Engineering Management
Field Project

Intranet Resource for the Mechanical Engineering Department at Green Industries

By

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An EMGT Field Project report submitted to the Engineering Management Program
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Executive Summary

The mechanical engineering department at Green Industries has grown substantially over the past several years to keep up with the company's overall growth. With this growth has come a reduction in the ratio of experienced team members to new team members and a shortage of appropriate mentors to serve these new engineers. In order to provide all team members with the information they need to successfully design and develop new products, the department must find a more efficient way to transfer information to individuals when experienced mentors are not available.

The purpose of this field project is to determine an accurate and timesaving method to transfer needed information to team members and save man months of development effort while working within the limitations of the current intranet system at Green. Team members and team leaders will work together in a collaborative effort to determine the content needed to achieve these goals. This project should also provide a process for all engineering departments within Green to use when looking to manage the information their associates need on a daily basis.

A solution to this problem is to create the framework for a home page for the consumer mechanical engineering department at Green that can manage this information. This web resource will be the home page for team members and allow them to find all of the information they need on a daily basis in one location. It will also help organize and store some of the documents used within the department.

Chapter 1

Introduction

The consumer mechanical engineering team at Green Industries has always prided itself in being a small, nimble department that is efficient enough to handle the large number of consumer products the company produces. During the past few years, the company has grown rapidly, which in turn required the department to increase its staff to support the growth seen in the other engineering departments and the increase in number of consumer products produced each year. Over the past three years alone, the department has grown from a staff of thirteen engineers to its current size of thirty-one.

One result of this sudden influx of new engineers within the department is a lack of experienced mentors available to train the engineers new to the company. In the past, new engineers learned the "right" way to do things from an experienced engineer sharing an office with them. This did not necessarily result in everyone doing everything the same way, but for the most part it served the company well. These experienced engineers were available at all times to answer questions and they handed down their methods used to successfully complete projects.

As the company and department continued to grow the importance of standardizing processes and procedures and sharing knowledge amongst the team has become more apparent. In order to comply with Green's standard operating procedures, it is required that product development personnel follow the proper guidelines. Green also put these procedures in place to ensure products meet the company's standards and intended specifications. Team members have documented technical data, design guidelines, and some "best practices" over the years to educate team members about what

they have learned in past projects. More recently, some senior team members created training documents to summarize some of the more important information new engineers must know in order to carry out their jobs successfully. The senior team members created these training documents to assist young mentors not yet fully trained on all company procedures and design practices assigned to new engineers and to give new engineers a reference guide so they can answer many questions that might come up on their own. These are just a few examples of the information team members might refer to during their day-to-day activities.

Current Document Management System

Currently, the reference material needed by engineers in the consumer mechanical department is stored in several locations throughout the company network drives. Information such as the technical reference data, design guidelines, and project status report forms are stored on a network drive only accessible by the consumer and mechanical engineering team members. Within this drive, the departmental procedural flow charts and training documents are stored. This drive is the "Mech_eng" drive and the image on the following page shows its contents.

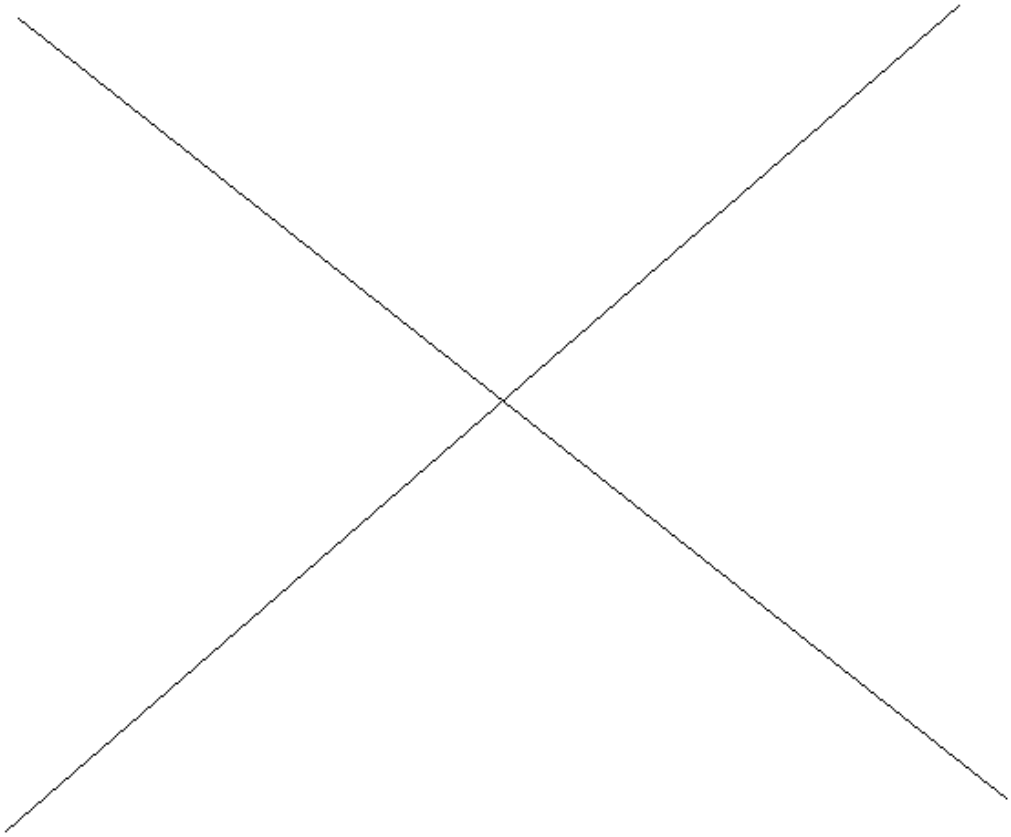

Figure 1: Mech_eng Drive Contents Used by the Consumer Mechanical Engineering Department at Green Industries

A consolidated list of company procedures and released forms also exists and is stored on a separate drive for use by the entire company. The company refers to this list as the "Master List." Active links embedded in the Master List open the needed documents and forms directly, but the documents and forms themselves are stored in other network locations. In another network location, individual project folders contain other project-specific information. The team members from various disciplines responsible for each project share these folders. These folders include such information as new component research, cost data, project status reports, and the product development plan. Green's standard operating procedure requires these project folders.

When the project starts, the lead project engineer creates the project folders and gives team members write access to the folders so they can add information as needed.

Project and program managers maintain and store project schedules in yet another location. Team members with viewing rights can see the schedules on a Microsoft Office Web Access page. Many individuals also create personal folders and use them to save some information during the development process. Associates create these personal folders on their local machines or on their private network drives.

Some departments and product sectors are beginning to use other methods for sharing and distributing information. Among these methods, SharePoint sites are one of the more popular. They are web-based sites that allow users to post documents for distribution and collaboration, create calendars, and add comments and general information for users to see. Many of these sites have restricted access, but others are for public use. An example of a runner's forum SharePoint site shown below gives an idea of their basic construction.

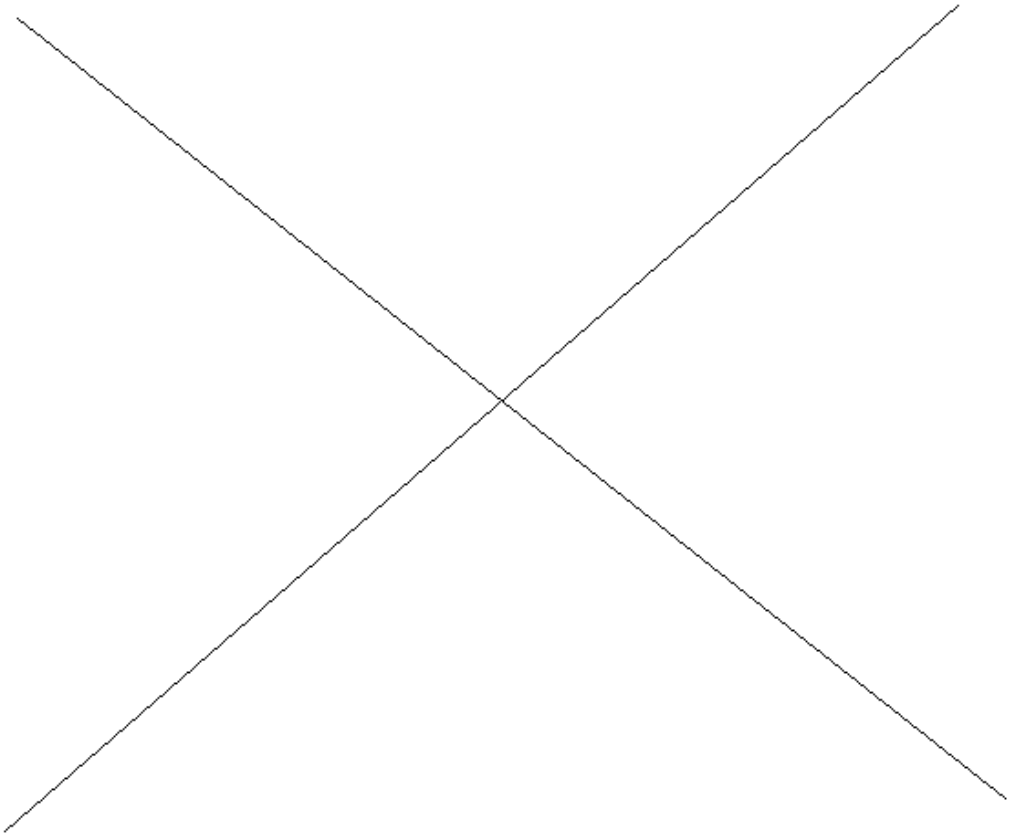

Figure 2: Green Runners SharePoint Site

Problems with the Current System

Mechanical engineering team members have been able to succeed over the past few years while using the current information organizational system. In most instances, team members find the information after some searching or after asking a coworker where it can be located. However, there are several reasons why this system is not sufficient.

As schedules become more compressed and time to market becomes more critical, any timesaving methods implemented by the team become more and more beneficial to the team members, the department, and Green. When looking at NRE (non-recurring

engineering) costs on projects, the cost per man-month is substantial. The added time spent searching for information are direct costs added to the cost of development. Although these costs might seem small, the cumulative amount of wasted time over all of the projects under development in any given year would likely be surprising. If the company assumes that the mechanical engineers waste only one hour on each product development cycle per month of development searching for information, the company would stand to save approximately five man months of development effort by eliminating this wasted time on the consumer side of its business alone. With a cost of approximately $20,000 USD per man month, this equates to $100,000 USD in development costs. Based on experience from several full product development cycles, the one-hour estimate is much lower than the amount of time actually spent.

One of the most obvious problems noticed with the current information organizational system is the wide variety of locations used to store the information team members use. Individuals are responsible to keep track of where this information is at on their own. The company, team management, and project leaders often rely on email to inform team members where new information can be located. The team members must then be responsible for saving this email or its contents for future reference so they can utilize the new information source. This is not ideal, but is better than the often-used alternative, which is a lack of communication about new information or resources available to employees.

This lack of communication leads into the next area of concern found with using the existing system, which is the problem of associates not being aware of resources created for them by others. Researching the various resources and tools available to

Green associates uncovered many examples of information sources most team members were not aware even existed. It was good to see the creation of new resources, but without an easy way for people to get to these resources, it seems their utilization will be minimal and they will not be used to their utmost potential.

Because some information can be hard to find, many associates choose to make local copies of forms and documents or reuse old copies of documents created in the past rather than using the latest information available to them because the time required to find the latest information is too great. This can work well at times, but it creates problems when the forms or information they are referencing becomes outdated. According to ISO procedures, associates must use the latest version of any controlled document and "uncontrolled" versions should not exist. In addition, as the company updates cost data and other values used in some forms, it is important associates use these new values so cost estimates and other calculations are as accurate as possible.

Looking at the bigger picture, it appears that the problems seen in the consumer mechanical engineering department relating to the informational management system are becoming a problem for all of the engineering departments within Green. Rapid growth, new and more detailed processes and procedures, and the utilization of new information sources are factors all departments are dealing with and are creating a problem all groups must solve. This project should provide a solution for all departments within Green to use when looking to manage the information their associates need on a daily basis.

Project Objective

Utilizing the existing intranet network at Green Industries, this project intends to create the framework for a home page for the consumer mechanical engineering department to support team members during their daily work activities. This home page will tie several existing pieces of information together and better organize it so team members can take full advantage of the information while carrying out their responsibilities. The manager and team leaders within the department recognize the value this web resource will have for team members and this project has the full support of upper management as well. With this support, utilizing company resources was possible and development work could begin.

Project Benefits

Probably the most important improvement this web resource will provide for the department is the clarification of procedures team members must follow when developing new products. This will in turn lead to greater standardization and efficiency during product development. The page will achieve this by posting the process flow on the web page, along with shortcuts to the latest product development forms needed. Team members will have instant access to the information at all times and be able to see where they are on the development timeline.

Another area this web resource will improve is the organization of data needed by team members. Procedural forms created during the development process will no longer need to be stored in individual project folders and other network locations. Instead, all of these forms will have a centralized storage location where team members can find them

easily. The training documents created to assist new engineers in becoming familiar with their job requirements and the information they need to get started with their work will no longer be separate documents stored in a folder on the network where they are hard to locate. Instead, the home page will embed the documents directly into an intranet page for instant access. Mentors use this training information as well, so it is useful to the entire team.

With so many new intranet web resources used throughout the company, tying these independent sites together and making them accessible is important to their success. Another portion of the mechanical engineering home page will simply include direct links to all available company intranet resources to ensure everyone on the team is aware of them and can take full advantage of them. In talking to team members and team leaders, this would be a very useful portion of the web page.

One piece of information that is currently not readily available to team members that this project will create and make available to everyone is a list of all of the mechanical engineering team members and the projects they have worked on while at Green. Individuals can learn from the problems other engineers have solved on past projects, so knowing who to go to when a specific product comes to mind will encourage open dialogues between associates that normally do not work together.

As mentioned earlier, data organization will be one of the key benefits of implementing this intranet resource. One piece of information in particular holds a lot of value when new projects are in their early development stages. With cost control becoming more and more important within Green, providing accurate estimates for mechanical costs is one of the main tasks of the project's mechanical engineer during the

product development plan's creation. These costs include prototyping costs, production tooling costs, part costs, and engineering development time. In order to track cost information, the department manager created a form that team members fill out at the beginning of each project that gathers all of these pieces of cost information onto one page. Man months are calculated based on a percentage of the overall expected project duration automatically, but team members still must find cost estimates for prototypes, tooling, and part costs. At the end of the project, team members are to go back and fill in the actual project costs. Using similar products already in production is usually the best way to get the initial cost estimates, but finding this cost data can be difficult. By storing all completed cost estimate forms in a centralized location accessible from the intranet page, team members can quickly search through the completed forms from other projects and come up with a reasonable estimate for their products in development.

Project Goal

Marti A. Hearst provides an interesting description of the communication between humans seeking information and the information retrieval systems they employ. She states the following:

> Information seeking is an imprecise process. When users approach an information access system they often have only a fuzzy understanding of how they can achieve their goals. Thus, the user interface should aid in the understanding and expression of information needs. It should also help users formulate their queries, select among available information sources, understand

search results, and keep track of the progress of their search (Baeza-Yates and Ribeiro 1999).

One benefit of the site proposed in this project is there is a smaller, controlled group of individuals using the site that is already familiar with much of the information presented. However, this does not mean the goal should deviate from the expectations laid out by Hearst. Ben Shneiderman, an expert in the field of human-computer interaction, describes what makes an effective human-computer interface in the following way:

> Well designed, effective computer systems generate positive feelings of success, competence, mastery, and clarity in the user community. When an interactive system is well-designed, the interface almost disappears, enabling users to concentrate on their work, exploration, or pleasure (Baeza-Yates and Ribeiro 1999).

Reaching this state of perfection could prove difficult, but it provides a sense of what is theoretically possible if the project lays out the site properly. In the end, the expected outcome of this field project is the creation of an easy-to-use reference for the entire consumer mechanical engineering department that updates and expands easily to adapt to the fast-growing company and department it serves.

Chapter 2
Literature Review

While conducting research to gain a better understanding of the work done in the field of managing and distributing information effectively, it became clear many researchers have done a large amount of research in areas relating to knowledge management. One way to define knowledge management is the way various team members and colleagues within an organization locate, store, and retrieve the data, information, and knowledge needed to do their work (Hinds and Kiesler 2002). These three items (data, information, and knowledge) are often used interchangeably in most work environments, but researchers tend to treat them as separate items with unique definitions.

Data is strictly raw information or facts given without context. An example of this would be measurements taken during an experiment. Information adds the context to the data in order to make the data more useable. This could include such information as the people who collected the data, how it was collected, conditions when the data was collected, and other parameters that relate to the data. Knowledge takes it a step further by adding such things as insights, experience, beliefs, and lessons learned to the information (Hinds and Kiesler 2002). These are characteristics added by people and one of the reasons why knowledge is so difficult to collect and retain by companies. It is this continued difficulty with knowledge retention and the value it possesses that makes it so valuable and worth researchers' time to study and find ways to conserve it.

Although much of this information was useful in narrowing down the topic of this research, it does not completely cover all of the areas this project hoped to explore. Instead of understanding the proper way to capture the useful information held by the

employees within a company, this project focused on how a company intranet can be used to better facilitate the sharing of information already documented and readily available throughout the organization.

In order to do so, the next area to research was the utilization of intranets in companies today. Looking at intranets, they have three main characteristics that make the technology what it is. The first main characteristic of an intranet is that it is a network based on the TCP/IP internet protocol suite and can run typical internet applications. This is beneficial because it allows different operating systems and equipment to communicate with one another. It also allows users to access the system through a web browser and makes it easy to share various types of files such as pictures, text files, audio files, and video clips. Traditional client-server systems, on the other hand, require proprietary software and use different protocols that can make sharing some types of information challenging (Prichard et al. 2000).

The second defining characteristic of an intranet is it is a private network and only accessible to a select group of users. The intranet makes this possible by using firewalls or by actually separating the network from other outside networks (Prichard et al. 2000).

The third key characteristic of an intranet is it not used for any one specific task. Instead, organization members use the intranet to communicate general information and collaborate on day-to-day work activities (Prichard et al. 2000).

After establishing this basic understanding of what an intranet is and how it is different from traditional networks within a company, it is important to understand a few basic guidelines on how to implement them. In many cases, a company will develop an intranet network with the hope of enabling communication between coworkers,

departments, and other locations. Without a clear vision of how the intranet will be organized, maintained, and utilized, it can quickly become another failed company initiative designed to improve efficiency.

Before development of the intranet begins, a company should first clearly define the problem or objective the network is supposed to overcome (Wagner, Chung, and Baratz 2002). In the case of the mechanical engineering team at Green, this would mean creating a clear outline of exactly which sources need to be included in order to provide team members with all of the information they need to complete their job requirements successfully.

Another important step to take when creating an intranet within an organization is to test it thoroughly. This includes testing the firewalls put in place to protect the network from unauthorized users, checking to make sure any available web browsers work with the system, verifying the pages fit properly on different screen sizes and resolutions, and running through the links to ensure users can access all of the pages easily (Wagner, Chung, and Baratz 2002). At Green, the IT department could assist with this step. They are aware of the system requirements, approved software (web browsers), and equipment specifications used within the company.

Once the intranet is tested and ready to go, the company should offer training or information about the usage of the system to encourage people to use the resource and help them feel comfortable with the new technology (Wagner, Chung, and Baratz 2002). Since the intended user group for this site is the consumer mechanical engineering department, the training can probably be limited to an overview of the information available on the site. The team members should be familiar with similar sites and if the

information is that difficult to find, the site is not meeting the goals created for it. The hope is that all information is easy to find and there is no confusion as to where to look for it when on the site.

In the study titled "Methods for Manipulating Electronic Documents in Relation to Information Retrieval" by Maria Gonzalez de Cosio and Mary C. Dyson, the authors looked at what elements of a web site best serve the user when they are searching for information. Often times, web developers use intuition instead of facts to determine the best layout for the information on a site (Gonzalez de Cosio and Dyson 2002). The authors looked at how different types of layouts affect the users' ability to find information when conducting searches. The researchers timed different groups of students as they searched for information on four different styles of pages. Each page style contained the exact same information. One page presented the information using a scrolling format, another page used links, a third option utilized paging, and the fourth page incorporated a frame. The results showed that of these four options, the paging and linking sites allowed the students to find the information they were searching for in the least amount of time. The appendix includes some of the results from this study. Even though the page using a frame incorporated links to direct students to the correct location, it was not as fast as the linked page for finding information. The framed page provided a smaller reading pane due to the table of contents always displayed in the frame at the top of the page, which could have contributed to this result. By not requiring the students to search through the document to get to the information they were looking for, the linked and paging sites proved to be the most efficient (Gonzalez de Cosio and Dyson 2002).

Since the storage and control of some documents will also be goals of the intranet site resulting from this project, document management was another area researched. Even though tying this intranet site to Green's document control system is not something this project hoped to achieve, understanding the problems document management attempts to resolve seemed like an important area to cover to help ensure the site handles the documents it does contain properly.

One goal all document management strategies hope to achieve is to provide employees with the right version of the right document at the right time (Harris et al. 1997). An example of how this applies to the mechanical engineering intranet site would be to ensure the site provides the latest NRE form when team members are looking to track costs on a new project. If an old version is used, the cost information generated could be inaccurate and even have a direct impact on whether management grants approval for the product's development.

Another goal of document management strategies is to prevent users from referencing old or outdated documents. In the world of document control, this refers to the ability of users to distinguish between a master document and an uncontrolled copy (Harris et al. 1997). The mechanical engineering intranet site will not contain "controlled" documents, so procedural issues are not of concern. Instead, the problem the site hopes to solve is the need for team members to copy and save redundant copies of the documents kept on the site. With the original document in an easy-to-find location that is accessible to everyone, there should be less of a need for anyone to create his or her own copy.

The findings in the article “Design and Maintenance of Data-Intensive Web Sites” by Atzeni, Mecca, and Merialdo (1998) converge on the points made in several of the areas researched for this project. They agree in most cases intranet resources are not fully utilized. Poor data organization caused by careless site development can make the desired information difficult to find and require users to sift through large amounts of information unrelated to their intended search. Over time, these intranet sites are often abandoned and the information on them becomes obsolete (Atzeni, Mecca, and Merialdo1998).

To avoid these issues, the authors stress the importance of considering and coordinating two key aspects when designing an intranet site and planning its maintenance. The first part of the design to consider is the data management. This includes the management of information stored on the site itself or in other network locations. The second thing to consider when designing an intranet site is the hypertext structure of the page itself. The goal is to create a site the users can browse easily and efficiently (Atzeni, Mecca, and Merialdo 1998).

Literature Review Summary

Based on the research done in support of this project, it is clear many companies struggle with finding ways to utilize the intranet resources they have created. While knowledge management is still a goal Green should strive for, it is outside the scope of this research project. Instead, by combining the research done by others to understand the basic guidelines for using intranets, what the most efficient page structure is when searching for information, and document management, this project hopes to establish a framework for an intranet-based web resource for the consumer mechanical engineering department. This resource should either provide the information or direct links to information the team members need on a daily basis to successfully complete their job requirements.

Chapter 3

Procedure & Methodology

This section discusses the steps necessary for the successful creation of the intranet web resource for the mechanical engineering department at Green Industries in the order in which they should occur. The steps required include the following:

- *Determine Scope of Information to be Included*

  In order to decide what information will be included on the intranet home page for the department, the team leaders and the department manager will provide input to see what they feel will be the most important information for their teams to have access to on the site. These team leaders and manager have a great deal of experience in product design at Green and understand what is required to succeed. Team members will also provide information on what they would like to see on the intranet page if they have any suggestions beyond what the team leaders and department manager suggest.

- *Determine Limitations of the Current Intranet*

  There are several ways to create an intranet page, but it will be important to understand the limitations of the current intranet system at Green before doing any real development work. Confluence and Microsoft SharePoint are the two main systems available for use on Green's intranet today. Confluence is a Java-based wiki system only available to the engineering teams at Green. Atlassian Software Systems developed Confluence as a wiki solution for corporations. The software engineering team selected Confluence for several reasons. One reason is it is a much better wiki site than SharePoint, which was the original use case for

the software engineering teams that set it up. Confluence also integrates well with the issue tracking software used by the software teams. It allows some flexibility when creating pages, but limits flexibility by requiring the use of the available features within the Confluence wiki markup language. The site essentially provides individual spaces for independent web pages and acts as the administrator for all of the sites created within it. Attachments to a site and the site information are stored and backed up in a Green database. The site can also search this information and the information in attachments easily. Attachments are limited in size and cannot be larger than 10MB. The creators did not intend for it to be a depository for large numbers of documents.

Microsoft SharePoint, on the other hand, is available to the entire company for use as a collaboration tool. SharePoint is a software package focused on collaborative workspaces and it utilizes a web interface to display and share information. Currently, Green's human resources department, engineering departments, and Information Technology department all utilize SharePoint. It is also available for use by groups, such as Green Runners, outside of the standard work organization. This allows groups of Green employees with similar interests to communicate. Developers create pages in SharePoint by using pre-defined tools called SharePoint web parts. Like Confluence, SharePoint does not allow complete freedom when designing a page like creating a page in HTML would. Another limitation of SharePoint is the system limits the types of files that can be stored on its sites. Some examples of file types SharePoint will not accept include .exe, .bat, .config, .dll, and .reg files. These are all files containing code that can

execute at the file level on the server. Like Confluence, SharePoint limits the file size that can be stored on a page and stores the site information and page attachments in a Green database. It maintains the search capabilities of Confluence and the ability to create a wiki within the program like Confluence while still being available to departments outside of engineering. The size limit for a single document stored in SharePoint is 100MB. The standard size limit for a single site is typically set to 250MB. However, a site can be as large as 100GB if needed. Green's IT department stated if the site needs to be around 10GB or more, more planning should be done to ensure this is really what the team wants and the space is being used efficiently.

One of the main benefits SharePoint provides is revision control and management of the documents stored on its sites. This will eliminate the need to save .pdf versions of status report forms and some of the other documents that currently require regular updates and records of previous versions. Users will be able to access the old revisions when necessary while not affecting the most recent copy of the form.

- *Coordinate with Team Members Working on Additional Team Web Resources*

  While this project was underway, a few other team members in the consumer mechanical engineering department began work on other team web resources. One team member is working within Confluence to create a team wiki site to share general information amongst team members. Another team member is working to develop a knowledge management system to capture information not currently documented and organize technical information already

documented. These efforts will not conflict with this project and actually could enhance the benefits to team members. Instead of simply creating a link to the network folders where the team files technical information, this intranet home page could direct team members to a knowledge management site. This could potentially see a great deal more use than the existing reference files.

- *Determine Document Storage Locations*

  Once the file size limitations of the chosen system is known, it is possible to determine which information should be stored within the system and which information should be stored in other network locations. Initially the goal was to store several pieces of information on the site directly. Knowing this will be important for the next step of the process.

- *Create Page Layout*

  A page layout will be selected using information gathered during the literature review and a review of the limitations of the system chosen. The material gathered during the literature review will help by giving some background information about the research completed in web page design. The studies on web site structure and the structure's affect on user efficiency when searching for information on the site are particularly of interest during the page layout creation process. Understanding the limitations of the system chosen (Confluence or SharePoint) will help determine which documents can and cannot be stored on the site and how many will remain in their current network locations and linked to the site.

- *Nominate a Team Webmaster*

  In order to maintain the web resource created from this project properly, finding a person willing and able to handle maintenance duties will be very important. As the department updates procedures and other information to align with changes within the company, keeping the web resource current will help ensure its usefulness to the team and its value to the company.

- *Create Pages*

  The page creation can begin once the page layout and structure are determined. A mechanical engineering team member who has volunteered to help with the project will do this work. This team member has several years of web design experience and is excited for the opportunity to do the work. Reviewing the progress often and meeting with the page designer will be two keys to this step to ensure the site matches the intended structure and function. As shown in the schedule on page 29, the page creation process should take approximately four weeks to complete.

- *Test Pages*

  Thorough testing of the page will be the next step of development to ensure the home page functions properly and meets the needs of the team. Initially, a small number of consumer mechanical engineering team members will have access to the site to verify there are no major problems. The team members performing the testing should exercise as many links and documents as possible to ensure the site is functioning properly. The schedule allows one week for this phase of the testing. Next, the entire consumer mechanical engineering

department will have access for further beta testing. Team members should exercise the site thoroughly just as in phase one, record any problems they find, and give suggestions on how to improve the site. If there are conflicting suggestions, the web creator and team leaders will resolve it and present the information in the way they feel will benefit the team the most.

- *Implement Suggestions from Testing Feedback*

  With an assigned individual available to upkeep and maintain the web site, any useful feedback provided during the beta testing stages should be implemented. Team members can continue to use the web site at this time and provide additional feedback as needed. The original page creator should also be involved in this process to help bring the new team webmaster up to speed and help reduce the chances of the creation of new mistakes. The webmaster should be able to complete these updates in approximately two weeks.

- *Share Information with Other Departments*

  When this web resource is a success and valuable to the mechanical engineering department, the hope is that other groups will create similar pages based on this model if they feel it would help them. All departments could benefit from a more efficient method of accessing the information they use regularly. Once the team feels the page is ready for full release, the group will give access to other departments within Green that may find the information on the site useful.

Project Schedule

The following schedule shows the timeline for which the department would like to have the web page created:

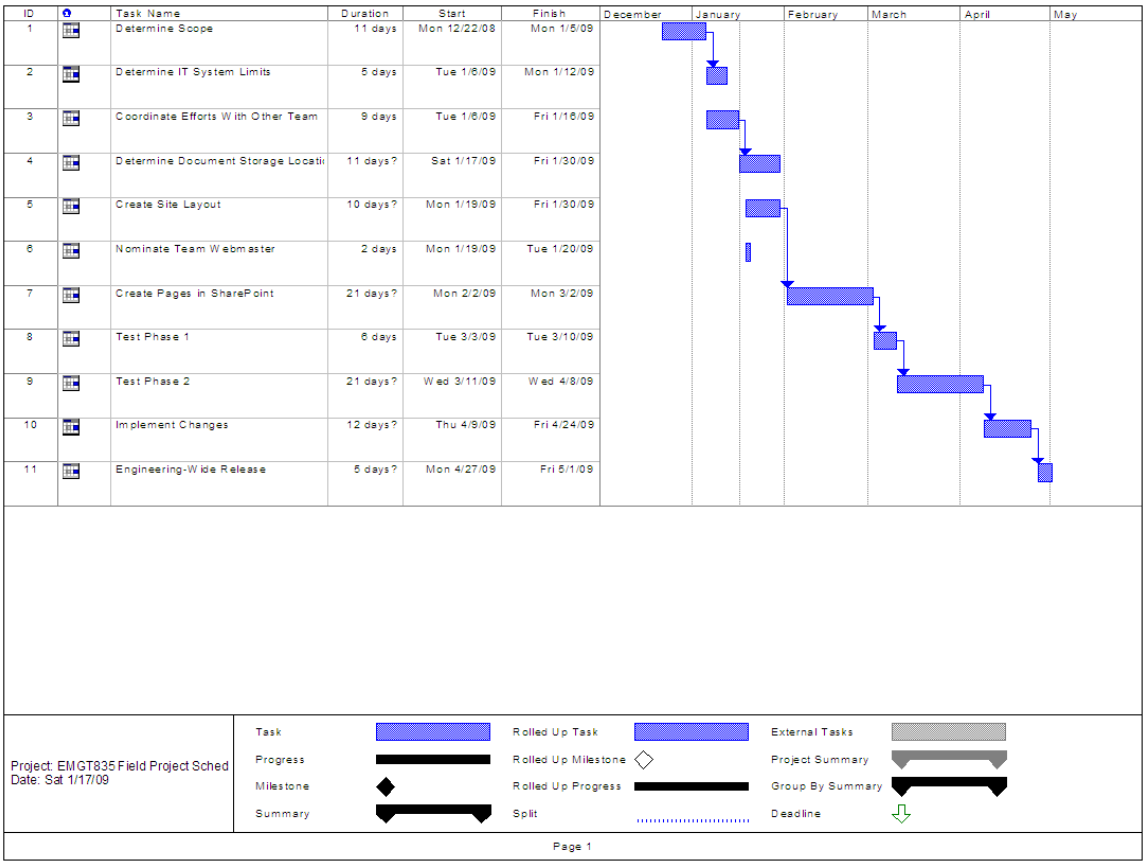

Figure 3: Project Schedule for the Consumer Mechanical Engineering Intranet Home Page

Chapter 4

Project Implementation

- *Determine Scope of Information to be Included*

The first step of the project implementation was to determine the scope of the project and decide what information would be most valuable to the team. In order to gather this information, team leaders distributed a survey for team members to fill out and discussed it at several team leader meetings as well. The survey results confirmed the areas this project development thought would be good to include on the intranet site. A copy of this survey and the feedback from team members are included in the project appendices.

Many team members asked for information such as the team's product development procedures, required process forms, organizational charts, training documents, and internal and external web links they could use to find information. As mentioned in previous sections, these areas will be included in the intranet site. There were also several requests for technical information, such as material specifications, component information, and customer repair reports. This project will not develop these areas, but the knowledge management sub-site will potentially cover them instead due to the large scope of work associated with a knowledge management site.

Concerning the structure of the site, team members repeatedly said they would prefer a simple, uncluttered intranet site with easy-to-find information. Several people mentioned having too much information available on a page makes it difficult to find what they really want.

- *Select the Proper Intranet System*

  After defining the project scope and reviewing the information about the current systems available, the team determined the best system to implement the intranet home page for the consumer mechanical engineering department on would be Microsoft SharePoint. A meeting was held with key team members from the mechanical engineering team and the software team members responsible for developing and maintaining their department's Confluence and SharePoint sites to review the information discussed in chapter 3 concerning these two systems. The notes from that meeting are included in the appendices. In the end, the team decided it did not need the advanced wiki tools in Confluence for this application and SharePoint would allow more integration between this site and other SharePoint sites within Green someday.

- *Coordinate with Team Members Working on Additional Team Web Resources*

  While meeting to discuss the details of SharePoint and Confluence with the members of the software team responsible for intranet web development, the meeting attendees also discussed trade offs between the two systems for the knowledge management system and team wiki the department is looking at establishing. After the discussion, the meeting attendees decided to design the knowledge management site within SharePoint as well. Having both the knowledge management site and the team home page on SharePoint will be beneficial to both systems as they will be able to be more easily connected. Users will also be able to search text and documents located on both sites simultaneously according to the software web managers in the meeting. The

knowledge management site can simply be a sub-site within the intranet home page. The meeting attendees dismissed the idea of creating a team wiki, as it would be absorbed into the knowledge management site.

- *Determine Document Storage Locations*

  Determining the storage locations for several documents was another important step in the intranet resource's development. This step will most likely be a work in progress even after initial development ends. Initially, the team plans to move all of the team's development forms onto the site in order to take advantage of SharePoint's revision control capabilities and the benefit of having all common forms in one centralized location. These forms include the ME/ID Status Report Forms, Cost Estimate Forms, Testing Results Forms, and Project Experiences Forms. Other documents may migrate onto the site as needed, but the team felt it is important to avoid placing unnecessary information on the site as much as possible.

- *Create Page Layout*

  With SharePoint now selected and the initial file locations determined, the next step was to lay out the overall framework of the intranet site. This step is critical in determining the long-term success of this project. Without a proper structure for the website, information will be difficult to find and team members will revert to their previous methods of information retrieval. Following the results of the research done by Maria Gonzalez de Cosio and Mary Dyson, the intranet site will use a paging format to provide users with the most efficient searching method when they are looking up information (Gonzalez de Cosio and

Dyson 2002). Separate pages will store information and users will click on the appropriate link to access these pages from the main page. In order to simplify the search even further, the main page will only give users four choices when they begin their search. These choices will be Product Development, Knowledge Management, Training/Mentoring Information, and Useful Links. These four areas were chosen based on the types of information the team leaders, department manager, and team members requested be included on the site. The areas of need broke down clearly into these segments. As mentioned previously, the knowledge management sub-site is outside the scope of this project. Other team members will develop this portion of the team resource. The flow chart on the following page shows the overall structure for the consumer mechanical engineering intranet site. As can be seen, the layout tries to simplify the choices available to users so they can quickly determine where the information they need is located. The layout also eliminates redundant information as much as possible to prevent the presentation of conflicting information. Removing redundant information also makes it clear where users need to go to get the information. If the web site gives the user two options on where to find the same piece of information, the project did not lay out the site properly.

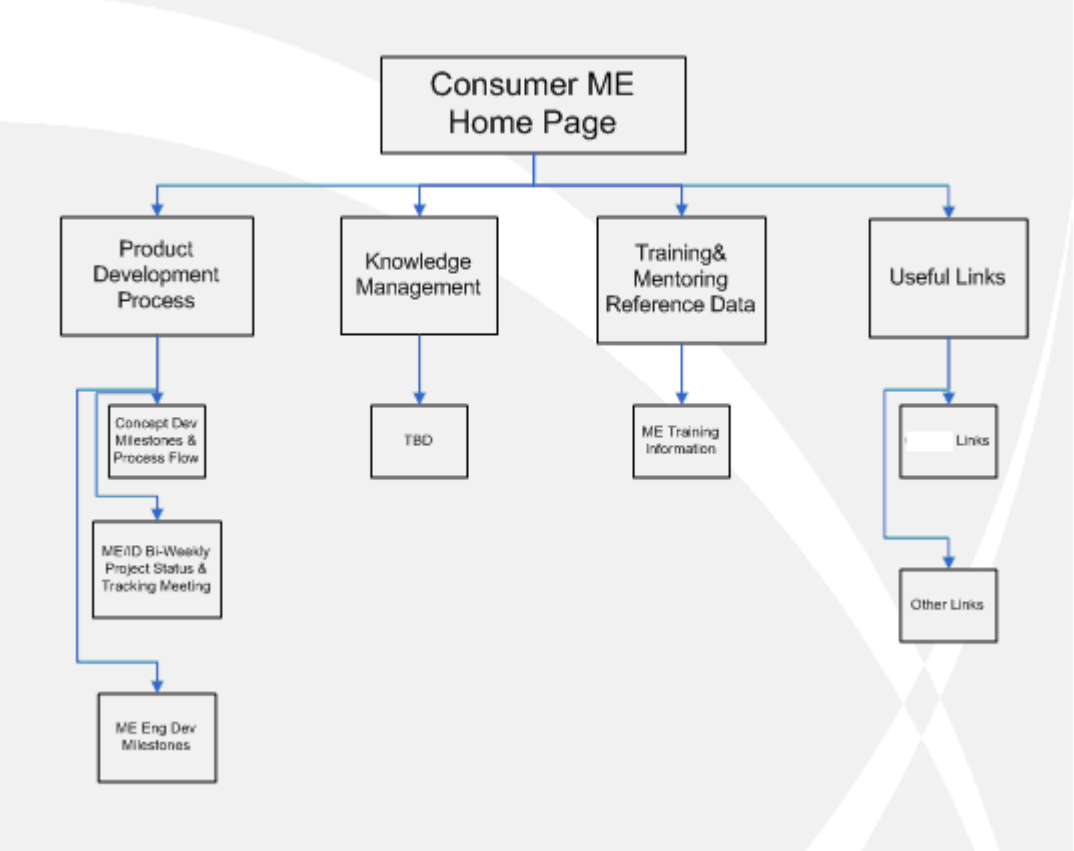

Figure 4: Consumer Mechanical Engineering Intranet Home Page Layout (The appendices include layouts for the Product Development Process and Useful Links Portions of the Site.)

- *Nominate a Team Webmaster*

  As stated in the schedule, the team nominated an individual to be the team webmaster during the layout creation process in order to save time and allow the individual to begin learning more about SharePoint and the design goals this site hopes to achieve. This individual, along with the two other team members working on the web page designs, will be the department's web design team.

- *Create Pages*

  At this time, this intranet site is still in development and the page creation portion of the project is underway. The web developer will create the main site and sub-sites, other than the knowledge management sub-site, before any testing will begin.

- *Test Pages*

  Once the web developer completes the main intranet site and three sub-sites (this project excludes the knowledge management site), the test phase can begin. A limited rollout to a small number of team members and the team leaders and manager is the first phase of testing. A beta release to the entire consumer mechanical engineering department is the second phase of the testing process. The schedule allows five weeks for this process. IT can control who has access to the site and who does not, so they can assist the department's web development team to define who has access at each stage of testing.

- *Implement Suggestions from Testing Feedback*

  Following five weeks of testing, the webmaster will update the sites based on comments received during the testing process. The webmaster should be able to complete these updates in approximately two weeks. If the team requests a large number of major changes and the layout must be overhauled, the team will adjust the schedule accordingly to provide more time to the webmaster. The original web designer can also be involved in the update process if needed.

- *Share Information with Other Departments*

When the completed intranet site has been tested and updated to reflect all of the suggestions from the mechanical engineering team, the team will give the entire engineering department access to the sites so others can utilize the information on the sites. The site could also show other engineering departments how they could utilize the intranet to improve their own efficiency and find the information they need more easily than before.

Chapter 5

Summary

This field project determined a need for an intranet resource for the consumer mechanical engineering department at Green Industries. Once the project determined this need and identified the problems with the current information management system, the proper method of how to organize needed information was determined. Through academic research, investigating the intranet resources available at Green, and discussing these resources with IT and other engineering team members familiar with the systems supported by the company, a plan was chosen. The plan selected was a SharePoint intranet site dedicated to the consumer mechanical engineering team. This site will serve as a home page for the department and give team members quick and easy access to the information they need while saving the company its most valuable resources: time and money.

Even using conservative estimates, this project should produce a timesaving of five man moths of development effort and approximately $100,000 USD in development costs each year by reducing the amount of time consumer mechanical engineers waste searching for the information they need. In the end, the department's management agreed with this project's findings and work on the intranet home page has begun.

Chapter 6

Conclusion

During the creation of this field project, one of the main lessons learned was the importance of understanding the problem before a person or team can formulate a proper solution. In the case of the consumer mechanical engineering department at Green Industries, this need was for an efficient way to organize and display the information all team members need to carry out their tasks successfully. The current system of using several network locations and various personal folders is no longer acceptable given the rapid growth the team has seen over the past several years.

Another important lesson learned during the development of this field project was how knowing the system constraints from the beginning can help a project team quickly narrow their focus and work towards a realistic final product. In this case, any initial plans for the web resource would have been a waste of effort if the team did not understand the constraints from IT right away.

Finally, this project showed the value of working together with team leaders and team members alike when working to try to change procedures. By gathering team members' feedback and consulting with them on what they really want, the level of support has been excellent. When implemented, team members should be more likely to adopt the team intranet site and help add to its effectiveness as time goes on.

Chapter 7

Suggestions for Additional Work

This project dealt with the information management issues of the consumer mechanical engineering department at Green Industries. However, in looking at other departments within the company, it became evident that information management is a problem for other areas of the company as well. Researching the needs of these various departments and creating a plan to organize their information more efficiently could be another useful area of study for others within the company.

When looking at the needs of the consumer mechanical engineering team once again, one area not covered by the intranet site proposed in this field project is the interaction with Green's industrial design department. Industrial design is a department the mechanical engineering team works closely with, but the two teams have always had trouble sharing information effectively. Studying the interaction of these two departments and determining a better method of communication utilizing the company intranet could be the next logical addition to the site this project is creating.

A third area this field project did not cover was whether Confluence and SharePoint really are the best two intranet systems for Green Industries to support. This project's scope worked within the confines of the current IT system. Researching other systems available on the market today and possibly making recommendations of a better system to use could be very beneficial to the company.

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Appendices

Appendix A: Definitions of Scrolling, Paging, Linking, and Framing (Gonzalez de Cosio and Dyson 2002)

Scrolling:

"Scrolling can be defined as the vertical or horizontal movement of the page on screen. This movement can be done through the use of a scroll-bar which slides up and down, right and left and helps the reader go through the text."

Paging:

"The paging manipulation tries to emulate turning the pages of a book. The reader will click on a specific mark on the page and a new page appears, completely changing the screen. This 'does not pronounce the linearity very well' and makes it difficult to know at which level of depth the reader is."

Linking:

"Links are the connections of nodes of information contained in a hypertext document, such as a web page. A 'node is a sort of stimulus material that can be activated and presented to a user.' Links show readers the departure point to an explicit object when they are activated, they are mere indicators that another related content can be accessed. By choosing and responding to links, readers interact with the hypertext system. 'If a word or a picture is highlighted, the reader has to understand that it points to a relevant development of the text.'"

Framing:

"The use of frames on a web page implies the division of the page into separate web pages next to each other. The frames are contained within a frameset, which defines the position and dimension of each frame; they might have a border, a scroll bar, different color or any sign to let the reader know that there are other active spaces that can be clicked on. One or two of the frames have fixed text that usually corresponds to the table of contents or the navigation bar; the other frames change their contents depending on the link that the reader accesses."

Appendix B: Study Results

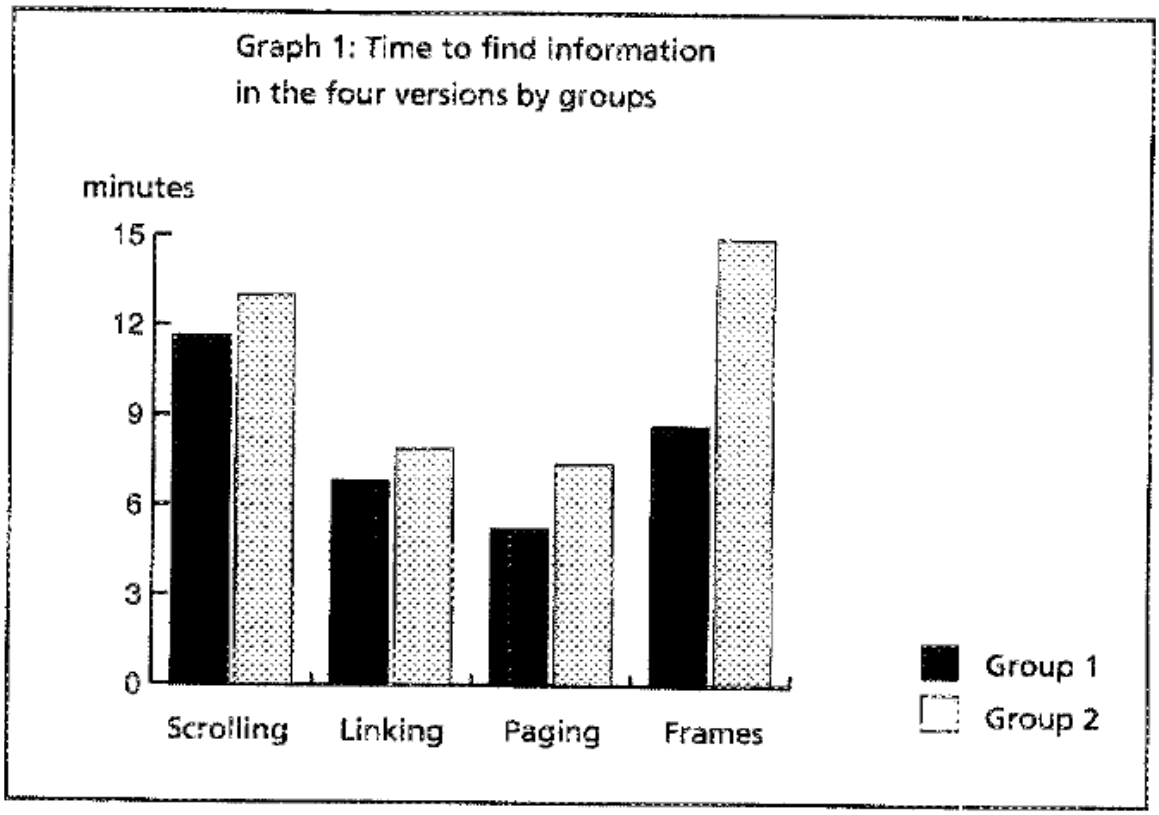

Figure A1: Time to Find Information Using the Four Types of Page Layouts (Gonzalez de Cosio and Dyson 2002).

Appendix C: Consumer Mech Eng Department Intranet Site Survey
1/15/09

Hi Team-

We are looking at creating an intranet-based resource for the consumer ME department in order to better communicate and share information. Providing one central location for all of the product development process information is one of the main purposes of this site (including links to the most recent forms needed, etc), but there are several other areas we've thought of adding. Some of them include:

- ME team org chart with a list of projects everyone has worked on in the past.
- Company org charts (Kansas City, Taiwan, etc).
- Knowledge Management site (shared experiences, test results, bulletin board to post questions, etc).
- Useful links (SharePoint sites, engineering homepage, web resources, other teams' web sites, etc).
- Training documents.

These are just some initial thoughts. Our questions for you are:

1. What information would you find useful on a site like this?

2. Do you have any recommendations for how you'd like to see the information presented?

3. Do you have any interest in gathering information for any possible sections that might be included?

4. What do you waste the most time searching for when looking for information?

5. Do you utilize any of the design guidelines currently in the Mech_Eng Reference Data directory?
   a. If not, why?
      a. Too hard to find anything.
      b. Didn't know it was out there.
      c. Information is out of date.
      d. _____

6. What specific areas would you like information more readily available?
    e. Design
    f. Materials
    g. Processes
    h. _____
7. Where do you usually start your search when a design question arises?
    i. Internet
    j. Team member
    k. Mech Eng directory
    l. _____
8. Would you find a searchable central database of information useful?
    m. Yes
    n. No

Appendix D: Summary of Consumer Mechanical Engineering Department Intranet Site Survey Responses (20 team members responded to the survey)

1. **<u>What information would you find useful on a site like this?</u>**

- List of commonly used resins and their pros/cons and where used.
- Taiwan org chart with pics
- Links to commonly used forms (doc req, ECO form, testing form, status report, prototype request, shipping request, purchase req, etc)
- Calendar of relevant team events.
- Office map with team member's names, photo, and areas of specialty.
- List of tools on workbench.
- List of catalogs and vendors in team library.
- A place to add links to useful websites.
- List of commonly used metals, platings, etc with where used and pro/con information.
- Information on commonly used connectors.
- Information on decoration processes.
- Show a randomly selected "ME Fact of the Day" on the homepage that is updated daily. Users would be able to add new information to the list that it is selected from.
- A flowchart showing the mechanical design process, including links to relevant documents and required forms. Examples of completed forms might also be useful.
- Cable and wire UL information.
- PDM works tips & trips
- Summary of mechanical related ELOT testing procedure
- Customer return/repair data, broken down by projects (would be good to have in the same location as the project experience info).
- Project responsibilities list
- Test Report templates for ELOT tests that we commonly conduct here in Kansas City
- List of helpful websites containing helpful resources & information
- I like the bulletin board idea to ask questions for the team without sending out a blanket email, but it would depend on people committing to checking it regularly to answer questions, not just ask them.
- Quick links to all of the files under the ME Forms folder and other forms which are used on a regular basis would be useful.
- Audio / acoustic design guidelines
- Links to vendor websites
- Links to test procedures, or commonly used Master List documents
- Links to tear-downs of competitor devices
- Design review forms
- Stuff above looks good. I'd also like a list of special tools and their "owners" or "expert users."
- Common notes for drawings

- Material differences and common applications and examples of past applications
- Helpful informational internet links
- I would like to see links page that is separated by category with an interactive ranking column. For example, if there are 4 websites under the MATERIALS category (i.e. www.matweb.com) the user could rank this and/or select the highest ranked website.
- Some kind of material cross-reference would be great. We have part numbers for our plastics but don't call them out on BOMs, so the only way to find where a material has been used before is to ask around or search through drawings manually. Along with that, if the key characteristics of the material (ie "cold environment, high cost, overmoldable with TPE) could be summarized it could also save some time in trying to deduce them based on their previous applications. And if they need additional paint or coatings to function in their environment that would be good to know too.
- I would love to see an area about the different types of materials (specifically plastics, but also rubbers, foams, metals, etc). There so many types, that it is difficult to know what each is, and the pros/cons of each. To begin with, some sort of "family tree" showing the broadest material category at the top, and then breaking the categories down from their (like our BOM trees). Included in this could be the full names of the materials, along with their more common acronyms. More details (specs, common applications, pros/cons, Green experiences. could then be added about each material or family.
- Painting Specs for various types of Paint/base materials.
- Cosmos "set up" recommendations for stress analysis on spring contacts
- Stainless Steel specifications of various grades and when to use what where.
- Preferred material thicknesses available in Taiwan.
- Elastomer selection Guide
- Draft required for various textures.
- Lessons learned on: Lenses, Gaskets, Mounts, keypads
- Preferred plastic Resins for various applications (fuel, high stress, high temp, etc)
- Maybe a **vendor list**? Break it down by commodity, and keep it to vendors Green has had success with.
- Quick links to useful things that I don't use everyday (such as org charts, Taiwan addresses, travel request forms, etc.)
- A searchable way to document lessons learned from past projects to make sure we don't repeat the same mistakes. Materials info and tests we've run with different materials would be good too.
- Link to ME/ID meeting summary for each sector.
- Link to masterlist
- Link to findpart

2. **Do you have any recommendations for how you'd like to see the information presented?**

- Keep it familiar. A website with links would be easiest. Make the data searchable so that we can "Google it" to find what we're looking for quickly and easily.
- Lots of graphics.
- Breakdown of information using many layers of pages (main page with broad links to pages with narrower subcategories and so on).
- Only a small amount of information per page (a new page for information not related to information on other pages).
- By subject with a search option.
- Some websites are hard to use because they present too much information in a single screen.
- Maybe creating a tab at the top of the screen for each main section of the site would be useful.
- If it could be searchable, it would be easier than trying to mine through folders of information like we currently do with the Design guidelines and project folders. Also, if there were some sort of site map or other overview to help find out where to look for information, that would be useful.
- Any format that is easy to access and navigate through is fine with me.
- Make it simple – don't crowd too much onto each page
- Easy to read format with no broken links! The eng support and purchasing web sites either have broken links or other problems directly opening pdf and excel files from their web sites.
- needs to be easy to use, maintain, and add information (Surprise surprise)
- It would be helpful if there were categorized folders and anybody could easily dump links and add whatever useful information they might have.
- I am a fan of general headlines with detailed drop down menus.
- If the search function is effective that will help a lot. Also, if you could have an array of icons all on one page that would be much easier than having to search through several levels of categorization to get to them. Often things fall into more than one category, so if they're one level deep or less it's very helpful.
- This would be one big family tree, to big to view the info on a single page. If taking a web form, you could probably simply have the "tree structure" (similar to our FindPart BOMs) on the side of the page, with the detailed info about that particular material or family on that page. Clicking on links in the tree structure would take you to that page.
- In very basic subgroups such as:
    - ENGXXX docs
    - Design Guides: Plastics, Spring Contacts, Plating, Painting
    - Forms: ECO, Doc Req, Reliability test, Material Transfer,
    - Internet Links:
    - Reference Info: Conversions, facility map, Employee search, Taiwan currency conversion, etc

- For Test Results, NRE, Lessons Learned forms, an "upload" feature would be neat. However, since we store it elsewhere on the network, "upload" would really mean **"add new link."**
- A **"Recently Added/Updated"** area of the front page would let us see when people add new experiences/forms/etc.
- This is probably outside the scope of this project, but I would like to see Green have a one stop intranet home page that has links to everything employees need. One of the links would be the ME page, which would include links to everything that ME's need.
- Consider making this new ME webpage can be available from the xxx.xxxxx.com/Engineering site, much like component eng, compliance eng, PCB design, are. That way you will already have one-click link access to the other "one stop shopping" efforts: (masterlist; findpart)

3. <u>Do you have any interest in gathering information for any possible sections that might be included?</u>

- Yes: Would take charge of the library/vendor sample data and tool inventory.
- Yes (IIIIIIIII).
- I would be willing to help put together a test report template for vibe testing. I think this would be valuable since we usually are pretty lax in putting together a report after we run tests, other than just saying we passed or failed. Often any detailed notes of the testing and results is usually just recorded in my design notebook. This makes it hard to find later on, and impossible for other engineers to view.
- I can contribute to CAD/PDM news, materials and finishes, etc.
- I would be most interested in materials if I were to be persuaded.
- I would be happy to help. The searching for info to include would probably help me better understand the topic.
- PDM. I would be willing to help with other areas if needed.

4. <u>What do you waste the most time searching for when looking for information?</u>

- Material properties.
- Which assemblies and parts go with a particular project.
- Proper procedure in Green product design
- Phone numbers (need easier access to documentation on how to use phone system to full capacity…search function, etc…)
- Links to forms and when and how to use them in flow chart (this may already be done, but I don't know where it is…needs a prominent place on the site).
- Figuring out which designs use a certain material or process.
- Materials: Which are good/bad/recommended for certain applications.
- Researching different materials, such as tapes, adhesives, paints and plastics seems to take a lot of time. Creating a searchable list of mechanical parts for each product, with materials and finishes for each part might be helpful. For example,

this would allow the user to quickly determine if we are currently using a specific type of plastic resin, and if so, what products it is used on.

- Digging and sorting possible wire connectors to use.
- Trying to find the location of forms such as the Design Review notes
- Trying to find the various locations that info from previous projects is saved, such as tooling costs, test reports, etc.
- Looking for products we have made in the past with a similar feature or to get ideas for a current project. I also have spent time searching for electrical connectors for certain applications.
- It is often difficult to figure out which form or document on the master list contains the information needed
- Material coating info
- Looking for standards like ASTM, UL, ASME, IEEE: Sometimes someone has already downloaded a standard and no one knows about it.
- I am very uniform with my time wasting. Perhaps a STATE OF THE ART page with anything new and exciting.
- Outside of FindPart-related searches, I would say project experiences and costs. It would be great to have a centralized portal for these documents.
- Things like Plating call-outs on gold plated spring contacts, Paint Specs (RCA), Best DXF and STEP formats for CADStar import, etc.
- The right templates to use (SW, infopath,)
- Vendor provided component drawings
- ISO specifications (should be in component eng library, but many times is not.)

Appendix E: Meeting Minutes from ME/Software Web Developers (1/13/09)

Attendees: RS (software), KC (software), JM (mechanical engineering), RL (mechanical engineering), JW (mechanical engineering), JR (mechanical engineering)

- Sharepoint (SP) and Confluence (C) probably only options at the moment.
- C better if lots of people modifying each document.
- SP has a wiki in it, too.
- SP has web tools to use.
- SP handles discussion board and announcements.
- SP: limit on size, total # of files??
    - Check with IT.
- SP: Some file types don't work (.exe's, etc).
    - Check with IT.
- SP can search within one site, including sub-sites.
- SP can control permissions easily.
- SP: RS and KC can help with organization, set up, etc of pages.
- SP can do limited release before going live.
- SP: alerts can be set up to let people know when new postings, etc.
    - Have discussion board area for people to post questions, etc.
- SP: will need to think about how to grant access to limited sites.
    - For other SP sites, could have list of all links, but could control access to them.
- SP: need security group from IT to give access
    - Send IT list of people to put in a group.
- SP: go to IT SP site to put in a page request.
- SP: is there a limitation for the number of revisions SP can save on record?
- SP: If requesting, we would want a "collaboration site."

Appendix F: Product Development Process Page Layout

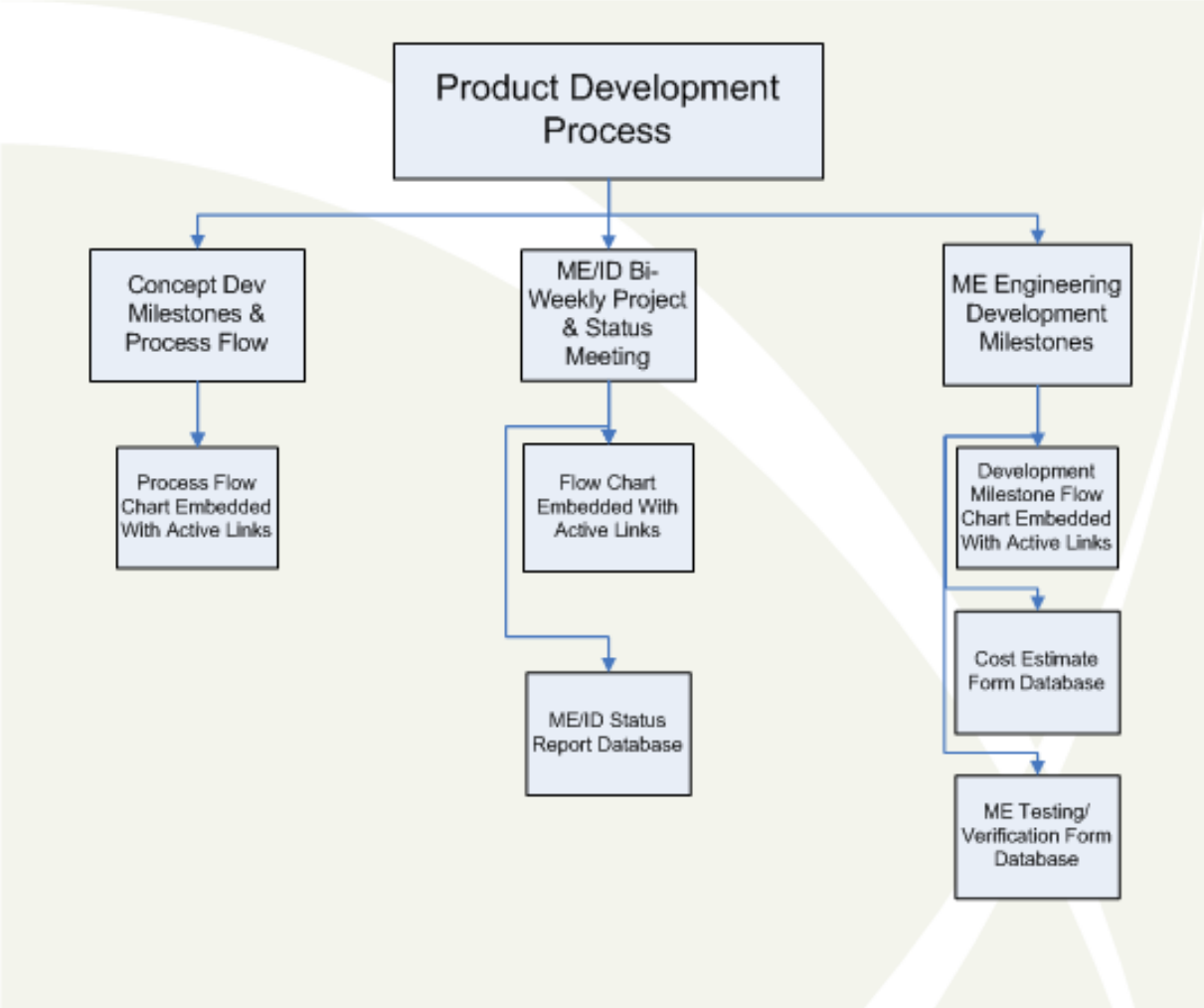

Figure A2

Appendix G: Useful Links Page Layout

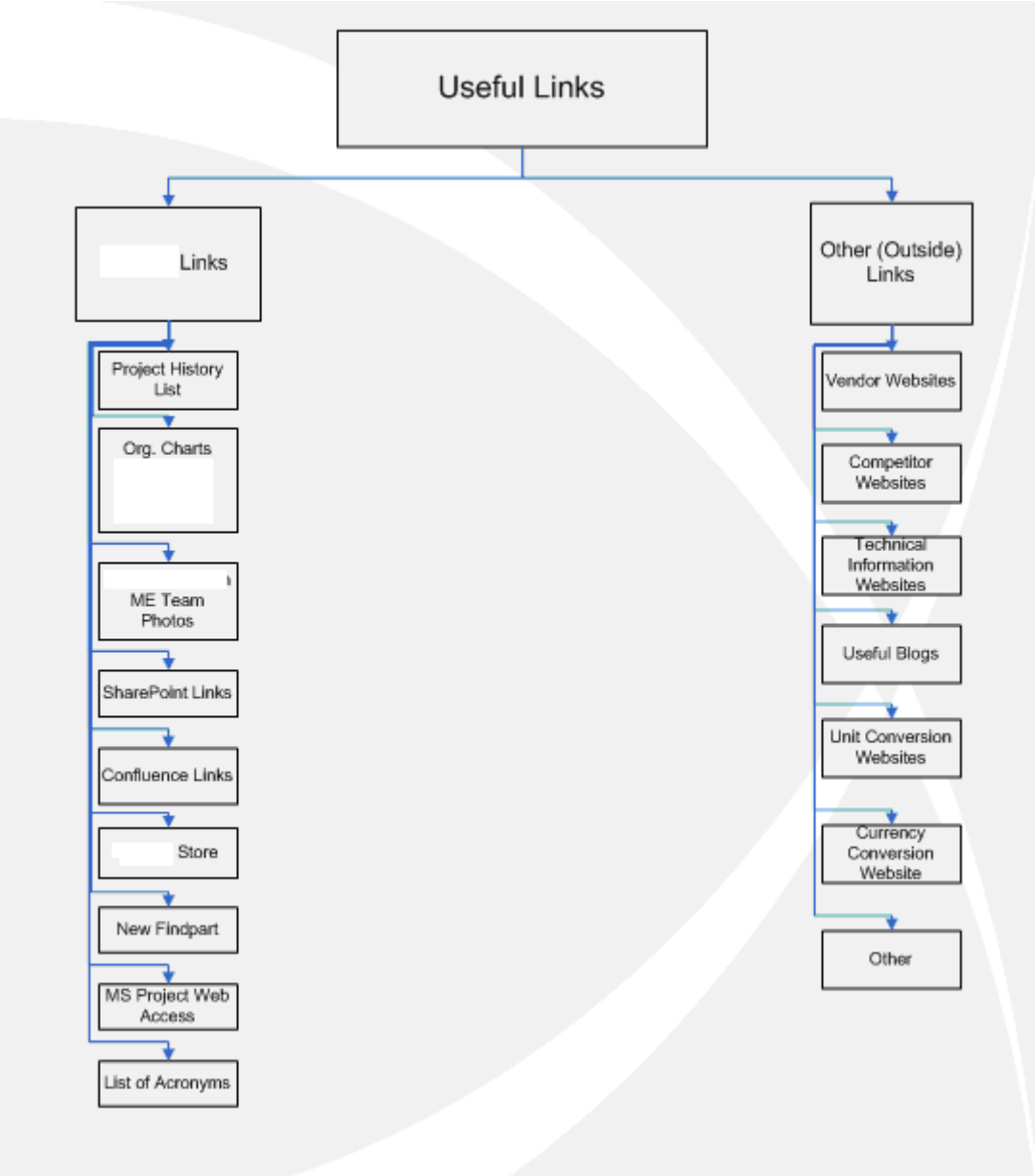

Figure A3