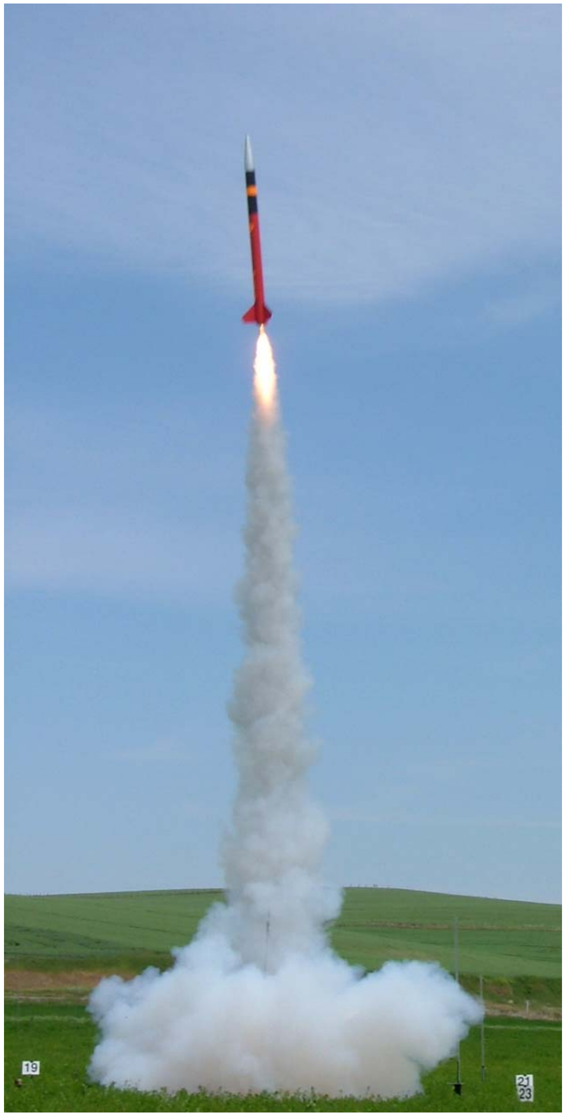
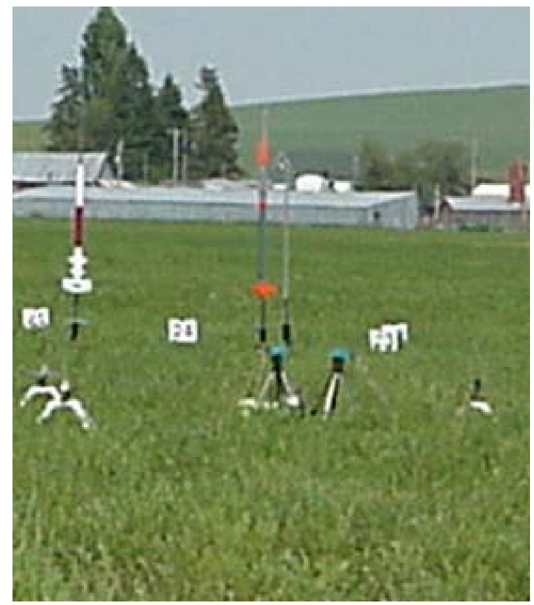
Glenda Project – Multiple Launches

“Lone Tree” Launch Site – Dayton, WA - June 11th, 2011



Dragon Slayer Launch with an RS92 GPS Radiosonde Payload

9875 Booster with a Holux GPS Datalogger Payload



5475 HV Booster (First Flight) flying an RS92 GPS Radiosonde Payload

“Lone Tree” Launch Site – June 11th, 2011

The flight plan for the June BMR launch was to expand on the advancements made at the May BMR launch with a second flight of the Holux GPS datalogger and to further expand the altitude envelope with the intent of finding the upper boundary of the “Lone Tree” updraft layer.

Two weeks prior to the launch, the Glenda Project was approached by Tim Quigg with the offer of using his Dragon Slayer booster to launch a Glenda payload. A rapid development project ensued which produced a coupler / rack assembly containing a Vaisala RS92 GPS radiosonde payload.

“Lone Tree” Launch Site – June 11th, 2011

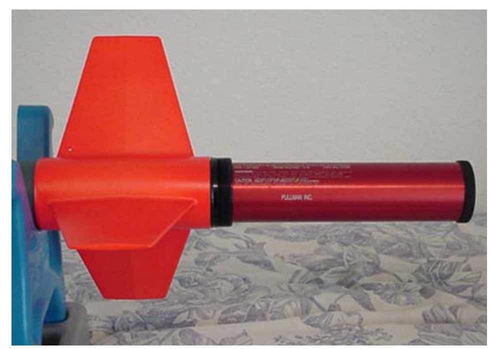
Booster Flight Plan

9875 - 98mm Booster / 75mm Capsule

- 4” diameter booster, 3” diameter capsule
- Holux M-241 GPS datalogger payload
- Optimal capsule sink rate of 25 feet per second
- Aerotech I211-M motor for a 3,000 + foot altitude

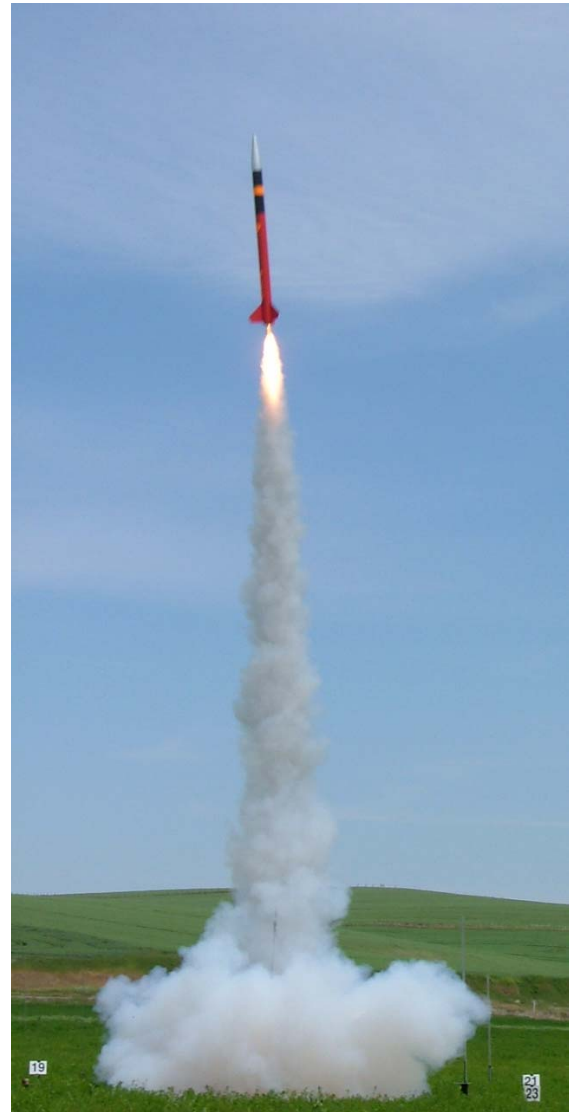
5475 - HV Booster

- 2.125” diameter booster, 3” diameter capsule
- RS92 Digital Radiosonde Payload with GPS
- I218 CTI 54mm motor with 4,000 + foot altitude



“Lone Tree” Launch Site – June 11th, 2011

Launch of the Dragon Slayer



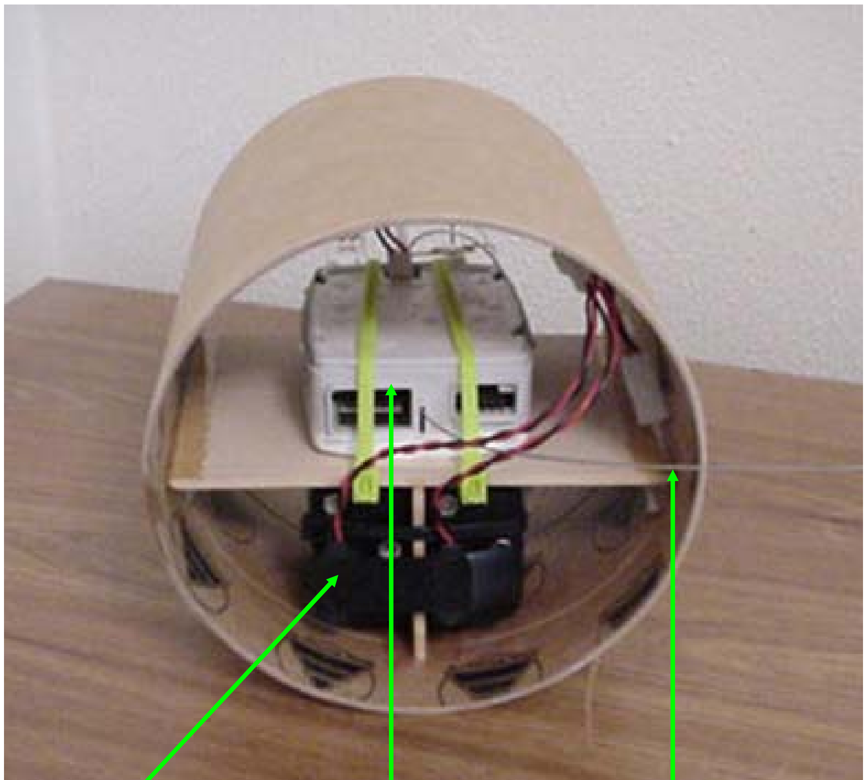
Dragon Slayer Booster with Glenda Payload

- 6” diameter booster
- Vaisala RS 92 GPS Radiosonde payload
- Capsule sink rate of 25 feet per second
- Aerotech J570-M motor for an estimated 2,500 foot altitude

“Lone Tree” Launch Site – June 11th, 2011

Dragon Slayer Payload

Forward View

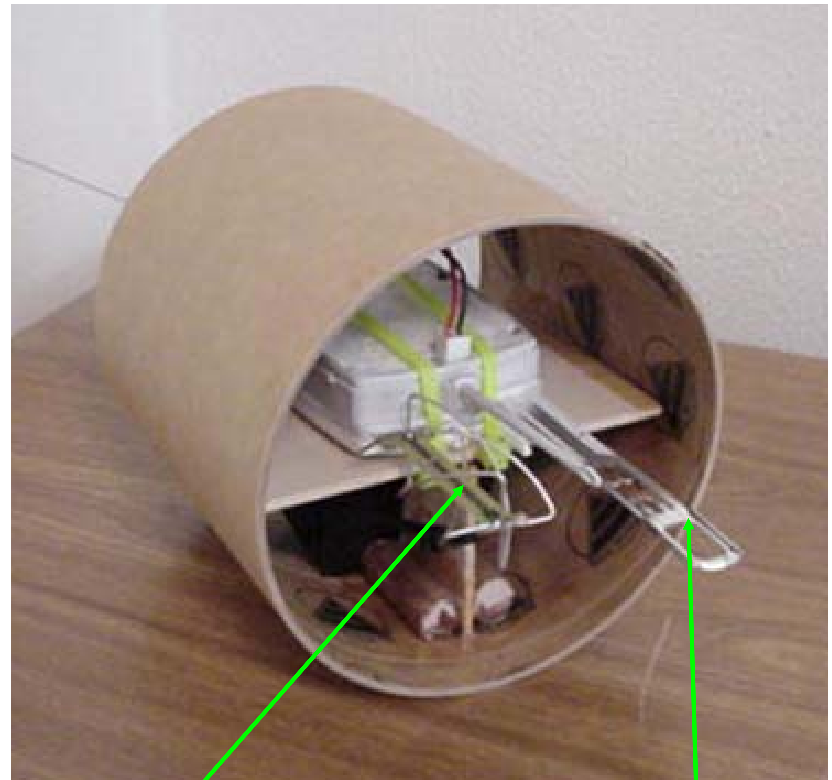


Battery Packs

Transmitter Antenna

Vaisala RS92 Radiosonde

Aft View



GPS Receiver Antenna

Temperature & RH Sensors

Coupler / Rack fits inside the Dragon Slayer payload capsule

“Lone Tree” Launch Site – June 11th, 2011

Dragon Slayer Flight Data

The flight of the Dragon Slayer was extremely successful with an altitude of close to 3,600 feet! The payload performed remarkably well based on all of the increased G forces and vibrations.

While the temperature and RH sensors went erratic during flight, the GPS system continued to function and transmit usable position, windspeed, and sink rate data.

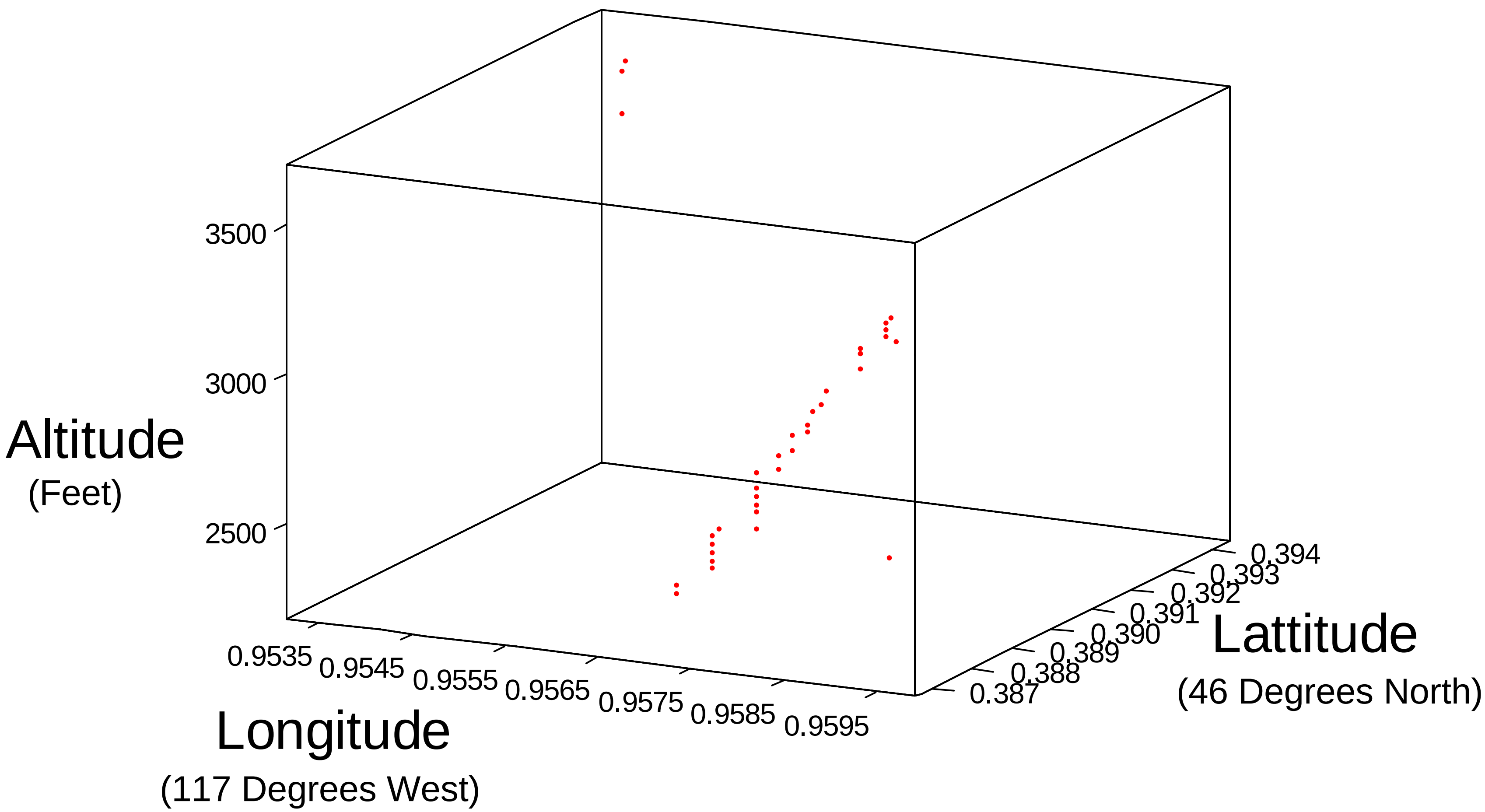
The increased flight loads also produced a bending of the radiosonde transmitter antenna reducing its signal. However, our new “Quad-Plane” receiver antenna was able to mitigate this in-flight failure and still capture usable data.

The following slides show the data captured during the Dragon Slayer flight.

“Lone Tree” Launch Site – June 11th, 2011

Dragon Slayer Flight Data - 4D Plot

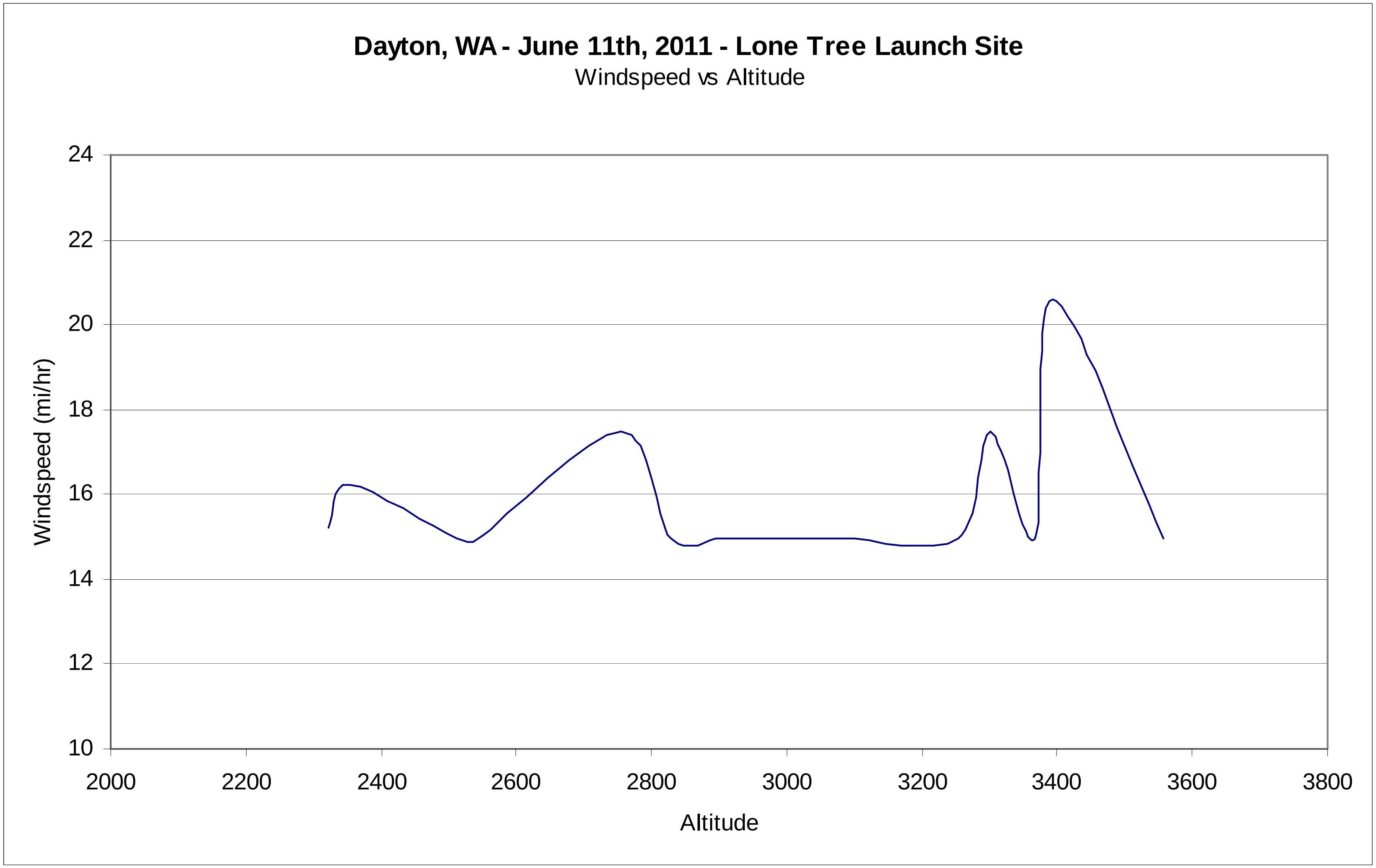
Lattitude / Longitude / Altitude / Motion



Note: After an initial shift at altitude, due to the winds aloft, recovery was nominal

“Lone Tree” Launch Site – June 11th, 2011

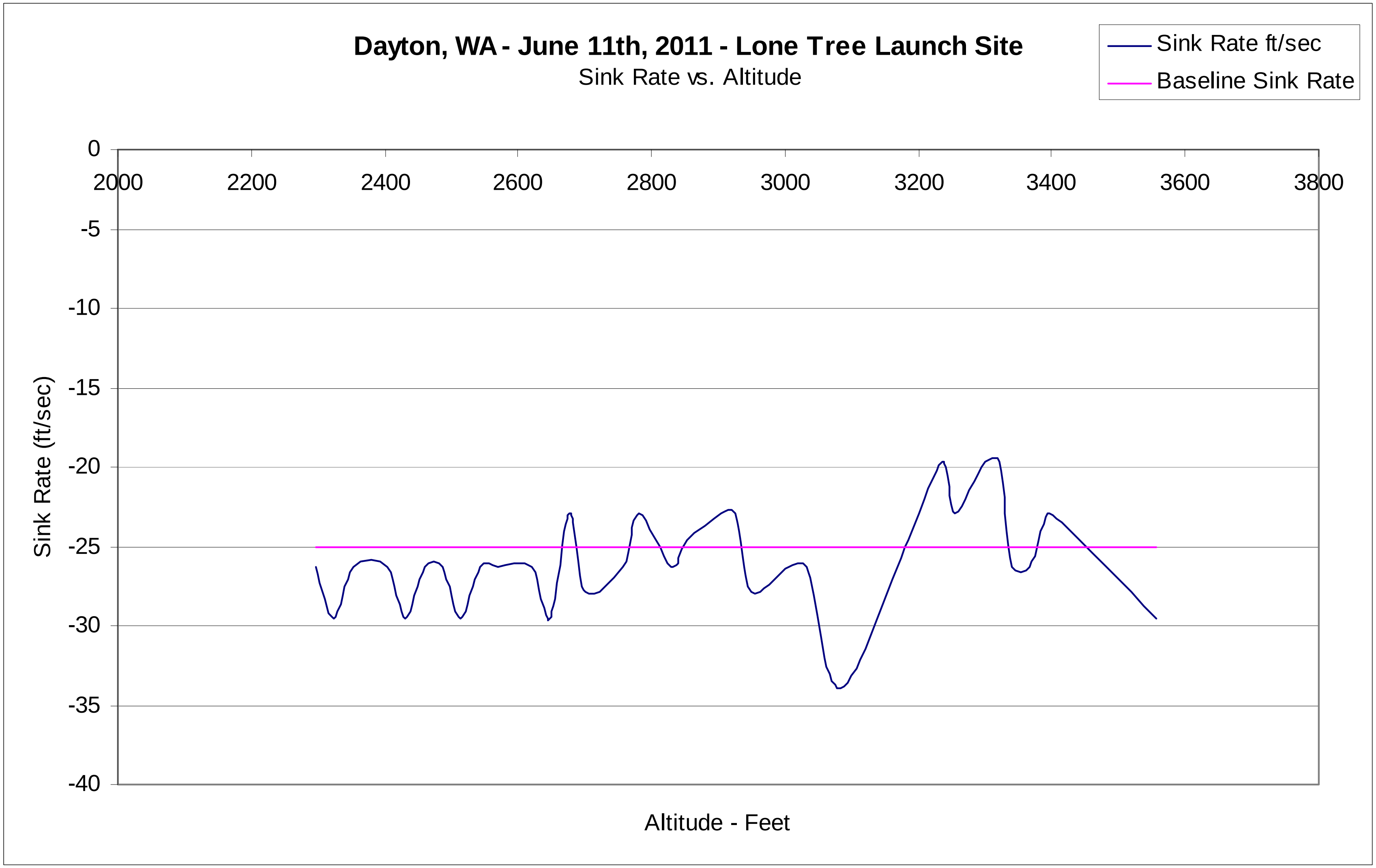
Dragon Slayer Flight Data – Windspeed vs. Altitude



Note: Windspeed values remained relatively consistent during the flight

"Lone Tree" Launch Site – June 11th, 2011

Dragon Slayer Flight Data – Windspeed vs. Altitude



Note: The baseline capsule sink rate was 25 feet per second (-25 fps) and was able to continue to detect updrafts and downdrafts. No consistent pattern was detected.

“Lone Tree” Launch Site – June 11th, 2011

Holux M-241 GPS Datalogger Payload

The original plan was to make this flight using an Aerotech I211-M motor for an estimated altitude of over 3,000 feet. However, due to the high winds aloft and the safety requirement of landing the vehicle within the field boundaries, a lower impulse CTI I170-10 motor was selected with its predicted altitude of 2,500 feet.

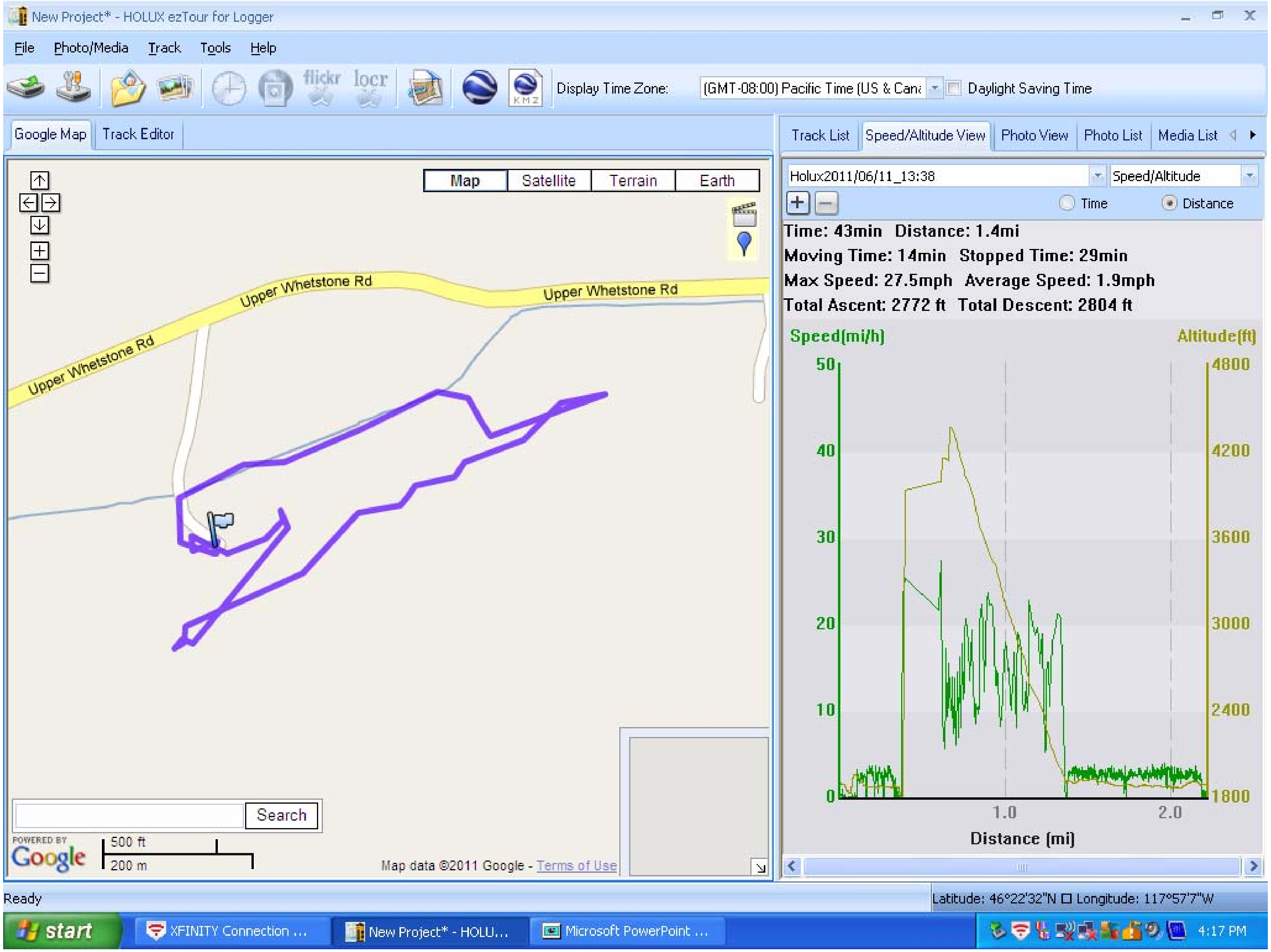
The following slides shows the data collected by the Holux datalogger during the June flight. While the ground track and velocity data displayed by the supplied Holux software is interesting, it does not provide the visibility that the data is capable of displaying.

Our Glenda 4D mapping software allows the data to be shown in its true fidelity displaying the motion of the capsule as it descends.

While the flight did not meet the mission requirement of expanding the flight envelope to above 3,000 feet, it did produce additional raw data captured by the datalogger to continue to add to our wind velocity, and updraft / downdraft datasets allowing us to build a more effective prediction model.

"Lone Tree" Launch Site – June 11th, 2011

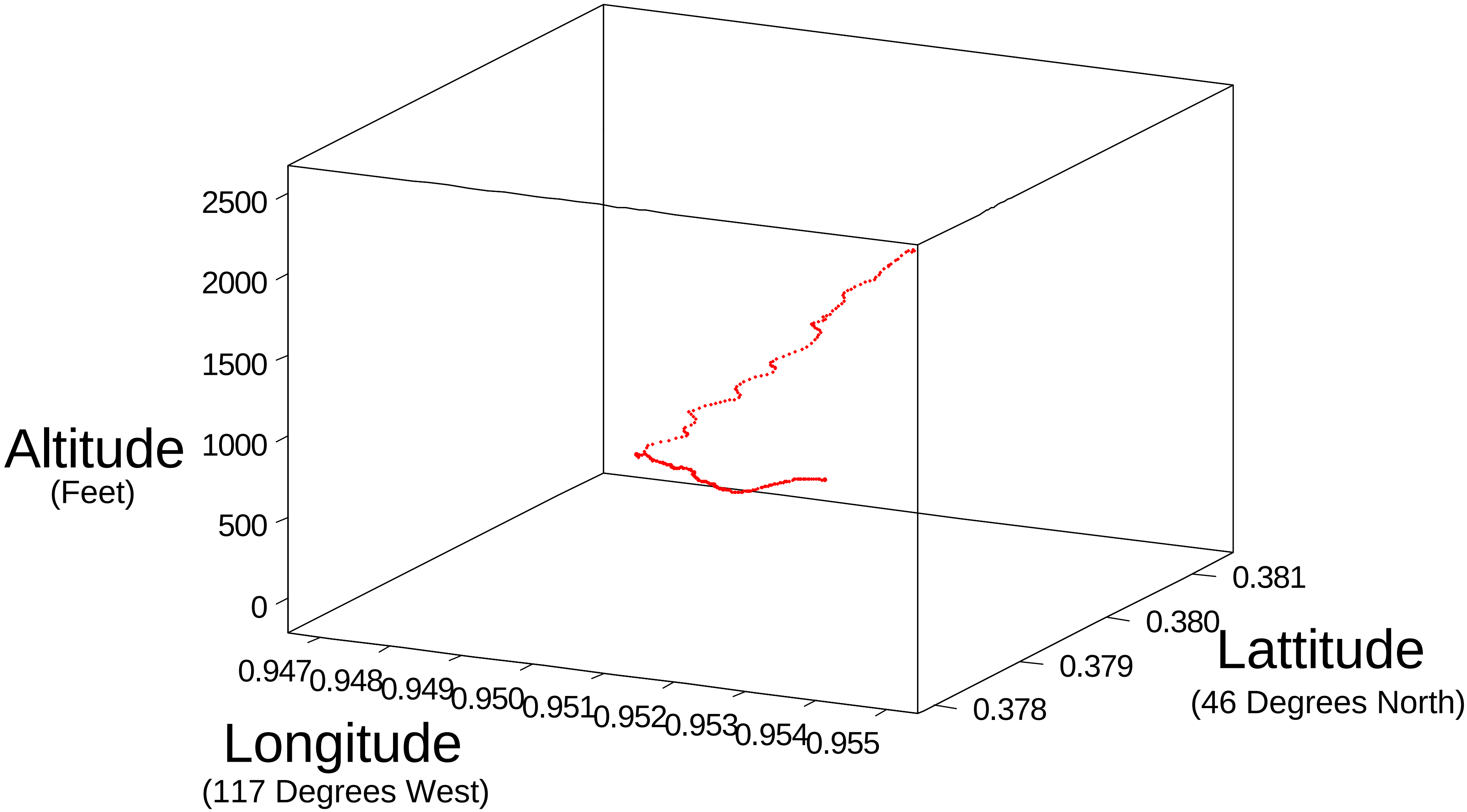
Holux M-241 GPS Datalogger - Groundtrack



"Lone Tree" Launch Site – June 11th, 2011

4D Plot – Lattitude / Longitude / Altitude / Motion

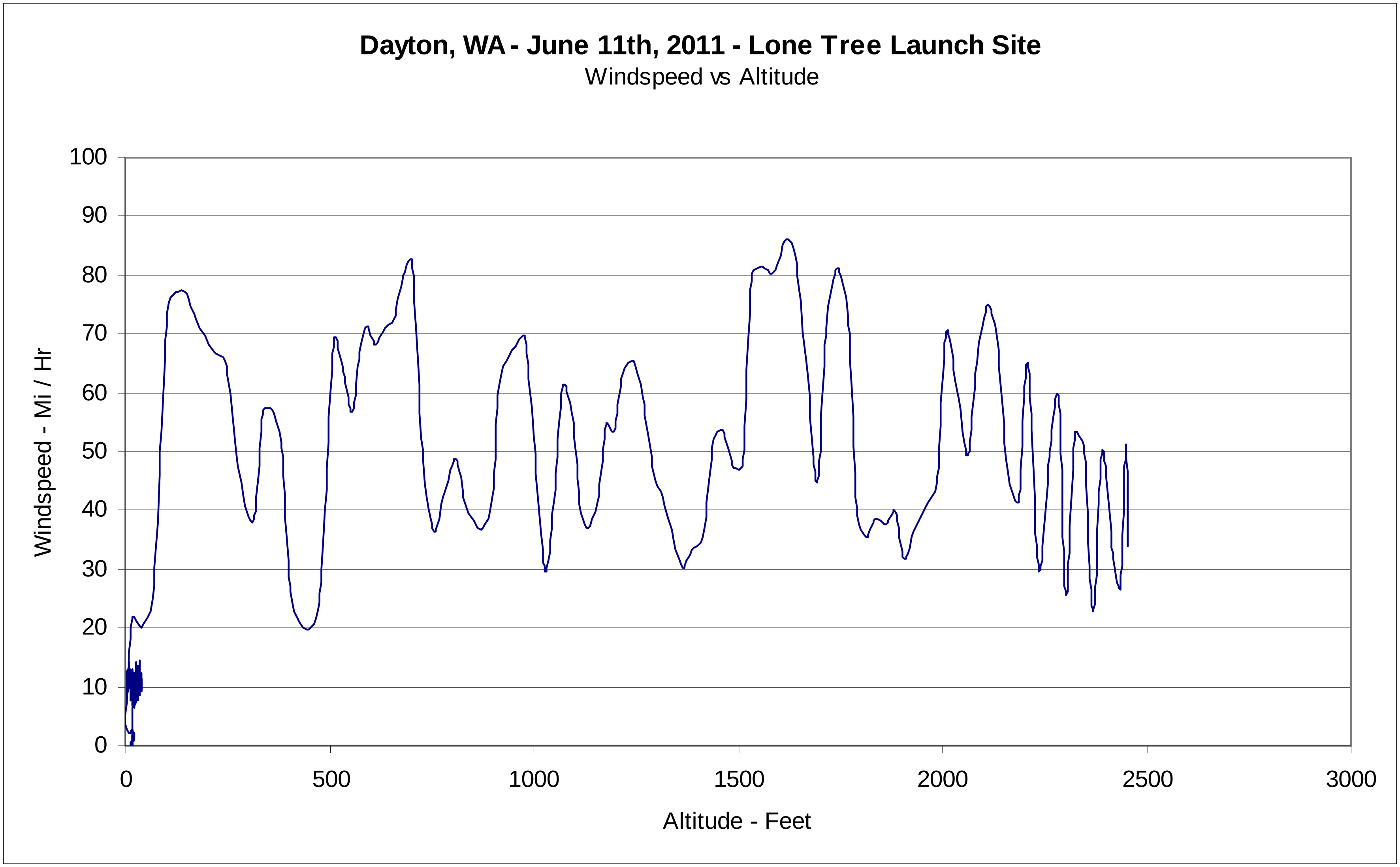
Holux M-241 Datalogger Payload



Note: The capsule changes direction at around 500 feet

“Lone Tree” Launch Site – June 11th, 2011

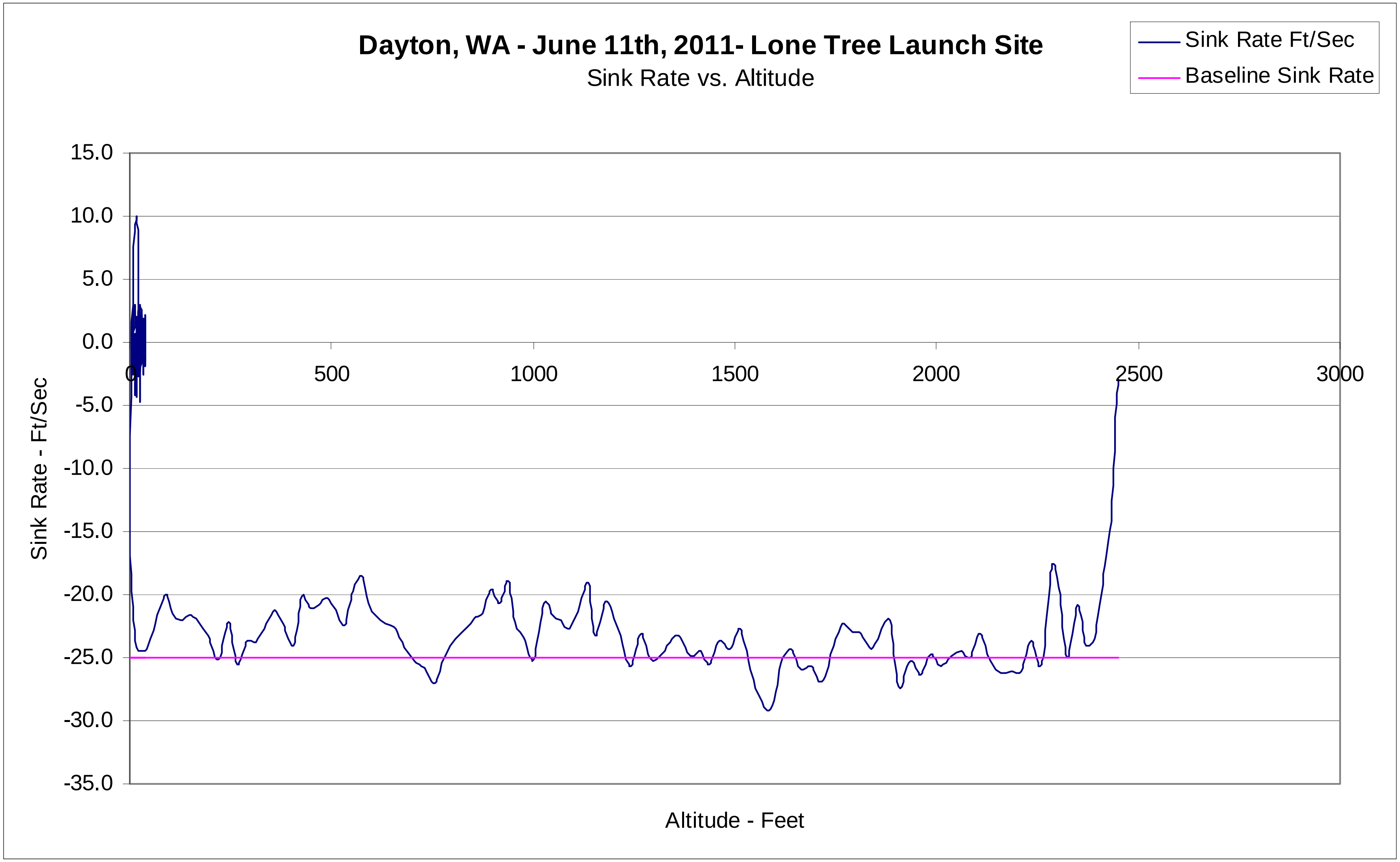
Wind Speed versus Altitude – Holux M-241 GPS Datalogger payload



Note: While the winds at ground level appeared calm, at altitude, they were intense

"Lone Tree" Launch Site – June 11th, 2011

Holux M-241 - Sink Rate versus Altitude



Note: The "Baseline" Sink Rate of the capsule is 25 feet per second (-25)
There are significant Updrafts near the ground, and near 2,500 feet

“Lone Tree” Launch Site – June 11th, 2011

First Flight of the 5475 HV Booster with RS92 Radiosonde GPS Payload

The original flight plan was to go to over 4,000 feet for a first flight powered by a CTI I218 54mm motor. Due to the wicked winds aloft combined with the designed intent of landing within the field boundaries, the lower impulse CTI I170 was selected with a predicted altitude of just over 3,000 feet. Even with this lower impulse motor, the booster and capsule landed across the gravel road on the top of the first ridge. This was not the intent, as the mission was to gather data above the launch site and not from the surrounding terrain.

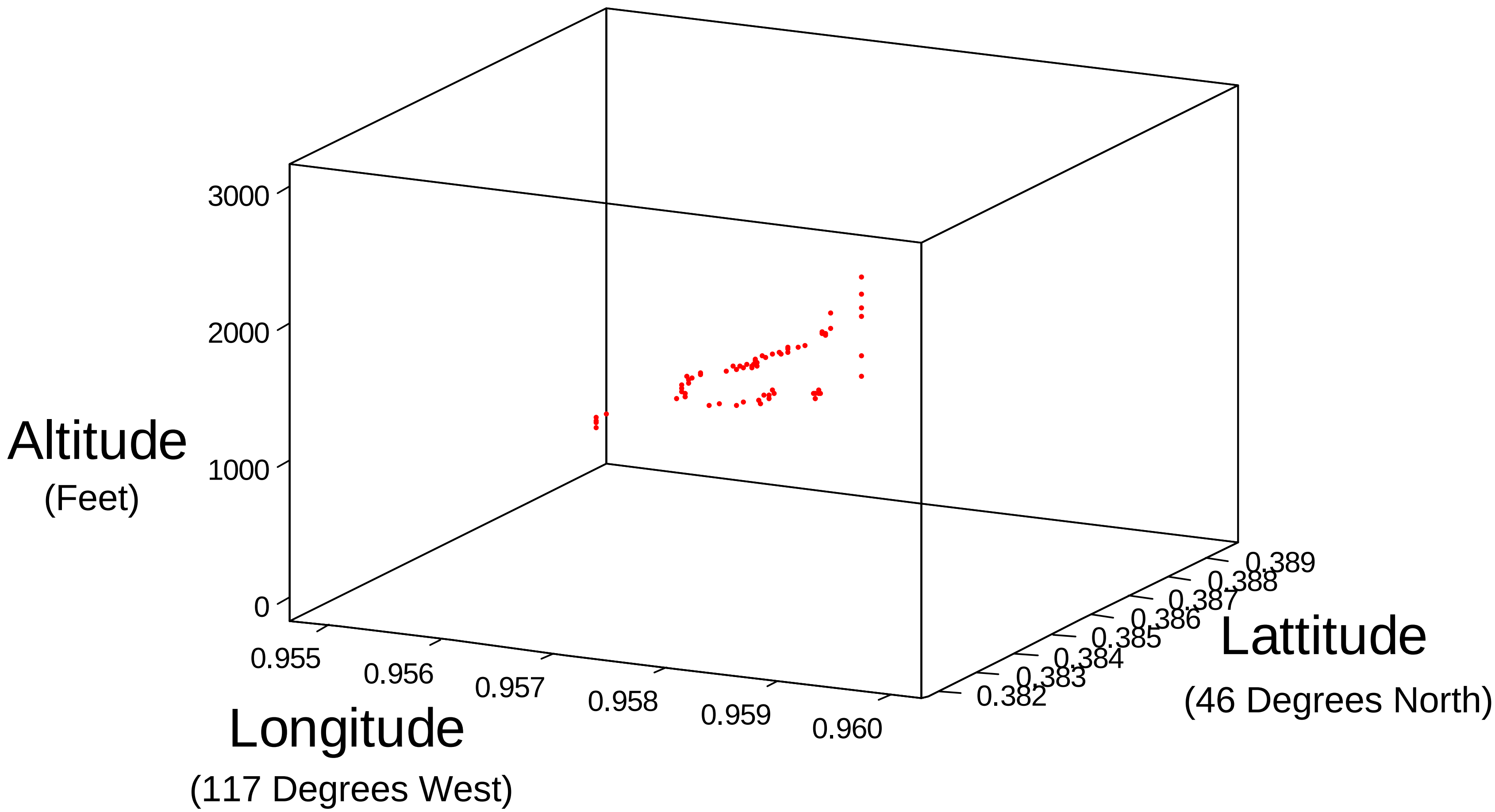
The first recorded data point registered at 2,993 feet just after GPS satellite signal re-acquisition. We were finally in the altitude ball park. Solid windspeed and sink rate data was captured, plus the supporting temperature and relative humidity readings.

The following slides present the results.

“Lone Tree” Launch Site – June 11th, 2011

4D Plot – Lattitude / Longitude / Altitude / Motion

5475 HV Booster with RS92 Radiosonde Payload

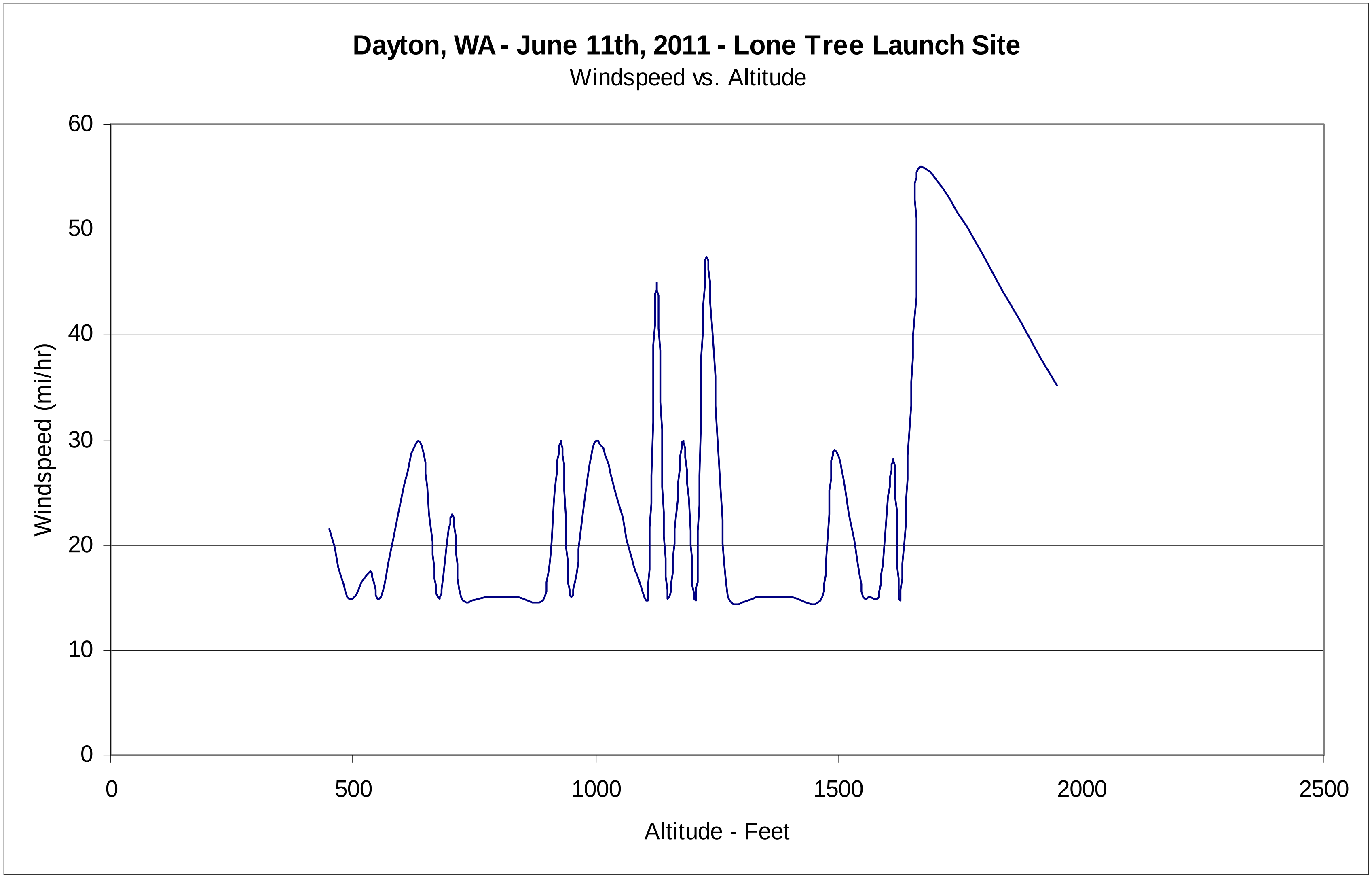


Note: The capsule changes direction multiple times as it descends due to the changing wind currents

"Lone Tree" Launch Site – June 11th, 2011

Wind Speed versus Altitude

5475 HV Booster with RS92 Radiosonde Payload

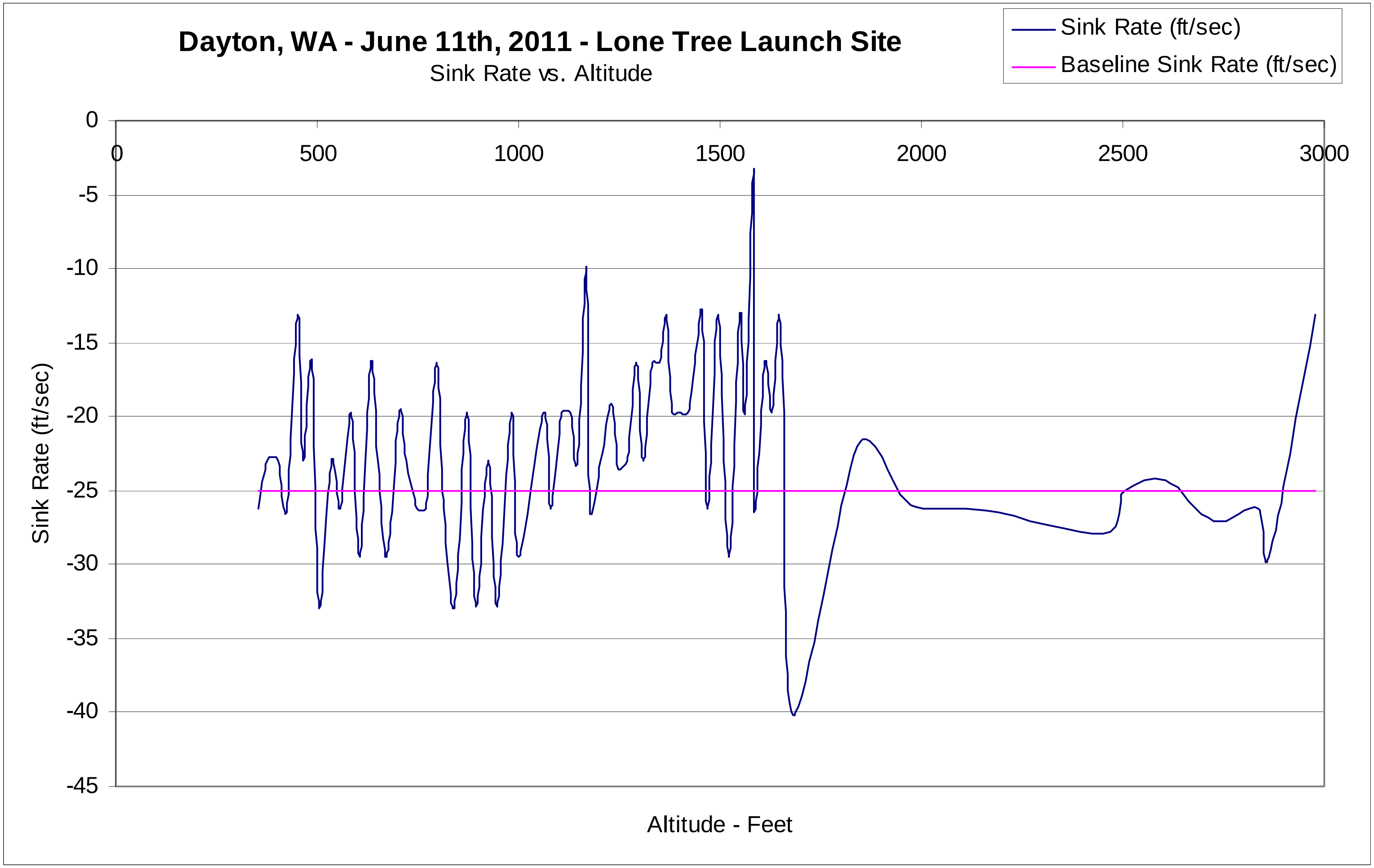


Note: While the winds at ground level appeared calm, between 1,500 and 2,000 feet, they became intense

"Lone Tree" Launch Site – June 11th, 2011

Sink Rate versus Altitude

5475 HV Booster with RS92 Radiosonde Payload



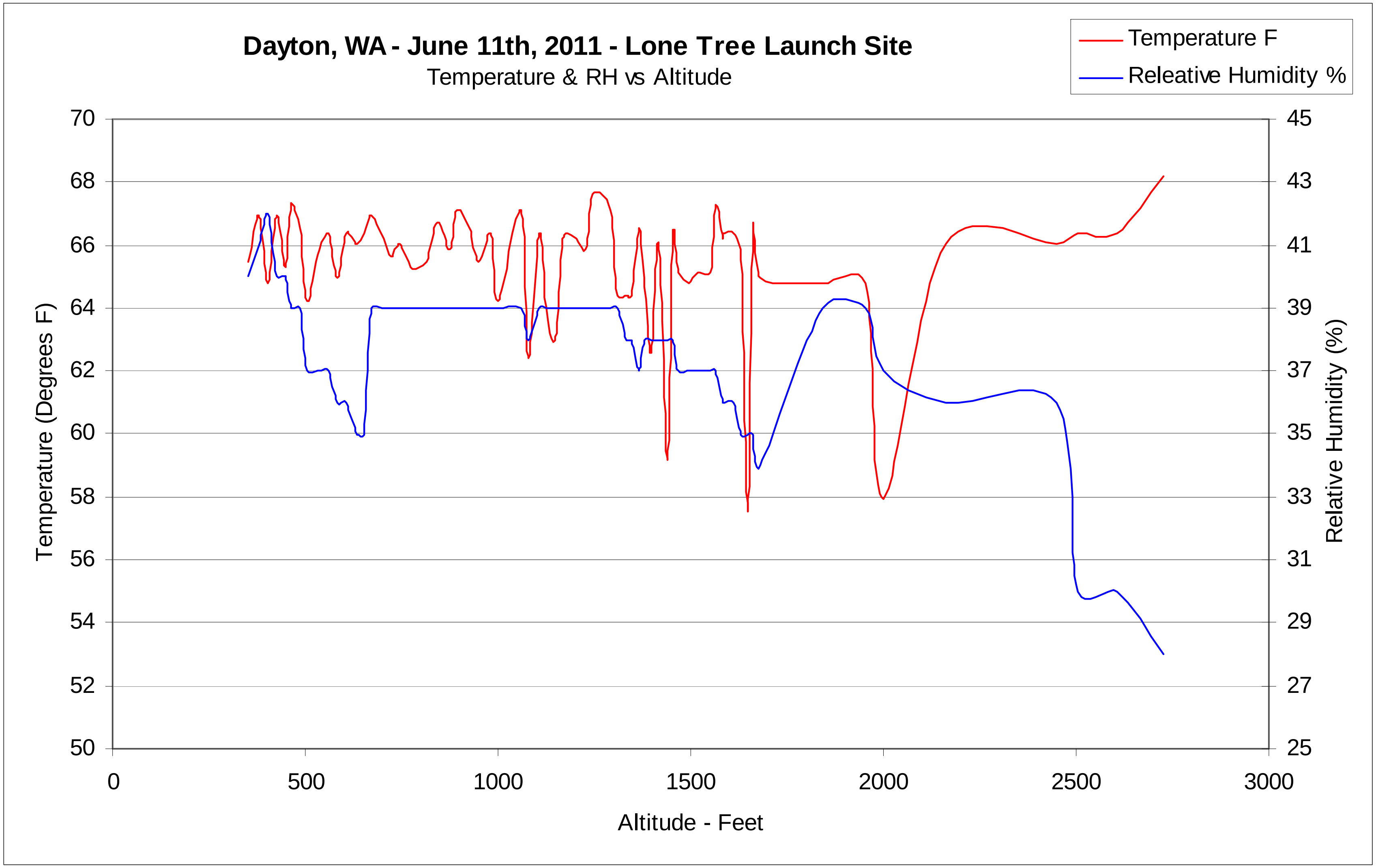
Note: The "Baseline" Sink Rate of the capsule is 25 feet per second (-25)

There were increasing updrafts to 1,500 feet, then stabilized

“Lone Tree” Launch Site – June 11th, 2011

Temperature and Relative Humidity versus Altitude

5475 HV Booster with RS92 Radiosonde Payload



Note: The divergence of the temperature and relative humidity at the 1,200 level noted in previous data collections is now at the 2,000 foot level

“Lone Tree” Launch Site – June 11th, 2011

Groundstation Data

Our groundstation continues to perform above expectations recording data at one second, and 1.5 second intervals based on the sensor type.

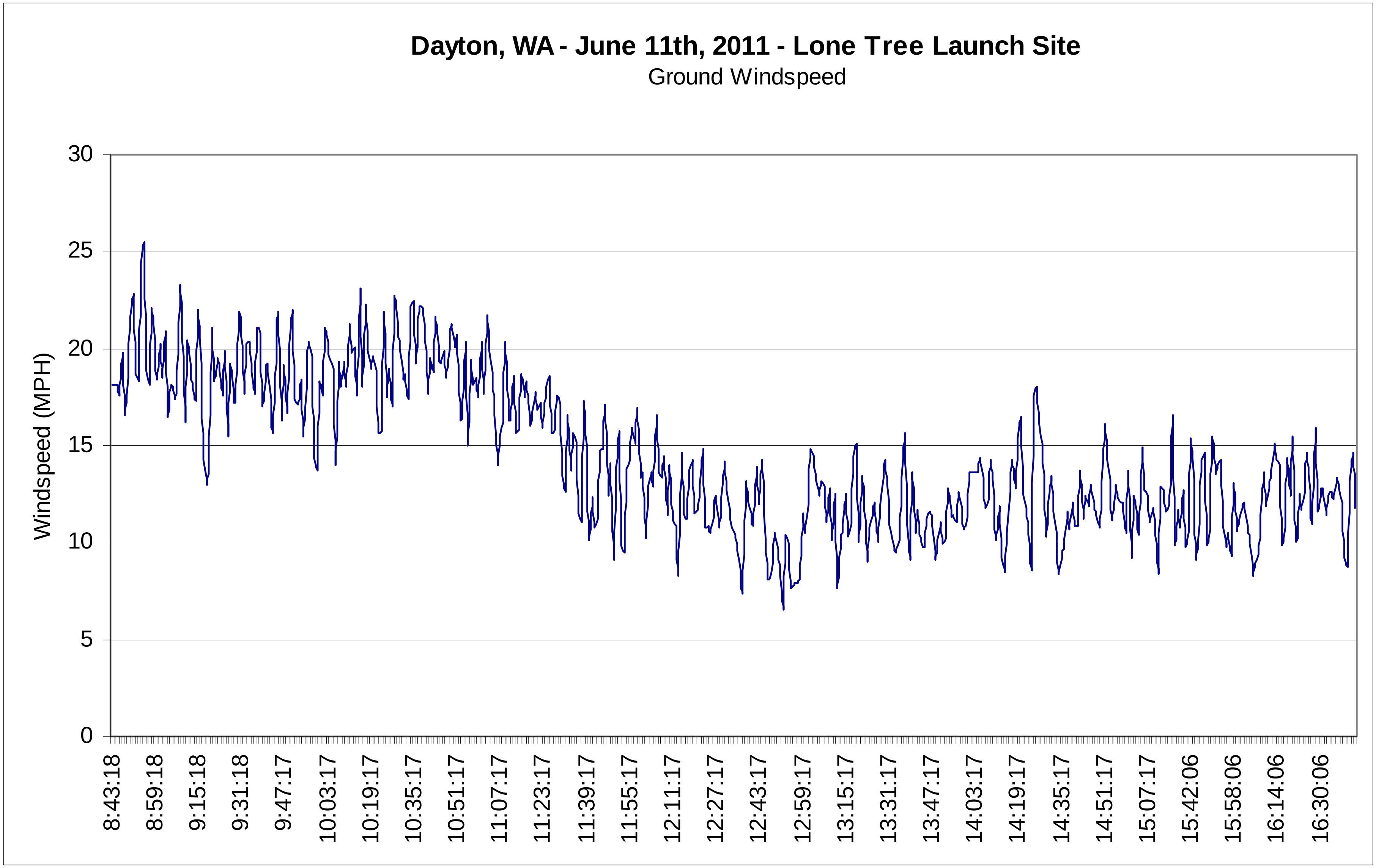
Barometric Pressure remained below the “baseline” nominal value due to the passing of a storm system from the previous few days.

Temperature increased and Relative humidity fell as the system remnants passed through.

Ground wind speed decreased during the day. However, the winds aloft remained excessive combined with severe updrafts and down drafts.

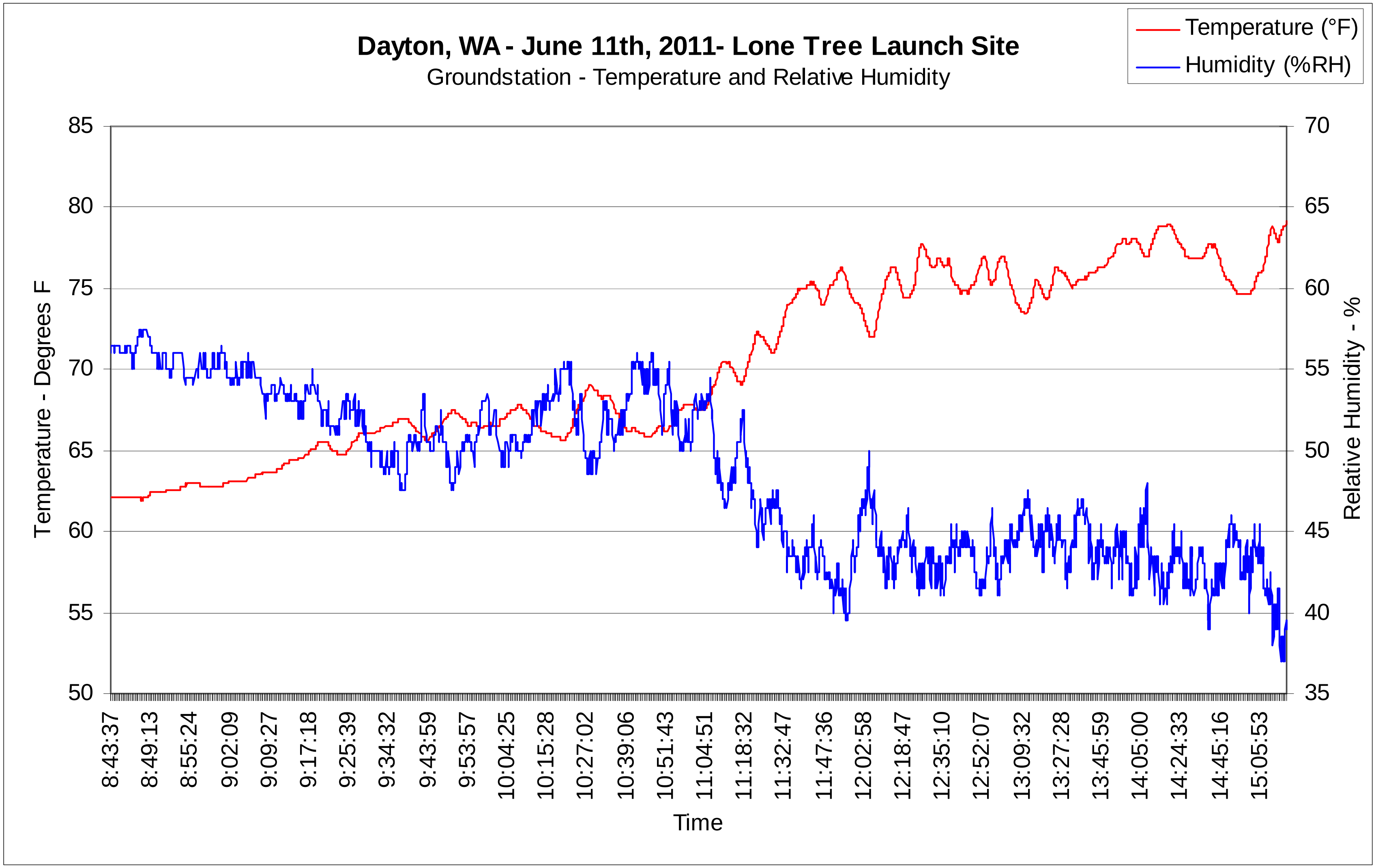
“Lone Tree” Launch Site – June 11th, 2011

Groundstation Windspeed



“Lone Tree” Launch Site – June 11th, 2011

Groundstation Temperature and Relative Humidity



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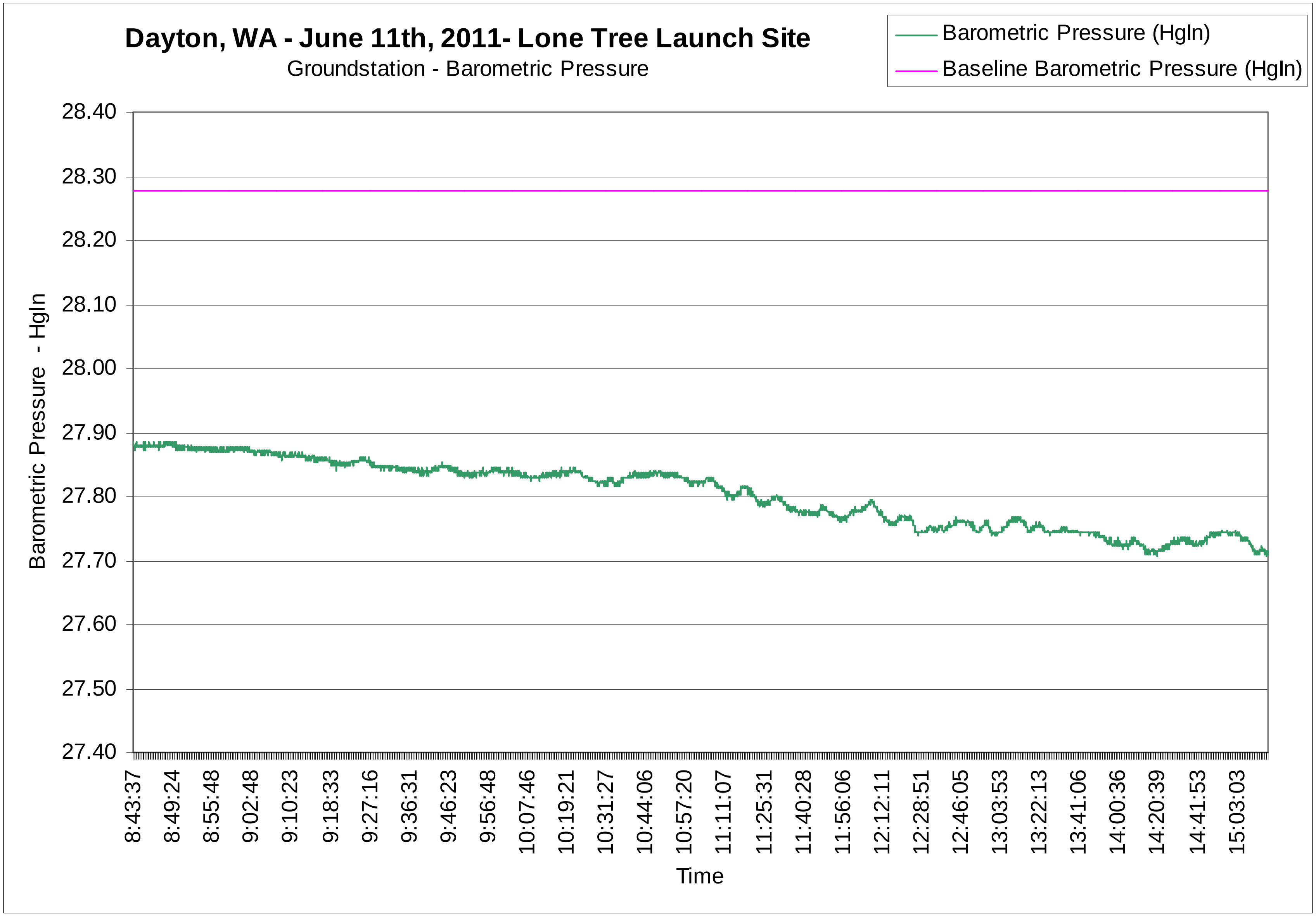
Groundstation - Barometric Pressure



"Lone Tree" Launch Site – June 11th, 2011

In Conclusion

The primary mission of the June launch was achieved by launching two of the three payloads to over 3,000 feet, capturing the data, and their successful return.

The data between the flights failed to pick up a an updraft upper boundary as severe updrafts and down drafts continued to occur even up to the altitudes recorded by the Dragon Slayer flight. It was hoped that the upper limit to the updraft layer would occur before the 3,000 foot mission threshold was reached.

The key factor in all of this were the brutal cross winds aloft. The continuing updrafts combined with the cross winds resulted in several vehicles going outside of the fields boundaries during the weekends launch activities. The bulk were mid powered birds with altitudes in the 3,000 foot range flying standard round parachutes. It is highly recommended that if people plan on flying in excess of 2,500 feet, x-formed, or similar parachutes be used in order to keep within the fields boundaries.

“Lone Tree” Launch Site – June 11th, 2011

In Conclusion

The flight of the Dragon Slayer payload also revealed the weakness of the RS92’s boom mounted sensors to flight loads and vibration. While these sensors work great on weather balloons and lower velocity Glenda flights, their effectiveness is significantly reduced at the higher velocities and vibrations produced by higher thrust motors. The solution to this is to transition to board mounted sensors for our higher velocity flights.

For the September BMR launch, our Flight Plan is to take on the “Updraft Upper Boundary” problem from a different approach. Two flights are planned to the 2,000 foot level flying the Holux M-241 GPS datalogger to gain a high resolution dataset of the “lower” altitude updrafts and downdrafts. Two additional flights are then planned at the 3,000 foot level flying the Holux datalogger to produce a high resolution dataset for the altitude range between 2,000 and 3,000 feet. If conditions allow, a flight to 4,000 feet is planned with either a RS92 radiosonde, or Holux datalogger payload.