FAMU-FSU COLLEGE OF ENGINEERING

Crowley Hazardous Material Handling

A report submitted to Dr. Okenwa Okoli
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This report is the first of five progress report. It defines the problem that will be solved, the processes that are involved, and the customer requirements. This report address the approach that the team will use to solve the problem and the next step that will be taken.

Table of Contents

List of Figures

List of Tables

Abstract

The purpose of this project is to improve the process for handling hazardous material shipments at the Jacksonville port. By improving the processes Crowley will have less delays in their shipments, receive fewer fines, face less regulations and create a safer environment. The Crowley team began this project several months ago and identified multiple bottlenecks and gaps in their processes. During this phase the senior design team review the work that Crowley completed and visited the Jacksonville port in order to gain a better understanding of the shipping processes. Based on the information gathered from the previous documentation and the visit to the port the senior design team identified four key areas of improvement, customer interfacing, computer system integration, teamwork functionality, and the layout and labeling of the HazMat containers at the port. As the team moves on to the next phase solutions will be developed that address these four main categories. This strategy will allow for multiple issues to be addressed by one solution.

1. Introduction

Founded in 1892 by Thomas Crowley, Crowley Maritime Corporation is a family and employee-owned company that offers transportation and logistics services to their customers in both the United States and international markets. Crowley Maritime provides their shipping services using a fleet of more than 300 vessels, including RO-RO and LO-LO vessels, tankers, Articulated Tug-Barges (ATBs), tugs, and barges [1]. Their land operations consist on facilities that contain terminals, warehouses, tank farms and specialized vehicles. Crowley has facilities and employees around the world, however, this project will focus on their port in Jacksonville, Florida.

Approximately 11% of all shipments done at the Jacksonville port involve hazardous materials. There are strict regulations on the documentation that must be completed before shipping hazardous materials and additional regulations on how the containers must be stowed on the ship. These regulations need to be followed in order to ensure that their vessels are as safe as possible. Additionally, if the regulations are not followed the company faces fines. In an attempt to ensure that all regulations were followed shipments would often times be delayed while documentation was completed or containers were moved throughout the vessel.

Hazardous shipments require that additional documentation be completed before the vessel can sail. These shipments also require that the container be marked with the appropriate placard. A placard is simply a sign that is placed on the side of the container that denotes that there are hazardous materials inside and of what class the hazardous materials belong to.

When a customer wishes to ship with Crowley they contact the booking department and inform them of the items they wish to ship and the date they wish to ship them. If their shipment

contains hazardous materials they must submit additional documentation. Once the booking has been scheduled the customer will have the shipment delivered to the Crowley port where the in-gating team will check the Bill of Lading (BOL) and any placards on the container. At in-gating a receipt is printed and taken to equipment control and traffic so that each team can verify the shipment and what is in the container. When the loader is placing the containers on the ship he references the placards on the container to ensure that it is placed appropriately. Throughout this process not all teams have access to the same information to ensure that the documentation, BOL, and placards are all complete and accurate. Additionally many of Crowley's computer systems do not share information or communicate to each other.

Crowley recognized that there were areas where they could potentially improve their processes in order to reduce the delays and errors they were experiencing. Therefore Crowley began a project to analyze their processes and attempt to improve them. They identified that there are currently bottlenecks and gaps in their processes for handling hazardous materials. After identifying the bottlenecks and gaps Crowley reached out to the FAMU-FSU College of Engineering to recruit the help of a senior design team. This team was brought in after the project had begun to help further analyze the identified issues and propose and implement solutions.

The goal of this project is to add additional steps to the shipment process that will allow errors in the shipment of hazardous materials to be eliminated or caught earlier so as to ensure that there are fewer shipment delays and that no vessel leaves the port with incorrectly stowed containers. Some of the initial ideas for achieving these goals include:

- Providing all teams with HazMat training and additional resources to reference for the proper handling of hazardous materials

- Improving the communication between teams and computer systems by creating forms that will be utilized by all teams
- Adding additional steps to the in-gating process to check for correct placarding and documentation
- Allowing teams access to additional systems

2. Project Charter

2.1 Project Overview

2.1.1 Objectives and Expected Benefits

There have been 8 major bottlenecks and 20 gaps identified throughout the HazMat shipping process. The goal of this project is to reduce these bottlenecks and gaps by using the following methods:

1. The team will create resources that will allow the HazMat booking team additional information on the handling of hazardous shipments.
2. The team will create standard forms that will allow the booking, in-gating, equipment control, traffic and loading teams to communicate more easily.
3. The team will modify the in-gating process to prevent incomplete hazardous material paperwork to go unnoticed at the gate
4. The team will modify the booking and in-gating processes to prevent incorrect placarding
5. The sponsor will provide HazMat training for all teams

As a result of these improvements there will be fewer delays in the shipping process and fewer errors in the stowing of hazardous material containers. A reduction in these delays and errors will also result in a reduction of fines and regulations.

2.1.2 Business Case

The threats are the large driving factor of this project. Each time that a shipment goes out without proper documentation Crowley is fined and the more times this occurs the more susceptible the company is to receive more strict regulation. Additionally in the long-term the more violations Crowley has the more it will impact their insurance premiums, the more likely an accident is to occur and there is a potential for loss of business.

If this project successfully decreases the number of errors and delays Crowley will receive less fines and regulation and be able to send more shipments on time, which is good for business. In the long term a clean record will allow for Crowley to have decreased insurance premiums. By reducing the risk of a HazMat incident, the brand will be protected by minimizing the likelihood of negative publicity.

	Threat	Opportunity
Short Term	• Increased regulations • Increased fines	• Decreased regulations • Decreased fines • Decrease in shipping delays
Long Term	• Increased premiums for insurance • Increased safety risks • Potential loss of business	• Decreased premiums for insurance

Figure 1: Threats and Opportunities Matrix [2]

2.1.3 Project Stakeholders and Team Organization

Name	Role	Title
Allison Moothart	Member	Phase leader, Design Engineer
Kyle Neff	Member	Design Engineer
Johanna Robinson	Member	Webmaster, Design Engineer

Table 1: FSU Student Team

The student team is made up of Allison Moothart, Kyle Neff, and Johanna Robinson who are all senior Industrial Engineering Students. For each phase of the project there will be a new team leader. Allison is the team leader for the Define phase. Johanna is responsible for writing the introduction and project charter sections of the report. Kyle is responsible for defining customer and technical requirements and all accompanying figures and for writing the conclusion. Allison is responsible for writing the business analysis and project progress sections of the report. All student team members are expected to understand the processes involved in the problem as well as the scope of the project. As the phases change each person will be responsible for updating their sections from the Define report and will also write additional sections of the new report.

Name	Role	Title
Coleman Cosgrove	Sponsor	Vice President, Operations
Dorinda Geans-Jay	Project Lead	Process Engineer
Kyra Roca	Process owner	Vice President, Customer Care
Ken Orben	Process owner	General Manager, Jacksonville terminal
Rodrigo Fuentes	Member	Analyst, Documentation
Cindy Lee	Member	Specialist, Traffic
Michael Lesser	Member	Manager, HSSE
Danielle McQueen	Member	Supervisor, Traffic
Edwin Marte	Member	Director, HSSE
Lesli Pacheco	Member	Supervisor, booking
Yvette Quevedo	Member	Manager, Freight Services
Doug Walker	Member	Director, Port Ops
Joe Whitfield	Member	Analyst, Business Systems

Table 2: Crowley Team

The contact for this project is Dorinda Geans-Jay. The student team contacts Dorinda via email as well as phone conferences. She has provided the team with all material necessary to complete this project. Dorinda also supervised the team visit to the Jacksonville port and scheduled meetings with many of the members listed in Table 2. The process owner's and members listed in Table 2 are all members or managers of different teams that will be affected by this project. Their role in the project is to help provide information related to their areas. Coleman Cosgrove is the sponsor for this project.

Dr. Okenwa Okoli is the Industrial Engineering senior design professor as well as the FAMU-FSU IME Department Chair. Ryan Adams and Margaret Scheiner are the teaching assistants for the senior design class.

2.2 Approach

2.2.1 Scope

The scope of this project involves improving the hazardous material process at Crowley's port in Jacksonville, Florida. The scope will not be changed to include non-hazardous materials shipping or any additional ports. The project will examine the booking, in-gating, equipment control, traffic, and loading operations. These departments encompass the entire shipping process and therefore will each be in the analysis throughout this project. Improvements will be suggested to processes in any or all of the mentioned operations. Should the sponsor decide that one of the departments is outside of the scope of the project they will inform the student team who will then focus their efforts on the remaining departments. Improvements will be suggested to processes in any or all of the mentioned operations.

2.2.2 Assumptions & Constraints

In order to analyze the current process and make recommendations for improved processes there will need to be some assumptions made. These assumptions are

1. There will be no changes to the regulations regarding shipping hazardous materials during the duration of this project.
2. There will be not changes to Coast Guard regulations during the time frame of this project.
3. There will be no changes or updates to the technology that Crowley uses during the time frame of this project.
4. There will be no changes made to the commercial process as a result of this project.

As changes to the process are made there are a number of factors that cannot be changed. The constraints on this project are that any changes that are recommended cannot negatively impact any of the following:

- Alpha error: rejecting the HazMat cargo when it should be approved
- Beta error: accepting/approving the HazMat cargo when it should not be
- HazMat booking volume
- HazMat booking volume vs. total booking volume
- Adherence to the shipping schedule
- Administrative burden
- Amount of exposure in related processes

2.2.3 Deliverables

Table 3 contains all of the deliverables for this project. For each phase a phase report will be submitted to the senior design teaching assistants as well as the project contact. A presentation will be given at the end of each phase to the senior design class. The due dates for the Analyze, Improve and Measure phases have not been set yet and this section will be updated when that information becomes available. Any other deliverables or presentations that the sponsor requests will be added as well.

Deliverable	Received By	Date
Define Report	Senior Design Teaching Assistants	October 20, 2015
Define Presentation	Senior Design Class	October 20, 2015
Define Report	Dorinda Geans-Jay	October 30, 2015
Operational Definitions	Dorinda Geans-Jay	October 30, 2015
Poster	Senior Design Teaching Assistants	November 24, 2015
Measure Report	Senior Design Teaching Assistants	December 1, 2015
Measure Presentation	Senior Design Class	December 1, 2015
Measure Report	Dorinda Geans-Jay	December 11, 2015
Analyze Report	Senior Design Teaching Assistants	TBA
Analyze Presentation	Senior Design Class	TBA
Analyze Report	Dorinda Geans-Jay	TBA
Improve Report	Senior Design Teaching Assistants	TBA
Improve Presentation	Senior Design Class	TBA
Improve Report	Dorinda Geans-Jay	TBA
Control Report	Senior Design Teaching Assistants	TBA
Control Presentation	Senior Design Class	TBA
Final Report	Dorinda Geans-Jay	TBA

Table 3: Deliverables

Figure 2 shows a SIPOC diagram which shows the basic steps of the process that will be improved. It also shows the supplier which in this case is the customer because they are creating the documentation and sending the container in addition to the information given to us by Crowley. The inputs of this process are the documentation, placarding and bill of lading provided by the customer. The outputs correspond to the information the teams create with the information given by the customer, which also are necessary for the completion of the process. The

customers are the checker who receives the information necessary for loading the vessel. The captain of the vessel must also receive all information before the vessel is able to sail.

SIPOC				
HazMat Process				
Suppliers	Input	Process	Output	Customer
• Customer • Crowley	• Document • Placard • Bill of lading (BOL)	1. Booking 2. In-Gating 3. Equipment Control 4. Trafficking 5. Loading	• Document Receipts • Container marking • Barge layout	• Checker • Captain

Figure 2: SIPOC

3. Defining Customer & Technical Requirements

3.1 Current Process

When a customer wants to ship with Crowley they contact the booking team (located in El Salvador) via phone call or email. They inform the booking team of when they would like to ship their container and the items they intend to put in the container. If the customer informs the booking team that they plan to ship items that are considered hazardous materials, there are additional steps to the booking process. The booking team should then communicate the additional steps to the customer and request the necessary documentation. A container with hazardous materials cannot be shipped until all documentation is completed correctly. The booking information is recorded in Crowley's booking system.

The customer will then have the container delivered to the port typically anywhere between seven days and two hours before the shipment is scheduled to leave. When the container arrives at the port the In-Gating team receives the Bill of Lading (BOL) from the truck driver and confirms that the BOL matches the container that is at the gate. If the BOL indicates that there are hazardous materials in the container the In-Gating team confirms that the correct placards are on the container. The In-Gating team does not have access to the booking system and cannot see

if all required documentation has been completed. If the container is correct the container is dropped off and a receipt is given to the truck driver and a copy is made for the Equipment Control team.

The Equipment Control team receives the receipts from all containers that have been delivered to the port. Using the receipt and the BOL they input all of the items that are in the container into the computer system. This step cannot be completed until the container has arrived at the port and been accepted.

Next the receipt and BOL are passed to the Traffic team. They do a second review to make sure that everything that is on the BOL was put into the computer. This team is also responsible for making sure that all documentation is completed for any HazMat shipments. If the documentation is not complete they must call the customer and request the proper documentation. A container with hazardous materials cannot be shipped until all of the proper documentation has been completed. This team also notes all containers with hazardous materials in them and has someone check all containers in the yard to ensure that they have the proper placard on the container.

The day that the vessel is schedule to leave the Traffic team gives the loader and load list of all containers that are scheduled on the vessel, have arrived at the port, and have been cleared to be shipped. The load finds all of the containers on the load list checks that the placards are correct if necessary, and marks the containers that will be put on the vessel. As the vessel is being loaded the loader can see the placards and it is his responsibility to make sure that containers with placards are loaded according to the rules and regulations.

3.2 Bottlenecks and Gaps

The process relies on multiple computer systems as well as communication between individual teams via phone and email. The computer systems do not communicate to each other and not all employees have access to all systems in order to update them. Late container arrivals or a change in shipping details can result in miscommunication, incorrect documentation, or incorrect marking of the containers. There are strict regulations on the documentation that must be completed and the location of containers on the vessels for all shipments involving hazardous materials. If it is discovered that information is missing at the last minute there are delays in shipment. If the mistakes are not caught and regulations are not followed Crowley risks receiving fines, having additional regulations placed on their shipments, and they are also putting their equipment and employees at risk.

When the Crowley team initially began this project they identified several bottlenecks and gaps in their processes. These bottlenecks and gaps will be the primary focus for the duration of this project. The bottlenecks and gaps are listed below as given by Dorinda Geans-Jay.

Bottlenecks [3]:

1. HazMat Booking Team: The team is unable to adequately determine proper HazMat requirements for all customers and to communicate detailed requirements. There is an inconsistent use of BG1C to input notes and missing data information. There is inconsistent usage of individual and group emails boxes which causes delays in updates.
2. Internal HazMat Review: Inaccurate OffShore internal HazMat review resulting in improper HazMat designations

3.Documentation: Customers may update data with Documentation but the loop is not closed by updating the HazMat Booking team.

4.Approval/Denial: There is a complete stoppage if Michael Lesser is unavailable.

5.On Hold: Delays occur while researching HazMat details, awaiting customer responses, and during data updates.

6.Customer End/Restructure: Delays occur due to customer updates going to the incorrect team.

7.Corrective Action: Delays are caused when updates are not distributed to necessary parties.

8.Traffic/Storing: Placards could reflect land travel only and not vessel travel, causing a need to update the placard.

9.Traffic/Storing: There is no specific designated area for HazMat (could be a colocation issue).

10. Traffic/Storing: Traffic specialist must spend time reviewing, analyzing, and correcting any discrepancies (Booking, EC, & placard variances).

The gaps are divided into general gaps and port specific gaps. General gaps are errors in communication and order processing between the booking, office administration, port teams, and customer requirements. Port Gaps are area specific issues within the booking process unique to our scope (Port of Jacksonville).

General Gaps [3]:

1. During updates, COS bookings will only update what is in COS and override any CICS data.

2. JIRA (admin system) is not consistent nor can everyone view the Inbox, which causes delays.
3. Late updates and corrections can cause delays.
4. The port is not always prepared for LNG tanks, which poses more risk involving horizontal & vertical co-mingling.
5. Updates on EC1E should be limited to Michael Lesser, Lori Danger, and Jim Whitfield.
6. Information and updates on CLI is inconsistant.
7. Some HazMat bookings never reache the HazMat Booking team or are listed as generic bookings.
8. OffShore terminals are not originating HazMat bookings with the HazMat booking team.
9. There is a need for more HazMat professionals to assist Mike Lesser.
10. All personnel have not received the HazMat training to identify discrepancies.

Port Specific Gaps [3]:

1. Inspectors do not have access to the Booking data during the In-gate process. They compare the BOL document provided by the driver to the placards. If the Booking has different information, the Inspectors are unaware, which causes a future delay (if not identified) and incorrect placarding.
2. Occasional entry errors from the EC team causes future delays if not identified.
3. Pre-staging (searching for all containers/breakbulk that are ready for vessel stowage and placing a tape marker on them for future reference) is time consuming (saves truckers some time, but pre-stage is time consuming).

4. Pre-stagers spend time reviewing placards and documentation to prevent delays during stowage (stowage delays are not an option and occur rarely due to the 3 other inspection steps prior to stowage).
5. HazMat vessel stowage is determined at last moment during the stowage process (requires an analytical, quick thinker with a detailed HazMat knowledge, accurate documentation, and correct placarding to prevent errors).
6. COS only supports 8 commodities, only accepts full data, and currently has no ORMD or LQ Functionality.
7. CICS - Currently no ORMD or LQ Functionality, EC1E & EC65 only notes primary placard details so secondary is ignored, all placard data is important.
8. Incorrect placards: usually applied for road or rail rules ignoring vessel specifications
9. Time lag sending BOLs to traffic and via pneumatic tube to EC.
10. Toughbook issues: EC54 transfer errors, all doc receipts not on handheld, and stow the barge handheld marine pollutant issues

3.3 Critical Requirements

Based on the given process information and the previously identified bottlenecks and gaps the senior design team has defined four main areas of focus. The four critical areas of interest are related to customer interface, computer system integration, the placement and labeling of hazardous materials on property, and teamwork functionality. By grouping the bottlenecks and gaps into four critical areas the team will be able to identify solutions that address more than one problem at a time. The team will conduct analysis on ways to improve each of the critical points according to their chronological place is the overall shipping process. By starting at the beginning with the first step of the process errors will be eliminated early on

and will result in fewer errors during each step of the shipping process. Figure 3 shows the cause-and-effect diagram which illustrates each of the four critical points.

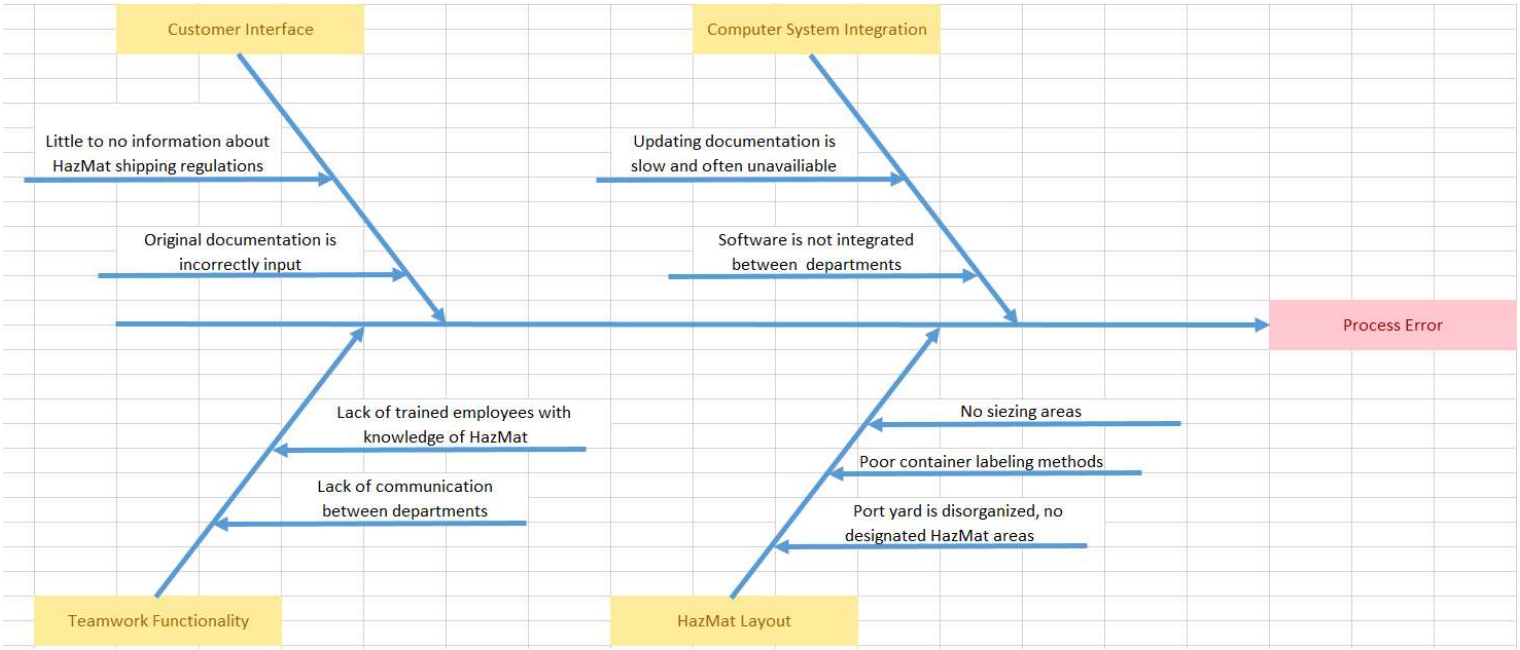


Figure 3: Cause-and-Effect Diagram

Figure 4 [4] contains a detailed process flow chart for all the components of booking and how they are integrated into the shipment of a container. The areas marked in yellow circles, in Figure 4 [4], indicate areas that need improvement and are bottlenecks in the current process. The highlighted areas below provide a visual representation of where the four critical points, mentioned in Figure 3, are located in the booking process.

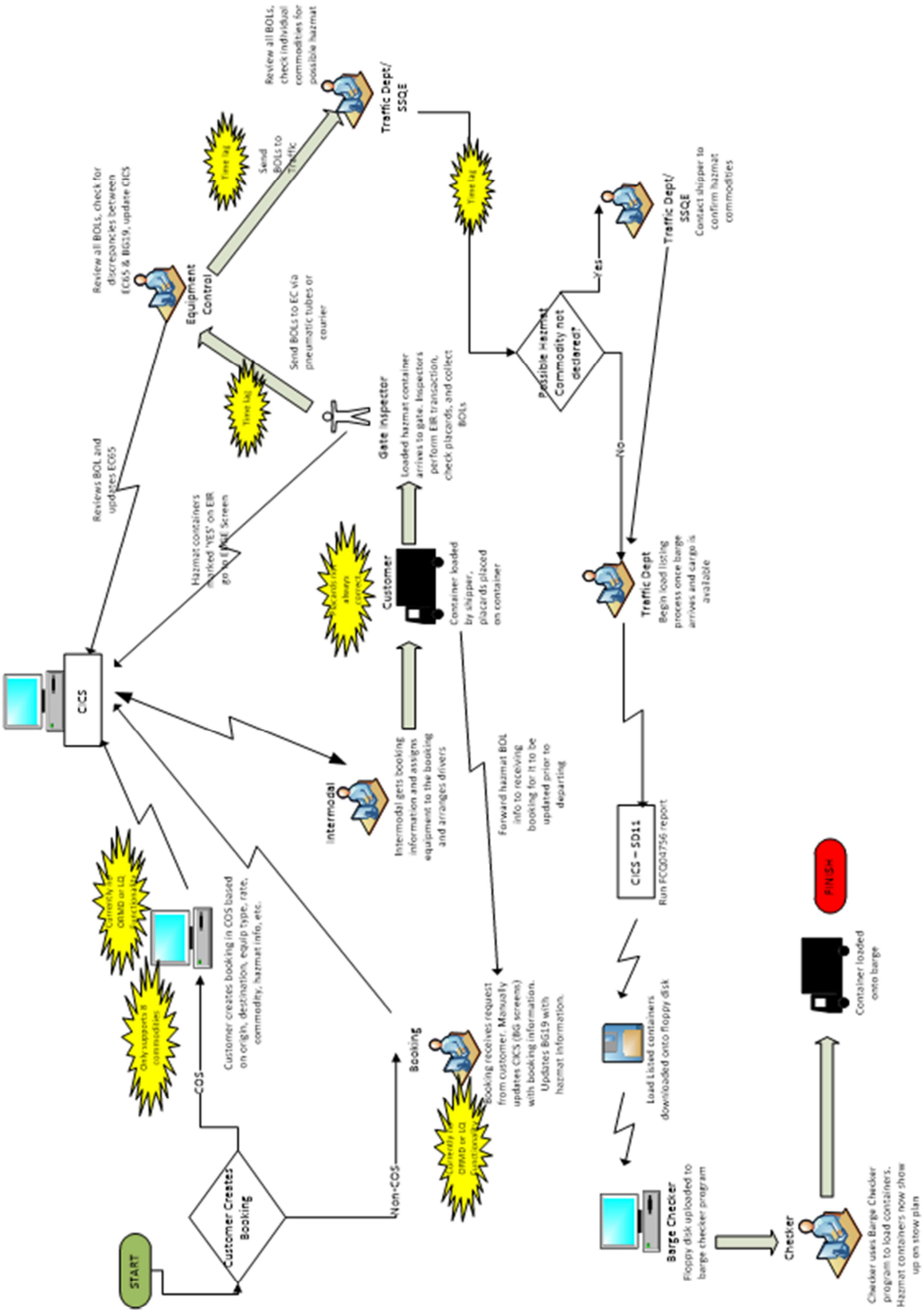


Figure 4: Process Flow Chart [4]

3.4 House of Quality

A House of Quality matrix will be used in this project, Figure 5, to help define the customer requirements and how the team will achieve those requirements. The box on the far left is referred as the "what" or the customer requirements [5]. The customer requirements displayed in Figure 5 are the 4 critical points mentioned in Figure 3. The customer requirements are listed and will be assigned an importance rating from one to five based on discussions between the stakeholders and the team. The top floor of the house indicates the "how" or technical requirements [5]. The technical requirements box displays how the team will accomplish the customer goals or demands.

The roof of the house displays the correlations between technical requirements. They are defined as strong positive, positive, negative or strong negative (refer to the key in Figure 5 for symbols). In Figure 5, it can be observed that improved communication and placarding have a strong positive correlation with one another. The objective of each technical requirement is displayed directly under the roof. Each requirements objective can be either to minimize, maximize or hit the target.

In the middle, the box located at the center of the House of Quality is called the relationship matrix. A relationship matrix is used to link the customer and technical requirements. Each link between the customer and technical requirements is given a symbol that represents the strength of that relationship. In this House of Quality matrix, a triangle indicates a weak relationship with a value of 1. A medium relationship is symbolized by a circle with a corresponding value of 3. Lastly, a circle with a dot in the center signifies a strong relationship with a value of 9.

In the final boxes, near the floor of the House of Quality, are the weighted and relative importance of each the technical requirement. For the weighted importance of the technical requirement, a simple calculation can done using the following equation:

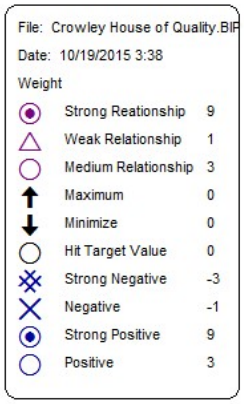
$$\sum(Importance\ of\ Demanded\ Quality\ \times Value\ of\ relationship\ strength)$$
$$= (4 \times 9) + (5 \times 3) + (3 \times 9) + (1 \times 3) = 81$$

Equation 1: Weighted Importance of Technical Requirements

The relative importance of each technical requirement is the percentage of each weighted importance to the whole. This calculation can be done by using the following equation:

$$\frac{Weighted\ Importance\ of\ the\ N^{th}\ Techincal\ Requirement}{\sum of\ All\ Weighted\ Importances} = \frac{81}{81 + 51 + 75 + 63} = 0.3$$
$$= 30\%$$

Equation 2: Relative Importance of Technical Requirements



Crowley House of Quality Matrix		Customer Importance	Techinal Requirements: Improved communication method	Techinal Requirements: Offer HazMat Training for all HazMat team members	Techinal Requirements: Provide ease of access of shipment data	Techinal Requirements: Prevent incorrect placarding
Direction of Improvment			↑	↓	○	○
Customer Requirements	Customer Interface	4.0	◉	◉	○	◉
	Computer Systems Integration	5.0	○	△	◉	○
	Team Functionality	3.0	◉	○	○	△
	HazMat Container Labelin and Layout	1.0	○	△	◉	◉
Weighted Importance			81.0	51.0	75.0	63.0
Relative Importance			30%	19%	28%	23%

Figure 5: House of Quality

3.5 Work Breakdown Structure

The senior design team joined this project after it had already begun and the Crowley team members had designed a work breakdown structure to track progress of the project. Figure 6 was given to the senior design team by Dorinda Geans-Jay. The work breakdown structure displays what goals have already been achieved (white boxes) and which goals need further analysis (orange boxes). The orange boxes will be covered in this senior design project.

Using the work breakdown structure provided, a responsibility assignment matrix (RAM) was created to outline team member responsibilities for each work package delivered. This can be seen in Figure 7. A lettering system was implemented to define each type of responsibility for each team member. The team member that is directly responsible for the work package is given the letter “R”. Each work package is expected to have justifications for the actions or decisions made and those responsible will be assigned the letter “A”. Those responsible for consulting will be assigned a letter “C”. If a team member does not fit into any of the 3 main categories, they will be kept informed and assigned the letter “I” [7].

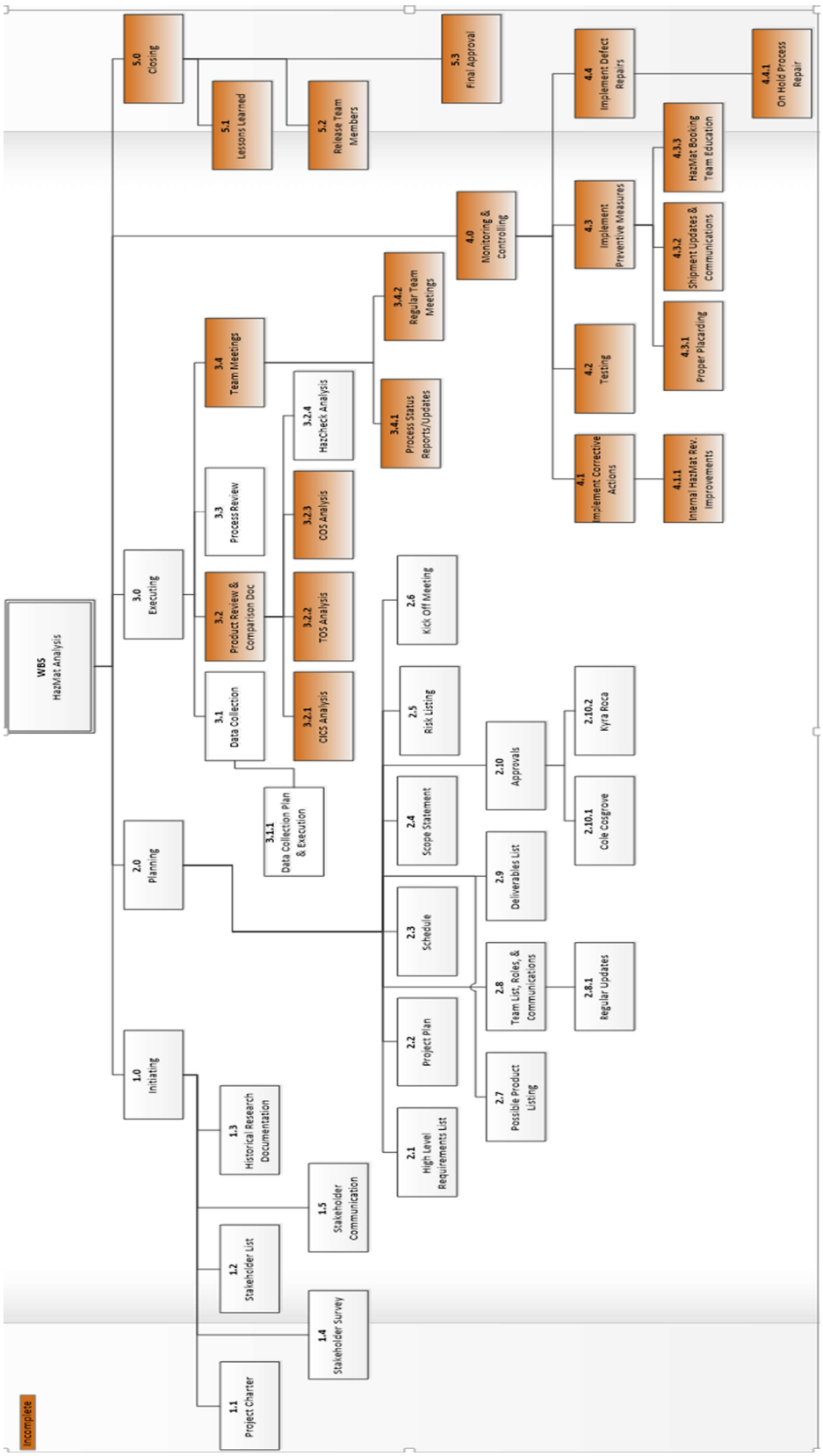


Figure 6: Work Breakdown Structure [6]

Responsibilities Assignment Matrix (RAM)				
Tasks	Dorinda	Allison	Kyle	Johanna
1. Initiating	R	I	I	I
2. Planning	R	I	I	I
3. CICS Analysis	I	A	A	R
4. COS Analysis	I	R	A	A
5. TOS Analysis	I	A	R	A
6. Implement corrective actions	C	R	R	R
6.1. Internal HazMat review improvements	I	R	R	R
7. Testing	I	R	R	R
8. Implement Preventive Measures	C	R	R	R
8.1. Proper Placarding	I	A	R	A
8.2. Shipment updates and communication	I	R	A	A
8.3. HazMat booking team education	I	A	A	R
9. Implement defect repairs	I	R	R	R

Figure 7: Responsibility Assignment Matrix

4. Business Analysis

4.1 Economic Analysis

The only investment required of this project will be the time that is spent training employees on any new procedures that will be implemented. At this time it is estimated that there will be 10 employees that will need to take a 2 hour training class. Crowley uses a standard of $80 per hour to estimate their employees' pay rates. Based on this information implementing a new procedure is estimated to cost $1,600. Compared to the potential losses if the process is not

fixed this is a relatively low investment. The lapses in the current HazMat processes leave room for error that could result in fines, damages, or loss of customers.

4.2 Environmental Impact

This project evaluates how a process can be improved to ensure that hazardous materials are handled properly. The goal is to decrease the potential for an accident either in the shipping yard of the Crowley port or on one of Crowley's vessels. If hazardous materials were to interact there could be devastating effects on the environment. If these materials were to spill or react at sea there would be a negative impact on the marine life.

4.3 Ethical Considerations

The goal is to create a process that improves the accuracy of the handling of hazardous materials while also ensuring that the process is simple and efficient so that employees will use the process correctly every time. The employees at Crowley have an established way of doing things and many of them have been working for the company for an extended period of time. Part of this project will be ensuring that all employees understand why it is necessary to update the processes that they are used to. They must also be properly trained so that they are fully capable of performing the new process.

4.4 Health and Safety

Crowley currently has a number of safety procedures in place to ensure that all employees in the shipping yard are safe. All of these policies will remain in effect and any procedures developed as a result of this project will not interfere with the current safety practices. There are both domestic and international regulations for the shipment of hazardous

materials. Crowley follows the international standards for all of their shipments. Therefore when implementing processes the international standards will be used throughout this project.

4.5 Social and Political Considerations

The implementation of this process will require some additional communication between different teams within the organization. It aims to increase interaction among different parts of the organization throughout the process of booking, receiving, and shipping hazardous materials. The process does not given any department or team additional power over another. Additionally the process aims to reduce the opportunity for departments to place blame on other departments for their mistakes. The process could potentially affect the way that the company communicates and interacts with the customer.

4.6 Sustainability

In order for the processes developed by this project to be sustainable long-term the team must ensure that the processes they develop are able to be easily implemented and used by the teams that use them. They must also ensure that all teams are willing to use the processes. There should be sufficient documentation surrounding the processes created by this project so that future leaders will be able to continue implementing them. The senior design team must also come up with a plan for training employees on how to use the processes and the sponsor must provide the training sessions. Because of the systems and technology involved in all Crowley operations, it is likely that over the next several years there will be updates that may affect the functioning of the processes created. Some components of these processes may need to be reevaluated. However, changing and improving technology may make the processes even easier.

5. Project Progress

5.1 Milestones and Schedule

Figure 8 shows all of the major tasks for each phase of the project. All of the tasks in the Define Phase have been completed at this time. As the team moves into the measure phase it will focus of reviewing the measurement documentation that has already been completed. The sponsor has provided some measurement documentation and the team and sponsor will review that information and make a decision on whether additional measurements will be needed. If so the team will schedule another site visit in order to collect that data. The team will then compete the measurement phase report and presentation. The results obtained from the measurement phase will greatly impact the tasks in the following three phases, however a tentative outline of the required tasks for the Analyze, Implement, and Control phases is shown in Figure 8.

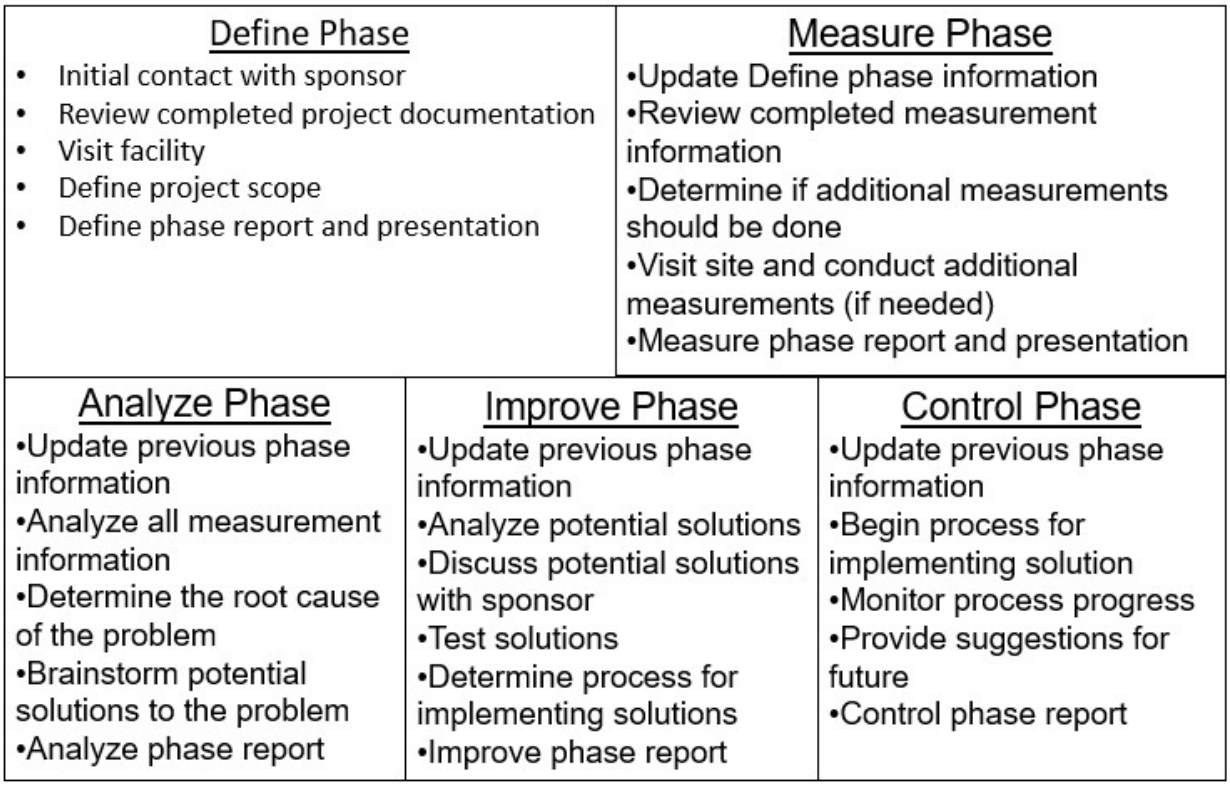


Figure 8: Major Tasks

Figure 9 shows the network diagram for the upcoming phase of the project, the measure phase. Each of the tasks that must be completed in the measure phase are represented in the diagram. In the upper left hand corner is the earliest possible start date of that task and in the upper right hand corner is the latest possible start date of the task. The bottom shows the float, the number of days between the earliest possible start and the latest possible start of the task. For this phase there is no critical path because no tasks have a float of zero. This means that there is some flexibility for schedule throughout the measure phase.

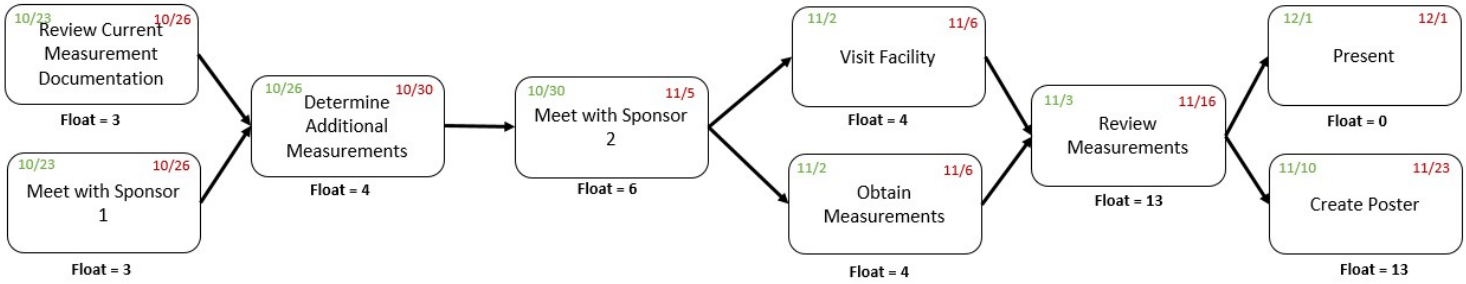


Figure 9: Network Diagram

Figure 10 shows a Gantt chart for the Define phase. A Gantt chart is used to show the estimated timeline of activities and when the activities were actually completed. It allows the reader to see if activities were completed on time or if there were any delays. The Gantt chart for the define phase is shown in days. The primary focus during the Define phase was to establish the team and project and gather as much information as possible about Crowley, their processes, and the project. The Define phase spanned from September 18 when the team was assigned a sponsor until October 20, 2015 when the team will present their Define phase information to the Senior Design Class. The team did experience some delays at the beginning of the phase due a change in project from the sponsor. However, once the project was established the team remained on schedule.

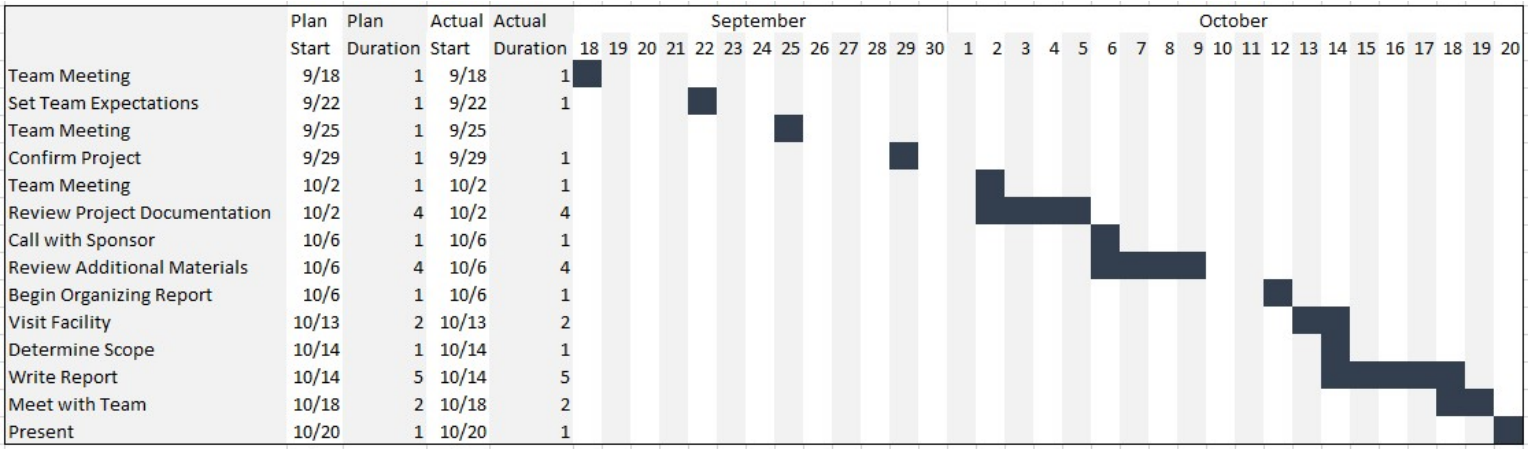


Figure 10: Define Phase Gantt Chart

Figure 11 shows the Gantt chart for the next phase, Measure, in weeks. During the first week of the measure phase the team will meet to begin preparing for this phase. The team will review the measurement information that was already provided by the sponsor and form any questions before meeting with the sponsor to discuss the information. Next the team will determine if additional measurements need to be taken and if so there will be an additional meeting with the sponsor to discuss the plans the schedule a visit. From there the team will take and review all measurements before beginning the measurement phase report and presentation. The Gantt charts for the remaining three phases can be found in the appendix section and will be updated as the project continues.

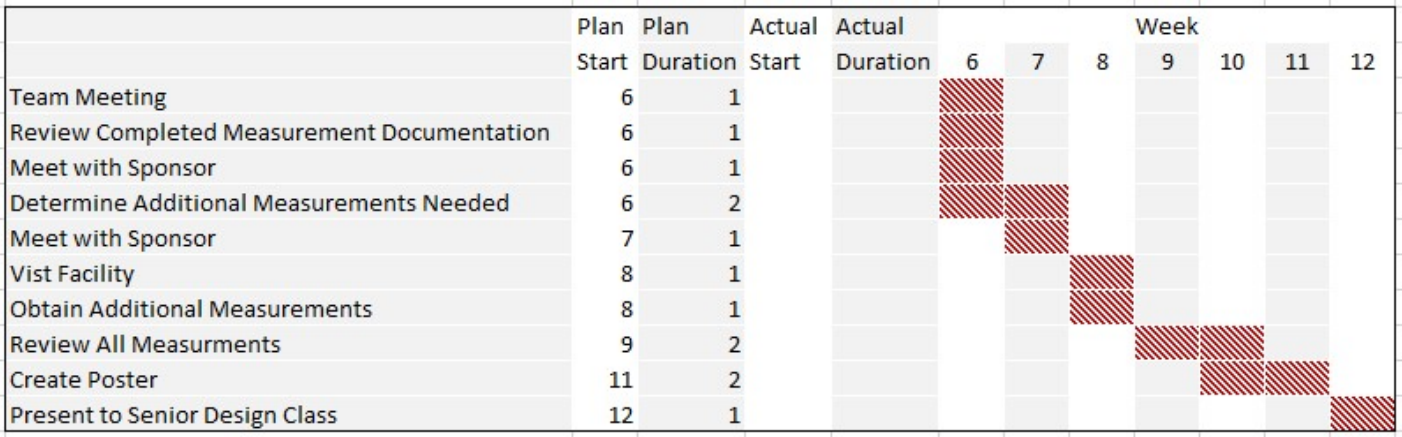


Figure 11: Measure Phase Gantt Chart

5.2 Risk Management

Figure 12 shows the Strengths, Weaknesses, Opportunities, Threats (SWOT) Matrix. This project is driven by the potential threats. For any errors that are made in the shipment of hazardous materials Crowley faces fines and increased regulations on their business. Additionally, if an error were occur that created a dangerous situation or caused damage to the goods being shipped Crowley would suffer the consequences of a poor reputation which would likely result in a loss of business. However, if this project is able to improve the process of handling hazardous materials Crowley will see a decrease in fine and regulations as well as a decrease in shipping delays.

The strength of the current process is that there are a number of stops that a shipment goes through before leaving the port. These stops create the potential to implements checks that would help to decrease errors. The weaknesses of the process are that there are a number of computer systems which are unable to interact and not all employees have access to all of the systems.

Strengths	Weaknesses
• Shipments go through multiple checkpoints throughout the booking, receiving, and shipping processes	• The recording systems are unable to communicate to each other • Not all employees have access to all systems
Opportunities	**Threats**
• Decrease in fines and regulations • Decrease in shipment delays	• Increased fines and regulations • Loss of business

Figure 12: SWOT Matrix

5.3 Budget

The Sponsor indicated that there is not a budget for this project. They do not intended to spend any additional money on purchasing technology or equipment nor do they intend for the operation of the process to require additional capital. The budget in Table 4 includes the investment of time that the sponsor will spend on the project, 20 hours per weeks for the entire duration of the project at 34 weeks. The amount of time that Crowley employees will spend training and meeting with the senior design team is estimated to be 5 hours a week for 2 different weeks during the project. The final item is the time that Crowley employees will spend taking a training class on any new processes that are implemented as a result of this project. Currently it is estimated that 10 employees will take a single 2 hour training class. This information will be updated if the estimated time required changes. Crowley uses a standard $80 per hour to estimate the salary of each of their employees and their benefits.

	Rate Per Hour	Hours Per Week	Weeks	Total
Sponsor's Time	$ 80.00	20	34	$ 54,400.00
Training Senior Design Team	$ 80.00	5	2	$ 800.00
Training Ten Employees on New Process	$ 800.00	2	1	$ 1,600.00
				$ 56,800.00

Table 4: Budget

6. Conclusion

The purpose of this project is to improve the processes related to the handling of hazardous material shipments. Crowley noticed that they were experiencing delays in their

shipments and were receiving fines due to improper handling of hazardous materials. Additionally improper handling of hazardous materials possess safety threats and the potential for loss of business.

The project began in March and the senior design team was brought on in September. When the senior design team began the project there were already identified bottlenecks and gaps in the booking, in-gating, equipment control, traffic, and loading processes. During the define phase the senior design team review previous documentation given by the Crowley team. Additionally the team made a visit to the Jacksonville port to watch the processes first-hand and gain a better understanding of Crowley operations.

The team used the identified bottlenecks and gaps and their knowledge of the current process to identify four critical areas of improvement, customer interface, computer system integration, teamwork functionality, and the layout and labeling of HazMat containers in the port yard. By grouping the goals into these four categories the team will be able to solve multiple bottlenecks and gaps with fewer process changes. The team will address the four critical areas in the order in which they occur throughout the overall shipping process so as to minimize the errors flowing through to the next step of the process.

During the upcoming measurement phase the team will review the measurement information that has already been gathered by the Crowley team. They will analyze how this information fits into the established critical areas and determine if additional measurements need to be taken. If additional measurements are required a visit to the Jacksonville port with be scheduled to obtain that data. The measurement information will allow the team to identify specific steps within each department that will be most beneficial to modify. The team will then work to find solutions to help resolves the issues in the four main areas of concern.

References

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[3] “Bottlenecks and Process Gaps”. *Crowley*. Web. 15 Oct. 2015.

[4] “Process Flowchart”. *Crowley*. Web. 19 Oct. 2015.

[5] “House of Quality Matrix”. *Okoli*. Web. 18 Oct. 2015.

[6] “Work Breakdown Structure”. *Crowley*. Web. 18 Oct. 2015.

[7] “Senior Design Report Outline”. *Okoli*. Web. 19 Oct. 2015.

Appendix A: Analyze, Improve, Control Gantt Chart