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Hagie Ideal Welding Cell

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Hagie Ideal Welding Cell

Problem Statement

Hagie Manufacturing is a company based in Clarion, Iowa, where they build sprayers for agricultural applications. There are around 140 employees currently working at Hagie, and they are ranked in 2nd among their other top 10 competitors. Hagie has an impact in Iowa by being known as a locally established company, created by a friendly farmer that wanted to have personal and family-oriented business to support his neighboring farmers. Welding production requires an increase to 2 machines per day in order to stay up with demand. Hagie has full capability to keep up with John Deere's standards, which have been set by a business deal in early 2016 between the companies.

Hagie is struggling with the flow of their boom arms in their weld cell, and they also have areas for organization and ergonomic improvements. Costs could include line downtime while changing the layout of the cell, moving workers to other areas, hiring new workers, and implementing new machines and fixtures. Risks could include not keeping up with current takt time after making changes to the process, or greatly improving their task time. Working on these improvements fosters the business relationship Hagie now has with John Deere, and the network they will be expanding into.

Many other companies, especially small family established businesses like Hagie, are working on solving the same types of problems. Some ended up growing too fast, which made the organization difficult to be prepared for mass production. The solution could be used in other situations, but it would be particular to the space Hagie has to build the boom arms. The ideas used in breaking up the process and movement of parts could assist other companies in understanding how to create better flow in their facilities. Many aspects of life could use an assessment of process layout and movement, everything from manufacturing, to healthcare, could benefit from using these tools.

Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

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IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

Hagie Ideal Welding Cell

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PROBLEM STATEMENT

Hagie Manufacturing is a company based in Clarion, Iowa, where they build sprayers for agricultural applications. There are around 140 employees currently working at Hagie, and they are ranked in 2nd among their other top 10 competitors. Hagie has an impact in Iowa by being known as a locally established company, created by a friendly farmer that wanted to have personal and family-oriented business to support his neighboring farmers. Welding production requires an increase to 2 machines per day in order to stay up with demand. Hagie has full capability to keep up with John Deere's standards, which have been set by a business deal in early 2016 between the companies.

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Business Case Statement

We received the Hagie project, and have been assisting in improving their welding cell operations and organization. They feel that there is a bottleneck in the boom welding section, keeping them from having a two machine per day pace. They also needed to move the cell closer to the painting booth and consolidate the cells into a smaller space in order to have an ideal cell. With the welding area for booms moving faster, they can get a bigger batch in to paint which will improve production speed. Hagie customers waiting for their machines care about this problem because when efficiency increases, they can get their machines earlier. John Deere also cares because they would like to use their connections to sell Hagie products, and unless Hagie improves efficiency, the increased sales will dig a hole for Hagie to try and climb out of. This is an opportunity for Hagie to become more flexible and able to attack other problems moving forward.

GOAL STATEMENT

Our goal is to aid Hagie in forming the ideal operation for welding sprayer booms. We aim to assist them with achieving a faster pace while keeping quality as high as possible. Our project will allow Hagie to operate in a smaller area while speeding up production to achieve a pace of two machines per day.

After performing a root cause analysis, Hagie determined that their production bottleneck lies within the boom welding section. As a team, we performed a root cause analysis and concluded that the cell is out of place and with newly added technology, creating a need for an organization adjustment. We identified that the operators lose valuable time traveling to the paint booth when they have to be closer. Once we have an idea of a new layout, we can work on a theoretical time study that will show where we can cut extra time out and see how the flow can improve.

For this project, we have collected square footage for the new cell and time studies to analyze the time we can save. Time is the biggest variable we are chasing. We have also collected measurement for a cart design that is more ergonomically friendly compared to their current configuration.

We will not be able to see our proposed layout in action that we designed due to when they will be able to shut down and implement. This project has been leaning to the theoretical side, which has proven difficult because we cannot actually test anything. We will deliver our plans for the improved layout with whatever number of comparisons we can collect. We will also show them some areas that we have improved ergonomically.

Main Objective(s) and Specific Objectives

The main objective is to:

- Develop an optimized weld cell layout in order to improve the flow of boom arms through the facility and increase efficiency

Specific objectives include:

- Design a new floor plan that meets all client criteria and constraints:
 - 40' x 45' work area, reduced by 25% to allow for part storage
 - Must allow for three fixtures to build all booms in work area
- Constraints:
 - Time and work requirements on software to build an idea
 - Will not include research with the intent of spending money to install or make changes in the facility

Rationale:

- Our client will:
 - Achieve two machines per day
 - Work in a smaller more efficient area
 - Follow a standard process for pushing booms through production

Project Scope

Our scope is to design an ideal welding cell layout for Hagie manufacturing to cut time and keep quality.

- The scope of the project continually changed throughout the two semesters we worked with Hagie. We dealt with many challenges head-on, which developed the results we were working towards this project.
- We have worked with the floor managers and a production engineer to work through what was wanted
- We noticed that the paint booth was the slower of the two processes. However, Hagie does not have the power to improve that area at this time.

PROJECT PLAN/OUTLINE

REFERENCE MATERIAL(S):

- Time studies previously conducted by engineers at Hagie, floor plan designs, current floor plan layout, other studies conducted on the process and information given by Hagie

Data collection:

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- All information required for this project, i.e., time studies, current floor plans, flow plan, etc., were provided by Hagie employees for use to reference and improve

Skills:

- TSM 440/444
- Autodesk Inventor, Flow planner

Solutions:

- We developed multiple floor plans for Hagie; the first was based on customer restraints, supplemental floors plans were designed off team expertise
- All of our floor plans were theoretical based plans designed from restraints or personal expertise
- The proposed floor plans were not tested based off time studies or implementation, but rather employee touch reduction
- All floor plans are theoretical and come with specific reasoning for each change, but no actual testing could take place

Organization: We communicated with Hagie every week throughout both semesters, with multiple site visits. The use of the weekly group reports helped keep the group members organized, and the project focused. The major milestones for our project included the first visit to Hagie in order to understand the project better, then working towards sharing information and data with us, and finally getting access to the documents we needed. We understood coming into this senior project that changes would need to be made from the start, regardless of what occurred to cause these changes. The client continually altered the scope in small amounts, so coincidentally we did our best to be understanding of the challenges giving us this project caused them. We began with contacting the lead person who was the contact for the project originally, but then we got sent to three other people to work with directly. Problems occurred with communication on both sides being busy and unclear about what was expected. Overall, we just worked with the bumps along the way and did our best to stay motivated and ready to help Hagie.

RESULTS

The main deliverables within our project include a complete visual layout of the weld cell within set criteria, using a ladder, finish, and cleaning fixtures. We have been developing a complete visual layout of the weld cell with our improvements, using the two fixtures to completely weld booms with one cleaning area. We will present our new cart design that will be used for essential part transport within the manufacturing area. A statement of Standard Work and flow plan throughout the weld cell will be created for our design.

BROADER OPPORTUNITY STATEMENT

As time goes on, many manufacturing facilities that weld are gearing more towards automation. However, the initial investment for automation has very high costs. Hagie is different in that as a company; they intend to continue hiring human welders. Therefore, the layout of their facility has to save time and effort while being safe and versatile. Our project deliverables appeal to companies and the average worker by being simple to understand while providing a baseline to fix a standard welding cell's time constraints. Simple tune-ups such as a new floor design to increase flow while decreasing total movement can solve significant challenges within a manufacturing facility. This way of thinking applies not only to welding cells but in many types of manufacturing settings. Decreasing effort and steps saves time and money, which in turn will increase your daily production ability.

Graphical Abstract

Creation of the Ideal Welding Cell for Sprayer Booms

Client: Hagie Manufacturing, Clarion, Iowa

Problem Statement

Welding production requires an increase to 2 machines per day. Hagie has full capability to keep up with John Deere's standards set by a newer business deal between the companies.

Who cares about this problem?

Hagie Customers, John Deere, Dealers

Objective(s)

- Complete ideal layout to achieve a 36% efficiency improvement
- Tooling, lifting devices, and fixtures improved to assist in efficiency demands
- Material flow plan and body travel reduction completed to assist with ideal layout

Constraints

This project requires time and work on software to build an idea, but will not include research with the intent of spending money to install or make changes to the facility. Time line October 2018-April 2019

Scope

As Hagie's design team, we will be designing an efficient layout for the ideal welding cell. We will not be changing processes or designing building layouts.

Methods

Major Activities

- Time Studies, floor plan designs

Type of analyses to be used and what they will be used for

- Time, order of processes, foot traffic, number of touches

Software type and use

- Proplanner-extension of AutoCAD
- Used to create current state of floor layout and how materials and operators move
- Used to create future state of most efficient layout and movement
- AutoCAD- Used to create floor plan

Proposed Solutions

- Break down the hybrid cell into multiple fixtures and combine with 90'100 cell
- Double the hybrid fixtures and combine with 90'100 cell

Major Outcomes

- Ideal work center executed
- Layout planned and executed in AutoCAD
- Material flow plan and body travel reduction executed
- WP and container plan executed
- Tooling, lifting devices, fixtures improved where necessary
- Achieve a 36% efficiency improvement

Benefit to Client

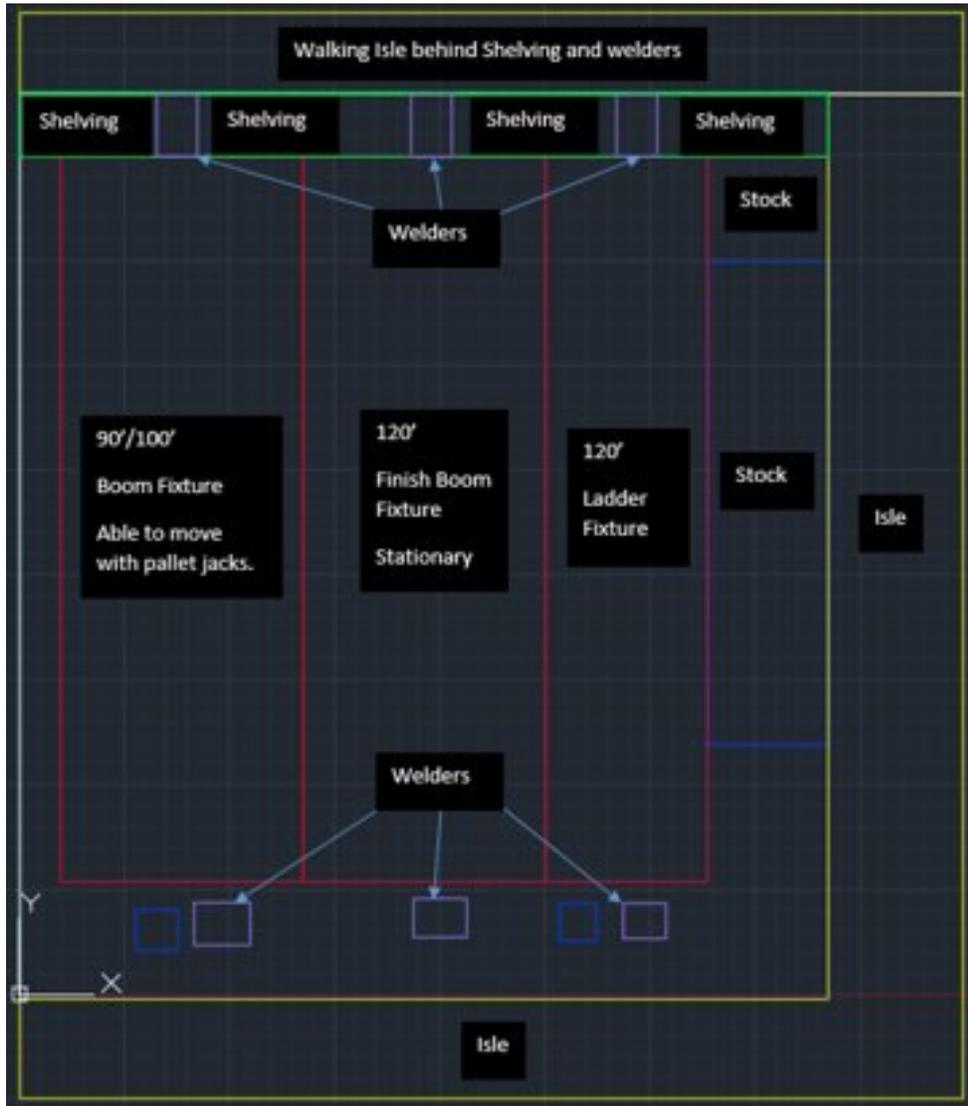
- Efficient production, increased revenue
- More jobs in Iowa, Quality farm equipment

REFERENCES

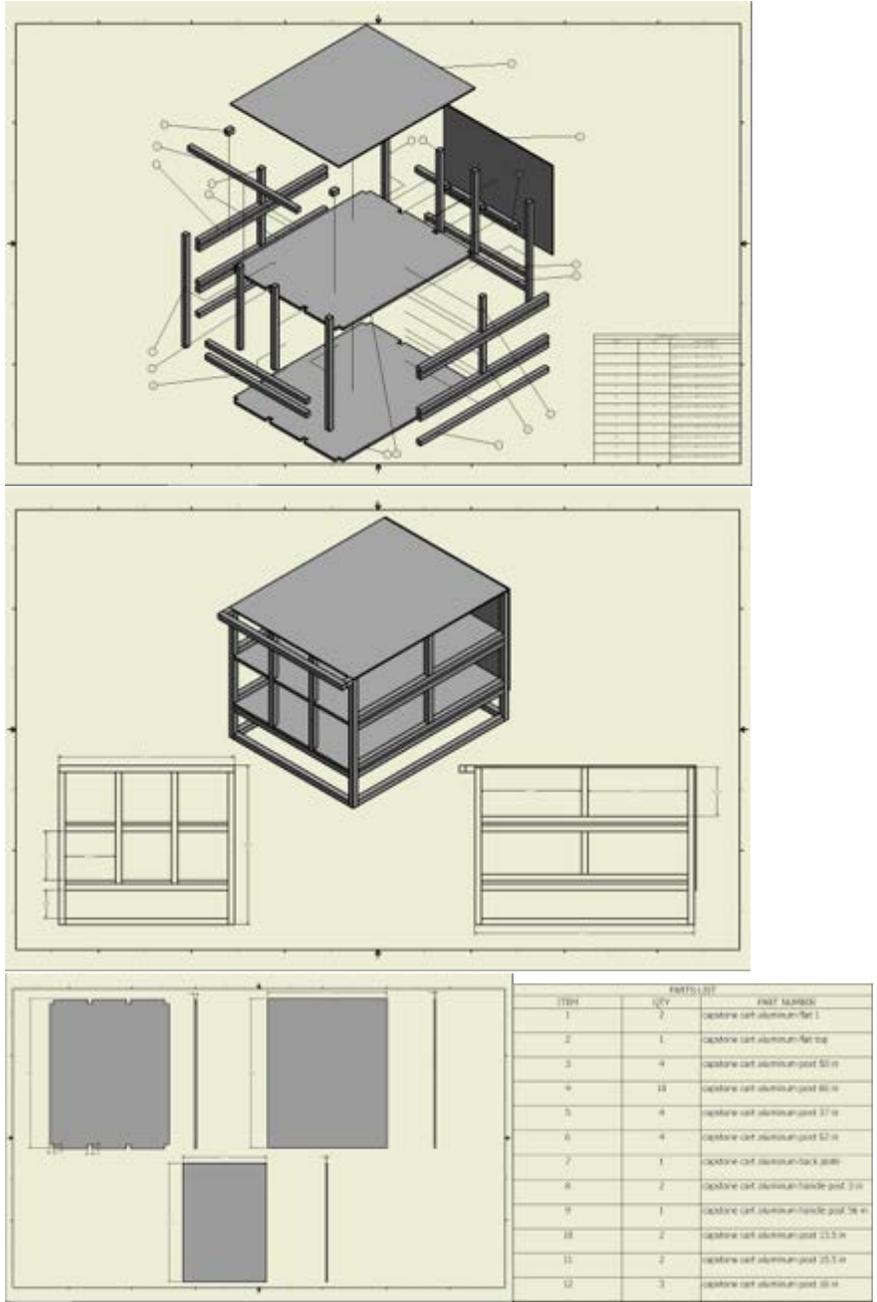
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APPENDIXES



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