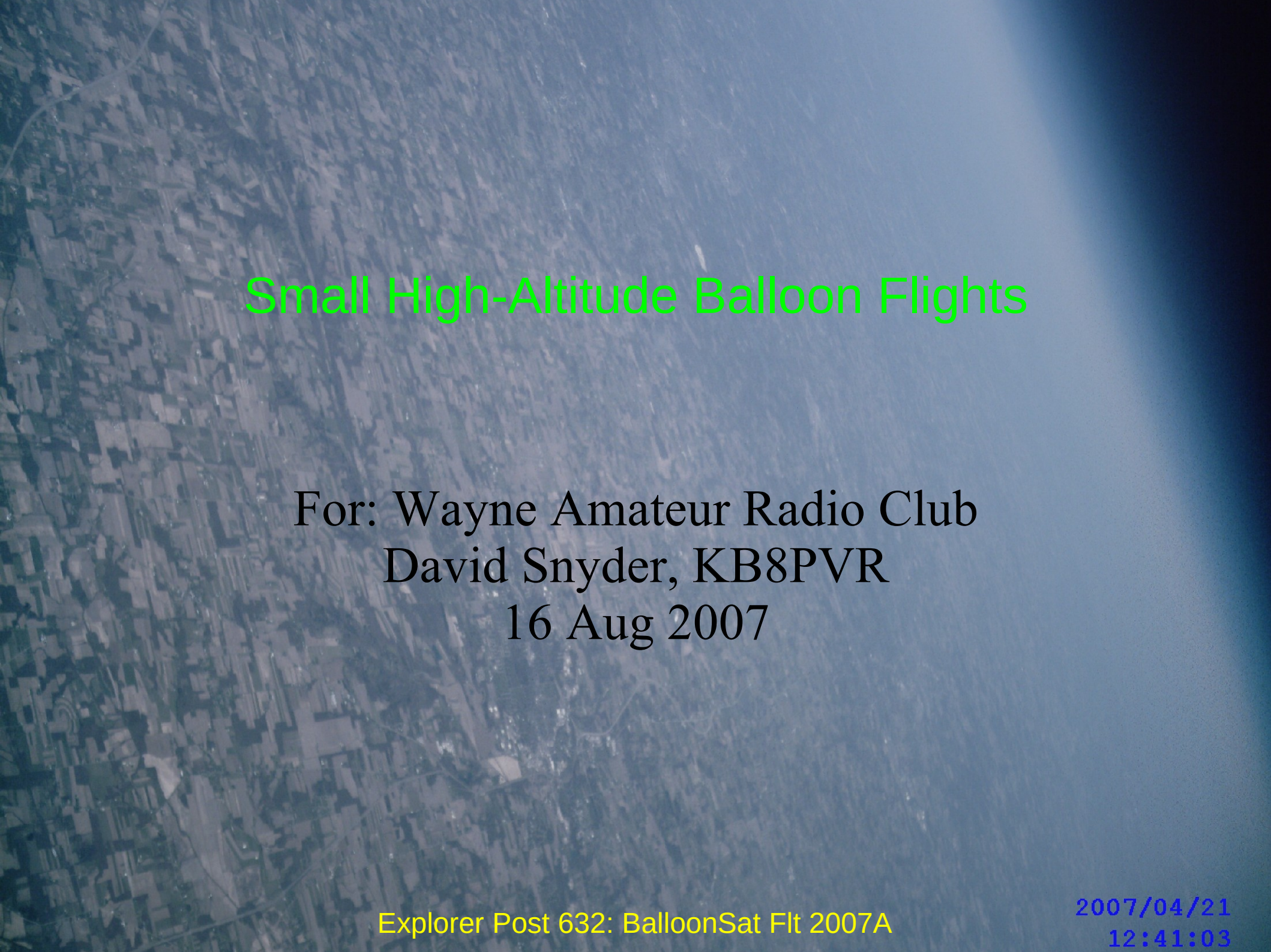

Small High-Altitude Balloon Flights
For: Wayne Amateur Radio Club
David Snyder, KB8PVR
16 Aug 2007
Explorer Post 632: BalloonSat Flt 2007A
2007/04/21
12:41:03

Explorers at NASA GRC

- Expose High School Students to NASA related careers.
  - Science
  - Technology
- Presently Three posts meet for two hours, once a week.
  - 630 Aeronautics Activities
  - 631 Computer Technology
  - 632 Satellite Technology (BalloonSat)
  - 633 Exploration: Mission to the Moon

Explorers Post 632

- Goals

  This post exposes Explorers to the technology and careers behind satellites by developing and flying a BalloonSat payload for a high altitude balloon.

  Our goal is to: Build, Test, Launch and Recover a payload to 100,000 ft.

- Plan for two flights/season
  - Fall - Demonstration Flight
  - Spring - Students Missions

High Altitude Balloons in Northern OH

- Nov 7, 1964 (attempt)– Southeast Amateur Radio Club of Cleveland, Ralph Trefney, W8TGX Cleveland, OH.
- Bill Brown, WB8ELK, began modern era of HAM High Altitude Balloon Flights, August 1987 from Findley OH
  - WB8ELK 20th Anniversary Balloon Celebration, 11 Aug 2007

Launch

HAM Applications

- Fox Hunt
- Long range VHF/UHF
  - Repeaters
  - ATV
- Potential Emergency Long Range Communication

- “Sounding Rocket” class missions

Outline

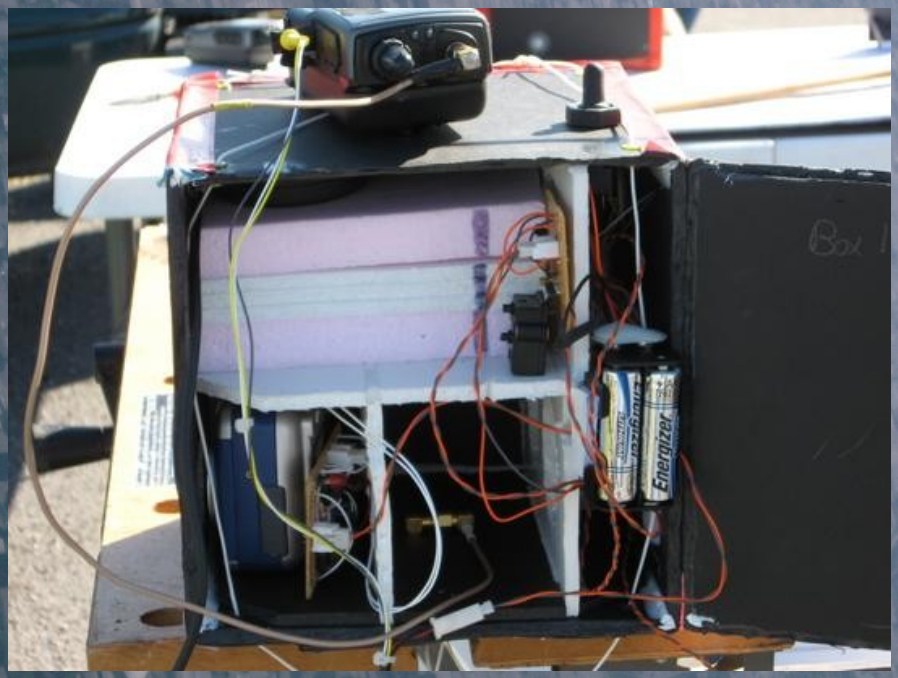
- Experiments/Instruments
- Flight Planning
  - FAA
  - Weather
  - Launch Site
- Launch
- Tracking
- Recovery
- Reports (Closing Ceremony, 22 May 2007)

BalloonSat

- Low-cost access to near-space
  - 100 kft, 19 miles, 30 km
  - 0.01 Atmosphere
  - Mid Stratosphere
- Sounding Rocket-like mission
- Launch costs
  - Helium (2 tanks - $40 ea)
  - Balloon (1500gr - $90, 1200gr - $60)
- Equipment costs - near $1000

Payloads (1)

Goal: Include Student Experiments
Three payload Boxes



- Payload 1
  - Agar Diffusion Exp
  - Horizontal Camera w/timer
  - Internal/External Temp
  - Pressure
  - GPS/40cm APRS radio (Kenwood)
  - 6V power bus (4-AA Li Batteries)
  - HOBO 4 chan 12 bit data logger

Payload 2

- Video
- Jello
  - Freezing?
  - Passive Heating
  - HOBO Data logger
- Grass Seed
  - UV exposure
  - Flight control
    - Temp exposure
  - Ground Control
- Wii Controller (survival)

Payload 3

- Vertical Camera
  - w/timer
- Atmosphere Spectrum
  - Basic Stamp Data logger
- 2 meter radio
  - GPS (APRS)
  - OpenTracker (TNC)
    - Bus voltage
    - Temperature
- 6V power bus

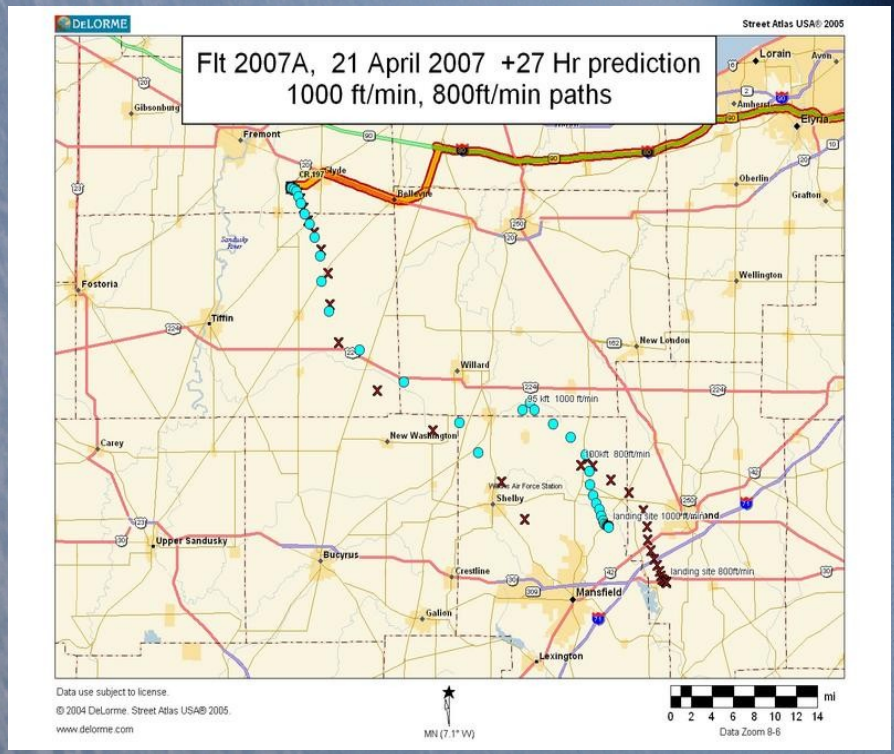
Flight Planning

- FAA
  - Exempt Payload
    - No Wavers needed
  - Notify Oberlin
  - File NOTAM
- Weather
  - Reasonable trajectory
    - <70 mi
  - Low ground winds @ launch
  - No (little) rain

```
# 21 hr forecast
# <http://www.arl.noaa.gov/ready/cmet.html>
#  Lat/Lon:  41.29  -83.03
# PRESS HGT(MSL) TEMP DEW PT  WND DIR  WND
SPD
# HPA       M      C     C       DEG     M/S
# E = Estimated Surface Height
#
  998.    251.   15.9    4.9    53.9     0.2
  975.    435.   12.2    0.4    23.9     0.4
  950.    651.   10.8   -1.4    16.7     0.5
  925.    873.    9.8   -4.1   357.2     1.1
  900.   1100.    8.6   -6.4    10.0     1.1
  850.   1569.    5.7  -11.6   346.2     0.8
  800.   2063.    4.1  -20.0   251.1     0.7
  750.   2586.    2.3  -24.6   282.9     1.3
  700.   3139.   -0.7  -27.7   300.1     3.2
  650.   3727.   -3.8  -28.7   307.2     4.4
  600.   4354.   -7.2  -29.1   335.7     6.0
  550.   5027.  -11.3  -35.0   339.9     8.2
  500.   5751.  -16.0  -36.6   339.3    11.0
  450.   6534.  -22.5  -39.7   332.6    10.5
  400.   7385.  -29.7  -43.8   337.0    12.7
  350.   8322.  -37.7  -48.3   343.0    15.3
  300.   9363.  -46.9  -51.1   356.5    17.3
  250.  10542.  -57.0  -59.3   345.8    19.5
  200.  11938.  -60.2  -67.9   319.2    26.3
  150.  13743.  -57.7  -82.6   304.2    23.0
  100.  16300.  -59.2 -273.1   304.7    20.4
   50.  20596.  -60.4 -273.1   326.5     6.1
   20.  26383.  -53.7 -273.1   228.0     8.1
```

Planned Trajectory

- Launch from near Fremont
  - Due to South East Trajectory
  - Sandusky County Regional Airport
  - Expected Landing near Ashland



2007/04/21
12:41:03

Launch Preparations

2007/04/21
12:41:03

Launch Preparations

2007/04/21
12:41:03

Launch Preparations

2007/04/21
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Launch Preparations

Launch

Balloon Sighted near burst

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Parachute Sighted

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Landing

Recovery Attempt

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Recovery

Many Thanks to the
Mohican Trail Club

Especially:
Duane Hart, WD8BVV
Mark Welty, N8MFS
Stanley Kinney, N8RNK

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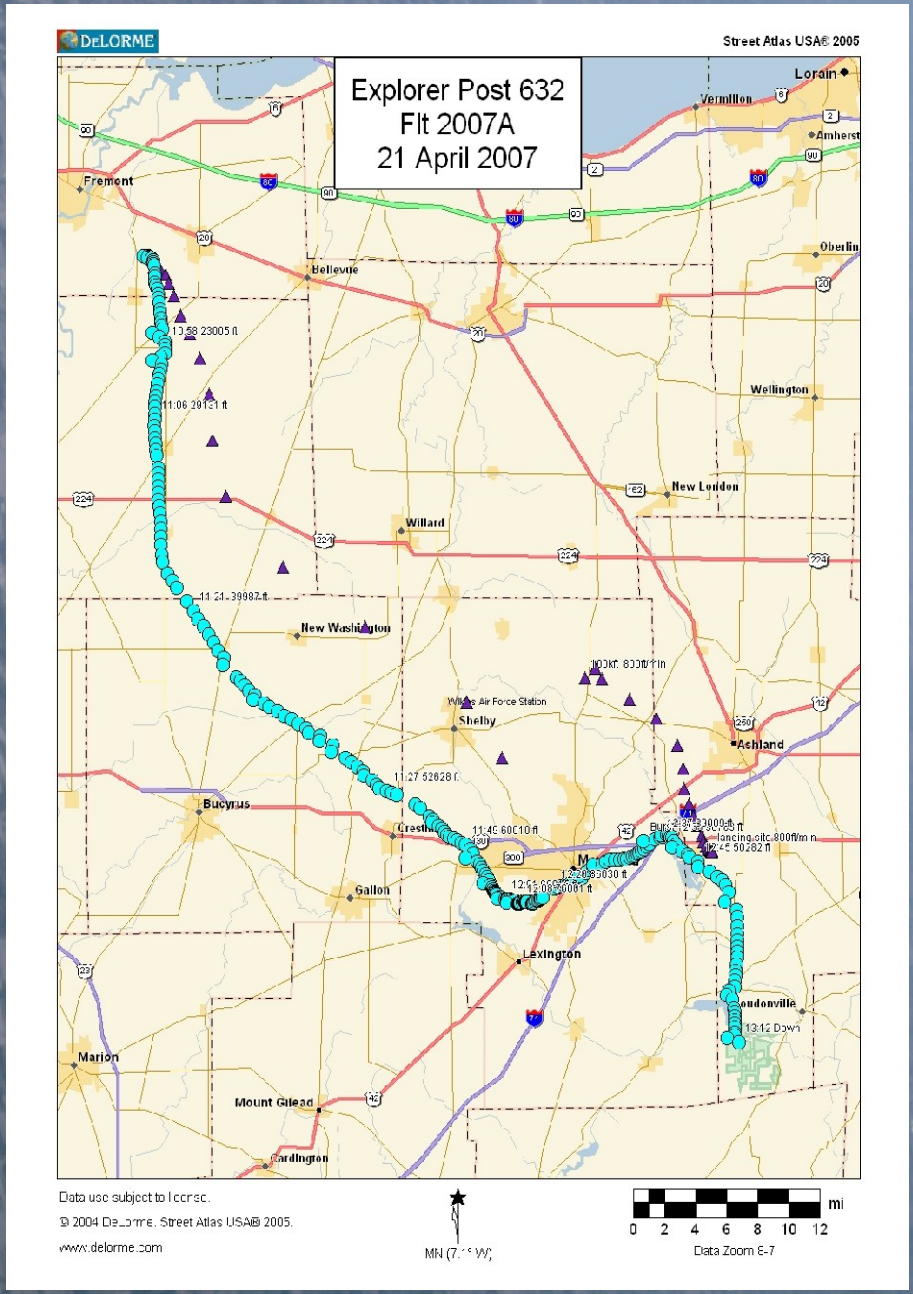
12:41:03

Flight Path



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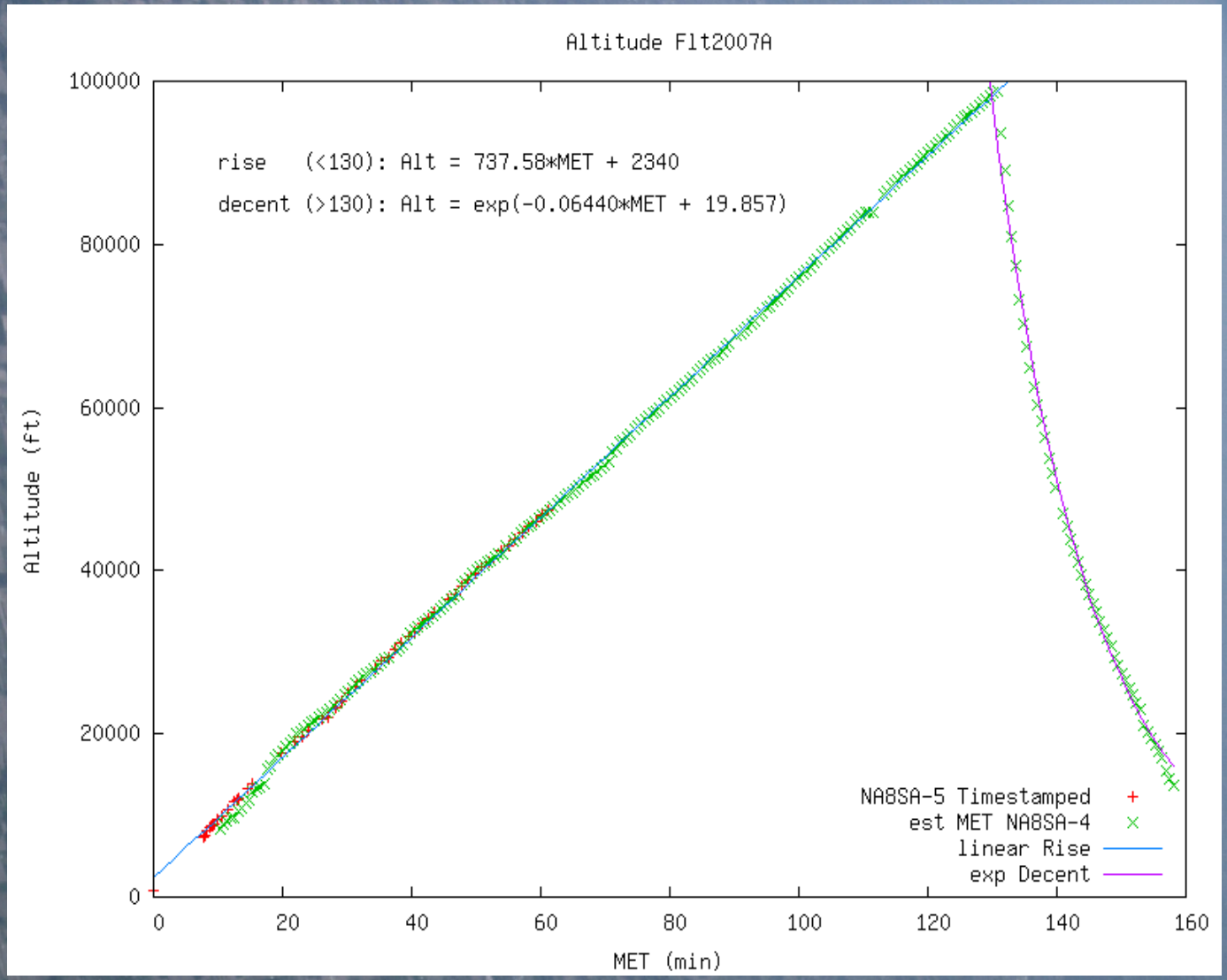
2007/04/21
12:41:03

Flight Trajectory



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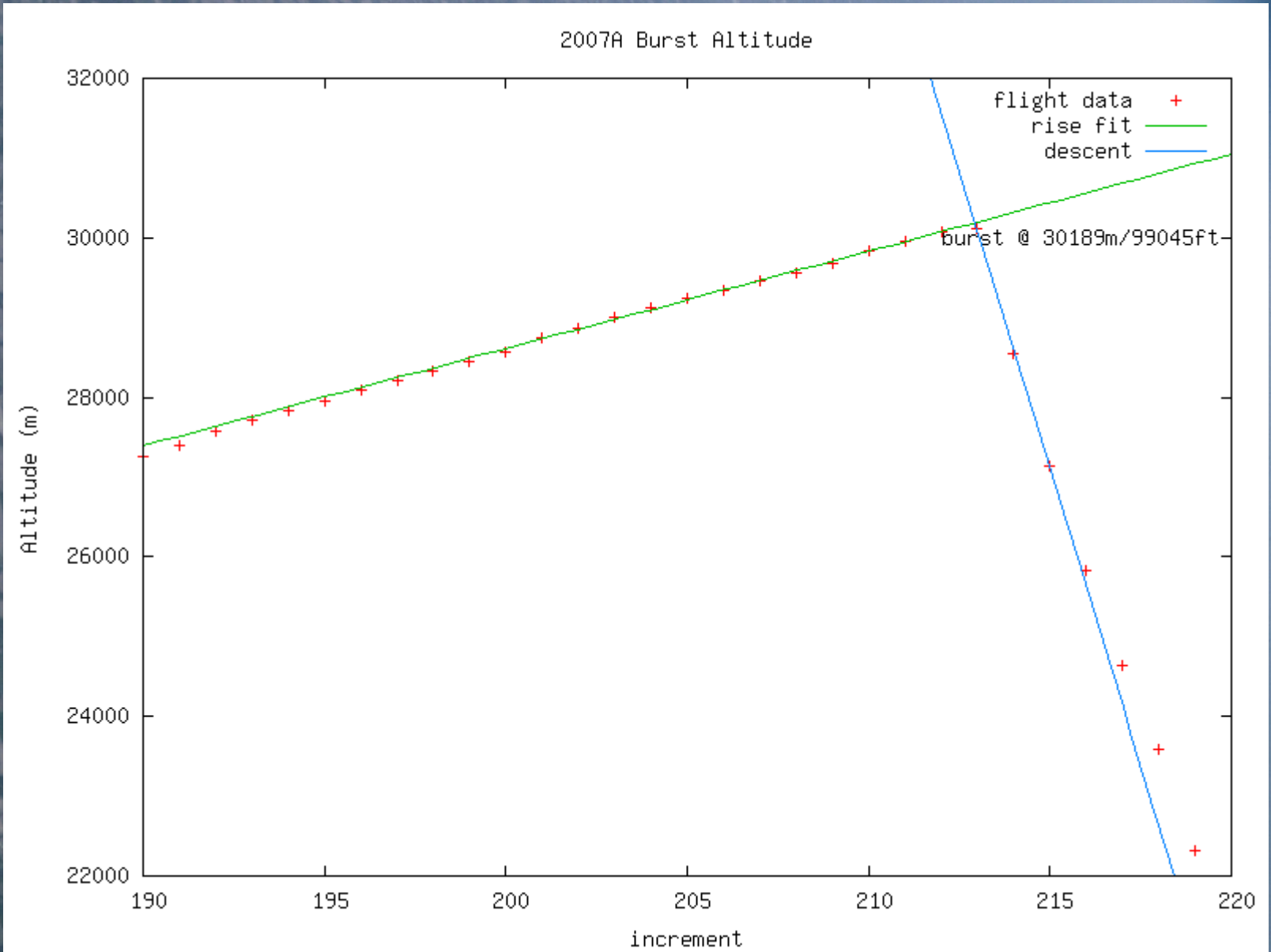
2007/04/21
12:41:03

Reached 99kft (barely)



Video

- Launch
- Burst
- Landing

Launch

Landing

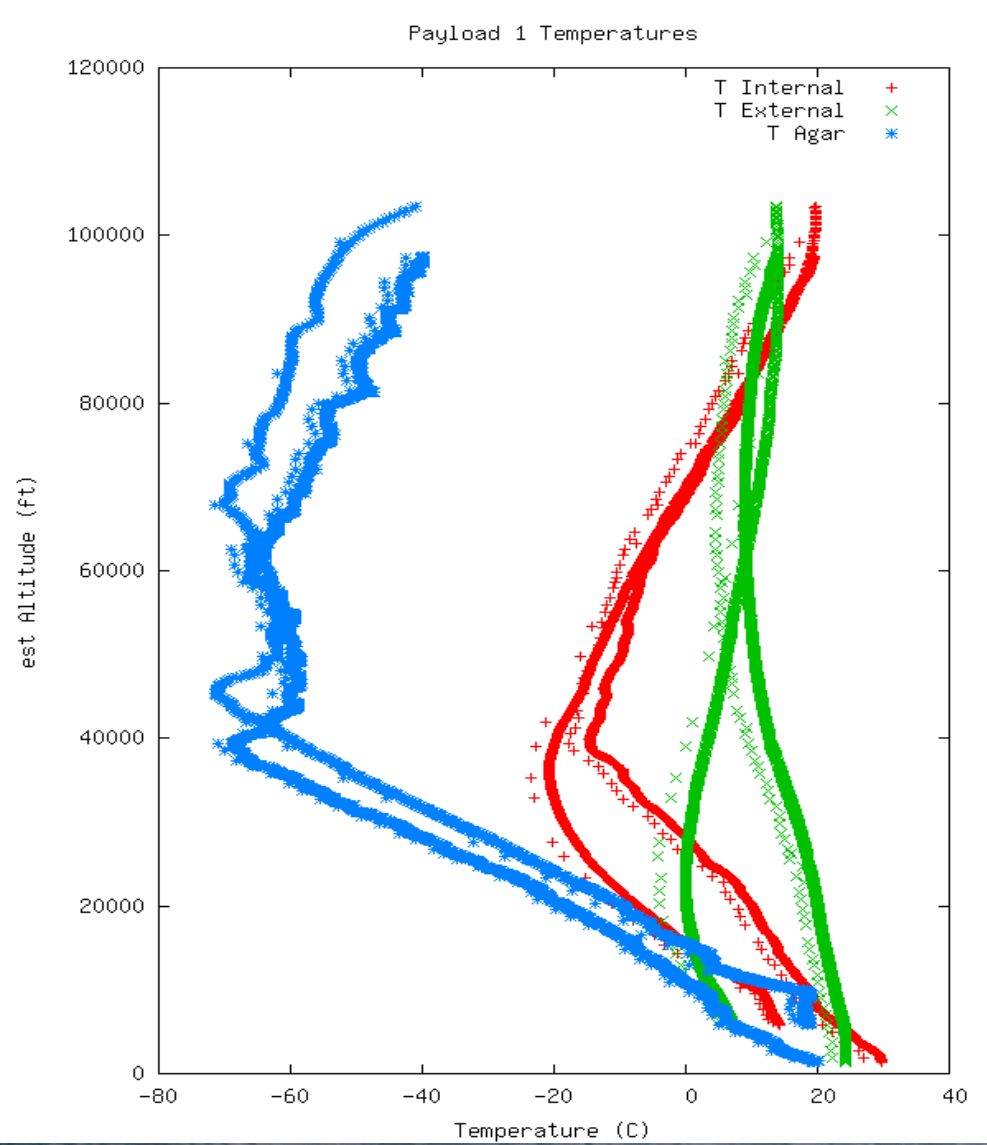
Burst

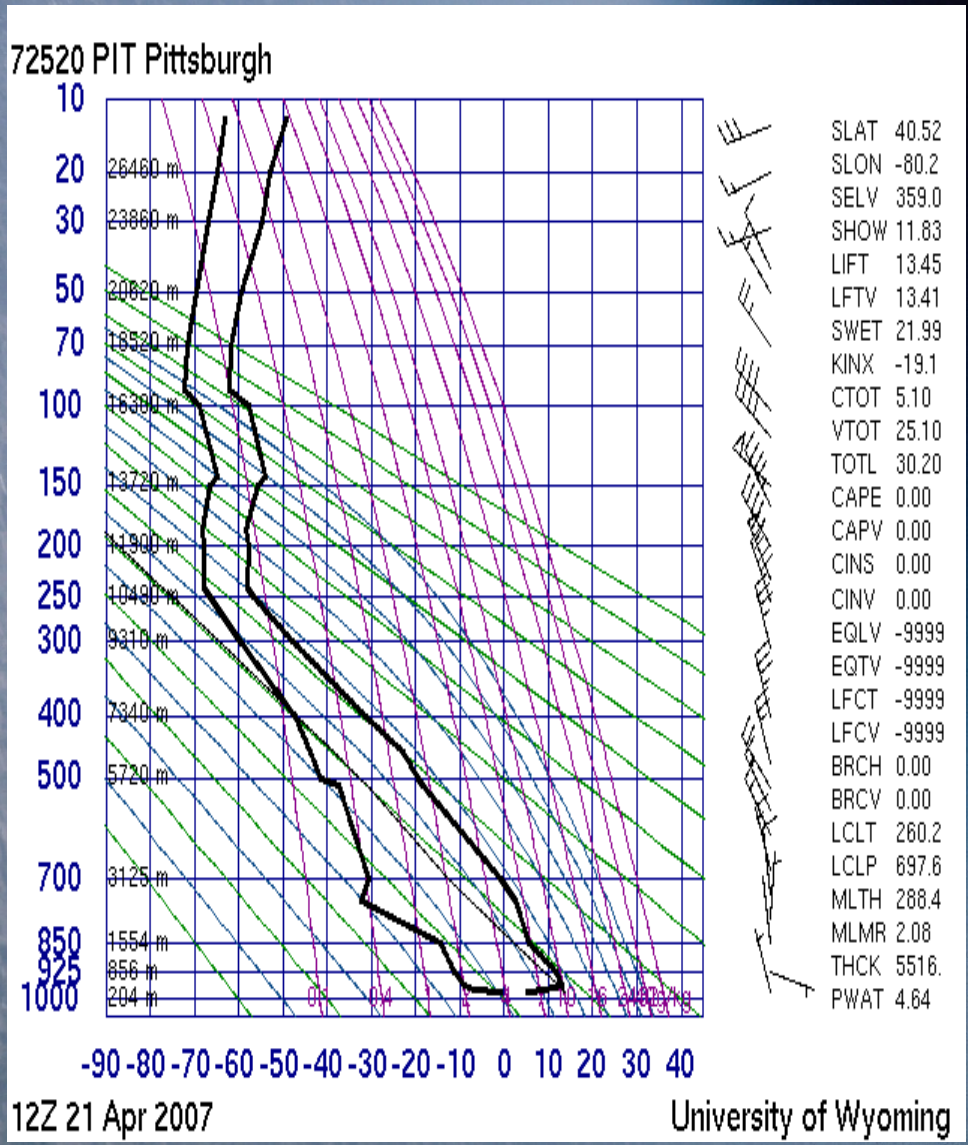
2007/04/21
12:41:03

Problems

- Horizontal Camera
  - Photo/review switch
- Agar
  - Diffusion indicator did not make contact
- Pressure sensor broken
- Atm Spectrum measurement
  - 9V battery not connected?
- 2m radio stopped near 50kft
  - Temp & voltage OK
- Forgot Checklists

Internal/External Temperature





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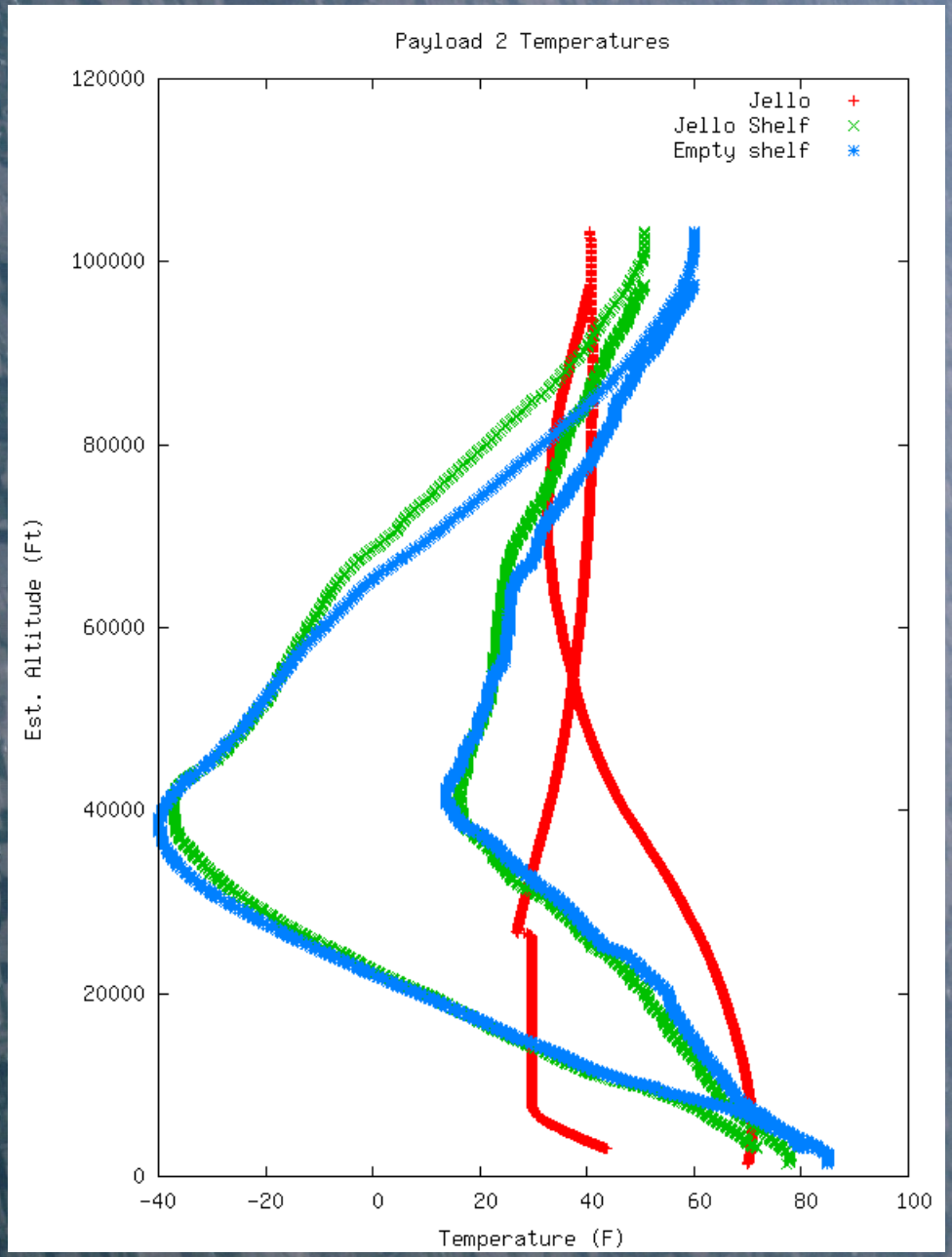
2007/04/21
12:41:03

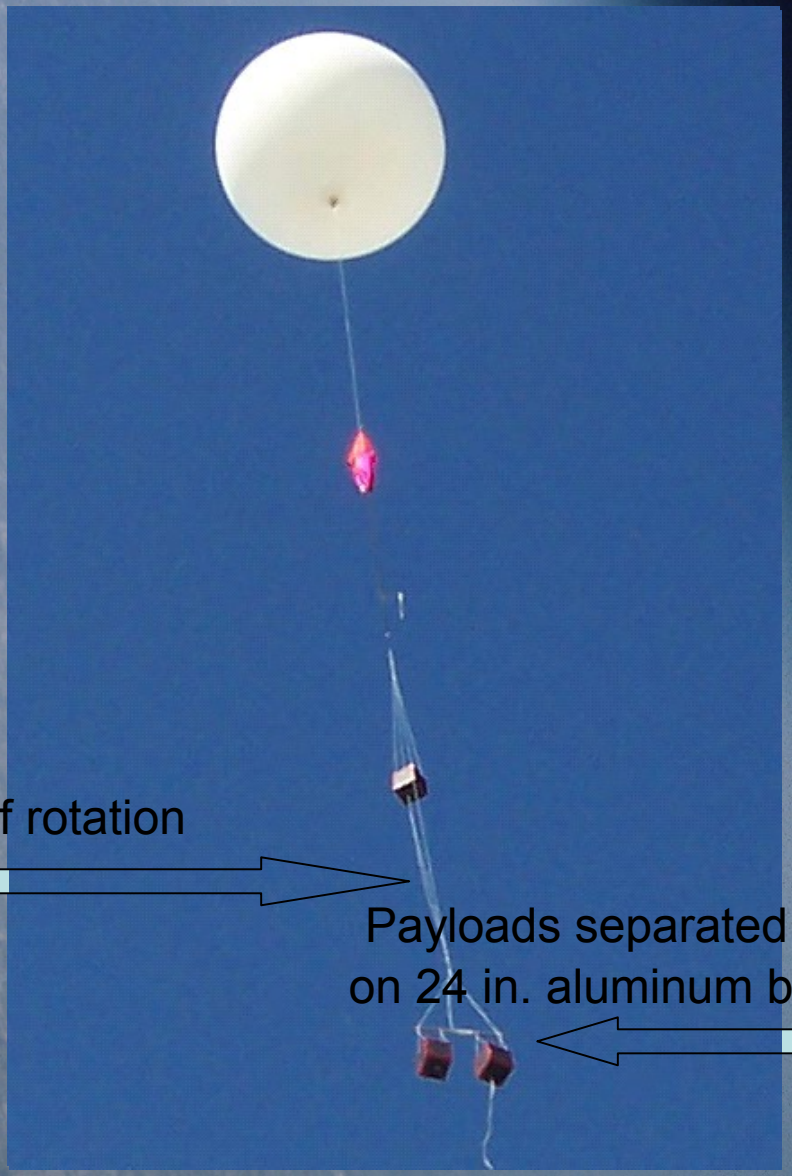
Payload 2 Temperatures



- Did Jello Freeze?
  - Didn't completely freeze
  - Didn't go below isotherm
- Was Jello shelf moderated?
  - Not very much
- Observations?

2007/04/21
12:41:03

Photo Stability



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12:41:03

Flight Photos

Sandusky County Regional Airport, 9900 ft

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2007/04/21
12:41:03

Flight Photos

Green Springs, 19 k ft

2007/04/21
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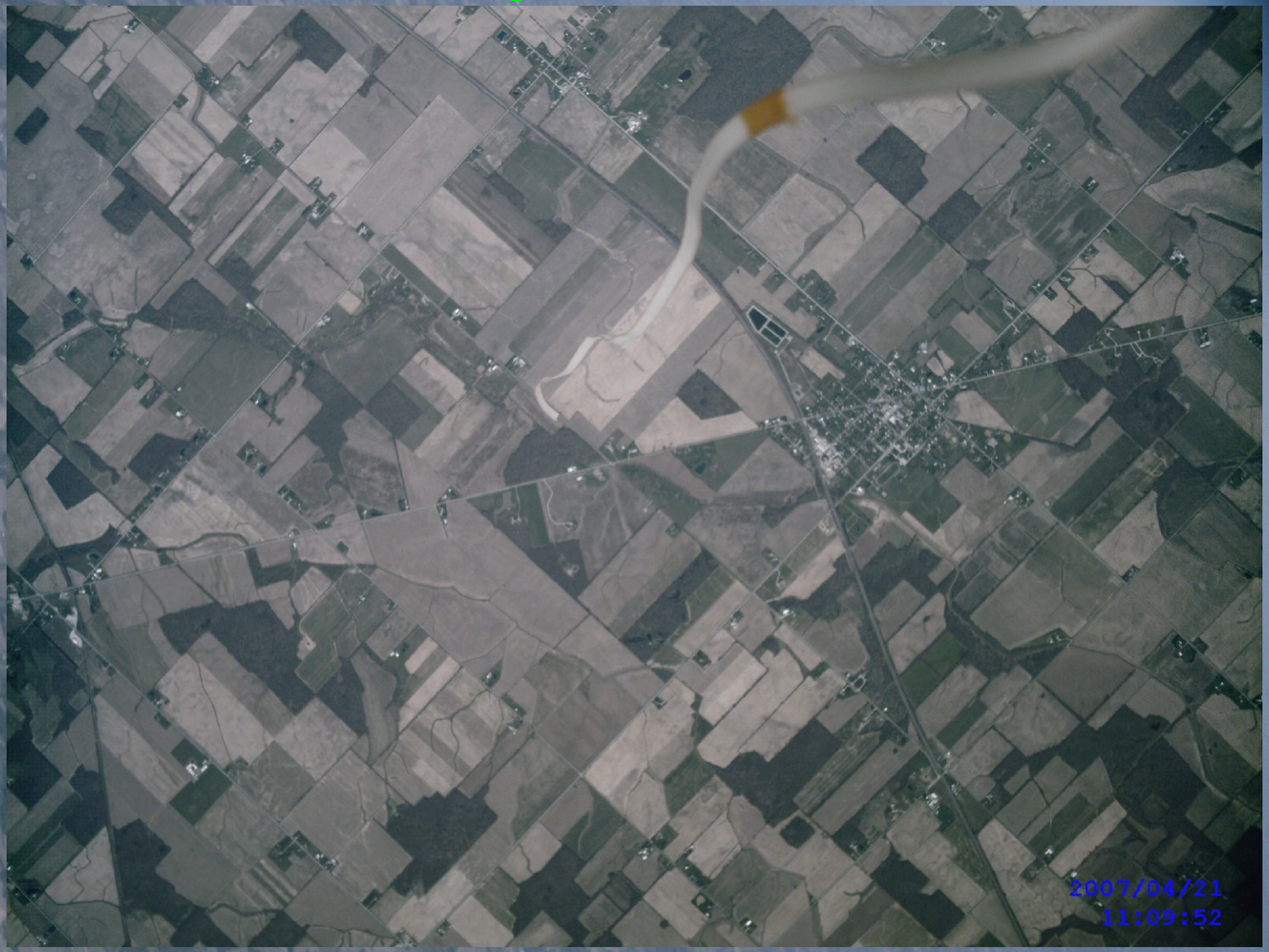
Flight Photos



Republic? , 31.5 k ft

Flight Photos

Chatfield , 44.6 k ft

Flight Photos

Mansfield, Clear Fork Resevoir, 60 kft

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2007/04/21
12:41:03

Flight Photos

Mansfield, 76 k ft

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Flight Photos

Ashland & Mansfield, 99 k ft

Flight Photos

Lake Erie, 70 k ft

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Flight Photos

Atmosphere, 65 k ft

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Flight Photos

Charles Mill Lake,44 kft

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Flight Photos

Parrysville, 36 kft

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Flight Photos

Parrysville & Pleasant Lakee, 30 kft

Flight Photos

Mohican State Forest

Flight Photos

Mohican State Forest

Flight Photos

Mohican State Forest

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2007/04/21
12:41:03

Flight Photos

Mohican State Forest

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Conclusions

- Success
  - Recovered Payload
- Best Vertical Pictures to date
- Video Fascinating
  - Spin and motion information
  - Audio
- Wii Controller Survived
  - Potential sensor?
- Thermal Mass will stay warm
  - But does not warm the compartments effectively
- Potential for 3 sec of freefall