

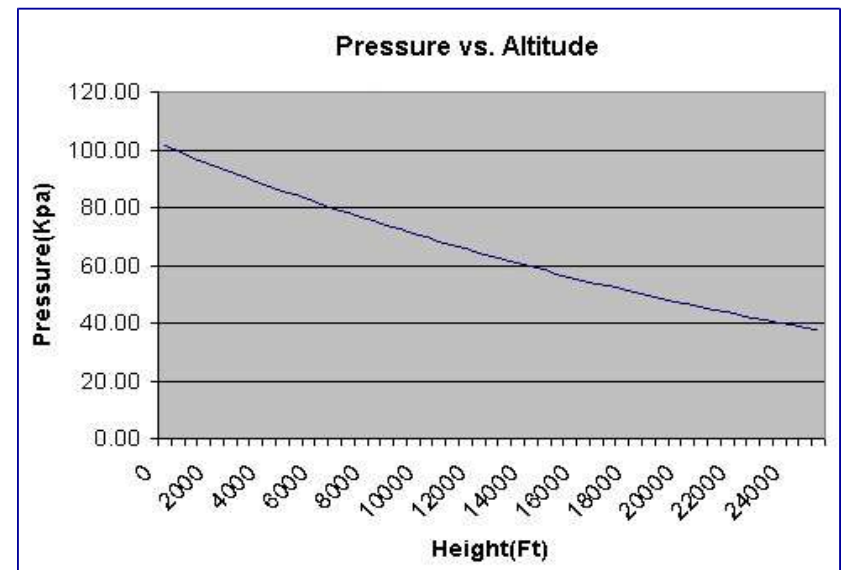
# Data Analysis

# Data Analysis

- Now that the flight has occurred and data has been collected, it is time to analyze the data. The Excel spreadsheet will be used to analyze the data. There should be three columns of data, the first is a time tag, second is pressure, and third is the temperature.
- From the pressure data, the altitude can be calculated using a long equation.

$$\text{Altitude} = (10^{(\log(P/P_0)/5.2558797)} - 1) / -6.8755856 \times 10^{-6}$$

- P is the pressure at some altitude and P\_0 is ground pressure. This equation was developed in 1930s by the Army.
- This equation will be used in the spreadsheet to calculate the altitude. Plots are to be generated showing air pressure versus time, altitude versus time, and temperature versus time.



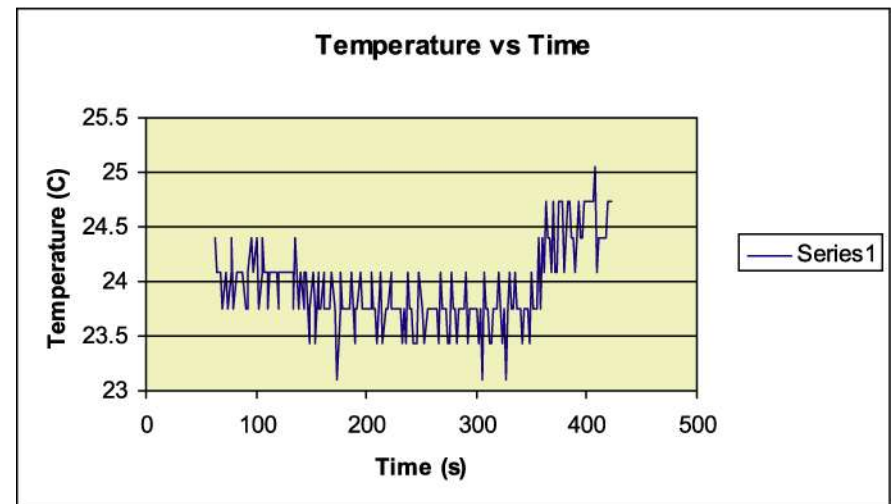
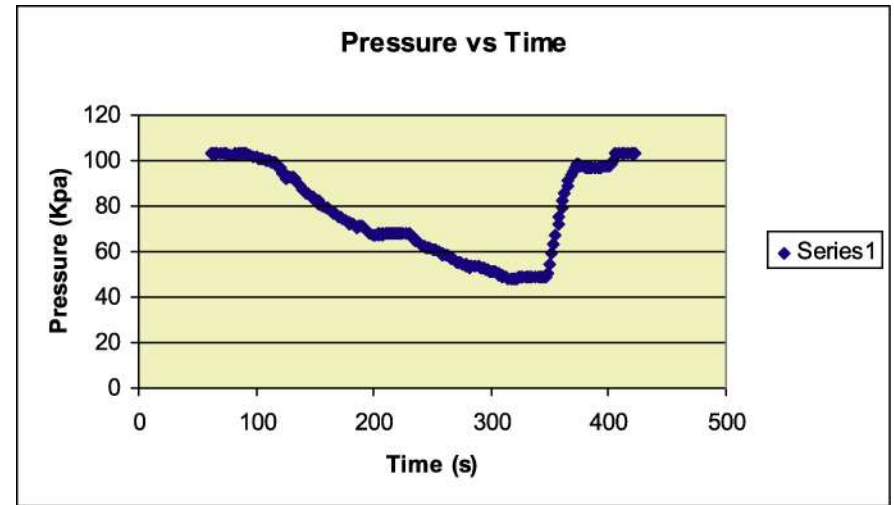
# Analyzing the Data

- **Excel Spreadsheet can be used to perform the data analysis. With the spreadsheet, the altitude can be calculated and plotted along with the temperature.**
- **Start by inserting the floppy disk and starting the Excel program.**
- **Click on the File menu and select OPEN. At the bottom of the OPEN dialog window where it says “File of Type”, select “Any”. Select the floppy drive and look for the file with your group number. Click on OPEN and another dialog window will open. Select the “Delimited” button and click on “NEXT”. Check the “Space” checkbox and click on “FINISH”.**
- **The data should be loaded in. Ignore the first two columns. It is time to plot.**

KD4HBO-1	62	102.994	24.402
KD4HBO-1	64	102.994	24.077
KD4HBO-1	65	102.994	24.077
KD4HBO-1	67	102.994	24.077
KD4HBO-1	69	102.994	23.752
KD4HBO-1	70	102.994	23.752
KD4HBO-1	72	102.994	24.077
KD4HBO-1	74	102.873	23.752
KD4HBO-1	75	102.873	23.752
KD4HBO-1	77	102.63	24.077
KD4HBO-1	78	102.63	24.402
KD4HBO-1	80	102.63	23.752
KD4HBO-1	82	102.873	24.077
KD4HBO-1	83	102.752	24.077
KD4HBO-1	85	102.994	24.077
KD4HBO-1	87	102.994	24.077
KD4HBO-1	88	102.994	24.077
KD4HBO-1	90	102.994	23.752
KD4HBO-1	92	102.994	23.752
KD4HBO-1	93	102.63	24.077
KD4HBO-1	95	102.146	24.402
KD4HBO-1	97	101.782	24.077
KD4HBO-1	98	101.782	24.077
KD4HBO-1	100	101.298	24.402
KD4HBO-1	102	100.934	23.752
KD4HBO-1	103	100.571	23.752
KD4HBO-1	105	100.45	24.077
KD4HBO-1	106	100.45	24.402
KD4HBO-1	108	100.086	24.077

# Plotting Raw Data

- Click on the second column which is the time tag. Hold down the “Ctrl” key and click on the next column to the right. Open the Insert menu and select Chart. Select the XY Scatter plot.
- Click on the “Next” button twice. The chart window should show entries for the title and x and y axis labels. Fill them in. This chart will show the air pressure over time.
- Click on “Finish” and the data will be plotted.
- Do the same for temperature versus time.



# Calculating Altitude

- Now it is time to calculate the altitude based on the air pressure. Remember the equation from an earlier page.

$$\text{Altitude} = (10^{(\log(P/P_0)/5.2558797)} - 1) / -6.8755856 \times 10^{-6}$$

- For the value P\_0 set it to the value in cell C1.
- In the E column, insert the following:

$$=(10^{(\log(C1/P_0)/5.2558797)} - 1) / (-6.8755856e-6)$$

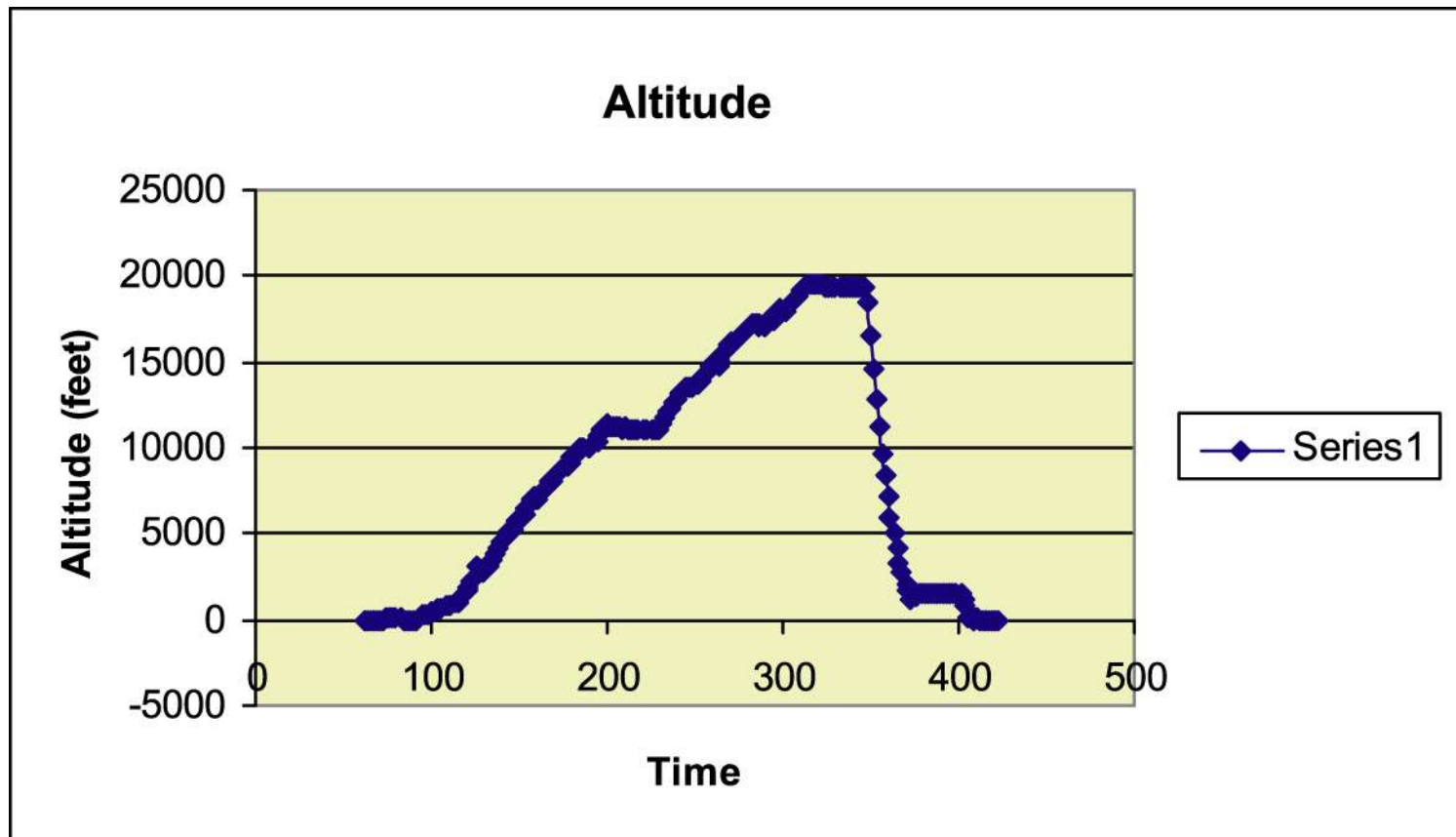
Where P\_0 is set to the value of C1.

- Select cell E1 and press <Ctrl> and C. This copies the cell.
- Click on the column designator to highlight the whole E column. Press <Ctrl>V. This will copy the E1 cell into the whole column and adjust the equation to use the appropriate C cell. The E column now contains the altitude.

KD4HE	72	103	24.08	0
KD4HE	74	102.9	23.75	32.53
KD4HE	75	102.9	23.75	32.53
KD4HE	77	102.6	24.08	97.94
KD4HE	78	102.6	24.4	97.94
KD4HE	80	102.6	23.75	97.94
KD4HE	82	102.9	24.08	32.53
KD4HE	83	102.8	24.08	65.08
KD4HE	85	103	24.08	0
KD4HE	87	103	24.08	0
KD4HE	88	103	24.08	0
KD4HE	90	103	23.75	0
KD4HE	92	103	23.75	0
KD4HE	93	102.6	24.08	97.94
KD4HE	95	102.1	24.4	228.6
KD4HE	97	101.8	24.08	327.2

# Plotting Altitude and Temperature

- Now to plot the altitude, follow the plotting instructions as before and select column B and E.



# Summary

- **This completes the lesson. Hopefully you have learned some new things. There should be a better understanding about satellites and what is involved in a space program. Satellite development requires many disciplines and many people.**
- **The aerospace industry will be needing many new people. The average age of an aerospace engineer is 52. A shortage of engineers is expected in the next few years as the current engineers start retiring.**
- **From this lesson, you should be able to design and build more complex CanSats. In 2005, a CanSat design competition will be announced. Students will be given a mission to design for and compete for cash awards.**