Stow-Away Pool Table

Team Number: 6

Deliverable #3: Project Plan and Product Specification.

Submission Date:

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Submitted To:

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Abstract

Throughout the existence of the game of pool, there have been two reoccurring issues that have caused pool table owners to have get rid of their table: the room is needed for another purpose and the playing surface must be leveled for proper play every time the table is moved. This pool table will feature both stow-away and self-leveling capabilities to solve these issues. The design process for this revolutionary product will be demanding so we will ensure that we remain as organized and detail-oriented as possible. This starts with laying out a needs assessment plan to determine what will be required of us during production. Our sponsor, Alexander York, has and will continue to provide us with insight into this design. Our goal for Senior Design is to design and produce a system to stow away and level a fully functional pool table for immediate use. We have a few concrete objectives to meet this semester: finalize CAD drawings for the mechanisms and structural elements, analyze the system for failure, select appropriate materials, and source long-lead items in preparation for the Spring semester. Some constraints were established, among the most important ones: the need for the table to be moveable by one person, the cost of the system must not exceed $11,000, and the surface must be self-leveled in under 5 minutes. We also determined dimensions for the table to remain compliant with tournament regulations, such as playing height, and playing field area. Finally, we came to the conclusion that for the product to be considered up to par with the professional tables out there, opposite ends (longitudinally) must be within a 0.0125” of height from each other, which translates to a reading of 2 mV from the inclinometers chosen.

We will utilize a Gantt chart to keep us on schedule with production, which begins with cleaning and organizing our workspace, and ends with the presentation of the final product and its report.

1 Introduction

In order to allow the room used for a pool table to be quickly and easily repurposed without sacrificing the pool player's recreation, the pool table must stow away and level itself at the push of a button. The purpose of our project is to redesign last year's self-stabilizing and stow-away pool table to be more economical, more easily manufactured, and more marketable overall. Alexander York, the entrepreneur/engineer who started this project last year, is sponsoring this project and the funding is provided by him and by the FSU-FAMU College of Engineering.

In this report, the desired specifications and the plan for our design will be discussed. The first steps to this design process is the project planning stage. This begins with background research of previous designs for similar problems. Next, a need statement must be developed that expresses the situation at hand. This will lead to creating a goal statement in which an ideal situation that solves the problem discussed in the need statement. This goal can only be reached if objectives and constraints are recognized. Setting objectives aids in reaching goals in small steps and avoiding becoming overwhelmed. Recognizing constraints of the design allows you to design potential concepts that are practical and effective. These constraints are formed by analyzing the design and performance specifications. Finally, a schedule must be made in order to help get the objectives achieved in a timely fashion. A Gantt chart is a great way to form a schedule and it allows the group to visualize the tasks at hand and stay on track with completing the objectives.

2 Project Definition

2.1 Background research

The inspiration behind the design idea comes from two mechanical engineering students Alexander York and Norman Gross who graduated from the FSU/FAMU College of Engineering in 2013. Their Group 19 Senior Design project, led by Alexander York, was sponsored by Beyond Innovation LLC to design a self-leveling pool table that was also "*capable of vertically stowing itself in a discrete housing whenever additional space is needed in the area the table is kept*." [i]

The team utilized stepper motors located on each of the four legs and a control system programmed with a stabilizing algorithm to stabilize the pool table with just the push of a button. The group was very successful with their design, and ended up winning the senior design project competition. We will be creating a pool table with similar functions by using improved methods of storing and leveling as well as a more marketable look. We plan on rotating the table about its longitudinal axis rather than its latitudinal axis as in the original design. We plan on focusing more on the stow-away capabilities of the pool table and less on the stabilizing capabilities, however we will be looking at improving the leveling function for opportunities to improve its overall time to level.

The main difference between our goal and the goal last year is to improve the design of the pool table to be more production friendly and marketable going beyond building the first prototype which proved the design was practical. This practicality is evidenced in the budget report from last year's team shown in Table 1[ii].

Table 1. Last year's final Budget Report

Total spent	$2,723
Budget	$3,000
Funds remaining	$277

This stow-away pool table is the first of its kind so there is no opposition to our design. There are, however other applications for leveling mechanisms such as for water vessels (Fig. 1) and space saving furniture like wall beds. Group 19's original "Self-Stabilizing Pool Table" (Fig. 2) lifts the pool table vertically until the playing surface is perpendicular to the ground and the table is fully in the housing.

Figure 1. David Hall's self-leveling boat platform[iii]

This design has the potential to be revolutionary because of its wide range of possibilities. It could be of great use to sports bars, hotels and homes. Basically, anywhere that can't afford to permanently sacrifice the large amount of room needed to comfortably house a pool table can benefit greatly from this design. Perhaps in the future, a more robust model with real time active leveling could be marketable to seafaring vessels but since that is a smaller market, it will not be included in the scope of the current model.

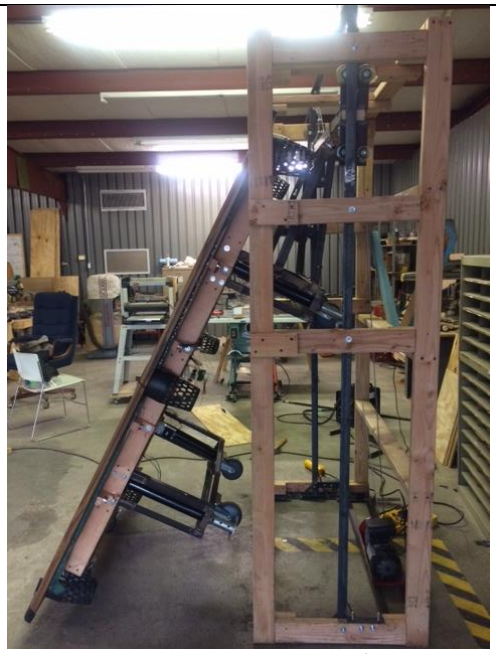


Figure 2. Group 19's original prototype[iv]

2.2 Need Statement

The sponsor for our project is Alexander York, with additional funds managed by Dr. Michael Devine, Professor at the College of Engineering. This project is a continuation of Alexander's 2013-2014 Senior Design, which needs higher aesthetics value and improved functionality. The proof of concept was successful, but the product cannot be sold until the quality and aesthetics are enhanced. Additionally, the nature of the vertically stowed design posed a higher risk of serious injury to the common user, while also requiring vertical space that may not be available in households.

Pool tables take up too much space and require professional leveling.

2.3 Goal Statement & Objectives

Our goal for this project is to design and produce a system to stow away a fully functional pool table, and to level it automatically when ready to use. This goal will be reached by the end of the spring 2015 semester.

Objectives for the fall semester:

- Finalize CAD model of the structural elements and translating mechanism.
- Select materials for the translating mechanism considering its structural design analysis.
- Source long-lead items.

3 Constraints

The entire concept of this design in based around making storing of the pool table quick and easy. In order to satisfy these requirements the pool table must be movable and must be ready to play on within minutes of moving it. The project as a whole must meet the customer needs specified in the original 2013-2014 project, since this product is meant to be sold to the public eventually. To guide some future decisions, here is a recollection of such needs:

1. Easy to move
2. Must be able to stow away to save space
3. The operation of the system should create minimal noise
4. Needs to be a regulation sized table
5. Easy to use by the average person
6. Must feel no different than a regular pool table
7. System needs to be aesthetically appealing
8. System needs to be durable (long-lasting)

More specific goals have been decided on. This design must be more production friendly and thus it must be affordable from a manufacturing perspective. With this being said, we have set our constraints as follows:

- The pool table must be movable by one person on a hard surface.
- The total cost must not exceed $11,000.
- The system must self-level in less than 5 minutes.

3.1 Design Specifications

As per regulation the table dimensions must follow these requirements:

- Must have a length to width ratio of 2:1
- Outside dimensions: 86 inches x 48 inches
- Playing Field: 78 inches x 39 inches
- Height Restriction: Between the range of 29 inches to 31 inches

In line with those specifications, the housing must fit our 7’ X 3.5’ table, being no more than 6 inches bigger per side, except for the width, for which we have allowed 2 ft.

Considering that our slate will weigh approximately 650 lb., the system will be kept under 1,000 lb. This weight will be reevaluated as the design evolves.

3.2 Performance Specification

Expectations of performance in the field or when used by consumer including: instrumentations output requirements (operation range, accuracy, and resolution), display features, detection capability, energy and fuel consumption, data transmission, efficiency.

Following the successful readings of the inclinometers used last year, their ±10 degrees will be sufficient again. Since these inclinometers have a resolution of 200 mV/deg, a reading of 2 mV will yield a measurement approximately equivalent to 0.0125” for the long span of the table.

The leveling system must finish its task in less than 5 minutes. This means that the players will not be made to wait more than that after the table has been set horizontally. The system will have a graphic user interface so that the player knows when the leveling system is working, and when it is finished.

4 Methodology

Our strategy for the completion of this project begins with team brainstorming and organization. It is necessary to then plan out our financial situation and determine a budget. We will prepare our workspace, located at TCC's campus by cleaning up and acquiring all needed tools, supplies, etc. From there we will begin our selection process for ideas and start creating designs for our table.

After our designs are complete, the building process will commence and we will work together through the issues and obstacles to a final product. Throughout all of these steps we will be meeting up as a team regularly and constantly be updating our strategy and plans. The designing process we be starting with the completion of the product specifications report and the finalization of the planning process. Although the official start of the build will occur next semester, we already have plans to receive our most basic part: the slate. We will receive the slate from our sponsor before the 30th of October, which will allow us to take real dimensions and draw our system around it.

4.1 Schedule

To help plan out our project for this semester, we have created a Gantt chart and detailed table of events. Both of these will keep us on top of our deliverables and enable us to manage our time well while staying on top of our objectives. The detailed Gantt chart can be found in the Appendix.

4.2 Resource Allocation

The team meets regularly to brainstorm on all aspects of the project. We have found that great suggestions come even when the subject is somewhat trivial. Each member is leading a subsystem: Jarboe handles financial and procurement aspects, Manahan is in charge of the leveling subsystem, McHugh takes care of assembling the components that increase esthetic value, and Silva develops the stowing mechanism. The Gantt chart in the appendix lays out expectations that can be easily traced back to a subsystem or the person ultimately responsible for its execution. To successfully put together the system as a whole, we have agreed to personally devote our time to our assigned subsystems before dedicating efforts to other tasks.

5 Conclusion

With abundant information from last year's project, and with a team member who had direct involvement in its development, our Senior Design project has the potential to greatly improve on specific features developed previously. While researching the end purpose of this project, we found that there is a strong desire to take the product to market, which further motivates the team to create a product that is both functional and visually appealing to potential buyers.

The objectives and Gantt chart for the Fall semester were laid out to function as a guide that the team must adhere to. We will work to finalize CAD drawings for an ideal system, along with the selection of structural materials that satisfy a Finite Element Analysis for an appropriate factor of safety. Materials that have a long lead-time will be procured before the beginning of the Spring semester. Some of the key strategies we will implement are clear communication between members and sponsor (for which we have set up rules in our Code of Conduct), clean workspace and organized meetings, and frequent reviews of our progress toward our goals. This document will serve to set up expectations for our Project Plans and Project Specs report.

6 References

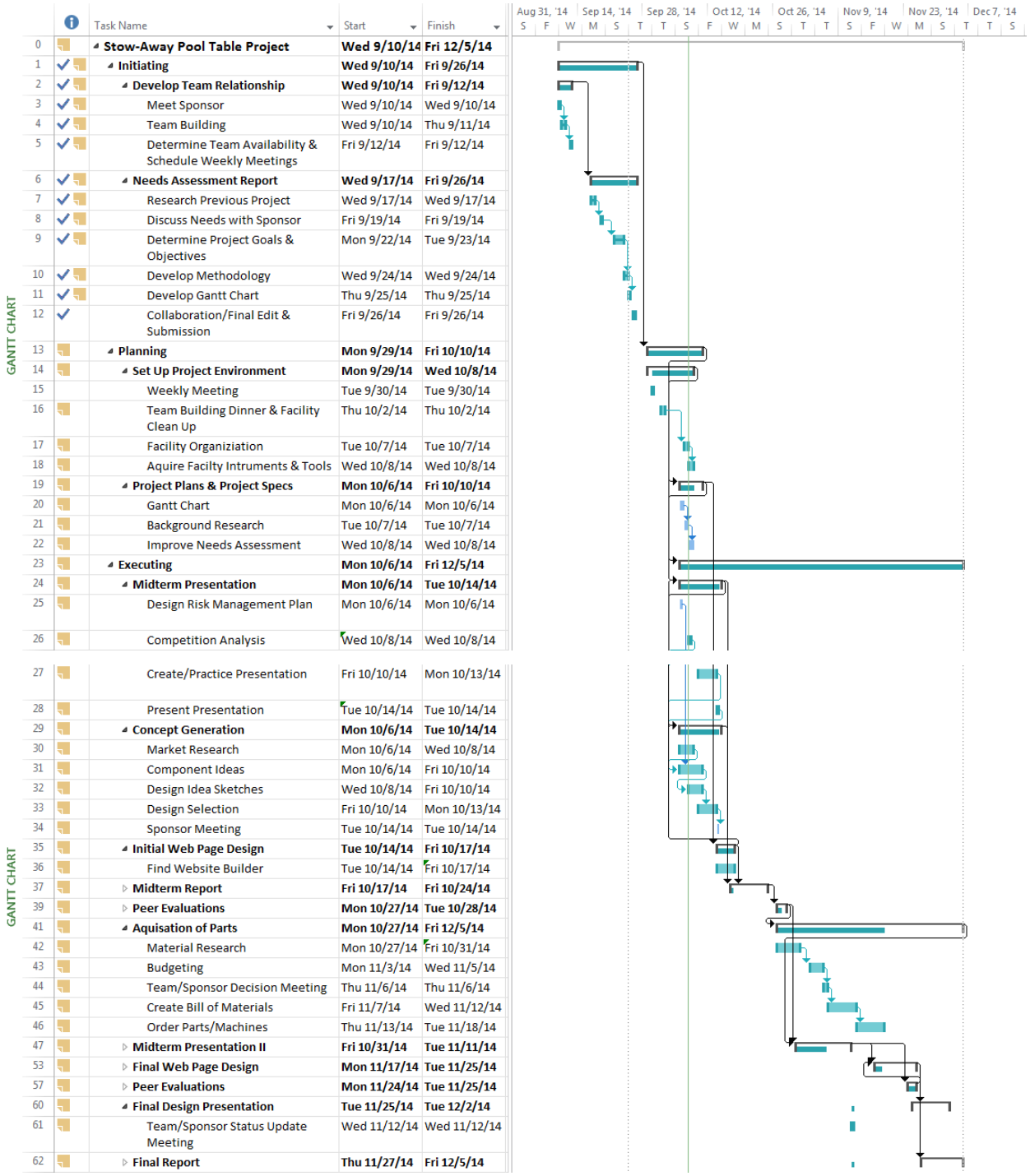
[i] Gross, Norman, and Alexander York. "Deliverables 2014 Final Report." *2013/2014 Senior Design Team19*. Beyond Innovation, LLC, n.d. Web. 26 Sept. 2014. <http://eng.fsu.edu/me/senior_design/2014/team19/deliverable.html>.

[ii]Gross, Norman, and Alexander York. "Deliverables 2014 Final Report." *2013/2014 Senior Design Team19*. Beyond Innovation, LLC, n.d. Web. 26 Sept. 2014. <http://eng.fsu.edu/me/senior_design/2014/team19/deliverable.html>.

[iii]Vescia, Paolo. "Velodyne Inventor Builds Self-leveling Boats." *Widgets RSS*. San Francisco Business Times, 15 Apr. 2014. Web. 26 Sept. 2014. <http://www.bizjournals.com/sanfrancisco/gallery/22511>.

[iv]Gross, Norman, and Alexander York. "Deliverables 2014 Fall Midterm Report." *2013/2014 Senior Design Team19*. Beyond Innovation, LLC, n.d. Web. 26 Sept. 2014. <http://eng.fsu.edu/me/senior_design/2014/team19/image_21.html>.

Appendix



	Task Name	Start	Finish
0	**Stow-Away Pool Table Project**	**Wed 9/10/14**	**Fri 12/5/14**
1	**Initiating**	**Wed 9/10/14**	**Fri 9/26/14**
2	**Develop Team Relationship**	**Wed 9/10/14**	**Fri 9/12/14**
3	Meet Sponsor	Wed 9/10/14	Wed 9/10/14
4	Team Building	Wed 9/10/14	Thu 9/11/14
5	Determine Team Availability & Schedule Weekly Meetings	Fri 9/12/14	Fri 9/12/14
6	**Needs Assessment Report**	**Wed 9/17/14**	**Fri 9/26/14**
7	Research Previous Project	Wed 9/17/14	Wed 9/17/14
8	Discuss Needs with Sponsor	Fri 9/19/14	Fri 9/19/14
9	Determine Project Goals & Objectives	Mon 9/22/14	Tue 9/23/14
10	Develop Methodology	Wed 9/24/14	Wed 9/24/14
11	Develop Gantt Chart	Thu 9/25/14	Thu 9/25/14
12	Collaboration/Final Edit & Submission	Fri 9/26/14	Fri 9/26/14
13	**Planning**	**Mon 9/29/14**	**Fri 10/10/14**
14	**Set Up Project Environment**	**Mon 9/29/14**	**Wed 10/8/14**
15	Weekly Meeting	Tue 9/30/14	Tue 9/30/14
16	Team Building Dinner & Facility Clean Up	Thu 10/2/14	Thu 10/2/14
17	Facility Organiziation	Tue 10/7/14	Tue 10/7/14
18	Aquire Facilty Intruments & Tools	Wed 10/8/14	Wed 10/8/14
19	**Project Plans & Project Specs**	**Mon 10/6/14**	**Fri 10/10/14**
20	Gantt Chart	Mon 10/6/14	Mon 10/6/14
21	Background Research	Tue 10/7/14	Tue 10/7/14
22	Improve Needs Assessment	Wed 10/8/14	Wed 10/8/14
23	**Executing**	**Mon 10/6/14**	**Fri 12/5/14**
24	**Midterm Presentation**	**Mon 10/6/14**	**Tue 10/14/14**
25	Design Risk Management Plan	Mon 10/6/14	Mon 10/6/14
26	Competition Analysis	Wed 10/8/14	Wed 10/8/14
27	Create/Practice Presentation	Fri 10/10/14	Mon 10/13/14
28	Present Presentation	Tue 10/14/14	Tue 10/14/14
29	**Concept Generation**	**Mon 10/6/14**	**Tue 10/14/14**
30	Market Research	Mon 10/6/14	Wed 10/8/14
31	Component Ideas	Mon 10/6/14	Fri 10/10/14
32	Design Idea Sketches	Wed 10/8/14	Fri 10/10/14
33	Design Selection	Fri 10/10/14	Mon 10/13/14
34	Sponsor Meeting	Tue 10/14/14	Tue 10/14/14
35	**Initial Web Page Design**	**Tue 10/14/14**	**Fri 10/17/14**
36	Find Website Builder	Tue 10/14/14	Fri 10/17/14
37	**Midterm Report**	**Fri 10/17/14**	**Fri 10/24/14**
39	**Peer Evaluations**	**Mon 10/27/14**	**Tue 10/28/14**
41	**Aquisation of Parts**	**Mon 10/27/14**	**Fri 12/5/14**
42	Material Research	Mon 10/27/14	Fri 10/31/14
43	Budgeting	Mon 11/3/14	Wed 11/5/14
44	Team/Sponsor Decision Meeting	Thu 11/6/14	Thu 11/6/14
45	Create Bill of Materials	Fri 11/7/14	Wed 11/12/14
46	Order Parts/Machines	Thu 11/13/14	Tue 11/18/14
47	**Midterm Presentation II**	**Fri 10/31/14**	**Tue 11/11/14**
53	**Final Web Page Design**	**Mon 11/17/14**	**Tue 11/25/14**
57	**Peer Evaluations**	**Mon 11/24/14**	**Tue 11/25/14**
60	**Final Design Presentation**	**Tue 11/25/14**	**Tue 12/2/14**
61	Team/Sponsor Status Update Meeting	Wed 11/12/14	Wed 11/12/14
62	**Final Report**	**Thu 11/27/14**	**Fri 12/5/14**