Project Specification

EML 4551C – Senior Design – Fall 2011 Deliverable

Team # 9

Michael Brantley[2], Ryan Ferm[2], Jason Newton[1], Reginald Scott[1], Nadia Siddiqui[2]

[1]Department of Mechanical Engineering, Florida State University, Tallahassee, FL

[2]Department of Industrial Engineering, Florida State University, Tallahassee, FL

Project Sponsor

TECT Power

Project Advisor(s)

Dr. Chiang Shih, PhD
Department of Mechanical Engineering

Dr. Okenwa Okoli, PhD
Department of Industrial and Manufacturing Engineering

Reviewed by Advisor(s):

Introduction

Turbine Engine and Components Technology (TECT) Power has requested a modification to their current manufacturing methods. The goal of this project is ergonomic improvement and mechanical design for the processing and handling of 68K turbine blades. The blades weigh approximately 45 lbs prior to broaching and current handling methods require manual lifting to and from containers as well as milling machines. These methods lend themselves to a high risk of personal injury.

Product Specification

Our task is to develop a new procedure for the receiving and transportation of these blades as they move through the manufacturing line. The blades travel through a multi-step process. This process is discussed in further detail below.

Shipping/Receiving

Currently, TECT Power receives a shipment of crates. Each crate contains between five and eight forgings. Depending on the shipment, the forgings could either be received in a horizontal or vertical orientation. In order to remove these parts, an employee must manually lift the blade from the container to a minimum height of thirty inches. Frequently the parts are entangled and must be maneuvered free of the crate. Due to the shape of the blades, one must grasp the middle section during lifting. Because of the weight of each part, this vastly increases the level of difficulty. This could be avoided if the shipping were redesigned in a more efficient fashion for retrieval. The new receiving method should allow for the forgings to be easily removed from the container without significant effort or personal strain.

Processing

After the blades are received, they are relocated to the storage area of the factory. The transition from receiving to storage takes place in the same container. This area holds various types of blades until processing and is located adjacent to the broaching section. The blades are stored in a manner that limits access. A blade handling mechanism would need to approach the containers, remove a single blade, and return to the milling location without hindrance from other stored forgings. To solve this problem, the storage must be reorganized to allow blade access without encountering obstacles. In addition to their storing location, the blades should be stored in a way that would eliminate any physical damage.

Handling

The blades are transported between storage and milling machines via a hand cart holding multiple parts. There are various types of carts used, each holding the blades in a

different orientation. This poses the problem of having to manually re-orient the blade for placement into a broaching fixture. The handling mechanism will have to be easily maneuverable, yet stable under the weight of at least one forging. The milling machines have beds that require the blades to be laid either vertically or horizontally. The mechanism will be required to present the blade in a manner most suited for attachment to each broaching machine. These machines use oil as lubrication, because of this, each machine has a raised oil bed around its base that prevents a cart from rolling directly up to the mounting fixture. Therefore, the operator must retrieve the blade from the cart and step onto the oil bed to place the blade into the machine. The oil usage can also cause splashing which results in slick walking surfaces.

Constraints

The redesign of this process as well as the design of a mechanical handling mechanism must adhere to the following constraints set forth by the company:

The Mechanical Design Must:

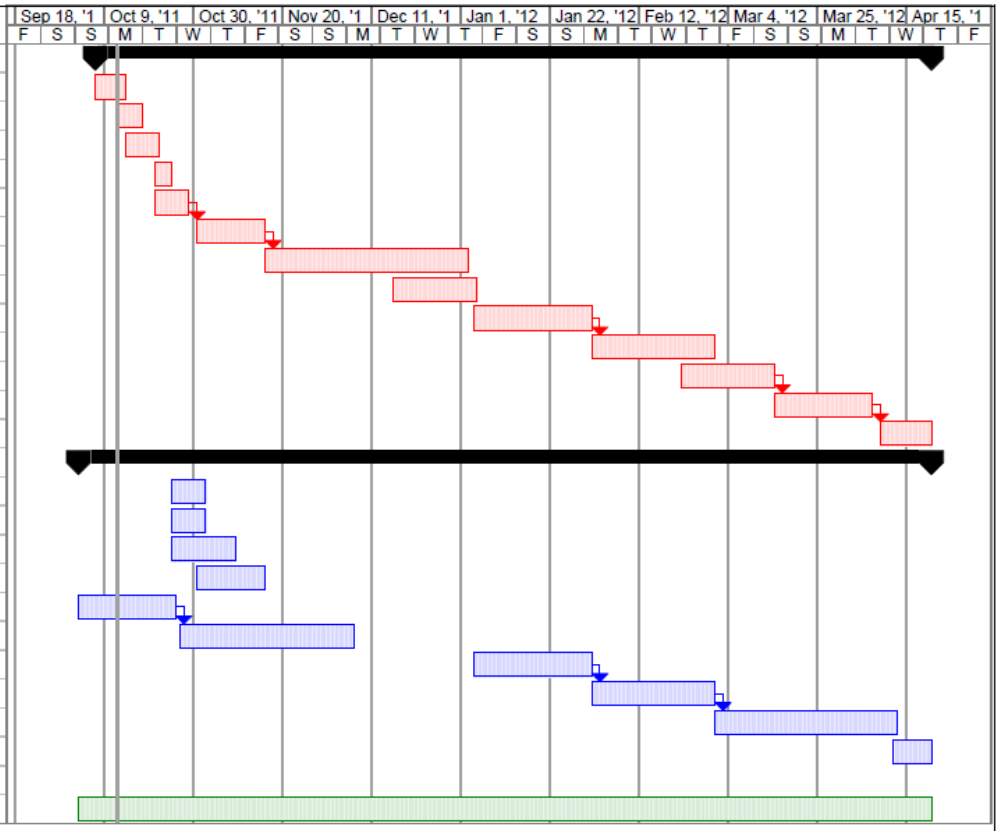
- Carry a minimum of 45lb
- Be able to extend the blade between 3-5 feet
- The device cannot exceed allowable path dimensions

The Process Redesign Must:

- Maintain or improve efficiency
- Not be operator exclusive
- Reduce time spent between machining

Project Schedule

ID	Task Name
1	**Mechanical**
2	Product Specification
3	Concept Generation
4	Concept Selection
5	CAD
6	Design Analysis
7	Material Selection and Cost Analysis
8	Purchasing
9	Design Refinement
10	Part Machining
11	Prototype Assembly
12	Prototype Testing
13	Design Modifications (If Necessary)
14	Project Summary
15	**Industrial**
16	Operator Interview
17	Storage/Receiving Layout
18	Shipping Packaging
19	Cost Analysis
20	Define Phase
21	Measure Phase
22	Analyze
23	Implement
24	Control
25	Project Summary
26	
27	Customer Communication



Project: Tect+Project_Schedule
Date: Wed 10/12/11

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline