

Manufacturing Line Labor Optimization

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Abstract —*The identified manufacturing line had 45 operators distributed in three (3) shifts for a total of 135 operators. The rebalancing process included the consolidation of multiple current operations using procedure changes and process validations. The manufacturing process was rebalanced in order to reduce from 15 to 13 operations. After analyzing the results, there was a significant reduction in the manufacturing cycle time of the product. With the implementation of this change, the manufacturing line now has 39 operators distributed in three shifts for a total of 117 operators. This is 18 operators less, which significantly reduces the overhead of the line. The project engineer relied on the input and support of the Manufacturing and Quality Engineers of the affected line.*

Key Terms - *Line Balancing, Cycle Time, Operation Consolidation, Process Validations.*

INTRODUCTION

A manufacturing company has identified a manufacturing line as a candidate for cost saving improvements because the overhead and the output time are considered very high with room for improvement. Currently the identified manufacturing line has 45 operators distributed in three (3) shifts for a total of 135 operators. The goal is to increase production and try to keep the labor costs as low as possible. The change being implemented will be only focused optimizing the labor distribution in the manufacturing process. The actual finished good will remain the same. As part of a cost saving initiative, this proposed change will decrease the product output time and reduce personnel required from the affected manufacturing line. This change will only apply to the affected manufacturing line in a Medical Device company in Ponce, Puerto Rico.

Proposal

The manufacturing line is designed for a visualization system that enables optimal visualization throughout a procedure for a smoother laparoscopic and robotic surgery. The system is composed of a kit that provides warming, cleaning, defogging, and protection of laparoscopic cameras during surgical procedures.

The rebalanced line will apply basic subsystems will dictate how the manufacturing cell operates but will not change the final product in terms of material or design. The current manufacturing process will be rebalanced in order to reduce from 15 to 13 operations. The rebalancing will include the consolidation of multiple current operations. The project will help improve cost savings by eliminating the personnel from each shift; therefore the overhead will be reduced.

This project should be implemented within a time span of approximately 3 months. The project engineer will rely on the input and support of the Manufacturing and Quality Engineers of the affected lines. The timeline and schedule includes all project activities such as Initial Assessment, Data Analysis and Implementation. Refer to Figure 1 for a detailed description of all action items and project deliverables.

Tasks	Duration	Aug			Sep			Oct				
		14	21	28	4	11	18	25	2	9	16	23
Initial Assessment and proposal	1w	█										
Identify operations to be consolidated or simplified.	1w	█										
Consolidate operations and rebalance line.	1w		█									
Train personnel and identify new task time.	1w			█								
Identify operators that will be removed	2w				█	█						
Dry Run of Rebalanced Line	2w						█	█				
Perform official run with rebalanced line and confirm results	2w								█	█		
Update Procedure and Train Personnel	2w										█	█
Final Presentation and Report	1w											█

Figure 1
Project Schedule

ANALYSIS

This section will cover and detail the identified parts of the manufacturing process that were improved and how these tasks were completed. The first task was the assessment of the data provided by the current manufacturing process.

The line consists of 15 operations that work in series in order to manufacture the unit. The line has a one-piece flow and completes one unit every 144.8 seconds. Refer to Table 1 for the time distribution between the 15 operations.

Table 1
Operation Time Distribution

Operation	Seconds
1	13.3
2	13.7
3	10.1
4	9.6
5	6.6
6	9.3
7	8.7
8	5.5
9	8.3
10	7.3
11	7.4
12	3.5
13	12.3
14	12.3
15	16.9

Operation 15 was identified as being the longest step in the manufacturing process with a total of 16.9 seconds. The distribution can be seen clearly in Figure 2. The project engineer concluded that Operations 8 and 12 had room for improvement and that it was possible to consolidate the identified operations. Figure 3 demonstrates the proposed changes that will be done to the layout with the operations being removed.

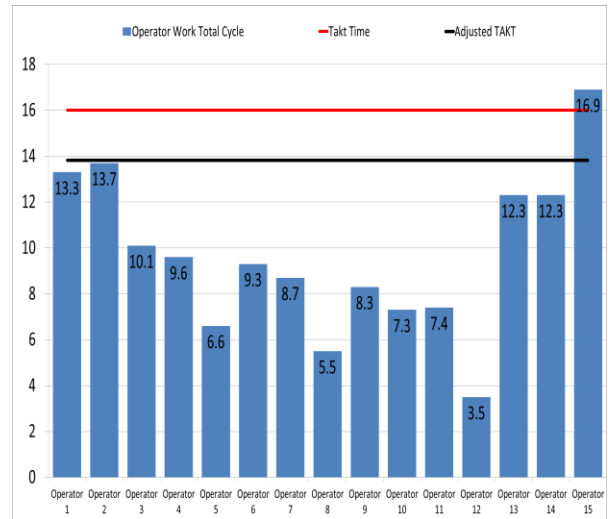


Figure 2
Current Operation Time Distribution

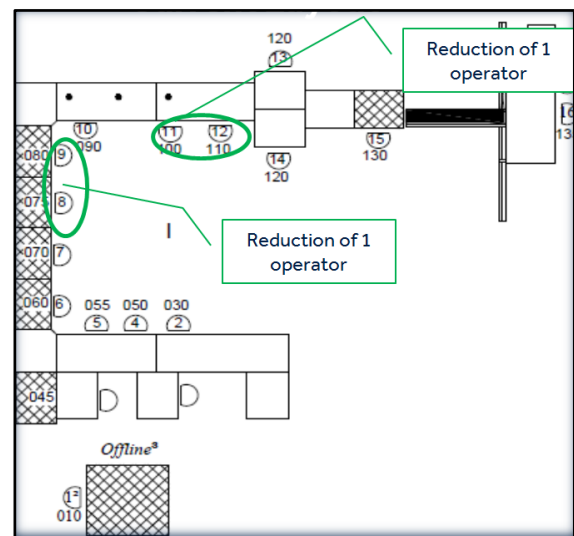


Figure 3
Current Layout Distribution

Methodology

In order to calculate the proposed time, a total of 10 dry runs was performed focusing on Operation 8 in order to get an estimate and understanding how the line performs currently and how the line is going to perform once the identified operation has been consolidated.

Operations 8 and 9 were consolidated, meaning that all operators involved in Operation 8 were no longer required. This was made possible by having

Operation 9 perform the task of Operation 8 adding an additional 5.5 seconds for a total of 13.9 seconds in Operation 8.

In addition, Operations 11 and 12 were also consolidated. This was made possible by installing automatic equipment that reduces the need for Operation 11. The Equipment Validation was subcontracted by the Manufacturing Engineer and was not included as a deliverable for this project, but it affected the results of the line balancing because it reduced an additional operation. Operation 11 will now be part of Operation 12.

RESULTS

The inclusion of the automated equipment eliminated the need for the operator in Operation 11 and will help reduce the operational time of the new consolidated operation. An additional 10 dry runs were performed to identify the new output time for the affected Operation 11.

The average output time for one unit to come of the operation was lowered to 13.8 seconds. The new layout of the line consists of 13 operations that work continuously in series in order to manufacture the unit. The line has a one-piece flow and completes one unit every 138.3 seconds.

The project engineer confirmed with the Manufacturing Engineer of the affected line and all required documents such as procedures and layouts were updated in order to make the change official.

Refer to Figure 4 for the new time distribution between the 13 operations.

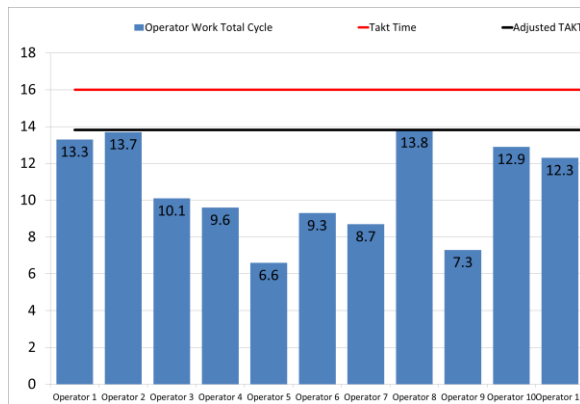


Figure 4

Rebalanced Operation Time Distribution

CONCLUSION

After analyzing the results, it is clearly shown that there was a significant reduction in the manufacturing cycle time of the product. The line previously completed one unit every 144 seconds. This amount of time has been reduced to producing one unit every 138 seconds.

In addition, the manufacturing line previously had 45 operators distributed in three shifts for a total of 135 operators. With the implementation of this change, the manufacturing line now has 39 operators distributed in three shifts for a total of 117 operators. This is 18 operators less, which significantly reduces the overhead of the line.

The objectives of the project were completed and the implementation was deployed successfully within the allotted three month time frame.