



**OVERHAUL FACILITY PLANNING AND CONTROL TOOL SELECTION AND
IMPLEMENTATION ANALYSIS**

THESIS
MARCH 2016

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AFIT-ENS-MS-16-M-114

**DEPARTMENT OF THE AIR FORCE
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THESIS

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Santiago Luis Martin

Lieutenant Colonel, Argentine Air Force

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Abstract

The Argentine Air Force Materiel General Directorate (AAFMGD) has initiated an effort to assure logistical support and to gradually increase the productivity and efficiency of related processes. Within the efforts of increased productivity and efficiency over the AAF Overhauling Facilities, the Planning and Control Departments (PCD) became targets for improvements. These departments are tasked with providing the best certainty and visibility of all assets within their facilities to feed the logistics pipeline, and better support air operations.

This thesis, sponsored by the MGD, is focused on achieving improvements in the PCD processes, through an academically rigorous evaluation of confounding factors and the eventual selection of appropriate information technology solutions. Software solutions were evaluated on their ability to produce the desirable benefits of improving current processes control, improving project timeline certainty, and obtaining visibility over the overhauling and maintenance activities so as to better support management-level decisions. Two solutions are proposed to the AAFMGD for final review.

To my Wife, son and daughters, for their support and patience during this challenging journey. You have supported and carried all the hidden efforts during the last eighteen months and through that we were able to achieve the goals for our amazing trip as a FAMILY. Love you all.

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Lt. Col. Santiago Luis Martin

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List of Acronyms

AAF	Argentine Air Force
AAFMGD	Argentine Air Force Materiel General Directorate
AC	Administrative Circular
AM	Aircraft Maintenance
AMRIV	Area de Material Rio Cuarto
CMMI	Capability Maturity Model Integration
CMMS	Computerized Maintenance Management System
ERP	Enterprise Resource Management
IPM	Integrated Project Management
MG	Maintenance Group
MGD	Materiel General Directorate
PCD	Planning and Control Department
PMBOK	Project Management Body of Knowledge
PMC	Project Monitoring and Control
PMI	Project Management Institute
PP	Project Planning
QPM	Quantitative Project Management
RSKM	Risk Management
SAM	Supplier Agreement Management
SIL	Sistema Integrado Logistico - Integrated Logistic System
UBP	Unified Base Practices
UFSC	Universidade Federal Santa Catarina
WBS	Work Breakdown Structure

OVERHAUL FACILITY PLANNING AND CONTROL TOOL SELECTION AND IMPLEMENTATION ANALYSIS

I. Introduction

Within the Argentine Air Force (AAF) organization, the Materiel General Directorate (MGD) has the task and responsibility to provide and supply spare parts, reparable and consumable, needed to support present and future operations. Spare parts are obtained from several different sources: Sometimes directly from the weapon system's manufacturer, from manufacturer authorized dealers, manufacturer authorized overhauling facilities, third parties overhauling facilities and also from the Argentinean Air Force overhauling facilities.

The AAF has two main overhauling facilities to support operations, "Area de Material QUILMES" and "Area de Material RIO CUARTO" (AMRIV). Both of these perform overhaul of different aeronautical assets. They also provide engineering support for overhauling and spare parts production with high quality standards.

During 2007 and 2014 the AAF began undertaking two different plans to recover the operational capabilities first, and then to assure the logistics for that recovered capability with the main goal of better support for AAF air operations. The first plan, *recovering the operational capabilities*, involved several tasks to assure airworthiness of aircraft and reparable parts, recover the certification of maintenance processes and introduction of the necessary technology. By 2014, the Director Plan aimed to gradually increase the productivity and efficiency of the related processes.

Within the efforts of increased productivity and efficiency over the AAF Overhauling Facilities, the Planning and Control Departments became targets for improvements. These departments should give the best certainty and visibility of all the assets within the facility to feed the logistic pipeline that support air operations.

This thesis is sponsored by the MGD to gain additional information and generate options for improvement.

Problem Statement

Aircraft Maintenance (AM) management represents a big task to perform for a manager. Despite the difficulty, it becomes a regular activity for companies, and may appear to be easy to perform, but it is not indeed. Daily, the AM is full of problems, from simple to complicated, from purely technical to logistic. These tasks can be manning tasks, union problems or facing organizational behavior challenges.

The spectrum of problems that an Aircraft Maintenance manager faces is quite broad. The aeronautical industry is constantly pressing for shorter grounded periods. Facing this pressure, managing dead time, disruption and delay becomes critical to achieving success and keeping facilities operative and the business running.

Facilities that manage more than just a few items are quite complex. Their complexity involves multiple tasks, different spare parts and consumables, variously skilled people, common tasks, and shared workshops. These complex facilities need planning and control processes to keep everything running on time. The visibility of the ongoing processes becomes critical to aid managers on making the best decisions to keep

the facilities running and parts flowing through the pipeline, eliminating bottlenecks and delays.

When disruptions appear, visibility and certainty are key to assess the impact of the problems. Managers should solve the problem, re-plan all the activities involved or affected, and quickly inform and update the plan.

The main tasks that need to be planned and controlled, among others are: ordering and obtaining specific parts, manning with the properly certified workers, obtaining updated documentation and specific tools, and keeping current the maintenance records and documents. Visibility and certainty cannot be achieved just with expertise and deep knowledge of all tasks. For the context of multiple levels of assets to overhaul, planning and control becomes a task itself, involving not only several skilled people but also the appropriate tools to perform it.

There are many software tools for planning and control available on the commercial market. Most of them can be customized or adapted to fit different customer needs. Choosing the appropriate tool provides the chance to make a large impact in the production and the ability to analyze the ways in which the work was carried out.

Within the AAF, the “Area de Material RIO CUARTO” is one of the overhauling facilities for several aeronautical and non-aeronautical assets. It has a Planning and Control Department with their own specific set of procedures. During the last few years, and for variant different reasons, the planning and control activity has been operating without a standardized specific software planning tool. Instead, it was reliant on the effort, expertise and knowledge of the people assigned to the department. Lack of

visibility and certainty are the issues that came to light while working over the plans issued by the MGD

The purpose of this research is to determine and compare different planning and control tools to better help with gaining visibility and certainty. It is assumed that not all of the tools will be functionally compatible with the organization, or even with the personnel acceptance.

Research Objectives and Questions

As stated previously, the objective of this research is to find and compare suitable planning tools for the Planning and Control Department of the “Rio Cuarto” overhauling facility. In order to accomplish the research objective the following research questions were addressed:

First research question: Are the actual planning procedures enough to fulfill the mission of the Planning and Control Department?

Second research question: What should be the main characteristics for a software planning tool in order to be helpful over the Planning and Control Department?

Third research question: Which measures should be taken to install and implement a software planning tool?

Research Focus

The main focus of this research is to analyze the actual procedures for planning, the current issues and problems present. The available software planning tools in the commercial software market are also examined with respect to their capabilities and characteristics in order to compare the tools to discover the most suitable ones, set the

desirable aspects for the best selection and make useful recommendations for the implementation of a software planning tool.

Investigative Questions

The following investigative questions are used to answer the primary research questions:

1. Which is the Planning procedure in use? Is it complete and fulfilled at the appointed time?
2. Are there problems and weaknesses actually stated by the Planning and Control Department?
3. What are the main characteristics and capacities of the commercial planning software?
4. Is the introduction of a software planning tool going to be helpful for the Organization?
5. What would be the obstacles for introducing a new software tool that the organization will probably face?

Methodology

The methodology for developing a recommendation for choosing and evaluating the implementation of an IT Planning Tool for the Planning and Control Department of the “Area de Material Rio Cuarto” follows these steps:

The first step addresses the insight of the planning procedures that rule the activities within the Department. With this better insight of the procedures, the most important problems and issues will show up as opportunities for improvement and point to the capabilities and characteristics that an IT planning tool should cover and fulfill.

As part of this process an overview and analysis over the previous year’s planning and outcomes is conducted to assess the strengths and flaws of current procedures. With

the previous information in hand, a search over the market of commercially-available software is conducted to determine the tools that are used in industry in general, and within the aircraft repairing and overhauling industry in particular. A proper comparison between the main characteristics, features, capabilities and specifications is conducted to discover the most applicable tool for the Planning Department of the “Area de Material Rio Cuarto”.

The last step concerns assessing the issues that the PCD most likely faces while implementing a particular planning tool. Other future studies and actions should emerge as a result of this assessment.

Scope and Limitations

Given the timeframe to complete this thesis it is necessary to scope the areas that need improvement to be addressed in order to implement a possible solution for the problem under analysis. Also, the data that the different software companies are able to provide about their respective software will limit the conclusions derived from this research.

The actual data from the Planning and Control Department of the “Rio Cuarto” overhauling facility is obtained directly from contacts within the Department. The data covers the last 4 or 5 years of full activity. As these activities cover planning over more than 3500 part numbers, a scope covering the more relevant and active ones is necessary.

To address the problems that the organization may face during new software rollout and implementation, the study will consider historical issues faced on the matter, personal experience, and perceived problems as stated by the personnel of the PCD.

Implications

This work will show possible improvements to an actual procedure over the PCD. The constant activity over the facility and the scope and limitations applied to this work may result in longer full implementation times and serve to expose other hidden problems over the organization not directly addresses by this thesis. The conclusions and recommendations provided could be used to implement a first-step solution over the most important and active items, and then with preliminary results in sight, take the next steps with the appropriate corrections and modifications.

II. Literature Review

Chapter Overview

This chapter presents a review of the AMRIV mission and organization. It also describes the relevant procedures that involve the planning and control activities. The literature review then addresses different aspects of IT tool comparison and selection for aeronautical and other industrial organizations. Finally, this literature review examines organizational behaviors that could affect the introduction of a new IT implemented in an operating facility.

Area de Material Rio Cuarto

General Overview

The “Area de Material Rio IV” is a logistic unit that serves under MGD. The MAPO 55 is an internal AAF regulation that states the mission, organization, responsibilities, and duties for all the AMRIV dependencies.

The primary mission as stated in the AMRIV MAPO 55 is to “Execute the maintenance, determination, storage and distribution of all the materiel under their responsibility; Take part in the definition of technical and logistical applicable procedures for the materials to be incorporated to the AAF; Fulfill the development and fabrications of parts assigned; all in order to support the achievement of the goals of the MGD.”
(Area de Material Rio Cuarto, 2009, p. 1)

The achievement of the objectives of the AAF, as an entire organization, relies on the achievement of the goals of every single subordinate unit mission.

The primary activity is the repair and overhaul for different weapon systems and the associated parts, involving structures, avionics, accessories, hydraulics, electrics and armaments as well as alternative engines and propellers.

As a main overhauling facility, it operates with approximately 250,000 square feet of hangars, shop buildings and administrative buildings, plus two paved runways. Also included is a laboratory for non-destructive tests, chemistry and metrology; one engineering department; and a flight test center each manned with the appropriate engineers and technical personnel. It is estimated to produce approximately 650,000 labor hours annually.

Historically and according to the AAF responsibilities assignment the “AMRIV” works over several part numbers, ranging from minor to depot level and overhaul inspections. In recent years, and following different orders and plans from the MGD, the AMRIV was working over 400 items. Effort is now on defining scope and focus to reach the proper levels of quality and safety. Most of the items are related to the following aircraft and systems: Mirage MIII-V, Douglas A-4B/C/M, Hercules C-130, Learjet 35A, Cessna C-182, Tucano EMB-112, and Beechcraft B-45 Mentor.

Among others, the facility has the following capacities:

1. Mirage MIII – MV, Douglas A4-AR, and EMB-312: up to depot level maintenance.
2. Continental O-470 R/N and Lycoming O-540 engines up to rebuild and overhaul.
3. Mc Cauley and Hartzell propellers: up to rebuild and overhaul.
4. Bendix and Collins Avionics and communications systems. (VHF, VOR, ADF, MKR)

5. Hydraulic Accessories: actuators, pumps, reservoirs, valves, brakes, actuators, dampers, shock absorbers, pressure regulators, main landing gears.
6. Electric Accessories: starters, generators, CC/CA controllers, switches, actuators, magnets, motors, electric pumps, converters and inverters, temperature controls.
7. Mechanical Accessories: fuel systems components, pressures regulators, turbo pumps, shut off valves, pneumatic starters, temperature controllers, actuators.

Organization Chart

The AMRIV has an organizational chart that involves more than 500 dependencies, and is depicted in “Appendix A”. It contains three main Groups. Maintenance Group that performs basically the maintenance over the assets. Base Group that take care of the whole facilities. And Logistic Squadron that basically take care of the logistic channels. Also there are other assistant departments helping the Base Commander, like Quality Control Department, Safety Control Department, Economic and Financial Department, Operations, Purchasing Department, and Airworthiness Department.

The maintenance is performed within the Maintenance Group (MG), which is organized with 6 squadrons and 2 departments as follows:

1. Maintenance N 1 Squadron
2. Maintenance N 2 Squadron
3. Electronic Systems Squadron
4. Armament Squadron
5. Aeronautical Workshops Squadron
6. General Workshops Squadron
7. Engineering Department

8. Planning and Control Department

Figure 1 shows the organization for the Planning and Control Department (PCD), part of the MG of the AMRIV. As depicted in Figure 1, the Department has two Divisions, the Organizations and Processes Division and the Planning Division. The Planning Division consists of three sub-sections: Planning and Coordination Section, Material Management Section, and Historic Records Section.



Figure 1 - Planning and Control Department Organization Chart

MAPO 55, in paragraphs 161 – 167, states the tasks, functions, and organization for the PCD. The planning and control responsibility is given to the Department. It states that an annual and monthly plan should be prepared in order to fulfill the objectives and goals of the Operational Annual Plan.

Procedures Handbook

According to the Administrative Circular (AC) # CA 065B0997 and subsequent # CA 065R0806 issued in 1997 and 2006, respectively (Fuerza Aerea Argentina, 2006), every Aeronautical Maintenance facility should have their own PROCEDURES

REGISTRY. The overall idea is to have a record of every single procedure to be fulfilled by all people within the organization, assuring better standards and reliability over the tasks. The objectives of the procedures, as described, are to achieve efficiency, reducing time on management and better usage of assets. The normal usage of the procedures also gives better quality assurances and accurate tracking of the logistics functions over the facilities.

From the AMRIV Procedures Registry (Area de Material Rio Cuarto, 2009) there are four main procedures that are related with the PCD activities:

1. XV- 0.0-00-06 Solicitud de elementos para cumplimiento del PAO – “Elements request to fulfill the Operational annual plan”
2. XIII-0.0-00-28 Actualización de los programas de mantenimiento – “Maintenance programs update”.
3. XIII-0.0-00-22 Planificación de trabajo mensuales o anuales para trabajos generales reiterativos – “Planning of monthly and annually repetitive general works”.
4. XIII-0.0-00-01 Emisión de ordenes de trabajo objetivo – “Issue of work orders for specific jobs”

Examining in detail all of the procedures, we realize that there are no references about the planning task itself. Despite allusions to references to actual monthly and annual plans, there are no instructions in place on how to formulate these plans or what respective procedures to follow.

Several literature references describe planning as a kind of art form, but actual facts show that, no matter the way that the plan is obtained, it should be done in such a way as to give the organization visibility, order, and goals to achieve. None of the procedures currently in place tell the planning and control personnel how to obtain,

present, or improve a plan for annual or monthly activity. In other words, there is a gap, a large grey area, around how to plan and what tools should be used to plan.

After a thorough review of the procedures, only a minor reference about a task presenting tool was found, it is Procedure XIII-0.0-00-28 Actualización de los programas de mantenimiento – “Maintenance programs update” (XIII-0.0-00-28 -201), that mentions the Pert or Gantt graphs.

Searching for available IT Tool options

Non applied or nonspecific industries.

While conducting an internet search for Planning IT Tools and their common characteristics, many open-source tools as well as commercial products were found. To

Features [\[edit \]](#)

Below is a list of common features in project management tools.

Software	Collaborative software	Issue tracking system	Scheduling	Project Portfolio Management	Resource Management	Document Management
10,000ft Plans	Yes	No	Yes	Yes	Yes	No
2-plan	Yes	No	Yes ^[21]	Yes	Yes	Yes
5pm	Yes	Yes	Yes	Yes	Yes	Yes
24SevenOffice	Yes	Yes	Yes	Yes	Yes	Yes
AceProject	Yes	No	Yes	No	Yes	Yes
Advanced Projects	Yes	Yes	Yes	Yes	Yes	Yes
Apache OFBiz	Unknown	No	Yes	Yes	Yes	Yes
Apache Bloodhound	Yes	Yes	No	No	No	No
Apollo	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Asana	Yes	Unknown	Unknown	Unknown	Unknown	Unknown
Assembla	Yes	Yes	Yes	Yes	Yes	Yes
Axosoft	Yes	Yes	Yes	Yes	Yes	Yes
Basecamp	Yes ^[22]	No	No	No	Yes ^[20]	Yes
Binfire	Yes	No	No	Yes	Yes	Yes
Bitrix24	Yes	No	Yes	No	No	Yes

Figure 2 - Comparison table for Types of software

gather a frame of reference of the complete set of options available from open sources, and as is becoming more common in any research task, the first scan through the internet

landed at Wikipedia (Wikipedia, 2015). The link for PM software tools listed the most popular software products for project management, presenting 143 different planning software tools. Each software entry presented is an active link to the software tool itself, giving the user the ability to visit the developer company site to obtain deeper information, a free demo, or timed trial of the software.

The free encyclopedia prepares and presents the software tools listed in three double entrance tables, with features, characteristics or conditions. For each software tool the different items presented are: Web-Based condition; Hosted-on premises; Software as a Service; License type; Programing Language; Collaborative software; Issue Tracking System; Scheduling; Project Portfolio Management; Resource Management; Document Management; Workflow system; Reporting and Analysis; Budget Management; Time tracking; and Invoicing.

Software	Web-based	Hosted On-Premises	SaaS	License
2-plan	Yes ^[1]	Yes	Yes	Proprietary, Open source ^[2]
5pm	Yes	No	Yes	Proprietary
24SevenOffice	Yes	No	Yes	Proprietary
10,000ft Plans	Yes	Yes ^[3]	Yes	Proprietary
AceProject	Yes	No	Yes	Proprietary
Advanced Projects	No	Yes	No	Proprietary
Apache OFBiz	Yes	Yes	Yes	Apache License
Apache Bloodhound	Yes	Yes	Yes	Apache License
Apollo	Yes ^[4]	No	Yes	Proprietary
Asana	Yes	No	Yes	Proprietary
Assembla	Yes	Yes	Yes	Proprietary
Axosoft	Yes	Yes	Yes	Proprietary
Basecamp	Yes ^[5]	No ^[6]	Yes	Proprietary
Binfire	Yes	Yes	Unknown	Proprietary
Bitrix24	Yes	Yes	Yes	Proprietary, Open source
Bontq	Yes	No	Yes	Proprietary
Brightpod	Yes	No	Yes	Proprietary

Figure 3 - Comparison Table for Common Features

Figure 2 and Figure 3 depict general aspects of the tables presented on the website. Active links to the specific software developer pages are provided. Additionally, some one of the characteristics are explained and provide even more active links.

Tailored software for Aviation Maintenance.

Within the Aeronautical industry the search was a little more difficult. The search over the web for specified IT Tools showed a more tailored set of software, with other common sets of features and a different working philosophy.

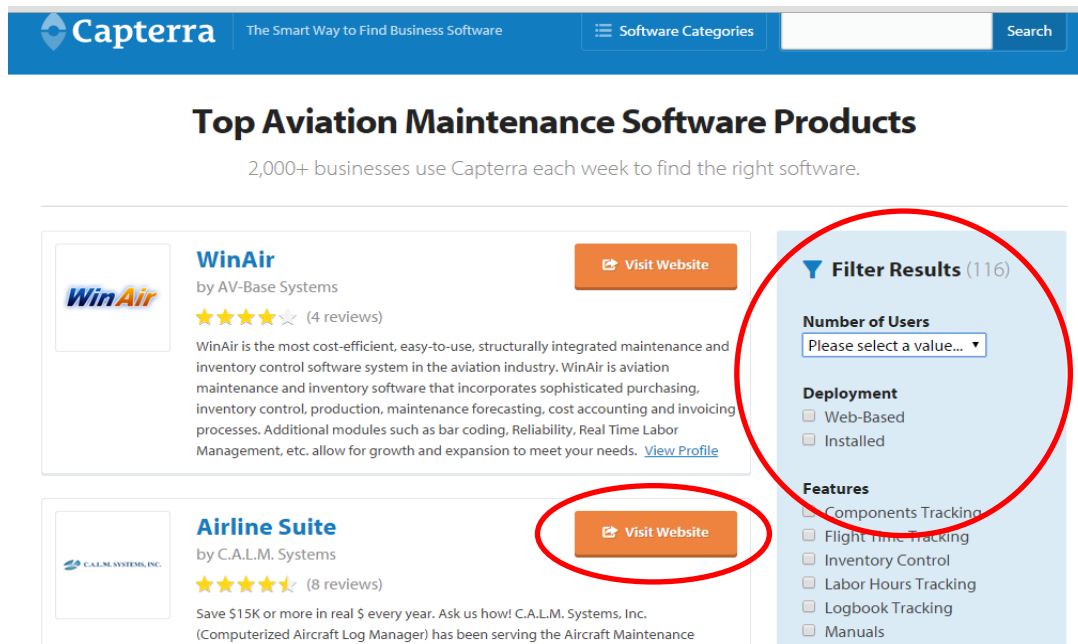


Figure 4 - Capterra Web Page for Business Software searches.

In the process of finding tailored software for aviation maintenance, the CAPTERRA Company was found to assist in this task. Particularly, Capterra offers a free service to help businesses find software that best matches their needs.

Searching the word “Aviation Maintenance” with the Capterra web page tool (Capterra, 2015), the retrieve presented a total of 116 software tools that are being used in

the aviation maintenance industry, each with an active developer website. This filter tool works based on three different basic aspects: the number of users, the deployment type, and the features desired.

To help scoping over the options a filter with different features is available to activate. It comprises different capabilities and characteristics for the software like: The number of users; the deployment type; Component tracking; Flight Time Tracking; Inventory control; Labor Hours Tracking; Logbook Tracking; Manuals; Safety Management System; Service Bulletins; and Work Order Management.

Figure 4, in the previous page, presents a screen capture of the Capterra software selection web page. It shows the filter aid on the right side and the active buttons to the developer's webpages, both circled in red.

Other related works

During the last 30 years, the management project software has been growing and evolving with the help of several organizations of users and developers. Since organizations often faced the challenge of selecting the proper IT tool for their projects or activities improvements, a search over project management tool selection was conducted. The common thread between all of the related works was the need for standards processes and practices for evaluation criteria for some of these works that can be used to form a framework to coincide with the thesis methodology.

Tim Bryce presents a set of criteria that “good” project management software tools should be evaluated against in the “*Project Management System Evaluation Checklist*” (Bryce, 2006). The different criteria cover general requirements, planning

support, estimating support, reporting support, control support, and computer related considerations.

For Project Manager Software Organizations, Clare (Clare, 2015) presents another set of criteria or simple guides that a software tool should fulfill. Despite general considerations about project management, it covers other aspects such as features, software costs, and considerations on how to choose the right one. Clare also analyzed the fifteen most popular commercial and open source tools.

In another work performed in the Universidade Federal de Santa Catarina (UFSC) from Brazil, Christiane Gresse von Wangenheim (Wangenheim, et al., 2010) proposes a set of Unified Best Practices (UBP) for project management. They mapped the best practices to the Project Management Body of Knowledge (PMBOK) processes and the Capability Maturity Model Integration (CMMI) specific practices. As they conclude that *“the work may help to implement and asses project management processes more effectively and efficiently...”* we can compare and asses different project management software by comparing these set of UBP with the features and ability to support those practices.

Within the works that perform assessments and evaluations of different project management software tools, Chapman (2015) assessed what she considers the best 15 software applications. She presented and analyzed both paid and free options.

Another work that presents an evaluation of different project management software tools is Mustafa (2015) which directly maps the requirements from clients to software features and characteristics.

The “Comparison of Open Source Tools for Project Management” is another related work, presented by Andre Marques Pereira et al. (Pereira, et al., 2013) from the Federal University of Santa Catarina, Brazil. They use the UBP (Wangenheim, Silva, Buglione, Scheidt, & Prikladnicki, 2010) published by a previous related work as a frame to assess the open source software. As the author states “*The results of this research can be used by organizations to make decisions on a tool adoptions...*” (Pereira, et al., 2013: 209), the work presented a framework that could be modified in order to fill the needs and characteristics of any other organization and also comparing not just open source software.

IT Tools Implementation

Considerations

Palmer (2006) identifies the difference between the planning activity functions and the use of a computerized maintenance management system (CMMS). It is normal for people to tend to think that the perfect IS/IT Tool will do a perfect job. Far away from that, the IS/IT tool is just that, a tool. If used smartly better results can be realized but even so other tough problems may arise. As he states “*The CMMS can be a tremendous resource for planning, but it is not planning itself*”.

Palmer (2006) brings up the six planning principles and six scheduling principles. He also examines those principles against the CMMS and concludes that CMMS contains and gives the necessary information, but should not influence the planning strategy.

After an organization decides to move into the implementation of a CMMS, Palmer points to several considerations, benefits and cautions related to this kind of tool.

Within the considerations he mentions the software already in use; single users or larger networks; and creating vs. purchasing. Benefits of CMMS are described as: standardizing work processes; inventory control; information for metrics and reports; finding work orders; linking information to equipment; common database; scheduling and PM generation. On the other hand, the cautions considered are: faulty processes, system reliability and speed, data protection; improper costing; open access to work orders and status visibility; creating unnecessary metrics; unwisely eliminating all paper; expecting a CMMS to do everything; expecting a CMMS to think; overuse of templates; user friendliness; and finally, cost and logistics.

He considers the following characteristics as helpful for a planning and scheduling IT tool: user friendly; speed; reliability; inventory help; helpful fields; deficiency tag; status; priority; how found; attachments/links; and equipment module.

Critical Failures and Success Factors

David L Olson (2004) discusses critical factors of IT/IS projects, reports failure rates of general IS/IT projects as well as in Enterprise Resource Planning (ERP) projects implementation. Concurrently, he defines the implication of users training on the new systems in order to benefit the organization.

Olson defines in terms of information system projects “*a critical success factor is what a system must do to accomplish what is designed to do*” (Olson,2004). As critical success factors he points to top management support, client consultation or user involvement, and clear project objectives.

He also states that other studies have examined different critical success factors. One of those studies refers to E. J. Umble (Umble et al. (2003) which showed the integration critical factors over the next ten different categories:

1. Clear understanding of the strategic goals.
2. Commitment of top management.
3. Excellent implementation project management.
4. Great Implementation team.
5. Successful coping with technical issues.
6. Organizational commitment to change.
7. Extensive education and training.
8. Data accuracy.
9. Focused performance measures.
10. Multisite issues resolved.

Although this thesis is not focused on an ERP implementation but on IT/IS tools implementation, there are still many similarities where reviewing ERP research is applicable. In this case, the first two categories are common. Categories 3, 4 and 5 for this case should be scoped to the internal organizations and procedures. The sixth category, related to the second one, can face major issues because the implementation may require several changes not only in procedures but also in the organization itself. The seventh category requires the provision of training for people involved in the changes. Number 8 requires the commitment for accurate data from the people involved in order to achieve useful information and results. The ninth category requires clear guidance from top management in order to provide them with the information needed.

Finally, the last category relates to the issues that each of the different sites involved on the IT/IS implementation may face.

Olson (2004) identifies five different categories for potential IS/IT project failures:

1. Corresponding Failures.
2. Process Failures.
3. Interaction Failures.
4. Expectation Failures.
5. Strategic/competitive failure.

Correspondence failures refers to the different goals between the organizations and the IS/IT projects. The process failures refer to failure in setting up the project in the proper time and budget. Interaction failures are related with the failure of the actual usage of the system. It is in this category where the organization behavior has a major impact. Following the interactions, the expectations about the results could not fulfil the organization's points of view or expected goals. The last of the categories, the strategic and competitive failures, provides that even when systems work perfectly but organizational goals are not achieved may lead to the total or partial abandonment of the project.

Planning within the Organization

Appendix M of Maintenance Planning and Scheduling Handbook (Palmer, 2006) is a good compilation of what a Planning Group or team represents for the organization. Also it indicates, as is common, that Planning is interacting with all the other departments or areas within. Manning, selecting, waging, training and evaluating the planning group

are key activities for having a proper planning group. As Palmer (2006) states “*Having the right person as a planner is the single most critical factor governing the success of the planning program.*”

The Appendix M has a special section identifying and analyzing the utilities and barriers for each aspect of the planning and scheduling program. He differentiates the setting up of a planning group from each of three other different special circumstances: improving an existing planning group, new plants, and self-directed teams. Despite that a CMMS is a higher level tool compared with a planning and scheduling IT tool, the utilities and barriers depicted still have the same validity.

The case of improving an existing planning group is more related to the actual problem presented in the AMRIV. Palmer then presents what is needed or might help with successful implementation: someone in charge; the two white knights (management support and someone directing the changes); management understanding, support and communication; planning and scheduling principles; right planners; planner training; keep planners together; focus on scheduling; focus on schedule success; allow some help for jobs-in-progress; and wrench time study. As for constraints or impediments he lists: change/inertia; losing face; past baggage; the right persons do not want to become planners; expecting perfect plans; complex process for purchasing, inventory and tools; budget; wrench time study; lack of IT support; and trying to do it all with the IT tool.

Managing change within the organization

Gibson et al. (2012) presents a full chapter to analyze managing organizational change and learning. As the research will imply different changes for an established and

running organization a special consideration is going to be taken to face the problems that those changes present.

Gibson et al.'s Chapter 17 shows different aspects for managing changes. It states Learning Principles and change as three different steps: unfreezing old learnings, move to new learnings, and finally refreezing the new learned behavior. As well as these principles, Gibson et al. marks the different change agents to perform or implement the improvements. External agents, internal agents or external-internal team agents, could face the challenge to implement a change within an organization, and the choice of each type is defined by the relationship between the change agent and the key decision makers.

Some form of resistance to change will arise eventually, as the authors state:

“...resistance to change is a behavioral and/or emotional response to actual, perceived, or emotional threats brought about by work change...” and the reasons why people resist changes are the following four, primarily, according to Gibson et al.:

1. Parochial Self-interest.
2. Misunderstanding and lack of trust.
3. Different assessments.
4. Low tolerance for change

The following steps are enumerated to follow in order to reduce the resistance to change, among others:

1. Education and communication
2. Participation and involvement
3. Facilitation and support

4. Negotiation and agreement
5. Manipulation and cooptation
6. Explicit and implicit coercion

Chapter 17 also presents a seven-step model for the management of organizational change. Figure 5 shows the seven step model presented by Gibson et al.

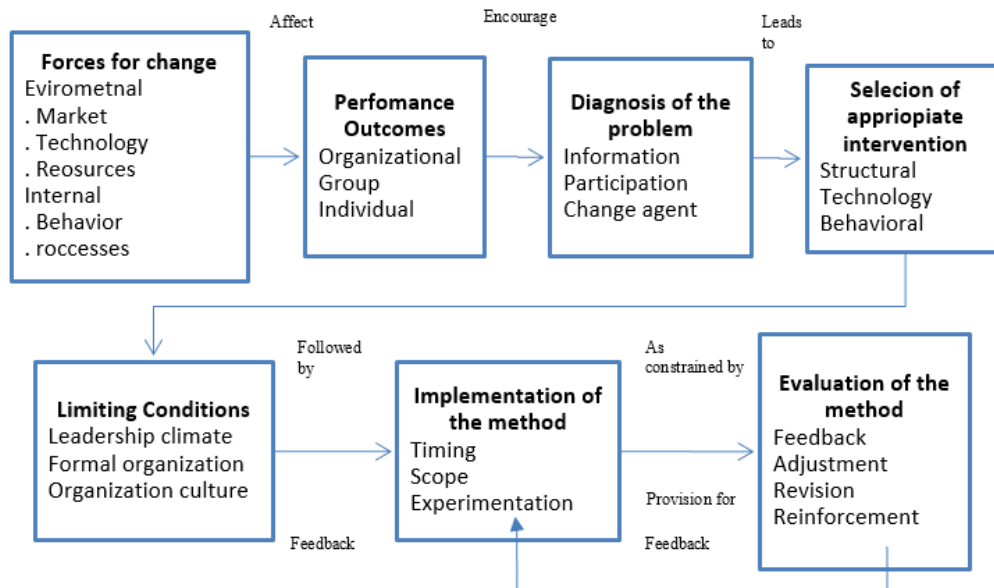


Figure 5 - Seven-step model for the management of Organizational Change

Conclusions

After going through the AMRIV organization and taking deep insight into the procedures being followed, it can be seen that there is a large grey area within the planning and scheduling processes. The MAPO 55 and the Procedures Registry do not provide a clear idea about how the Planning and Control structure should work. They only state that the PCD is responsible to build up Yearly and Monthly plans. Within the procedures for the PCD there is nothing that guides planners in how to accomplish this task, or even, how to report the key decision personnel or managers. With the lack of standards for

planning and reporting, visibility and certainty of future work or works-in- progress would be difficult.

The necessity for the implementation of a proper IT tool for aiding the planning and scheduling task is assessed in this study. Searching for proper alternatives produced a list that involves not only specific industry software, but also commercial software to perform the required tasks. From this search, the necessary features and characteristics will help in the scope and selection of a set of appropriate tools and perhaps the one most suitable one.

Implementation of the new tool will likely bring new challenges for the organization. There is always resistance to new change, and a proper plan to successfully implement and avoid possible failures and take advantage of the critical success factors should be constructed.

III. Methodology

Chapter Overview

The purpose of this chapter is to describe the software selection method developed and followed for the purpose of selecting the “best” software tool that to enable project management. The human elements that arise concerning implementations issues are addressed using previous software implementation experience in the identification and assessment of the issues for this new change.

The Unified Best Procedure, Capability Maturity Model Integration and the Project Management Body of Knowledge frames.

The Capability Maturity Model Integration (CMMI) framework is basically a process improvement model for the development of products and services over their entire life cycle. The purpose is to guide organizations over each step of the life cycle, improving processes and decision making. The CMMI framework was developed with the assistance of the Software Engineering Institute, U.S. industry, and government. Sponsored by the Department of Defense (DoD) and the National Defense Industrial Association (NDIA). The CMMI framework covers different areas of interest, and the three current frameworks available today are for development CMMI-DEV, services CMMI-SVC and acquisitions CMMI-ACQ.

Focusing on project management, the CMMI-DEV covers:

1. Project planning (PP): establishing and maintaining plans that defines the project activities.
2. Project Monitoring and Control (PMC): following the project progress to react accordingly.

3. Supplier Agreement Management (SAM): managing the relations with suppliers.
4. Integrated Project Management (IPM): managing the involvement of stakeholders and process that carry outs the objectives for the project.
5. Risk Management (RSKM): identifying potential problems in advance, so proper alternative plans could be raised to mitigate the consequences and adverse impacts.
6. Quantitative Project Management (QPM): matching the processes with the established quality goals.

The Project Management Body of Knowledge (PMBOK) is recognized as a standard for project management (Wangenheim, et al., 2010) providing guidelines to properly manage individual projects. Also, it defines and describes project management and its life cycle. Through the years the PMBOK has evolved with the help of a consensus standard coordinated by the Project Management Institute (PMI).

The PMBOK presents project management processes grouped into five process groups:

1. Initiating Process group: process defining the new projects.
2. Planning Process group: process scoping, refining objectives, and setting courses of actions.
3. Executing Process group: process completing the works.
4. Monitoring and Controlling Process group: process tracking, reviewing and regulating progress and performances. Identifying areas for improvements and changes.
5. Closing Process group: finalizing all activities across all the groups.

PMBOK and CMMI agree that the life cycle for a project is composed of five basics process groups: Initiating, Planning, Executing, Monitoring and Control and

Closing. The group processes for each one follows these basic groups (Wangenheim, et al., 2010). Please see Figure 6.



Figure 6 - Project Management Process groups

CMMI and PMBOK frameworks for project management were fused as a set of Unified Best Practices (UBP) (Wangenheim, et al., 2010). This framework is presented in Table 3 in Appendix B, and divides the project management processes into the PMBOK groups.

The UBP, are presented, related with each model, and graded accordingly with correspondence as (T) total correspondence, (P) partial correspondence and (–) no correspondence. For this research only the practices that are most related with the needs of the PCD are selected from the UBP in order to compare the support to those processes from each one of the project management software tools.

Project Management Software Tool selection

There is a large body of software with vastly different features, characteristics, and support for project management developed and being upgraded. The search

conducted retrieved many software products in different areas like general industries and business applications, specific aeronautical industry, open source software and commercial software.

The literature review found several works assessing and selecting project management software within those four groups. In order to keep the scope within the research resource constraints, two of the best software options from each group were selected to compare and assess the support for the selected UBP that covers the needs of the PCD of the AMRIV.

Implementation issues

Any new software implementation may cause several issues to arise within the organization. In order to assess and propose measures to mitigate these issues, the experience with a previous software implementation was used.

During the last 10 years the “Sistema Integrado Logistico” (SIL), an Enterprise Assets Management software tool, has been implemented over the entire Argentinean Air Force. While it was a broad project that involved the whole Air Force organization, implementation issues emerged in the PCD, with different measures taken to mitigate them at different levels. This experience provided the principal starting point to assess the expected reaction to change implementation.

Summary

As a summary of all the steps performed in the selection of an appropriate tool, and assess the probable issues for implementation, the next steps were followed:

1. Selection of the UBP for project management that covers the needs for the Planning and Control Department.
2. Selection of the two best project management software tools from the different groups (general industries, Aeronautical industries, open source and commercial software).
3. Assessment of the support for each of the selected UBP from the project management software tools.
4. Assessment, based on the previous experience, of the possible implementation issues over the PCD.

The next chapter will present the results for each one of the steps. A total of twenty UBP were selected to cover the needs of the PCD, the eight software tools selected will also be presented as well as the comparison results and implementation issues that probably arise.

IV. Analysis and Results

Chapter Overview

This chapter presents the analysis and results for the three main areas of the present work: the planning and control process needs, the project management software comparison and assessment, and finally implementation issues. To determine the needs of planning and control, the processes were examined and the primary needs were compared with the UBP in order to establish a relative framework with which to perform a proper comparison between software tools.

The selection of the PM software was done by taking the highest-rated software tool within each of the main groups: the open source software, the commercial software, general industry software and aeronautical tailored software. Next, a comparison was made by assessing how much each software product corresponded with or provided coverage for, the selected processes. Finally, and based on the SIL previous experience, potential issues for implementation were pointed out and mitigation actions were highlighted. It is known that, even with the recommendations, several other actions should be conducted in order to improve the success of the implementation, and accordingly with the reaction from the organization.

Planning and Control Department insight.

After obtaining insight on the procedures established in the Procedure Registry and MAPO 55, two items become clear. First, the PCD is responsible for the yearly and monthly task plan preparation, as well as reporting the evolution of those plans. Second, a general lack of standards in some planning procedures was identified. Figures 7 through 9

show some of the different plans used by different squadron planners, all of them done on Excel spreadsheets and are available in Appendix C. Among the lack of standards, the figures shows a lack of visibility on work-in-progress, types of assets being processed, and the time needed to complete the tasks.

Figure 7 presents the yearly plan of Maintenance N 1 Squadron. The plan is done

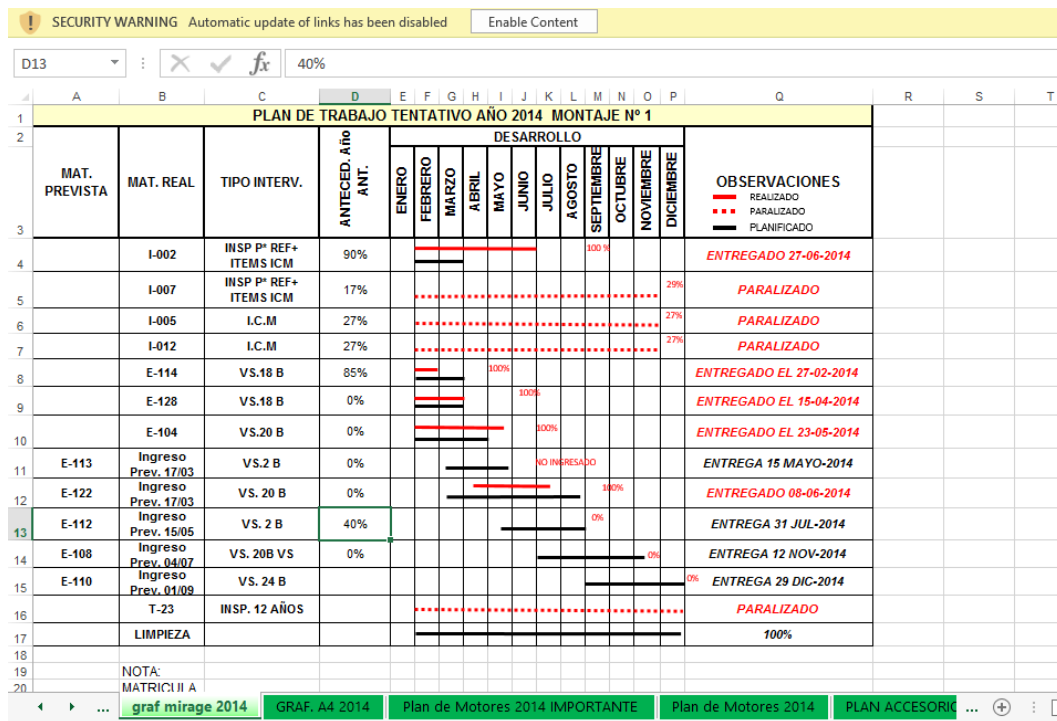


Figure 7 - Maintenance Sqn. N 1 - 2012 Plan

on an Excel spreadsheet and only shows the main tasks (depot level inspection for Mirage and EMB-312 tail numbers). There is no break-out of related tasks, spare parts or additional work required. There is a big lack of information, just desired dates for starting and finishing the inspections. Also, the update of the spreadsheet is done by hand and upon request, which typically resulted in a 1 or 2 day delay in providing an update to it.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	JL	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF	KG	KH	KI	KJ	KK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	Z
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update. Certainty is not present in this plan, due to the fact that there is no way to know what specific work is going through at any given time. For the case of the engines and propellers plan, it is carried separately and presented in Figure 9. The information is scarce with the addition of some information on problems observed.

were kept away from the planned activities, and because these type of activities are common tasks for all the overhauling assets in the other squadrons, they become bottlenecks during high demand periods. The planners assign priority once the problems appears in a reactionary manner and not in advance. Not surprisingly, tasks have been interrupted or delayed due to unplanned changes. The scarcity of resources for these common jobs were also a source of delays which impacted several other assets.

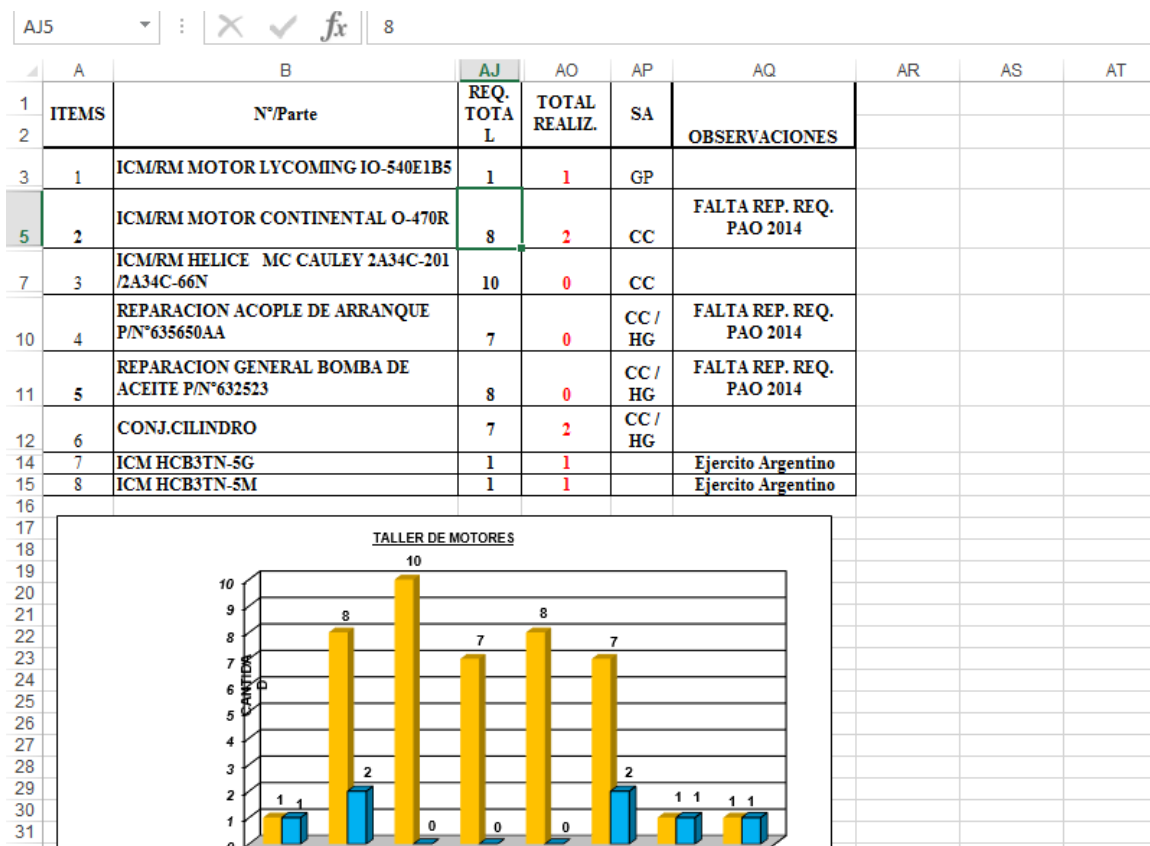


Figure 9 – Aeronautical Accessories – Engines - 2014 Yearly plan

The lack of specific instruction or guidance resulted in a grey area over planning procedures also allowed staff personnel to make changes as best they could determine, to change over time, the way that plans are being proposed. . The lack of standards became critical as success was completely reliant on the ability of the planner. This situation

answers the first research question about the fulfillment of the mission of the PCD, as well as for two of the investigative questions, about the planning procedures in use and the problems and weakness that they present.

Moreover, the combination of all the flaws results in zero certainty on the project or project's planned completion dates. Even reports delivered by the PCD to the higher levels were relying on the planner's expertise and without strong or specific support.

Planning and Control Department needs.

A second step was to seek for a suitable framework to perform the comparison between the software candidates. Departmental needs that should be supported by the software had to be identified for that framework.

The framework covers processes from each one of the four groups of the project management life's cycle. However, other aspects related with the organization are also taken into consideration. A total of 20 UBP were selected, one of the initiating process groups, thirteen of the planning process group, one of the executing process group, four of the monitoring and controlling process group and one of the closing process group.

From the organization aspect, and out of the UBP, a total of four basic characteristics and features were desired for comparison. These four were training availability, clients support, and the type of license and the security of the data involved.

Also the next list shows the general features and characteristics that were desired and taken as exclusion criteria.

1. The tool should run under the Windows platform. That is the platform used in the PCD.

2. Allow up to 10 users at a minimum. The PCD is manned with at least 1 person per squadron, plus the PCD chief and MG chief.
3. Contain the core needs without the necessity of other add-on type software. It should be installed and start running without other future installations to cover core aspects.
4. Accessible and broad available training and client support
5. Considered within the 10 most popular ones by the software analyst. In order to assure that the software selected has reached certain maturity.
6. Include a trial mode for evaluation on site. Giving the chance to obtain feedback, improving in that way the end user support.

Table 4 on Appendix B shows the UBPs and features selected to be used in the software comparison.

Selection of the PM software tools

With the objective to keep the scope and the workload within the time limits, a total of eight software tools were selected. The two highest rated of each of the proposed groups: commercial, open source, general industry/business and aeronautical tailored software, were taken.

Commercial Software

The commercial project management software tools search was conducted web search. The words “project”, “management” and “software” were used to initiate the search, and lead to three different organizations related to the project management issues and software. First, the Project Management Institute (Project Management Institute, 2015), a non-for-profit organizations dedicated to analyze related project management issues. Second, the Project Management Software (Clare, 2015), that is another project management organization that collect, analyze and review the available tools for project

management. And finally the Capterra company (Capterra, 2015) that is dedicated to organize, analyze and review commercial software for business.

The Project Management Software search retrieve more than 90 available options, while Capterra, retrieved a total of 63 available options.

By applying the exclusions criteria, looking over the best rated ones and filtering for the core features needed, the two commercial software selected were Microsoft Project® and Basecamp®.

Microsoft Project ® (Microsoft, 2016) was released by Microsoft Corporation on Jun 01, 2000 and evolved to the latest available and complete version on 2016. Microsoft

Figure 10 - Microsoft Project 2016

is leading on developing project management tools; Microsoft Project has been in constant movement since appearing on the market and has many different versions and

edition options. The three editions currently available are standard, professional and server. Features change and vary between those editions and versions, but the core project management features remain the same. Among those, coverage for scheduling, calendar, project portfolio management, Gantt charts, task assignment with WBS, resource planning, automated status updates, custom report generation, assign task priorities, document management, financial reports, track of task progress, collaboration features for team work, forecasting for resources, email notifications and integrations with other office tools. The learning and support is vast in the published market, the customer support is available via email, forums, help desk, remote training, and online self-serve type. Figure 10 shows a screen capture for Microsoft Project 2016.

PROS:

- Easy and intuitive tasking management with WBS (UBP P4, P5)
- Manage of priorities (UBP P7),
- Groups, and dependence (UBP P7);
- Powerful custom reports generator and customizable dashboard (UBP M5)
- Tracking of task, rates, and changes (UBP M2)
- Automatically updates the schedule (UBP M5).

CONS:

- It requires keeping the software updated to avoid several bugs or operational hang-ups. Collaborative features requires the server edition to fully work (UBP E5).

Basecamp® (Basecamp, 2015) is a web based tool from Basecamp LLC Company, it is fully team work and collaboratively oriented. The product was originally released on 2004 and the latest version, Basecamp 3, was released on Nov, 2015. It covers all of the core features needed for project management, task management, calendar, scheduling, priority setting, tracking time, interactive Gantt charts, custom reports, resource management, document management, milestones management, notifications,

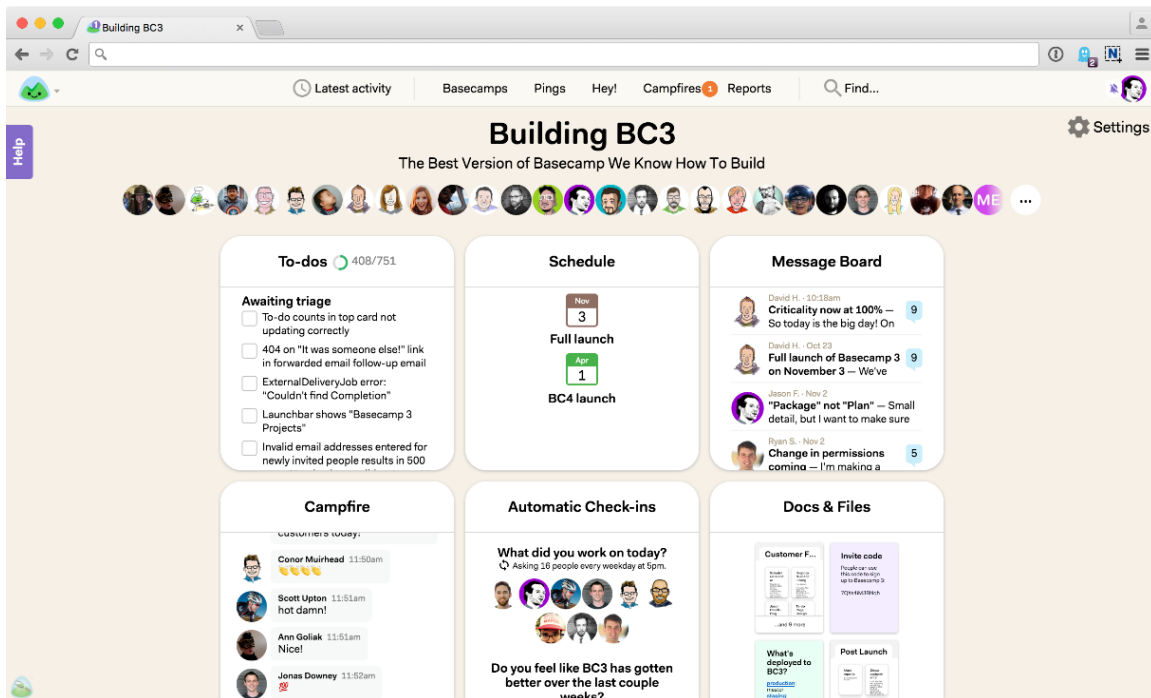


Figure 11 - Basecamp 3 Dashboard

messages and collaborative tools. The company is customer service oriented, so the online support looks promising. Figure 11, on the next page, shows a screen capture of Basecamp 3.

PROS:

- It is very easy to set up and use
- Best in collaborative support features

- Sharing documents and team work (UBP E5)
- Task assignment and priorities are easy to use and set (UBP P5, P7).

CONS:

- It is not too intuitive.
- Requires more in-depth learning.
- It has a steep learning curve.
- The workload is not easy to view
- Requires effort to observe overlapping tasks (UBP P12).
- The group activity could easily become large, taking the focus away.
- It present a lack of flexibility to modify from templates
- Cross project dependency
- Recurrent task managing and reports for task completion.

Open source

The open source project management software was conducted through different efforts, the related works and the Source Forge (SlashdotMedia, 2016), an open source organization that helps on open source software development, distribution, improvement, review and publication. The directory they manage is the largest and most popular for open source. It could be accessed, sorted and compared, becoming a useful tool in finding the proper software for any given customer. From the criteria, reviews and evaluations the two software candidates selected from this group were DotProject and Project.net.

DotProject (2015) is a web based tool, the basic features include the user management for task, WBS and hierarchical definitions, the schedule visualization with Gantt charts, calendar, client management and other non-core such contact lists. It is

developed based on PHP programming language and based on modular development. It was published on Jan 28, 2001 and the last version 2.1.8 was updated on Jul 27, 2007.

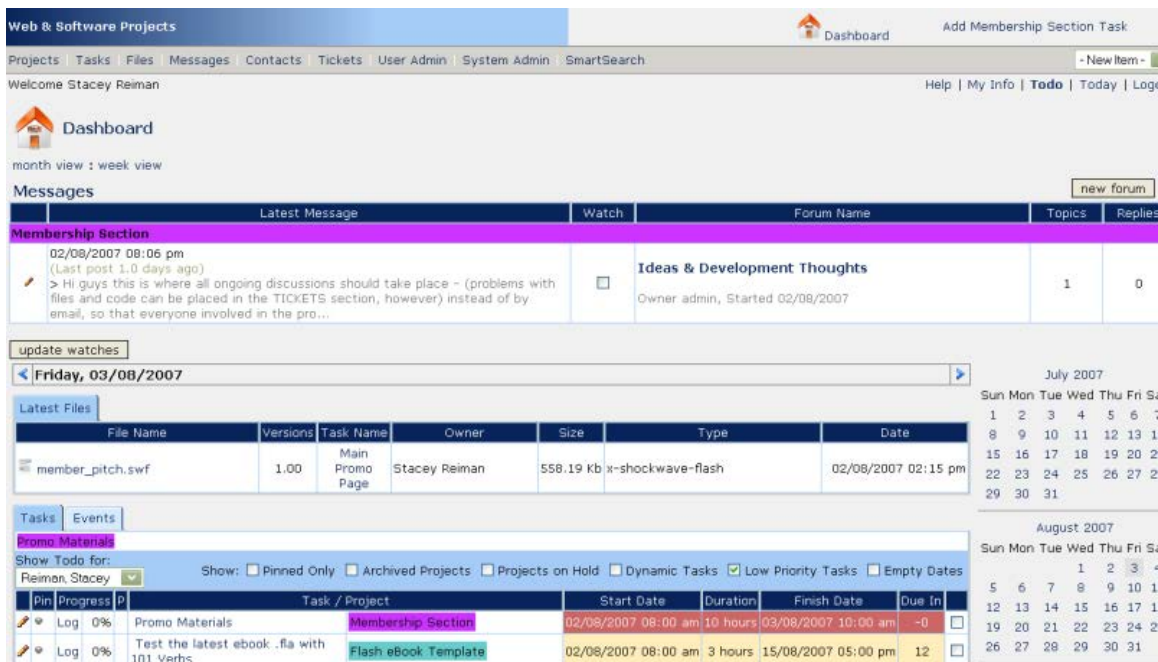


Figure 12 - DotProject dashboard

PROS:

- Excellent task time planning and sequencing (UBP P7, P11)
- Provides issue tracking through different workflows (UBP M5)
- Collaboration provided through social media type platform (UBP E5).

CONS:

- It is a rigid software with very little customization
- It lacks reporting options and document management
- It will require a well-established IT department to maintain the software.
- Resources and requirements management is not present (UBP P6, P10)
- The support and training are scarce and only web based.

Please see Figure 12, in previous page, presenting a screen capture of dashboard.

Project.net (2015) is an open source option written in the Java programming language. It was registered on Jul 11, 2007 and the latest version v9.2.9 was released Apr 20, 2015. The tool is team collaboration oriented. The core features covered are collaboration, document management, Issues, milestones and expenses tracking, resource and task management. It presents custom reports and the learning and support is done mainly via web through blogs, email and forums. Figure 13 presents the typical dashboard for Project.net users.

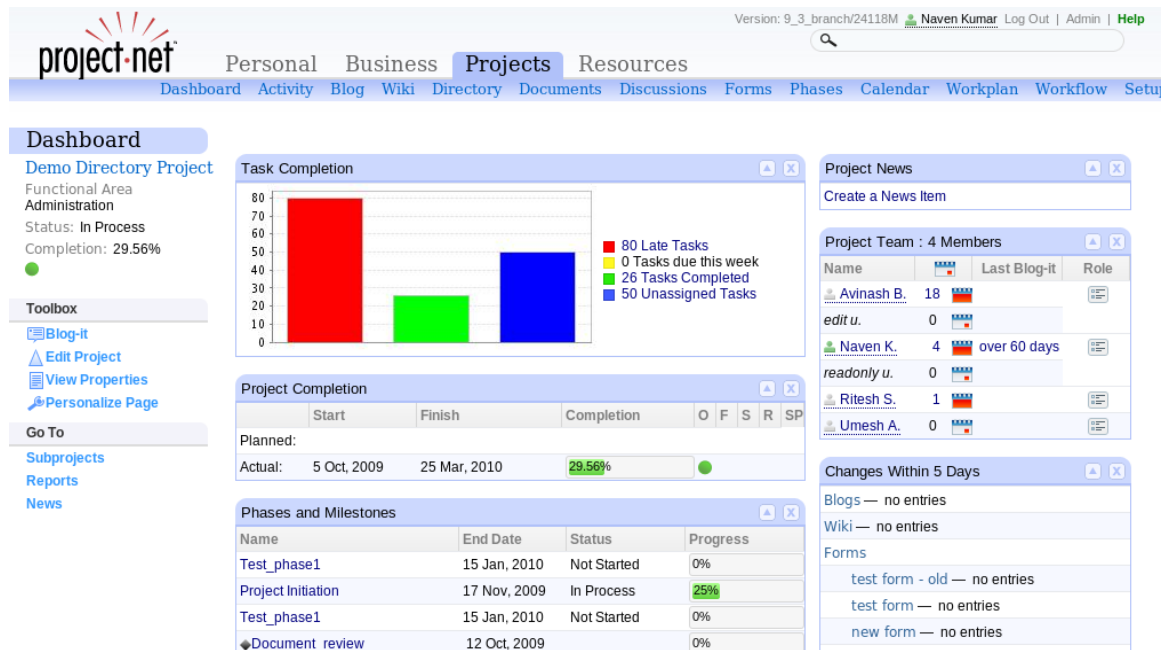


Figure 13 - Project.net dashboard

PROS:

- Team collaboration is the strongest characteristic (UBP E5)
- Provides a great issue tracking tool with multiple workflows options (UBP M5)

- The resource management presents good capabilities to allocate and monitor (UBP P10)
- The report tool is customizable, allowing for different reports (UBP M5).

CONS:

- The biggest con is the absence of Gantt chart, so easy visualization will missed (UBP P12, P25)
- It does not track changes, making it complicated to follow as projects evolve (UBP M2, P19, P21)
- The scalability for larger projects is lacking on project.net.

General industry / business selection

The search for the general industry / business software was conducted using the web site Listio 2.0 (Boxador, 2015). It is a site that was developed to track and review web 2.0 applications. Listio 2.0 was founded in 2007 and keeps growing as a community-based directory for web 2.0 apps, services and new media. It is focused on the products, usability, features, ease of use, cost and customer satisfaction.

Following the words “project”, “manage” and “schedule”, Listio 2.0 retrieved a total of 20 different project management software tools. Once sorted by the top rated ones and by recently added the best two options that fitted the needs for the PC department were GanttProject and LiquidPlanner®.

GanttProject (2015) is a free software application. It was first released on February 25, 2014 with most recent version, 2.7.1 released on Jul 23, 2015.

It is popular due to the ease of use in managing small projects and its ability to run over different operative systems like windows, OSX and Linux. It is self-hosted, and can read and write MS project files, exporting to different other formats like PDF or

HTML. It supports project baselines with an orientation to scheduling. Include features for Gantt, Pert and resource charts. Has an easy handle of task and work breakdown structures (WBS), as well as percent-complete tracking of tasks. Please see Figure 14, on the next page, for the user dashboard.

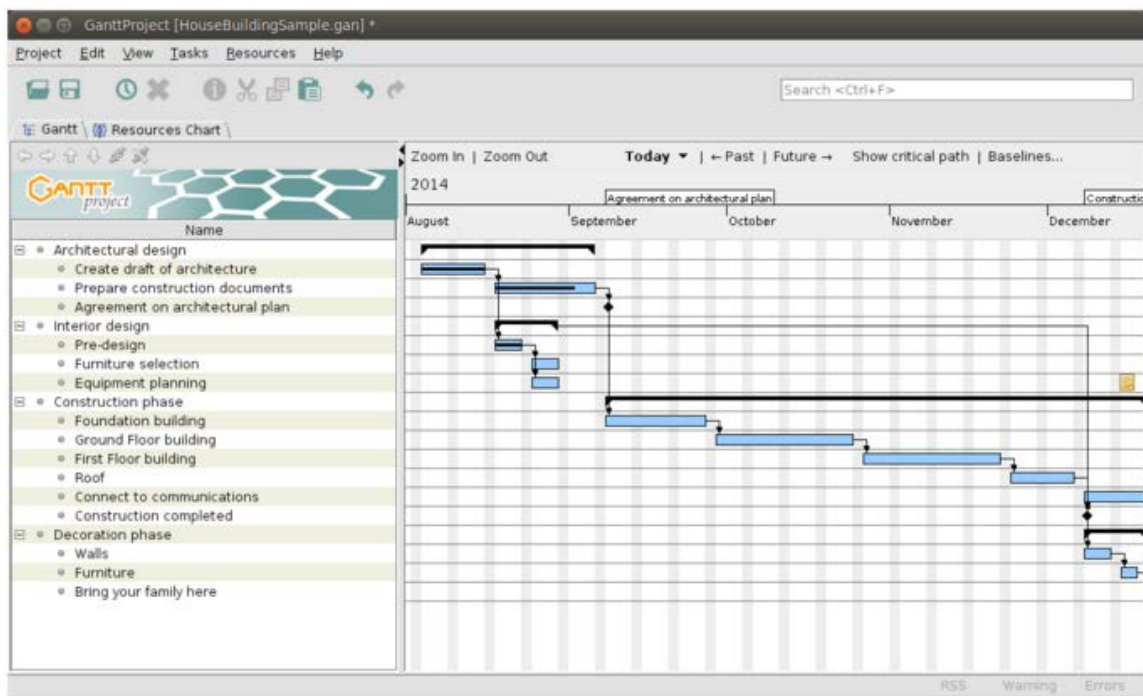


Figure 14 - GanttProject dashboard

PROS:

- Ease of use when working on scheduling tasks (UBP P4, P5, P7, P12)
- Gantt, Pert and resources charts are well presented.

CONS:

- The generation reports are not complete as there are no requirements or budgeting management (UBP P10)
- Collaboration is weak (UBP E5)
- It appears to be a single planner/scheduler software.

- Additionally, documentation support is absent,
- The learning and support is done by forum activity, blog and FAQ on site.

LiquidPlanner® (LiquidPlanner, 2015) is a web-based tool oriented for small, medium or large business. It was released by LiquidPlanner on Nov 23, 2009 and the latest version is 4.55.0 released on Jul 15, 2015. The tool is team and collaborative oriented. It supports and covers almost all aspects of project management, reporting, budgeting, issue tracking, resource management, tasking and scheduling, Gantt charts,

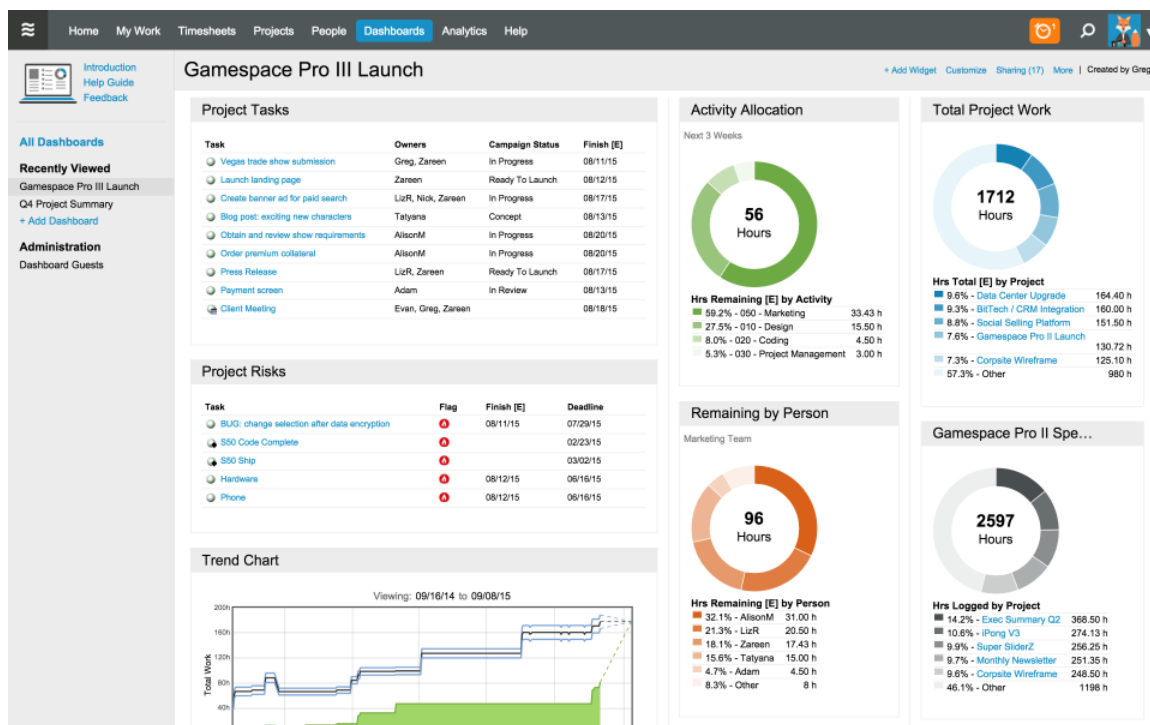


Figure 15 – LiquidPlanner® dashboard with risk managing

risk analyzer, document management, notifications, requirements, status and milestones tracking among others. It presents a solid client support system. There are three different license type offered: standard, pro, and enterprise. The training support is done by different ways according to the license type acquired, email support on request for standard, phone/consultations/trainings for pros and dedicated customer manager for

enterprise. A Free Demo or Time trial are available to test the software with some feature restrictions. Please see Figure 15 and 16 for different aspects of LiquidPlanner®.

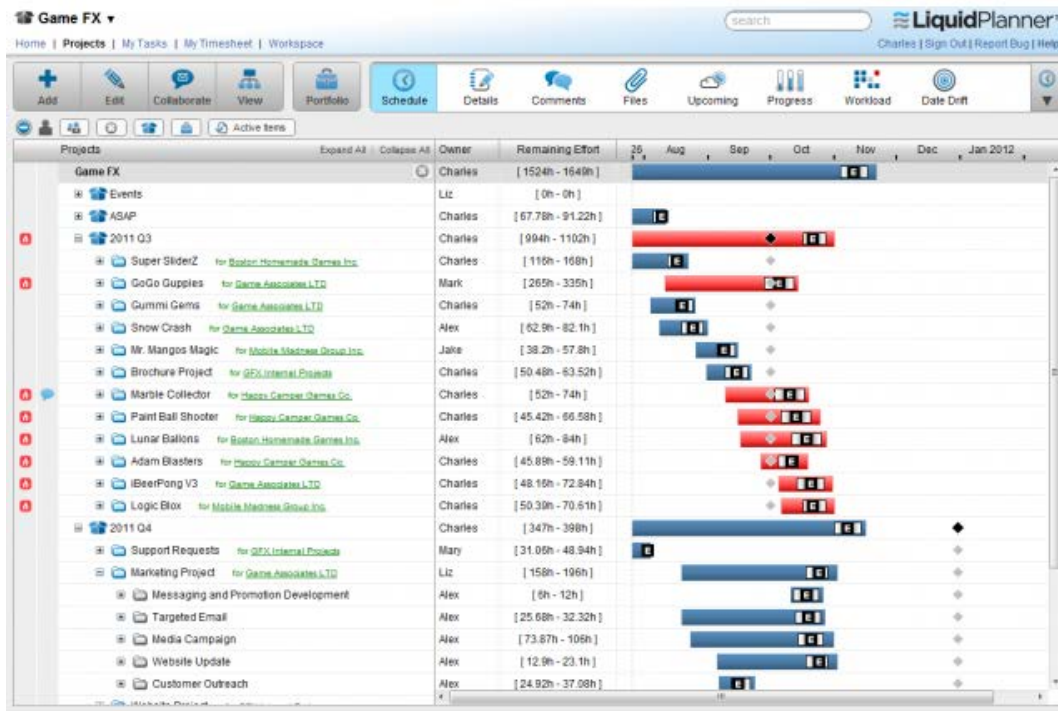


Figure 16 – LiquidPlanner® Tasking

PROS:

- Wide coverage of most of the project management aspects
- Team and collaboration features (UBP E5) are comprehensive and let the planner team improve the work
- Reports are customizable by users
- Possess a great task scheduling tool (UBP P12) that is easy to use
- WBS capabilities (UBP P4)
- One of the big improvements is the risk analysis tool (UBP P19)
- What-if scenarios that can be explored and reported (UBP P21)

- The learning and customer support is substantial for smoothing the learning curve.

CONS:

- The lack on customization and scalability could present a problem if the organization changes over time
- The interface is not fully intuitive and there is a lack on labels and buttons for easy feature access
- Because the project management approach way is different than others tools, the learning curve presents some challenges.

Aeronautical Tailored software

The aeronautically tailored software was selected by searching and comparing the best rated tools for aviation maintenance business software Capterra (2015). The first attempt returned a total of 52 available options. To narrow the options, a filter was done by selecting the web based / installed types of deployment and five core features: components tracking, flight time tracking, inventory control, labor hours tracking and work order management which resulted in 28 candidates.

It was quickly determined that the tailored software was not the best fit as the project management core features and characteristics desired on the UBP and comparison criteria were not completely met. The IT tools are more focused on the broad maintenance operation and not as focused on the project planning operations. So, adoption for this software tool implied a total change of maintenance procedures for the whole Air Force fleet and not only for the PCD, scaling the problem to the entire AAF organization.

Despite the implications that selecting this type of software presents to the organization, two of them were selected to take a more in-depth examination due their

modular characteristics. WinAir, a product of AV-BASE System, Inc. and Alkym® by Volartec, Seabury MRO Solutions required the inclusion of specific planning modules for proper comparison with the list of candidate project management software previously mentioned.

WinAir (AV-Base, 2015) is a locally installed software product owned by AV-BASE Systems, Inc. that was released in 1995 and has evolved up to version 6. It is built over 9 modules: programs, planning, production, records, stores, accounting, administration, support and reliability. The planning module core functions are maintenance forecasting, maintenance scheduling and material forecast. It incorporates features for tasks management, documents management, resource and requirements

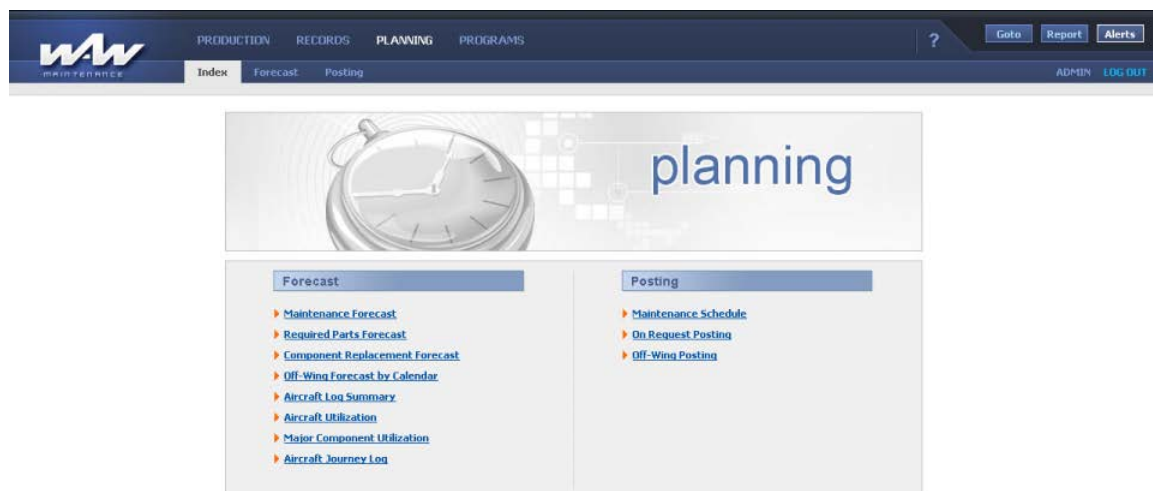


Figure 17 - WinAir Planning module dashboard

tracking, and job estimates. Among the forecasting tools the maintenance and requested parts are available. The learning and training is done via webinars and in person on request with additional support available 24/7 online. Figure 17 presents the main dashboard for the planning module.

PROS:

- Easy to use, user friendly and very intuitive.
- Great client support system
- Tasking management is an easy process (UBP P4-P7)
- Modular updates provide an advantage in order to avoid extra expenses and loss of focus.

CONS:

- Learning curve is very long and rough, requiring substantial hands-on time
- Report customization and available formats are scarce (UBP M5).

Alkym® (Volartec, 2015) was released by an Argentinean software firm founded in 1997, but became part of the Seabury Group in 2003. Alkym® is a web-based modular software built from 18 different modules: maintenance control, planning, engineering, reliability, workshop, purchasing & repair, inventory, receiving & shipping, sales, technical library, human resources, quality assurance, MRO production planning, production kiosk, and Alkym M-files. The high modularity makes the software really flexible and adaptable to different organizations. Within the features presented in Planning and MRO production planning modules are, production control, resource management, workshop inventory management, materials procurement and planning, work orders and tasks administration, schedule management, personnel qualifying management, and report for utilization for aircraft and work-in-progress. The support and training is done via online and 24/7 through live representatives. Figure 18 present a typical Alkym ® planning module dashboard.

- User friendly and ease of use.
- Tasking and scheduling presents a good handling. (UBP P4-P7, P12)
- The resources management and procurement tool are well implemented (UBP P9, P10, P23)
- It report a very quick implementation time, 5 weeks to become operational
- Flexibility is achieved by modularity
- Good customer support.



- The initial data introducing could be complicated and hard (UBP I1, P3)
- Should be managed by specialized personnel in order to avoid inaccurate later information.

Comparison

The comparison was carried out by evaluating and grading the support and coverage of each tool to the UBP selected as best related with the needs of the PCD. The comparison used a 4 point scale to assess the degree of support or coverage, and is shown in Table 1. Then the comparison presented as Table 2 includes all software grading.

Table 1 - Grading scale

Grade	Description
0	Not coverage
1	Cover part of the processes, with basic tools
2	Cover almost all the processes with basic or specific tools
3	Coverage exceed the processes with tailored tools

Table 2 – Software Grading

UBP	MS Project	Basecamp	DotProject	Projec.net	Gantt Project	LiquidPlanner	WinAir	Alkym
Initiating Process Group								
I1. Develop Project Charter	1	1	1	1	0	1	0	1
Planning Process Group								
P3. Define Scope	1	1	0	0	1	1	0	0
P4. Create WBS	3	1	1	1	2	3	1	2
P5. Define Activities	3	2	1	2	2	2	2	2
P6. Establish Estimates of Work Product and Task Attributes	2	1	1	1	1	2	2	2
P7. Sequence Activities	3	2	3	2	2	2	1	1
P9. Plan for Needed Knowledge and Skills	3	2	0	1	1	1	1	2
P10. Plan for Project Resources	3	2	0	2	0	2	2	2
P11. Estimate Activity	3	2	2	2	2	3	2	2

Durations								
P12. Develop Schedule	3	3	3	2	2	3	2	3
P19. Identify Risks	3	1	0	0	1	3	2	2
P21. Perform Quantitative Risk Analysis	1	0	0	0	0	1	0	0
P23. Determine Acquisition Type	0	0	0	0	0	1	0	0
P25. Establish the Project Plan	2	1	1	1	1	2	1	1
Executing Process Group								
E5. Manage Project Team	1	3	2	3	1	2	1	1
Monitoring and Controlling Process Group								
M2. Perform Integrated Change Control	2	1	1	0	1	1	1	1
M5. Monitor and Control Schedule	2	2	2	2	2	2	2	2
M13. Monitor Supplier Processes	0	0	0	0	0	1	0	0
M17. Analyze Issues	1	1	1	2	1	1	1	1
Closing Process Group								
C3. Transition the Acquired Product	1	1	0	0	1	1	1	1
TOTAL	38	27	19	22	21	35	22	26

Results for comparison

From Table 2, it was observed that the software tools fell in three different grading groups, higher than 30, between 25-30 and 19-22.

The first group was better at covering the needs of the PCD. Table 2 shows that MS Project ® by Microsoft Corporation is the best rated followed by LiquidPlanner ®. Both of them are commercial software and the high grades are understandable by the extensive investment that Microsoft has included through the years of development of the

software and in the case of LiquidPlanner, by their better understanding of the project management processes to include client feedback and tailoring.

Following these two commercial software products and being graded within the second group, appears Basecamp ®, which presents a good alternative for team collaborative projects. Next, in fourth position, is the Alkym ® aviation tailored software, due the modularity of design, and the presenting of good options for a better business oriented solutions.

Finally and falling in the third group with grades within 19-22 appears DotProject, Projec.net, GanttProject and WinAir. For the case of WinAir and being an aviation maintenance software, the focus is more oriented over the broad aspect of the maintenance industry than to the project management itself dropping its grades. The other three software packages present low grades basically due to missing coverage over the resource and risk management aspect plus some lack in needed monitoring and control tools.

Implementation issues

By reviewing previous IT tool implementation issues experienced by the AAF, following the key success factor stated by Umble et al. (2003), knowing the different categories for project failures (Olson, 2004) and being alerted of some reasons for change resistance stated by Gibson et al. (2012), the following actions are recommended measures to avoid strong reluctance to change and adopt issues.

Along with the Chief of the PCD commitment, select a civilian champion with high acceptancy between their peers to lead the efforts of the implementation. One of the

problems with the SIL implementation was that the ranking officer in charge of the implementations processes was changed several times, so a civilian helped to lead the effort eventually will provide consistency over time to keep in the implementations process on-track.

Before implementing the IT solution, a revision of the Procedures Registry, should be conducted. The improvements over the planning and control processes should include standardization over the planning tasks, reporting activity, and tools to be used for as a baseline. The improvement over the processes will set the basis for the IT solution implementation along with a shaking over the steady state of the organization behavior.

Once a decision has been made, conduct a department meeting to clearly state the goals for the usage of the IT tool. Critical success factor stated by Umble as category one. It also will reduce possible failures by unrelated expectancies described in the first category for IT failures by Olson. The SIL experience showed that many end users were not addressed about the goals pursued by the implementation and what were the desired improvements. That lack of information lead the people to consider that the effort would be unworthy and without sense, that behavior finally brought a lot of missed information that was needed to implementation.

Implement a well-supported training process for all the planners and personnel involved in the implementation processes. Education and training is included by Umble within the seventh category for a successful implementation and is the first step stated by Gibson to reduce the resistance to change. The lack of knowledge of the capabilities of the SIL and their functionality was one of the key factors for resistance, so the more

training and information provided to the involved people will help in the implementation by letting the people in which ways the software could help them on their daily tasks.

Implement short weekly planners meetings to share the new experiences and issues encountered over the implementations. The tenth category stated by Umble, multisite issues resolved, and working on the explicit and implicit coercion of the users pointed by Gibson, will smooth the roughness of the implementation process and issues. The sharing of the knowledge will improve the whole team, making easy the way for solving related problems. During the SIL implementation, the lack of cross information about solving problems between the users, kept every problem as a new one instead vs a known one.

The implementation should be performed in small steps, following the learning curve of the IT Tool. Trying to request a full implementation with coverage of all the features at once will bring frustration to the users and resistance to use it avoiding the expectation failures pointed by Olson as the fourth category for IT implementation failures. During the SIL implementation the step by step was tried to achieve, but the users perceived them as a huge effort demanding that were avoided or half fulfilled. So, keep simple implementation steps.

Summary

This chapter brought the answers to the different investigative questions through the three different steps presented on the previous sections.

The first step, by getting insight on the procedures and processes being followed by the PCD answered the first investigative question and showed the flaws and problems

with the planning and control procedures. It showed the lack of standardization, fulfillment and opportunity of the information, affecting the certainty and visibility of the works in progress.

The next step was searching for the features, characteristics and capabilities that project management software is able to provide in covering the PCD's needs. At this point the framework provided by the UBP were key to assess and compare the different tools on the market. The selection of eight of the best software tools grouped as commercial, open source, general business and aeronautical tailored helped with the narrowing and scope over the several available options. Finally, the comparison between the UBP selected as needed vs the support provided by each one, a custom-made scale was achieved. Two out of eight final candidate software IT tools were recommended for implementation as planning and control tools.

Finally, while taking into consideration previous experience with software implementation projects, this research briefly advises and recommends actions to avoid failure and to be successful over the implementation processes. To enable this, a set of different measures or actions were recommended as an answer to the final investigative question.

V. Conclusions and Recommendations

Chapter Overview

This chapter summarizes the conclusions of the research, proposes two different suitable solutions in order to achieve improvements over the processes covering the needs of the PCD, and refers different actions to implement the solutions proposed. Finally, it recommends some future research related topics.

Conclusions of Research

Planning, controlling and reporting are central activities to fulfill the responsibilities clearly assigned to the PCD. These activities indeed require individual expertise, deep knowledge of maintenance processes, spare parts required, special jobs needed, and other regulations to successfully achieve good results. To coordinate all the activities, processes, assets, spare parts, consumables, and skilled workers it becomes complicated without the proper assistance. Obtaining visibility and certainty over the ongoing activities are significant for decision makers to be proactive and make accurate reactions in order to best manage scarce resources.

The gray area in the planning procedures and the lack of standards and information over the last year's plans indicate a good opportunity for improvements. By selecting a project management IT tool that could help on the planning process, with the goals set on increase standardization, visibility and certainty over the production, it will provide the PCD and MG chiefs with improved support in decision making and resource management.

Project management involves several processes to achieve projects success. Over the past years the project management community evolved and came up with different “best processes” lists to successfully achieve goals. Those lists show “the best” procedures not to avoid. By matching the needs of the PCD with those best procedures provided the framework needed to compare the IT tools in order to grade them accordingly with regard to support and coverage.

The search over the different software markets showed several options for project management software. The selection criteria and framework built to assess different software guided the search down to eight different software tools. The best and most popular (top 2) software tools from commercial market, open source software, general business software, and aviation maintenance software groups were selected and assessed against the PCD needs.

At the end of the grading, assessment and comparison between the two options, Microsoft Project® and LiquidPlanner®, become the most suitable options and should be recommended to evaluate on-site for final selection. Both software tools come from the commercial market and significantly cover the needs for the PCD department with enabling features, and have good training and client support features. With different levels of details both tools could handle, not only the ongoing production but also some diverse “what-if” scenarios. The features and characteristics will enhance the visibility and certainty over the tasks, procedures, resources, requirements and risks while key decision makers will be able to support their decision on better and clear information.

The implementation of new software and changes to procedures will inevitably result in other issues and will require some preventative actions to avoid repeating the same errors of past experiences.

Several implementation tasks should be conducted, but to successfully implement the software, this research recommends at least taking the following actions:

1. Commit the Chief of the PCD along with a high level civilian to lead the implementation processes and efforts
2. Review the actual planning and control procedures to update and improve them. They should cover the grey, undefined area over the planning, controlling and reporting processes, and it should include the use of the IT tool on them.
3. Conduct a Department meeting to inform and clearly state the goals for the change
4. Plan and implement a training process for all the planners and future users of the new IT tool
5. Implement short weekly meetings to update the implementation situation and share of experiences between the users
6. It is recommend to incorporate change in small steps at a time.

Significance of Research

In the present context of scarcity and lack of resources, the best management of resources becomes significant. The lack of visibility and certainty over production would lead to the unwise use of resources and eventually impact other unexpected areas.

The implementation of a tool that is able to give the decision makers the visibility and certainty needed to best manage scarce resources will avoid undesired effects. Giving the chance to proactively act and accurately react facing different kinds of disruptions over the processes are highly desirable products of this research.

Recommendations for Action

To be successful in the implementation stage, evaluate both recommended tools on-site by using the available free demos. Then, push for feedback from the actual planners in order to involve them in the process of selection as well as to update and improve the planning and control processes. The final users' feedback will provide those people in charge of the implementation a deeper insight in order to take other actions, than the ones pointed in the research, to smooth the transition. The update of the PCD processes should be aimed to cover all the aspects of the planning and control, leaving no gray areas and focusing on standardization.

With the software tool implemented a new set of information will arise. The new available data may show improvements opportunities to enhance efficiency. Then it would be possible identify bottlenecks, high demand items and high demand services. Moreover, quantifying the resources usage will become available, so comparisons between different what-if scenarios would become accessible for decision makers.

Recommendations for Future Research

The third option of the research is the Alkym ® MRO Planning Module. This tool is just a module of a larger software solution for aviation maintenance. The implementation of the single module could cover the needs of the PCD, but the implementation of the rest of the modules could lead to potential improvements over the broad spectrum of activities that aviation maintenance involves.

To implement this IT tool, which will cover the whole AAF organization affecting not only maintenance but operative and administrative procedures, will bring bigger implementation issues, as in the previous experience with the SIL.

So, another future research could be focused on getting a deep insight over the organizational cultural behavior trying to asses and smooth those issues to facilitate future change and transitions.

Appendix A

Area de Material Rio Cuarto Organization Chart

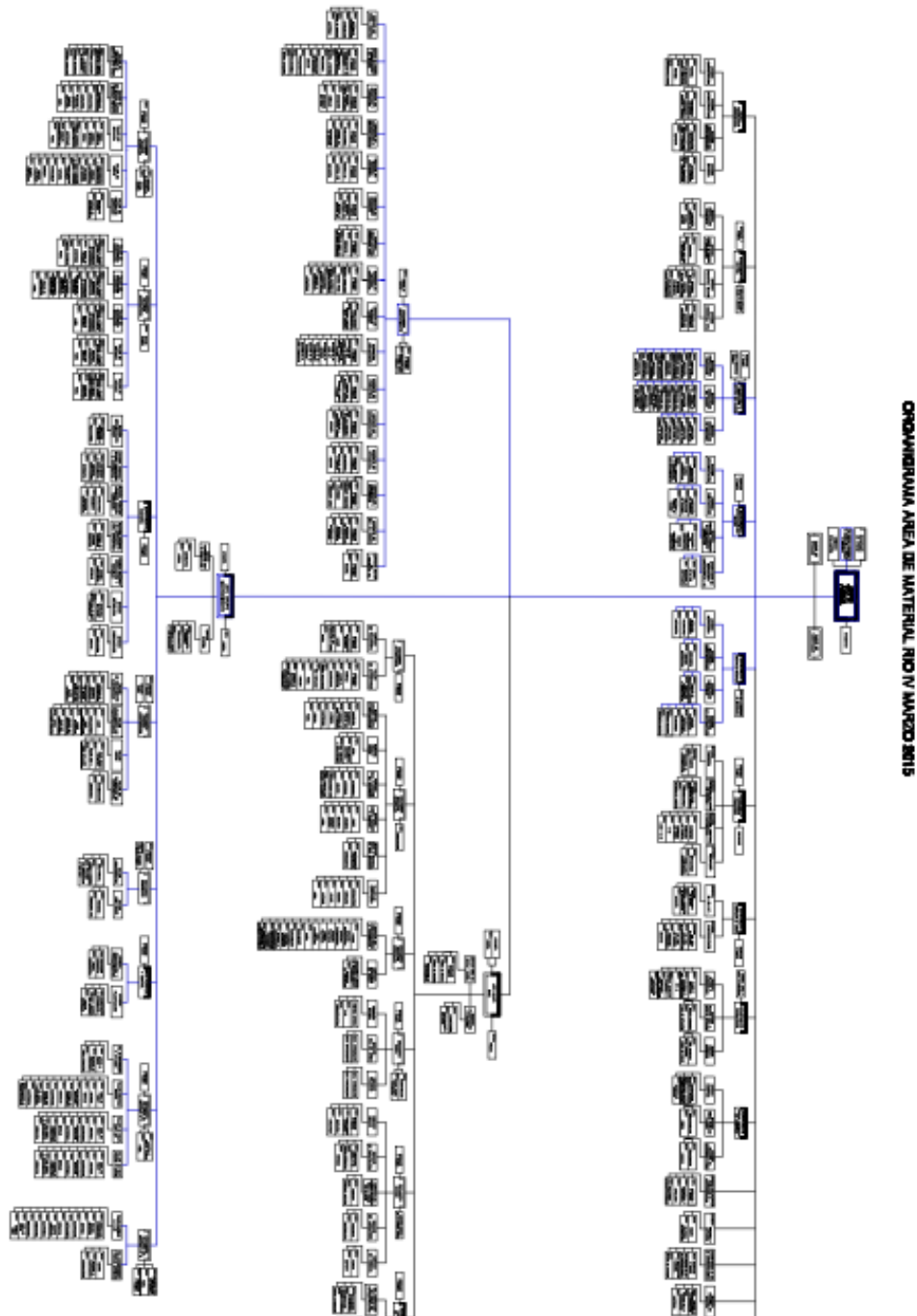
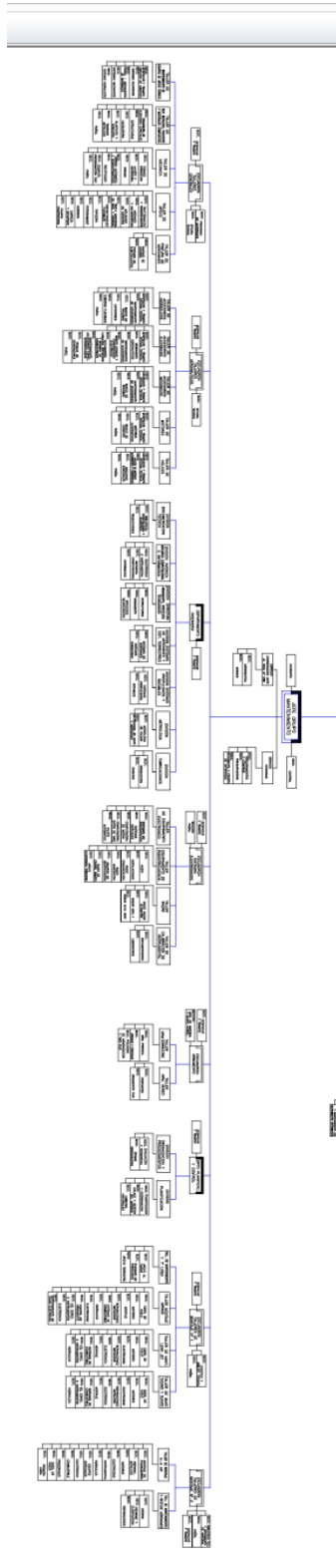


Figure 19 - AMRIV Organizational Chart



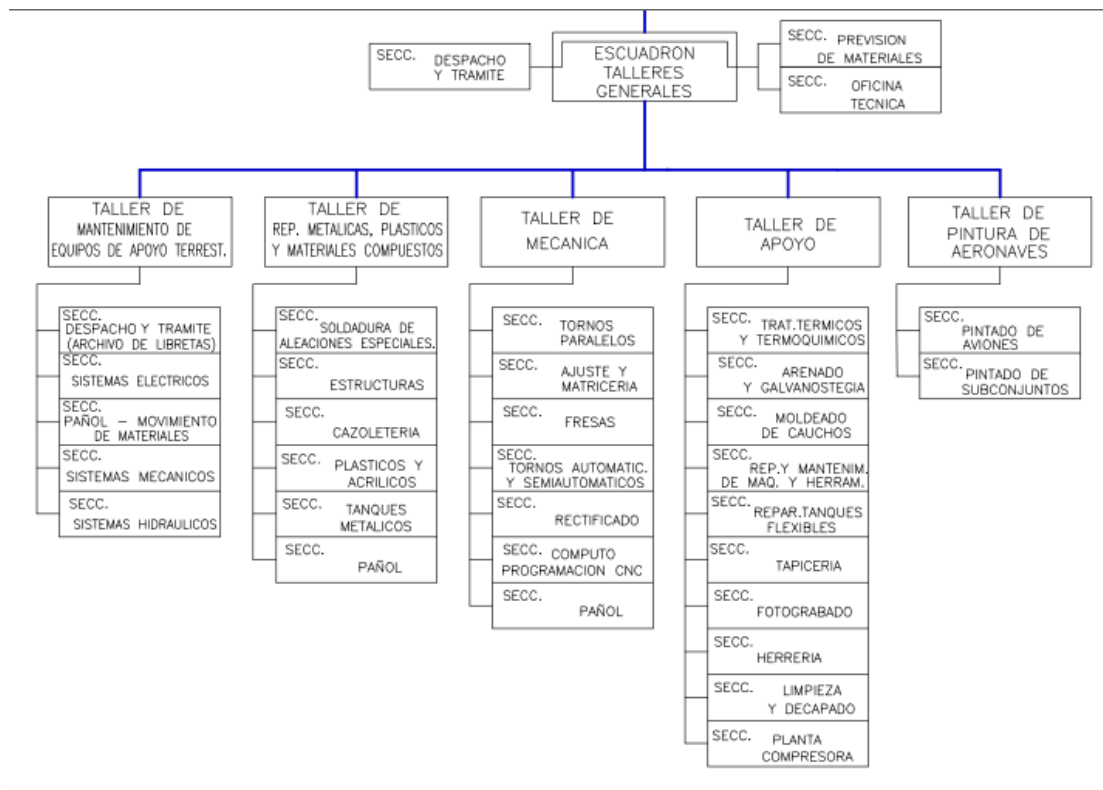


Figure 21 - GM - General Workshops Squadron

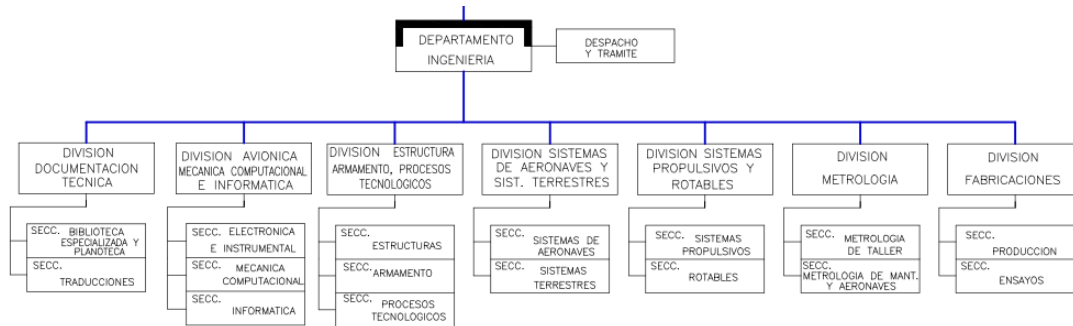


Figure 23 - MG - Engineering Department

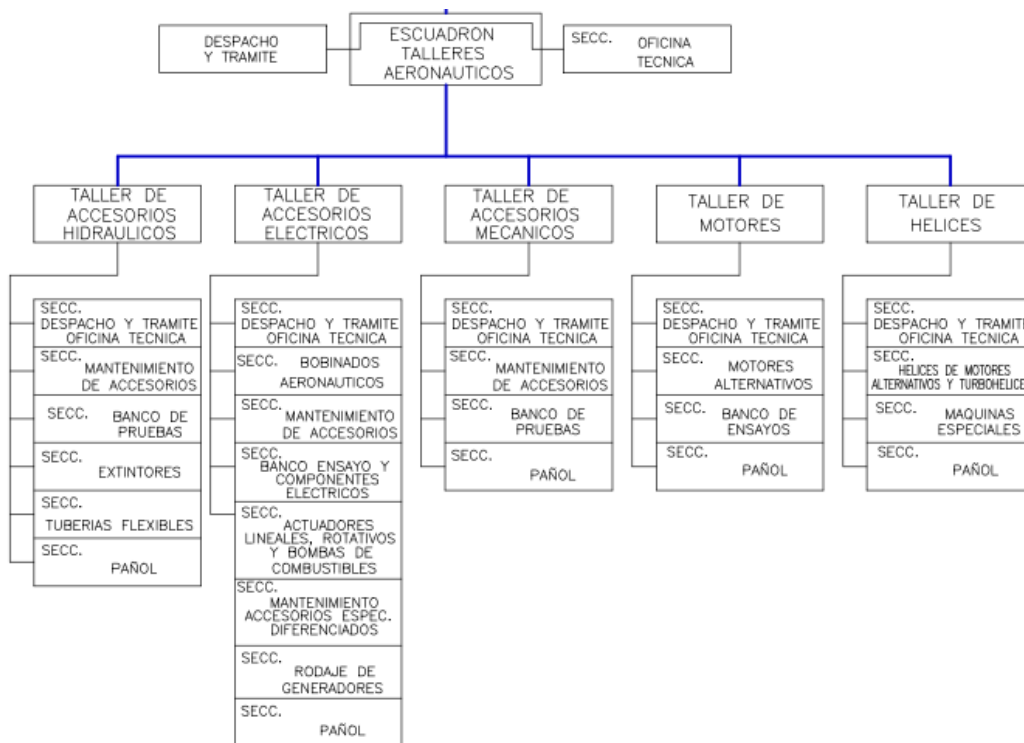


Figure 22 - MG - Aeronautical Workshops Squadron

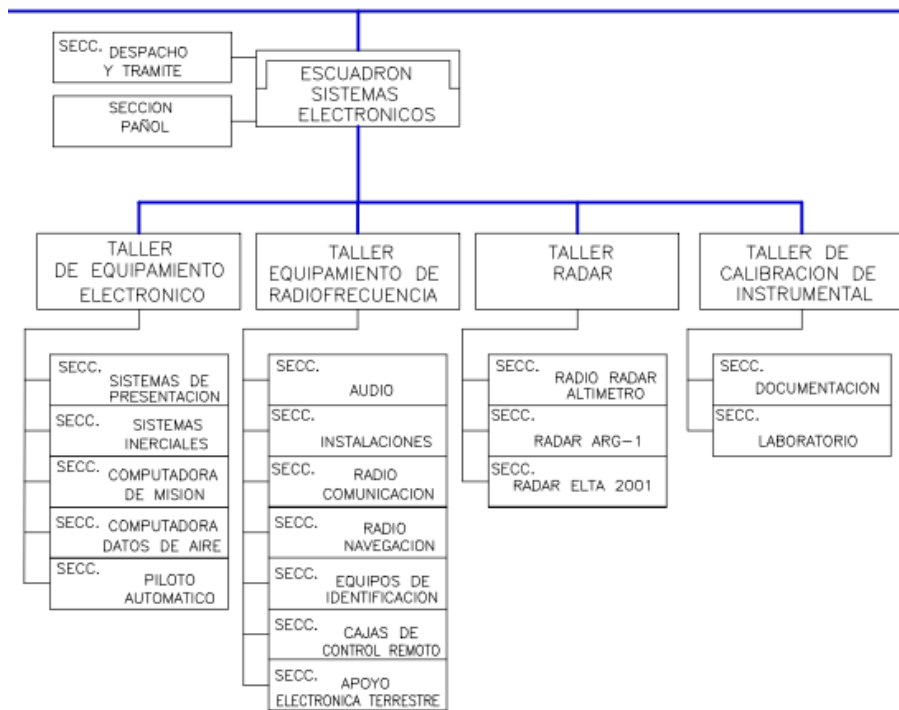


Figure 25 - MG - Electronic Systems Squadron

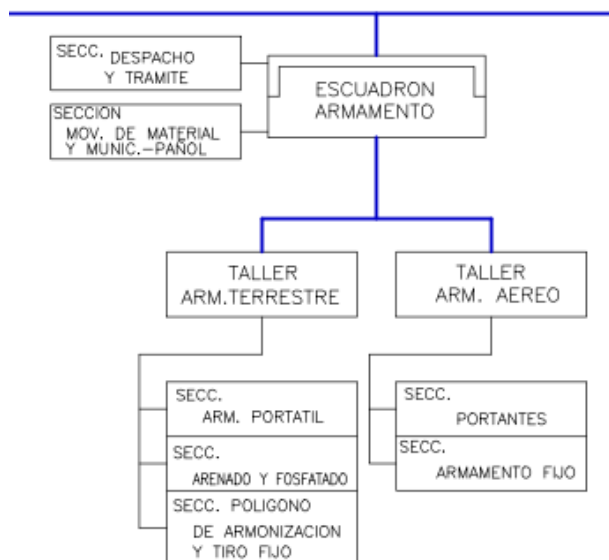


Figure 24 - MG - Armament Squadron

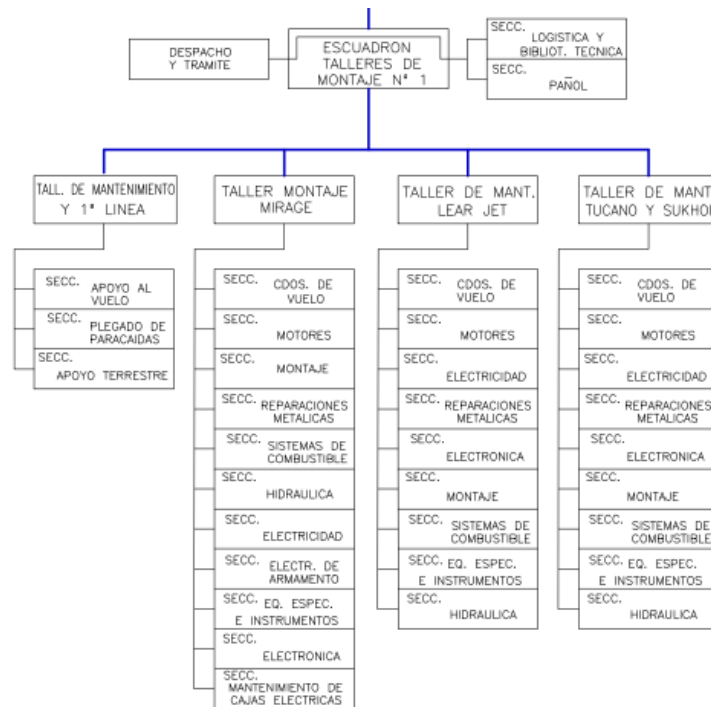


Figure 27 - MG - Maintenance N 1 Squadron

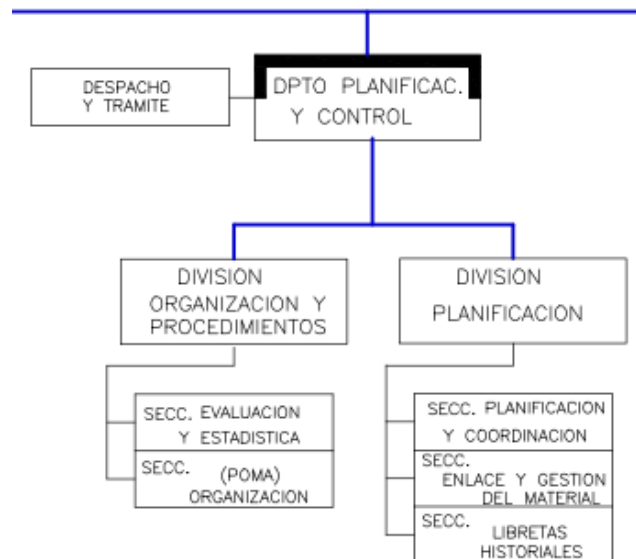


Figure 26 - MG - Planning and Control Department

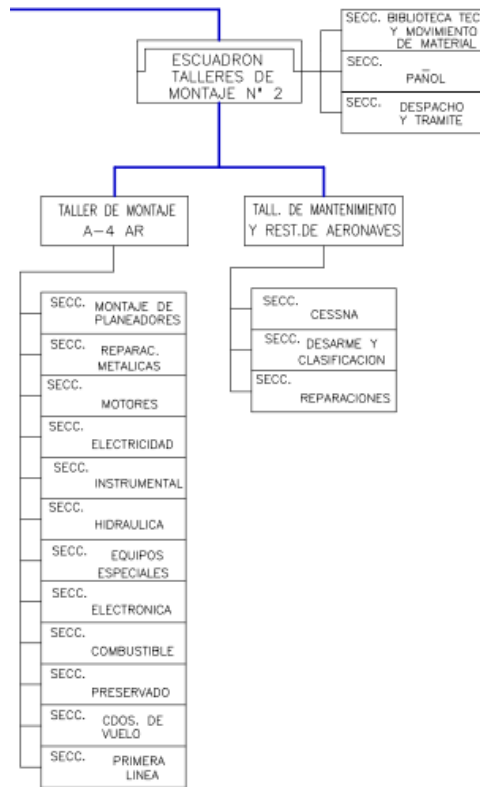


Figure 28 - MG - Maintenance N 2 Squadron

Appendix B

Unified Best Practices for Project Management

Table 3 Unified Best Practices UBP (Wangenheim, Silva, Buglione, Scheidt, & Prikladnicki, 2010)

Unified best practice (UBP)	Description of UBP	CMMI-DEV v1.2:2006 (process area/specific practice)	Degree of coverage (T, P, –)	PMBOK 4th ed:2008 (project management process)	Degree of coverage (T, P, –)
Initiating Process Group		–	–	4.1 Develop Project Charter	T
I1. Develop Project Charter	Develop a document that formally authorizes a project or a phase and document initial requirements that satisfy the stakeholder's needs and expectations				
I2. Identify Stakeholders	Identify all people or organizations impacted by the project and document relevant information regarding their interest, involvement, and impact on project success	PP/SP 2.6 Plan Stakeholder Involvement	T	10.1 Identify Stakeholders	T
Planning Process Group					
P1. Define Project Lifecycle	Define project lifecycle phases to be adopted in project	PP/SP 1.3 Define Project Lifecycle	T	–	–
P2. Collect Requirements	Define and document stakeholders' needs to meet the project objectives	[RD and REQM]	Not considered here	5.1 Collect Requirements	T
P3. Define Scope	Develop a detailed description of the project and product	PP/SP 1.1 Estimate the Scope of the Project	P	5.2 Define Scope	T
P4. Create WBS	Subdivide project deliverables and project work into smaller, more manageable components	PP/SP 1.1 Estimate the Scope of the Project	P	5.3 Create WBS	T
P5. Define Activities	Identify the specific actions to be performed to produce the project deliverables	PP/SP 1.1 Estimate the Scope of the Project	P	6.1 Define Activities	T
P6. Establish Estimates of Work Product and Task Attributes	Establish and maintain estimates of the attributes of the work products and tasks	PP/SP 1.2 Establish Estimates of Work Product and Task Attributes	T	–	–
P7. Sequence Activities	Identify and document relationships among the project activities	PP/SP 2.1 Establish the Budget and Schedule	P	6.2 Sequence Activities	T
P8. Develop Human Resource Plan	Identify and document project roles, responsibilities, reporting relationships, and creating a staffing management plan	PP/SP 2.4 Plan for Project Resources	P	9.1 Develop Human Resource Plan	P

Unified best practice (UBP)	Description of UBP	CMMI-DEV v1.2:2006 (process area/specific practice)	Degree of coverage (T, P, –)	PMBOK 4th ed:2008 (project management process)	Degree of coverage (T, P, –)
P9. Plan for Needed Knowledge and Skills	Plan for knowledge and skills needed to perform the project	PP/SP 2.5 Plan for Needed Knowledge and Skills	T	9.1 Develop Human Resource Plan	P
P10. Plan for Project Resources	Plan for necessary resources (labor, machinery/equipment, material and methods) to perform the project	PP/SP 2.4 Plan for Project Resources	P	6.3 Estimate Activity Resources	T
P11. Estimate Activity Durations	Approximate the number of work periods needed to complete individual activities with estimated resources	PP/SP 2.1 Establish the Budget and Schedule	P	6.4 Estimate Activity Durations	T
P12. Develop Schedule	Establish and maintain the project schedule, analyzing activity sequences, durations, resource requirements and schedule constraints to create the project schedule	PP/SP 2.1 Establish the Budget and Schedule	P	6.5 Develop Schedule	T
P13. Estimate Effort	Estimate the effort for completing the work products and tasks based on estimation rationale	PP/SP 1.4 Determine Estimates of Effort and Cost	P	–	–
P14. Estimate Costs	Estimate the monetary resources needed to complete the work products and tasks based on estimation rationale	PP/SP 1.4 Determine Estimates of Effort and Cost	P	7.1 Estimate Costs	T
P15. Determine Budget	Establish and maintain the project budget aggregating the estimated cost of individual activities or work packages.	PP/SP 2.1 Establish the Budget and Schedule	P	7.2 Determine Budget	T
P16. Plan Quality	Identify quality requirements and/or standards for the project and product, and document how the project will demonstrate compliance	[QPM]	Not considered here	8.1 Plan Quality	T
P17. Plan Communications	Determine project stakeholder information needs and define a communication approach	–	–	10.2 Plan Communications	T
P18. Plan Risk Management	Define how to conduct risk management activities for a project	–	–	11.1 Plan Risk Management	T
P19. Identify Risks	Identify and document which risks may affect the project	PP/SP 2.2 Identify Project Risks	P	11.2 Identify Risks	T
P20. Perform Qualitative Risk Analysis	Prioritize risks for further analysis or action by assessing and combining their probability of occurrence and impact	PP/SP 2.2 Identify Project Risks	P	11.3 Perform Qualitative Risk Analysis	T
P21. Perform Quantitative Risk Analysis	Analyze quantitatively the effect of identified risks on overall project objectives	[RSKM]	Not considered here	11.4 Perform Quantitative Risk Analysis	T

Unified best practice (UBP)	Description of UBP	CMMI-DEV v1.2:2006 (process area/specific practice)	Degree of coverage (T, P, –)	PMBOK 4th ed:2008 (project management process)	Degree of coverage (T, P, –)
P22. Plan Risk Responses	Develop options and actions to enhance opportunities and to reduce threats to project objectives	[RSKM]	Not considered here	11.5 Plan Risk Responses	T
P23. Determine Acquisition Type	Determine the type of acquisition for each product or product component to be acquired	SAM/ SP 1.1 Determine Acquisition Type	T	12.1 Plan Procurements	T
P24. Plan for Data Management	Plan for the management of project data	PP/SP 2.3 Plan for Data Management	T	–	–
P25. Establish the Project Plan	Establish and maintain a project plan as the basis for managing the project	PP/SP 2.7 Establish the Project Plan	T	4.2 Develop Project Management Plan	T
P26. Review Plans That Affect the Project	Review all plans that affect the project to understand project commitments	PP/SP 3.1 Review Plans That Affect the Project	T	–	–
P27. Reconcile Work and Resource Levels	Reconcile the project plan to reflect available and estimated resources	PP/SP 3.2 Reconcile Work and Resource Levels	T	–	–
P28. Obtain Plan Commitment	Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution	PP/SP 3.3 Obtain Plan Commitment	T	–	–
Executing Process Group		–	–		
E1. Direct and Manage Project Execution	Perform the work defined in the project management plan to achieve the project's objectives	–	–	4.3 Direct and Manage Project Execution	T
E2. Perform Quality Assurance	Audit the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operation definitions are used	–	–	8.2 Perform Quality Assurance	T
E3. Acquire Project Team	Confirm human resource availability and obtain the team necessary to complete project assignments.	–	–	9.2 Acquire Project Team	T
E4. Develop Project Team	Improve the competencies, team interaction and the overall team environment to enhance project performance	–	–	9.3 Develop Project Team	T
E5. Manage Project Team	Track team member performance, providing feedback, resolving issues, and managing changes to optimize project performance	–	–	9.4 Manage Project Team	T
E6. Distribute Information	Make relevant information available to project stakeholders as planned	–	–	10.3 Distribute Information	T

Unified best practice (UBP)	Description of UBP	CMMI-DEV v1.2:2006 (process area/specific practice)	Degree of coverage (T, P, –)	PMBOK 4th ed:2008 (project management process)	Degree of coverage (T, P, –)
E7. Manage Stakeholders Expectations	Communicate and work with stakeholders to meet their needs and addressing issues as they occur	–	–	10.4 Manage Stakeholders Expectations	T
E8. Select Suppliers	Obtain seller responses and select suppliers based on an evaluation of their ability to meet the specified requirements and established criteria	SAM/SP 1.2 Select Suppliers	T	12.2 Conduct Procurements	P
E9. Establish Supplier Agreements	Establish and maintain formal agreements with the supplier	SAM/SP1.3 Establish Supplier Agreements	T	12.2 Conduct Procurements	P
E10. Execute the Supplier Agreement	Perform activities with the supplier as specified in the supplier agreement	SAM/SP 2.1 Execute the Supplier Agreement	T	–	–
Monitoring and Controlling Process Group M1. Monitor and Control Project Work	Monitor and control the progress with respect to Project Planning parameters to meet the performance objectives defined in the project management plan	PMC/ SP 1.1 Monitor Project Planning Parameters	P	4.4 Monitor and Control Project Work	P
M2. Perform Integrated Change Control	Review all change requests, approving changes and managing changes to the deliverables, organizational process assets, project documents and the project plan	[REQM]	Not considered here	4.5 Perform Integrated Change Control	T
M3. Verify Scope	Formalize the acceptance of the completed project deliverables	–	–	5.4 Verify Scope	T
M4. Monitor and Control Scope	Monitor the status of the project and product scope and manage changes to the scope baseline	PMC/ SP 1.1 Monitor Project Planning Parameters	P	5.5 Control Scope	T
M5. Monitor and Control Schedule	Monitor the status of the project to update project progress and to manage changes to the schedule baseline	PMC/ SP 1.1 Monitor Project Planning Parameters	P	6.6 Control Schedule	T
M6. Monitor and Control Costs	Monitor the status of the project to update the project budget and to manage changes to the cost baseline	PMC/ SP 1.1 Monitor Project Planning Parameters	P	7.3 Control Costs	T
M7. Monitor and Control Quality	Monitor and record results of executing the quality activities to assess performance and recommend necessary changes	–	–	8.3 Perform Quality Control	T
M8. Conduct Progress Reviews	Periodically review the project's progress, performance and issues by collecting and distributing performance information, including status reports, progress measurements, and forecasts	PMC/SP 1.6 Conduct Progress Reviews	T	10.5 Report Performance	T
M9. Conduct Milestone Reviews	Review the accomplishments and results of the project at selected project milestones	PMC/SP 1.7 Conduct Milestone Reviews	T	–	–

Unified best practice (UBP)	Description of UBP	CMMI-DEV v1.2:2006 (process area/specific practice)	Degree of coverage (T, P, –)	PMBOK 4th ed:2008 (project management process)	Degree of coverage (T, P, –)
M10. Monitor and Control Risks	Monitor risks against those identified in the project plan, implement risk response plans, track identified risks, monitor residual risks and identify new risks	PMC/SP 1.3 Monitor Project Risks	T	11.6 Monitor and Control Risks	T
M12. Administer Procurements	Manage procurement relationships, monitor contract performance, select and evaluate work products from the supplier, and make changes and corrections as needed	SAM/ SP2.3 Evaluate Selected Supplier Work Products	T	12.3 Administer Procurements	T
M13. Monitor Selected Supplier Processes	Select, monitor, and analyze processes used by the supplier	SAM/SP 2.2 Monitor Selected Supplier Processes	T	12.3 Administer Procurements	P
M14. Monitor Commitments	Monitor commitments against those identified in the project plan	PMC/SP 1.2 Monitor Commitments	T	–	–
M15. Monitor Data Management	Monitor the management of project data against the project plan	PMC/SP 1.4 Monitor Data Management	T	–	–
M16. Monitor Stakeholder Involvement	Monitor stakeholder involvement against the project plan	PMC/SP 1.5 Monitor Stakeholder Involvement	T	10.4 Manage Stakeholder Expectation	P
M17. Analyze Issues	Collect and analyze the issues and determine the corrective actions necessary to address the issues	PMC/SP 2.1 Analyze Issues [CAR]	T	4.4 Monitor and Control Project Work	P
M18. Take Corrective Action	Take corrective action on identified issues	PMC/ SP 2.2 Take Corrective Action	T	4.5 Perform Integrated Change Control	P
M19. Manage Corrective Action	Manage corrective actions to closure	PMC/ SP 2.3 Manage Corrective Action	T	4.5 Perform Integrated Change Control	P
Closing Process Group C1. Close Project or Phase	Finalize all activities across all of the management process groups to formally complete the project or phase	–	–	4.6 Close Project or Phase	T
C2. Close Procurements	Ensure that the supplier agreement is satisfied before accepting the acquired product	SAM/SP2.4 Accept the Acquired Product	T	12.4 Close Procurements	T
C3. Transition the Acquired Product	Transition the acquired products from the supplier to the project	SAM/SP 2.5 Transition Products	T	12.4 Close Procurements	P

Table 4 - UBP and Features selected for comparison

Unified best practice (UBP)	Description of UBP
Initiating Process Group	
I1. Develop Project Charter	Develop a document that formally authorizes a project or a phase and document initial requirements that satisfy the stakeholder's needs and expectations
Planning Process Group	
P3. Define Scope	Develop a detailed description of the project and product
P4. Create WBS	Subdivide project deliverables and project work into smaller, more manageable components
P5. Define Activities	Identify the specific actions to be performed to produce the project deliverables
P6. Establish Estimates of Work Product and Task Attributes	Establish and maintain estimates of the attributes of the work products and tasks
P7. Sequence Activities	Identify and document relationships among the project activities
P9. Plan for Needed Knowledge and Skills	Plan for knowledge and skills needed to perform the project
P10. Plan for Project Resources	Plan for necessary resources (labor, machinery/ equipment, material and methods) to perform the project
P11. Estimate Activity Durations	Approximate the number of work periods needed to complete individual activities with estimated resources
P12. Develop Schedule	Establish and maintain the project schedule, analyzing activity sequences, durations, resource requirements and schedule constraints to create the project schedule
P19. Identify Risks	Identify and document which risks may affect the project

P21. Perform Quantitative Risk Analysis	Analyze quantitatively the effect of identified risks on overall project objectives
P23. Determine Acquisition Type	Determine the type of acquisition for each product or product component to be acquired
P25. Establish the Project Plan	Establish and maintain a project plan as the basis for managing the project
Executing Process Group	
E5. Manage Project Team	Track team member performance, providing feedback, resolving issues, and managing changes to optimize project performance
Monitoring and Controlling Process Group	
M2. Perform Integrated Change Control	Review all change requests, approving changes and managing changes to the deliverables, organizational process assets, project documents and the project plan
M5. Monitor and Control Schedule	Monitor the status of the project to update project progress and to manage changes to the schedule baseline
M13. Monitor Selected Supplier Processes	Select, monitor, and analyze processes used by the supplier
M17. Analyze Issues	Collect and analyze the issues and determine the corrective actions necessary to address the issues
Closing Process Group	
C3. Transition the Acquired Product	Transition the acquired products from the supplier to the project
Feature / Characteristic	Exclusion criteria
Running Platform	Windows
Amount of Users	Equal or over 10

Development stage	Mature
Training support	Training for staff members should be accessible and available.
Client Support	The client support from the developer of the software should be available.
Trial Mode / Time Trial	Trial mode or time trial availability
Security	Security of data used within the software.

Appendix C

2012 – 2013 – 2014 Rio Cuarto Yearly Plans

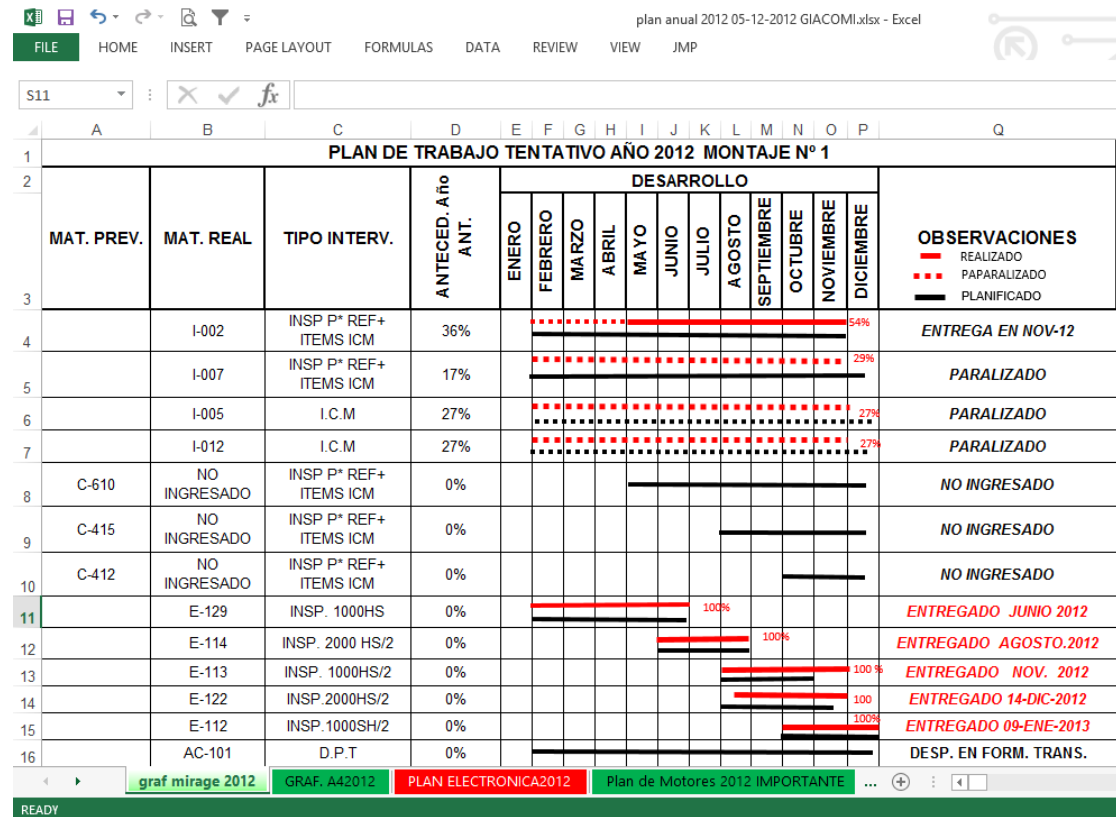


Figure 29 - 2012 Maintenance N 1 Squadron

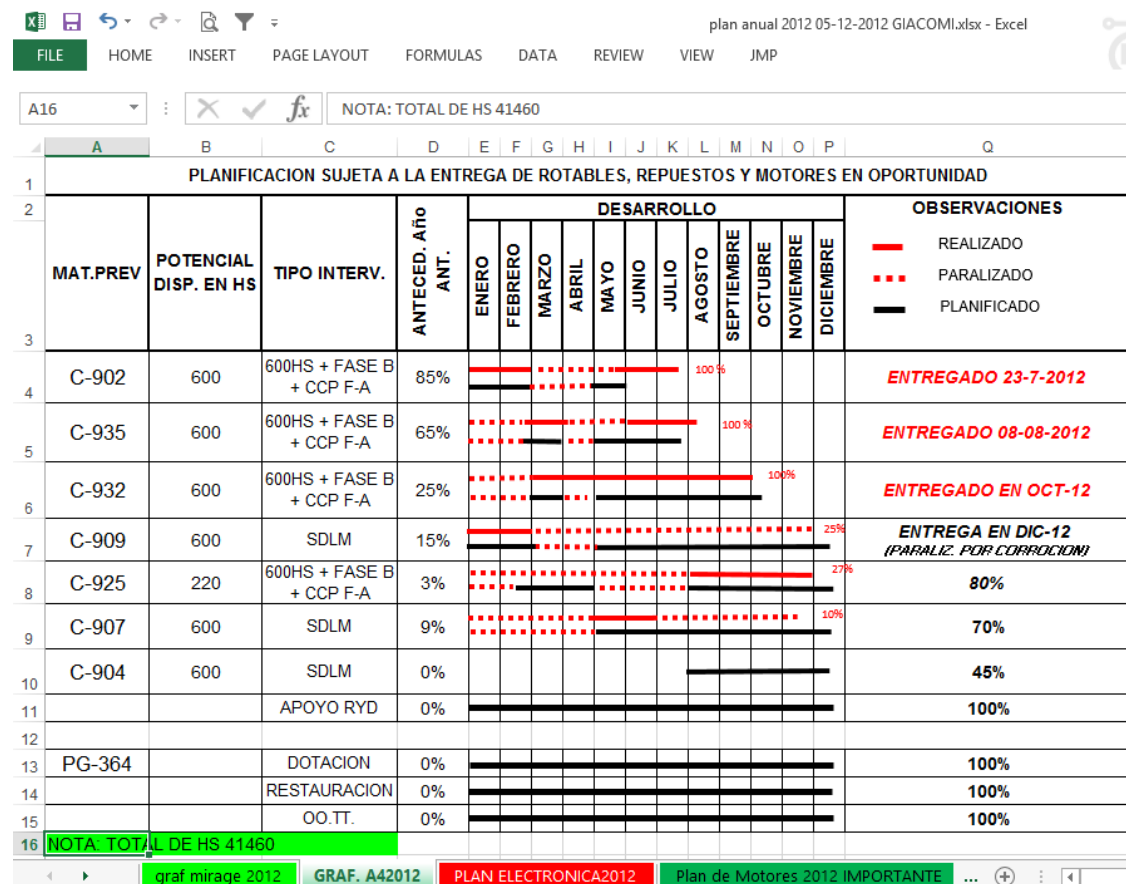


Figure 30 - 2012 Maintenance N 2 Squadron

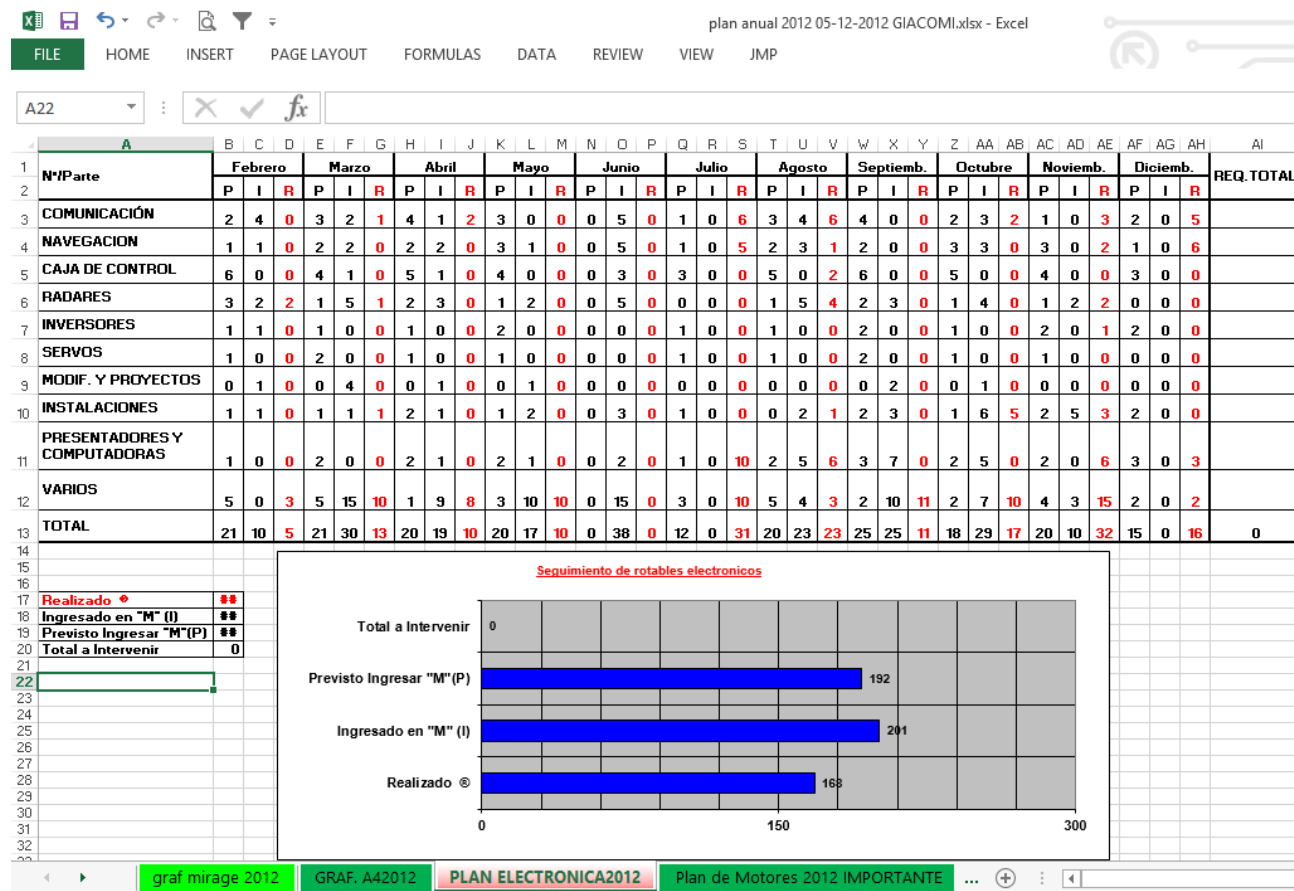


Figure 31 - 2012 Electronic Systems Squadron

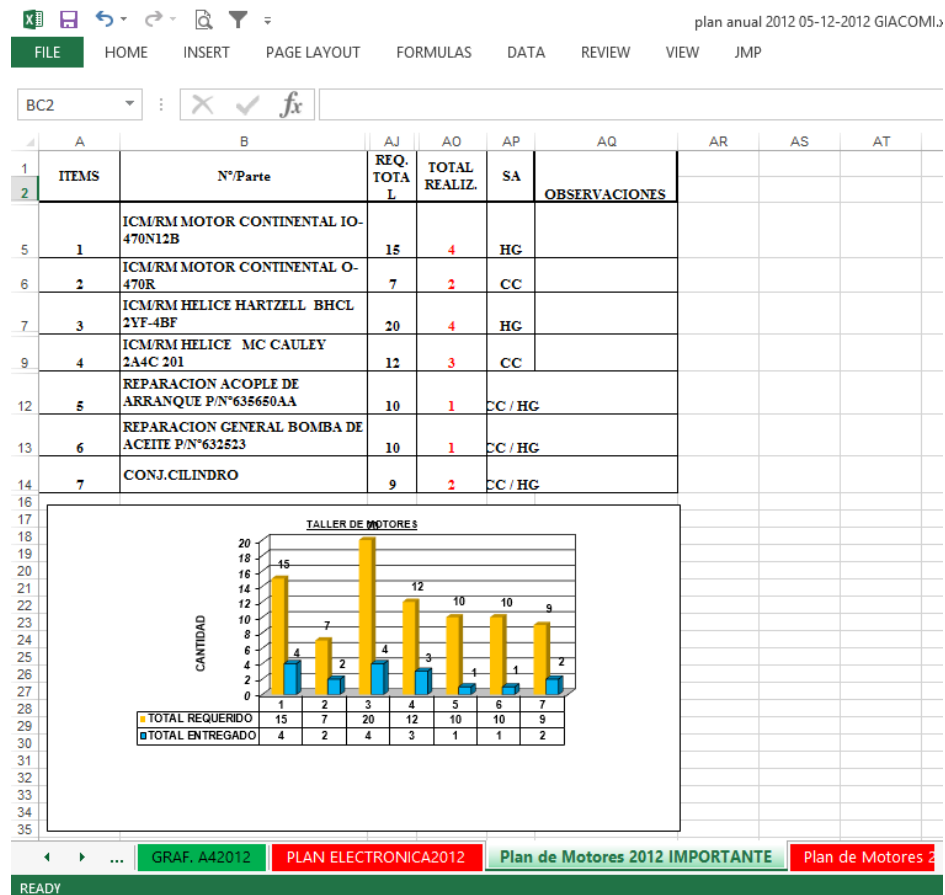


Figure 32 - 2012 Aeronautical Squadron - Engine Section

plan anual 2012 05-12-2012 GIACOMI.xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW JMP

A1 : N°/Parte

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1	N°/Parte	Febrero	Marzo	Abril	Mayo	Junio	Julio	Agosto	Septiem.	Octubre	Noviem.	Diciem.	REQ. TOTAL																						
2		P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	
3	ICM/RM MOTOR LYCOMING IO-540E1B5						1					1											1												3
4	ICM/RM MOTOR LYCOMING O-360																																		0
5	ICM/RM MOTOR CONTINENTAL IO-470N12B				2	2		2			2			2						2		2		1	2		1	1		1					15
6	ICM/RM MOTOR CONTINENTAL O-470R				1	1		1		1							1		1		1				1		1	1							7
7	ICM/RM HELICE HARTZELL BHCL 2YF 4BF				2			2		2		3		1		3		2		2		2		2			2			1					20
8	ICM/RM HELICE HARTZELL HCA3VK-2A							1				1								1							1								4
9	ICM/RM HELICE HARTZELL MC CAULEY 2A4C201				2			1		2		2		1		1		2		2		2		2		1									12
10	ICM/RM HELICE HARTZELL HCB3TN3C																																		0
11	HELICE RANQUEL AERO 1A 200																																		0
12	REPARACION ACOPLE DE ARRANQUE P/N°635650AA						3			3				1		2		1				1					1								10
13	REPARACION GENERAL BOMBA DE ACEITE P/N°632523						2			2				1		1		1		1		2		2		1	1								10
14	CONJ.CILINDRO									1		2		1		1		2		2		2		2		1			1					9	
15	TOTAL									3															5			6			2				90
16																																			
17																																			
18																																			

PLAN ELECTRONICA2012 Plan de Motores 2012 IMPORTANTE Plan de Motores 2012 PLAN ACC ...

Figure 33 – 2012 – Aeronautical Squadron - Engine Accessories Section

plan anual 2012 05-12-2

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BA6

		PLAN DE TRABAJO TALLERES DE ACCESORIOS AÑO 2012												TOTAL	
TIPO DE INTERVENCION		FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC			
		P	I	R	P	I	R	P	I	R	P	I	R	P	R
6	MIRAGE				1					7	5				
	MECANI			1						7	5			7	5
	ELECTR			1						7	5			7	5
	TOTALES			7						7	5			233	79
9	TUCANO		7		1	7	7	7				7	5		
	MECANI		7		1	7	7	7				7	5		
	ELECTR		7		1	7	7	7				7	5		
	TOTALES		7		7	7	7	7				7	5		208
12	DOUGLAS 4-4AR		1	7	7	7	7	7		7	5		5		
	MECANI		1	7	7	7	7	7		7	5		5		
	ELECTR		1	7	7	7	7	7		7	5		5		
	TOTALES		5	5	7	7	7	7		7	5		5		230
16	EXTINTORES			1	1							1	1		45
	HIDRAU			1	1							1	1		45
	MECANI			1	1							1	1		45
	ELECTR			1	1							1	1		45
19	SUKHOI SU-29		1	1	1	1	1	1	1	1	1	1	1		
	MECANI		1	1	1	1	1	1	1	1	1	1	1		
	ELECTR		1	1	1	1	1	1	1	1	1	1	1		
	TOTALES		1	1	1	1	1	1	1	1	1	1	1		24
21	RANQUEL		1	1	1	1	1	1	1	1	1	1	1		
	MECANI		1	1	1	1	1	1	1	1	1	1	1		
	ELECTR		1	1	1	1	1	1	1	1	1	1	1		
	TOTALES		1	1	1	1	1	1	1	1	1	1	1		30
25	AEROBOERO												1		
	HIDRAU												1		
	MECANI												1		
	ELECTR												1		
29	MENTOR B-45			5	5		5	5				5	5		
	HIDRAU			5	5		5	5				5	5		
	MECANI			5	5		5	5				5	5		
	ELECTR			5	5		5	5				5	5		
32	FOKKER F-27		1	1	1	1	1	1	1	1	1	1	1		
	HIDRAU		1	1	1	1	1	1	1	1	1	1	1		
	MECANI		1	1	1	1	1	1	1	1	1	1	1		
	ELECTR		1	1	1	1	1	1	1	1	1	1	1		
37	HERCULES C-130			7	7		7		7	7	7	5	7	5	
	HIDRAU			7	7		7		7	7	7	5	7	5	
	MECANI			7	7		7		7	7	7	5	7	5	
	ELECTR			7	7		7		7	7	7	5	7	5	
41	AEROCOMMANDER		1	1	1	1	1	1	1	1	1	1	1		
	HIDRAU		1	1	1	1	1	1	1	1	1	1	1		
	MECANI		1	1	1	1	1	1	1	1	1	1	1		
	ELECTR		1	1	1	1	1	1	1	1	1	1	1		
45	CESSNA 182		7	1	7	1			5			5			
	HIDRAU		7	1	7	1			5			5			
	MECANI		7	1	7	1			5			5			
	ELECTR		7	1	7	1			5			5			
49	LEAR JET		1	1	1	1	1			1	1	1	1	1	
	HIDRAU		1	1	1	1	1			1	1	1	1	1	
	MECANI		1	1	1	1	1			1	1	1	1	1	
	ELECTR		1	1	1	1	1			1	1	1	1	1	
52	TOTALES		5	5	5	7	1	1		7	5	5	5		65
														1579	464

Plan de Motores 2012 IMPORTANTEPlan de Motores 2012PLAN ACCESORIOS 2012

READY

Figure 34 - 2012 Aeronautical Squadron - Accessories

plan anual 2012 05-12-2012 GIACOMI.xlsx - Excel

	A	B	C	D
1	TALLER	TOTAL		
2		PLANIFICADO	INGRESADO	REALIZADO
3	A-4AR	4	3	3
4	MIRAGE	1	1	0
5	TUCANO	5	6	5
6	MOTORES	22	8	6
7	HELICES	32	8	7
8	ACCESORIOS	1579	892	464
9	ELECTRONICA	192	169	168
10	TOTAL GENERAL	1835	1087	653
11				
12				
13	RELACION PLANIFICADO / PRODUCIDO	35.59%		
14	RELACION PLANIFICADO / INGRESADO	59.24%		
15	RELACION INGRESADO / PRODUCIDO	60.07%		
16				
17				
18				
19				

Plan de Motores 2012 PLAN ACCESORIOS 2012 TOTAL 2012

READY

Figure 35 - 2012 Total Year

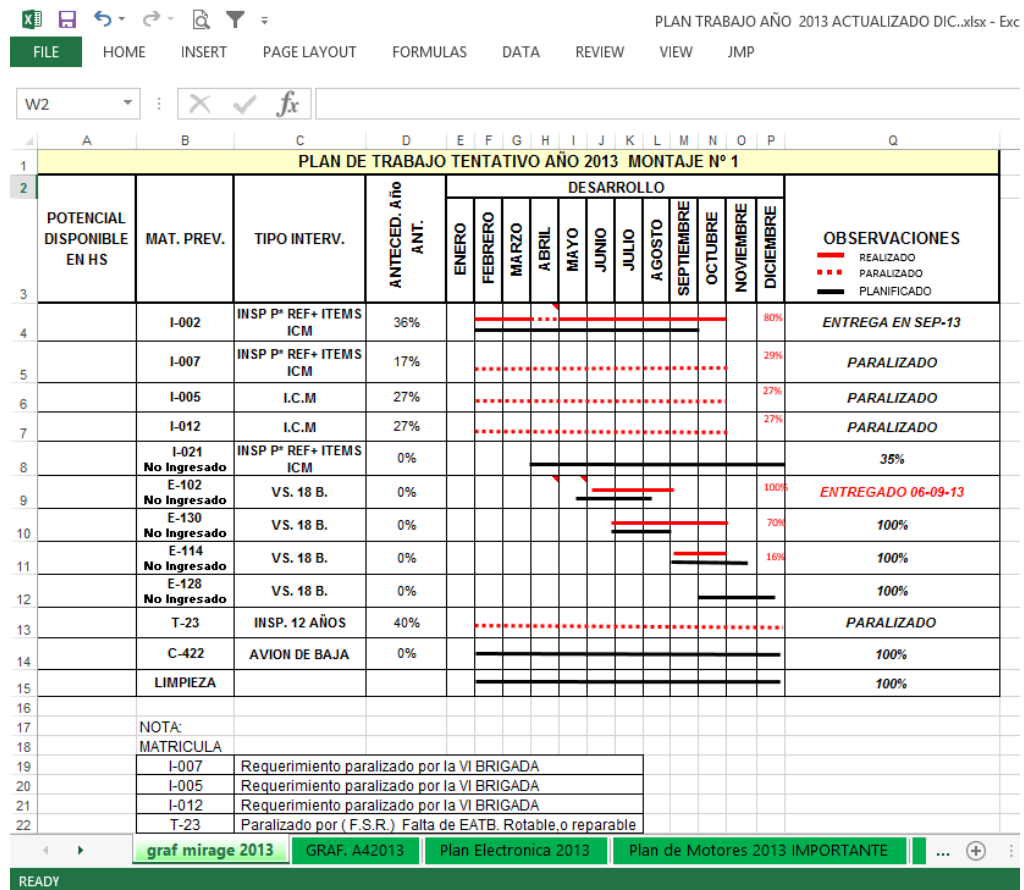


Figure 36 – 2013 Maintenance N 1 Squadron

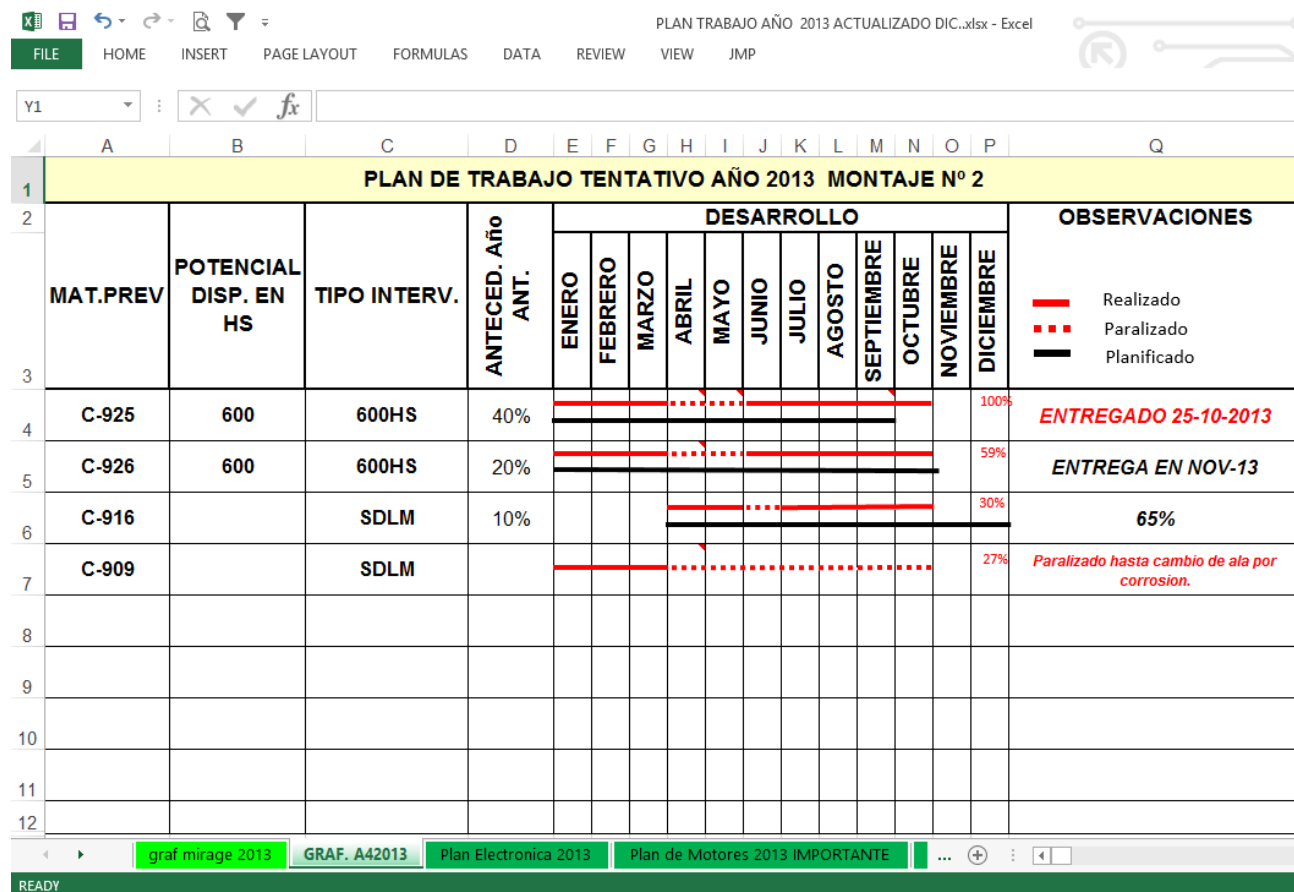


Figure 37 - 2013 Maintenance N 2 Squadron

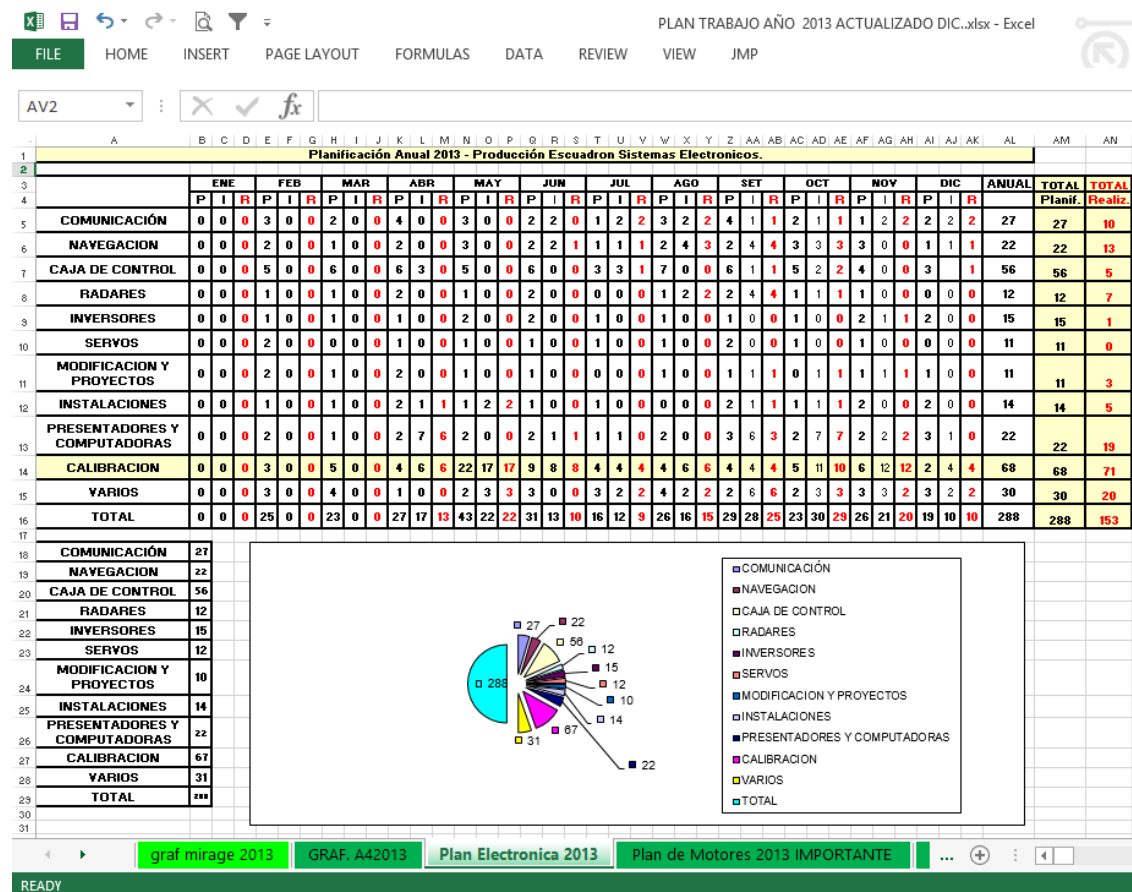


Figure 38 - 2013 Electronic Systems Squadron

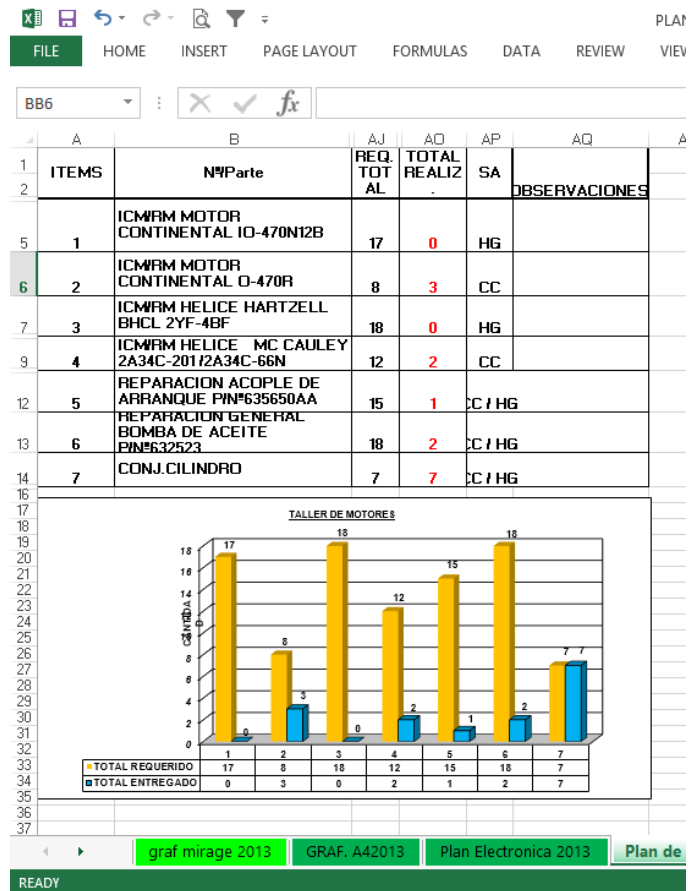


Figure 39 - 2013 Aeronautical Squadron - Engine Section

PLAN TRABAJO AÑO 2013 ACTUALIZADO DIC..xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW JMP

AS1 : X ✓ fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
	Nº/Parte	Febrero			Marzo			Abril			Mayo			Junio			Julio			Agosto			Septiem.			Octubre			Noviem.			Diciem.			REQ. TOTAL
		P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	P	I	R	
2	ICM/RM MOTOR LYCOMING IO-540E1B5							1					1									1													3
3	ICM/RM MOTOR LYCOMING O-360																																		0
4	ICM/RM MOTOR CONTINENTAL IO-470N12B				2	2		2			2		2							2		2		2				1							17
5	ICM/RM MOTOR CONTINENTAL O-470R				1	1		1			1		1		2		2		1		1		1		1		1								8
6	ICM/RM HELICE HARTZELL BHCL 2YF-4BF				2			2			2		3			1		3		2		2							1						18
7	ICM/RM HELICE HARTZELL HCA3VK-2A							1					1								1						1								4
8	ICM/RM MC CAULEY 2A34C-201/ 2A34C-66N				2			1			2		2	2		1	2			1	2	3		2											12
9	ICM/RM HELICE HARTZELL HCB3TN3C																																		0
10	HELICE RANQUEL AERO 1A 200																																		0
11	REPARACION ACOPLA DE ARRANQUE P/Nº635650AA							3			3					1		2		1															15
12	REPARACION GENERAL BOMBA DE ACEITE P/Nº632523							2			2					1		1		1		2				1									18
13	CONJ.CILINDRO										1	1		2		1		1		2															7
14	TOTAL										1		1									1													103

Plan Electronica 2013 Plan de Motores 2013 IMPORTANTE Plan de Motores 2013 PLAN ACCESO ...

READY

Figure 40 - 2013 Aeronautical Squadron - Engine Accessories Section



PLAN TRABAJO AÑO 2013 ACTUALIZADO DIC...xlsx - Excel

TALLER		TOTAL		
		PLANIFICADO	INGRESADO	REALIZADO
A-4AR		3	3	0
MIRAGE		1	1	0
TUCANO		4	2	0
MOTORES		25	4	3
HELICES		30	5	2
ACCESORIOS		1543	892	290
ELECTRONICA		288	169	153
TOTAL GENERAL		1894	1076	448
RELACION PLANIFICADO / PRODUCIDO		23.65%		
RELACION PLANIFICADO / INGRESADO		56.81%		
RELACION INGRESADO / PRODUCIDO		41.64%		

Plan de Motores 2013 | PLAN ACCESORIOS 2013 | Plan Total 2013

Figure 42 - 2013 Total Year

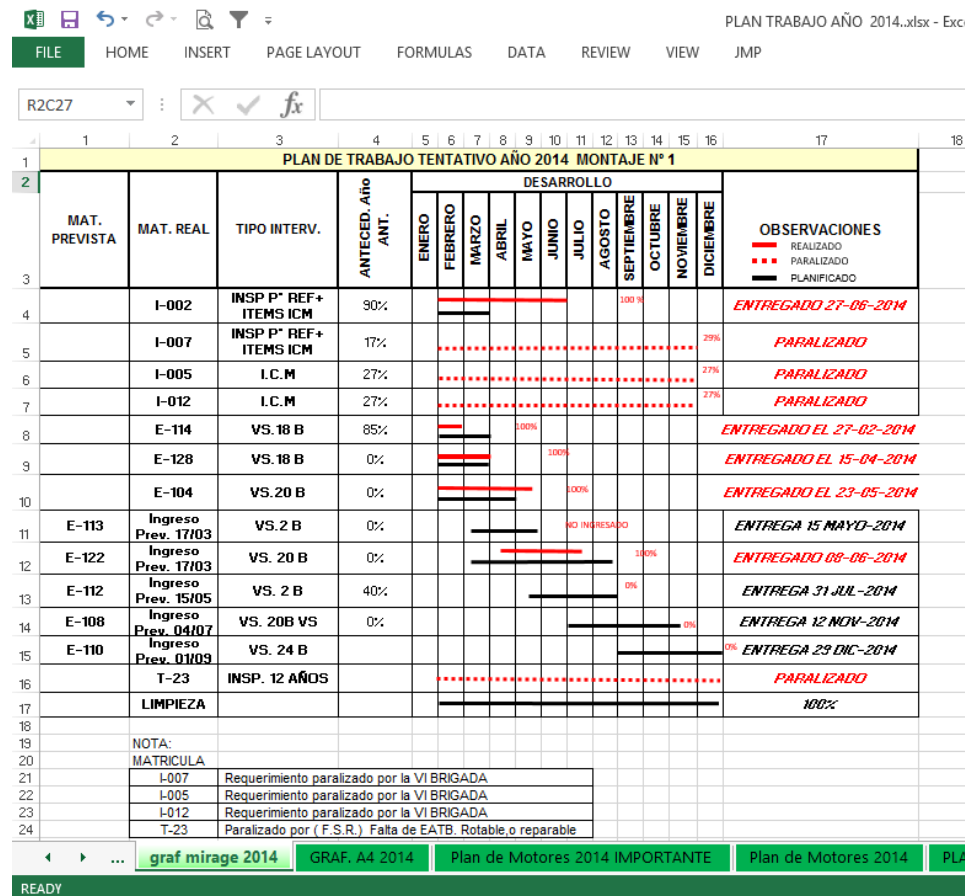


Figure 43 - 2014 Maintenance N 1 Squadron

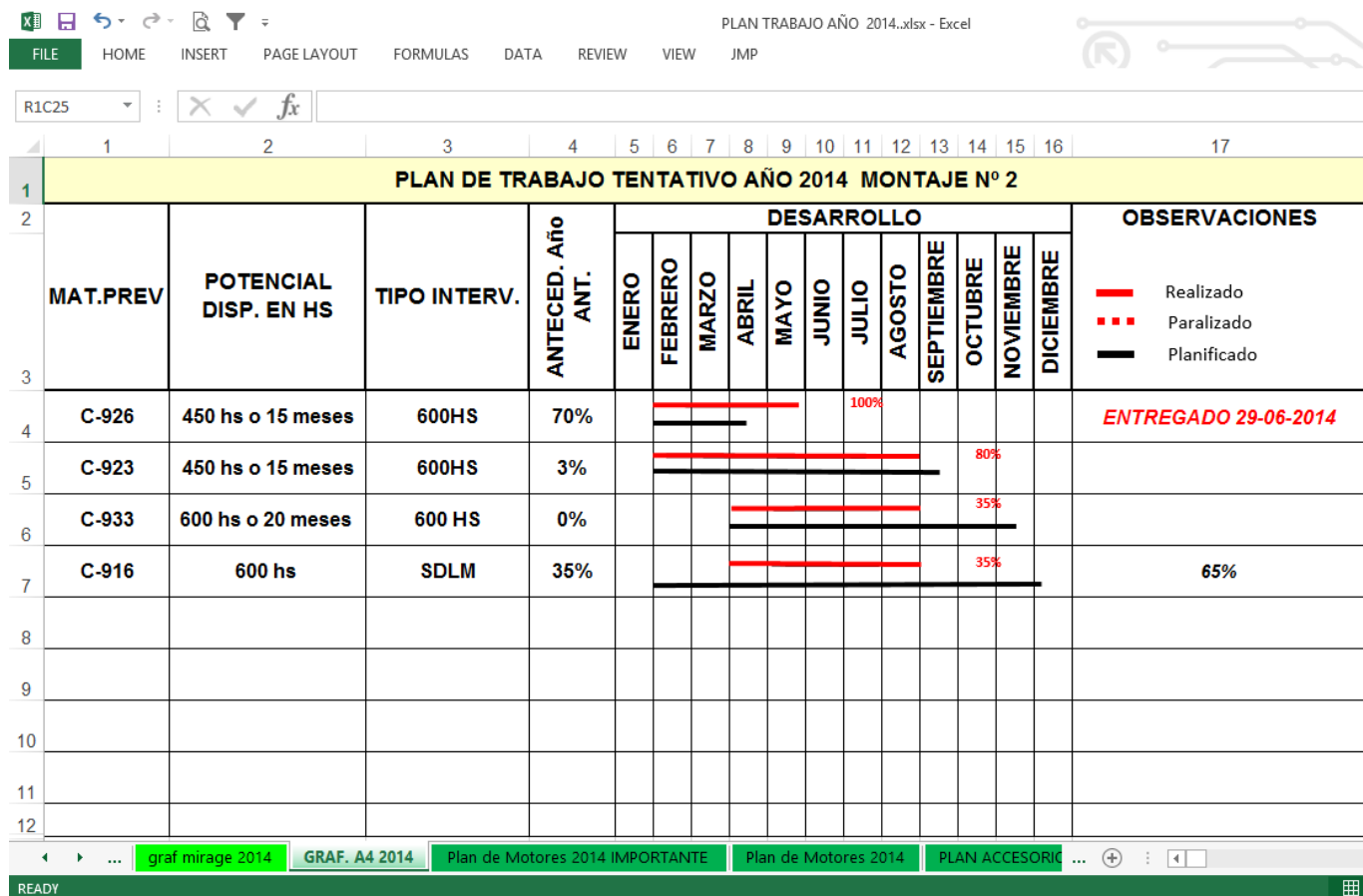


Figure 44 – 2014 Maintenance N 2 Squadron

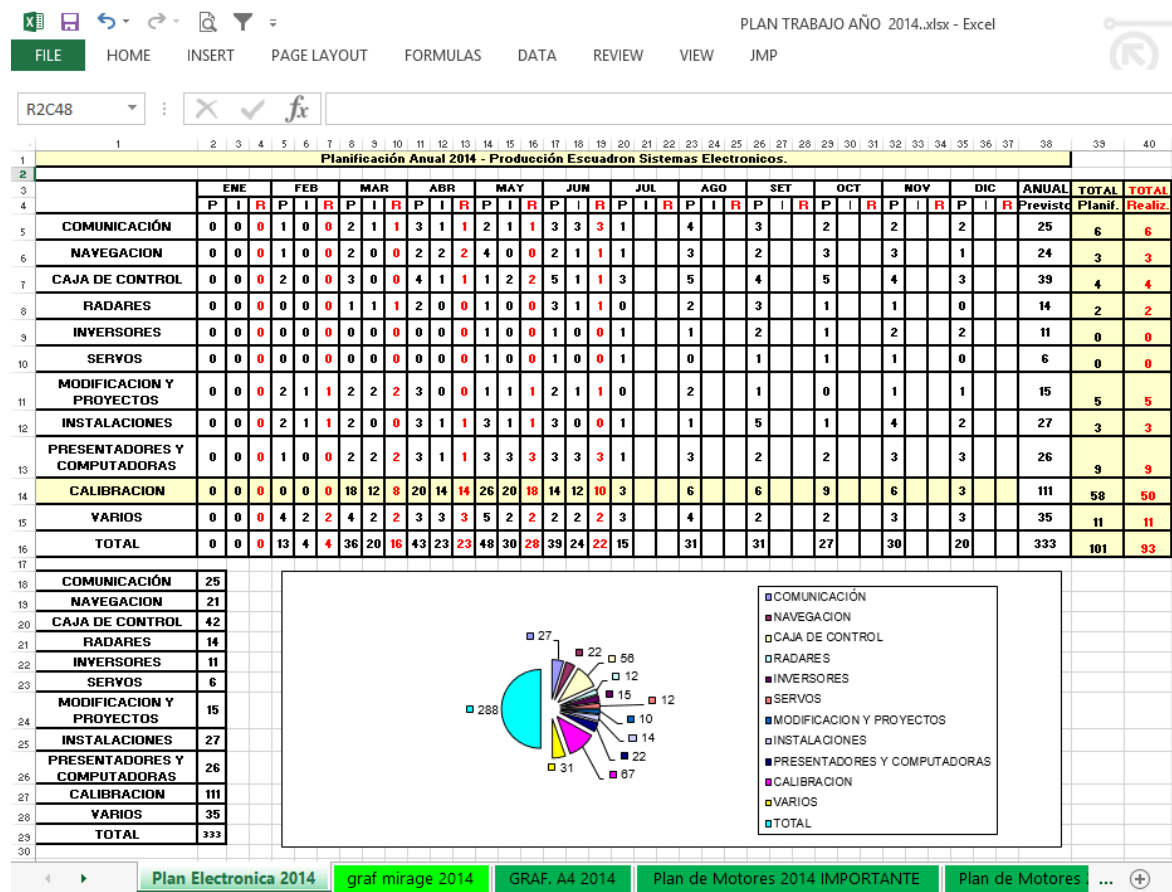


Figure 45 - 2014 Electronic Systems Squadron

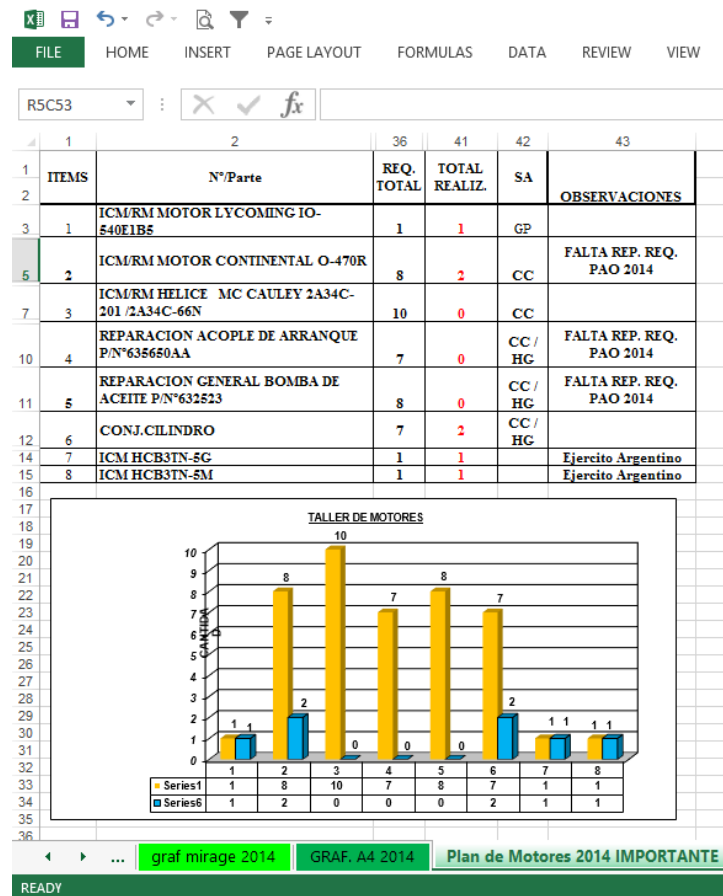


Figure 46 - 2014 Aeronautical Squadron - Engine Section

PLAN TRABAJO AÑO 2014..xlsx - Excel																																					
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW JMP																																					
R3C48																																					
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39																																					
PLAN DE TRABAJO TALLERES DE ACCESORIOS AÑO 2014																																					
TIPO DE INTERVENCION																																					
P R P																																					

PLAN TRABAJO AÑO 2014..xlsx - Excel

	1	2	3	4	8
1	TALLER	TOTAL			
2		PLANIFICADO	INGRESADO	REALIZADO	
3	A-4AR	3	1	1	
4	MIRAGE	1	1	1	
5	TUCANO	8	4	4	
6	MOTORES	8	2		
7	HELICES	10	0		
8	ACCESORIOS	1529	30	414	
9	ELECTRONICA	333	101	93	
10	TOTAL GENERAL	1892	139	513	
11					
12					
13	RELACION PLANIFICADO / PRODUCIDO	27.11%			
14	RELACION PLANIFICADO / INGRESADO	7.35%			
15	RELACION INGRESADO / PRODUCIDO	369.06%			

Plan de Motores 2014 IMPORTANTE Plan de Motores 2014 PLAN ACCESORIOS 2014 Plan Total 2014

Figure 49 - 2014 Total Year

Bibliography

- Area de Material Rio Cuarto, A. (2009). MAPO 55. *Manual Aeronautico de Procedimientos Operativos 55*. Rio Cuarto, Cordoba: Area de Material Rio Cuarto.
- AV-Base, S. (1995). *WinAir*. Retrieved December 15, 2015, from AV-Bae Systems: <https://winair.ca/>
- Basecamp. (1999). *Basecamp*. Retrieved December 15, 2015, from Basecamp: www.basecamp.com
- Boxador. (2013). *Listio.com*. Retrieved January 23, 2016, from Listio for web 2.0: www.listio.com
- Bryce, T. (2006). *Project Management System Evaluation Checklist*. Retrieved from Projectsmart: <https://www.projectsmart.co.uk/pdf/project-management-system-evaluation-checklist.pdf>
- Capterra. (n.d.). *Capterra*. Retrieved December 30, 2015, from Capterra.com: <http://www.capterra.com/aviation-maintenance-software/>
- Chapman, C. (2008). *Smashing Magazine*. Retrieved November 13, 2015, from Smashing Magazine: <https://www.smashingmagazine.com/2008/11/15-useful-project-management-tools/>
- Clare, S. T. (2010). *Project Management Software*. Retrieved December 20, 2015, from ProjectManagementSoftware.org: <http://www.projectmanagementsoftware.com/>
- dotProject. (2003). Retrieved December 02, 2015, from dotProject: <http://www.dotproject.net/>
- Fuerza Aerea Argentina. (2006). *IMPLEMENTACIÓN DEL REGISTRO DE PROCEDIMIENTOS EN ORGANISMOS TÉCNICOS DE MANTENIMIENTO AERONÁUTICO*. Ciudad Autonoma de Buenos Aires: Fuerza Aerea Argentina - Comando de Material.
- GanttProject. (2003). *GanttProject*. Retrieved December 13, 2015, from GanttProject Team: <http://www.ganttproject.biz>

- Gibson, J. L., Ivancevich, J. M., Donnelly, J. H., & Konopaske, R. (2012). *Organizations: Behavior, Structure, Processes*. New York: McGraw-Hill / Irwin.
- LiquidPlanner. (2007). *LiquidPlanner Inc*. Retrieved October 15, 2015, from LiquidPlanner: <http://www.liquidplanner.com>
- Microsoft, C. (2016). *Microsoft Corporation*. Retrieved January 10, 2016, from Office Project Home: <https://products.office.com/en-us/Project/project-and-portfolio-management-software>
- Mustafa, Y. (2007, May 13). *An Evaluation of Popular Project Management Tools*. Retrieved from The Cheap Revolution: http://www.cheaprevolution.com/the_cheap_revolution/2007/05/an_evaluation_o.html
- Olson, D. L. (2004). *Managerial Issues of Enterprise Resource Planning System*. McGraw Hill / Irwin.
- Palmer, D. (2006). *Maintenance Planning and Scheduling Handbook*. New York: McGraw-Hill.
- Pereira, A. M., Goncalvez, R. Q., Wangenheim, C. G., & Buglione, L. (2013). Comparison of Open Source Tools for Project Management. *International Journal of Software Engineering and Knowledge Engineering*, 189-209.
- Project Management Institute, I. (2014). *Project Management Institute*. Retrieved December 20, 2015, from PMI: <http://www.pmi.org/>
- Project.net. (2013). *Project.net*. Retrieved December 10, 2015, from Project.net: <http://www.project.net>
- SlashdotMedia. (2016). *Sourceforge*. Retrieved January 15, 2016, from sourceforge.net: www.sourceforge.net
- Umble, E. J., Haft, R. R., & Umble, a. M. (2003). Enterprise Resource Planning: Implementation Procedures and Critical Success Factors. *European Journal of Operational Research* 146, No 2, 241-257.
- Volartec. (2010). *Alkym*. Retrieved January 12, 2016, from VolartecAero: <http://www.volartec.aero/>

Wangenheim, C. G., Silva, D. A., Buglione, L., Scheidt, R., & Prikladnicki, R. (2010). Best practice fusion of CMMI-DEV v1.2 (PP, PMC, SAM) and PMBOK 2008. *Information and Software Technology* 52, 749-757.

Wikipedia. (2004). *Wikimedia Foundation*. Retrieved November 01, 2015, from Wikipedia: https://en.wikipedia.org/wiki/Comparison_of_project_management_software#Features

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14. ABSTRACT The Argentine Air Force Materiel General Directorate (AAFMGD) has initiated an effort to assure logistical support and to gradually increase the productivity and efficiency of related processes. Within the efforts of increased productivity and efficiency over the AAF Overhauling Facilities, the Planning and Control Departments (PCD) became targets for improvements. These departments are tasked with providing the best certainty and visibility of all assets within their facilities to feed the logistics pipeline, and better support air operations. This thesis, sponsored by the MGD, is focused on achieving improvements in the PCD processes, through an academically rigorous evaluation of confounding factors and the eventual selection of appropriate IT solutions. Software solutions were evaluated on their ability to produce the desirable benefits of improving current processes control, improving project timeline certainty, and obtaining visibility over the overhauling and maintenance activities so as to better support management-level decisions. Through the efforts of this research it was found that several solutions provided partial support for the needs of the PCD, and eight were chosen based on four general features and 20 capabilities. Ultimately, two of them were chosen as best suitable solutions, to be proposed to the AAFMGD for final review.					
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