

Collegiate Internship
Kennedy Space Center
Designing the Lunar Regolith Excavation Competition

Le, Christopher

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Reviewed by:

Greg Galloway

Applied Technology Directorate, KT-C-H1

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NASA/INSPIRE

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06/08/09 – 07/31/09

Abstract

The project assigned this summer involves designing a lunar regolith mining robotics competition. This process involves consulting several assets available at the Kennedy Space Center. The process involves several steps. The first step is to determine the requirements for the competition. Once these requirements are determined, the dimensions of the playing field are drawn up, first by hand, and then using computer models. After these drawings are tentatively decided upon, the cost of materials must be determined, so as to fit within the allotted budget for the project. The materials are to then be ordered, assembled, broken down, and stored throughout the duration of the competition. We must also design the advertisements and logos for the competition. This is to market and publicize the competition to college level teams. We must also determine the rules for the competition so as to have uniform requirements for all teams. Once these processes are completed, the competition can be finalized and publicized for the public. The contributing parties are Greg Galloway, Robert Mueller, Susan Sawyer, Gloria Murphy, Julia Nething, and Cassandra Liles.

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The main project assigned for the summer of 2009 involves designing a robotics competition, entitled Lunar Regolith Excavation Competition, which will take place next May. The purpose of this assignment is to introduce design methods and the process for the development of projects. This project involves several steps incorporating several aspects of KSC capabilities. The first step of this project is to investigate possible locations to set up the competition. One of the possible locations is the Kennedy Space Camp area at the Astronaut Hall of Fame. To secure this location, the point of contact must be contacted first. After receiving confirmation, the available area for the competition must be determined to ensure enough space is available and that there are enough accommodations for both participants and viewers. Since the Astronaut Hall of Fame has enough available space and accommodations, this location has been tentatively selected for the future competition.

The next step in this project is to design the arena for the robotics competition. The goal of the competition is to excavate a certain amount of lunar regolith simulant in a certain amount of time. Thirty metric tons of lunar regolith simulant, GRC-3, are available for this project and there is a requirement that the simulant be 0.6 meters deep to allow sufficient space for the robots to excavate and for the arena to be constructed and deconstructed within a 3 day period. Also, there is a requirement to split the competition surface into three sections: an O₂ production

area/starting point, an obstacle area, and a mining area. The O₂ production area contains a trough, based upon the actual in-situ resource utilization design to be sent to the moon. The trough is to be placed 1 meter above the surface of the playing field. The obstacle area will contain rocks and possibly craters to mimic the lunar surface as closely as possible. The mining area will contain little to no obstructions for the robots to excavate lunar regolith simulant. Based on the dimensions of the available space in the Astronaut Hall of Fame and the requirements listed, the arena was designed to be 7.5 meters long, 4 meters wide, and 1 meter deep.

Following the design stage of the project, the fabrication process involves several parties. With the requirement that the arena be constructed and deconstructed within 3 days, the materials for construction have been decided to be an extruded aluminum frame, provided by the company, 80/20, in a kit form and plywood as the walls. The reason behind choosing these materials is due to the cost and ease of constructing the arena. Since the frame is provided in a kit form, the frame can be constructed with minimal labor and tool assistance. Also, this allows for versatility in the dimensions of the arena and easy storage since the frame can be constructed and broken down in sections. This ability is exciting, since this allows for greater versatility in the use of this arena along with a greater importance for this project, since this may be used in future NASA projects. Plywood is relatively cheap and lightweight, which makes it an ideal material to be used for this project. In addition, plywood has a unique dampening characteristic, which assists in the compacting process, through physical vibration, of the lunar regolith simulant.

There is also a publicity aspect of designing this arena for the excavation competition. The prefabricated panels offered by the 80/20, which are easily incorporated with their extruded aluminum frame, are available clear, which would allow a transparent view of the lunar regolith

simulant in the arena. This would provide some aesthetic design to the arena, rather than having an industrial appearance to this. However, the use of these panels is contingent on the plan of placing advertisements on the arena sides and whether the panels are priced within the predetermined budget range. In addition, there are plans on creating a youthful and exciting atmosphere during the competition. Several venues are being consulted to provide entertainment, such as having a Master of Ceremonies. There are also assets available at other NASA centers that provide such services that may be employed for this purpose.

The advertisement of the competition is also assigned for this project. A logo and template for the competition must be designed to be used on various proposed merchandise to promote the competition, such as lapel pins, patches, stickers, buttons, banners, flyers, and business cards. After providing an initial design, the ideas are to be sent to the graphics design group to be professionally consulted and ultimately produced.

Several assets were consulted throughout this project. The Astronaut Hall of Fame, the Space Life Science Lab, and the graphics design group were consulted as part of KSC assets. The company, 80/20, is an external contact. There is a possibility that the machine shop at KSC will need to be consulted to help construct the arena. The engineering process for producing a project is exemplified through this project, from idea, to design, to consulting, and ultimately, to testing and production. The contributing parties are Greg Galloway, Robert Mueller, Susan Sawyer, Gloria Murphy, Julia Nething, and Cassandra Liles.

Christopher Le
Kennedy Space Center
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Reviewed by:
Joshua J. Manning
Planning and Operations Branch KT-A1

Le, Christopher

Title of Project: Researching, Analyzing, and Presenting a Collaborative Tool for Team Members

NASA/INSPIRE

NASA Center: Kennedy Space Center

Intern's Mentor: Joshua Manning

15 June 2008 – 8 August 2008

The intern's summer research project consisted of two goals. The first goal was to research two tools that provided a system to facilitate collaborative efforts among members of a team. The two candidates for this project were Window's SharePoint and a Wiki formatted website. SharePoint is an online based tool that can be used as a document repository, a content management tool, and a way to organize information. The Wiki site is located on the internal KSC website and is similar to an encyclopedia, having information on the Labs and Capabilities throughout KSC. The information contained in the Wiki is readily edited by anyone who wishes to update information or correct any errors in the data. The second goal was to present the findings to the Applied Technology Directorate Branches and answer any questions regarding the use and implementation of the two tools.

The main purpose of this project was to examine and review collaborative tools for use by KSC employees to facilitate their work by providing a way to present information quickly in a shared environment. The intern's role was to work with the internal Wiki site and Window's SharePoint to determine each ones' capabilities, benefits, and limitations as well as research existing documents and sources for information that can be utilized to learn about both tools. After researching the two tools, the intern was to give a presentation that highlights the basics of each tool and highlight any benefits and limitations the intern encountered. The intern's purpose was to learn the capabilities, benefits, and limitations of the Wiki site and SharePoint to present and possibly incorporate with NASA personnel to use as a collaborative tool. The hypothesis was that while both tools were beginning to be used by NASA employees, the tools were intuitive enough to be easily utilized by a large majority of personnel.

The procedure for completing this project followed the general outline of reading the available literature on the tools, interacting with and learning about the tools, collecting information on the tools, comparing the information, and presenting the tool that seemed best to assist NASA employees and contractors. For the Wiki site, the procedure for the intern was to initially familiarize himself with how Wiki sites were constructed. The intern was then to work with formatting and creating a web page in the Wiki site to learn of any benefits or limitations of using this tool. After working with the Wiki site, the intern was to collect the information he gathered and compare it to the information garnered from working with SharePoint. The procedure for learning about SharePoint consisted of initially finding literature on SharePoint and learning about the basic capabilities of this tool. The intern was then to create a SharePoint site and determining the capabilities, benefits, and limitations of using SharePoint through creating and managing documents, photos, lists, discussion boards, and surveys on the site. After learning about SharePoints' features, the intern was to consolidate the information he learned from both the Wiki site and SharePoint and compare the two products. After analyzing which

product would provide the greatest benefit, the intern was to create a presentation detailing the information he learned to be presented to the Applied Technology Deputy Director, the Division Chiefs, members of the Planning and Operations Branch, and his mentor.

From working with the Wiki site, the intern learned that this tool excels in keeping a current record of the Labs and Capabilities available at KSC. The Wiki site provided a quick reference for both employees and contractors that may need to learn about a certain Lab or Capability or to find certain specialized equipment. This application would make finding information on KSC Labs and Capabilities easier for not only existing NASA employees or contractors, but also potential future business partners. Along with these benefits, there were some limitations with using this tool that may make it difficult for wide spread usage. The ease at editing information on the Wiki web pages creates a collaborative environment where the community can contribute recent information. However, this open access to editing data leaves the website vulnerable to malicious alteration by anyone. A possible solution is to keep the Wiki site internal to the KSC network. While this would prevent non-NASA employees or contractors from altering the content, potential business partners would not be able to access the information on the Labs and Capabilities that are located at KSC, limiting the spread of information. An alternative solution is to review every change that is made to the Wiki pages before confirming the modification. However, with the amount of information that may be altered at a given moment, the task of evaluating and reviewing each change may be cumbersome and inefficient. Along with the possible problems of malicious editing, the format for editing pages on the Wiki site may be difficult for people to casually and consistently update the information. Also, Lab personnel may not have an available opportunity to take time from their work and edit the respective Lab page, making the information on the page outdated. Although the Wiki site has limitations that may hinder wide spread usage among NASA employees and contractors, this tool is an excellent way to quickly learn information on the Labs and Capabilities available at KSC.

SharePoint provides a way for users to work in a collaborative environment to organize projects and manage content. This tool allows for users to access document and picture repositories, lists for organization, a discussion board for conferring information, and surveys to gather data on team opinions. The interface is intuitive, making the tool user friendly. Also, SharePoint is a tool the KSC already has, so the cost of implementation is small. The method of accessing SharePoint sites is delegated by the head of the parent SharePoint site so the amount of people with access to information contained on a SharePoint site is limited, making the information relatively safe from malicious alteration or distribution. In addition, when accessing SharePoint, a user may log in with his or her KSC credentials, thereby facilitating extensive implementation as well as providing further security protection. While SharePoint may be accessed by different Internet browsers, Internet Explorer provides the most functions, making IE the preferred web browser when using SharePoint. This may be limiting to some users who use a different web browser, so these users may have a difficult time using SharePoint. However, the majority of KSC employees use Internet Explorer, so the users will easily become accustomed to using SharePoint. After reviewing both of the products and comparing the advantages and drawbacks of using each of the tools, the intern decided to give a presentation on SharePoint to the aforementioned people. While giving the presentation, the intern used SharePoint to organize the project describe in this abstract to demonstrate an example of how SharePoint could be used to

organize a project. After the presentation, the intern was assigned a continuation on this project by creating a user guide on SharePoint for first-time users.

The Wiki site provides an excellent system for the consolidation and reference of the Labs and Capabilities available at KSC. Although this tool has drawbacks that may hinder usage by KSC employees in terms of malicious editing and difficulty of modifying pages, the Wiki site provides uses that SharePoint does not. The Wiki site has the advantage of providing an easily read layout that facilitates quickly referencing data. Since the Wiki site provides advantages that SharePoint cannot, both tools will be utilized by KSC employees. The intern was assigned a continuation on this project by creating a user guide detailing the procedure to create and edit a page on the Wiki site, complete with screenshots and a visual walkthrough of the editing process. The Wiki site is currently in development with a number of Labs and Capabilities being added to the database for testing purposes.

SharePoint is a user-friendly tool that provides extensive functionality in document management and organizing projects. The collaboration potential provided by SharePoint allows team members an easy way to complete projects or work together in almost any setting. Also, the log in procedure in place makes this tool not only secure, but also easily implemented within the KSC system. The tools available with SharePoint are perfect for use with a project oriented format. The system is user friendly and intuitive, making SharePoint easy to begin learning.

Both Window's SharePoint and the internal Wiki site for KSC Labs and Capabilities provide different tools and assets and both can be used to help facilitate work at KSC. While both have their advantages and disadvantages to using them, SharePoint and the internal Wiki site are useful tools to both quick reference information and work in a collaborative environment. The intern learned how to research information on a topic, interact with a tool used for collaboration, gather information on the benefits and limitations of a tool, compare and contrast the data to formulate a conclusion, and create and give a presentation to members of a group.

Along with this main project, the intern was assigned other side projects. One project was to transfer images to a word document for further conversion into a PowerPoint for the Corrosion Laboratory. The purpose of this project was to assist in creating an updated reference binder for the different corrosion projects. The intern was also assigned to redesign the Applied Technology directorate webpage on the internal KSC website. The purpose of this project was to create a more concise layout that is also user friendly. The redesigned layout includes an extendable left side menu for KT Labs and Capabilities along with a left hand menu that provides relevant information that changes with the current page. The contributing parties to these projects consisted of Christopher Le, intern, Joshua Manning, mentor, Michelle Harvey, intern, and Jennifer Murray, mentor.