Knowledge Management and Organization of the Design/Build/Fly Competition and the Capstone Senior Design Class

by

Anna M. Royce

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Mechanical Engineering (Honors Scholar)

Presented May 2nd 2014
Commencement June 2014

AN ABSTRACT OF THE THESIS OF

Anna M. Royce for the degree of Honors Baccalaureate of Science in Mechanical Engineering presented on May 2, 2014. Title: Knowledge Management and Organization of the Design/Build/Fly Competition and the Capstone Senior Design Class

Abstract approved: ____

Javier Calvo-Amodio

The Oregon State University chapter of American Institute of Astronautics and Aeronautics competed in the Design/Build/Fly competition for the second time during the 2013/2014 school year. This chapter began at Oregon State in 2012 and still lacks an organized management system for the Design/Build/Fly team that could allow OSU to be more successful at competition. The team currently consists of four senior project teams and multiple club members, which creates many communication challenges. In the past students have not received clear defined projects and have left the group. This has left a very small group to complete the project before competition. The team wants to implement a system that assists the chapter with organizing documents, communicating with all members, delegating projects, and collaborating within different groups. Each of these are challenges that the chapter currently faces. The rapid turnover rate within the chapter is one of the contributing factors to these issues and must be addressed. The purpose of this thesis is to determine important characteristics of a knowledge management system that would improve the team's organization and recommend methods for implementing these characteristics.

Key Words: Knowledge Management, Senior Capstone Design, OSU AIAA, Design/Build/Fly, and Organizational Structure

Corresponding e-mail address: anna.m.royce@gmail.com

Knowledge Management and Organization of the Design/Build/Fly Competition and the Capstone Senior Design Class

by

Anna M. Royce

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Mechanical Engineering (Honors Scholar)

Presented May 2, 2014
Commencement June 2014

Honors Baccalaureate of Science in Mechanical Engineering project of Anna M. Royce presented on May 2, 2014.

APPROVED:

____

Mentor, representing Industrial Engineering

____

Committee Member, representing Mechanical Engineering

____

Committee Member

____

Dean, University Honors College

I understand that my project will become part of the permanent collection of Oregon State University, Honor's College. My signature below authorizes release of my project to any reader upon request.

____

Anna M. Royce, Author

TABLE OF CONTENTS

1. Introduction 1

DBF OSU Team 3
DBF Senior Project 3
Challenges 4
Problem Statement 4

2. Literature Review 6

Knowledge Transfer 6
Knowledge Creation 7
Leadership Role 8
Case Studies 9

3. Research Methodology 11

Organizational Structure 11
Knowledge Management System Implementations 13

4. Results 16

Survey Data 16

5. Conclusion and Future Work 20

Response to Survey 20
Recommendations 21
Conclusion 22

6. References 24

LIST OF FIGURES

Figure 1 - 2012/2013 Oregon State Design/Build/Fly team 3

Figure 2 - The knowledge conversion process [3] 7

Figure 3 - Organizational structure of 2013 -2014 DBF team 13

Figure 4 - How well the team believed that the website accomplished collaboration between subgroups ... 16

Figure 5 - How well the team believed the website accomplished communication between subgroups and chapter members 17

Figure 6 - How much the team believed that the website contributed to the success of the final project and design report 17

Figure 7 - Will the site be useful in future years 18

Knowledge Management and Organization of the Design/Build/Fly Competition and the Capstone Senior Design Class

1. Introduction

ABET Requirements and Application at Oregon State

In order to graduate from an ABET accredited engineering program students must complete the design of a technical project. This project is often referred to as senior project or capstone project. Through this project, students must show that they are able to design "a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability" [1]. There are many student competitions that meet these requirements. In the school of Mechanical Manufacturing and Industrial Engineering (MIME) at Oregon State University (OSU) two specific examples of these types of projects are the Design/Build/Fly (DBF) competition and the Experimental Sounding Rocket Association (ESRA) Intercollegiate Rocket Engineering Competition (IREC). The Society of Automotive Engineers (SAE) also offers many student competitions that can be used as senior projects. This paper will explore various knowledge management system aspects that can support a partnership between senior capstone design and student design competitions.

The SAE projects at Oregon State have been mainly designed and manufactured by capstone students over the past ten years and have achieved great success. OSU competes in both the Baja and Formula competitions, both of which are large-scale projects, which require designing and building a full-scale vehicle that fits a driver. Teams often use the design from previous years and consider ways to improve the product. Each project requires many capstone students who are all assigned to a specific part of one of the SAE projects. OSU's SAE program has won many championships and has created a model for other student competition teams that are combined with senior capstone course.

DBF and ESRA Competitions

DBF and ESRA competitions are annual competitions similar to SAE competitions, but the projects are on a smaller scale. These projects are much smaller, and often give students shorter time periods to complete the projects, so the structure from OSU's SAE program is not directly relatable. The DBF competition challenges students to design an RC aircraft that can complete a certain mission profile, usually consisting of three different flights. This mission profile is changed every year, but often has similar aspects to previous years.

The Design Build Fly (DBF) competition is an international competition that is sponsored by the American Institute of Aeronautics and Astronautics (AIAA). The competition is hosted by Cessna and Raytheon and switches locations between Wichita, Kansas and Tucson, Arizona each year. Every year a new mission profile is created that the teams must complete. This profile consists of different flights that the students must complete with their aircraft. Although the mission is changed each year in order to encourage students to create new ideas, the missions often have similar aspects. Because of this students are able to use information gained during previous years of competition. The DBF competition also requires students to write a design report about their aircraft. This report requires information about why students made certain design decisions and how they expect the aircraft to perform at competition. Many teams cite aircraft from previous years as support for their design. This is why it is important to have a knowledge management system that manages the knowledge gained from previous designs.

DBF OSU Team

The 2013- 2014 DBF competition will be the second year that Oregon State competes in the competition. The competition. The 2012 – 2013 team is shown below in

Figure **1** at competition with the plane. Most of the knowledge that was gained by the 2012 – 2013 team was lost because most of the students who worked on the project left OSU or moved on to other projects. This helped the team to understand the importance of a knowledge management system.

Figure 1 - 2012/2013 Oregon State Design/Build/Fly team

DBF Senior Project

The OSU team is unique in that twelve of the students dedicated to the project are using the aircraft as their senior capstone project. This allows those twelve students to dedicate more time and energy to the project, because it is a part of their course, however, this also requires those students to do additional work on the project, such as a separate design report. The competition requires that at least one third of the team consist of non-seniors, so the project also has chapter members from OSU AIAA who commit to work on the project. One of the biggest challenges has been to bring the two separate groups of people together as a team. In order for the team to be successful everyone must communicate and have access to the project.

Challenges

The biggest challenge with competing in these events and using them as capstone projects is that knowledge is often lost from year to year due to the high turnover rate of students. Students usually graduate immediately after completing their senior project, often taking all of the knowledge that they have gained with them. In order to address this issue, the creation and management of knowledge is a crucial element of the organizational operation. This management system must allow information to be stored in a way that allows the team to maintain knowledge and add to it each year. This system must be an active system that allows knowledge to be collected and captured as it is created. By being active, the system will integrate data collection into the team's everyday workflow. The system will require a team leader who understands the knowledge management system and keeps information up to date. This leader will be responsible for enabling opportunities for students to create knowledge through meetings, work sessions, and other methods discussed in this paper.

Problem Statement

Completing student competitions through the senior Capstone project provides a structure where the design and construction process can be managed and observed. In the past Capstone students have generated a great deal of knowledge, but this knowledge was not passed on to the chapter members or future Capstone students. An *ad-hoc* knowledge management system is required to accommodate the specific needs of the DBF project. The goal of this thesis is to determine which important characteristics the proposed knowledge management system should possess in order for the OSU DBF team to consistently build competitive aircraft.

The results from this thesis will provide the foundations to design and implement a knowledge management system for the DBF team.

2. Literature Review

This section discusses different reports that look at important aspects of a knowledge management system. A case study of one system is also considered. This will create a model for the OSU DBF team to apply to their project.

Knowledge Transfer

The OSU Design/Build/Fly team will gain success each competition year if there is a system that allows knowledge to be associated with the organization, instead of the individuals who gain the knowledge while working on the project, this is known as organizational knowledge creation theory [2]. This knowledge must be passed on and managed in multiple different ways in order to ensure that it is maintained within the group. According to Ikujiro Nonaka in his research on knowledge management there are four methods of transferring knowledge through socialization, externalization, combination, and internalization [3]. These four methods of transfer convert knowledge back and forth from explicit to tacit knowledge in a cycle. Explicit knowledge is knowledge that is physically documented, while tacit knowledge is an individual's knowledge that is gained through experience [3]. Each of these four methods must be implemented in the knowledge management system in order to ensure that the knowledge is maintained.

Socialization is a method that turns individual tacit knowledge into group tacit knowledge. This is how individual knowledge gained from experience can be spread to the organization. Externalization converts tacit knowledge into explicit knowledge. This is done when a group or individual records the knowledge that they have gained through experience. Combination converts the individual explicit knowledge to the group. Internalization converts explicit knowledge to tacit knowledge, through the group using recorded information to complete a process. When information is cycled through an organization using these four methods the knowledge gained will me stored in different ways, which also allow knowledge to be created [3].

The process through which knowledge is transferred through these four methods is a spiral because the because the knowledge is continuously built upon.

Figure **2** shows how knowledge is transferred from tacit to explicit and from individuals to groups using these methods.

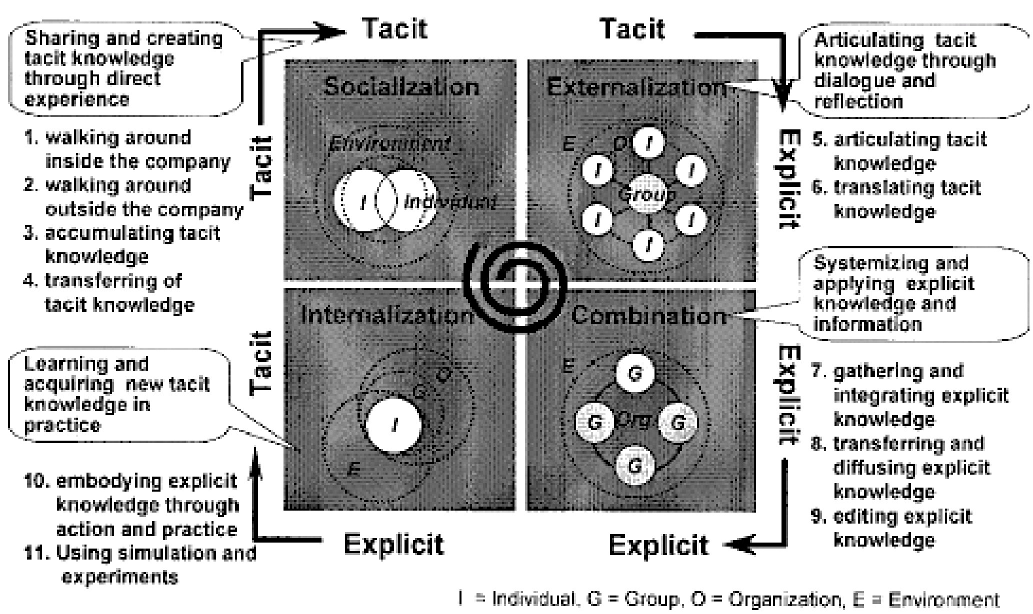

Figure 2 - The knowledge conversion process [2, pp. 5]

Knowledge Creation

Student organizations must be able to use the knowledge that was stored with the organization, but they also must continue to create and store new knowledge. Nonaka's research claims that knowledge is created in the ba, which is a Japanese word that means space. The ba is defined as either a time or space where knowledge can be created or shared with an organization [2]. Nonaka determined four different types of ba; originating ba, interacting ba, cyber ba, and exercising ba. The originating ba is an environment where organizations meet face to face to create knowledge through individual's ideas and group discussions. The interacting ba is a place where individuals within an organization take knowledge from the group and turn it into explicit knowledge. The cyber ba is a digital space. It allows members of an organization to create and store knowledge using cyberspace. This should give all members of the organization access to the knowledge that is being created. Finally, the exercising ba is a space where the explicit knowledge from the group is put into practice that supports the group. This also creates tacit knowledge from individual's experiences [2].

In order to have a successful organization each of these ba must be available to the group. The bas allow knowledge to be transferred using socialization, externalization, combination, and internalization. A leader or leadership team that manages the team must create these ba. The leader is not responsible for creating the knowledge necessary to complete a project, but they must create opportunities for this knowledge to be created. They are responsible for enabling the group to use information from previous years, and also create their own knowledge for themselves and future teams. The leader or leaders can do this by providing resources, scheduling group meetings, and making themselves available to the group.

Leadership Role

Nonaka describes the leadership role as a key position in the knowledge creation process. The leaders are not responsible for the direct creation of knowledge, however they are responsible for enabling the process [2]. The leader must provide the group with resources that allow them to go through the knowledge creation process. They are also responsible for creating the ba where the group creates knowledge. Nonaka states that the leaders are "knowledge activists", or people who spread knowledge and provide a new perspective that individuals working on a project may not see.

Case Studies

Case studies that look at the successful implementation of a knowledge management system in a high turnover environment are rare. One of the few examples can be found in the book Case Studies in Knowledge Management [4]. This book states that most knowledge management systems use a combination of theoretical models to create their knowledge management system, however many of the plans use Nonaka's work as a basis for their model. One example of a case similar to the DBF group is an international IT company called "CITE". Between 1999 and 2002 "CITE" went through significant growth, which was expected to continue. During this time the company experienced a high turnover rate similar to the DBF team. The company determined that the turnover rate lead to a significant loss in knowledge, which affected the company's revenue. "CITE" decided to implement a system that allowed the knowledge to remain with the company. Researchers were brought to the company to interview employees and give suggestions for a knowledge management system.

The final model that was created for "CITE" focused on training, management, communication, technology and corporate culture. The company attempted to address these issues, but was given five recommendations that would improve the system. The solution that improved the organization applied five key recommendations:

- **Recommendation 1 (R1):** Create a chief knowledge officer position. This person will act in a leadership role similar to what Nonaka described.
- **Recommendation 2 (R2):** Develop a specialized training program for their knowledge management system that allows new employees to understand the knowledge management system.

- **Recommendation 3 (R3):** Shift the corporate culture to encourage the spread of tacit knowledge between employees. This would create a very interactive work environment.
- **Recommendation 4 (R4):** Develop a communication mechanism between employees and customers.
- **Recommendation 5 (R5):** Improve technical resources because the limited features of the system were keeping employees from using the system.

If these five key recommendations are implemented at “CITE” it is believed that the company’s information system will improve, and the company will be more successful.

3. Research Methodology

The research consists of a case study of the 2013 – 2014 OSU DBF team and focused on the organizational structure of the team and the knowledge management system. The organizational structure included leadership positions that were responsible for the creation and spread of knowledge within the group. For the knowledge management system it was important to note key characteristics that were required and how they could be implemented in the future. A model was created using Nonaka's theory discussed in Section 2, and pieces of the model were introduced such as group meetings, and team website, and a lab space.

Organizational Structure

The team implemented a hierarchal organizational structure. This structure consisted of two faculty advisors, who both had experience in the aerospace industry and could provide technical advice and one faculty mentor, who advised the seniors involved in capstone project.

This year there were two student leaders, a project lead or chief engineer, and a team manager. The project lead needed to be a student who had technical expertise with aerospace projects, and had preferably worked with the DBF team on a previous competition. This should not be a capstone student, because they were focused on only one component of the project, while the team lead needed to oversee everything. This student was responsible for overseeing all of the technical aspects of the project such as component design, testing, and manufacturing. They were not responsible for physically completing these parts of the project, but they must make sure that the students were working in the right direction, and were able to complete everything and act as a “knowledge activist”. The team manager was responsible for the organization of the project. They needed to work with the team to create a schedule and see that everything stayed on track. This person also needed to schedule meetings for the group, and oversee communication and collaboration between groups. These leaders are responsible for creating the ba for the DBF team. They are key components to the knowledge management system because they act as a chief knowledge officer as one of the suggestions from the “CITE” case study.

**The students working on the DBF plane were broken up into four subgroups that each focus on a specific
specific component of the aircraft. Because an aircraft is such a complex structure it was important to have
important to have multiple different groups working on the design. After considering the major components of
components of an aircraft, and looking at how other DBF teams organized their groups, it was determined that
determined that the four groups should be aerodynamics, payload, propulsion/controls, and structures. Each of
structures. Each of these groups had three senior capstone members and a number of chapter members who
members who were interested in focusing on the component. The aerodynamics group was responsible for
responsible for designing the wing of the aircraft, the payload group was responsible for the payload
payload configuration and center of gravity, the propulsion/controls group was responsible for all of the control
of the control surfaces, including the tail and flaps, the motor, and the propeller on the aircraft, and the
and the structures group was responsible for the fuselage and landing gear. Each of these subsystems must be
subsystems must be designed, manufactured, and implemented into the aircraft, which makes them applicable
them applicable to the senior design class. The entire team organizational structure for the 2013 – 2014 team is
2014 team is shown in**

Figure **3**.

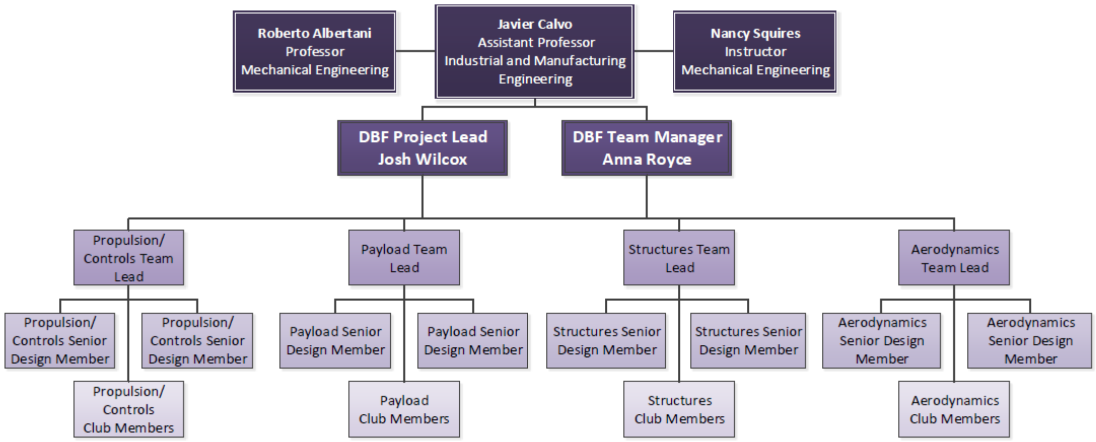

Figure 3 - Organizational structure of 2013 -2014 DBF team

<u>Knowledge Management System Implementations</u>

In order for knowledge to be transferred the leadership team must create the four different types of ba that were discussed in Section 2. The 2013 – 2014 team used different methods to implement the originating, interacting, cyber, and exercising ba.

The originating ba was created through weekly meetings. These meetings allowed all of the team members to meet face to face and update the rest of the group on the progress of each subcomponent. During these meetings other team members have the opportunity to help or give suggestions for specific subcomponents. Advisors often attended the meetings and helped direct the project. These meetings improve communication between everyone involved on the project, which is a key component of a knowledge management system.

The interacting ba was created in two different ways. One of these ways was through the formal writing of the design reports. These reports took much of the tacit knowledge that the team had gained and converted it to explicit knowledge by writing it down for future groups to use. This can be found in both the competition design report and the design report for each senior capstone team. A documentation system was also implemented that allowed the team to record each of the smaller projects that they completed. This system was a simple worksheet for process tips, mainly of the manufacturing processes. These documents will be available for future teams to use when determining manufacturing methods. This ba encourages the group to share there knowledge with the group and create an interactive environment similar to what was suggested to "CITE" in the case study in Section 2.

The cyber ba was created through a Google site. Access to this site was given to all of the team members so that they could see the progress of the project. This website had space for manufacturing and testing pictures, solid model designs, and resources that were used for the project. This website is managed by the project manager, but all of the team members have access to add anything that they feel will benefit the team. The website has a page for each subgroup and one page for general information. This is an effort to improve the team's technical resources. As stated in the "CITE" case study, it will be important to have a training session that introduces the team to all the aspects available on the site, and encourages use.

The final ba is the exercising ba. This ba is created through the group's physical lab space. The lab is an area where the team can manufacture the aircraft. This creates tacit knowledge through experience.

These four ba allow the DBF team to transfer knowledge through externalization, socialization, combination, and internalization. Socialization is where an individual's tacit knowledge is transferred to the entire group. This occurs in the originating ba during the weekly meetings. Externalization is when tacit knowledge is converted to explicit knowledge. This is done in the interacting ba when the knowledge gained during the build process is recorded on design reports and other forms of documentation. Combination is where individual explicit knowledge is converted to group explicit knowledge. This occurs in the cyber ba where the documentation and resources are posted for all of the chapter members both present and future. Finally, internalization occurs in the exercising ba when the group uses the recorded knowledge to build their own project.

If the group is able to continuously transfer and store knowledge, the organization will have more information to build their project on, and will most likely be more successful. In order to do this the entire group must use the knowledge management methods, such as the website, on a regular basis. This means that the tools must be easily accessible and simple to use. The student leaders are responsible for encouraging the use of these tools and ensuring that the knowledge is managed within the organization.

4. Results

Towards the end of the project results were gathered through the form of a survey. The author of this thesis was also a member of the team and therefore has personal insight to contribute to the results as well.

Survey Data

The team was surveyed on their opinions of the group organization and the knowledge management. The main focus of the survey was the group website. The average group response to the website was that the website was fairly easy to use and somewhat beneficial to the team. The group ranged from neither agreeing nor disagreeing to agreeing on the usefulness of the website and the ease of use. The group did agree however that the site would be useful to teams in future years, which was the primary goal. The group was asked three questions on how well they thought that the goals of the website were accomplished. The results of these questions are shown in Figures 4 – 6.

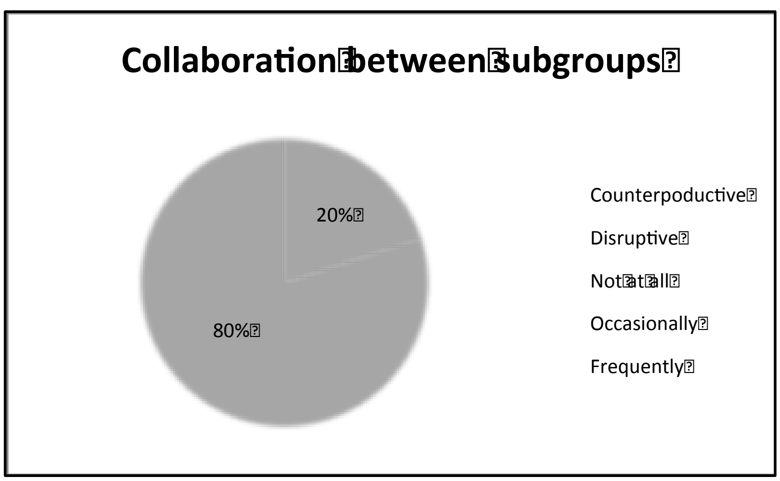

Figure 4 - How well the team believed that the website accomplished collaboration between subgroups

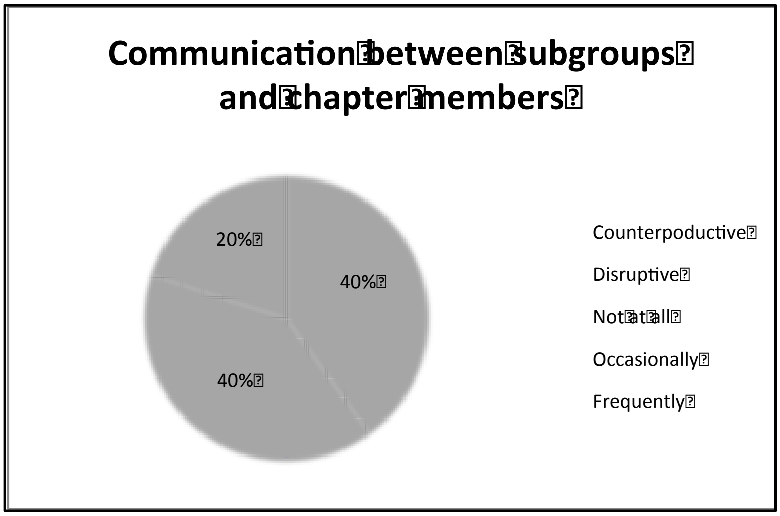

Figure 5 - How well the team believed the website accomplished communication between subgroups and chapter members

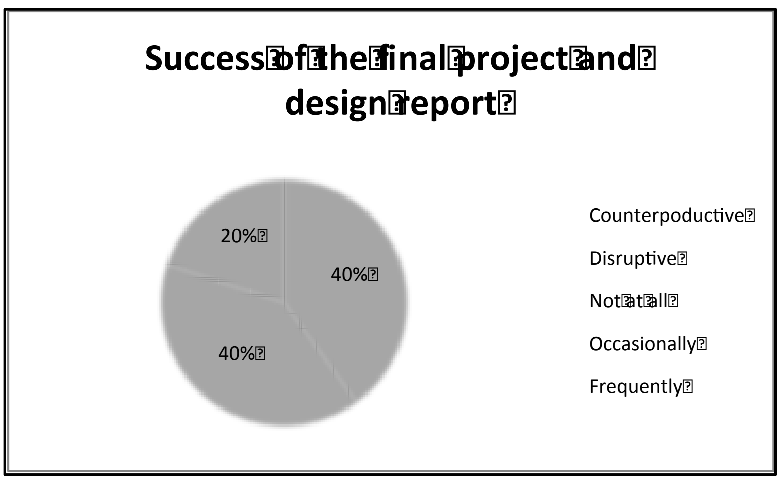

Figure 6 - How much the team believed that the website contributed to the success of the final project and design report

The above results show that the majority of the team believed that that the website contributed to the group's communication either occasionally, or not at all. Communication is a key element of a knowledge management system, as shown in the CITE case study in Section 3. This means that there is a need to improve the website to create better communication between the groups and chapter members. From the information collected in the survey it is clear that the website is a useful tool for managing knowledge, specifically long term, which the team agrees with as shown in Figure 7.

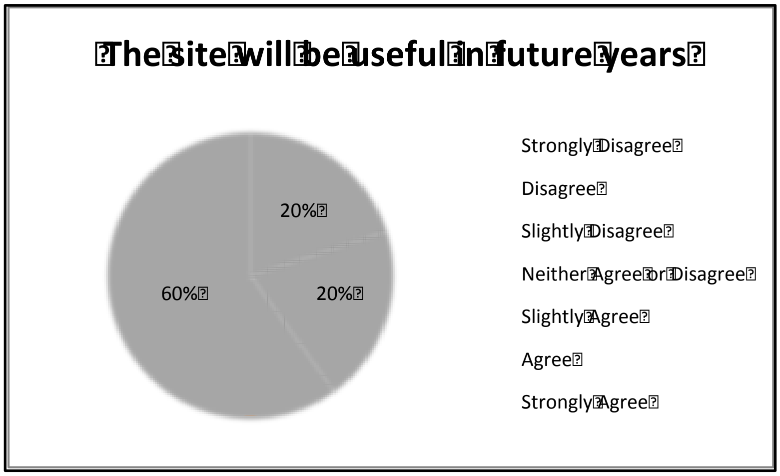

Figure 7 - Will the site be useful in future years

The data in Figure 7 shows that the team believes that the site will be a useful tool for future years, but as shown in Figures 4 -6 improvement of the site is required in order for it to achieve it's whole purpose. The site will be greatly improved by placing a team manager responsible for continuously updating the site and encouraging the group to use the site more often.

The survey also had a comment section where students had the opportunity to say what information they wish they had had at the beginning of the project. The five responses were as follows:

> "How crucial starting early is"
>
> "Updated more frequently and make needed information available on the website because not all of the groups used it"
>
> "More information about manufacturing processes from last year"
>
> "Information of how teams in the past went through their design selection"

Responses to these comments that will help improve the OSU DBF project in the future will be discussed in the nest section. Each of these questions, along with the survey results shown in Figures 4 -6 reveal that communication is one of the teams biggest challenges, because all of these issues can be solved with better communication. Communication, both written and verbal is what allows knowledge to spread through an organization. As, shown in the “CITE” case study, communication, and creating an interactive culture that encourages communication are two key aspects of a knowledge management system.

The final question on the survey asked whether or not the student would want to participate on the project in future years. All of the responses to this question were yes, which means there is still interest in the project, and that there should be students with experience working on the project in future years.

The senior capstone members gave recommendations for the project in their final presentations. One recommendation that was given and agreed upon was that better integration between the subgroups is needed.

5. Conclusion and Future Work

This section discusses, based on the findings in this thesis, what the DBF team needs to do in the future in order to implement a knowledge management system that is beneficial to the team, and reaches the goals discussed in the “CITE” case study.

Response to Survey

Students working on the project this year wished that they would have understood the importance of starting the project as early as possible. Ideally a first prototype of the plane should be manufactured during the fall term. This is challenging for the capstone students because the fall term is dedicated to writing three different drafts of a design report. This schedule does not allow the capstone students to work on the manufacturing of the aircraft. In the future it is recommended that the chapter members build a prototype of the seniors design beginning week 5 of fall term. This prototype will help the team collect data through testing. This will allow the students to create tacit knowledge and spread that knowledge throughout the team.

Students also wanted the website to be updated more frequently so that they know the progress of all the groups. As stated earlier, the team manager should be responsible for updating the site weekly. This person also needs to encourage the other students working on the project to update their sections of the website. The more that the website is utilized, the more successful it will be as a knowledge management tool. This is an example of improving the team’s technical resources. As stated in the “CITE” case study, it is also important to provide training for the new members. Because of this, the team manager should take time during one of the first meetings to show members all aspects of the website and encourage them to use it frequently.

Students wanted more information on manufacturing processes that could be used to build the plane. As stated earlier, the senior capstone members spend the majority of their time fall term focusing on the design of the aircraft. Because of this, researching different manufacturing techniques is neglected. The OSU DBF team will save time for future teams by documenting manufacturing techniques and giving suggestions to future teams. This will also give the team time to consider new manufacturing methods that may improve the aircraft. This is a method of communication that occurs through externalization within the interacting ba.

The final request was for information on how the team made their design selection. Each capstone team is required to write an in depth design report that shows the design decisions that they made. The team as a whole also completed a design report of the entire project. Each of these reports are posted on the website so that teams can use them when designing future aircraft. These reports create the exercising ba where the team takes previous explicit knowledge and puts it into practice.

Recommendations

In the future it is recommended that a report lead should be added to the leadership team. This person is responsible for putting together the report. They are not responsible for writing the entire report, but must put together, edit, and submit the report. The report lead should create an outline using previous year's reports and the current year's mission profile. This outline will show what kind of data that the team needs to collect with testing and when they need to have that data and research done. This person is responsible for creating part of the exercising ba, and will both improve communication and encourage the spread of knowledge through the team.

One of the biggest struggles for this year's team was integration between the different groups and between capstone members and chapter members. If the teams are unable to work together, or there is not assistance from the chapter members, then it will be very difficult to manufacture a competitive aircraft. Continuous use of the website, and regular group meetings should help to solve this issue, but other solutions should be considered as well. There should also be one capstone member from each subgroup who is the contact for any members who are interested in the project or need information. This will create better communication for the team.

One thing that should be done is to add team integration to the payload group's responsibilities. This means that the payload group will be responsible for the integration of components and also see that all of the subgroups are working together. In order to do this an industrial engineer should be added to the payload and integration group. Industrial engineers are trained on how to run a process efficiently. They should be able to contribute knowledge that will improve the group's ability to complete the project.

Conclusion

The DBF project will continue in future years due to the continued interest of the students and the dedication of the faculty advisors. Assigning capstone members to the team is good because it dedicates those students to the project, however it will be important to also utilize the OSU AIAA chapter members and better integrate the teams. As discussed earlier, an industrial engineer would be able to assist in this area. The team will also need to create a schedule and defined leadership roles and responsibilities from the beginning of the project. Finally, the knowledge that has been documented on the website will be available to the next team, and they will also be expected to add to this knowledge for future teams.

Assigning a team leader, improving communication, changing the group culture towards working together more, and improving the technical resources of the group were all key elements of the "CITE" knowledge management system discussed in Chapter 2. Although the implementation of the system is on a much smaller scale, these should bring similar success.

In conclusion, the Design/Build/Fly competition is a project that interests OSU students and is applicable as a senior capstone project. The project will benefit greatly from the implementation of a knowledge management system that uses Nonaka's theoretical model. With a knowledge management system the team would have access to information and tips from previous years that they will not have to rediscover. This information will add to the knowledge of future teams so that they will be better equipped for competition.

6. References

[1] ABET Board of Directors, "ABET Engineering Accreditation Commission," 26 October 2013. [Online]. Available: http://www.abet.org/. [Accessed 20 January 2014].

[2] I. Nonaka and R. Toyama, "The Knowledge-Creating Theory Revisited: Knowledge Creation as a Synthesizing Process," Knowledge Management Research & Practice, vol. 1, pp. 2-10, 2003.

[3] I. Nonaka, K. Umemoto and D. Senoo, "From Information Processing to Knowledge Creation: A Paradigm Shift in Business Management," Technology in Society, vol. 18, no. 2, pp. 203-218, 1996.

[4] M. E. Jennex, " A Case Study on Assessing the Readiness of Professional Services Company to Build and Organizational Memory Information System" in *Case Studies in Knowledge Management*, Hershey, PA, USA: Idea Group Pulishing, 2005, sec. 2, cha. 3, pp. 36 – 50.