

Prognostics and Health Management Optimization for Commercial Engines

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Abstract – *The purpose of this project was to determine an existing problem within the work environment of each individual user. During the duration of the project a process improvement initiatives were implemented by using their particular knowledge and skills sets in order for them to improve a current process within their work. For this project a specific process was selected from Infotech aerospace services located in Isabela Puerto Rico was selected in order to optimize the process and improve customer satisfaction. Specific programing languages were selected and evaluated in order for the team to determine what the best tool was in order to automate some of the manual inputs, improving some of the current steps in order to reduce the overall time to execute each report.*

Key Terms – *Joint Venture, Matlab, Process Improvement, Prognostics and Health Monitoring (PHM)*

INTRODUCTION

Infotech Aerospace Services, located in Isabela, PR is an outsourcing company that provides support in the following competencies: design, evaluation, and support of Gas Turbine Engines, Airframe Systems, and an array of Aerospace Products in the areas of software, drafting, structures analysis, modeling, mechanical design, tool design, electronic design, information technology, and supply chain [1].

Infotech is a joint venture between India's Cyient (formerly Infotech Enterprises Ltd), a global engineering services company, and Pratt & Whitney, a world leader in the design, manufacture and service of aircraft engines and auxiliary power units [2].

PROBLEM STATEMENT

Prognostics and Health Monitoring during the development stage of an engine program is of great importance. The goal of the PHM team is to detect any defects with the engines during this stage and record the lessons learned to the other disciplines before the engines go into service.

OBJECTIVE

The goal of this project is to automate some manual inputs received from multiple sources into a single output thus reducing the turnaround time for each deliverable.

LITERATURE REVIEW

The goal of the prognostics and health management is to make accurate assessment on the health of the engines and prevent damage from occurring to it [2]. The data analyzed comes from a variety of sensors and multiple sources. Based on the location of the aircraft some of the parameters monitored vary between engines.

Some of the outputs from the data are manual inputs this is where automation of some of the inputs is a useful tool in reducing some of the errors due to human inputs. For this project Matlab and Visual Basic where considered as possible programing languages.

Matlab is a powerful fourth generation programing language. Matlab has a variety of toolboxes which availability depends on the packages the organization purchases.

Visual Basic is a relatively easy to use programing language developed by Microsoft. Visual Basic supports a user friendly environment

by having a graphical user interface with access to multiple objects.

METHODOLOGY

In order to achieve the goals stated for this project multiple meetings were held in order to map the process and identify the areas of improvement. The Gantt chart presented in Tables 1 and 2 were created in order to maintain track of the process. Once the team identified the areas of the process that could be improved they evaluated which programming language was best suited to automate the specified tasks.

Once a programming language is selected based on the specified criteria the team will begin to create an algorithm to process these manual inputs as specified in Table 2. After the algorithm is completed the team will begin a testing phase in order to evaluate the outputs obtained by the code and validate them. Once the validation phase is completed the team will present the new process to quality and then the customer for approvals as stated by the last task in Table 2.

Table 1
First Stage of the project

Task	Week 1	Week 2	Week 3	Week 4
	8-Aug	15-Aug	22-Aug	29-Aug
Submit Problem Statement	Complete			
Submit Proposal		Complete		
Present Proposal		Complete		
Map the process		Complete	Complete	
Identify areas of Improvement			Complete	
Evaluate Available tools			Complete	Complete

Table 2
Development Stage

Task	Week 8	Week 9	Week 10	Week 11	Week 12
	26-Sep	3-Oct	10-Oct	17-Oct	24-Oct
Algorithm Development	WIP	WIP	WIP	WIP	
Test Tool	WIP	WIP	WIP	WIP	
Present to the quality team					
Present to the customer					
Wait for approval					

RESULTS

During the first meeting held the process was mapped, as shown in Figure 1. After the evaluation of each of the individual steps the team agreed that combining steps 2 and 3 extracting the data and generating the report template could be combined

into a single automatic step thus reducing error due to manual inputs. Note that due to export restrictions within the company the values presented on Figure 1 do not represent the actual values the process takes.

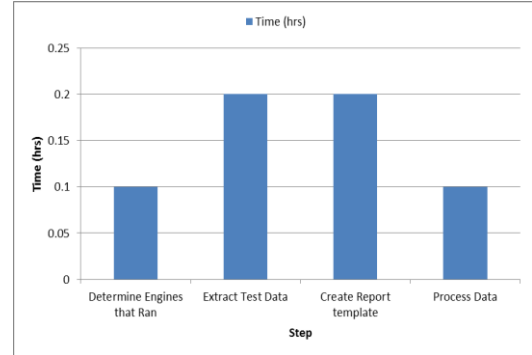


Figure 1
Current Report Generation Process

When evaluating the programming language that best suited the task presented the team agreed on Visual Basic due to the flexibility and the maturation available within the discipline to modify and update macros. The team created a macro to extract the data and generate automatically the report template.

DISCUSSION

During the development stage of the algorithm many issues have been encountered by the team. The most crucial issue for the report generation process is determining out a way to standardize the format for all of the data sources in order for the algorithm to populate the reports. The current code extracts and processes the data for two of the programs.

Currently the team is working on creating separate routines in order to extract the remainder of the programs into a similar format. Once completed the projects objectives will be met and the process time will be reduced.

CONCLUSIONS

As initially stated in the Objective section of this project the objectives of have not been met. As stated in Table 1 all of the task that have been

completed successfully. During the course of the project during the process presented in Table 2 many areas of the reports have been improved.

The current code has reduced the time to generate reports for two of the programs. There are many other opportunities within the working discipline for the application once the code is completed and tested.

REFERENCES

- [1] <http://www.infotechpr.net/>
- [2] Volponi, Al, "Aircraft Propulsion And Power", *Data Fusion for Enhanced Aircraft Engine Prognostics and Health Management*, Vol. No. 1, 2005, 36p.