Optimization of Project Management Software's and Applications for Tracking and Report Projects in the Engineering Aerospace Industry of Design Services

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Abstract *— The aerospace design industry constantly faces numerous challenges. Many of these challenges are related to the process scenario, service provided or product. Most of the designs are made on the Island, but their manufacturing is executed in the United States. This situation compromise project managers and project engineers time to be available and accountable to solve day-to-day problems fast and efficient. This research designed a process to define project requirements to be tracked and, in a spreadsheet, consolidated all functionalities, applications and/or computer software's to make the tracking process simple. Results proved that these systems should track just the information necessary to meet the requirements of the project. Productivity improvements of up to 60% in available time to solve day-today problems and $7,000 in project tracking and monitoring licenses savings were achieved.*

Key Terms *— Requirements, Productivity Improvement, Tracking Systems.*

PROJECT STATEMENT

The aerospace engineering design services industry in Puerto Rico constantly faces numerous challenges. Some of these challenges are directly related to the product or service that is provided. Many of these products and services are delivered remotely. This means that the design is made in Puerto Rico and the final product is manufactured and used in the United States. This scenario presents a challenge for project managers or project engineers, since the level of attention to the timeline, budget, resources, and product before, during and after delivery is key to its success.

For the management of timeline, budget, resources and product, project managers use automated programs to facilitate project status and tracking. On many occasions, different programs or applications needs to be used to make possible a successful tracking of the project. This forces and compromise the project manager to make additional efforts to feed and keep all the information up to date. Errors within the project tracking can occur due to the number of applications that must be kept up to date and spreadsheets to monitor.

This research seeks to create an efficient alternative within all existing software's and applications to centralize and minimize tracking efforts of the project manager. This solution will provide to the project manager an additional space for the resolution of problems and more accurate planning of each project or task that is desired to be carried out.

Research Description

The aerospace industry is highly regulated by state and federal government authorities. And that is why the status reports, the use of resources and its budget must be constantly reported to stakeholders, customers and/or government, sometimes in live mode.

This research seeks to offer project managers and project engineers one or two options of centralized, friendly, and easy-to-maintain software's or applications for tracking and report projects or tasks. Usually, three or more applications are used to make it possible to track projects successfully.

With this investigation I will provide alternatives to be able to track any project or task in a simple and efficient way. This will help minimize

the effort required to track and report projects providing to project managers extra time to perform other responsibilities satisfactorily.

Research Objectives

- Reduce the amount of software's and applications for the track and report of engineering aerospace projects or tasks.
- Optimize design project and task tracking process to avoid escapes during project execution.
- Determine the limits of information that are required to feed the software and applications. for reporting and tracking project status, timeline, budget, and resources.
- Reduce the cost of licenses for project management software's and applications.
- Improve the turn-around-time and touch time of projects.
- Avoid errors caused by additional time and effort by maintaining and feeding the different software and applications with information.

Research Contributions

This research will provide alternatives to be able to track any project or task in a simple and efficient way. This will help minimize the effort required to track and report projects providing to project managers extra time to perform other responsibilities satisfactorily. The reduction of these efforts will also help reduce escapes since the project manager will have a broader visibility of their project and will have the time to mitigate any situation that may arise.

HISTORICAL BACKGROUND

Project management is a discipline that gained great importance between the 1900s and the era of industrialization. The industrialization process was consolidated in the late 1950s and early 1960s; but it was during the period from 1958 to 1964, that an important impulse was given to the industrial sector [1].

If we look closely at the era of industrialization, this was a process driven by the invention of the steam engine. Legal changes in ownership, increased trade, and competitiveness between countries such as Great Britain, Germany and France also having a decisive influence for this era. The engines of industrialization were mining, metallurgy, and chemistry.

However, according to experts, the origin of project management can be traced back to the beginning of the 20th century when the Gantt Chart was created. The Gantt Chart was created by Henry L. Gantt with the purpose of help you to assess and make an estimation of how long a project would take [2]. By this time the other methods began to emerge. These methods will then become the base theory and tools used in the project management discipline.

History dates back to the 1950s that these methods began to be applied systematically throughout the industry. This is how the role of project manager or project engineer officially arises. This role was assumed by a person who assumes the management of time, resources, quality, and money of a project. Project managers started to use methods such as the Gantt Chart, network diagrams, critical path method, work breakdown structure, project documentation, to keep an updated track of the status and the time to complete the projects. All this was captured on paper and filed.

Actual History

Project engineers today face many challenges. Challenges in the tracking of the project, scheduling, budget, resources, etc. However, technology has evolved in leaps and bounds and has allowed the creation of various computer programs (software's) that offer collections of tools and tracking systems to document and monitor a project and its components from start to finish. Many of these software's can be customized based on the management method and/or the needs of a company or business. It should be noted that sometimes to manage a project, several software's

are used simultaneously. This can greatly compromise a project manager's time updating and entering the actual data to maintain these databases.

Activity Types

During the execution of this project, a timeline was established to identify the company's processes versus implemented processes to document results based on touch time (TT), delivery time or turnaround time (TAT) and number of licenses for computer programs. All this seeking to successfully meet the objectives of this design work and meet the customer's delivery expectations.

Each of these software's sought to perform the following activities: collaboration, scheduling, issue tracking, project portfolio management, document management and resource management (See Table 1). To cover all these project activities, a project manager may have to work with 3 to 4 computer programs that must be fed back as the project progresses. Sometimes updates are done daily.

Table 1
Activities to be Eecuted and their Definitions

Activity Types	
Collaboration	System to share relevant information and collaborate with team members, the client, stakeholders, or the government.
Scheduling	Activity tracking with time and date metrics.
Issue tracking	Manage and maintain list of issues.
Project portfolio management	Management of the process, methods, and technologies.
Document management	System used to receive, track, manage and store documents and reduce paper.
Resource management	Practice of planning, scheduling, and allocating people, money, and technology to a project or program.
Budget management	Manage hours invested in the project.

METHODOLOGY

This design project seeks to obtain as a result the centralization of all project management software's within one system. This system needs to be a user-friendly system that can generate reports and show the status of a design project. Also, should have the ability of being personalized to reduce the amount of time and money spent within what is relevant within the project.

Osman Mohammed presents in a recent publication worked in a scenario very similar to the one that this project is developed. Osman research sought to establish and develop a system or software for scheduling and tracking the status of pre-planned tasks using an open source to achieve projects in government institutions based on project management theory [3]. The system will also enable the work with the team to share tasks information and follow up their status during the lifecycle of these tasks. This project works to fulfill its objectives in a scenario like Osman's. A characteristic of this scenario was that the project engineer or project manager was spending a lot of time collecting data, updating status, and managing several tools in order to successfully monitor the project.

To achieve the established objectives of this project, all the software's that is currently used by the company will be taken into consideration. Metrics to be met will be selected and put into practice for a period of 5 weeks. It is expected to obtain a productivity improvement within the tracking process of a project to meet the required delivery dates and the assigned budget.

Company actual process

Here is a breakdown of the company's current scenario:

- 5 different software's are used to manage the project.
- The project consists of completing digital 3D designs of tools to assemble, disassemble and fix the plane.
- The team consists of designers and structural analysts.
- The final product consists of a 3D model, a drawing and a structural analysis that shows the quality of the design.

- The client is in Middletown, Connecticut (Mainland).
- The designs are not being delivered when the program requires. Affecting the time to be able to manufacture the tools on time.

Voice of the Customer

As a client requirement, the designs are required to go through a design review process. This has met the customer's quality expectations. However, delivery time and attention to detail have not met customer and stakeholder expectations. In 2 after action review meetings with the client, they manifested the deficiencies described above.

Model

The model to be created seeks to unify software qualities that the project engineer must maintain to reduce maintenance time and be able to focus on resolving issues related to late deliveries. The software and trackers to be unified are the following:

- Primavera
- MS Project
- SAP
- Scheduling tracker report
- Turn-around-time (TAT) and touch time (TT) tracker report
- Active tools inventory
- Tool status tracker

The unification process will be carried out on the MS Excel platform. This programmable tool will allow you to create macros and formulas that will help simplify the tracking process. For the reports we will use MS Access to automate them. MS Excel and MS Access communicate with each other facilitating the automation process.

MODEL IMPLEMENTATION

Before tool creation and implementation all monitoring tasks were executed using the following computer programs, applications or platforms for requirements.

Attention rate is defined as the time in hours required to be able to have all the systems updated and in good condition. Yearly total cost in licenses is $7,232.

Between all the applications and maintenance requirements, department project engineer must spend 10 hours a day to get all systems up and running (See Table 2). Not every day the same maintenance work is carried out, however a workday has 8 hours, leaving maintenance tasks still uncompleted.

Within these requirements, indefinite time is not being taken into consideration solving day-to-day problems.

It was also identified that the applications were not being used to their full potential and there were ways to use a single program between MS Project and Primavera. Both applications could track the requirements that each handled separately. This was able to decrease the number of applications from 5 to 4.

As a baseline we used historical data from past years since this package of spring tools are made every year for different development aircraft engines. In 2019, 2020 and 2021, just 5 of 20 tool was delivered on time. Three tools of the five that were delivered on time returned with structural problems.

Tracking System Model

A system very similar to a scorecard was built (See Table 2). The purpose of this system is to be able to identify the tracking requirements, their current maintenance time and the final time, using MS excel as a simple tool capable of conglomerating all the requirements in one place. This card should be completed at the beginning of the model execution and at the end. The collected data will be presented in the results chapter.

Attention rate 1 is the baseline and it is defined as the time in hours required to be able to have all the systems updated and in good condition with initial systems.

Table 2

Tracking Scorecard for Data Collection and Comparison

	Tracking Scorecard					
Project Title:						
Project Engineer:						
REQUIREMENT	Attention Rate 1 (hours/day)	Attention Rate 2 (hour/day)	Attention Rate 2 (hour/day)	Attention Rate 3 (hour/day)	Attention Rate 4 (hour/day)	Attention Rate 5 (hour/day)
Turnaround time	1					
On time delivery	1					
Budget (Hours)	2					
Resources (Design, Stress, Review)	1					
Status Track	3					
Status Report	2					
Total	10 hrs					

Tracking System Model

The tracking system was modeled in order to have a representation of the design process within the system itself. Dividing the process into different tables would be fulfilling the intention of seeing the process within the same system.

Core Information

This section collects all the baseline data or information of the task and the different metrics/requirements that will be used to establish the limits (See Table 5). These limits are the delivery date, the turnaround time and the budget assign to complete all the subtasks. It also contains descriptive information and the identification of resources allocated for design, structure and review.

This section will show us if the tool is on time taking into consideration delivery time, touch time and budget consumed. The construction of a programmed macro is what makes it possible for all these invoices to be translated into a color, blue when we are on time and red when the time is about to end or is over. The SAP platform was synchronized so that MS Excel could receive the information of the resources, budget and status provided by the same resources when the work is assigned, and the hours of their day enter the SAP system.

Execution Summary / Structural Analysis / Design Review

These sections document when the task started and when it went through the different subtasks. Each provides start and end dates, as well as status. The statuses are classified as: in progress, stopped, completed, awaiting information (See Table 3 and Table 4).

Table 3

Execution Summary Section of the Tracker

EXECUTION SUMMARY					
Date Started	Status	Date Completed	Total TAT (Week)	Total Hours	Final State
1/7/22	Completed	1/19/22	1.5	50	Approved
1/7/22	Completed	3/21/22	11	125	Approved
1/7/22	Completed	1/14/22	1	22.5	Approved
1/10/22	Completed	3/21/22	10	110	Approved
1/11/22	Completed	3/21/22	10	118	Approved
1/14/22	Completed	1/28/22	1.5	49	Approved
1/16/22	Completed	1/27/22	1.5	50	Approved
1/14/22	Completed	1/21/22	1	20	Approved
1/16/22	Completed	1/24/22	1	25	Approved
2/7/22	Completed	2/15/22	1	25	Approved
2/14/22	Completed	2/22/22	1	24	Approved
1/18/22	Completed	2/2/22	2.5	99	Approved
1/18/22	Completed	1/28/22	1.5	48	Approved
1/18/22	Completed	3/21/22	9	72	Approved
2/14/22	Completed	2/22/22	1	22.5	Approved
2/16/22	Completed	2/24/22	1	18	Approved
1/16/22	Completed	1/31/22	2	70	Approved
1/16/22	Completed	1/31/22	2	75	Approved
1/17/22	Completed	1/31/22	1.5	50	Approved
2/16/22	Completed	2/24/22	1	18	Approved

Table 4

Subtask of Structural Analysis and Design Review Section of the Tracker

STRUCTURAL ANALYSIS				DESIGN REVIEW		
Date Started	Status	Date Completed		Date Started	Status	Date Completed
1/14/22	Completed	1/18/22		1/18/22	Completed	1/19/22
1/20/22	Completed	1/21/22		3/21/22	Completed	3/21/22
1/12/22	Completed	1/13/22		1/14/22	Completed	1/14/22
2/14/22	Completed	2/16/22		3/21/22	Completed	3/21/22
3/14/22	Completed	3/20/22		3/21/22	Completed	3/21/22
1/20/22	Completed	1/24/22		1/24/22	Completed	1/28/22
1/24/22	Completed	1/26/22		1/26/22	Completed	1/27/22
1/19/22	Completed	1/20/22		1/20/22	Completed	1/21/22
1/19/22	Completed	1/21/22		1/21/22	Completed	1/24/22
2/9/22	Completed	2/10/22		2/11/22	Completed	2/15/22
2/16/22	Completed	2/18/22		2/18/22	Completed	2/22/22
1/25/22	Completed	1/28/22		1/28/22	Completed	2/2/22
1/21/22	Completed	1/25/22		1/26/22	Completed	1/28/22
3/14/22	Completed	3/20/22		3/21/22	Completed	3/21/22
2/16/22	Completed	2/18/22		2/18/22	Completed	2/22/22
2/18/22	Completed	2/22/22		2/22/22	Completed	2/24/22
1/26/22	Completed	1/28/22		1/28/22	Completed	1/28/22
1/27/22	Completed	1/28/22		1/28/22	Completed	1/31/22
1/20/22	Completed	1/24/22		1/25/22	Completed	1/31/22
2/19/22	Completed	2/22/22		2/23/22	Completed	2/24/22

Table 5

Core information Section of the Tracker

	CORE INFORMATION										
#	Tool Number	ON TIME (Yes, No)	Date In	Complexity (1, 2, 3, 4)	Requirements (Design, Stress)	Total Hours	Date Req.	Expected TT (Week)	Designer	Analyst	Reviewer
1	PR234001	1	1/7/22	2	Design, Stress	50	3/14/22	1.5	A. Ramos	K. Smith	E. Rivera
2	PR234002	-1	1/7/22	3	Design, Stress	75	3/14/22	2	S. Ortega	K. Smith	E. Rivera
3	PR234003	1	1/7/22	1	Design	25	3/14/22	1	J. Arroyo	K. Smith	E. Rivera
4	PR234004	-1	1/7/22	3	Design, Stress	75	3/14/22	2	D. Lowry	K. Smith	E. Rivera
5	PR234005	-1	1/7/22	3	Design, Stress	75	3/14/22	2	S. Ortega	M. Fitch	E. Rivera
6	PR234006	1	1/14/22	2	Design, Stress	50	3/14/22	1.5	L. Lewis	M. Fitch	E. Rivera
7	PR234007	1	1/14/22	2	Design, Stress	50	3/14/22	1.5	A. Ramos	M. Fitch	E. Rivera
8	PR234008	1	1/14/22	1	Design	25	3/14/22	1	D. Pagán	M. Fitch	E. Rivera
9	PR234009	1	1/15/22	1	Design	25	3/14/22	1	D. Pagán	K. Smith	E. Rivera
10	PR234010	1	1/15/22	1	Design	25	3/14/22	1	D. Pagán	K. Smith	E. Rivera
11	PR234011	1	1/15/22	1	Design	25	3/14/22	1	D. Pagán	K. Smith	E. Rivera
12	PR234012	1	1/15/22	4	Design, Stress	100	3/14/22	2.5	R. Carrión	K. Smith	E. Rivera
13	PR234013	1	1/15/22	2	Design, Stress	50	3/14/22	1.5	L. Lewis	M. Fitch	E. Rivera
14	PR234014	-1	1/15/22	2	Design, Stress	50	3/14/22	1.5	A. Ramos	M. Fitch	E. Rivera
15	PR234015	1	1/15/22	1	Design	25	3/14/22	1	J. Arroyo	M. Fitch	E. Rivera
16	PR234016	1	1/16/22	1	Design	25	3/14/22	1	J. Arroyo	M. Fitch	E. Rivera
17	PR234017	1	1/16/22	3	Design, Stress	75	3/14/22	2	D. Lowry	K. Smith	E. Rivera
18	PR234018	1	1/16/22	3	Design, Stress	75	3/14/22	2	S. Ortega	K. Smith	E. Rivera
19	PR234019	1	1/16/22	2	Design, Stress	50	3/14/22	1.5	A. Ramos	K. Smith	E. Rivera
20	PR234020	1	1/16/22	1	Design	25	3/14/22	1	J. Arroyo	K. Smith	E. Rivera

Table 6

Tracking Scorecard Results using New Tracking Tool

	Tracking Scorecard					
Project Title:	Comercial Spring Tools					
Project Engineer:	J. Arbelo					
REQUIREMENT	Attention Rate 1 (hours/day)	Attention Rate 2 (hours/day)	Attention Rate 3 (hours/day)	Attention Rate 4 (hours/day)	Attention Rate 5 (hours/day)	Attention Rate 6 (hours/day)
Turnaround time	1	0.5	0.5	0.5	0.5	0.5
On time delivery	1	0.5	0.5	0.5	0.5	0.5
Budget (Hours)	2	1	1	1	1	1
Resources (Design, Stress, Review)	1	0.5	0.5	0.5	0.5	0.5
Status Track	3	3	2	2	1	1
Status Report	2	1.5	1	0.5	0.5	0.5
Total	10	7	5.5	5	4	4

RESULTS AND DISCUSSION

Research results were divided into two areas of concentration. The first reflects the results of the scorecard. While the second presents the results obtained by the tracking system. All the information was contrasted with the baseline.

Tracking Scorecard Results

Attention rates 2 through 6 represent weeks 2 through 6 of project execution (see Table 6). During those 5 weeks the project engineer recorded the hours invested in each metric/requirement and averaged them. Obtaining as a result the total average hours it took to complete the requirement in one day.

We can observe in Table 6 that from week 3 the total time per day was reduced by half (from 10 hrs. to 5 hrs. per day). And if we continue observing the following weeks, we can observe that the time was decreased by 60% (4 hrs. total per day).

Tracking system results

Four (4) tools of (20) twenty were delivered late due to missing engineering requirements and dimensions to complete the tool. If we compare these results with the baseline of the project (2019, 2020 and 2021 delivery results for the same type of tool), just 5 of 20 tools delivered on time versus 16 of 20 delivered on time using the new tracking system.

Investigation results meet the objective of optimize tool design department tracking system in order to provide more time to resolve day-to-day situations. This time was not only invested resolving issues and problems, but it also allowed and gave the space to create and write work instructions that made easier to complete tasks and avoid any turnback as in the past.

The total yearly savings for the department in project management software and applications licenses costs is approximate $7,000. MS Excel is part of the Office 360 suite that costs $159 one-time purchase.

CONCLUSIONS

The aerospace industry is constantly changing. These changes are driven by many economic, social and technological factors. However, every day the evolution of this industry teaches us that the wheel does not have to be re-invented. Within the continuous improvement we must always seek to maintain that all systems are easy and simple to use. Depending on the scope of the task we can decide if we want to track the progress of the projects in a micro way. However, a micromanagement approach on several occasions makes the resources to doble effort based on the detail of attention that the project engineer needs to provide.

Observing the results of the investigation, the objectives were met, reducing the number of applications for tracking 3D design tasks and significant savings in time and money.

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