Introducing New Innovative processes into Traditional Manufacturing

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I. Abstract

The implementation of a new and innovative process into an established manufacturing process can be very disruptive to the current status quo but with correct analysis to support the change, "buy in" from both upper management, and good support staff the transition can be less disruptive. To find areas that were in need of change the Manufacturing Engineering (MFE) Manager assembled a small group of engineers. The team found several areas in which change could be implemented that would be high impact with low risk. The manager chose to "socialize" the thought of change with the Manufacturing managers long before the analysis had been conducted. This allowed him to address many of the concerns before making the actual changes.

II. Introduction

This paper is an inside look at the strategy used to manage the introduction of a new technology/process into a traditional Manufacturing process. The goal of this project was to find more efficient and effective processes and implement them into a traditional manufacturing process that had been in place for more than a decade.

The initial concept began with a need to address two different issues. The first was a need to improve an existing process that had become ineffective and slow. In the existing structure Manufacturing Engineer's (MFE) were responsible for managing all aspects of a particular product line. These responsibilities included everything from reviewing all new Engineering Change Orders (ECO), managing changes to existing system build procedure's, resolving issues on systems that were currently being built, and much more. Because of the amount of work on their plates the MFE's were forced to prioritize their work load. This put some issues on hold until they could find the opportunity to address them, making any process improvement impossible, thus the existing process fell into a rut. Because this factory is low volume, the process worked for many years but with companies expansion and an increase of product lines, the existing process became bogged down and ineffective. The time for change was now!

The second reason the manager wanted change stemmed from the fact that he was a new manager and needed to set the organization in a new direction, to break away from the old regime and make the organization his own. This would enable him to change the image of the current organization and to model it as a new entity within the company. To once again instill the idea on the manufacturing floor that the Manufacturing Engineering team was there to ensure the manufacturing floor was fully supported.

III. Concept

The initial concept to introduce a new process into a traditional manufacturing setting was brought to light by the need to accomplish several goals. First; increase product output of the factory while remaining within certain constraints. Second; remove the existing restrictions that the Manufacturing and Industrial Engineering team had worked under for more than a decade.

Under the existing process the factory output had reached its maximum capacity, the task of changing this fell upon the MFE Manager. According to MFE manager Mike Longwill [1] the need for change was self-evident, with bottlenecks in information flow, excessive amount of materials routed to the floor, sluggish material flow throughout the factory, and an overburdened staff the current process had become ineffective. To find a resolution for these problems the MFE manager assembled a small project team and challenged them to come up with ideas on how to increase factory throughput and increase efficiency. According to Clayton Christensen "the hallmark of a great manager is the ability to identify the right people for the right job". [2] The project team reviewed several possibilities and presented them to the MFE manager and after reviewing the various possibilities which will be covered in the analysis section.

IV. Analysis

In order to analyze the current process and find new and innovative ways to change to the organization the small team of engineers ran an analysis of existing "standard practices" within the factory. The only constraint placed on the team was the physical size of the building, which could not be increased, everything else was fair game. The team ran studies in several functional areas and found the ones that could be changed with the most impact with the least effort, the most bang for the buck). These areas were component critical path, part sequencing, material handling, the implementation of a Kanban system, and a departure from value study.

A. Critical Path Analysis:

The objective of the study was to find how the sub-assembly line could be changed in order to reduce the amount of time it takes for a chamber and a top plate to be assembled. The concept is to run as many steps in parallel as possible thus reducing the overall assembly time. The analysis was conducted using a basic Program Evaluation and Review Technique (PERT) chart, (Figure 1) [3] and reviled several steps that could be accomplished in parallel thus reducing the overall time taken in the assembly process.

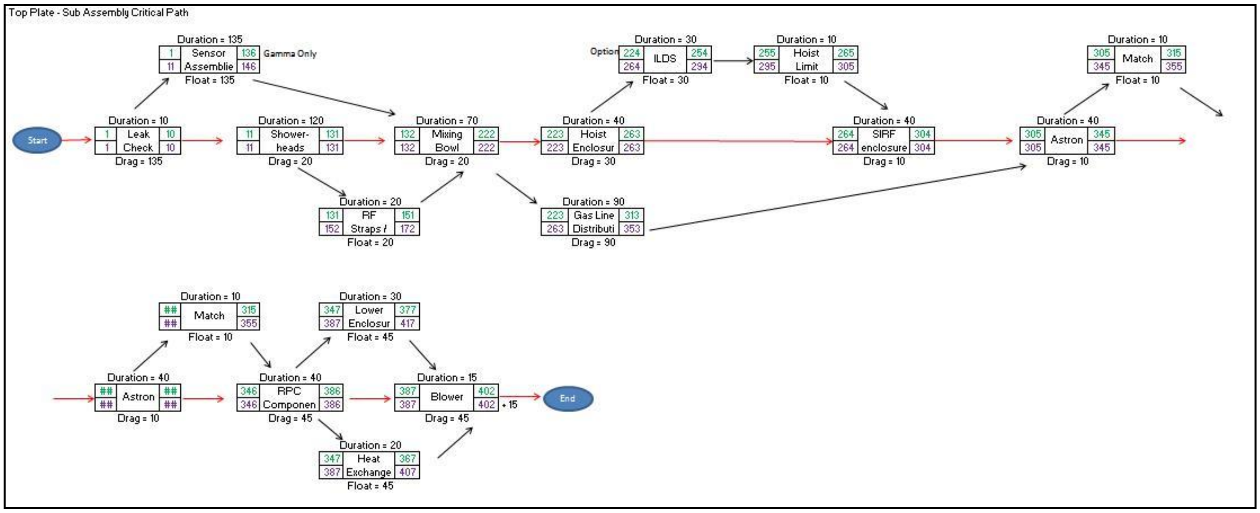

Figure 1 PERT Chart

Each of these chambers and top plates occupy a large fixture (Figure 2), with the decrease in assembly time the fixtures can be repopulated quicker therefore putting more material on the line to fulfill demand. This is another benefit of reducing the assembly time.

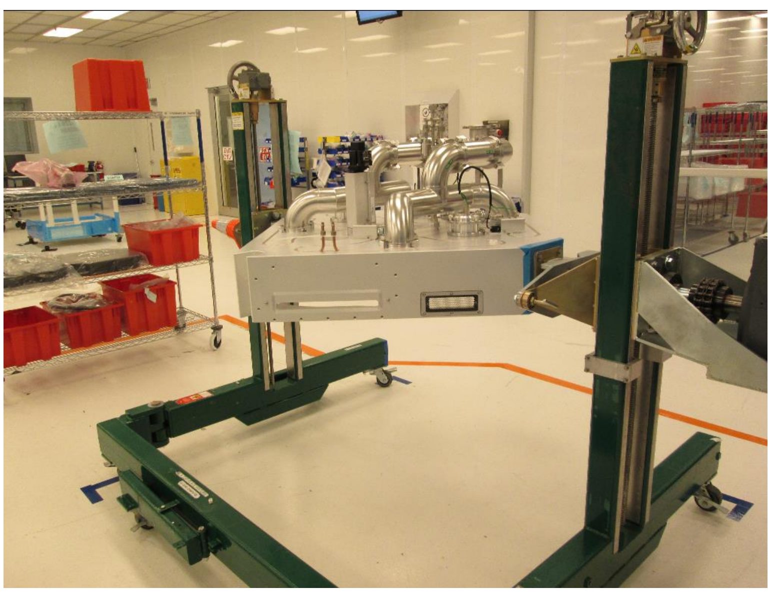

Figure 2 Chamber fixture

B. Part Sequencing:

The objective of this study was to determine how efficient parts were being sequenced to a particular system and how it could be modified to become more effective. What was found is that parts were being sent to the system in no particular order resulting in the assembly team to have to travel a total of 437 feet while moving around the entire system installing parts. (Figure 3)

The analysis found that by sequencing parts to particular areas on the system during the assembly process the amount of time lost in travel distance alone would be reduced by a total of 28%. [3]

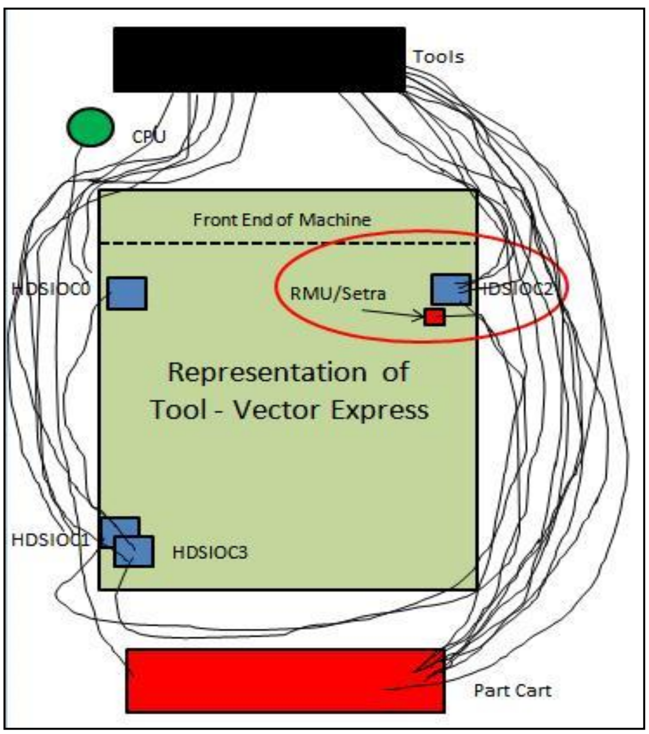

Figure 3 Part Sequencing

C. Material Handling:

Material handling analysis was one of the key components in these series of studies because so much time was being lost in searching for the next kit or part to be installed. Parts were often being lost or misplaced resulting in lost time and efficiency. (Figure 4) The resolution to this was to find an alternative method of issuing materials to the floor. The idea was to only issue materials to the floor at particular points of the build process, the materials for this point in a build was placed in clearly marked bins. By doing this there would be less material lost, less time spent looking for materials, and less space taken up on the floor. (Figure 5)

Figure 4 Material Handling

Figure 5 Post Kanban

D. Kanban:

The focus of this analysis was the method in which materials were being issued to the floor. As seen in figure 4 the material was being issued in bulk causing a huge back up of material. The root cause of this problem was the methodology in which materials were being requested. As seen in figure 6, materials for three different systems all shipping at the same time could be requested at the same time by different supervisors. If system D11111A was sequenced first it could be up to 14 hours before system D22222A was sequenced.

This presented several problems; first it placed excessive amounts of material on the floor at one time (figure 4) creating confusion and congestion. Second; it left assemblers idle while waiting for material. Lastly it was very overwhelming to the Shop Floor Control (SFC) personnel that were trying to get the materials to the floor in a reasonable amount of time and satisfy the need for materials.

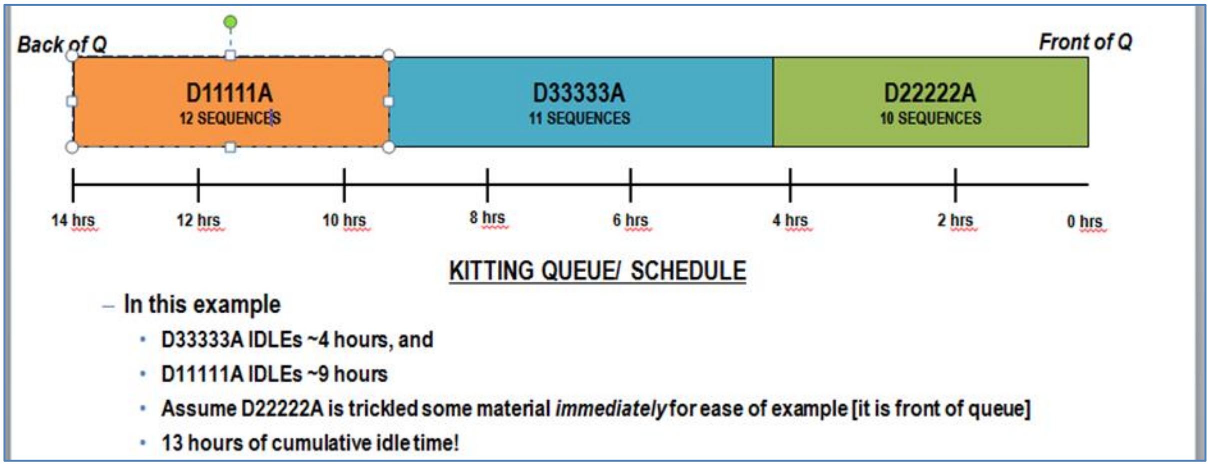

Figure 6 Material Sequencing

The resolution was to create a system that would solve the problem by:

1- Delivering material to the floor in the sequential order of the build.

2- Only deliver material for the next sequence once the current sequence was completed.

3- Create a system that would monitor which materials were currently on the floor and which were next to be issued to the floor. (figure 7)

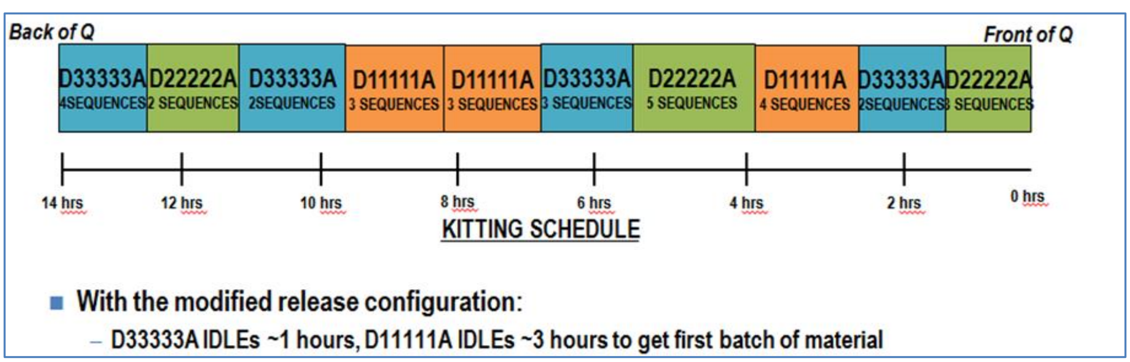

Figure 7 New Sequencing Method

This change accomplished an overall reduction of materials on the floor (figure 5), kept the assembly team supplied with materials, prevented supervisors from jockeying for position, created load leveling, and reduced the overwhelming requirement of SFC personnel focus on systems to a manageable focus on sequences.

E. Departure from Value:

The final study was departure from value which focused on identifying any occurrence that causes the line to stop moving. This included everything from the generation of quality notifications, for either failed parts or the request for engineering changes, to lost time for troubleshooting a problem in the testing phase. The departure study was done by initially observing several systems throughout their life cycle and recording all deviations from value added functions. Once this was completed, the data gathered was used to a find the frequency rate and amount of time each departure was taking.

The analysis found that on average each system was losing 73 minutes per departure and 48 hours per system from cradle to grave. [4] The information was valuable because it identified areas that could be potential candidates for future continuous improvement projects (CIP).

V. Implementation

According to *The Innovator's Dilemma* [2, p. 201] processes are very difficult to change for two primary reasons. First, "because of perceived boundaries" and second "the reluctance of managers to make a complete change". This was found to be particularly true during the changes in the existing processes. The initial step toward change was to the existing organization. The organization had set boundaries that had been in place for over a decade and changing these boundaries met with some resistance from both the manufacturing managers and the manufacturing Engineering organization. The primary reluctance from the manufacturing managers to this change was rooted in the concern of "Who do I go to if I need…." This concern was addressed in part by both formally publishing the new organizational and responsibilities matrix. Secondly by the manufacturing manager stating "who have you gone to before?" implying that he is always available as a primary contact if they needed emergent work from his team.

"Innovative change in American manufacturing has made huge production gains over the last 100 years." [5] Through trial and error manufacturing floors around the country have been making advances leading to more effective and efficient product lines [5]. Change began in this Manufacturing organization by changing the previous concept that Silo'd the MFE, it changed their focus from the product to the process. Forming the function groups of Line Managers, Final Test Engineering, and Floor support Engineers allowed each group to focus on process improvements. When asked if the analysis done by the small group of MFE's had any bearing on the implementation the manager replied "Not at all, it simply reviled areas in which change could occur with a reasonably high confidence of success." [1] The information found by the project group was made available to the entire MFE team with the anticipation that it would be used to assist the new organization in the change from traditional manufacturing practices to a streamlined practice.

Changes in the way the manufacturing lines flowed and addressing the issues found during the critical path analysis came after the implementation of the new organization. The newly formed Line Managers were now able to focus on the process and making it more effective and efficient. At the same time they were able to address the issues with material handling and part sequencing by implementing a new Kanban system. The Final Test Engineers are able to address all issues dealing with the testing and design of the systems. The Floor Support Engineers are able to address emergent issues that stop the production lines. The team also implemented rapid response system that enables the manufacturing floor to enter an issue into a database where it is reviewed by an MFE and then tracked to resolution. It also created an archive to the database that MFE's can use to recall past problems and the methods used to resolve them, thus reducing the need to find the resolution time after time.

VI. Conclusion

According to Kepner and Tregoe [6, pp. 220-222] there are seven basic conditions for success. To paraphrase them; "clearly define ideas, present them to those that will use them, apply them to real concerns, modify to fit within the organization, reward those who use the new process, continue process improvement and monitoring of the new process". During the implementation of this new process the manager used all of these either in part or in whole. He kept his team informed of the new ideas and allowed them to play key roles in the formation of the new organization. By "socializing" the his future concept of change months prior to the actual change the manager was able to anticipate any roadblocks or concerns from negative stakeholders allowing him to have a mitigation plan for each concern. [1] The manager was able to “build and prepare the right organization for the job” [2, p. 186] which increase his probability of success.

While conducting the research for this paper I found many references to adopting technology in manufacturing. In fact there was so much information available that it was difficult to decide which references were most closely related to the subject of this paper. One of the topics that I found fascinating was in a paper by David Beede and Kan Young called Patterns of Advanced Technology Adoption and Manufacturing Performance. The paper stated that ‘when a company has a higher adoption of new technologies they show a higher than average rate of job growth and labor productivity than plants that do not have a high rate of adoption”. [7] Since the adaptation of these new processes the organization has grown and the factory output has increased. At this point it is too early to say if it was because of the changes made or because of economic growth in the industry but it will be interesting to watch. Although there will be many changes to the new system as it matures I believe that this change will bring in new innovation and the continued growth of the company.

VII. Interviews

Mike Longwill

1) **Was there a need for change or did you just change for the sake of change?**

There were several reasons that I instituted change in the organization.

There hadn't been change in the organization in 12 to 15 years and the process had become silo'd. The MFE was assigned to a particular system or product and was responsible for reviewing ECO's, CF redlines, upgrades, all assembly and final test issues, etc… Because of the over burdening the MFE had to react to emergent issues on the product and could not work of the efficiency of the process and continuous improvement projects (CIP).

Second, as a new manager I wanted to make this organization my own and breakaway for the old mold. I felt that change was needed; my team was not functioning as a cohesive unit and providing the needed coverage.

2) **Do you think that the current system is where it needs to be or do you think that it can be improved?**

Yes, there are always things that can be improved in any process.

3) **Did the analysis done by Mr. Meuret drive your decision for change?**

No, not the decision to change, I knew change needed to occur.

Yes, in the different areas that changes were implemented and the method of implementation.

4) **How did you convince the manufacturing managers that this change could benefit the factory?**

I asked for forgiveness and not permission

I have a long standing relationship with the other managers and I predicted their responses to the changes and had the resolutions when the questions were asked.

I started socializing the ideas months before I made the changes

The main concern of the customers was, were their needs going to be met and how.

i.e. MFE Communication log

5) **What were the greatest barriers to the change?**

People within the MFE organization not accepting change

I started socializing the ideas months before I made the changes

Addressed concerns of the team

During the pre-change discussions no feedback was received, neutral or negative

There were more post-change concerns voiced. I wish I'd been more proactive in getting the information from the team.

Chris Dieringer

1) **What type of analysis did you do prior to the implementation of the Kanban system?**

Mostly observation

"When you have a hole in your chest you don't need to analyze why your bleeding"

Post analysis was conducted to evaluate effectiveness of the program

2) **How did you convince the Management team that this was the best method to improve material floor to the floor?**

This project was piggy backed with another project

I used buzz phrases like level load to "WOW" the crowd.

3) **What were the greatest barriers to change?**

Changing the mentality on both the manufacturing floor and Shop Floor control.

SFC was very unreliable and there was a lack of or non-participation.

I did catch both side "cheating" the system and had to reprimand them

4) **What would you change in retrospect?**

I would have kept supporting managers informed of their employee's performance and held them accountable or it.

5) **What if any are the CIP plans for the future:**

The method in which purchasing and SFC stock bulk materials offsite. We should have looked at "Improve bulk storage philosophy"

Improving definition on material delivery batch size. "cycle time base batch sizes"

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