# Pressure & Temperature vs. Altitude

# Presented by:

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# In Loving Memory

This is dedicated to our brave balloon, which spontaneously exploded during our experiment.

R.I.P.

Balloon

February 22, 2003 – February 22, 2003

# Why We Did It?

- Measure the pressure in relation to altitude
- Measure the temperature in relation to altitude
- Compare our findings to the NASA empirical model

# How We Did It?

1. Inflated balloon with approximately 1000psi worth of helium gas and attached a gondola to the end of it.

# How We Did It?



2. Hooked up equipment to gondola: LabPro to record data, pressure probe to measure atmospheric pressure, and thermometer to measure air temperature.

# How We Did It?



3. Attached balloon to a supposed 1000 ft reel of rope and slowly released the balloon to its ascent.

- At every 100 ft, the ascent was halted to give the instruments time to gather data.

# A shoddy illustration…
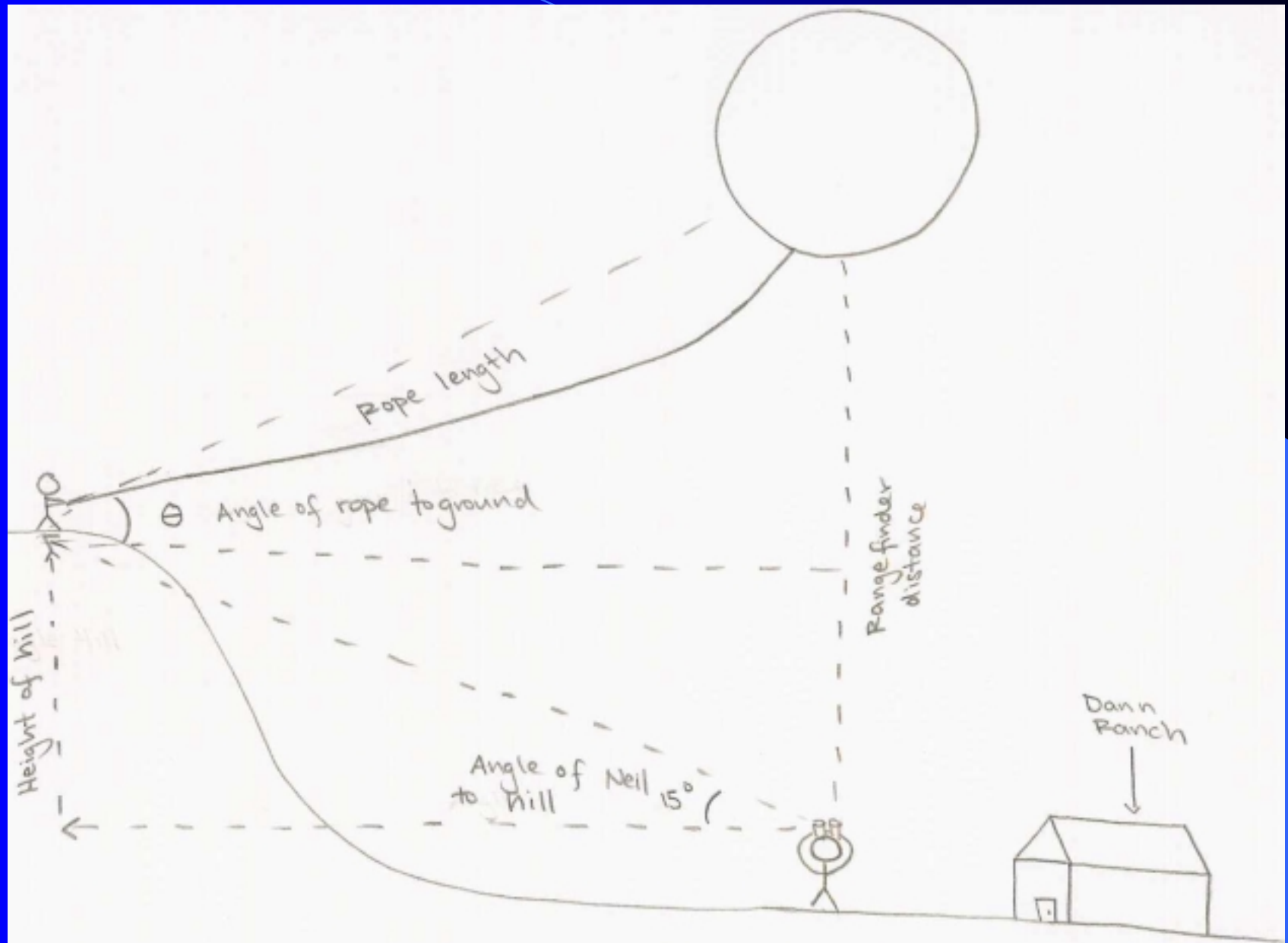
# What We Think?

Vertical distance of balloon to hill.

| Rope Length (meters) | Angle (degrees) | Height of Balloon (meters) |
|---|---|---|
| 30.5 | 40 | 19.6 |
| 61.0 | 30 | 30.5 |
| 91.4 | 30 | 45.7 |
| 121.9 | 25 | 51.5 |
| 152.4 | 20 | 52.1 |
| 182.9 | 15 | 47.3 |

# What We Think?

Range finder readings from ground to balloon.

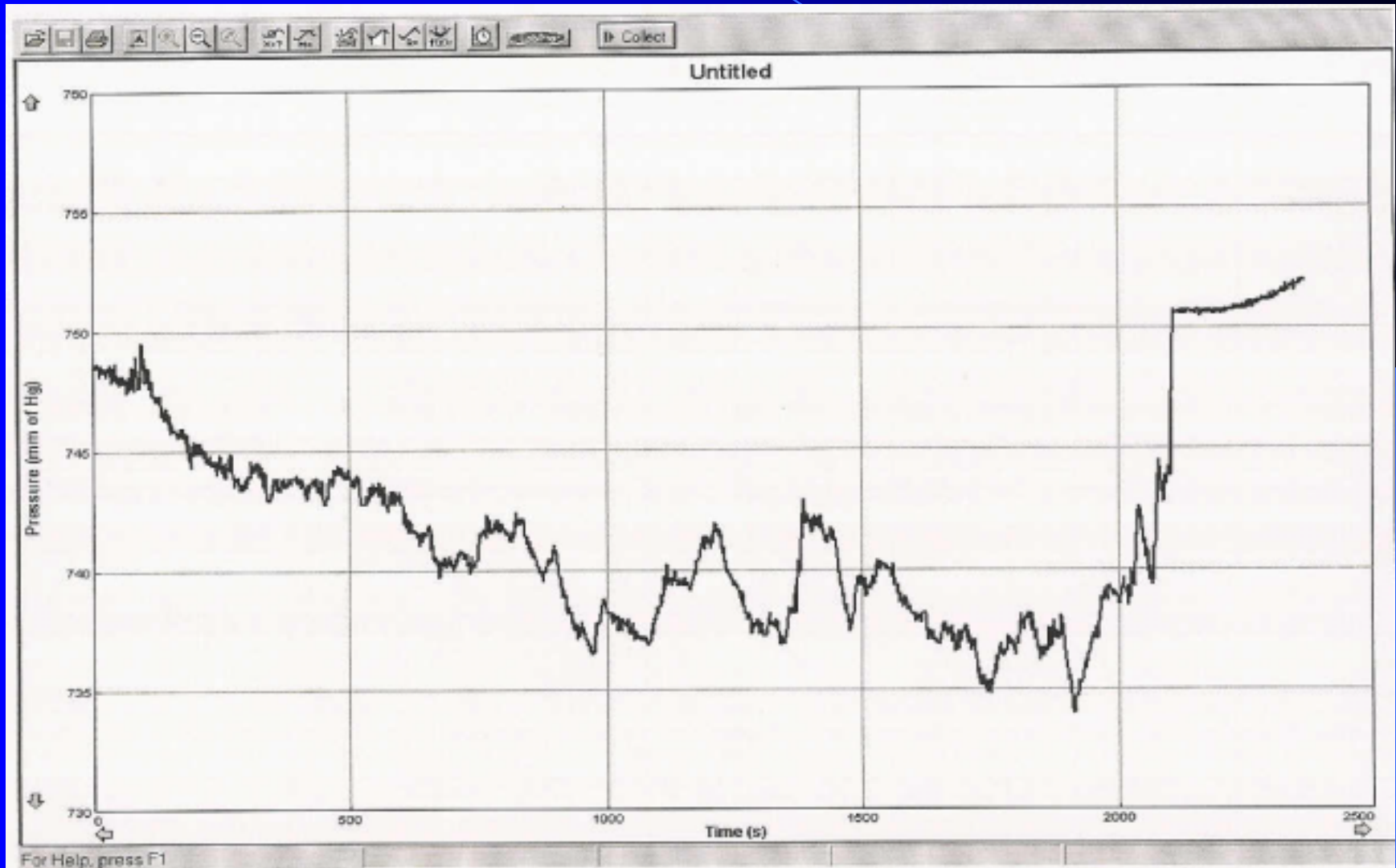| Range Finder (meters) | Height of Hill (meters) | Height of Balloon (meters) |
|---|---|---|
| N/A | N/A | N/A |
| 110 | 14.2 | 95.8 |
| 145 | 21.2 | 123.8 |
| 142 | 29.6 | 112.4 |
| 150 | 38.4 | 111.6 |
| N/A | N/A | N/A |

# What We Think?

Calculations vs. Range Finder

| Calculated Balloon Height (meters) | Range Finder – Hill Height (meters) |
|---|---|
| 19.6 | N/A |
| 30.5 | 95.8 |
| 45.7 | 123.8 |
| 51.5 | 112.4 |
| 52.1 | 111.6 |
| 47.3 | N/A |

# What We Think?

Raw pressure data graph

# What We Think?

Curve of our data fitted with the equation: $P = P_0 e^{-h/a}$



| | Data Set | |
|---|---|---|
| | X | Y |
| 1 | 0.0 | 7 |
| 2 | 20.0 | 7 |
| 3 | 30.5 | 7 |
| 4 | 45.7 | 7 |
| 5 | 51.5 | 7 |
| 6 | 52.1 | 7 |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |

Notes:

Auto Fit For: Data Set:Y
$y = 748.9 * \exp(-C*x)$
: 0.000317 +/- 1.16E-005
RMSE: 0.800
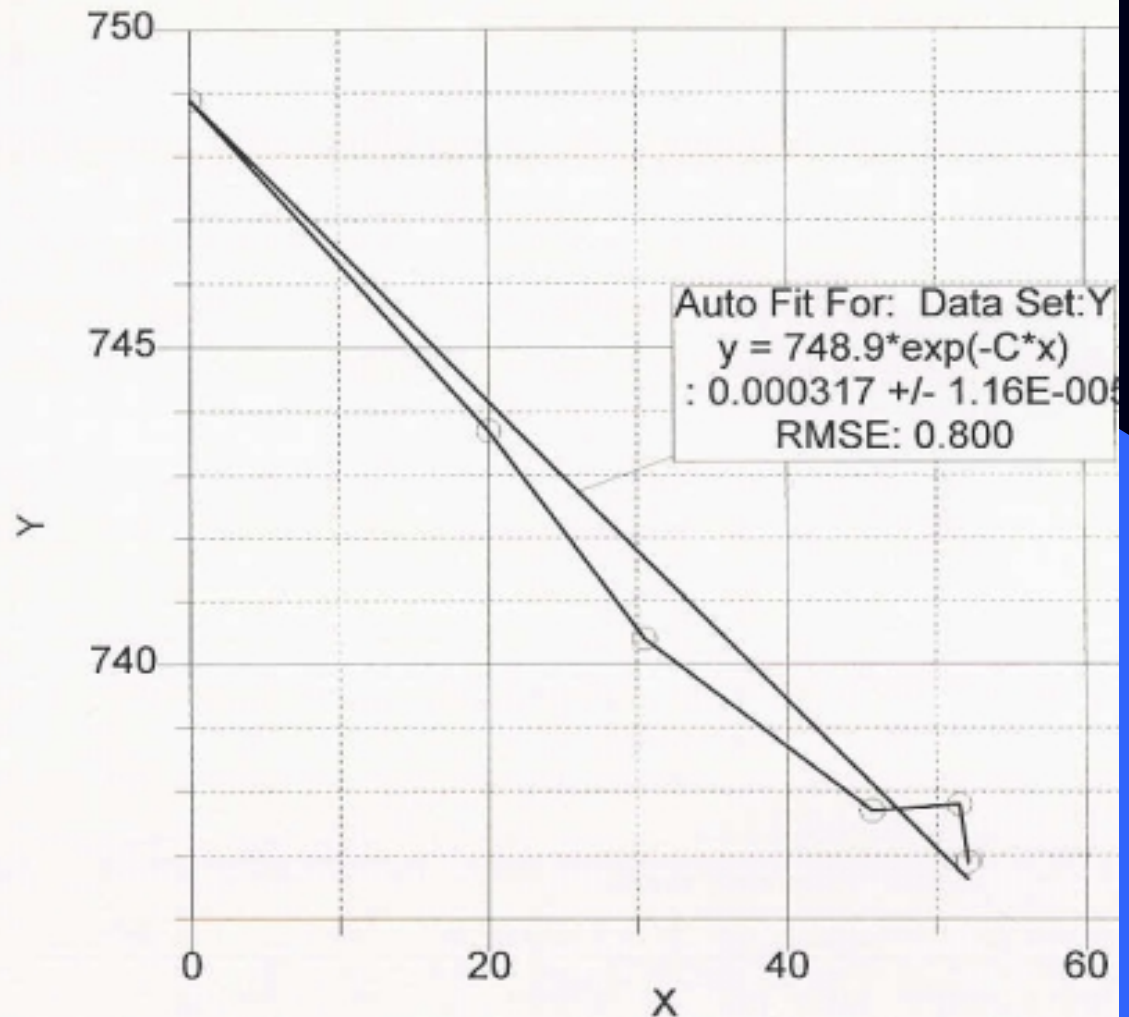
# What We Think?

Curve of our data fitted with the NASA model
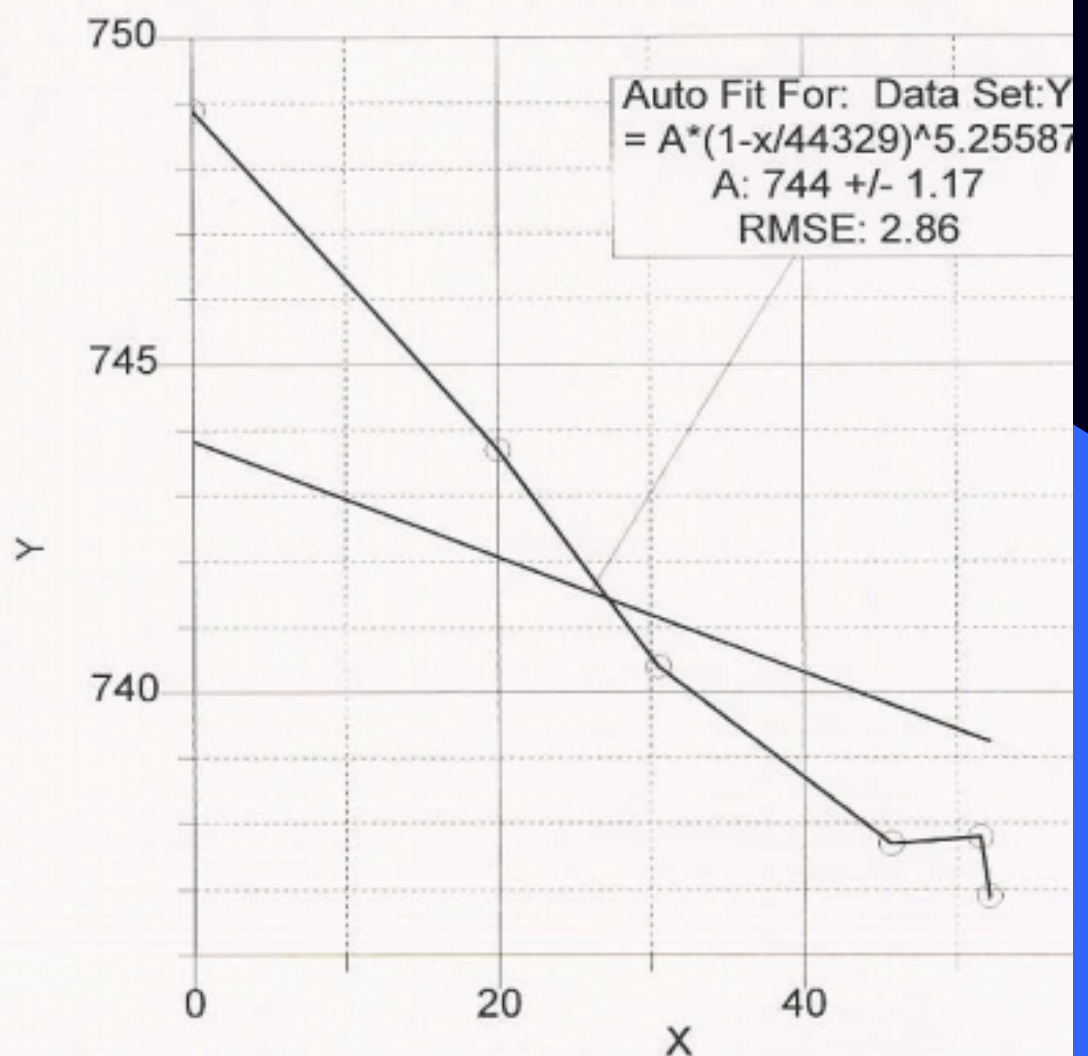
# What We Think?

Curve of our data fitted with our prediction of the variable "a" of the NASA model
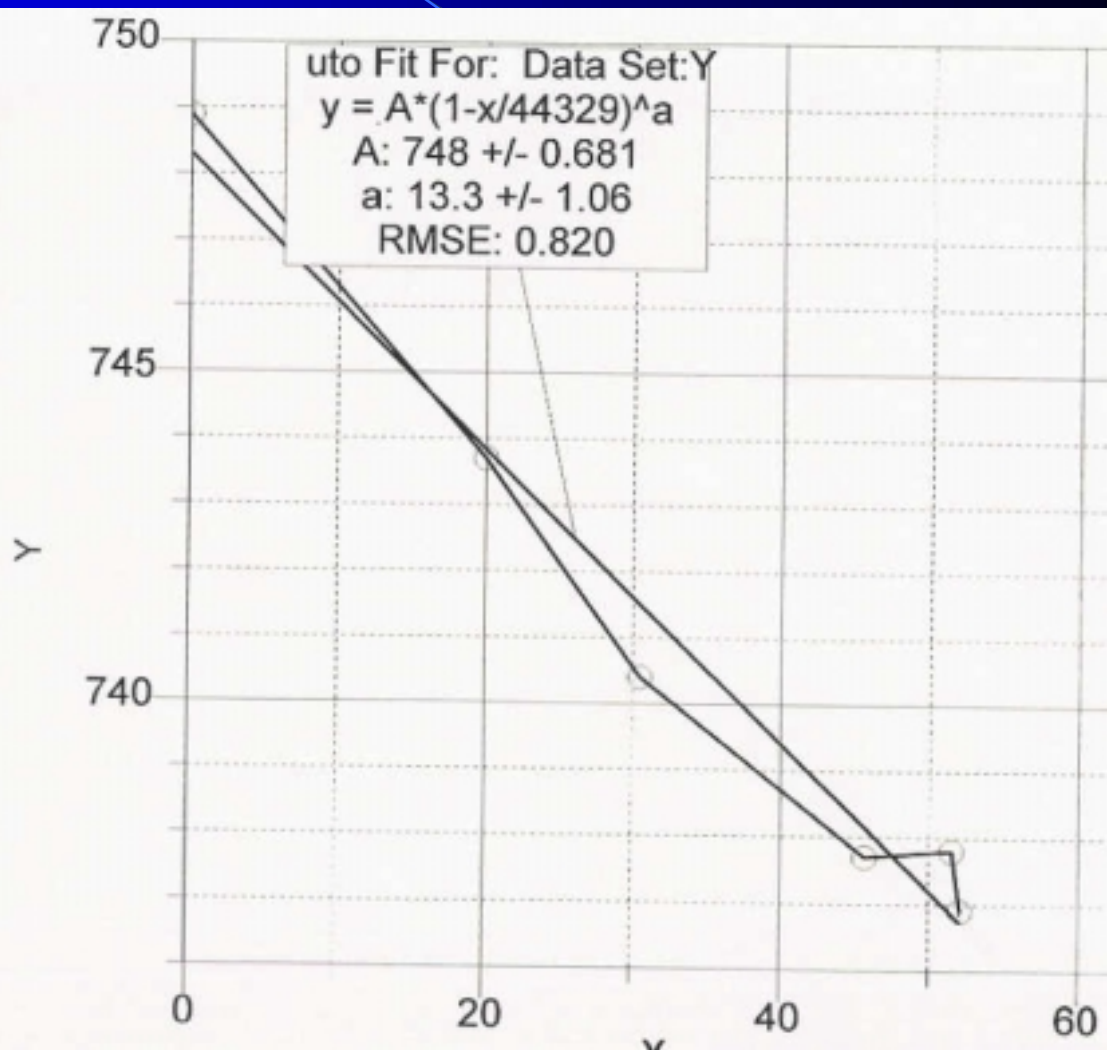
# What We Think?

NASA Model of Pressure vs. Altitude
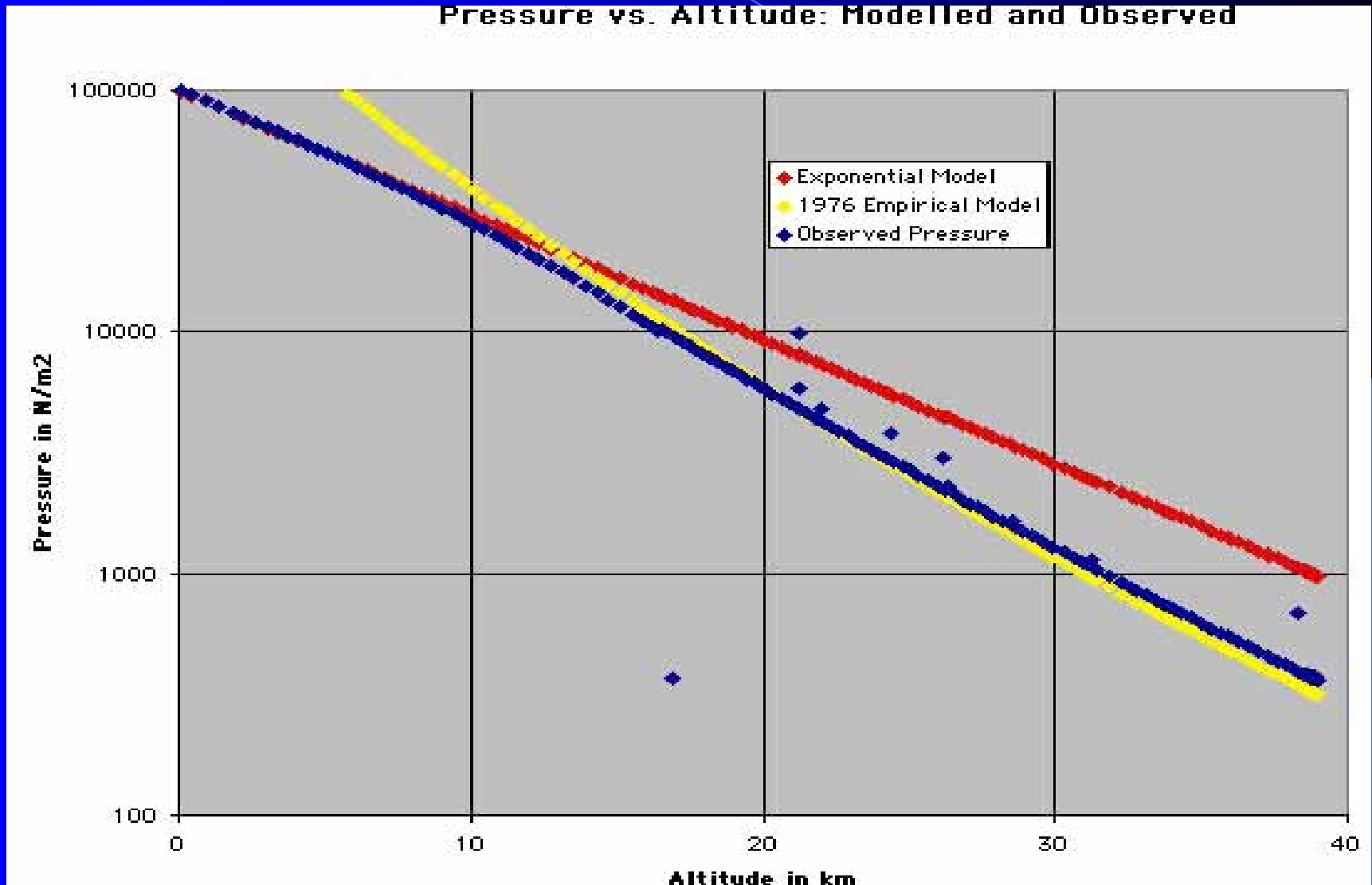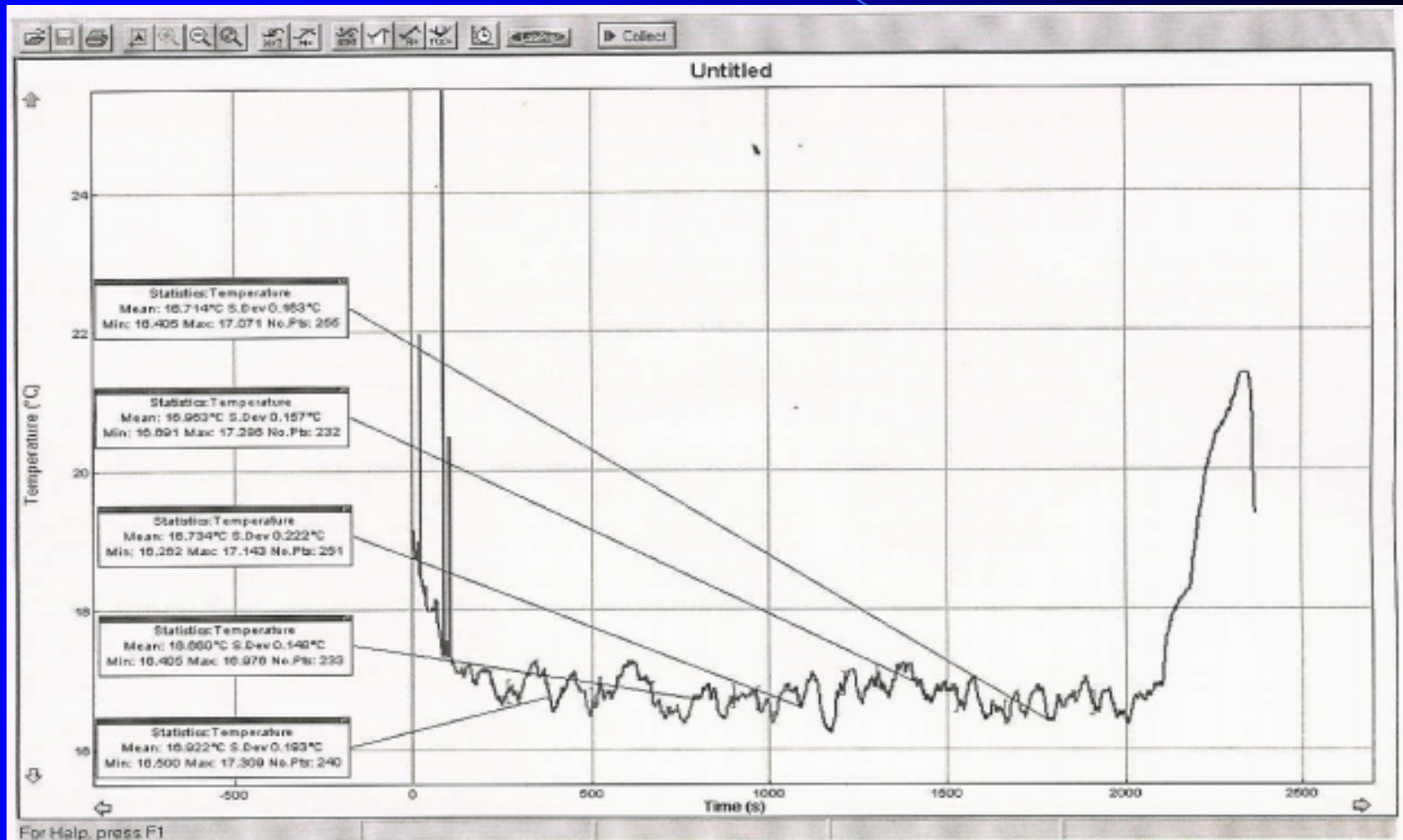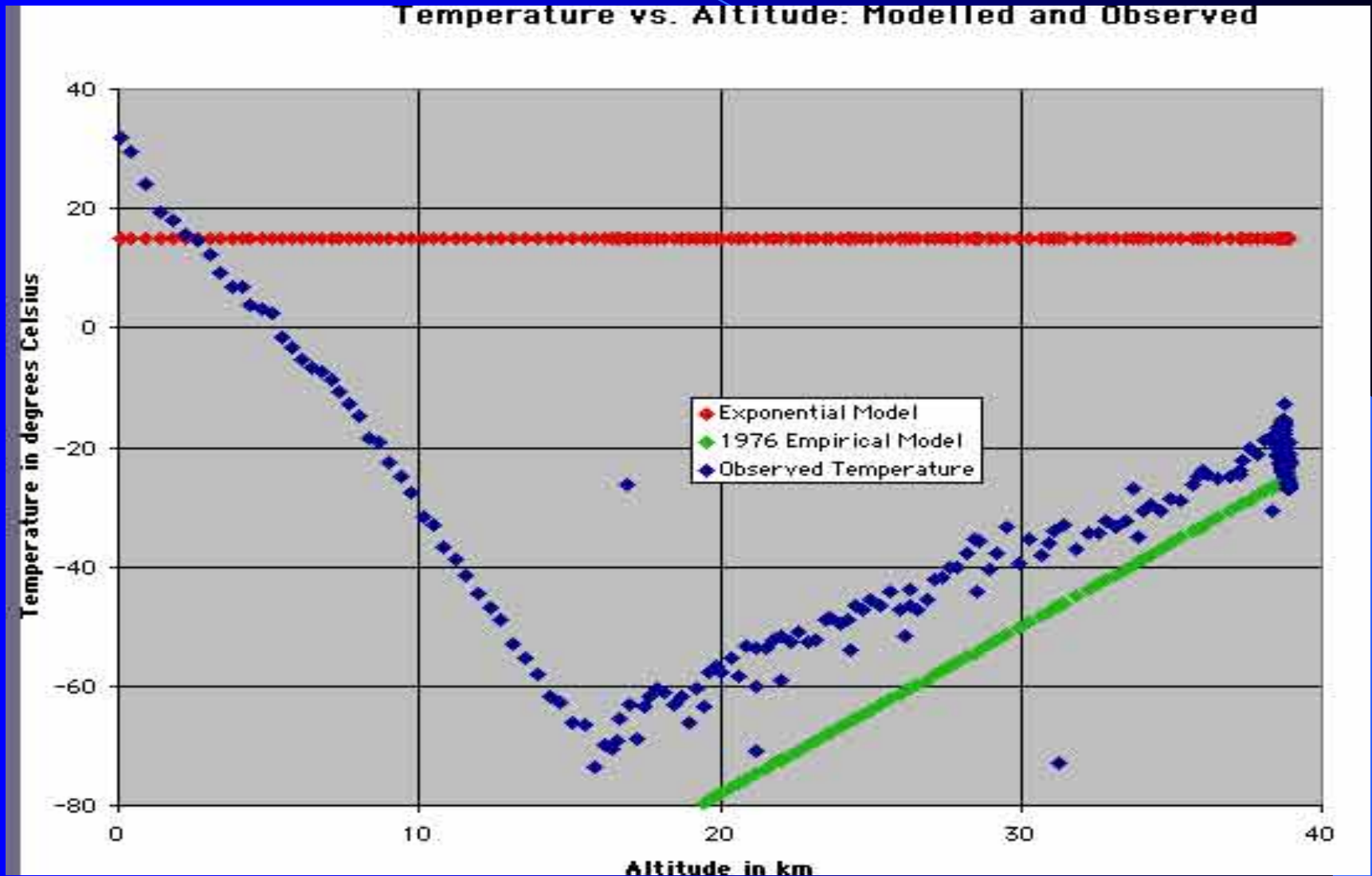
# What We Think?

Raw data of temperature readings and the averages of the temperature noted per 100 feet of rope

# What We Think?

NASA model of Temperature vs. Altitude

# Where We Went Wrong!

- The gale-force winds
    - Bow in rope
    - Shade caused by balloon
    - Gondola swinging violently
- Rough estimation and inaccurate tools
    - Missing marks on rope
    - Rough protractor estimations
    - Range finder
    - Angle of range finder to hill inaccurate
- Human error
    - Unable to hear readings over radio
    - Not directly under balloon with range finder
- Popped balloon

# What We Meant?

Although our experiment had many sources of error, the curvature of the data vaguely resembles the exponential curvature of the NASA atmospheric pressure model.  The temperature data was not good at all.  To improve upon our experiment, we would need to perform the experiment again on a much more calm day as well as make sure all our equipment is properly outfitted and plan out our procedure.  All in all, the experiment was not a complete disaster.  Please send all inquiries to:

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Thank you.