Request Management System of an Airline's Engineering Department: A Case Study

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Abstract

Company X's Engineering Department had seen complexity overtime in regards with monitoring each engineers' tasks and activity. If not properly executed, this could lead to several operational issues like aircraft-on-ground situations (AOG) or regulatory non-compliance caused by delays in response, and inefficient ways of updating activities. Using manual spreadsheet is inconvenient to some. From Engineering who is the main stakeholder, the Production Control, Purchasing and Materials who receives the information and/or instructions, and to management who tracks KPI. The need for automation aims to change not only the medium or system, but also the process flow of for the engineers. The implementation of this project needs to also consider the requirements of the regulatory body Company X is under. The system design will be able to manage requests from other departments to Company X Engineering, with following subsystems included: monitoring, request receipt, report generation, case assignment and case update. Also, the reports can be generated with only putting the necessary details. No need for the engineer to do formatting of such documents as it will be taken care of automatically by the system. With the help of all the data obtained from system analysis, design, and evaluation, the system will provide long term benefits not only to Company X's Engineering Department but also to other departments that require engineering assistance.

Keywords (
Airline, Airbus, AOG, Information System

1. Introduction

For most instances, the technology used on aircrafts are quite ahead of the average commercial industry. Some of these examples includes, but not limited to, GPS tracking, satellite communications, and anti-collision system. One thing Company X's Engineering department had ever since and was not changed since they receive their first aircraft is the use of manual monitoring for technical requests or assistance. The global technology already advanced wherein an average citizen is already using an electronic device for most of their daily task, but Company X's Engineering Department still use spreadsheet and print outs to monitor and update tasks.

1.1 Company Background

Company X's vision keeps changing every 2-3 years, and the reason behind that is they always seem to achieve the goal in their vision statement and aspire to higher goals to achieve in the future. This year's vision is to achieve 20 million passengers per year. The company's mission is to sustainably deliver superior services in a cost-effective manner. Figure 1 details Company X's organizational chart. The Chief Operating Officer or Senior Vice President directly reports to the Chief Executive Officer. For this study, the focus will only be geared towards Maintenance and Engineering, as there are other departments within the company like, but not limited to, Flight Operations, In-Flight Services, Ground Operations, and Safety. A Vice President oversights the whole Maintenance and Engineering, which are further divided into different sections like Contracts, Materials, Maintenance, Engineering, Compliance and Lease. For quality management, QA is also linked with VP of Maintenance and Engineering but directly reports with COO. An M&E Coordinator serves as a liaison officer for all sections under this department. Depending on the section it is further divided into manager, supervisor, or executives.

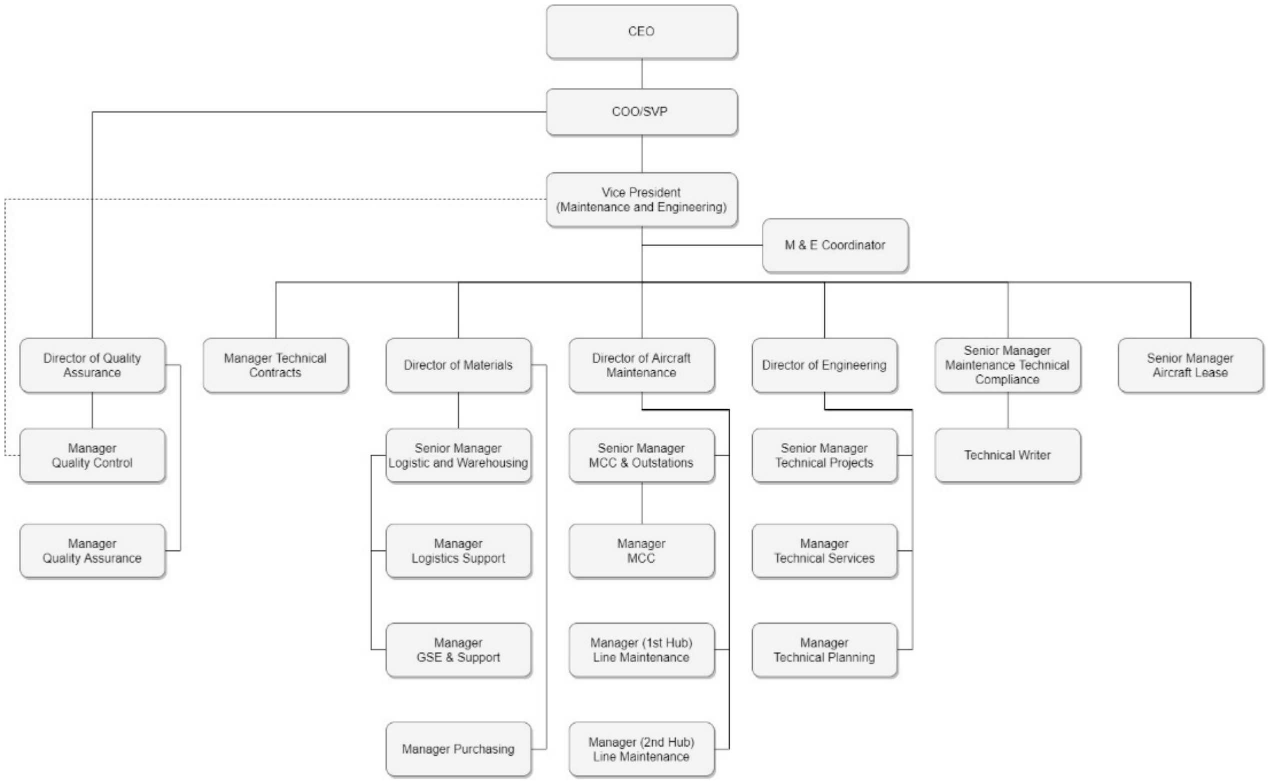


Figure 1**:** Company X Organizational Chart

1.2 Situational and Problem Analysis

1.2.1 Identification of Needs for Computer Based Information System (CBIS) based on interviews or survey. Based on the interviews done by the author to Company X's engineers, some of them are in great need of a system that will help them lessen their workload in relation to technical support. Implementation and transition may take a while, but they are willing to accept change if the needs will be answered by this system. Assessment of the current situation within Company X's Engineering Department are detailed in Table 1.

Table 1: SWOT Analysis

Strength	Weakness
• Most engineers are familiar with the traditional monitoring. New employees may be able to adapt easily when using this. • It is mostly independent and does not require any data connection. • Uses little company resources.	• Prone to errors and delays due to transcribing paper entries. • If any defect is reported, it will not be shown to other engineers in real time. • Spreadsheet can only be update via local network connection. • Some documentation uses paper resources; stock should be replenished at specific reorder points.
Opportunities	**Threats**
• Regulations has no issue with traditional request management system. • Can be upgraded to different types of platforms.	• Other airlines are already using certain types of request management system. • Volume of data required for different purposes gets bigger over a period of time. • Aircraft records and data are becoming more fluid.

1.2.2 Problem Definition on Specific Area. Figure 2 breaks down the root cause of difficulty in monitoring and tracking engineering related activities.

a. Maintenance – Most of the time, maintenance department doesn't receive required information from engineering regarding an issue raised by them. Vice versa, there are instances where the data they provide to engineering is not complete, hence, engineers cannot start addressing the issue.
b. Engineering - Difficulty in monitoring open, on-going and closed request. Redundant investigations performed on issues that are identical but done on different aircrafts.
c. Purchasing – Repetitive queries for parts interchangeability doesn't get addressed on time.
d. Management – Not enough way to monitor performance of every engineer (KPI).

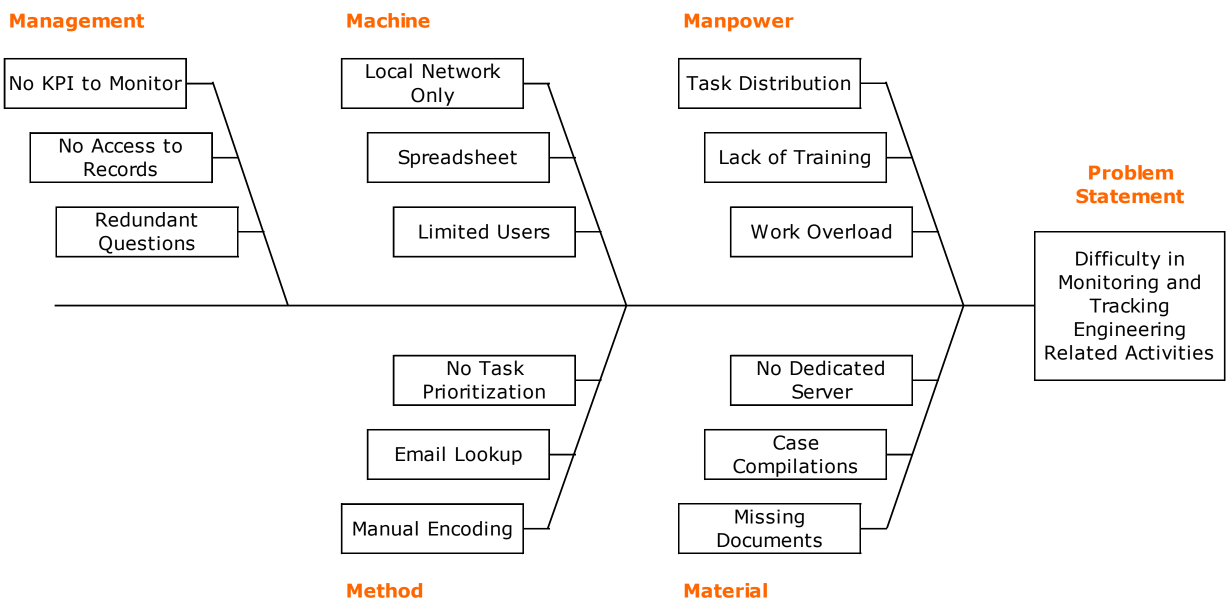


Figure 2: Root Cause Analysis

2. Literature Review

Field service mobility – as a function – has a different role at Airbus compared to most companies, which has to do with both the operating model and scope of portfolio. Mobility is embedded with the company's customers, whereby Airbus staff have an office within its customer facilities (Field Service Amelia Island 2022, 2020).

But because Airbus staff are located at customer offices, site access is more complicated as a result. They need to obtain authorization to conduct infrastructure re-wiring. Once they're granted permission, it's simply a matter of having the technician perform the appropriate tasks. And the second part of this transition relates to having staff from Orange – the main supplier – install the connection routers.

Most major airlines have one or more Airbus technical advisors in their facilities, and an SAP platform was recently installed to support technical requests that are submitted by airline technicians and engineers. Enquiries go through this tool, and answers are provided by appointed specialists.

The SAP platform was also integrated to plug a knowledge gap in long-term sustainability of the field service function at Airbus. Philippe mentioned that as various individuals resigned or moved on from the airline, they took a significant amount of project knowledge with them. This made it harder for information exchange with clients regarding specific job orders and aircraft componentry issues. As a result, the SAP platform also acts as a data warehouse, from which airline and Airbus staff can extract information. If requests or questions are related to the other departments, field service advisors can pass them on accordingly and focus on other jobs that need attention. The SAP platform is enabling advisors to manage their time more effectively, because they can re-direct tasks efficiently. (Mengual, 2016)

Most of the contemporary Information systems are based on the Database technology as a collection of logically related data, and DBMS as a software system allowing the users to define, create, maintain and control access to the database. The process of constructing such kind of systems is not so simple. It involves a mutual development of application program and database. The application program is actually the bridge between the users and the database, where the data is stored. Thus, the well-developed application program and database are very important for the reliability, flexibility and functionality of the system. The so defined systems differentiate to each other and their development comprises a great variety of tasks to be resolved and implemented. (Växjö University, 2006)

From 'chaos' to order - efficiency in your request management processes If business requests are in shared inboxes, spreadsheets, task lists and different systems, it is difficult to keep track of urgency, priorities or progress. A comprehensive request management system creates order for research, information, market data, operational & similar service teams dealing with a high volume of enquiries and requests. See the difference request management software like Quest can make — request your free copy of our self-assessment to gauge the benefits your organization can get through best practice. (Enquiry & Request Management Simplified, 2020)

In order to overcome the disadvantages of the present service request systems, a Web-based Graphic Service Request (WGSR) was developed in this research. The user interface is a key issue for this project to overcome other systems' disadvantage. (Lee, 2006, pp. 1–3)

To improve support to customers, Boeing is providing a single standard input method for submitting requests for in-service support. This new application, hosted on the Web portal MyBoeingFleet.com, replaces other methods of submitting service requests, such as e-mail, fax, and Technical In-Service Requests (i.e., TISRs). Boeing has a long history of providing its customers with technical support to ensure the safe and efficient operation of the Boeing in-service fleet. Continuing with that commitment, Boeing is enhancing its method of processing requests for in-service technical support.

The Service Requests Application provides the ability to input all the information required to create a complete service request and route it to the appropriate expert. This results in a faster and more thorough response to customer requests, making this the preferred method to request in-service support. In addition, the application provides customers with the ability to monitor all open requests and review historical requests. The improved data quality resulting from using the application can help Boeing engineers spot trends more easily and be more proactive in dealing with issues. (Numanoglu, 2010)

3. Methodology

Considering the major advancements of technology for the past decades, task monitoring seems to be outdated already. But this kind of procedure still contributes on how most of the engineers on Company X are able to perform most of their daily or routine task, in ensuring all of their operated aircrafts are in airworthy conditions.

The tasks and activity monitoring had grown in complexity over time, and it causes several operational issues if not properly executed, both to those that are operating older and newer generation aircrafts. The risk of aircraft-on-ground (AOG) situations and regulatory non-compliance caused by delays in response, and inefficient ways of updating activities had prompted the need for development of alternative solutions.

Using manual spreadsheet is inconvenient to some. From Engineering who is the main stakeholder, the Production Control, Purchasing and Materials who receives the information and/or instructions, and to management who tracks KPI.

This study aims to reduce the cost of the company when performing routine engineering activities by finding an alternative to the current procedure and tools being used. The author aims also to reduce the cost incurred of operational interruptions, delays, and aircraft-on-ground (AOG) situations. Another objective is to reduce the burden to several personnel, from Engineering Section, Production and Planning Control, Materials or Maintenance.

This study only covers data from Company X like average manhour and costings. This study is also limited only to its fleet of Airbus A320 CEO and A320 NEO. It will not include aircrafts that are used for Special Unscheduled Operations or chartered flights.

This study will help Company X reduce thousands of dollars not only in the long run, but also during the year this project is implemented. Company X will have more opportunities to update other systems in the aircraft because it will be easier to implement if a new alternative is used. This in turn, will provide other opportunities to increase aircraft utilization, reduce aircraft defect and faster turnaround time. Other than its significance in economic aspect, such upgrades will improve the safety of the passengers and the aircraft.

The monitoring currently being used by the engineers can be prone to different type of errors. Not only most of the data entry is manual, even the retrieval and recording will have to be done manually. Information retrieved from these records are so important that they must be secured and stored safely, something that prints already lack because of their tendency to deteriorate over time and being prone to environmental factors.

Based on Company X's experience, it is possible to lose thousands of dollars due to some missing or wrong entry. These data are sometimes used during redelivery of aircrafts and/or defect investigations. This was evident during the return of one of their aircrafts and a 3rd party hired by the lessor was auditing their records.

The need for automation aims to change not only the medium or system, but also the process flow of for the engineers. The implementation of this project needs to also consider the requirements of the regulatory body Company X is under.

4. Results and Discussion

4.1 System Analysis

4.1.1 System Requirements. The Engineering Department receives request from Airworthiness, Maintenance and Materials. Airworthiness requires assistance for review of an Airworthiness Directive, Maintenance for evaluation of a defect report, and Materials for aircraft parts applicability and interchangeability. Upon receipt of email, engineering checks origin of mail and if it is from Airworthiness or Maintenance, they have to update the applicable spreadsheet as necessary. Refer to Figure 3 for current flowchart of Company X Engineering.

For Airworthiness, it will always be a unique request. For Maintenance and Materials, certain cases have similarities on previous events. If the case is similar, Engineering needs to retrieve previous similar case and update it with applicable data. If it is new or unique, all requests whatever the origin is, needs to perform the required action. After this, the engineer needs to prepare the necessary documentations or send an e-mail as a response to the query raised. Email is sent to the concerned section. For materials, depending on engineer's response, they have to update the applicability/interchangeability of the aircraft part. For Airworthiness and Maintenance, if the Engineer's response is acceptable, they can close their item on their side and inform via email the engineer. If not acceptable, they need to inform also the engineer for him to go back and perform the required action again. After the engineer receives an email that his action is accepted, he needs to update then the spreadsheet.

Some of the pain points on the current process are as below:

a. Tedious record checking for the Engineers. It will take some time to find the previous case that is similar to the one being requested, especially if you already have so many to start with.
b. Sorting of mails and prioritization can be difficult and may take some time.
c. Multiple users using the same spreadsheet may encounter problems with control number. A wrong control number at the beginning can affect the whole process later.
d. There is no flow in order to close requests from Materials. This will affect database as reference for future issues.

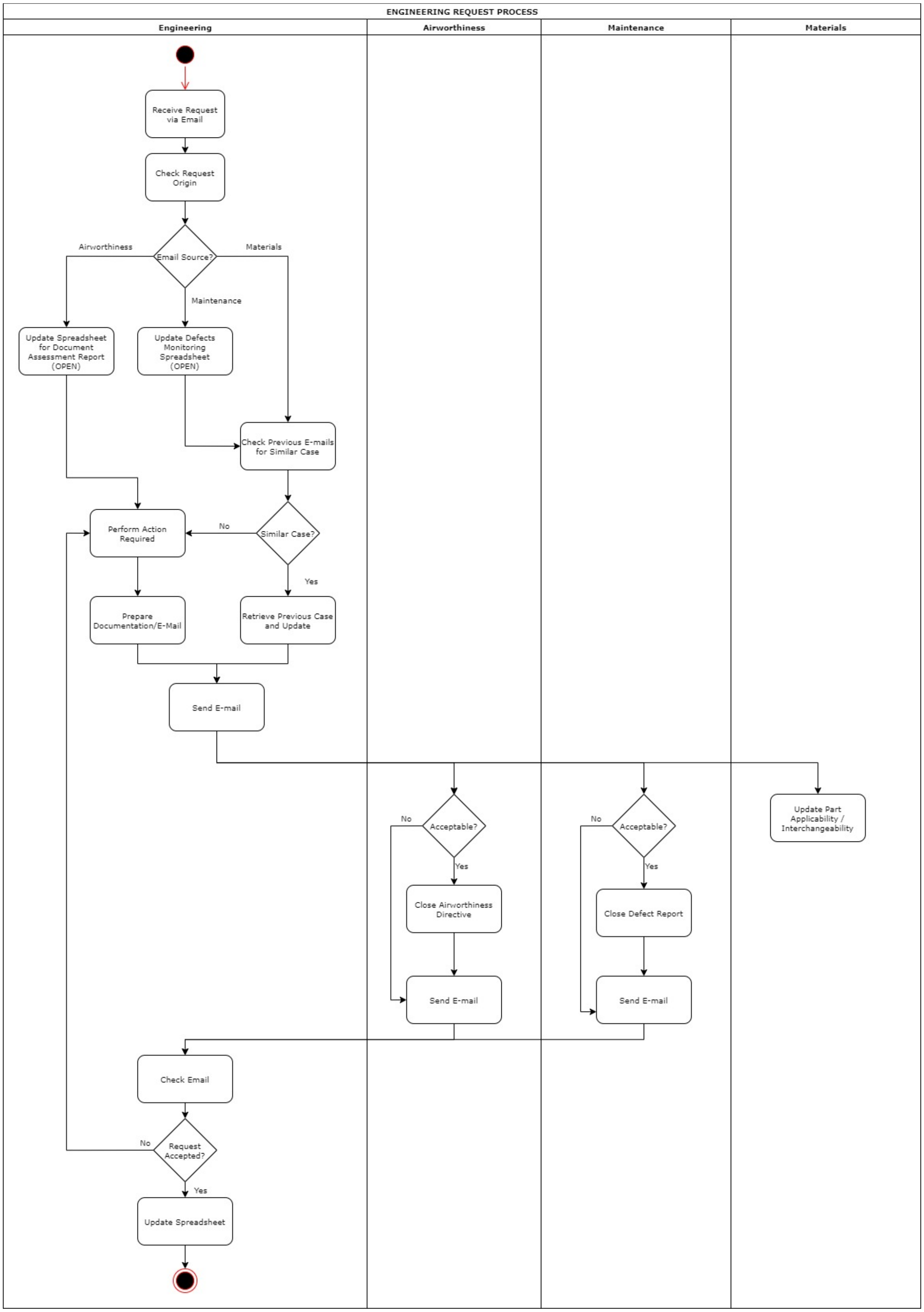


Figure 3. Current Flowchart of Company X Engineering

4.1.1.1 Output

- The system must be able to generate the report / document created by the engineer.
- Replies provided by engineer should be visible as what is shown when using the e-mail application.
- Complete historical data can be viewed.
- Reports can be generated for data analytics (per ATA Chapter, per Engineer in Charge, per Department supported)

4.1.1.2 Input

- Emails to be recognized by system.
- Details to be encoded by the engineer.
- Engineering tasks to be classified if it is related to Maintenance Defect, Engineering Review, Material Support or Others.
- All emails should have an ATA chapter on the Title, if it is not addressed to a specific section. Otherwise, the manager can decide to which section this will be forwarded to.

4.1.1.3 Process

- All communications will have a control number automatically generated by system and attached to all correspondences.
- Requests or queries will be forwarded to corresponding section depending on the ATA Chapter indicated on email's title. Otherwise, manager can override.
- System can compile tasks according to date, aircraft registration, MSNs, ATA chapter, Engineer in charge.
- System can make a search depending on required categories or keywords.

4.1.1.4 Performance

- The system can be accessed using remote desktop or web based login.
- It can support at least 10 users simultaneously.
- System must be operational 24 hours a day and 7 days a week.
- System must have a backup in local network server or cloud.
- System can generate graphs, charts, tables based on required data.
- It can export reports in .pdf format.
- System has capability to embed digital signatures on required documents.
- MS Outlook and the system can be linked or synchronized, in order for engineers to have options of using either when replying to queries.
- Can recognize urgent requests if AOG is mentioned in Title.

4.1.1.5 Control

- An employee must login using his employee number and password.
- User details are to be created by the administrator as per delegation of the technical services manager.
- All transactions should have log for auditing purposes.

4.1.2 Forms for Current Process

4.1.2.1 Engineering Action Log. This spreadsheet (Figure 4) is used for manual entry of cases/requests received by Company X Engineering. Case No. is the unique control number assigned per request. Requestor is the section or department requiring engineering assistance. Request date is the day the request was forwarded to Engineering while target date is the deadline, which may be subject to change upon agreement by both sides. Description provides brief details of the request. Duty Engineer will have to use the initials or employee number of the engineering handling the case. Remarks is for any comments or latest update. Status is for filtering purposes, to know if the case is Open, Close, or On-Hold.

COMPANY X **ENGINEERING ACTION LOG**

INSTRUCTION:
1) Fill-up all details, if applicable, required for traceability purposes.
2) For additional details, refer to Duty Engineer in charge of case.

ITEM	CASE NO.	REQUESTOR	REQUEST DATE	TARGET DATE	DESCRIPTION	DUTY ENGINEER	REMARKS	STATUS
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

Figure 4. Company X Engineering Action Log

4.1.2.2 Document Assessment Report. This form (Figure 5) will be used for the evaluation of Airworthiness Directives or other documents deemed necessary or mandatory by Airworthiness Section.

COMPANY X	DOCUMENT ASSESSMENT REPORT	DAR No: Issue Date: Revision:

DOCUMENT TYPE:
AD: ☑ SB: ☐ OTHER: ☐ ___________ (To be Specified)

Assessed Document	Document No.	Issued by	Issue Date	Rev.	Effective Date	Due Date

Related Document:
/A/

SUBJECT:

EFFECTIVITY:
☐ A319 ☑ A320 ☐ ENG. ☐ COMP. ☐ OTHER ____________________ (To be Specified)

APPLICABILITY:
Applicable ☑

Not Applicable ☑

Reason:

ENGINEERING COST ANALYSIS

	Amount in USD
Maintenance Labor Cost	—
Engineering Cost	—
Material Kit / Spare Cost	—
Tools and Equipment Cost	—
Subcontracted Cost (shipment)	—
Total Cost	----

ENGINEERING COMMENTS:

PREPARED	CHECKED	VERIFIED	APPROVED
ENGINEER	ENGINEER	MANAGER	HEAD OF ENGINEERING

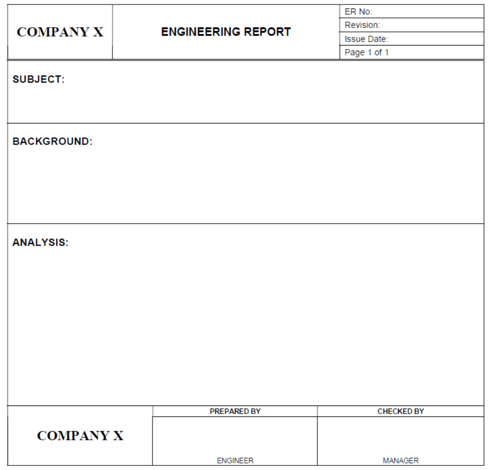
Flynas Document:

Document Type	Document No.	Issued by	Issue Date	Rev.

FN/TS/002 Rev.2 (09-2016)

Figure 5. Document Assessment Report

4.1.2.3 Engineering Report. This form (Figure 6) will be used for investigations requiring engineering assistance such as, but not limited to, aircraft defects, component reliability, and recurring technical issues.



COMPANY X	ENGINEERING REPORT	ER No: Revision: Issue Date: Page 1 of 1
SUBJECT:		
BACKGROUND:		
ANALYSIS:		
COMPANY X	PREPARED BY ENGINEER	CHECKED BY MANAGER

Figure 6. Company X Engineering Report

4.2 System Design

4.2.1 Scope of Proposed System. The proposed system must be able to manage requests from other departments to Company X Engineering. The following subsystems to be included: monitoring, request receipt, report generation, case assignment and case update. Monitoring for creating tracking numbers and ensuring no redundant control numbers are used. This will ensure that each case is unique. In the case that it is reused or revised, it should still pertain to the original case description. Request receipt for encoding of request received from other departments, or if it is possible to integrate the company used email system, it would be a good alternate. It should be able to sort requests depending on the originator for auditing purposes or other company related requirements. Report Generation for automatically generating AD Status Report and Defect Report directly from the system without encoding it anymore it word processor, also for possible exporting of the details encoded into this to other Maintenance Information System (MIS). Refer to Figure 3 and 4 for example of reports generated, taken from the current system. Case assignment is for the allocation of request to sections depending on the ATA chapter the request is related to. For example, ATA 31 Airworthiness Directives which is for Indicating and Recording System, shall be assigned to Avionics Section. APU defects, which is under ATA 49, will be handled by Powerplant Section. Depending on the closure rate and number of requests, management may have the means to check the KPI of each engineer. Case update will be used for informing requestors the feedback/action taken by engineers to address their specific concern. Such outputs could also be used for future request in case of similarities via archiving.

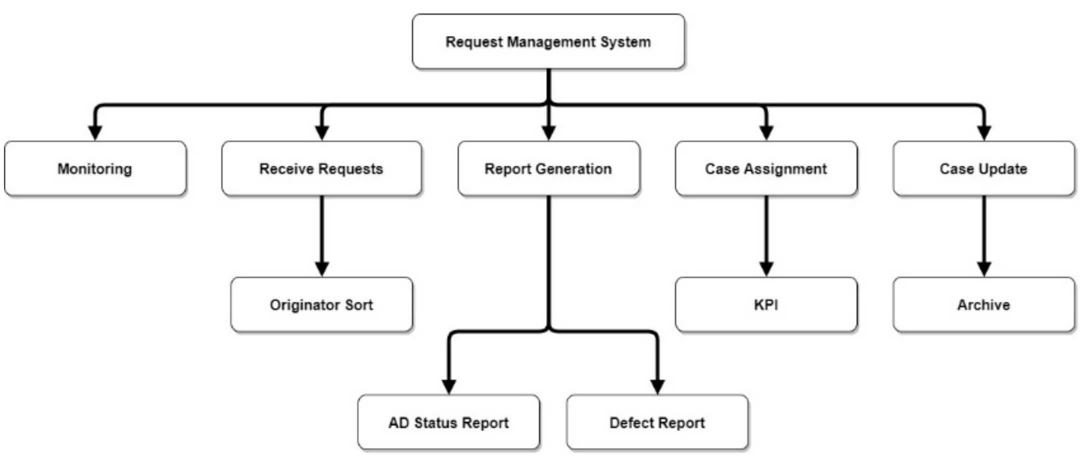


Figure 7. HIPO Chart of Proposed System

4.2.2 Proposed Process Mapping. The Engineering Department receives request from Airworthiness, Maintenance and Materials. Airworthiness requires assistance for review of an Airworthiness Directive, Maintenance for evaluation of a defect report, and Materials for aircraft parts applicability and interchangeability. Upon receipt of email, system automatically assign a control number for this request and the engineer fills in the other details. The item is then considered open and the management has access on information of all open items. For all origins, the engineer checks the archives if there is a similar request before. If it is similar, engineer can use the details related to it as reference and update. If it is new or unique, engineer needs to perform the required action.

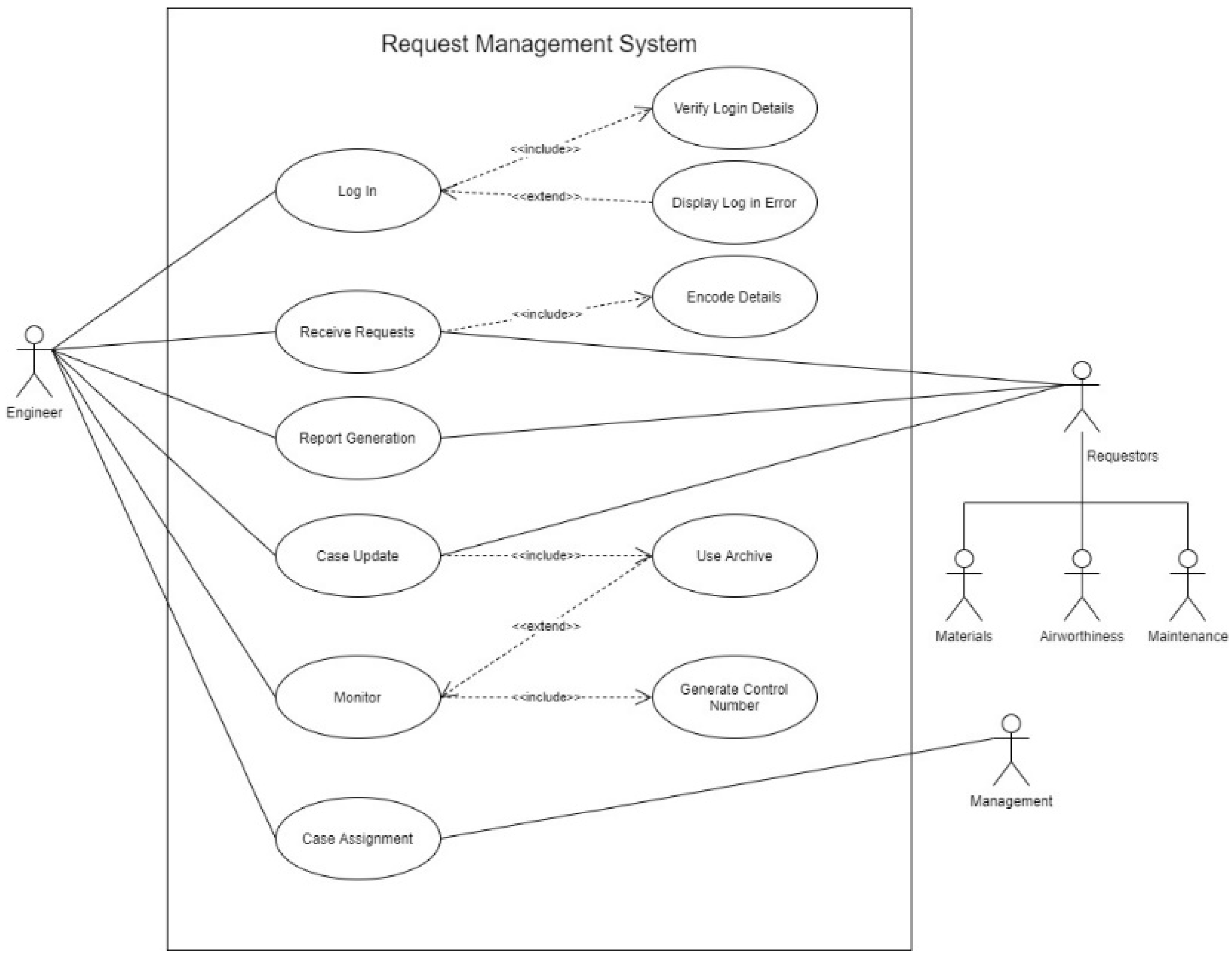


Figure 8. Use Case Diagram of Proposed Process

After this, the engineer needs to prepare the necessary documentations or send an e-mail as a response to the query raised. Email is sent to the concerned section. For materials, depending on engineer's response, they must update the applicability/interchangeability of the aircraft part and inform Engineering once done. For Airworthiness and Maintenance, if the Engineer's response is acceptable, they can close their item on their side and inform via email the engineer. If not acceptable, they need to inform also the engineer for him to go back and perform the required action again. After the engineer receives an email that his action is accepted, he needs to update the system by closing it. Management also has access on all closed items.

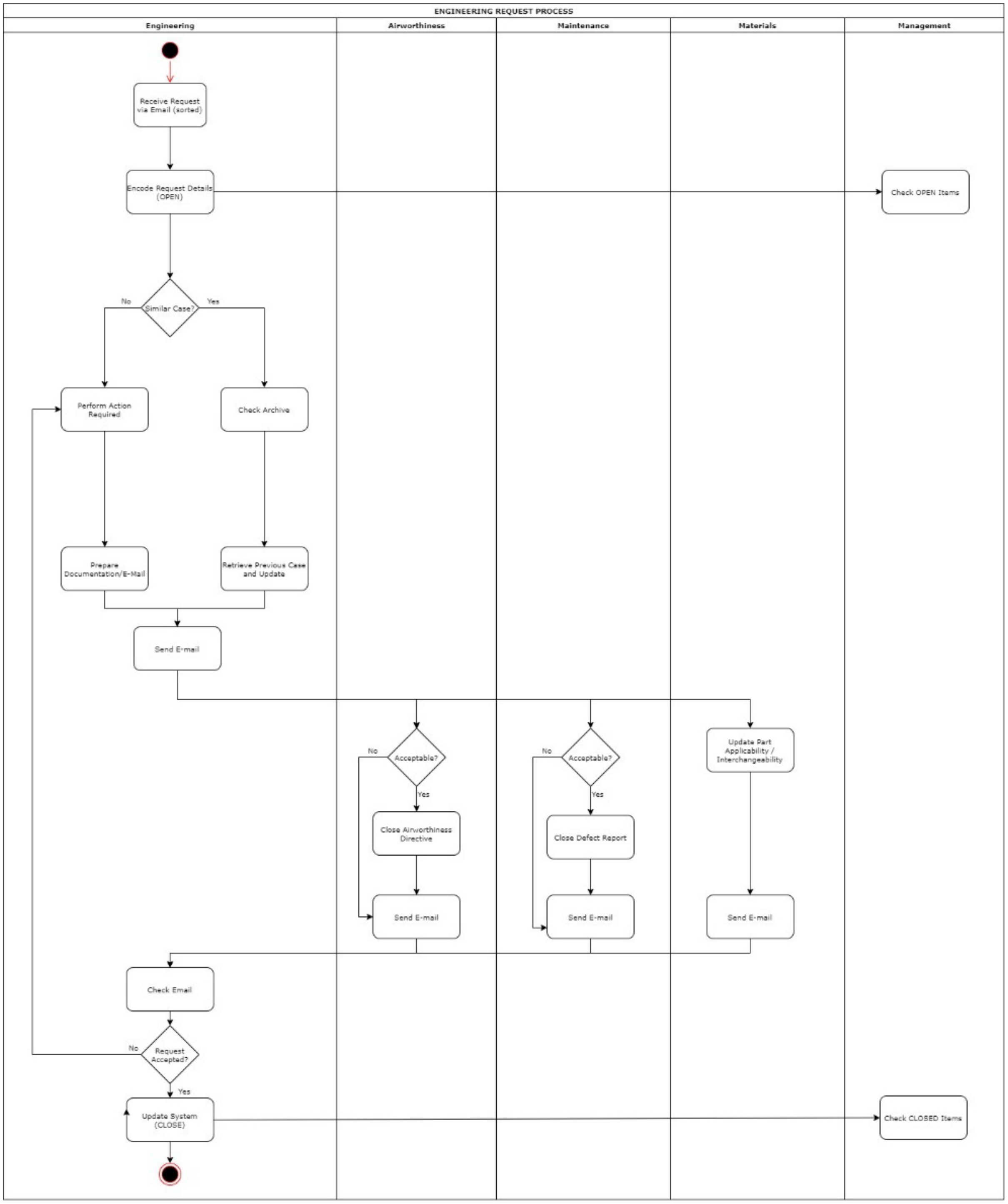


Figure 9. Proposed Process Flow

4.2.3 System / User Interface

4.2.3.1 Output Documents. For Internal Output, system will be able to generate 2 types of reports, detailed and summary reports. Detailed Reports are to be used by Engineers for tracking their cases. System will show the status, description, creation and changed date. Summary Reports will be used by management as quick overview on the performance of each engineer, to check the quantity and quality of their response in providing closures to cases raised to Engineering department.

4.2.3.2 Input Documents – Data Entry Forms. Engineer will have to encode details as required on entry from. The control number will be automatically generated by system in order to avoid redundant entries.

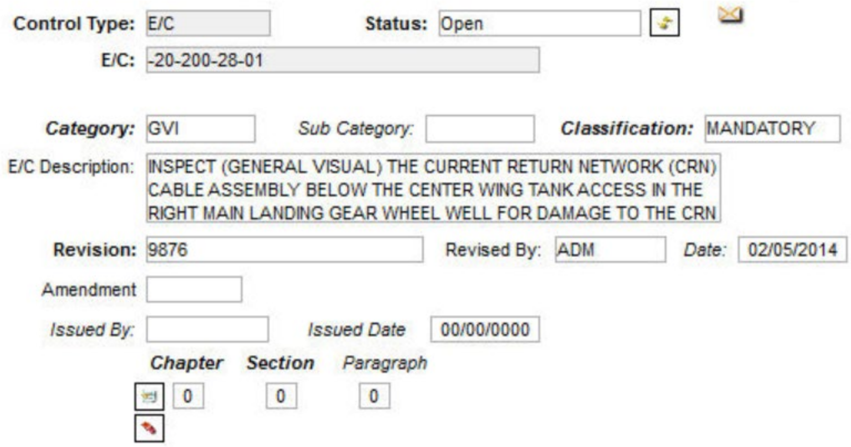


Figure 10. Request Detail Encoding (1 of 2)

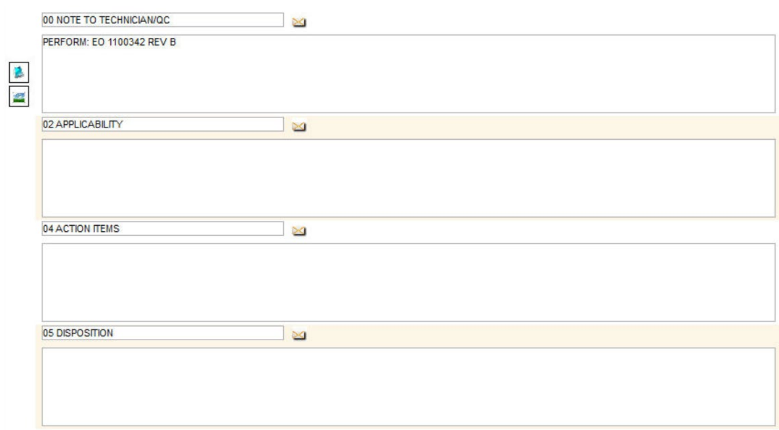
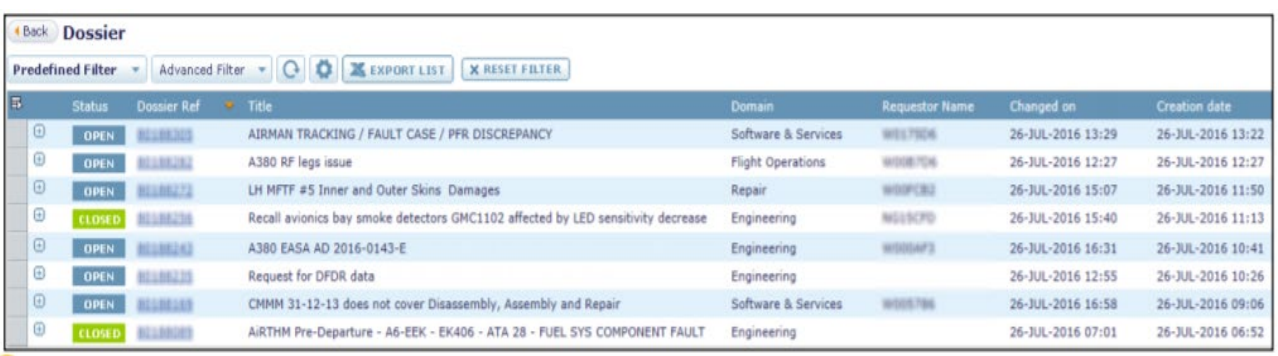


Figure 11. Request Detail Encoding (2 of 2)

4.2.3.3 Internal Output. Detailed Reports are to be used by Engineers for tracking their cases. System will show the status, description, creation and changed date.


Back Dossier

Predefined Filter | Advanced Filter | EXPORT LIST | RESET FILTER

Status	Dossier Ref	Title	Domain	Requestor Name	Changed on	Creation date
OPEN	[illegible]	AIRMAN TRACKING / FAULT CASE / PFR DISCREPANCY	Software & Services	[illegible]	26-JUL-2016 13:29	26-JUL-2016 13:22
OPEN	[illegible]	A380 RF legs issue	Flight Operations	[illegible]	26-JUL-2016 12:27	26-JUL-2016 12:27
OPEN	[illegible]	LH MFTF #5 Inner and Outer Skins Damages	Repair	[illegible]	26-JUL-2016 15:07	26-JUL-2016 11:50
CLOSED	[illegible]	Recall avionics bay smoke detectors GMC1102 affected by LED sensitivity decrease	Engineering	[illegible]	26-JUL-2016 15:40	26-JUL-2016 11:13
OPEN	[illegible]	A380 EASA AD 2016-0143-E	Engineering	[illegible]	26-JUL-2016 16:31	26-JUL-2016 10:41
OPEN	[illegible]	Request for DFDR data	Engineering		26-JUL-2016 12:55	26-JUL-2016 10:26
OPEN	[illegible]	CMMM 31-12-13 does not cover Disassembly, Assembly and Repair	Software & Services	[illegible]	26-JUL-2016 16:58	26-JUL-2016 09:06
CLOSED	[illegible]	AiRTHM Pre-Departure - A6-EEK - EK406 - ATA 28 - FUEL SYS COMPONENT FAULT	Engineering		26-JUL-2016 07:01	26-JUL-2016 06:52

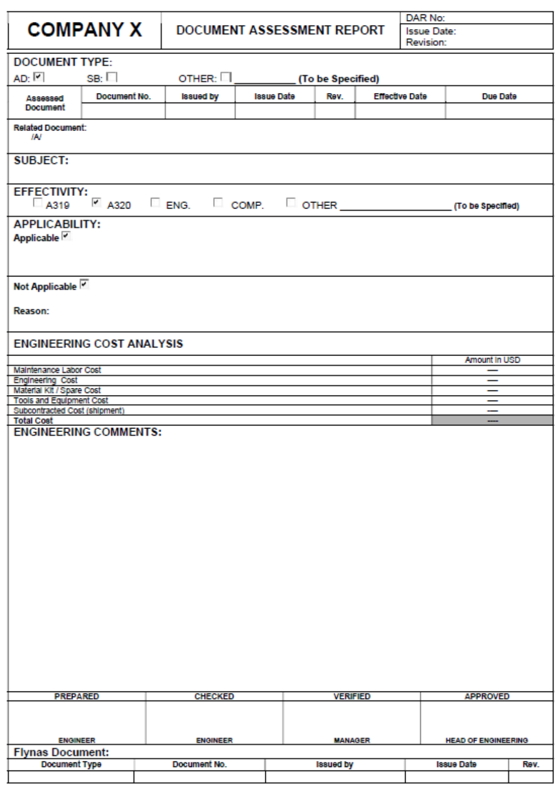
Figure 12. Detailed Report

Summary Reports will be used by management as quick overview on the performance of each engineer, to check the quantity and quality of their response in providing closures to cases raised to Engineering department.

Engineering Requests	CASES		
Duty Engineer	**Closed**	**Open**	**Grand Total**
ENGINEER NO. 1	10		10
ENGINEER NO. 10	1		1
ENGINEER NO. 11	1		1
ENGINEER NO. 12	5		5
ENGINEER NO. 13	12		12
ENGINEER NO. 14	1		1
ENGINEER NO. 2	81	2	83
ENGINEER NO. 3	5	1	6
ENGINEER NO. 4	7	1	8
ENGINEER NO. 5	17	1	18
ENGINEER NO. 6	1		1
ENGINEER NO. 7	4		4
ENGINEER NO. 8	2		2
ENGINEER NO. 9	1		1
Grand Total	**148**	**5**	**153**

Figure 13. Summary Report

4.2.3.4 External Output. Forms used initially as external outputs will be the same, only the manner of generation will be different as instead of entering it manually via word processor, it will be done via input mentioned on 5.3.2. This is to satisfy the requirements of National Aviation Authority and also Company X's own Quality Assurance requirements.



COMPANY X DOCUMENT ASSESSMENT REPORT

DAR No:
Issue Date:
Revision:

DOCUMENT TYPE:
AD: ☑ SB: ☐ OTHER: ☐ ________ (To be Specified)

Assessed Document	Document No.	Issued by	Issue Date	Rev.	Effective Date	Due Date

Related Document:
/A/

SUBJECT:

EFFECTIVITY:
☐ A319 ☑ A320 ☐ ENG. ☐ COMP. ☐ OTHER ________ (To be Specified)

APPLICABILITY:
Applicable ☑

Not Applicable ☑

Reason:

ENGINEERING COST ANALYSIS

	Amount in USD
Maintenance Labor Cost	—
Engineering Cost	—
Material Kit / Spare Cost	—
Tools and Equipment Cost	—
Subcontracted Cost (shipment)	—
Total Cost	—

ENGINEERING COMMENTS:

PREPARED	CHECKED	VERIFIED	APPROVED
ENGINEER	ENGINEER	MANAGER	HEAD OF ENGINEERING

Flynas Document:

Document Type	Document No.	Issued by	Issue Date	Rev.

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Figure 14. Document Assessment Report (New System)

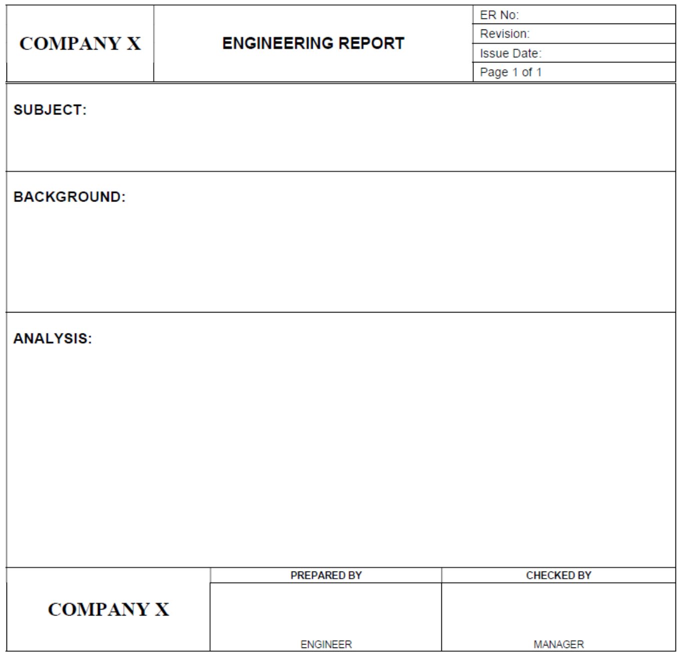
COMPANY X
ENGINEERING REPORT
ER No:
Revision:
Issue Date:
Page 1 of 1
SUBJECT:
BACKGROUND:
ANALYSIS:
COMPANY X
PREPARED BY
CHECKED BY
ENGINEER
MANAGER

Figure 15. Engineering Report (New System)

Figure 16. Dashboard and Chart as Output

4.3 System Evaluation

The current system heavily relies on manual generation of reports and tracking of engineering activities. In order to start the whole process, a control number listed on the spreadsheet shall be assigned to a specific case. The current system has a room for error by allowing redundant control numbers due to access on spreadsheet. Usually, control numbers are important during audit and redelivery of aircrafts. The new system will greatly lessen, if not mitigate this problem by automatic generation. This will save manpower and cost to correct the repercussions of such mistakes.

Also, the reports can be generated with only putting the necessary details. No need for the engineer to do formatting of such documents as it will be taken care of automatically by the system. The current system does not provide incentives to the performance of engineers as the KPI cannot be measured directly. With the new system, management will have solid data for them to base their appraisal or evaluation on specific engineer.

5. Conclusion

With the help of all the data obtained from system analysis, design, and evaluation, the author was able to conclude that the system will provide long term benefits not only to Company X's Engineering Department but also to other departments that require engineering assistance. The workload of every engineer will be lessened, and they can allocate the manhour freed to other issues that may require their attention. Author is open to the idea that this research, specifically for Company X, can be improved provided that more data and period is allocated. System design can be improved to be more specific and may address all other issues not yet discussed her. Overall, implementation of this research is still recommended if everything else will be considered with the current system Company X's engineering department is using.

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Biographies

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