# Improvement of Certification Review Documents Process

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## Abstract

The purpose of this project was to improve the Certification Documents Review Process for the Certification Software Release Reports. The process performed by Pratt and Whitney's Next Generation Product Family group is susceptible to human error and had a lead time of 210 hours. The objectives were to reduce the time required to generate the documents, the turn-backs and the delivery time. A Value Stream Mapping event was performed to design a new process that met these objectives. An action plan was developed to identify what needs to be done to accomplish the new process. With these actions, the non-value adding activities were eliminated from the process and a DXL script was used to simplify the two steps with the higher processing times. The script was used to compare the documents with the previous baseline and export the changes. The improvements of the new process resulted in a reduction of 50.71% of the lead time and a cost reduction of 32.79%.

## Background

Pratt and Whitney Puerto Rico is a company located in Isabela, Puerto Rico. The company formerly known as Infotech Aerospace Inc. was fully acquired by Pratt and Whitney in the last quarter of 2017. The company focuses on providing aerospace products and services. The Controls and Diagnostic Systems (CDS) is one of the company's departments and provide software related products for all Pratt and Whitney commercial and military systems.

The Next Generation Product Family group (NGPF) is responsible of delivering Certification Reports to the customers at the end of every Certification software release. As part of the process, the team manually reviews six documents related to the software requirements, design, traceability, interface and the parts libraries for the design and the requirements. Then, the team performs a Derived and Deferred analysis. Because the documents are reviewed manually, the process is susceptible to human error and has a lead time of 210 hours.

## Methodology

### Value Stream Mapping

The value stream is a set of activities needed to design, produce, and deliver a service to a customer and it includes the information and material flows [1]. As part of the activities, the previous process was mapped using the customer requirements to be able to represent the value of the process as perceived by the customer [2]. After creating the previous-state map, a new process was mapped to reduce waste and add value to the customer. For both processes, the time from starting the process until it is delivered to the client was calculated [1]. This time is known as the lead time and it is the result of the sum of the processing time and the waiting time of the process.

### Action Plan

The action plan included what is needed to be done to implement the process improvements.

### Timing analysis

A timing analysis is a time study of the previous and new processes, to compare the lead time of both processes.

## Methodology

### Cost analysis

To validate the costs reduction, a cost analysis was performed. The cost analysis used the processing time of both processes to determine and compare the costs of the previous and new processes.

## Activities Summary

### Value Stream Mapping Event

A Value Stream Mapping (VSM) event was performed on the Certification Documents Review Process. After establishing the inputs and outputs of the process, a map of the previous process was created in accordance to the customer requirements. Figure 1 presents the mapping of the previous process with a lead time of 210 hours, including a processing time of 154 hours and a waiting time of 56 hours.
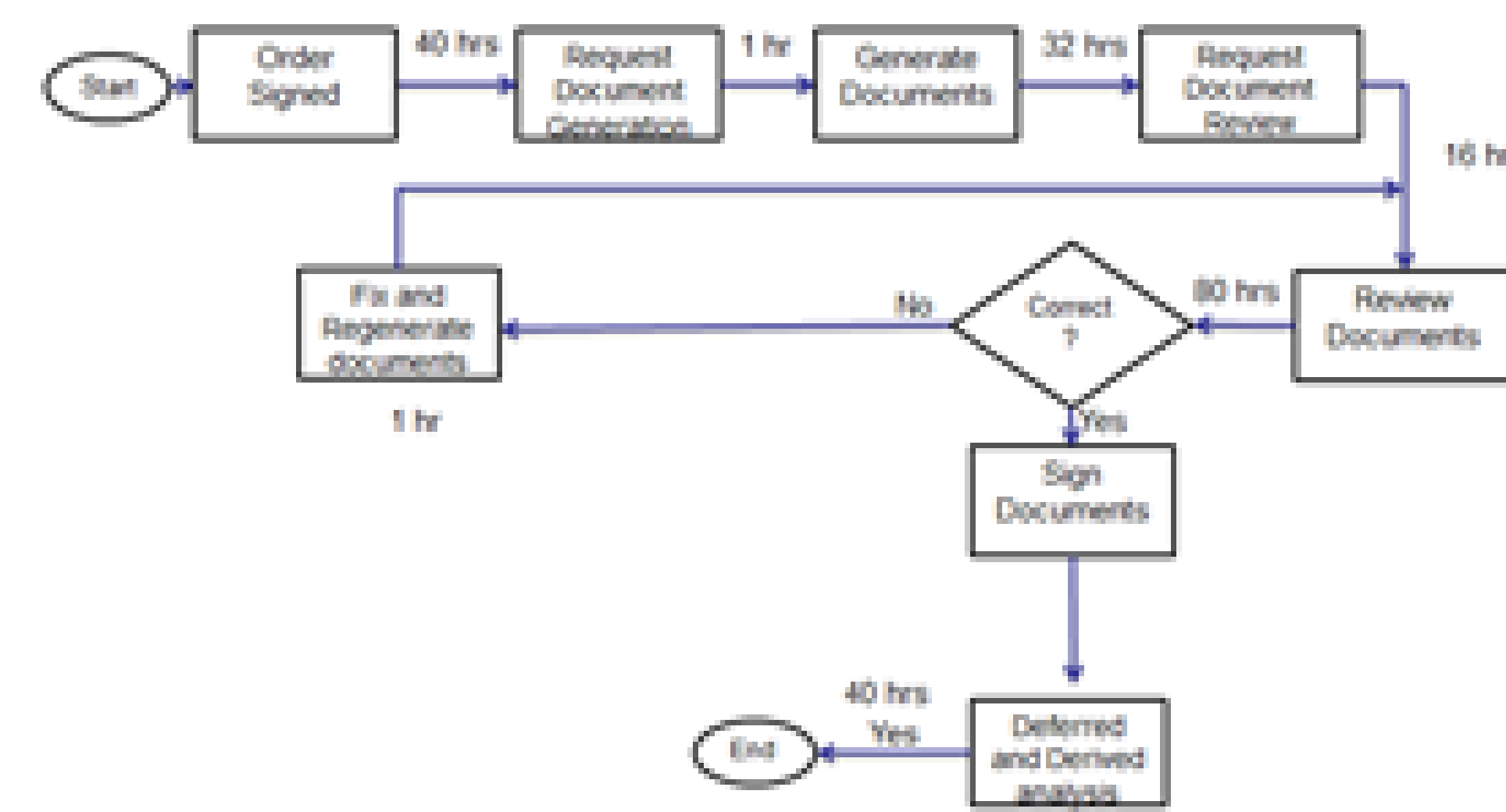


**Figure 1**
**Previous Process**

The areas of the previous process that needed improvements were:
- Order Signed step: in this step there is a delay of 40 hours to wait for the customer to sign the order.
- Generate documents step: in this step there have been many turn-backs incidences because the employees do not receive the proper training before performing the task.
- Review Documents step: in this step there is a waiting time of 16 hours and a processing time of 80 hours.

Figure 2 presents the mapping of the new process with a lead time of 93.5 hours. In the new process, the waiting time was eliminated and the lead time is equal to the processing time.
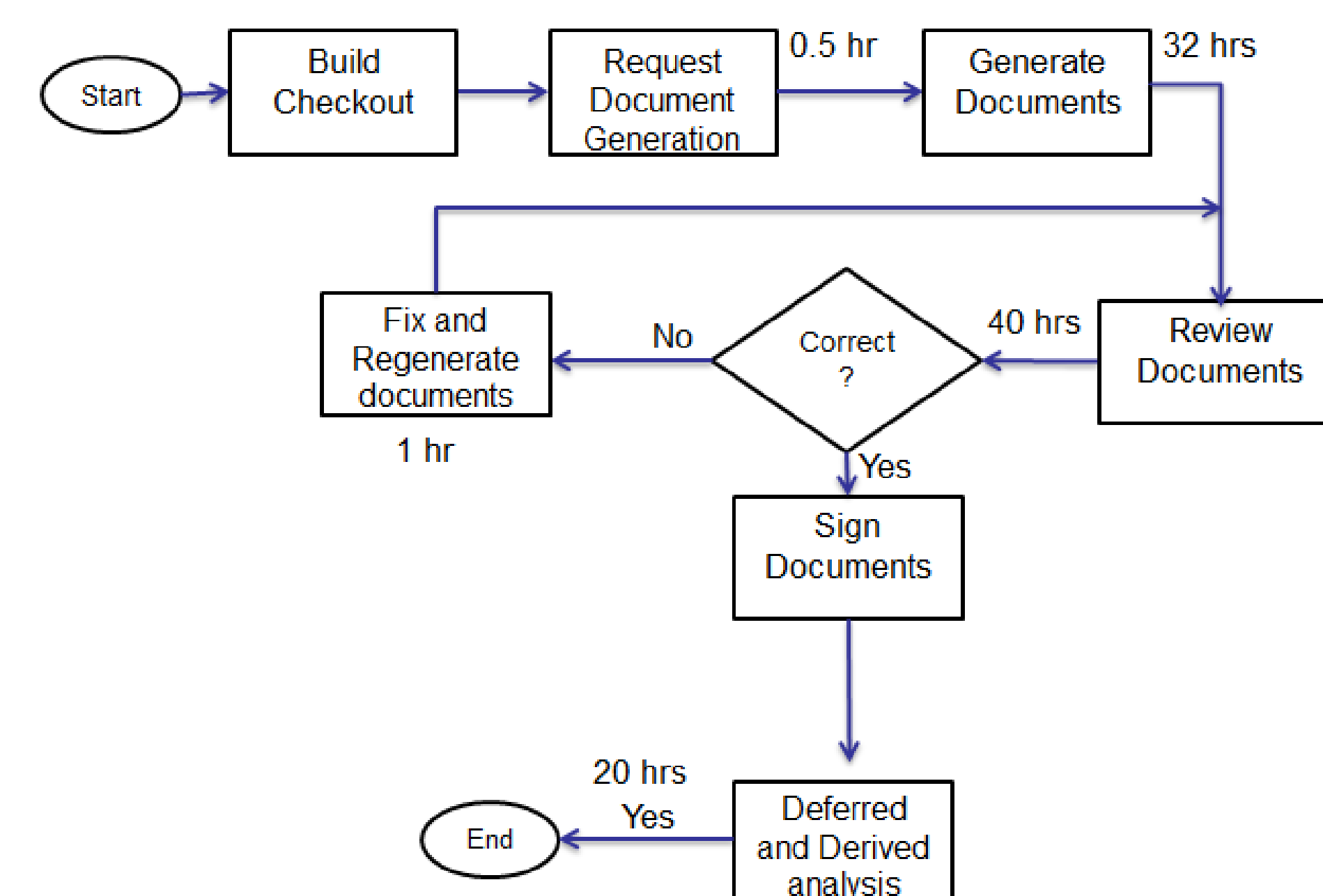


**Figure 2**
**New Process**

## Activities Summary

### Action Plan Development

The actions needed to accomplish the new process were:
- The documents are generated after the bench checkout instead of waiting for the customer to sign the order.
- The elimination of the Order Signed step results in the elimination of the 40 hours delay.
- The Request Document Review step was eliminated and, as a result, the documents will be sent for review as soon as each document is generated.
- In order to reduce the incidences of turn-backs in the new process, a group of employees will be dedicated to generating the documents. The employees will be familiarized with the standard work of the process and a checklist will be used to avoid defects.
- The new process will use a DOORS extension Language (DXL) script to reduce the processing time of the Review documents and the Derived and deferred analysis steps.

The script will compare the documents with the previous baseline and then export the changes. In the previous process, the documents were reviewed entirely; with the DXL script; just the changes are going to be reviewed.

In the user interface, the user will choose the baselines and the attributes that are going to be compared. Finally, the user will provide the path where the changes will be exported. The user interface and the script will not be shown to avoid export controls violations.

The script was tested with a set of documents and the results can be seen in Table 1. Using the DXL script will reduce the average hours from 120 to 70. This represents 10 additional hours than estimated, therefore the lead and processing time of the new process will increase to 103.5 hours.

**Table 1**
**Previous average hours vs. Average hours with DXL script**

| Document | Average hours | Average hours with DXL script |
|---|---|---|
| SR | 25 | 16 |
| DD | 31 | 20 |
| TM | 10 | 4 |
| SI | 4 | 3 |
| PLR | 4 | 3 |
| PLD | 6 | 4 |
| DDA | 40 | 20 |
| Total | 120 | 70 |

## Results and Discussion

### Timing Analysis Results

A timing analysis was performed to validate the time reduction of the new process. Table 2 shows that the new process represents a reduction of 50.48% of the lead time.

## Results and Discussion

**Table 2**
**Time Comparison**

| Lead time (hrs) | | Reduction Percent (%) |
|---|---|---|
| Previous Process | New Process | |
| 210 | 103.5 | 50.71 |

### Cost Analysis Results

The improvements of the new process represent a significant cost reduction as a result of the time reduction. A cost analysis was performed taking in consideration the processing time of both processes and the hourly rate. Table 3 shows that the cost reduction percent is 32.79%. The process is done about 24 times a year so the annual savings would be around $60,236.4.

**Table 3**
**Costs Comparison**

| Hourly Rate ($) | Cost ($) | | Reduction Percent (%) |
|---|---|---|---|
| | Previous Process | New Process | |
| 49.70 | 7,653.8 | 5,143.95 | 32.79 |

## Conclusion

The improvement of the Certification Review Document Process was completed as scheduled. The objective to reduce the time required to generate the documents was accomplished by the elimination of the non-value activities of the previous process. To meet the objective to reduce the turn-backs, the employees will be dedicated to generating the documents and will receive the proper training. The objective to reduce the delivery time was accomplished by the reduction of the lead time from 210 hours to 103.5 hours.

The improvements will make the process more efficient and cost effective. By reducing the delivery time, the customer will be satisfied and the team members will be able to perform additional tasks. The cost reduction will help to improve the company's profit and to fulfill the yearly goals. The project could lead to new improvements for this process or other processes of the company.

## References

[1] Martin, K. and Osterling, M., Value Stream Mapping: How to Visualize work and Align Leadership for Organizational Transformation, 2014.

[2] Rother, M. and Shook, J., Learning to See: Value Stream Mapping to Add Value and Eliminate Muda, 2003.