

Lead Time Reduction of Flight Test Documentation

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Abstract

Project work is being carried out at Pratt and Whitney in Puerto Rico where Flight Test Documents are drafted and delivered to Flight Test Managers in Pratt and Whitney USA. The current process Lead Time was calculated to be 40.58 days which was too high for Flight Test Managers. With the use of quality tools like Value Stream Mapping and Root Cause Analysis, the Lead Time was reduced to 28.92 days. This was achieved thanks to the removal of non-value added tasks and steps of the process.

Introduction

In today's Service Sector, companies need small lead times, low costs and high customer service quality to compete. Lead Time is commonly defined as the time that lapses between the placement of an order and the delivery of the order. Lead time can influence the customer service experience and impact companies costs. In an attempt to reduce lead time, companies can take existing activities that are non-essential and could eliminate them. By eliminating these non-value adding activities from the processes and streamlining the information flow significant optimization results can be accomplished.

The focus of this project is reducing the Lead Time of Flight Test Documents to Flight Test Engineers. This will be accomplished using Lean Tools and techniques to remove all operations or tasks that are non-value adding to the overall process.

Background

Flight testing consists of developing and collecting data during the flight of an aircraft and then analyzing this data in order to validate various aspects of the design. It is during this phase that design problems of the aircraft are caught and fixed. Once testing is completed, the aircraft can be certified and accepted by the customer who is purchasing it.

Pratt and Whitney Puerto Rico (PWPR) is tasked with creating a document used by Flight Test Engineers called Flight Test Documentation (FTD). FTDs are redacted to contain a list of changes in the aircraft along with the instructions on how to implement them. These documents need to be reviewed and approved by the Flight Test Engineers. Once approved, these documents are used by Flight Test Engineers and mechanics to implement the requested changes.

Problem Statement

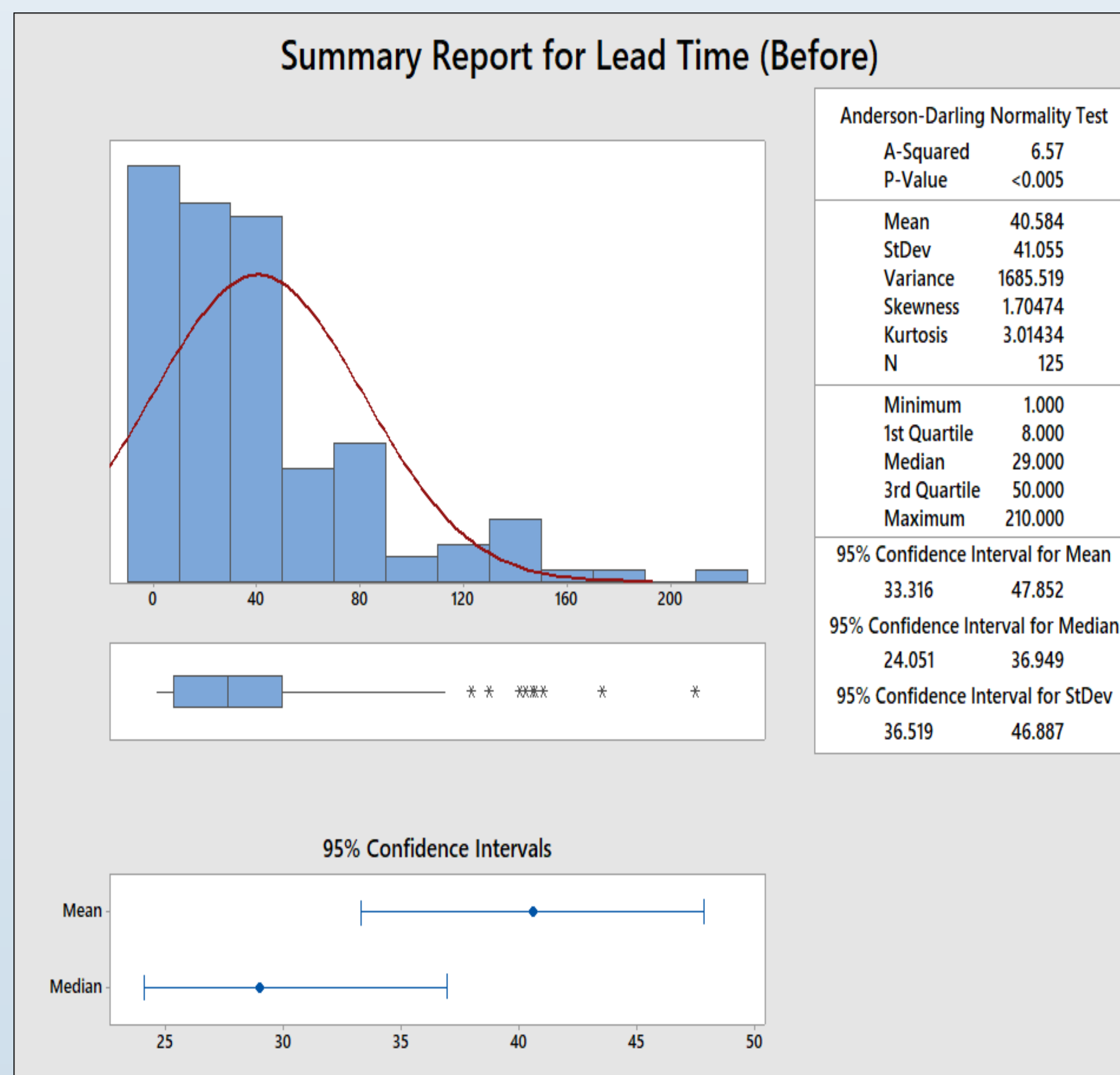
Recently it has come to the attention of Pratt and Whitney Puerto Rico (PWPR) that Flight Test Engineers are concerned that not all FTDs are being delivered on a reasonable time and that aircrafts flight testing is being affected. This can have severe effects on the customer certification dates of the aircrafts and is something that needs to be addressed.

Methods

- Time Study:** Work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance.
- Value Stream Mapping:** Is a flowchart method used to illustrate, analyze and improve the steps required to deliver a product or service. VSM is used to find and eliminate waste. Items are mapped as adding value or not adding value from the customer's standpoint, with the purpose of removing items that don't add value.
- Root cause analysis (RCA):** Is a systematic process for identifying "root causes" of problems or events and an approach for responding to them.
- Control Charts:** They are graphs used to study how a process changes over time. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit. These lines are determined from historical data. By comparing current data to these lines, the process variation can be deemed as consistent (in control) or unpredictable (out of control).

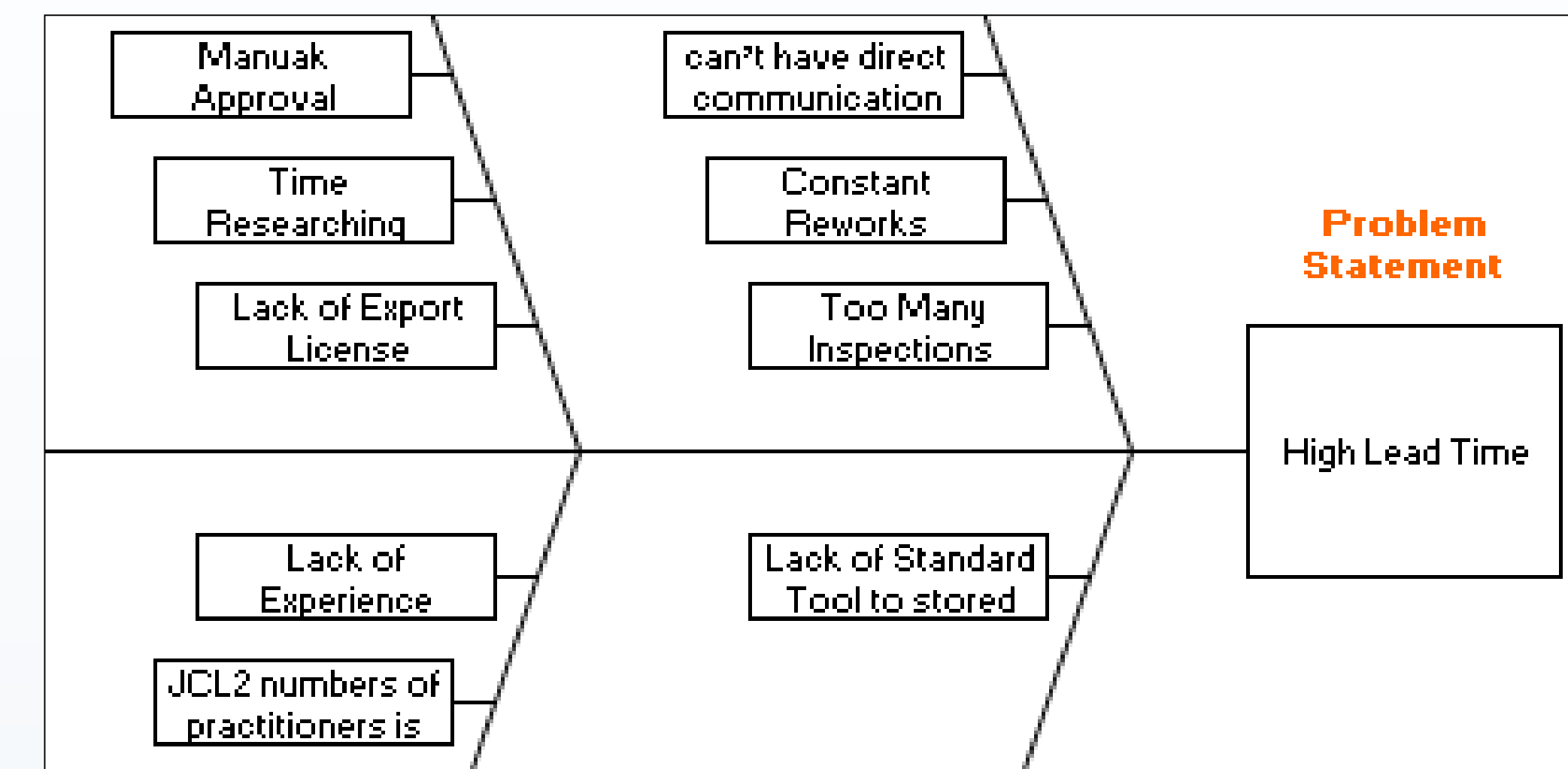
Findings

Using historical data, the current process Lead Time and variance was calculated using Minitab. Among the found Descriptive Statistics of the process, the Lead Time was calculated as 40.58 days per each document and its Standard Deviation as 41.06 days. Also, the Variance is of 1685.52 days.

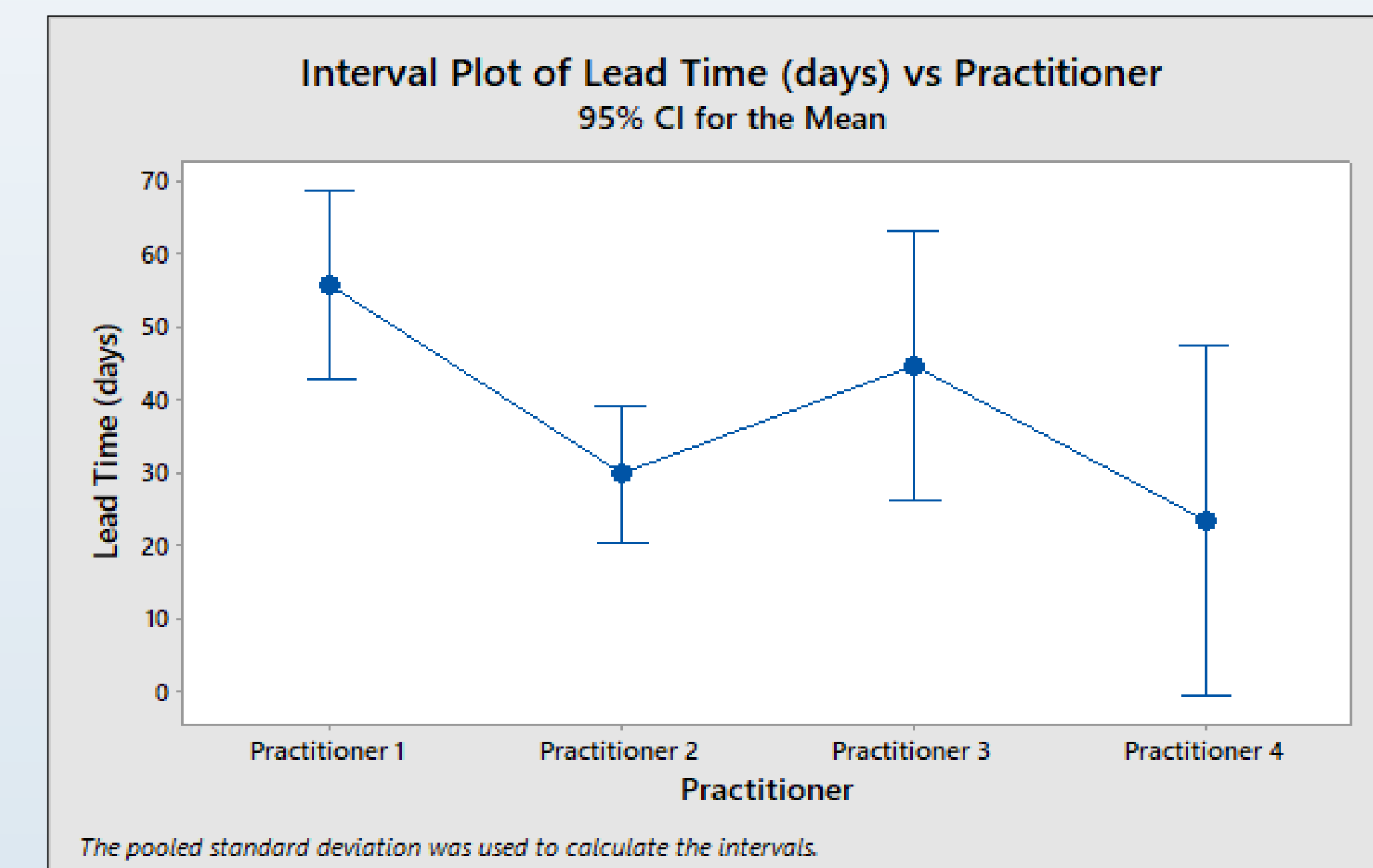


A Cause-and-Effect of non-Value adding and non-value adding but necessary activities is plotted to identify, sort, and display possible causes of a specific problem. It illustrates the relationship between wasted time and what customers are not prepared to pay for (Non Value Adding and non-Value adding but necessary Activity). For determining causes and effects of waste, the construct of a causes and effect diagram using the fishbone analysis will help in determining the root causes of waste and longer lead time.

Cause and Effect Diagram

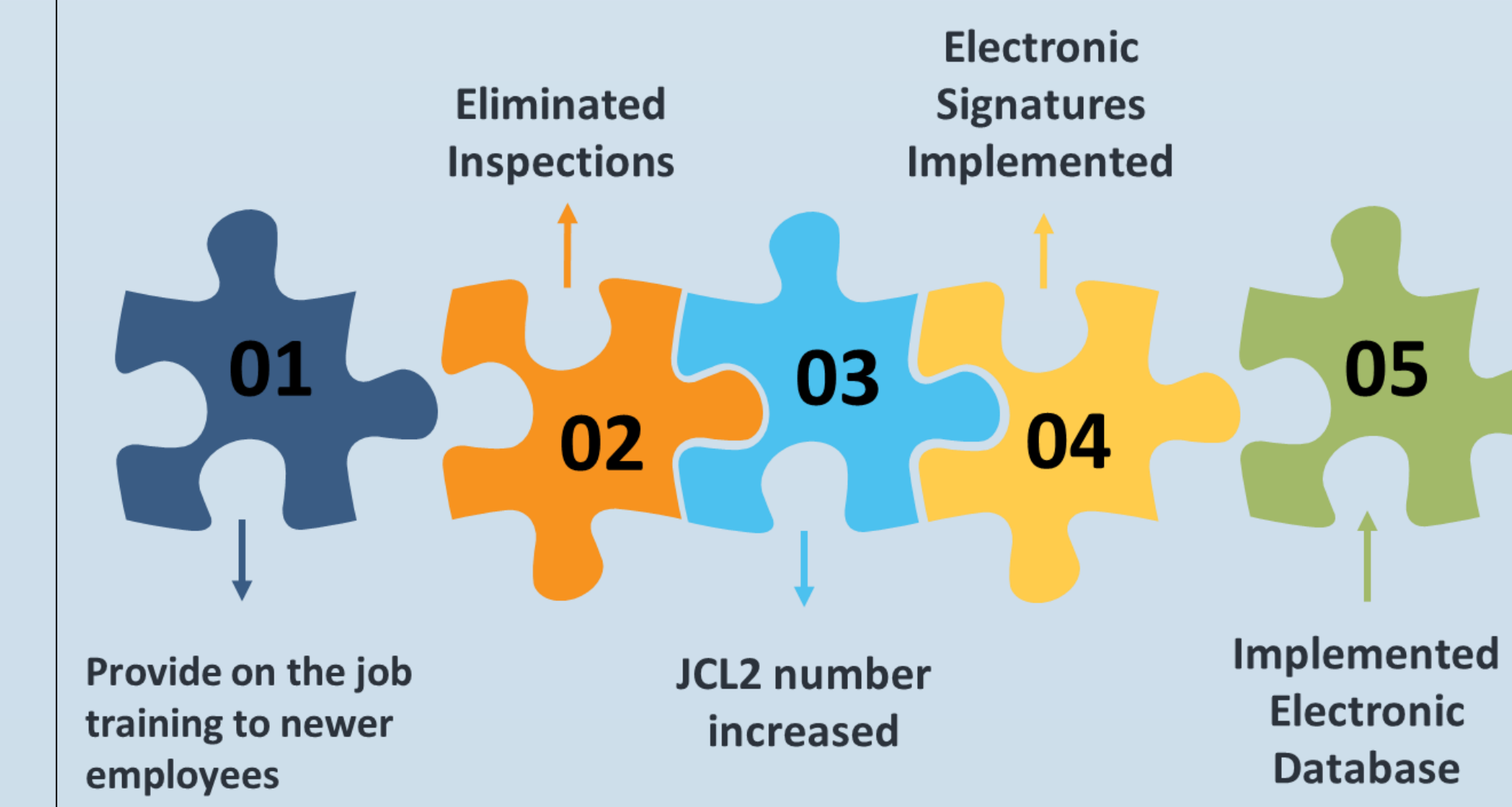


Among the findings of the Cause and Effect Diagram was that couple of the team members are newer employees. This clearly affects the lead time of the Flight Test Documents (FTD) as their defects numbers are normally high and their time in redacting the documents is slower in comparison to more seasoned members. Giving more guidance to these employees will clearly reduce the number of reworks and the time wasted in gathering the required information to successfully redact the FTD.



After the current state of the VSM was completed a number of steps that added no value to the process were identified and worked upon. Non value added activities were reduced or removed in order to eliminate wastes in the process. A future state value stream map was created with these new implementations.

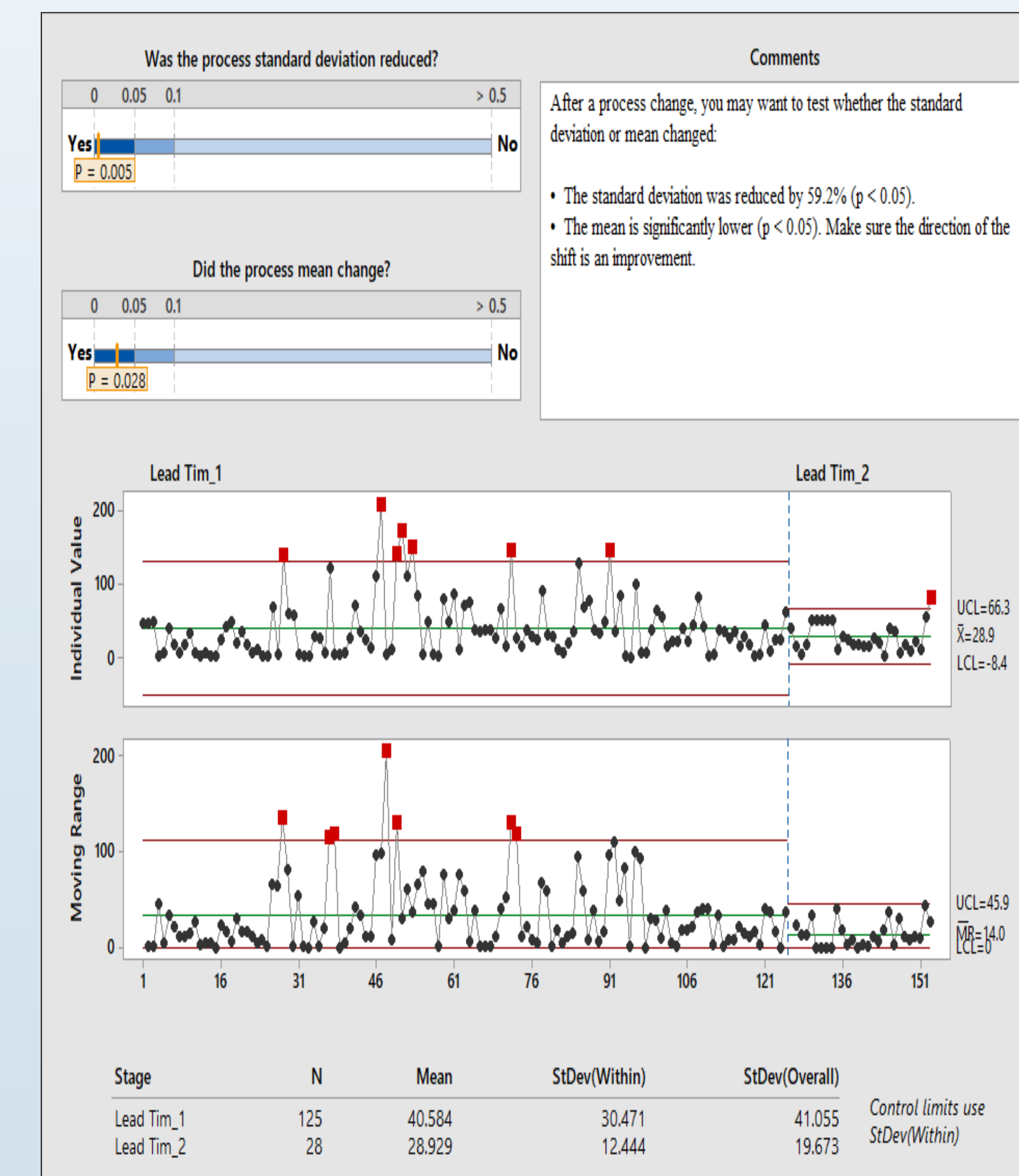
Future State Value Stream Map Implementations



Results

The implementation of the Future State VSM resulted in a significant change on the mean and standard variation of the process. The mean changed from 40.58 days to 28.92 days and the standard deviation changed from 41.055 to 19.673 which is a reduction of 59.2%. Figure 3 Control Charts also show the substantial decrease in Variance of the process.

These results were obtained via Minitab using a Before/After I-MR chart. This chart is intended to make comparisons before and after a process change. Although the primary objective is not process control, the I-MR chart checks the data for stability, normality, correlated data, and the amount of data, which can affect the accuracy of the chart. If the data is not normal, Minitab automatically corrects the problem when possible. Since the implementation of the Future State VSM, 28 FTDs have been delivered. This sample is large enough to consider this new tendency as reliable. Also, the new implemented changes have caused a 67.11% reduction in the defect ratio on inspections.



Conclusion

The implementation of the new process with non-value added tasks removed resulted in a reduction of the Lead Time from 40.58 days to 28.92 days. Also, the standard deviation was reduced from 41.055 to 19.673 which was a reduction of 59.2%. Both of these changes are considered significant and from now on PWPR has committed itself to deliver all FTDs in a 30 day period to Flight Test manager. The new process will be monitored with statistical control charts from now on to make sure it remains under control.