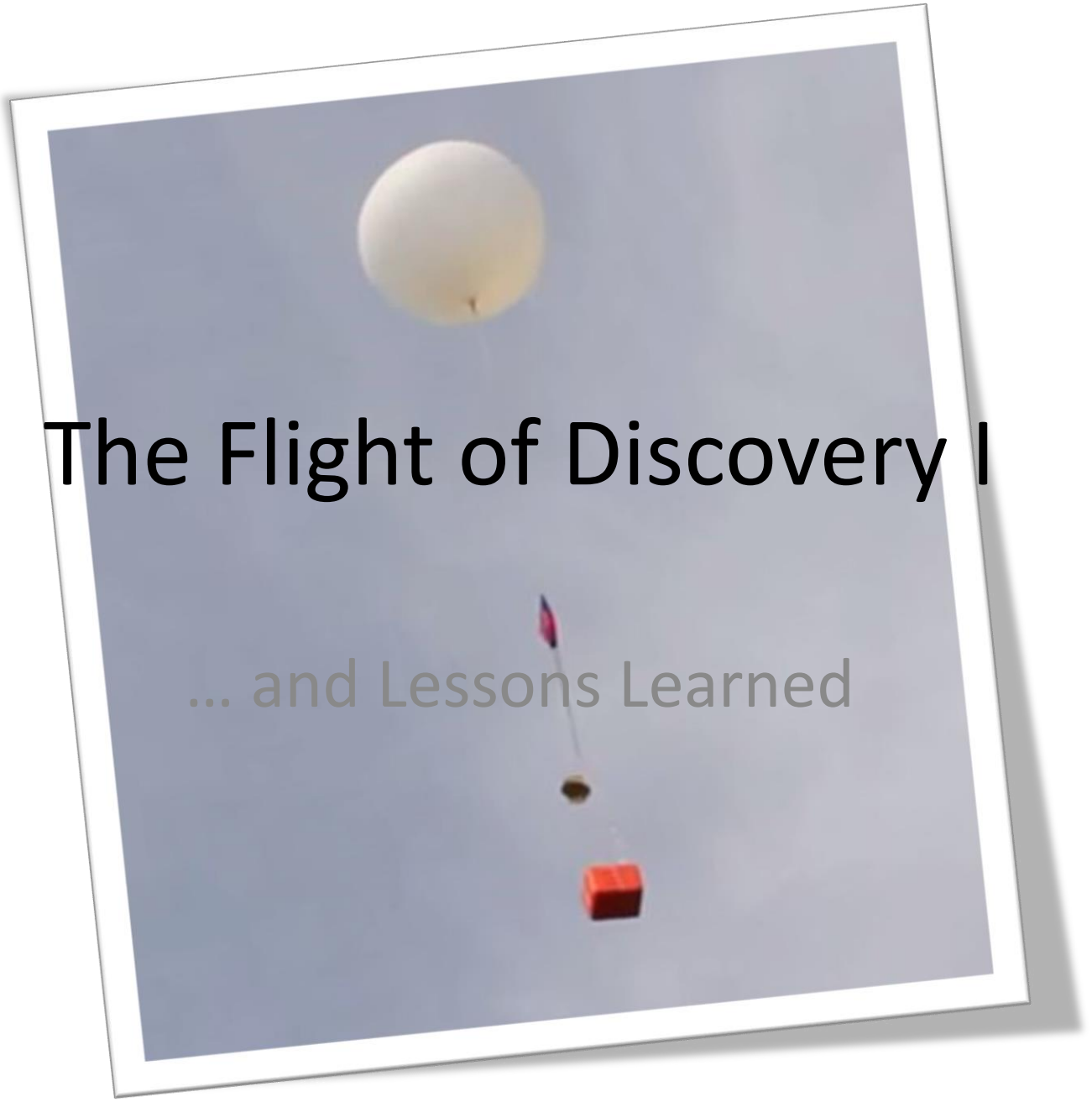


The Flight of Discovery I

… and Lessons Learned

Reason for the flight

- We have been working on a balloon package for several years. (Call it Discovery 3.)
  - Larry Reed AB1JC, Mike Miciukewicz K1MJM, and Eric Klaus, working with Dave Mestre KB1YYJ at the Discovery Museum
- Did not want to risk that package on our first flight.
- Had students from UB who were willing to help, but needed training

Discovery I

- Prototype package in an Omaha Steaks Styrofoam container
- VHF Radio
- Tiny Trak 4
- GoPro Camera donated by photographer Mike Florio
- 2 circuits for cut-down.

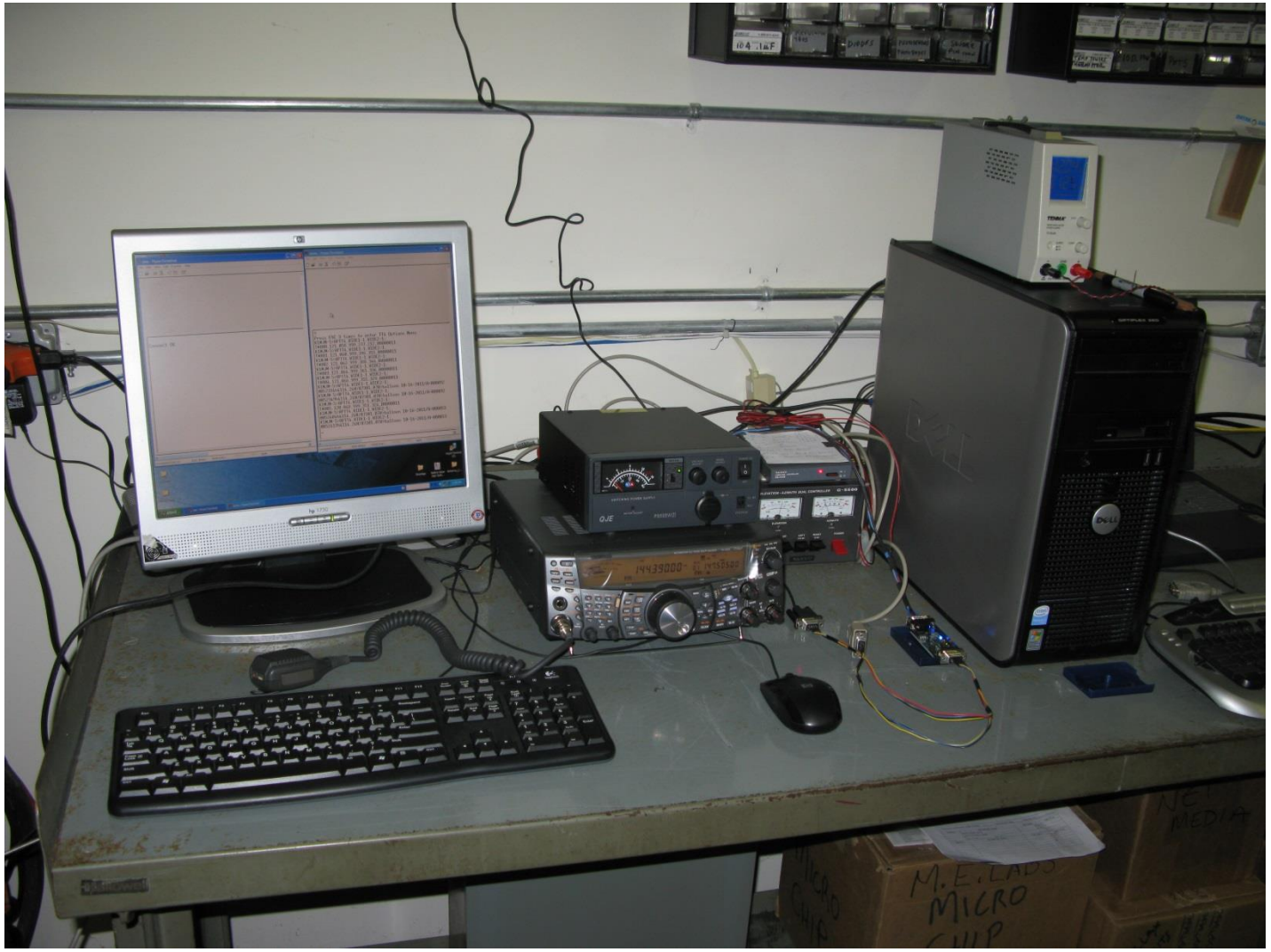
Discovery I Electronics

Student training

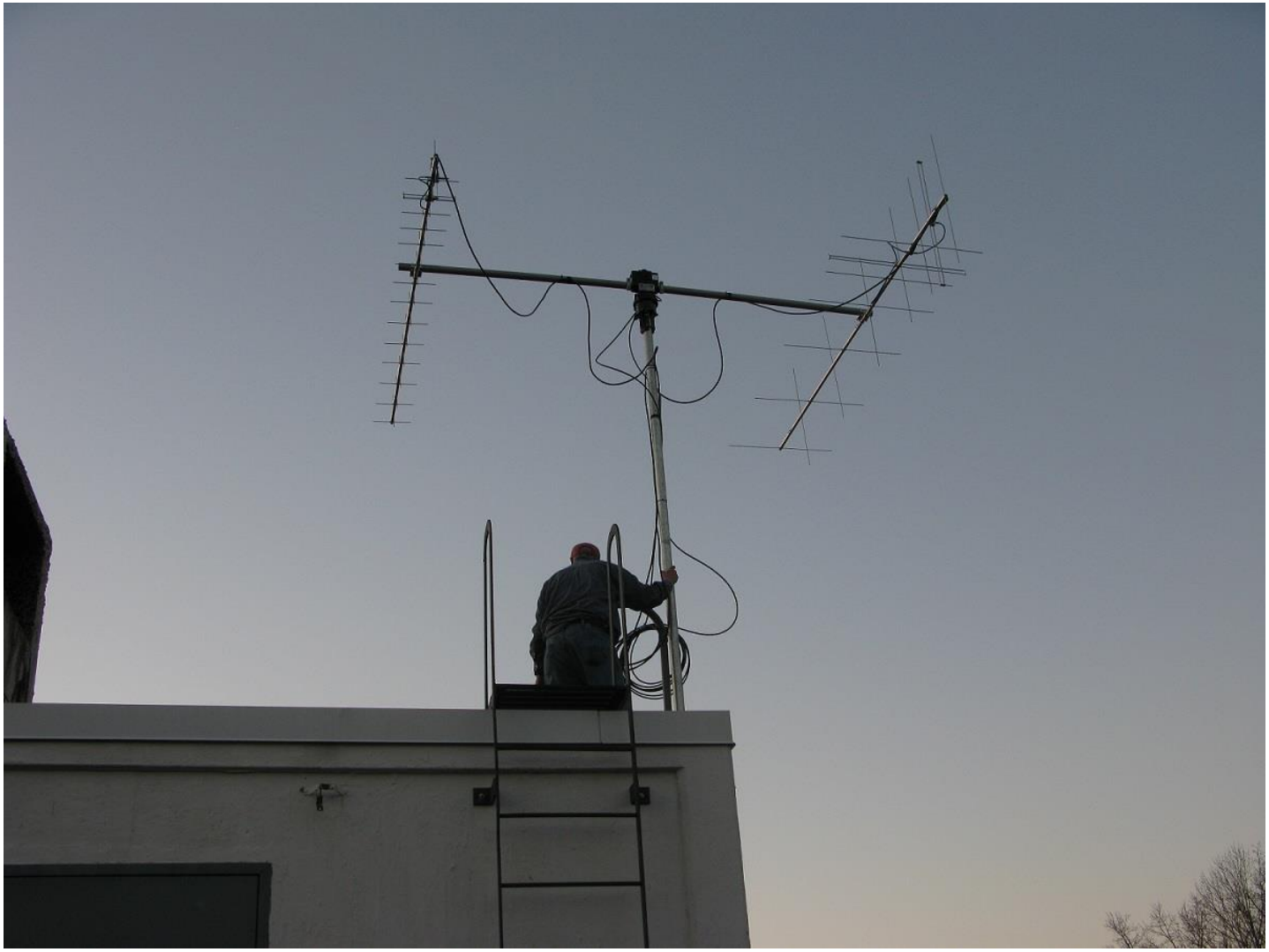
- 2 cars with students, with Dave Shadlich KB1LTW and Dave Mestre KB1YYJ assisting.
- Each car had a roof antenna, VHF radio, Laptop
- Dire Wolf software used sound card to decode APRS received packets, and fed them to APRSIS software for display on a (local) map
- AB1JC was the fox, and the hounds had to follow staying a mile behind, on the back roads all the way to Monroe
- They were given “last heard coordinates” for the “balloon” near Web Mountain park
- Students had to get coordinates from a squawker in the woods, and hike in half a mile to retrieve it


100 CRTG .50 CAL
LINK M9
4-API M8
1-APIT M20
LC-05M688L243

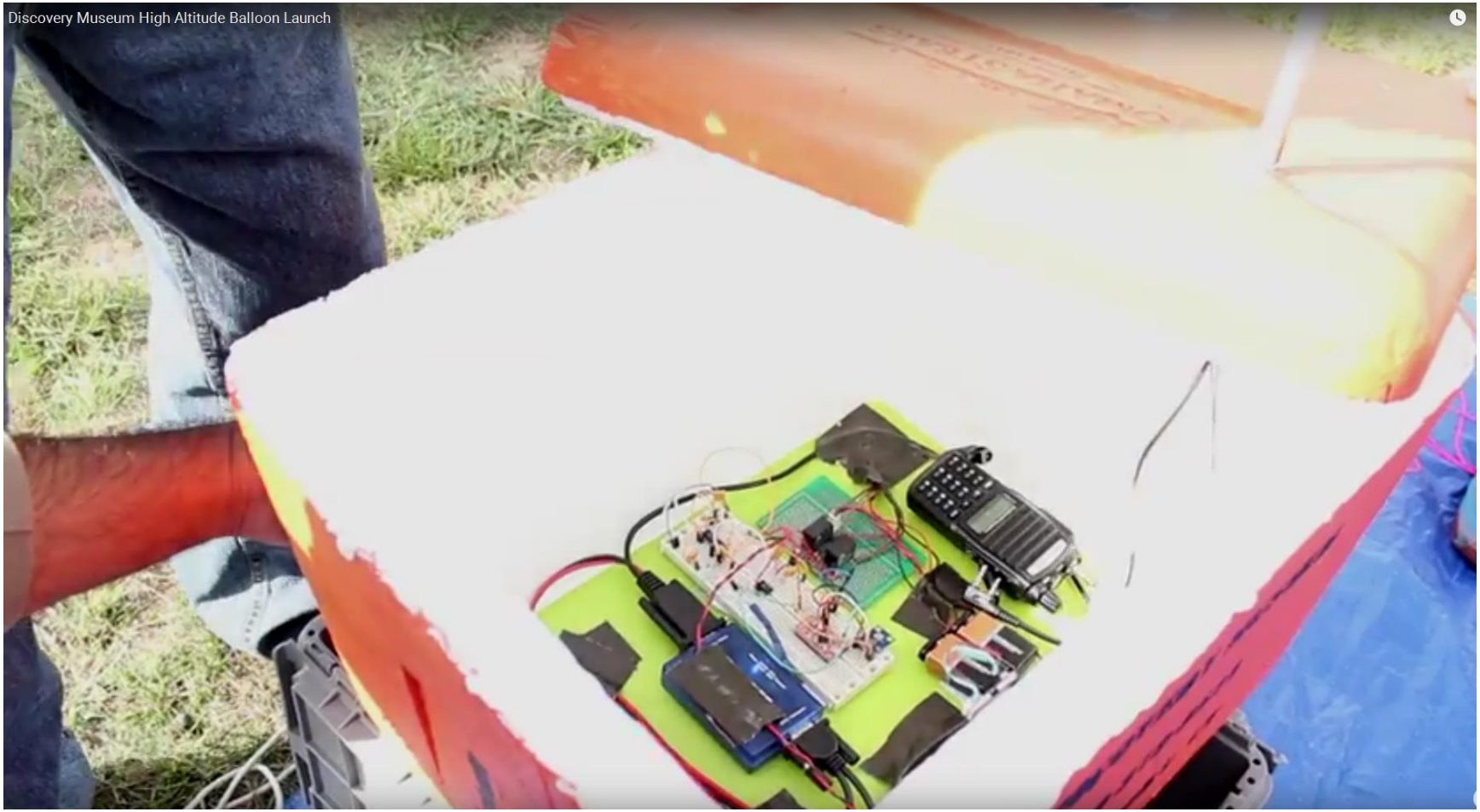
Our Ground Station



High-Gain VHF and UHF Antennas



Launch Day, 26 September 2015



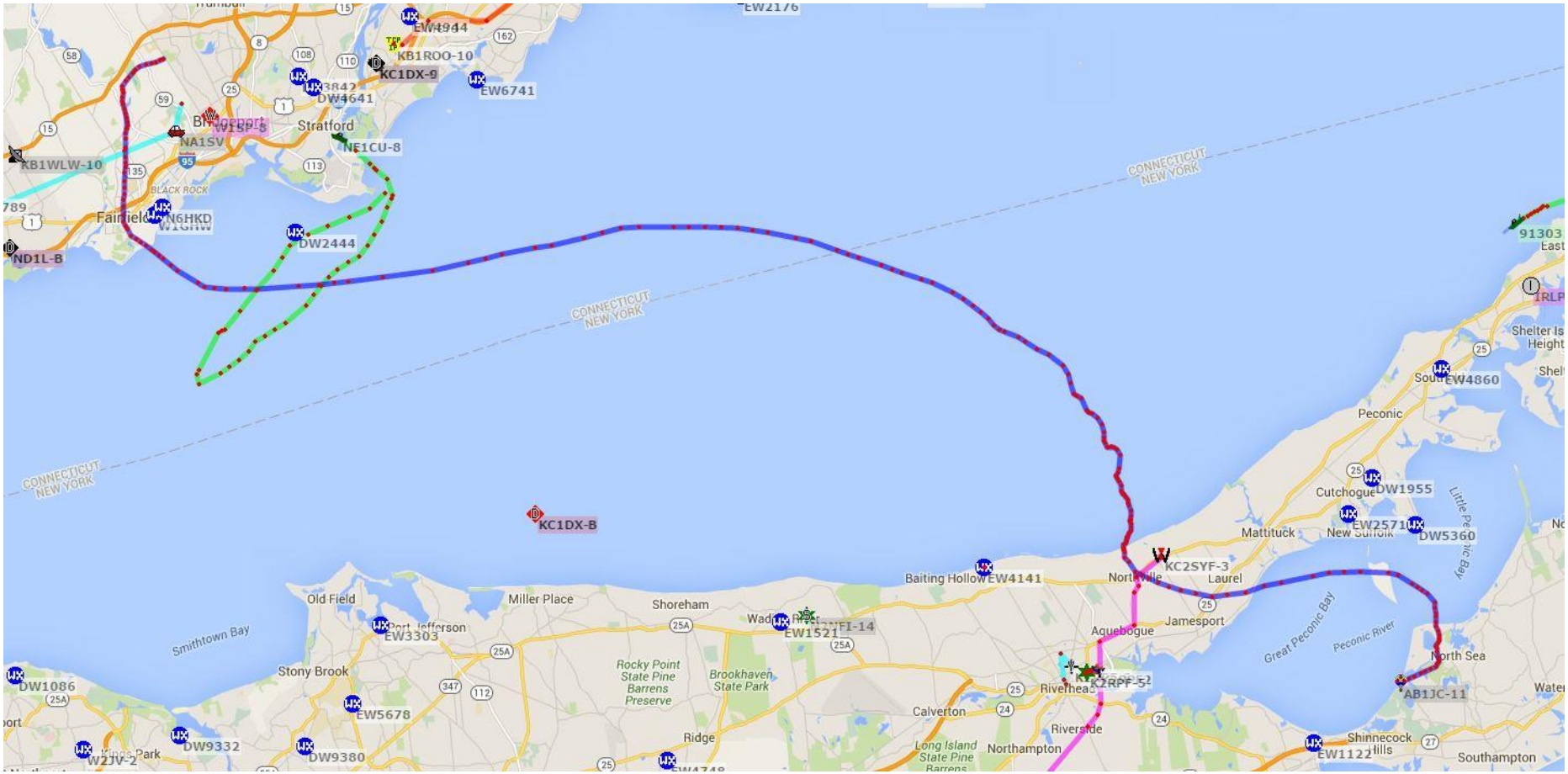
Up and away

Amateur Assistance

- Electronics
  - Larry Reed AB1JC and Dave Shadlich KB1LTW
- Two chase boats
  - Ken Johnson NE1CU and Greg/Jan Miller KC1CRT/KC1CRU
- Launch and Tracking assistance
  - Mike Miciukewicz K1MJM, Larry Gross W1LAG
  - Gary Moyher WE1M, Bob Gilmore WD1M
  - Dave Mestre KB1YYJ, at the Discovery Museum
- 441.700 Repeater usage
  - Ed/Kevin Cellini N1KGN/N1KGM

From the Air

Flight Path


EW4944
KB1ROO-10
KC1DX-9
EW6741
DW4641
Stratford
NE1CU-8
NA1SV
XB1WLW-10
Fairfield
N6HKD
DW2444
ND1L-B
CONNECTICUT
NEW YORK
KC1DX-B
Baiting Hollow
EW4141
KC2SYF-3
Laurel
Jamesport
Aquebogue
Peconic
EW4860
DW1955
EW2571
DW5360
Mattituck
Cutchogue
Old Field
Miller Place
Shoreham
Port Jefferson
EW3303
EW1521
FI-14
Smithtown Bay
Stony Brook
Rocky Point State Pine Barrens Preserve
Brookhaven State Park
EW5678
DW1086
DW9332
DW9380
Ridge
Calverton
Riverhead
K2RPF-5
Riverside
Northampton
Long Island State Pine Barrens
Great Peconic Bay
Peconic River
North Sea
AB1JC-11
Shinnecock Hills
EW1122
Southampton
91303

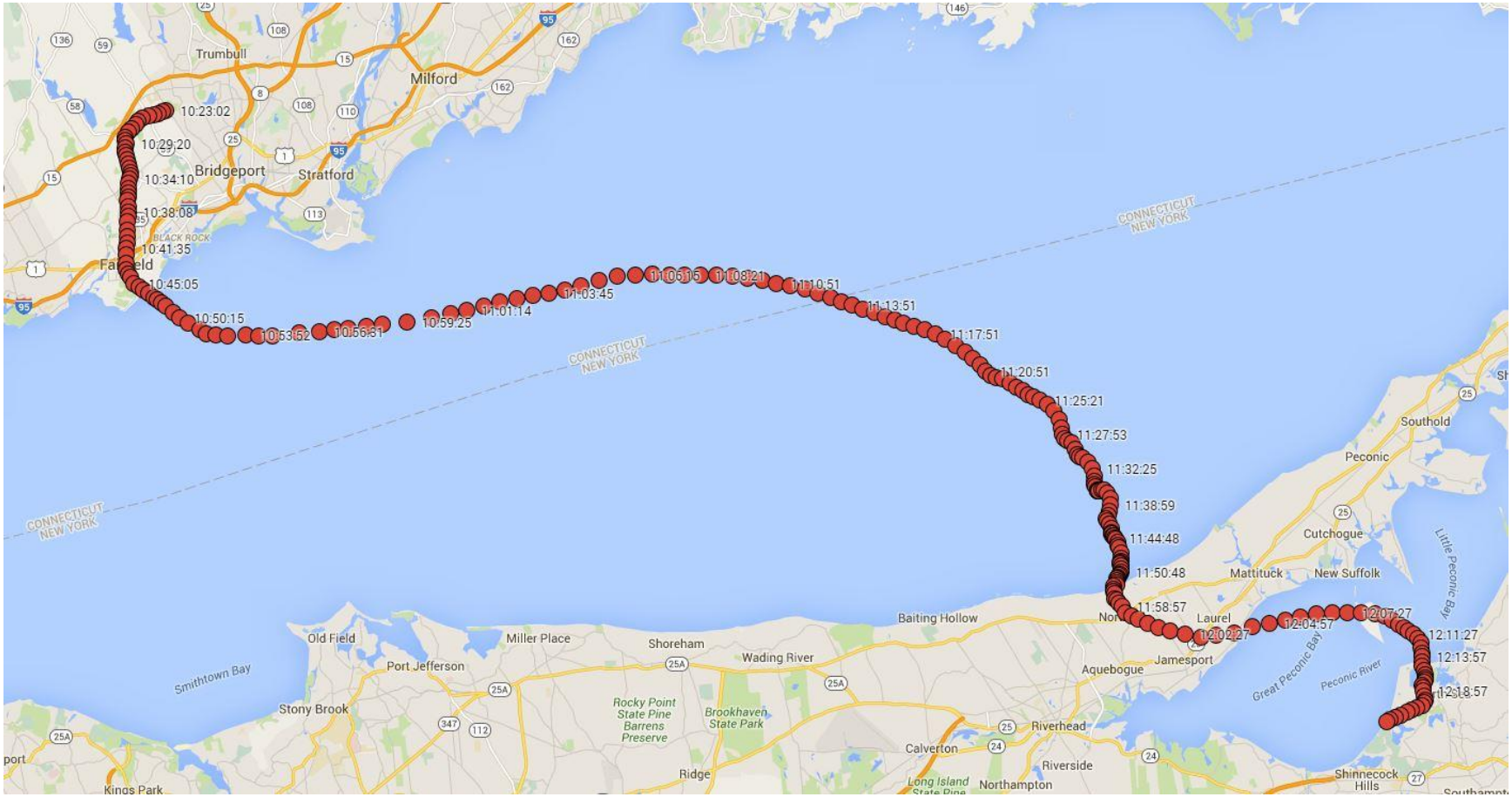
Cut-down circuits

- Nichrome wire wrapped around mason twine connecting parachute and balloon
- Two circuits
  - One fires when Tiny Trak Port C bit 0 goes high
  - One fires when pressure altitude exceeds 30k feet
- Connector inside the package connects separate relays from both circuits to the two wires running up the parachute to the nichrome wire

What happened

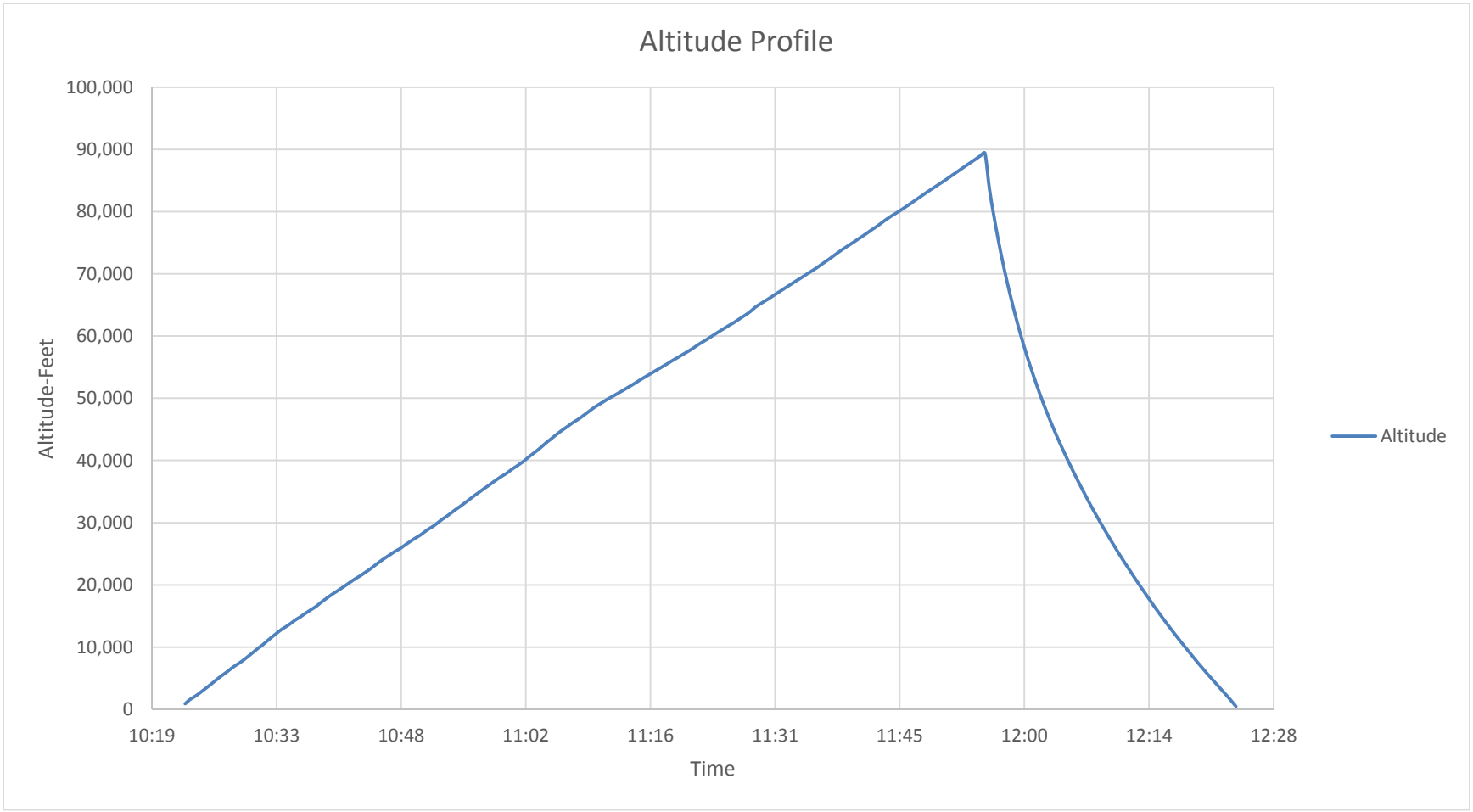
- During the Launch, the connector to the nichrome wire was pulled loose
- Neither cutdown worked, of course, and the balloon went up until it burst at 89,391 feet.
- We called a marina in Great Peconic bay, L.I., and someone was nice enough to retrieve the hardware.

Flight Path with Time

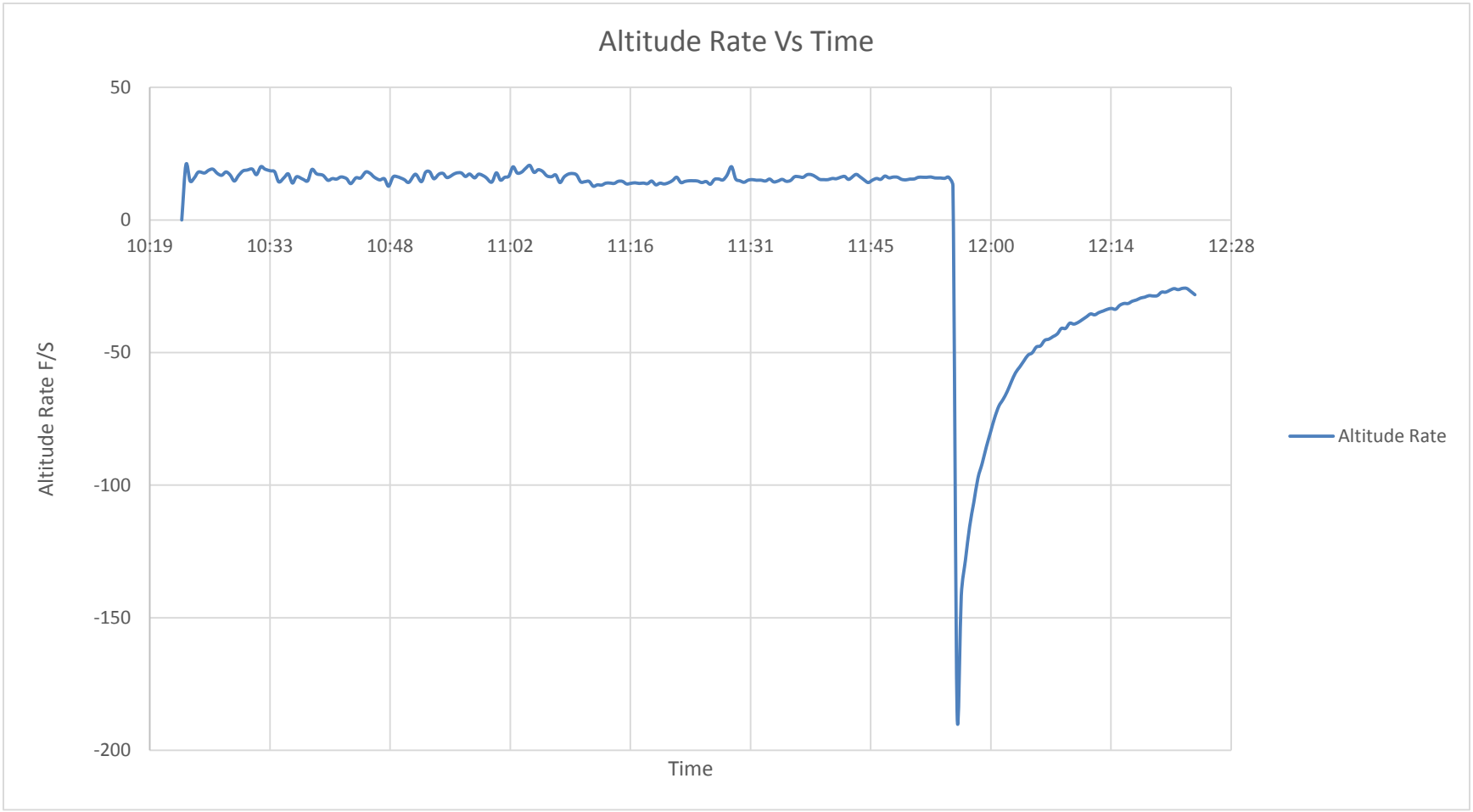


Montauk Point from 84,000 feet

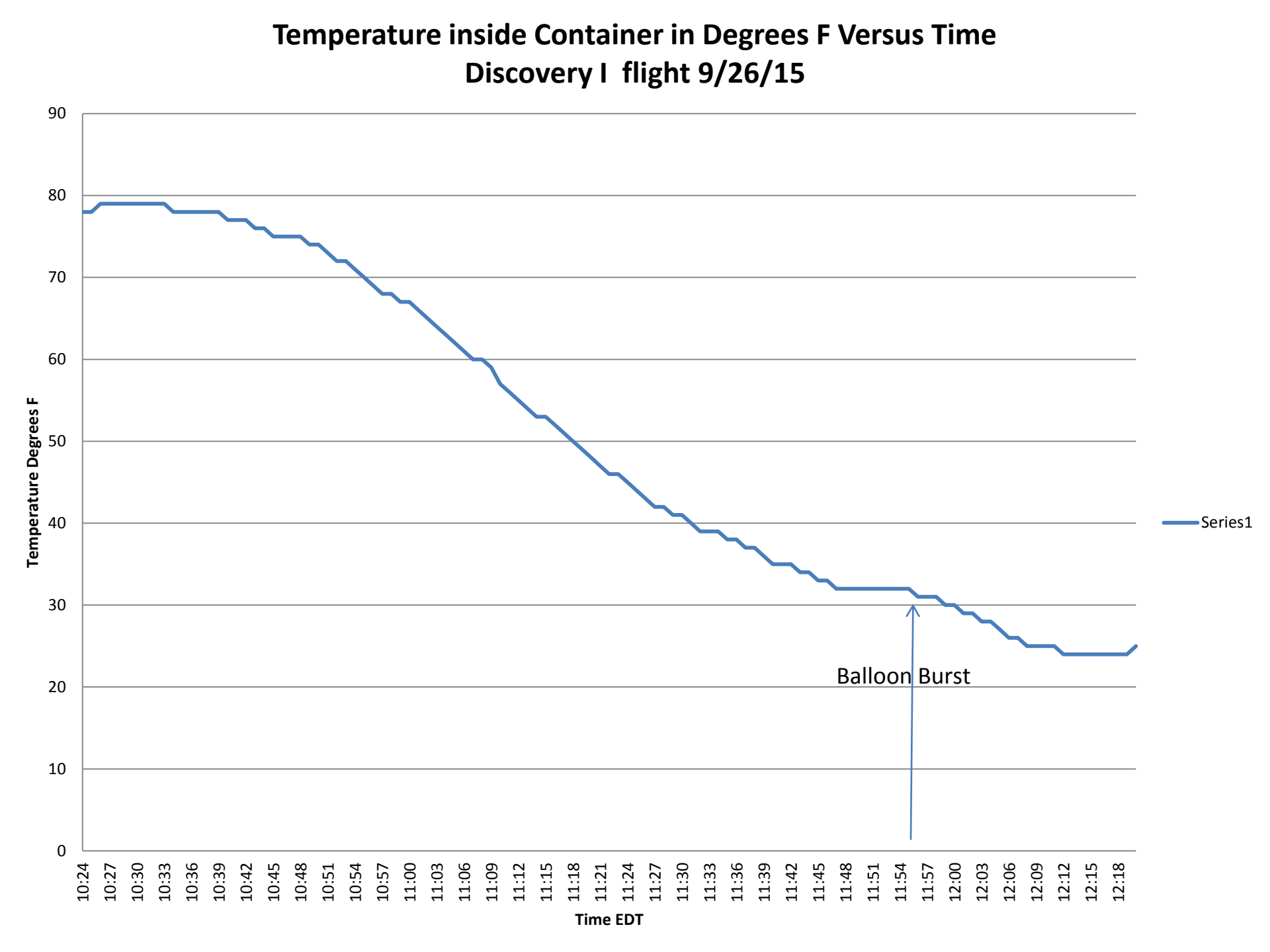
Altitude Profile

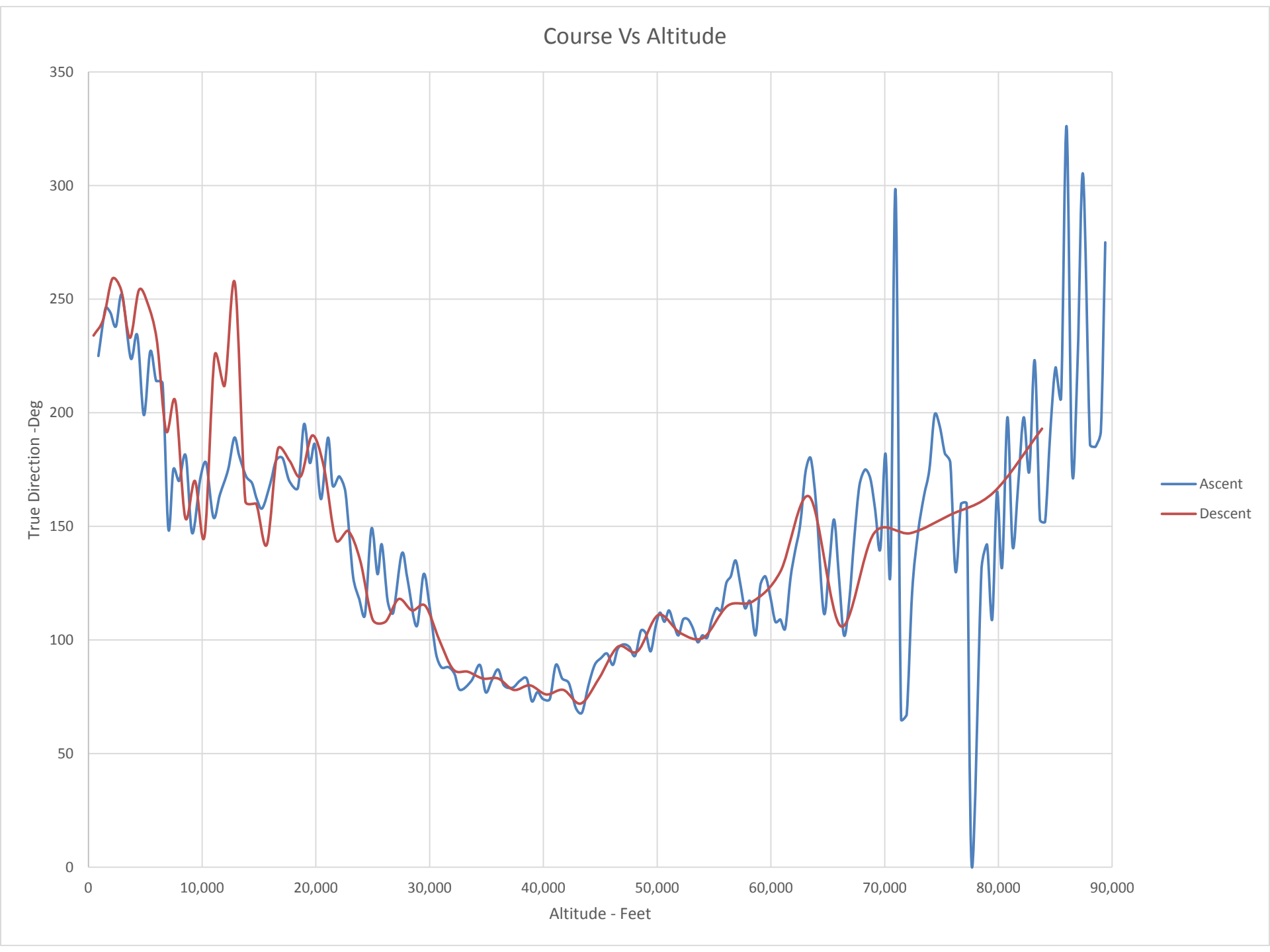


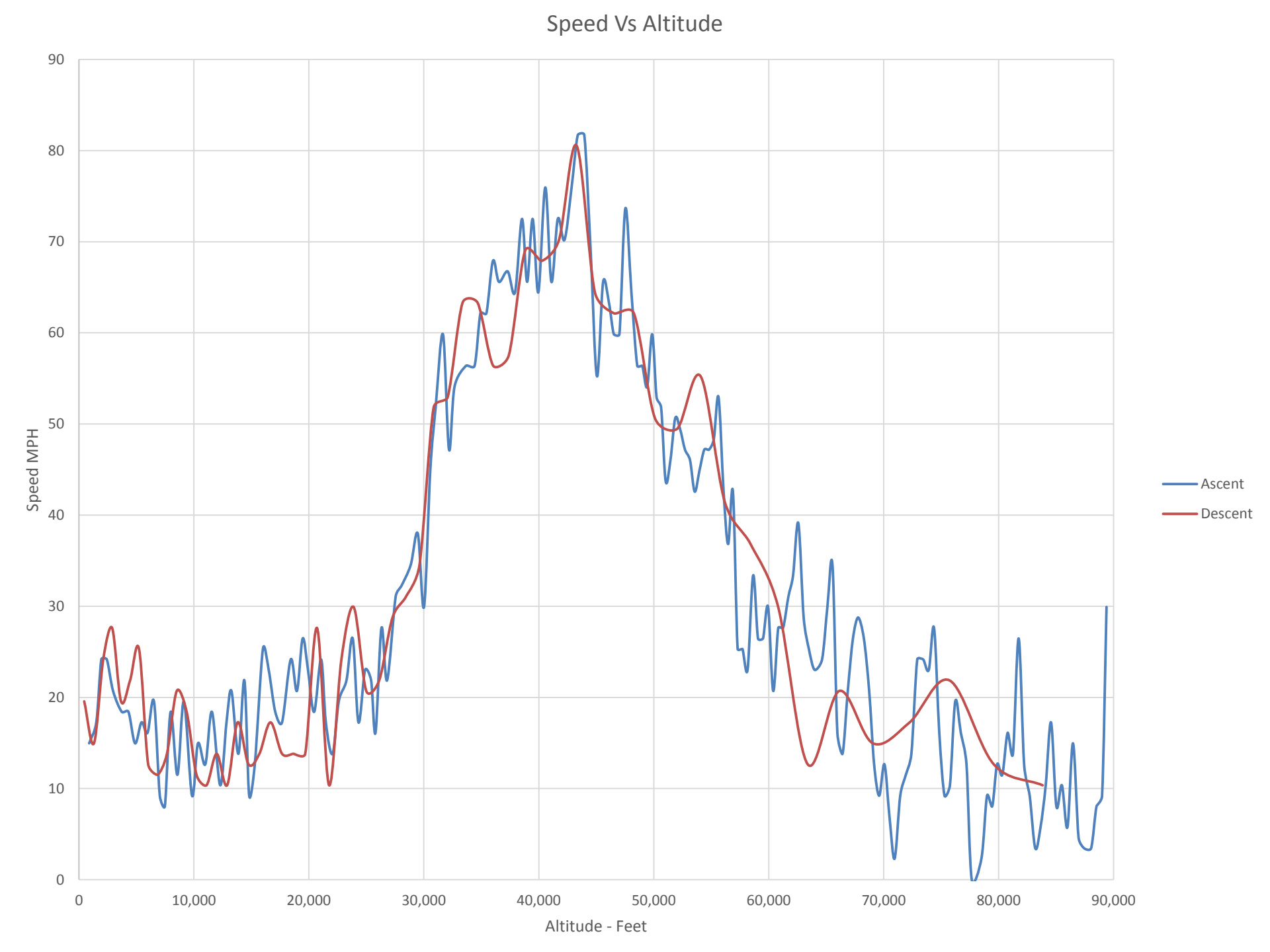
Vertical Speed



65,000 feet, coming down at 60 mph


Temperature inside Container in Degrees F Versus Time
Discovery I flight 9/26/15
Temperature Degrees F
90
80
70
60
50
40
30
20
10
0
Balloon Burst
Series1
10:24
10:27
10:30
10:33
10:36
10:39
10:42
10:45
10:48
10:51
10:54
10:57
11:00
11:03
11:06
11:09
11:12
11:15
11:18
11:21
11:24
11:27
11:30
11:33
11:36
11:39
11:42
11:45
11:48
11:51
11:54
11:57
12:00
12:03
12:06
12:09
12:12
12:15
12:18
Time EDT


Course Vs Altitude
350
300
250
200
150
100
50
0
True Direction -Deg
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
Altitude - Feet
Ascent
Descent


Speed Vs Altitude
Speed MPH
Altitude - Feet
0
10
20
30
40
50
60
70
80
90
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
Ascent
Descent

Lessons Learned

- Do NOT leave loose ropes on the craft – they act like whips on the way down.
- Rethink VHF antenna – it tangled the parachute on the way down. If using another Omaha box, consider putting it Inside the box.
- Don’t NEED 5 watts. One watt will do. PLENTY of coverage, and nicer for batteries and electronics.

Lessons Learned

- DO NOT put Proto-board circuitry on the bird. RF interferes with the circuit.
- DO NOT put edge-triggered Delay circuits on board. Implement in software.
- Shield sensitive electronics from the RF
- Thoroughly test all electronics IN THE FLIGHT CONFIGURATION before launch.

YouTube Movie Links

- The Launch (movie courtesy Relnick Observatory)
  - https://www.youtube.com/watch?v=aDNC5GbO__I
- The Launch (movie from Bob Gilmore WD1M)
  - https://youtu.be/J1DQse7jz3c
- From 84,000 to 89,391 feet, and DOWN!
  - https://www.youtube.com/watch?v=355MVkVnCw8
- Movie by University of Bridgeport
  - https://www.youtube.com/watch?v=vkwUepmWgTI

Servo Test Flight, Upcoming launch late April

Mission Purposes:

1. Test Servos in near space environment
2. Develop Sensors for temp and pressure
3. Establish secure cutdown with backup
4. (Optional) Do Handwarmers function at altitude?

Servo Test Plan

- Four servos
  - Two mounted inside the Styrofoam Container, where the temperature will (probably) not go below 20 degrees F.
  - Two mounted outside the Container, where the temperature will get down to -60 degrees F, and the air velocity will get to 120 mph down to 60 mph during the top half of the descent.
- Servos controlled from the ground, or from on-board CPU.
- Servo Positions sent to the ground via Telemetry.
- Each servo will move and be measured once per minute.
- We can determine from the telemetry if the servos worked even if the electronics package is not recovered.

Vehicle Electronics