Needs Assessment

EML 4551C – Senior Design – Fall 2011 Deliverable

Team # 9

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Project Sponsor

T.E.C.T. Power

Project Advisor(s)

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Needs Assessment

Blades used in jet, as well as some locomotive, engines require a meticulous multi-stage process in order to be useable in their various applications. T.E.C.T. Power products include: airfoil blades, airfoil vanes, diffusers, impellers, etc. Increased efficiency is an ideal goal for any mass production manufacturer. It is this company's desire to reduce work related injuries among processes involving direct human interaction. This brings to light a need for a safer, more productive work environment.

Project Scope

Problem Statement

The 68K blades can be difficult to handle, weighing approximately 45 lbs, and the incorporation of bulky lifting mechanisms decreases the overall production efficiency. This project incorporates both the redesign of receiving methods in order to create a more efficient process as well as the design and fabrication of a new mechanism able to safely handle the blades through the multi-step manufacturing process.

Justification and Background

Our contact for this project is Ashok Patel, an industrial engineer at T.E.C.T. Power. T.E.C.T. Power produces numerous 68K blades meant for engine use. The manufacturing process for each one of these blades begins in the shipping and receiving center of the plant where the blades are contained in a packaging with sometimes variable orientations. The next stages of the process include the transition from receiving to broaching stations wherein the blades must be milled down before progression to 68K manufacturing line which holds even more stages of processing.

Each phase of this process involves direct interaction and, in most cases, vertical lifting and reorientation of the 45lb blades to maneuver them through the range of required positions as the blade is transferred from one station to the next. While handling these blades the carrier must step onto and off of elevated platforms as well as hold the blade in extended positions while it is attached into each machine. These processes present themselves as an increased risk for work related injury. To add to the danger, most of the milling machines require oil during operation. This increases the risk by adding a slippery surface to maneuver through while maintaining control of the blade. The assistance of traditional lifting devices, such as cranes and hoists, could be used, but they become cumbersome in the confines of the process line and increase the amount of time necessary for manufacturing each part.

Objectives

This project can be defined using two related, but individual objectives.

1. Redesign the receiving methods
    a. Redesign storage area (optional)
2. Design and fabricate a blade handling mechanism

Both objectives will be designed while keeping in mind the overall process requirements. The receiving methods should be designed as to allow the parts to be in an orientation which is best suited for placement on the mechanism. This mechanism will relocate the blade to each station while maintaining the optimal orientation for milling attachment. For the initial goals, the project is only addressing the first stages of manufacturing: receiving and broaching. The goals may be extended to include other processes depending on time constraints.

Methodology

In order to match the expectations set forth by our sponsor, our group will first become completely familiarized with the exact process occurring through the receiving and broaching procedures as well as the constraints given to the design. The group will determine what blade orientation is necessary for the majority of the processes and the methods used for receiving. We will interpret the voice of the customer using a house of quality and fishbone diagrams. The next portion of design for each objective would be to brainstorm for initial design concepts. For the mechanical design, the brainstorming session would be focused on mechanisms that would both allow for the robustness of handling the 45lb blade while demonstrating the versatility necessary to easily interact with the many types of machines available on the manufacturing lines. The receiving and efficiency concepts would be primarily devoted to how to modify the current methods for increased productivity and safety.

Once each brainstorming session is complete, the group will rank the designs based on the following criteria:

Mechanism Design:

- Injury prevention
- Ease of Implementation
- Design Capability
- Durability
- Cost

Process redesign:

- Injury prevention
- Efficiency of implementation
- Cost of Implementation

Also, both the mechanism design and the process redesign will be characterized based on the capability to implement with each other.

Constraints

The following constraints have been placed on our concept designs.

The Mechanism Design Must:

- Be easily moved from station to station without limiting maneuverability
- Be able to carry at least one 68K blade
- Not damage any blades
- Reduce, if not remove, the need for manual lifting
- Decrease the overall risk of work related injury
- Allow for quick and efficient installation and removal of blade from machine fixtures
- Be able to be operated without requiring significant physical exertion
- Have a simple design and a small learning curve

The Process Redesign Must:

- Not greatly reduce the amount of blades able to be processed
- Be acceptable to operators
- Reduce time spent between machining

Both the mechanism design and the process redesign must cost a maximum of four thousand dollars.

Expected Results

This project, once completed, should have redesigned the receiving and processing method to allow for a more efficient procedure. The handling of the blades should be done by a mechanism that allows for the relocation, installation, and removal of 68K blades from the milling machines used in the broaching phases of manufacturing. The entire project should result in an increase in productivity and a reduction in risk of physical injury to T.E.C.T. Power employees.