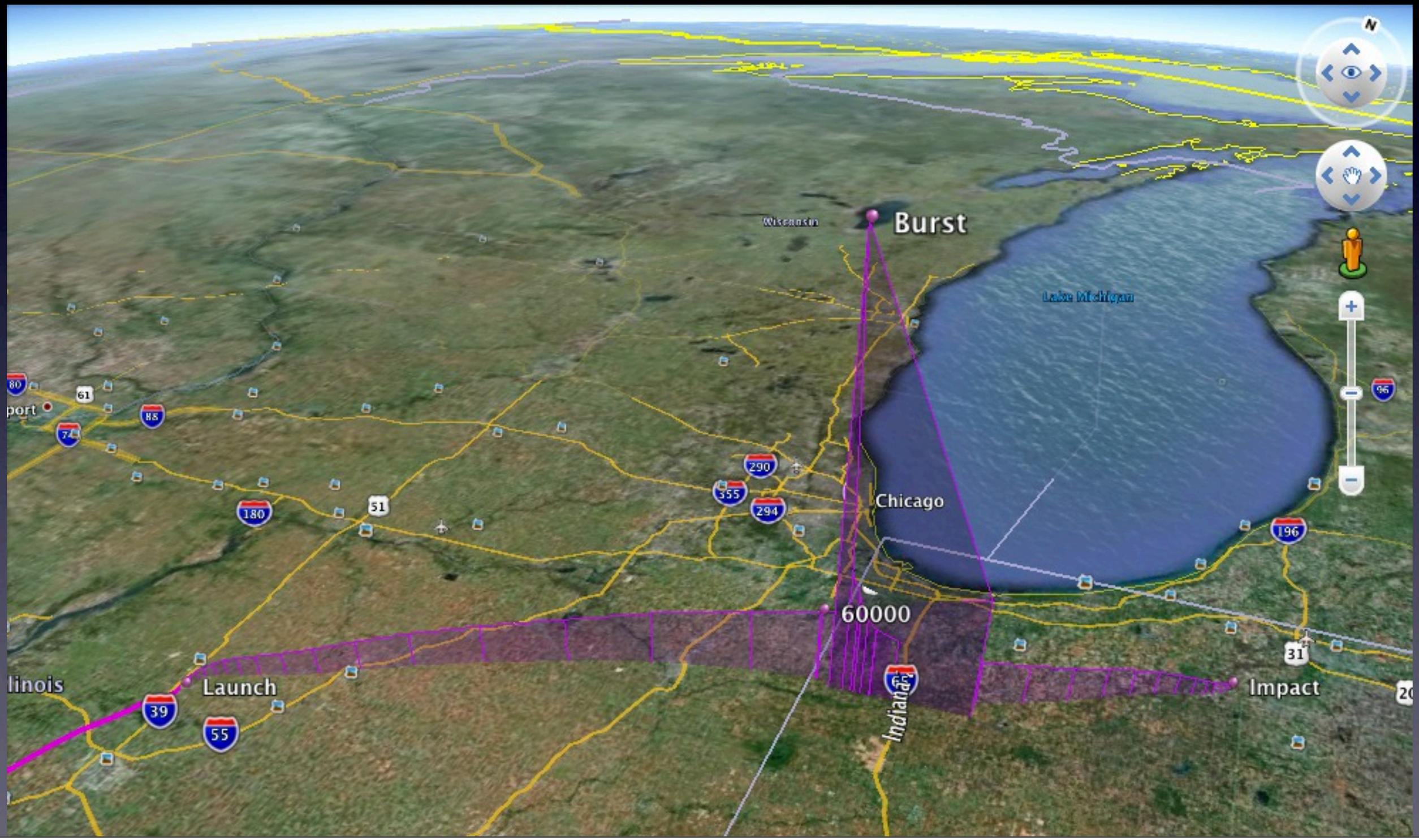
Experiments

- creativity runs wild
- bacteria samples
- gushers candies
- this year?

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

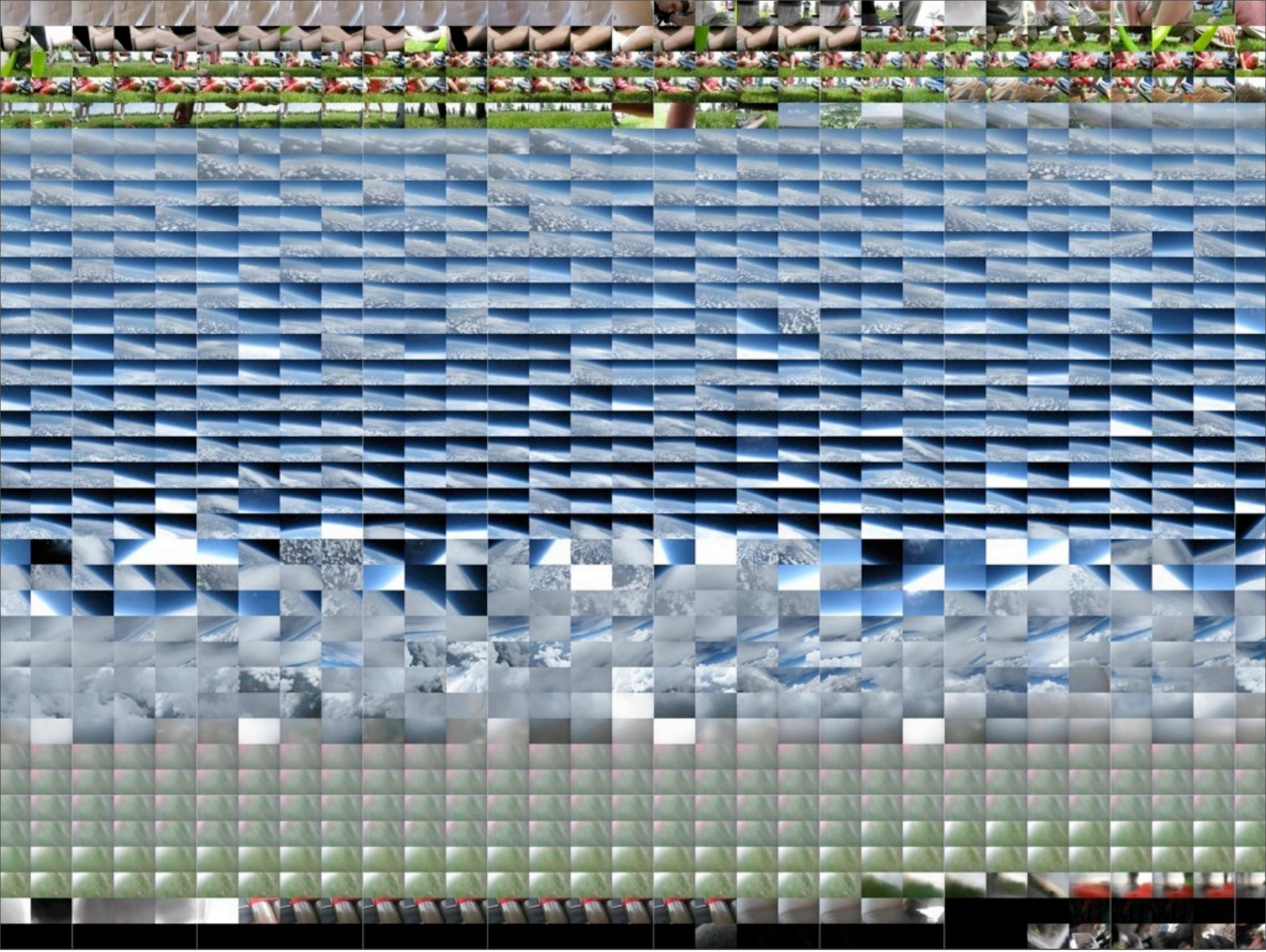
- ... and sometimes with APRS receivers you can catch the payload as it float to the ground

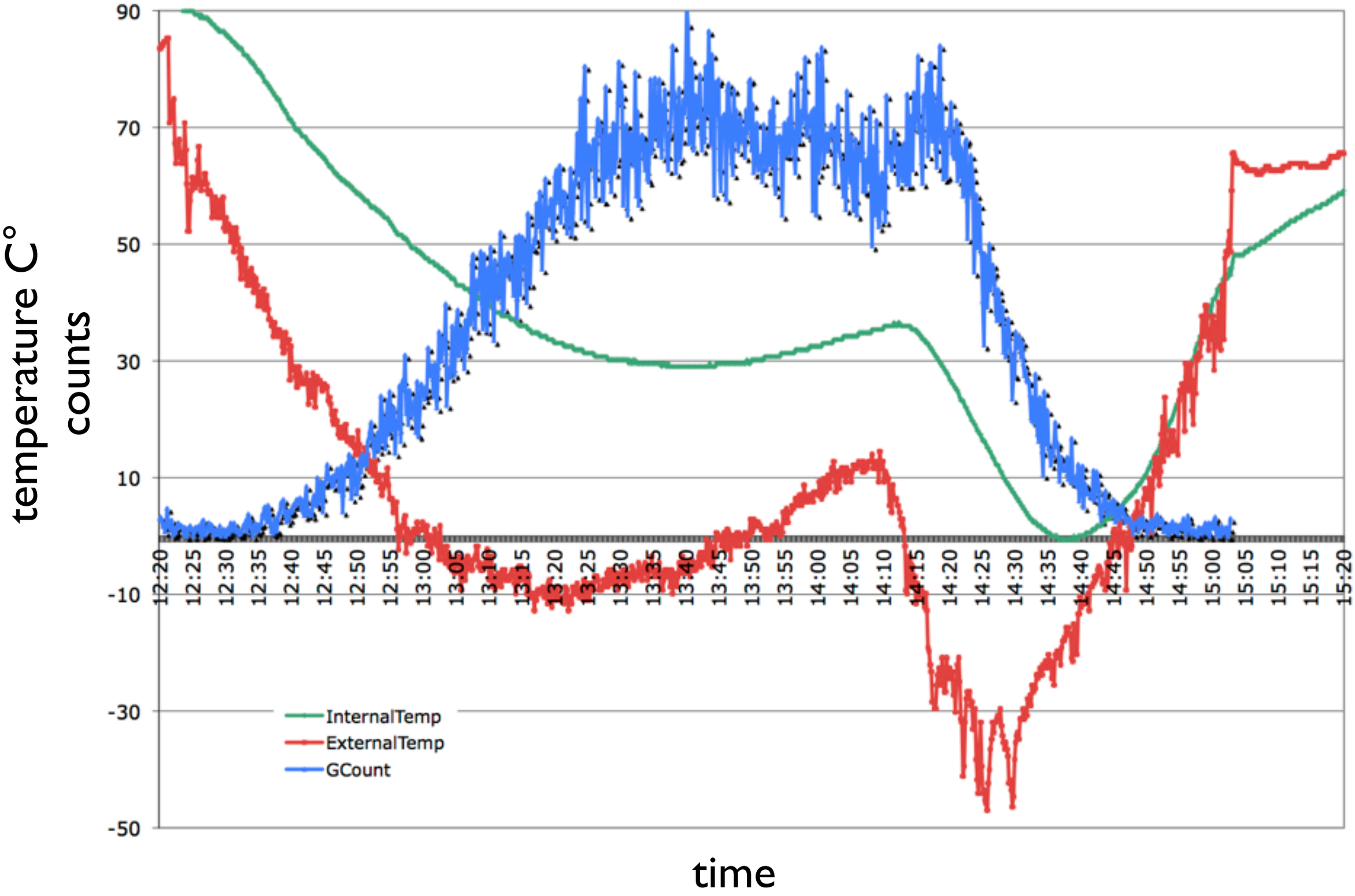
Recovery Plan

- ... 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

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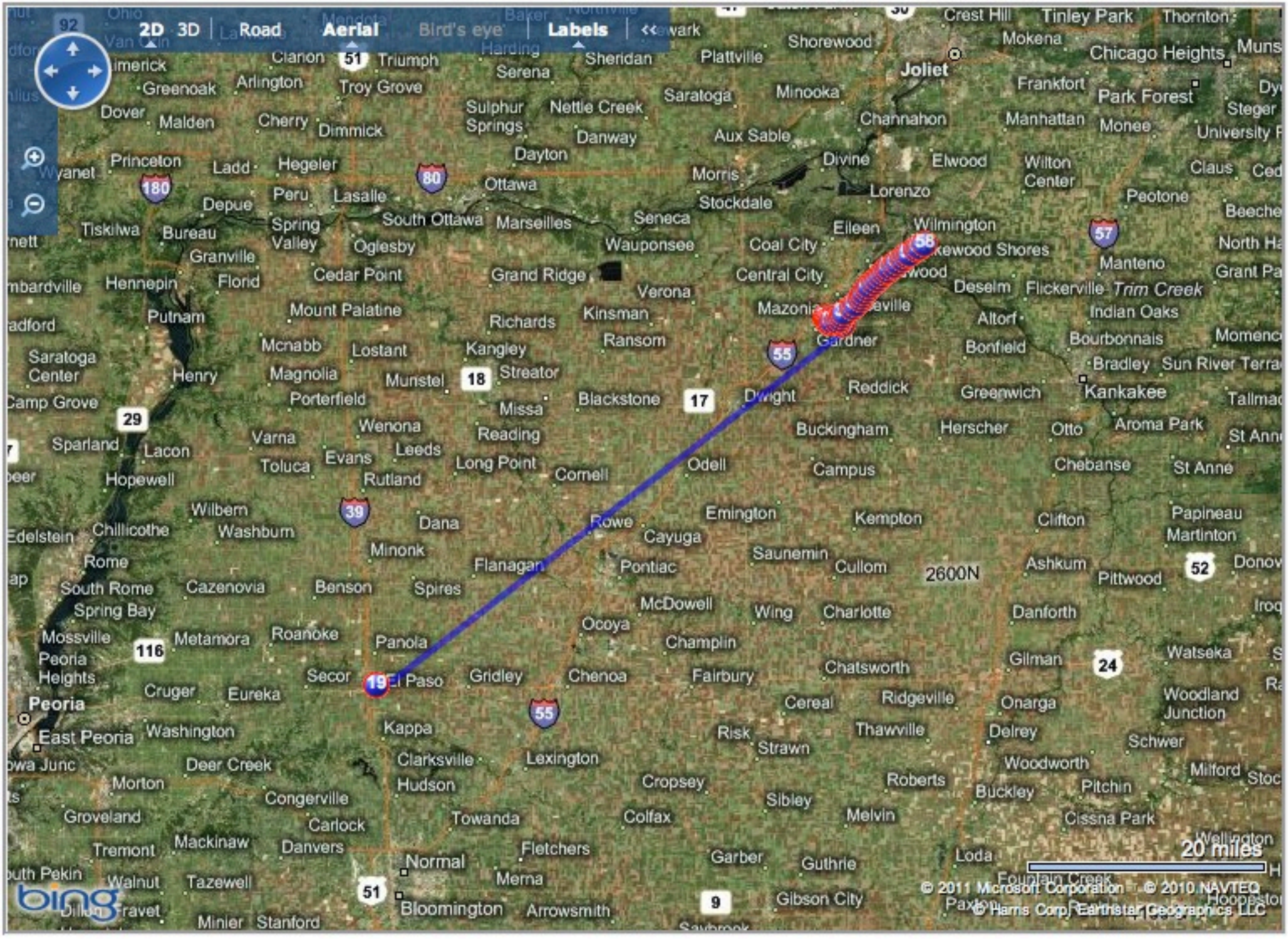

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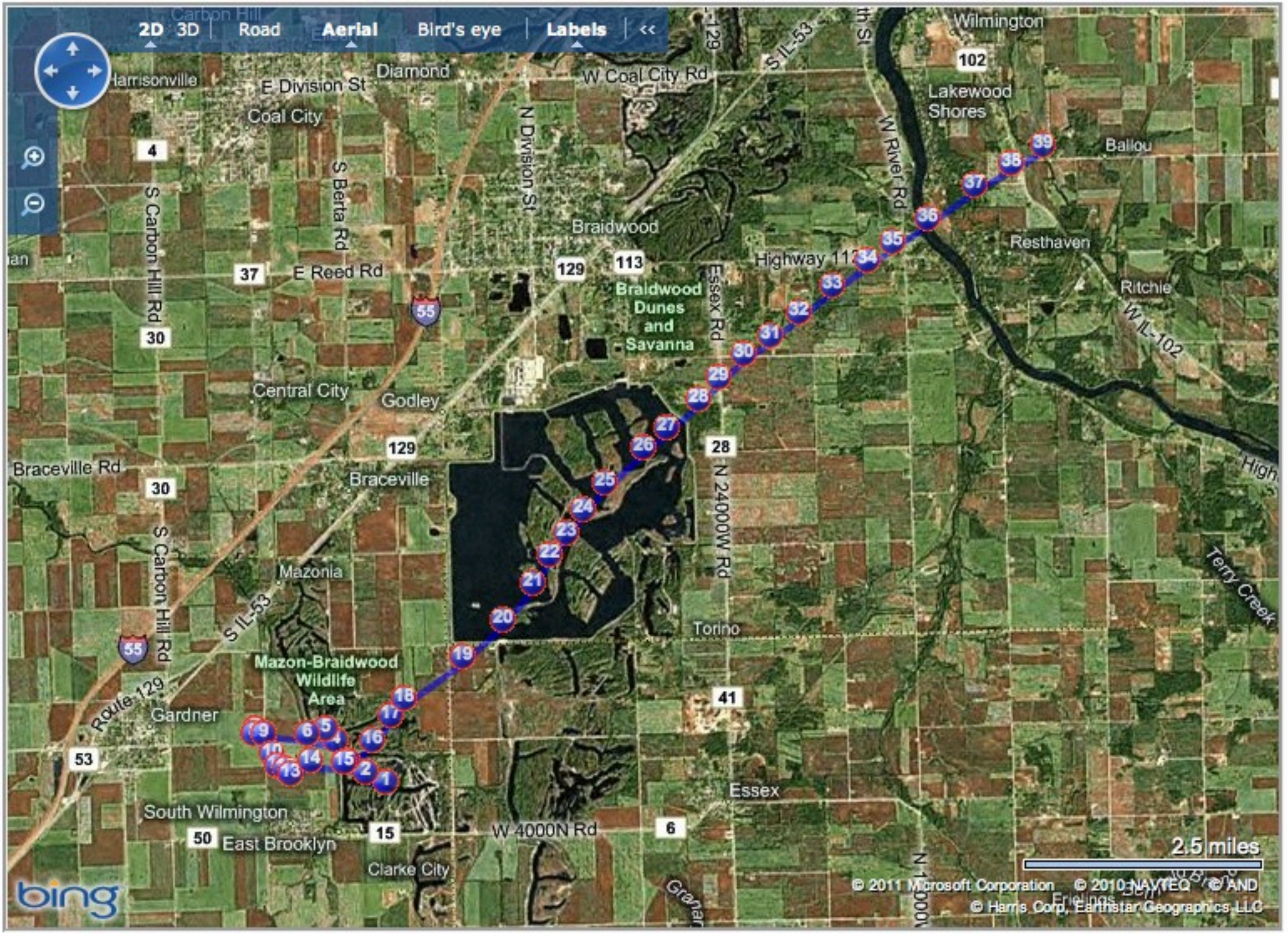
2D 3D
Road
Aerial
Bird's eye
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Diamond
Coal City
W Coal City Rd
S IL-53
Wilmington
102
Lakewood Shores
W River Rd
Ballou
Resthaven
Ritchie
W IL-102
4
S Carbon Hill Rd
S Berta Rd
N Division St
Braidwood
129
113
Highway 113
Essex Rd
Braidwood Dunes and Savanna
37
E Reed Rd
55
30
Central City
Godley
Braceville Rd
Braceville
S Carbon Hill Rd
Mazonia
S IL-53
Mazon-Braidwood Wildlife Area
Route 129
Gardner
53
N 2400W Rd
Torino
Terry Creek
41
Essex
South Wilmington
50
East Brooklyn
15
W 4000N Rd
6
Clarke City
28
2.5 miles
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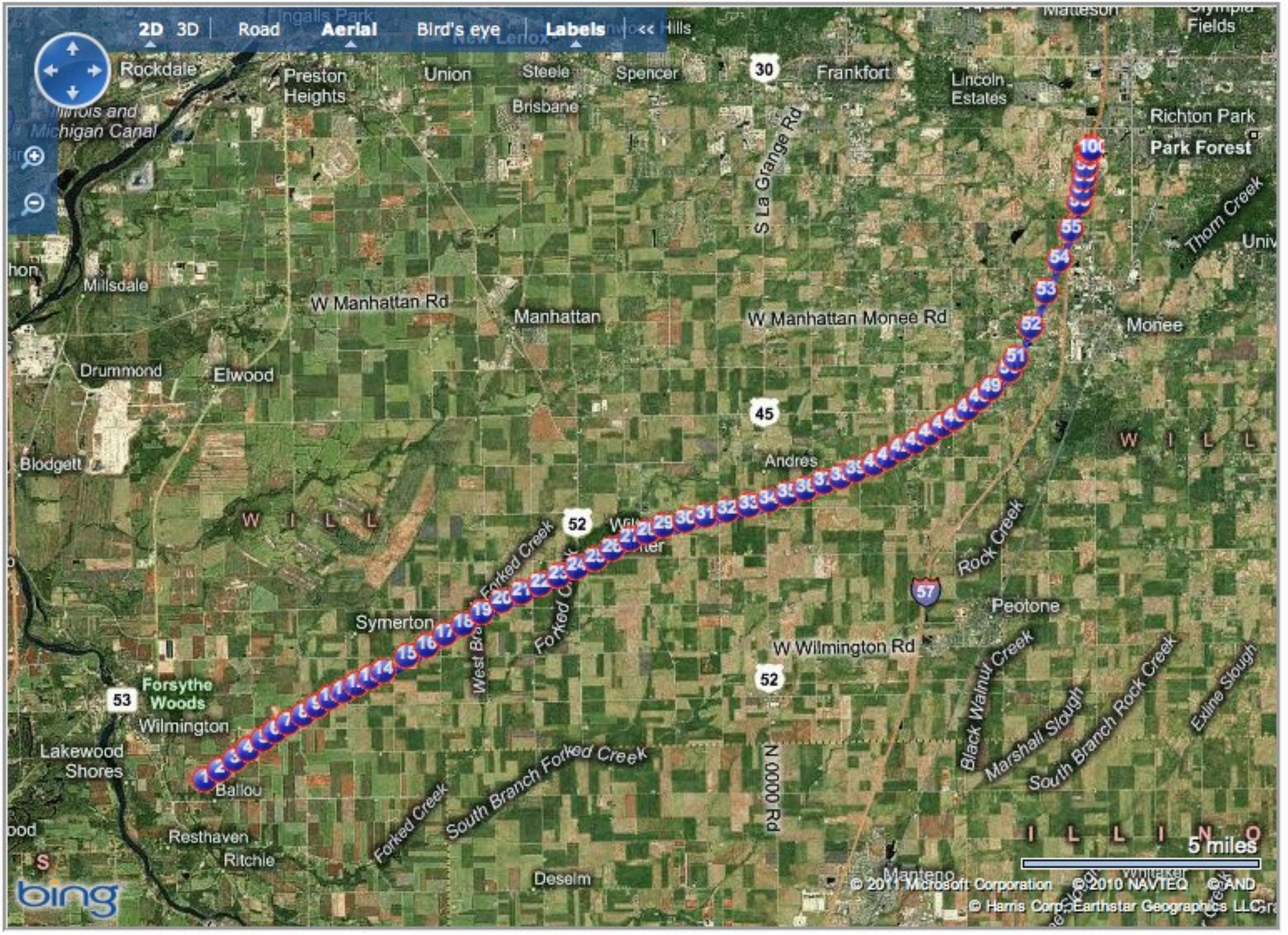

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COLLINS
EMERGENCY EXIT

Postscript

- One student has started his own nonprofit, Space for All, to share his passion for space exploration
- Another student is an intern at Adler Planetarium's Far Horizons project assisting with their launches

2012 Launch

- NNHS Physics Club will help 3 elementary and 2 junior-high groups develop experiment payload ideas
- Day at NNHS Mission Control with real-time tracking and video feeds on launch day

Questions?

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