

Process Improvement of the Applications Software Interface Builds for Commercial Engines

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Abstract — *The applications software interface builds take too much time to complete. Lean tools were used to analyze the process and determine the major areas for improvement. It was found that automation tools bring great benefits to the process. Working documentation tasks in parallel to the build process and sending them to review before the build is complete also contributed to the time reduction of the whole process. It was also desired to reduce the amount of turnbacks found in the Software Quality Assurance review. By using the SQA review tool employees can make a self-check of the work before sending it for review, this way documents need less or no rework. Builds process time was reduced by 50 hours.*

Key Terms — *automation, lean tools, on time delivery, turnbacks.*

INTRODUCTION

In the embedded systems department of Infotech Aerospace Services, there are many projects that cover a variety of work products, for military and commercial engines. These work products cover various phases of the software development life cycle. The software life cycle consists of Requirements Development, Design, Implementation, Verification and Deployment. The company deems Design, including Implementation, and Verification as critical to business (CTB) processes for the company.

After changes are implemented to the software system of commercial engines in the Design and Implementation Phases, the software goes through an applications interface build process. Currently, the applications software interface (ASI) build process takes too long to complete and to be finally

delivered to the client. Sometimes deadlines are not met. The generation time of the documentation associated to the process is extensive also. With the time pressure to complete the work on time, sometimes internal “turnbacks” emerge during the Software Quality Assurance Phase, which require rework in order to deliver a 100% compliant product. Turnbacks are found during internal inspection when the product does not meet all specified criteria.

The objectives of this project are:

- Improve builds documents generation time.
- Reduce software quality assurance turnbacks, and reduce rework (cut down waste time).
- Improve on time delivery.

LITERATURE REVIEW

Companies face many challenges in the competitive business world. Many companies focus on quality, customer value and reducing waste in order to adjust to the demands of the market. One way of reducing waste is by continuously doing process improvements. “Process improvement is the proactive task of identifying, analyzing and improving upon existing business processes within an organization for optimization and to meet new quotas or standards of quality.” There are different tools used to implement process improvements depending on the approach to be used and the area that needs improvement [1].

Lean and Six Sigma should be used together to have better results. In one hand lean tools are used to identify and eliminate waste, and in the other, Six Sigma methodology seeks to minimize process variability [2]. A process flow diagram can be developed when trying to understand how a process is done, and to study it for improvement. A more

detailed tool that helps describe a process is the Value Stream Mapping. It is a lean management tool that organizes the flow of actions and time to obtain a service or a product from the beginning until it is delivered to the customer. In the Profitable Applications of Value Stream Mapping Tutorial, Pitcher points that value stream mapping is seen “as the fundamental tool to identify waste, reduce process cycle times, and implement process improvement” [3]. The VSM should be used as a dynamic tool, to continuously identify areas of opportunity and implement improvements. VSM’s give more value if they are focused on specific processes instead of trying to map the company’s collection of processes. By doing this the resources are used in the most needed areas or the improvements that will have higher impacts [4]. After identifying which steps of the process can be improved, is necessary to determine what the best way to implement the changes is.

Automation tools are one of the ways to improve and standardize processes or parts of them. It must be noted that automation may not necessarily be the best option in all processes, is important to consider the advantages and disadvantages it may bring. Table 1 summarizes the strengths and weaknesses of automated systems.

Table 1
Human vs Machine: Strengths and Weaknesses [5]

Human Component		Automated Control System	
<i>Strengths</i>	<i>Weaknesses</i>	<i>Strengths</i>	<i>Weaknesses</i>
Judgment	Inconsistent	Consistent	Lacks judgment
Adaptable	Vision, hearing, reach, strength, limited attention span	Predictable	Cannot be programmed for all eventualities
Sentient knowledge	Unpredictable, possibly unreliable	Efficient	Lacks sentient knowledge
Interactive	Subject to emotion, bias, alternative motivations	Uniform, reliable	Constrained by human limitation in design, installation, use
Can use experience	Forgetful, subject to distractions	Fatigue-resistant	Subject to wear and tear
Can learn, adapt	Subject to fatigue	No attention span limits	Adapted responses must be programmed – human programmers

Process improvement have also proven to help reinforce the relationship with customers. Lean can be used in customer feedback tools. “Although Lean is sometimes associated simply with the

elimination of waste, it can be argued that Womack and Jones captured a dual customer- and process-focused approach in the five principles of Lean. According to Pettersen, customer focus is one of the hallmarks of Total Quality Management because every improvement should be based on an investigation of the customer’s requirements” [6].

Process improvements are necessary to reduce waste. When implemented effectively, the results can be measured in the enhancement of product quality, customer satisfaction, customer loyalty, increased productivity, development of the skills of employees, efficiency and increased profit resulting in higher and faster return on investment (ROI) [1]. All of which helps maintain competitiveness.

METHODOLOGY

The need to improve the process of applications software interface builds was evaluated using different six sigma tools. A process mapping and a value stream mapping (VSM) were used to identify the major offenders in the process, and determine where waste time could be eliminated. It was determined that automation tools and process changes had to be implemented in order to reduce the build delivery time.

One of the first steps taken to improve the build process was to implement better ways of communication between the department, SQA and the clients. A status email is sent daily to get awareness of status and build priorities. Additionally, documentation is sent to SQA as it is completed, before the build is finished, to advance this part of the process. To reduce the amount of turnbacks found in the SQA Review employees of the builds’ team use the SQA review tool to verify their work and the documents before sending them to SQA.

In addition, now IAS Local Build Machines are used to make test builds, this way errors can be detected before running official builds. It was proposed that they can also be used for official build processes when client’s machines are unavailable.

In order to improve the generation time of the metric file a Macro file was developed to automate this step of the process. Another automation implemented was the creation of a script that completes the bench checkout step and reduces bench time usage. The existing database of compiler warnings' database was modified and enhanced to reduce the analysis of new warnings.

A plan was developed in order to monitor action items and tasks, and take time measurements. Lastly, the accomplishments of the objectives was verified with the customer's and employees' feedback.

RESULTS

All the improvements in the process contributed to a great reduction in the time it takes to complete the build process. Table 2 presents a summary of the improvements along with the time it used to take to complete each step and the time it takes now. It can be observed that before improvements these steps of the build process took a total average time of 70 hours. Now the steps mentioned in the table take a total average time of 20 hours.

Table 2
Time it takes to complete a step in the build process before improvement vs after improvement

<i>Step</i>	<i>Improvement</i>	<i>Before improvement</i>	<i>After improvement</i>
Metric Tool	Automation (Macro)	5 hours	0.5 hours
Bench Checkout	Automation (Script)	2 hours	0.7 hours
Compiler warnings' analysis	Modify database of warnings	13 hours	0.8 hours
Build Documentation (Generation, Internal Review, SQA Review, Fixes)	Better communication, use SQA review tool, send documents to SQA as they are completed (parallel to build)	50 hours	18 hours
Total time		70 hours	20 hours

CONCLUSIONS

The purpose of this project was to improve the applications software interface build process. The main objectives were to: improve builds documents generation time, reduce software quality assurance turnbacks and reduce rework (cut down waste time), and improve on time delivery. The activities that contributed the most to the accomplishments of the objectives were the automation of the creation of the metric tool and the modifications to the warning database. Working tasks in parallel to other steps, such as sending documentation to Software Quality Assurance review and generating the parameters database in parallel, also proved to be very efficient. This contributed to meeting the first objective of improving builds documents generation time.

Software Quality Assurance turnbacks were also reduced (The turnbacks database will be verified in order to provide up to date quantifiable data). This was accomplished by using the SQA Review file before sending the documents for review. Therefore, rework has also had a marked reduction.

The build process was practically reduced by 50 hours, this improvement obviously contributes to the accomplishment the objective to improve on time delivery. Clients and employees are happy with the results. Even though all the objectives were met, it is important to remember that the Lean Philosophy teaches us to continue improving and always be aware to identify areas of opportunity.

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