College Student Investigators

2007 Cohort

Activity Journal

January – March 2007

PDS CSI Coordinator
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Progress Updates

January 29, 2007

John Bulalacao

My objective is to create a web-based interface through the existing JPL/NASA NAIF website that can analyze details such as quality, size, and type of information stored on multiple SPICE kernels for an appropriate time-interval (selected by a user) from which specific data can be retrieved. This is an experimental endeavor working with the existing SPICE database, potentially using HTML and Linux as the language for the drivers of this interface. Free Toolkits and Tutorials have already been made available for end-users in several programming languages such as Fortran, C, and MATLAB from which customers can use off-line or as an addition to customers' existing software, however our intent is to create a tool that can help individuals using the JPL/NASA website, who are not necessarily familiar with the criteria used by the Space Science and Engineering community, select data from these SPICE kernels.

Stephen Bussard

I started working with the PDS on 1/31/07 (Wednesday after the first teleconference). The first day I got an account on the *titan* workstation and started learning how to use the Solaris 8 OS. Then I started learning some basic IDL functions, and the general structure of the PDS system. The first plot that I made using IDL was a plot of Altitude vs. Zonal Wind Speed for the Huygens probe (similar to the one found on the PDS website).When that was finished, my supervisor and I decided to set up another exercise analyzing data from the Mars Rovers. That is what I am working on now.

Jodi Gaeman

Data retrieved during the Deep Impact mission shows varying amounts of outgassing by Comet Tempel 1. This outgassing occurs in the form of both seemingly random outbursts and jets. Images taken during the mission show minimal amounts of water ice on the comet's surface. The visible amount, however, is not enough to account for the comet's outgassing. Therefore, it is believed that there is more water ice within the small body's nucleus. But what determines where and when an outburst will occur? Comet Tempel 1 has a rotation period of approximately 40 hours. Some believe that these outbursts occur around sunrise. By analyzing the data from the Deep Impact mission, it may be possible to determine when precisely these outbursts occur. The locations of these outbursts are uncertain as well. While one is believed to be known, there are still others yet to be determined. Using this data and knowledge about the comet's motion, it may be possible to determine the locations of the remaining outbursts.

Ashley King

The NASA Planetary Data System will be a great opportunity for undergraduate research. My project will include studies of the Deep Impact mission. I will do research on the studies of other comets and similar missions to help provide background information to my specific project and to learn from those experiences. After doing this research my project will probably involve research on the ejecta cloud of the mission. The goal may be to determine the materials that make up the cloud or other properties of the cloud. I will use the light that is reflected off the cloud vs. the nucleus to determine these properties. This is what I imagine my internship will involve.

Daniel Morozoff

Simply put I will be studying the vorticity present in the plasma behind Saturn. The effect was first seen by Pioneer in 79, and then again by Cassini. It became of interest for this effect is only present around the 2 main gas giants in our Solar System (Jupiter and Saturn). We will be working we magnetometer data collected from both space probes and provided by PDS to create a simulation model that would be able to give us a better understanding of the phenomenon.

February 26, 2007

John Bulalacao

Per the project’s action plan, I am currently researching several programming languages and over-the-counter software that possess tools that can be utilized to perform the functions outlined by our objective stated in the previous summary. So far, the languages being investigated include HTML/XHTML, JAVA, PERL, PHP, PYTHON, and RUBY, while the OTC software has been narrowed down to Web Development Software that is portable by multiple operating systems. In addition to researching these tools, more time is also being dedicated to the familiarization of the details of the metadata contained within SPK files. This process is a necessary step towards understanding the nature of the navigation information and its organization within the SPK files so we can better create a tool for its extraction by end-users such as JPL/NASA customers, the Space Science and Engineering community, as well as the general curious public. As eager as I am to start developing algorithms and creating testable data-extraction techniques, my mentor, Charles Acton, and I have discussed the importance of this Research phase in order to get the Development phase off on the right foot. Procedures are being developed to measure the efficiency of each language's ability facilitate the search for SPK files.

Stephen Bussard

Spent time learning IDL, in particular plotting functions. Set an objective to try to derive Altitude, Temperature, and Pressure data for Mars Rovers.

Jodi Gaeman

Over the past month, I have concentrated on learning more about the tools that I will be using over the next year and a half. As the Deep Impact mission captured data in the form of images, I will be working mostly with a software package called IDL, Interactive Data Language, and certain programs created specifically for IDL, which will allow me to analyze the images obtained. My first goal this month was to learn about the operations and features of IDL and the basic skills necessary to manipulate generic data.

I then worked with programs downloaded from the Small Bodies Node website. The goal in working with these programs was to learn more about how each operates within IDL and what information they are capable of extracting from labels of information corresponding to a particular image. This particular part proved to be most challenging, as I frequently encountered errors in the attempt to run programs. Finding and correcting the sources of these errors proved to be beneficial, however, as it allowed me to understand more about each particular program's structure, as well as the data being analyzed.

One of the biggest problems that I faced was reading images into IDL. Within the programs created specifically for PDS-Small Bodies Node, there were two particular ways to read an image. Both methods initially proved unsuccessful for a variety of reasons. For example, small details, related to punctuation, prevented IDL from recognizing data. These notation errors occurred in several areas of the labels. Finding them was initially problematic, but since all of the labels are formatted similarly, this should not cause any trouble in the future.

The project that I was considering at the beginning of the month has now changed. Rather than completing a research project related to the comet's outgassing, I will be attempting to create a topographic relief map of comet Tempel 1. Now that I understand more about the programs I will be using, I am beginning to work on my background research for this particular project. In the coming weeks, I hope to learn more from the data taken during the Deep Impact mission and comet Tempel 1 so that I may begin to formulate a more detailed procedure for achieving this goal.

Ashley King

This month I primarily worked on understanding the PDS data images and the programs that will allow me to open, read and manipulate them. I spent time reading and understanding what the PDS data labels said, as well as what each PDS function, that I downloaded from the PDS Small Body Nodes web site, did. I ran into a lot of problems with the IDL programs. These included errors with the data labels as well as the images which prevented me from seeing or using them. To fix these problems I had to make corrections in the PDS data labels as well as the code typed into IDL to view the images. I also spent many hours learning the IDL programming code so as to become more familiar with the tools I will need when I collect new data from the Temple 1 images. I have just recently finished learning the tools for the research. My mentor, Dr. A'Hearn has now guided me in a new direction. He has me looking at specific images, those right before and during the Temple 1 impact. He wants me to find a way to measure the intensity of images in a line perpendicular to the comet's edge. Now that I know more about the programming system and about my project, I can begin to do background research on similar projects and on the Deep Impact Mission.

Daniel Morozoff

This month we got started with the project. We began with looking at the Pioneer data, the first instance of discovered vorticity in plasma. We spent most of the time converting the data into a usable form. Because it was collected in PE coordinates we had to come up with a field-defined coordinate system and covert it. Further we had to compare it to something. We decided to look at a running average and some Taylor series. Most likely we are going to stick to the running average as a comparison tool. With this average we will create whisker plots for the B-field centered around the satellite's trajectory. We are hoping to compare the data to the newly collected Cassini data and come up with similar results.

March 26, 2007

John Bulalacao

Sent summary in .swx format. Coordinator has requested a more commonly available format.

Stephen Bussard

Since the last CSI teleconference I have finished working on data corrections for the Mars rover "Opportunity". When I finished the corrections I made some plots with the fixed data. My advisor and I found that the data behaves somewhat as expected: there are small oscillations in the accumulated velocity plots. Since then my advisor and I have been trying to learn how to use the Quaternion data to figure out the radial acceleration of the rover during descent to mars so that we can construct an accurate density profile. I feel like the major accomplishment since the last conference was getting the data fixed -- the process came along very nicely after a cer**ta**in point and the final method used proved itself to be extremely effective.

Jodi Gaeman

Over the past few weeks, I have focused on two particular tasks. First, I have begun doing background research related to my particular topic. This research has included learning about similar studies that have used stereo pair images to create topographic maps. Several projects have mapped the surfaces of various structures mainly on the

Earth, but on Mercury and the Moon as well. I have also been researching topographic features of other comets that have been examined in previous studies, such as Wild 2.

In addition to background research, I have begun to sort through data collected during the Deep Impact mission to find stereo pair images. In particular, I have been sorting through ITS, Impactor Targeting Sensor, and MRI, Medium Resolution Imager, images. I am attempting to find images that correspond with a particular distinguishable feature of the comet's surface, but also present two different perspectives of the feature. The two differing perspectives will allow for a distinction in height. As there are many images to be compared, this process is proving to be a time consuming and tedious one.

Ashley King

This month I focused my efforts on research about the Deep Impact mission and what has been accomplished so far. I learned that the Deep Impact mission's goal was to discover more quantitative information about the nucleus of the Temple 1 comet as well as clues to its evolution. To do this they impacted the comet with a 370kg impactor at 10.3 km/s. This allowed the scientists to study the inside of the comet by looking at the ejecta as well as the impact crater. The ejecta cloud only lasted a few days which was documented by the intensity of the comet decreased back to normal. There were many measurements done on the ejecta cloud including the velocity in which it propagated into space. There was also a lot of work done on the spectra of the dust particles that indicated that the Temple 1 comet has less water then usual Jupiter family comets as well as a more processed surface which may give information as to what evolutionary path this comet has taken. I should note that I have all the articles and their citations.

After doing my research, I talked to my mentor Dr. A'Hearn to understand more about the project he wanted me to do. The idea was that I measure the intensity of many different lines that are perpendicular to the edge of the comet, and compare these to before and after the impact. By doing this, I would be able to determine the effective cross section of the dust particles. So the second part of this month I have been developing a way to measure the intensity of the different visual images perpendicular to the comet and have made a lot of progress with the IDL programs.

Daniel Morozoff

Awaiting input.