

2009 Teacher Quest Tampa Bay Pilot Program

Action Plan

Author: Doug Haskitt

Lesson Title: The Golden Parachute Solar Motor Home Project

Grade Level: 8

Subject Area: Technology

Summer Work Experience:

Company: Alliant Techsystems, Inc.

Position: Purchasing / Planner Analyst

My duties as Purchasing / Planner Analyst Assistant included working with buyers in compliance with supplier standards to purchase, track and schedule the movement of materials. I also assisted buyers with requests for quotes, communicated with suppliers, and assisted in the tracking of material receipts. I visited many areas of our facility and observed the arduous testing of various materials (heat, cold, stress, vibration, etc.). In addition, I attended many meetings wherein we tracked materials needed for various projects. Included in this formula was information about how many pieces were in stock, how many were ordered, how many were needed to complete the work, when the items were expected, the costs involved in ordering new stock, etc. There is a whole new language of acronyms such as DLTS, CSS, ESS, ECO, CP BUILD, CCA, OCA, ATP, MPBOARDS, CI, PMT, ETM, AO, BP, EI, CP DCS, WIP, DCS, UCA, BAE, AV2, BV2, LTPA OSC, QPS, etc. In addition, my knowledge of Excel was augmented, as I learned some new spreadsheet functions, which I can take back to my students.

Philosophically and morally, above the factual data I learned, was the overall gist of my experience: The value of detail in the specifications of each component requisitioned in Supply Chain Management. I have learned that the performance of each component of any project may be vital, indeed crucial to the success of a project. Two prime examples of this are the Titanic and the Challenger Space Shuttle. We have proof from the meeting notes of Harland and Wolf shipbuilders that pressure to complete the Titanic on schedule compelled them to use wrought iron rivets, which were one quality level below the specifications. Titanic was completed in Belfast on April 30, and sailed from Southampton on May 10, so they barely finished the ship in time. They also compromised their standards by allowing previously uncertified suppliers of wrought iron to sell Harland and Wolf rivets which contained 3 times the amount of slag allowable. All six compartments were flooded, and Titanic sank in only two hours and 40 minutes. If only 5 compartments had flooded, Carpathia (6 hours away), would likely have rescued most passengers. If only 4 compartments had flooded, Titanic might have been able to limp into New York Harbor. One

thousand, five hundred and seventeen (1,517) people died; 706 survived. The point here is that if Harland and Wolf paid attention to the details requested by their engineers and ordered by their Supply Chain Manager, many more people would have survived.

The Space Shuttle Challenger Disaster was caused by “O” rings with improper specifications. Morton Thiokol engineers were concerned about temperatures that were lower than 53°F they knew to be safe. Morton Thiokol engineers’ “Red Line Temperature” was 40° F. Temperatures dropped to 8° F on the morning of Jan. 28, 1986 at Kennedy Space Center, so the “O” rings were asked to perform well beyond the areas in which they had been previously tested.

NASA officials overrode the objections of the Morton Thiokol engineers because of political reasons. President Reagan wanted Challenger airborne during his State of the Union Address, as one of his pet themes was Education. With the teacher, Christa McAuliffe, as part of the seven astronauts orbiting the Earth, his message about Education would have more clout and authenticity. Also, there was competition from the European Space Agency, and there had been a record number of delays in the Space Shuttle Mission prior to Challenger’s launch. Another reason was that the launch pad needed refurbishing for sending a probe to Haley’s Comet, beating the Russians by three days.

What I will bring back to the students in my classroom and in my school is the idea that attention to detail is vital, especially in building products wherein lives are at stake. The details that could have saved the 1,517 passengers aboard the Titanic and the 7 astronauts aboard Challenger were ignored by Harland and Wolf and NASA, respectively. Students should understand that any job, however menial or insignificant, should be done correctly, as the consequences for not performing a job well can be catastrophic.

I will also bring to my students a vision of what it is like to work in Supply Chain Management, and the opportunities inherent in this field.

Overview:

The class will study the photovoltaic processes involved in how the sun’s energy is converted into power for vehicular transportation. Students will build and race solar powered model cars, and will be awarded prizes based upon the results. Students will research the three top hybrid automobiles, and will determine their strengths and weaknesses vis-à-vis price, MPG, and guarantee.

Teacher Introduction:

The teacher will contact local private and public businesses and organizations to determine if they are using any solar vehicles. If they are, the teacher should try to get the organization to bring it on campus to

show the students all of its component parts, demonstrate its functionality, and explicate the vehicle's benefits and drawbacks.

In addition, the teacher should build one of the model cars so that the students will see the finished product, and can use this as a construction pattern for each team to build their own.

KWL [What does the student know (K), what does he want to learn (W), and how will we know that he has learned it? (L)]

Determining the depth of student background knowledge (K): Begin by posing 3 questions to the group:

1. What type of energy does your family car use? (gasoline, diesel, hybrid).
2. What other types of energy are possible alternatives for automobiles? (Biodiesel, electric, hydrogen fuel cells, propane).
3. What are the benefits and liabilities of each type of vehicle?

Vocabulary:

alternative – viable auxiliary choice or substitute

biomass – organic matter, such as plants or garbage, that can be used as an energy source

drive shaft – steel tube or rod that transfers rotating motion from the transmission to the rear wheels of a car

fossil fuel – a hydrocarbon deposit, such as oil, coal or natural gas, created from previous living matter over the centuries

hybrid car – a car that uses two or more sources of power (usually gas and electric)

motor – a machine that produces motion or power for doing work

photovoltaic (PV) – technology for converting sunlight directly into electricity via solar cells

pollution – a material that is harmful to living things

power (as in power system) – the capacity for doing work

power outlet – receptacle providing a place in a wiring system where current can be accessed to run an electric appliance

recharge – to restock or reapply energy again (as into a battery)

reduce – to make less or diminish

renewable energy – forms of energy that derive and quickly replenish from the processes of nature, such as sunshine, wind, movement of the seas and the heat of the earth

smog – a combination of smoke and other particulates, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds, usually causing harmful health effects.

solar – relating to the sun

solar thermal – uses the sun's energy to make heat

transportation – the act of moving something or someone to another place

Student Objectives:

The Student will:

- ✓ Understand that light energy from the sun can be converted into electrical energy via photovoltaic cells.
- ✓ Understand the variable elements of the photovoltaic equation such as intensity of sunlight, cloud cover, direction and angle of panel tilt, angle of the sun's rays, rotation of the earth, angle of earth's axis, the earth's atmosphere, and how these factors affect the amount of electricity that can be generated from the solar cells.
- ✓ Understand the value of research, and will research the top 3 Hybrid cars to compare price, MPG, and guarantee.

Sunshine State Standards:

Benchmark SC.A.2.3.3 – The student knows that radiation, light, and heat are forms of energy used to cook food, treat diseases, and provide energy.

Grade Level Expectations

The student:

Sixth

- Knows forms of radiant energy and their applications to everyday life.

Seventh

- Knows uses of radiation, light, and thermal energy to improve the quality of human beings.

Eighth

- Extends and refines knowledge of uses of forms of energy to improve the quality of life.

Benchmark SC.B.1.3.1 – The student identifies forms of energy and explains that they can be measured and compared.

Grade Level Expectations

The student:

Sixth

- Knows different types of energy and the units used to quantify the energy.
- Understands that energy can be converted from one form to another.

Seventh

- Knows examples of uses of energy in the home and ways to measure its use.

Eighth

- Understands that energy can be transferred by radiation, conduction, and convection.
- Knows examples of natural and man-made systems in which energy is transferred from one form to another.

Benchmark SC.B.1.3.2 – The student knows that energy cannot be created or destroyed - only changed from one form to another.

Grade Level Expectations

The student:

Sixth

- Understands that energy can be changed in form.
- Uses examples to demonstrate common energy transformation.

Seventh

- Knows examples of uses of energy in the home and ways to measure its use.

Eighth

- Understands how the principle of conservation of energy is applied during the transfer.

Benchmark SC.B.1.3.3 – The student knows the various forms in which energy comes from the Sun.

Grade Level Expectations

The student:

Sixth

- Knows types of radiant energy that come to Earth from the Sun.

Seventh

- Knows that useful energy is lost as heat energy in every energy conversion.

Eighth

- Knows that energy conversions are never 100% efficient and that some energy is transformed to heat and is unavailable for further useful work.

Benchmark SC.E.1.3.3 – The student understands that our Sun is one of the many stars in our galaxy.

Grade Level Expectations

The student:

Sixth

- Understands that our Sun is one of the stars in our galaxy.

Benchmark SC.G.1.3.5 – The student knows that life is maintained by the continuous supply of energy from the sun and by recycling of the atoms that make up the molecules of living organisms.

Grade Level Expectations

The student:

Seventh

- Knows that life on earth is dependent upon a continuous supply of energy from the sun.

Benchmark SC.G.2.3.1 – The student knows that some resources are renewable and others are nonrenewable.

Grade Level Expectations

The student:

Sixth

- Knows renewable and nonrenewable energy sources.

Seventh

- Knows the importance of informed use of natural resources.

Eighth

- Knows that some resources are renewable and others are nonrenewable.

Materials Needed:

Computer, Internet access, paper, printer, pen, paper.

Internet Sites:

Solar Matters I

<http://www.fsec.ucf.edu/en/education/k-12/curricula/sm1/index.htm>

Solar Matters II

<http://www.fsec.ucf.edu/en/education/k-12/curricula/sm2/index.htm>

Solar Matters III

<http://www.fsec.ucf.edu/en/education/k-12/curricula/sm3/index.htm>

US Dept. of Energy:

http://apps1.eere.energy.gov/education/lessonplans/topic.cfm/topic_id=2

Solar and Electric Cars

<http://www.ecotopia.com/st/solarcar.htm>

Background Information:

Photovoltaic cells (solar cells) are made up of silicon, which is the main ingredient contained in sand. The silicon is heated to extreme temperatures and then is mixed with certain chemicals (boron and phosphorous) to achieve an unstable environment. When the light from the sun (or any other source) strikes the photovoltaic cell, the electrons become dislodged, and flow along the wires that are positioned within the cell (electricity). In this case, we are connecting the wires to the electric motor within the toy cars, so the motor turns the wheels, and the car runs. The benefit of solar energy and the reason that it is one of the mainstays of the Green Revolution is that it leaves no carbon footprint, and is clean and non-polluting.

Lesson Plan/Unit of Study—Instructional Procedures:

1. Determine the (K) by asking the 3 Questions mentioned above, discussing the Background Information and Vocabulary with the class.
2. Divide the group into teams of two.

What the students want to know (W) is (A) How to build a solar car, (B) How a solar car works, (C) What elements affect its performance? (D) How do the top Hybrid cars in the marketplace compare in price, MPG, and guarantee?

1. Give each team the component parts to make a solar car, based upon the model the teacher has previously built and exhibited.
2. Once all of the cars have been built, hold electric car races among teams, with prizes awarded to the top 3 teams. Discuss with the class the effects of cloud cover, time of day, angle race track and solar panels of each car to the sun, on the speeds of the cars.
3. Instruct teams to team research what they consider the top 3 Hybrid cars in the marketplace today, and compare price, MPG, and guarantee. Each team will create an Excel spreadsheet, and graph their results.

The Golden Parachute Solar Motor Home Project

Student Name: _____

Date: _____

Period: _____



Congratulations! You've just retired! You are Sam and Gabriela Pasquale, of Pasquale's Sicilian Style Pizza. You've worked hard for 38 years to develop a chain of pizza shops featuring your mama's famous "Hand-Tossed" crust, and you've been very successful. You and your wife have invested well and saved for your retirement, and in spite of the bad economy (and having to pay protection \$\$\$ to the Mob) you have enough capital put away to buy a Solar Motor Home and do the traveling you've always wanted to do. However, before you set out to do any touring, you need to find out approximately how much sunlight will generally be available in each of the areas you wish to see. In order to find out how much sunlight is available in each part of the country, you will need to go online and access the Latitude/Longitude Locator:



<http://www.mashupsoft.com/maps/latlonlocator>

The Golden Parachute Solar Motor Home Project Tour Itinerary

You and your wife plan to fly to Miami to pick up your new Solar Motor Home, and the itinerary that the two of you have planned is the following:

1. Miami, FL (A) (25.7207 N, 80.2441 W)
2. San Antonio, TX (B) (29.3056 N, 98.5254 W)
3. Phoenix, AZ (C) (33.4314 N, 112.1484 W)
4. San Francisco, CA (D) (37.7186 N, 122.5195 W)
5. Seattle, WA (E) (47.5765 N, 112.4316 W)
6. Anchorage, AK (F) (61.1856 N, 149.9414 W)
7. Salt Lake City, UT (G) (40.7140 N, 111.9727 W)
8. New York City, NY (H) (40.9135 N, 72.5098 W)
9. Columbia, SC (I) (33.2111 N, 79.8925 W)
10. Tampa, FL (J) (27.4498 E, 82.7051 W)

Total Estimated Time: 209 hrs, 19 minutes Total Estimated Distance: 12,723.98 miles



Once you have determined the latitude and longitude for each of the 10 cities (round off to the nearest 4 decimal places to the right), you need to go to NASA's website:

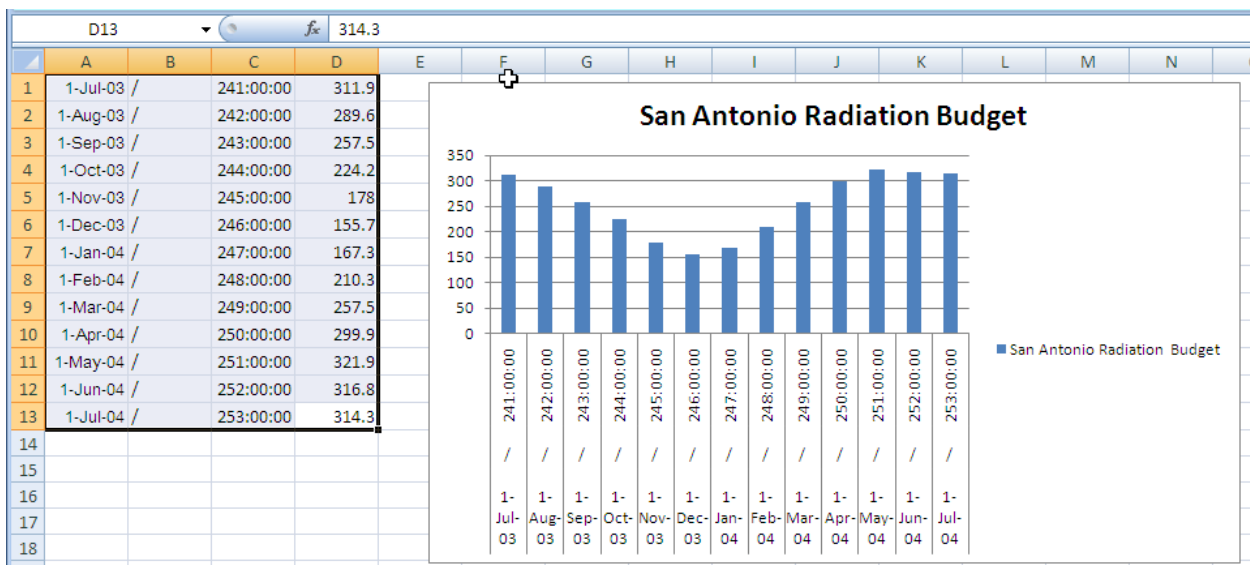
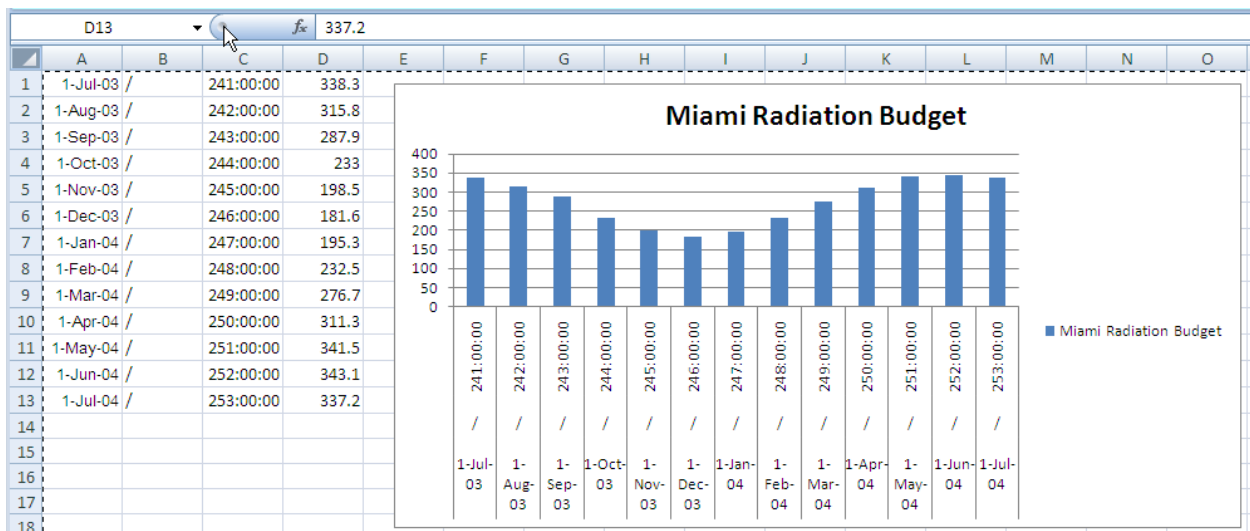
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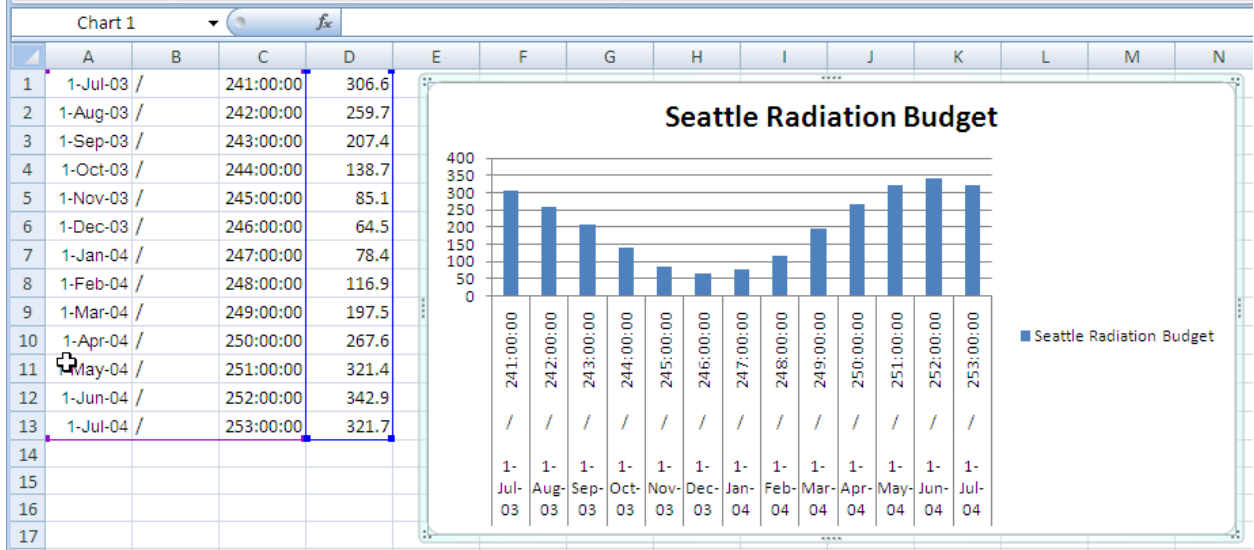
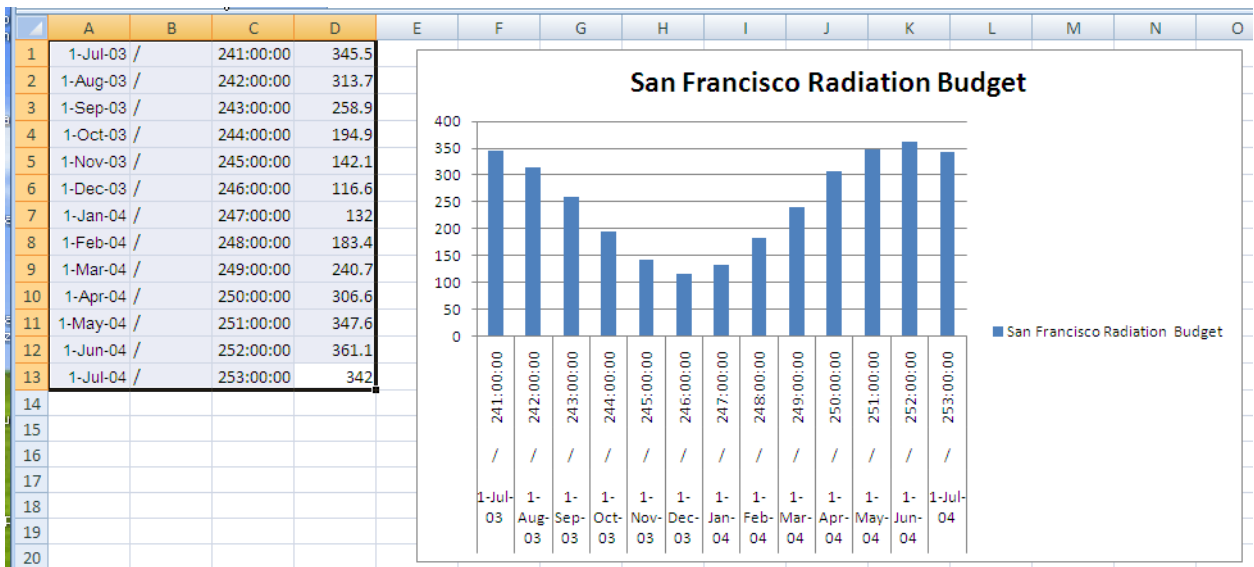
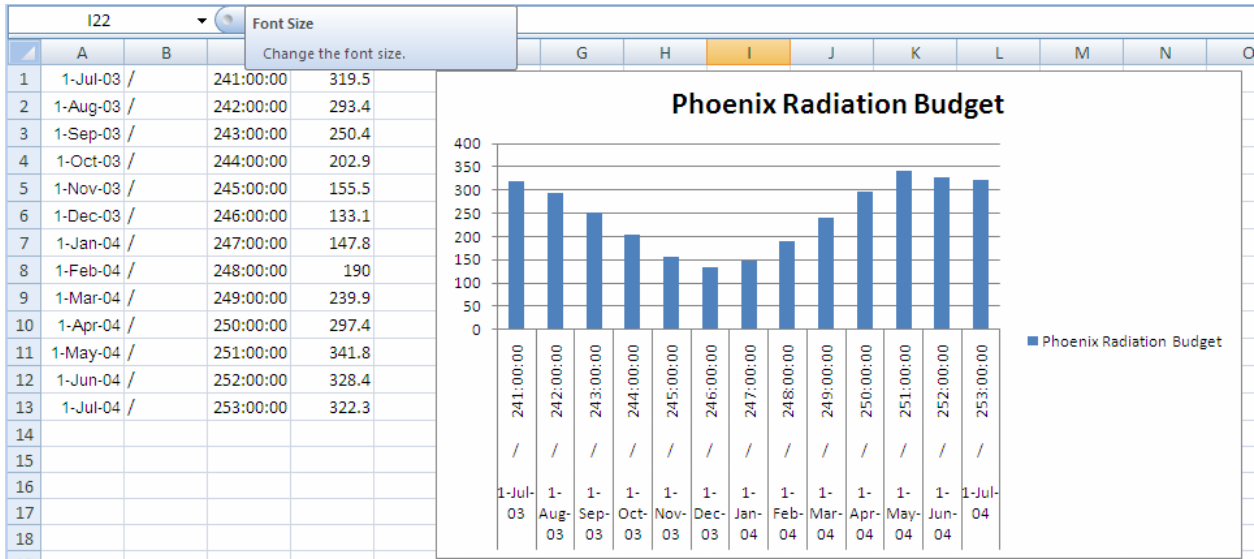
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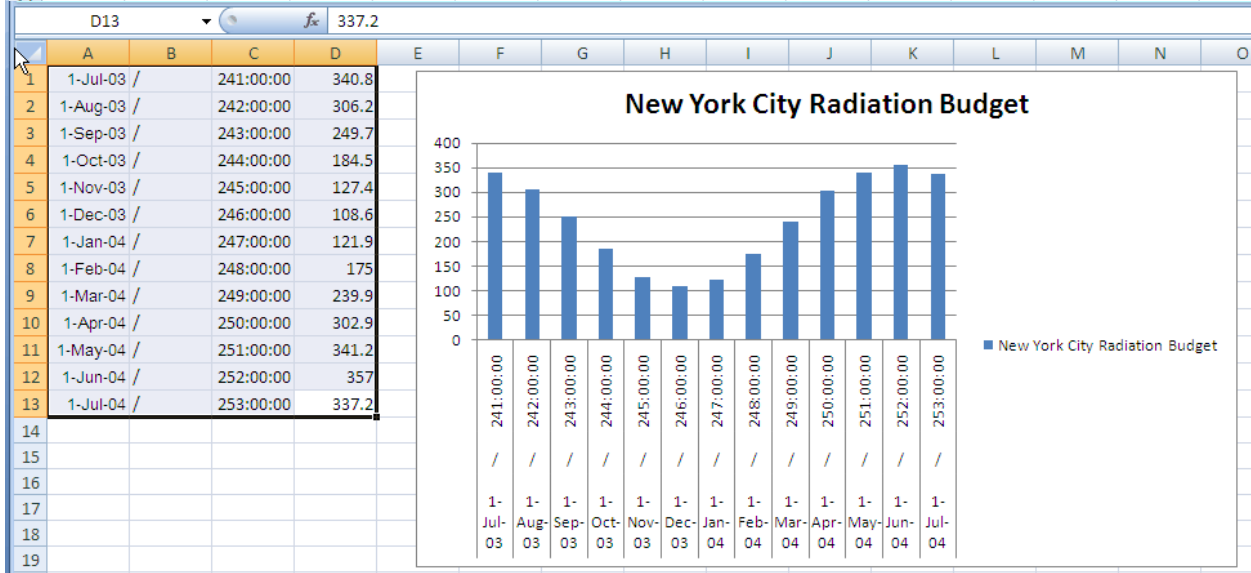
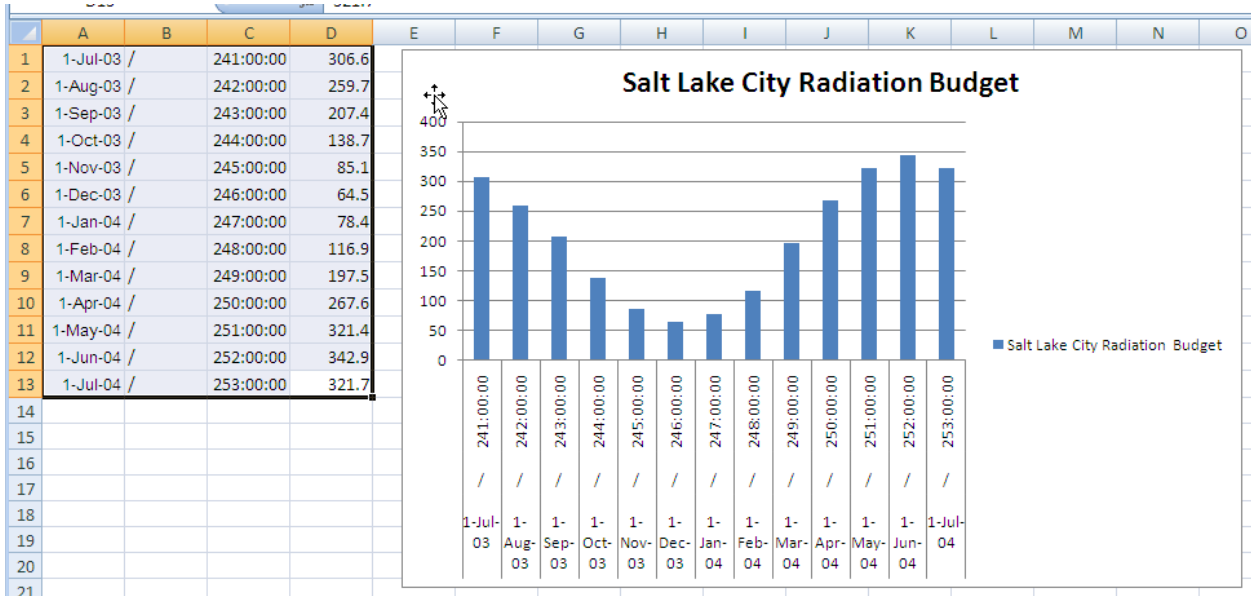
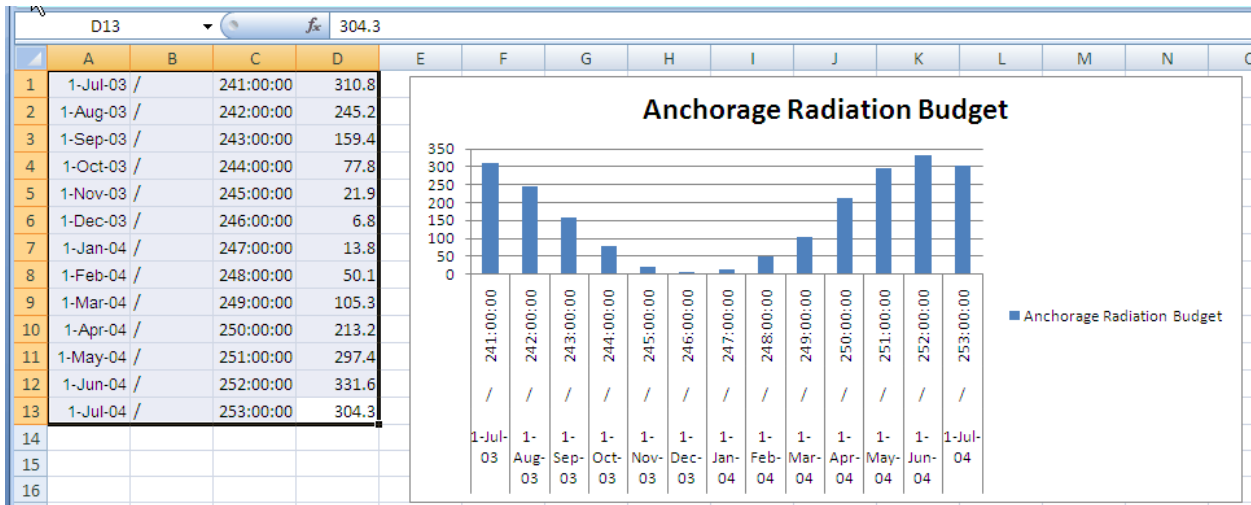
<http://mynasadata.larc.nasa.gov/las14/servlets/dataset?catitem=13>

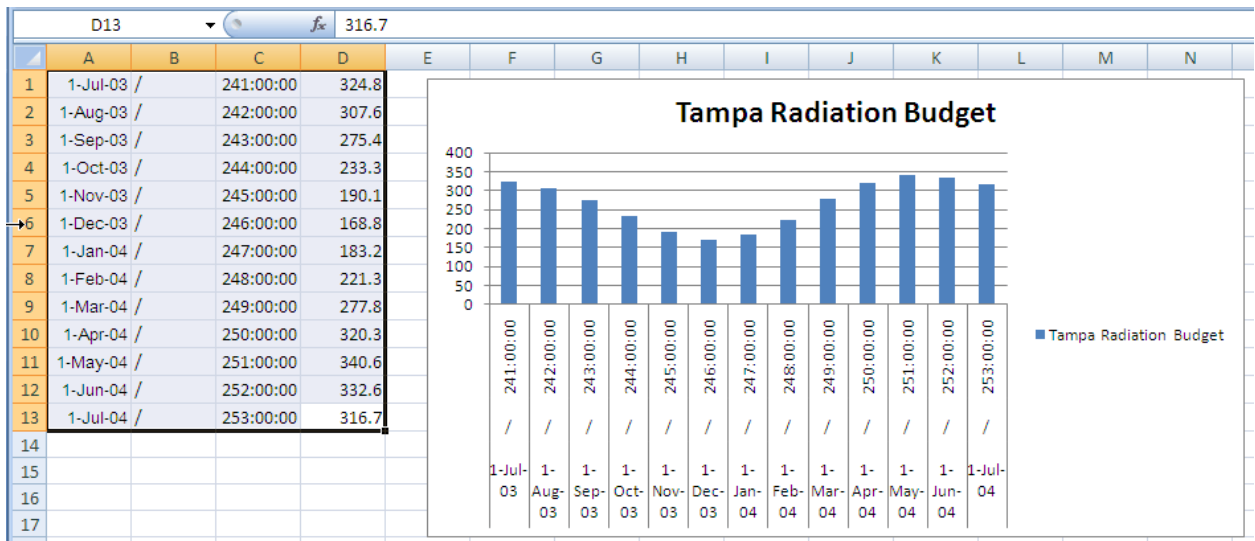
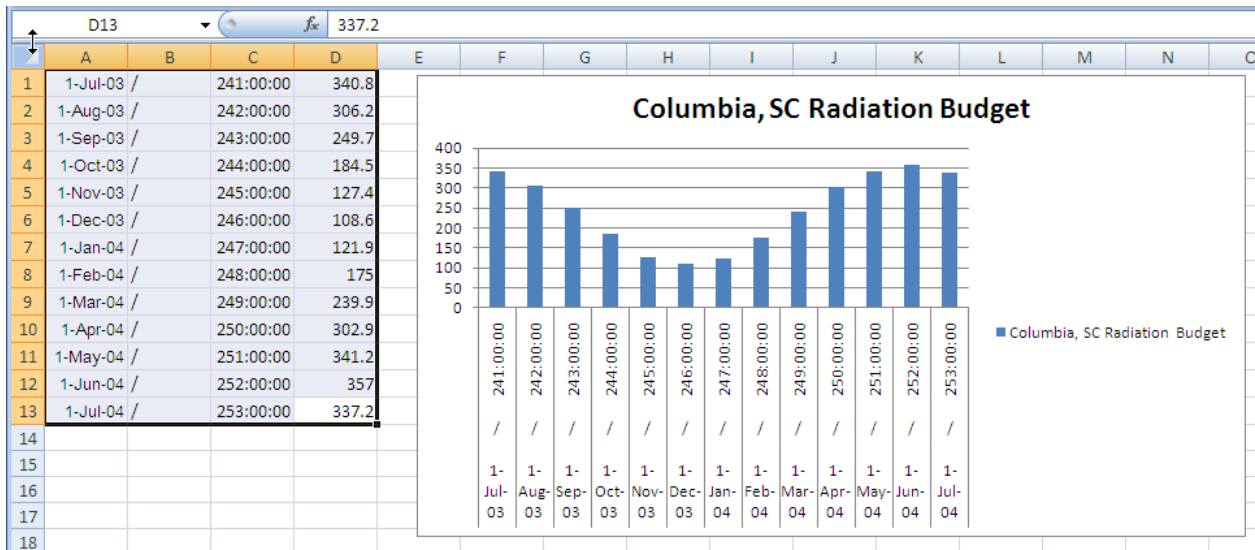
Place the radio button inside “Energy from the Sun (Clear Sky).” Click the red “Next:” Select view: Graph vs time; Select output: Numbers; Enter the latitude and longitude for Miami on the right; Select time range: 01-Jul-2003 to 01-Jul-2004; Click the red NEXT on the right side. You now have the data for the average monthly amount of solar energy (Radiation Budget) from the Sun (with a clear sky) for Miami. You are going to transfer this information into an Excel program. Open a blank Excel worksheet. Copy the information, and then click into cell A1, and paste. Click on the “Data” tab, “Text to Columns,” and then follow the steps. If you have questions on how this is done, click on the link titled 'MY NASA DATA - Using Imported Data In Excel: Plot Atmospheric Temperature (Word file)' under Create your graph.

Here are the Excel spreadsheets and graphs for Radiation Budgets in the 10 cities that Sam and Gabriela Pasquale will visit (in the order they will visit them):









Class Discussion and Conclusions:

Students will evaluate the differences in the Radiation Budgets for each of the ten cities, and will identify which city receives the most radiation in any given month (San Francisco, surprisingly), and which city receives the least (Anchorage, not surprisingly). What this means for Sam and Gabriela is that they must plan to be close to AC power, or plan on using their gas generator if they are staying for any projected length of time in remote areas near Anchorage, whereas they may be able to be totally solar dependent in remote areas near cities which receive more solar radiation.

Integration of Summer Work Experience/Follow-up Activities:

The emphasis on detail in Supply Chain Management will inspire me to keep track of the recent changes in the technology affecting photovoltaics. For example, the industry (Enphase Energy) has just invented a microinverter. This new technology allows each solar panel to convert the current from DC to AC without relying upon one large inverter for all of the panels. The result is a much more efficient, productive system, although the start-up costs are significantly more. Also, Foster's Wine Estates in Napa, California and Perpetual Energy Systems (PES) have a recent 25-year contract in which Foster's supplies the land for 4 Photovoltaic Systems, and in return, gets to buy electricity from PES for below grid prices. I firmly believe that we will see more and more arrangements such as this one, which is beneficial to both parties. Schools, businesses, and residences could all take advantage of similar contracts with PV companies. I will have the students research the latest in photovoltaic inventions and see how they will impact our model solar cars and the solar panel project which I hope to obtain for our school, either via the SunChips/National Geographic Grant I applied for, or via Progress Energy's SunSmart Schools Program.

Assessment Instrument:

Students will create a PowerPoint presentation in which they will capture the latitude and longitude of each of the ten cities (using ScreenHunter), will place this data into an Excel Spreadsheet, and graph the results. Students will be graded upon how accurate they are in determining the latitude and longitude of each of the ten cities, and how well they have captured the Radiation Budget data and graphed it. In order to properly transfer the data from the NASA satellite to an Excel spreadsheet, students must be able to copy the data, and follow the "Text to Columns" procedure. Each student will present their slide show to the class with the projector and large screen that is located at the front of my lab.