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An Internship Report on

"QUALITY ASSURANCE"

Submitted in partial fulfillment of the requirement for the award of degree of

BACHELOR OF TECHNOLOGY

In

AERONAUTICAL ENGINEERING

By

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Under the esteemed guidance of

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At

TATA

TATA ADVANCED SYSTEMS

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TO WHOMSOEVER IT MAY CONCERN

Sub: Completion of Internship

This is to certify that **Mashaboina Sushmitha** has successfully completed her Internship in **Quality Engineering** at TATA Advanced Systems Limited, Hyderabad for a duration of 4.5 months starting w.e.f. 04-07-2022.

We appreciate her valuable contribution and wish her all the very best in her future endeavours.

For TATA Advanced Systems Ltd.

Payal

Payal Dua
Deputy Manager BHR, TCOE

TATA ADVANCED SYSTEMS LIMITED * SEZ-Unit-II

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DECLARATION

I do declare that the internship report entitled "**QUALITY ASSURANCE**" submitted in the **Department of Aeronautical Engineering**, **MLR** Institute of Technology, Dundigal, Hyderabad, in the partial fulfillment of the requirement of the award of the degree Bachelor's of Technology in Aeronautical Engineering is a bonafide record of my own work carried out under the supervision of **Mr. Nirmith Kumar Mishra** Faculty Internship Coordinator, **Department of Aeronautical Engineering**

Also I declare that the content embodied in the internship has not been submitted by me in full or in any part thereof for the award of any degree/diploma of any other institution or university previously.

MASHABOINA SUSHMITHA 19R21A2169

ACKNOWLEDGEMENT

"Task successful" makes everyone happy. But the happiness will be gold without glitter if we didn't state the persons who supported us to make it a success.

Foremost, I would like to express my sincere gratitude to my mentor **Mr. M. Shiva Subramanyam** for the continuous support of my internship, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped us in all the time of internship and writing of this documentation.

My special thanks to **Dr M Satyanarayana Gupta** Professor & Head of the Department Aeronautical Engineering for guiding us in the right way to complete Internship.

I sincerely thank **Mr. Nirmith Kumar Mishra** Internship Coordinator and Asst Prof in the Aeronautical Department for their technical advice and suggestions which helped me to overcome hurdles and kept us enthusiastic and made this work a wonderful learning experience.

I am thankful to my principal **Dr. K Srinivas Rao** for encouraging us throughout the course. I highly appreciate my colleagues for their constant friendship and intellectual input. It would have been all work and no play in the lab, if it were not for their friendly and humorous demeanor. I am thankful to all faculty members and staffs of the **Department of Aeronautical Engineering** for their assistance in my internship, as well as in my graduate studies.

I would like to express my gratitude towards my parents & members of **MLR** Institute of Technology for their kind co-operation and encouragement which helped us in the completion of this internship.

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TATA ADVANCED SYSTEMS

Included in this paper are accounts of my internship undertaken in the partial fulfillment of my Bachelor of Technology with Tata Advanced Systems Limited (TASL). As part of my TASL internship, I worked on Statistical Process Data, Mini Tab, Ecav, Inspection Plans& Manufacturing Execution System. The internship at Tata Advanced Systems provided me with the opportunity to work as a Quality Intern in Quality Assurance Department. At the end, the report made would provide us with a better perspective for the scope of optimization in the required fields.

Key Words: *Statistical Process Data, Mini Tab, Ecav, Inspection Plans*

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LIST OF ABBREVIATIONS

UAV	Unmanned Aerial Vehicles
QA	Quality Assurance
MRB	Material Review Board
DMAIC	Define Measure Analyze Improve Control
DMADV	Define Measure Analyze Design Validate
QC	Quality control
SEG	Spark Erosion Grinding
EDM	Electrical Discharge Machining
AFT	Air Flow Test
ECM	Electro Chemical Machining
WJ	Water Jet
MRR	Material Removal Rate
SPC	Statistical Process Control
MES	Manufacturing Execution System
LSC	Least Square Centering

CHAPTER – 1 INTRODUCTION

1.1 About the Company

Tata Advanced Systems Limited (TASL) is an Indian aerospace, Defence, military engineering & construction and technology company. It is a fully owned subsidiary of Tata Sons, a holding company for the Tata Group.

TASL entered into a joint-venture with Sikorsky Aircraft Corporation to manufacture the Sikorsky S-92 helicopter in India for the domestic civil and military markets. The plan was to have a US$200 million manufacturing plant operational in Hyderabad by 2010. As production began, the first S-92 cabin was delivered in November 2010, and capacity was expected to increase to 36–48 cabins a year. By the end of July 2013, assembly of 39 cabins had been completed.

The joint-venture with Sikorsky has since been expanded to include development of aerospace components for other OEMs. This facility, called Tara, also located in Hyderabad, was completed in 2011 and commenced production in 2012. Another TASL joint-venture, with Lockheed Martin, is producing aero structures for the Lockheed C-130 Hercules and the Lockheed C-130J Super Hercules in India. It is a 74:26 joint venture which currently assembles Hercules centre wing boxes and empennages.

In partnership with Airbus Defence and Space, the company fielded the EADS CASA C-295 for the Indian Air Force light-cargo fleet renewal program, which the Indian government approved on 13 May 2015. Under the project 16 complete aircraft will be imported, while 40 aircraft will be manufactured in India.

The company has also entered an agreement to produce structures for the Pilatus PC-12NG from 2016 to 2026. On 3 May 2018, Tata Advanced Systems acquired Tata Motors' aerospace and defense unit in a sale.

In Sept 2018, Lockheed Martin announced that it is going to build all wings for the F-16 fighter jet in collaboration with TASL

In 2018, Tata Boeing Aerospace Limited (TBAL), a joint venture between Boeing [NYSE: BA] and Tata Advanced Systems Ltd. (TASL), inaugurated a facility in Hyderabad which will be the sole global producer of fuselages for AH-64 Apache helicopter delivered by Boeing to its global customers. In 2020, Tata Advanced Systems acquired Tata Power SED from Tata Power.

In early 2021, it was reported that Tata Advanced Systems of India had likely bought the intellectual property rights of the Grob G180 SPn aircraft for the development of a military variant to be offered to the Indian army as a signals intelligence gathering and surveillance platform.

In February 2021, Lockheed Martin announced that they are teaming with Tata Advanced Systems for meeting the Indian Navy's proposed requirement for Naval Utility Helicopter (NUH).

In September 2021 India has signed deal of buying C-295 Cargo aircraft and that will be made by Tata Advanced System.

1.2 Major Programs

- License production of the C-295 in a JV with Airbus Defence and Space.
- Design, development and production of TATA Kestrel for Indian Army.
- Upgradation and modernization of 37 Airfields of Air Force Stations, Naval Stations and Coast Guard Civil Enclaves.
- Production and maintenance of Pinaka Multi Barrel Rocket launchers, command Posts and other support vehicles for Indian Army.
- Production and Maintenance of Akash SAM launchers, command posts and other support vehicles for IAF.
- Production and maintenance of MRSAM launchers, command posts and other support vehicles for IAF.
- Production and maintenance of the control systems for Arihant-class submarine .
- Production and development of Advanced Towed Artillery Gun System for Indian Army.
- Design, development and production of Portable Diver Detection Sonar.
- Production and Maintenance for PDV Mk-II launcher.

1.3 UAV's & Rajak

TASL is bidding to develop and build unmanned aerial vehicles (UAVs) for the Indian Armed Forces for surveillance. It has agreements with Israel Aerospace Industries (IAI) and "Urban Aeronautics" for cooperation and co-development of UAVs in India. It has developed and successfully flight tested long range kamikaze drone known as ALS-50 which can strike beyond ranges of 50 km and return back in case of abandoned mission and will soon be inducted into Indian armed forces.

TASL developed Rajak-XLR an enhanced variant of Rajak-ULR for Regiment of Artillery. It consists of a long-range continuous zoom-type thermal camera, long-range continuous zoom-type day camera and a laser rangefinder for analyzing the distance of target. The system can detect vehicles within a range of 50 km including the type and humans within 40 km.

CHAPTER – 2 QUALITY

Quality is a measure of excellence in manufacturing. The purpose of a Quality Department is to ensure profit margins by reducing inefficiencies, operations errors and product defects. In addition, the purpose also must include proactively improving capability and capacity of operations through new methods, tools or skills. Present day advanced understanding is aware that increased quality and productivity are interdependent. The undertaking is more integrated (when this progressive view is adopted). Each worker is responsible for work quality.

However, the necessary tools, powers, and motivation must be present to perform work correctly. The modern production cycle is beginning to resemble the days when each worker was complete master in the shop, as well as dealing with customers, making the products, and checking their quality. In order to manage both the total process or the sub process requires many skills, including level of education in their craft. Usually a well-endowed Quality System consists of the quality departments necessary functions as well as a guideline for the deployment of quality policies.

In most cases, the quality department in an organization plans, measures, analyses and reports on quality. This is a staff function to support other departments in the day-to-day improvement of products and services.

Generally, multiple plan, multi-division and multi-national organizations include a corporate quality group. There are instances in which laboratories report to a divisional quality manager. There are often autonomous divisions based on a product line. It is customary for each of these autonomous divisions to have its own quality department (at the corporate staff level).

The common functions of quality department include:

- Quality Control
- Quality Assurance
- Inspections
- Reliability/Durability/Maintainability
- Quality Engineering
- Quality Audit
- Procurement Quality
- Metrology Measurement

Quality is of utmost importance in an organization, but there are other important functions as well. The quality function must be sensitive toward its dealing with other activities within the organization (company). Quality is not the only means of bringing about success to the company and it is not free from making blunders, mistakes, poor judgment, or even lapses of human error.

CHAPTER -3 QUALITY ASSURANCE

Quality Assurance (QA) is any systematic process of determining whether a product or service meets specified requirements. QA establishes and maintains set requirements for developing or manufacturing reliable products. The core purpose of Quality Assurance is to prevent mistakes and defects in the development and production of both manufactured products, such as automobiles and shoes, and delivered services, such as automotive repair and athletic shoe design.

Assuring quality and therefore avoiding problems and delays when delivering products or services to customers is what ISO 9000 defines as that "part of quality management focused on providing confidence that quality requirements will be fulfilled". This defect prevention aspect of quality assurance differs from the defect detection aspect of quality control and has been referred to as a *shift left* since it focuses on quality efforts earlier in product development and production (i.e., a shift to the left of a linear process diagram reading left to right) and on avoiding defects in the first place rather than correcting them after the fact.

Quality assurance comprises administrative and procedural activities implemented in a quality system so that requirements and goals for a product, service or activity will be accomplished. It is the systematic measurement, comparison with a standard, and monitoring of processes in an associated feedback loop that confers error prevention. This can be contrasted with quality control, which is focused on process output.

Quality Assurance methodology has a defined cycle called PDCA cycle or Deming cycle. These above steps are repeated to ensure that processes followed in the organization are evaluated and improved on a periodic basis. The phases of this cycle are:

Figure 3.1 Quality Assurance

- **Plan** – Organization should plan and establish the process related objectives and determine the processes that are required to deliver a high-Quality end product.
- **Do** – Development and testing of Processes and also "do" changes in the processes
- **Check** – Monitoring of processes, modify the processes, and check whether it meets the predetermined objectives

- **Act** – A Quality Assurance tester should implement actions that are necessary to achieve improvements in the processes

3.1 IDENTIFICATION & TRACEABILITY

This method operating instruction scope and purpose id to identify, define, implement and standardize specific identification and traceability requirements for finished parts, raw materials, semi-finished parts, assemblies, standard parts and other traceable items used.

Identification of Serial/Lot Numbers:

- Stores shall use RM serial number as identification & traceability for raw materials.
- For serialized/ lot number parts that are manufactured from serialized (or) lot number material, traceability shall be maintained by PPC and QA to those details & their product acceptance records respectively.
- For Serialized/ Lot number parts that are manufactured from single serialized or lot number material, traceability shall be maintained by PPC and QA to those details and their product acceptance records. RM serial number in every consecutive detail/ assembly work order, by PPC & QA to those details and their product acceptance records.
- PPC shall ensure printing of RM serial number on MIS before first operational step.
- QA shall ensure that all product acceptance records shall be traceable to each other by the unique serial number and work order numbers cross referenced in them.

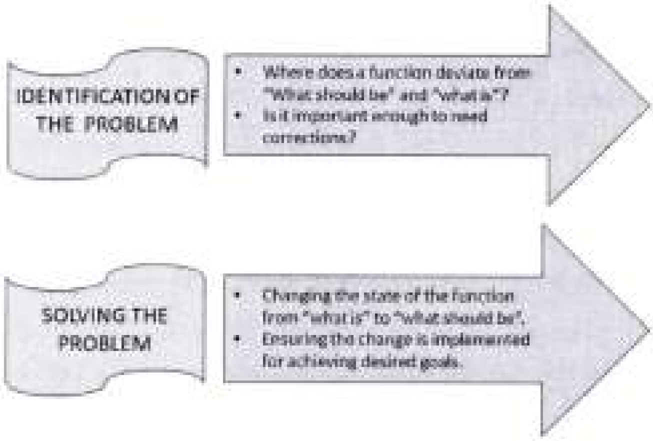

Figure 3.2. Identification and Traceability

3.2 MATERIAL REVIEW BOARD

A Material Review Board (MRB) is a group of people who review nonconforming material that has been referred to this board. MRB is usually made up of SMEs who represent various departments within an organization. The MRB has four possible dispositions: scrap, rework/repair, return to vendor and acceptance as is.

The MRB is typically composed of the subject matter experts (SMEs) from:

- Quality Engineer
- Engineering Representative
- Purchasing Representative
- Production Representative

Typically, the MRBs will be scheduled on a weekly or monthly basis. This schedule can vary depending upon the volume of nonconformity items being reviewed.

For the MRB to decide the disposition of the item(s), they must have all of the information necessary to make the correct determination.

The disposition provided by MRB can be in one of these four categories: scrap, rework, return to vendor and accept as- is.

1. Scrap:

Items that do not conform to specifications and cannot be corrected are scrapped. These items are considered unusable and are disposed of accordingly.

2. Rework:

Items that do not meet specifications but can be corrected are repaired to meet the specification. The MRB needs to review if the effort required to repair the item is worth it.

3. Return to Vendor:

Items that do not conform to specification and do not affect the work schedule can be sent back to the supplier as the rejections.

4. Accept As-Is (or Accept under concession):

If the nonconformity is minor in nature and does not affect the functioning of the finished product, then the MRB can decide to accept the item as is.

In addition, MRB could also suggest changing the specification. For example, the MRB might suggest a slight modification to the design so that it would meet the requirements better.

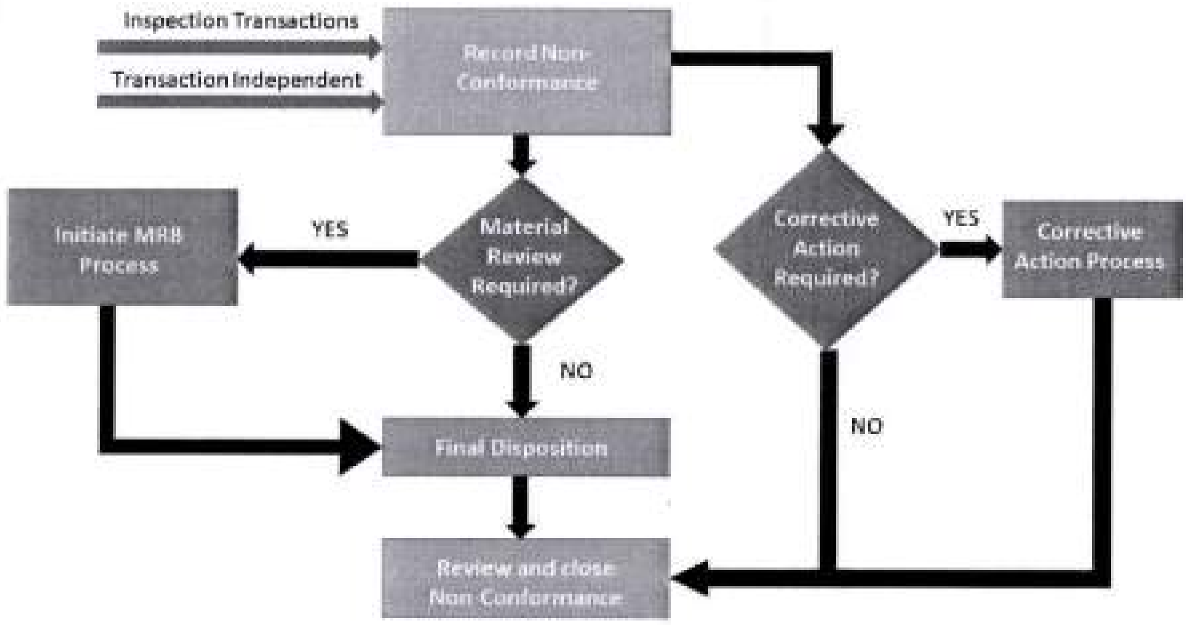

Figure 3.3. Material Review Board Process

3.3 SIX SIGMA

Six Sigma tools are defined as the problem-solving tools used to support Six Sigma and other process improvement efforts. The Six Sigma expert uses qualitative and quantitative techniques to drive process improvement. Although the tools themselves are not unique, the way they are applied and integrated as part of a system is. Six Sigma is a method that offers organizations tools to improve their capabilities in managing their businesses. This increase in performance and decreasing process variation, it is possible to reduce defect rates, improve employee morale, and improve the quality of products or services, which all contribute to a higher level of profitability.

3.3.1 The Six Sigma Methodology

The two main Six Sigma methodologies are DMAIC and DMADV. Each has its own set of recommended procedures to be implemented for business transformation.

- DMAIC is a data-driven method used to improve existing products or services for better customer satisfaction. It is the acronym for the five phases: D – Define, M – Measure, A – Analyse, I – Improve, C – Control. DMAIC is applied in the manufacturing of a product or delivery of a service.
- DMADV is a part of the Design for Six Sigma (DFSS) process used to design or re-design different processes of product manufacturing or service delivery. The five phases of DMADV are: D – Define, M – Measure, A – Analyse, D – Design, V – Validate. DMADV is employed when existing processes

do not meet customer conditions, even after optimization, or when it is required to develop new methods. It is executed by Six Sigma Green Belts and Six Sigma Black Belts and under the supervision of Six Sigma Master Black Belts. We'll get to the belts later.

3.3.2 The Six Sigma Process of the DMAIC method:

Figure 3.4. Six Sigma DMAIC Method

Each of the above phases of business transformation has several steps:

1. **Define**

The Six Sigma process begins with a customer-centric approach.
Step1: The business problem is defined from the customer perspective.
Step 2: Goals are set. What do you want to achieve? What are the resources you will use to achieve the goals?
Step 3: Map the process. Verify with the stakeholders that you are on the right track.

2. **Measure**

The second phase is focused on the metrics of the project and the tools used in the measurement. How can you improve? How can you quantify this?
Step1: Measure your problem in numbers or with supporting data.
Step2: Define performance yardstick. Fix the limits for "Y."
Step3: Evaluate the measurement system to be used. Can it help you achieve your outcome?

3. **Analyse**

The third phase analyzes the process to discover the influencing variables.

Step 1: Determine if your process is efficient and effective. Does the process help achieve what you need?

Step 2: Quantify your goals in numbers. For instance, reduce defective goods by 20%. Step 3: Identify variations using historical data.

4. **Improve**

This process investigates how the changes in "X" impact "Y." This phase is where you identify how you can improve the process implementation.

Step 1: Identify possible reasons. Test to identify which of the "X" variables identified in Process III influence "Y."
Step2:Discover relationships between the variables.
Step 3: Establish process tolerance, defined as the precise values that certain variables can have, and still fall within acceptable boundaries, for instance, the quality of any given product. Which boundaries need X to hold Y within specifications? What operating conditions can impact the outcome? Process tolerances can be achieved by using tools like robust optimization and validation set.

5. **Control**

In this final phase, you determine that the performance objective identified in the previous phase is well implemented and that the designed improvements are sustainable.

Step1: Validate the measurement system to be used.
Step 2: Establish process capability. Is the goal being met? For instance, will the goal of reducing defective goods by 20 percent be achieved?
Step 3: Once the previous step is satisfied, implement the process.

3.4 Risk Management

The concept of management is used in various contexts due to the many aspects it can regard. In the IT field, risk management is one of the basic terms that should be familiar to specialists. All development activities involve risks. Organizations have to invent effective coping mechanisms to handle those risks. With that said, a standard step-by-step risk management model implies identification, analysis, subsequent assessment, and treatment of the unfavourable conditions.

If done right, it results in preventing any kind of negative effect on the processes or their outcomes. Throughout this process, teams involved in a project should communicate with stakeholders – they approve all decisions when certain risks arise. The tricky thing is that, in addition to the general pool, each team and each development phase has a specific set of risks. In this article, we'll tell a bit about those a software testing company usually encounters.

It would be easier to define risk management by listing the activities this process includes. So, risk management means to: know the issues your team may face; understand the degree of importance of each problem; arrange the risks in descending order in terms of the severity of the problem; develop and implement measures for prevention of the most severe issues; What factors can reduce the risk probability? check the effectiveness of the activities, making sure the applied measures help; and evaluate the work done in general.

This typically involves judging what could possibly happen and how, as well as what factors affect the risk and whether the risk is in fact acceptable. When it comes to managing risk, your team will need to judge the importance of each problem, developing measures of risk prevention, checking how effective these measures are and evaluating the entire process.

Those in QA respond to risk when a major bug is reported, but they don't carry that awareness into the long-term planning of our quality assurance and testing initiatives. In other words, they're not effectively managing risk. There is much more to be done to promote risk awareness in QA and ensure it's responded to accordingly in terms of how risk is actually managed.

Figure 3.5. Key Elements – QA Approach

Quality risk management is a systematic, risk-based approach to quality management. The process is composed of the assessment, control, communication, and review of quality risks. It is especially critical in the pharmaceutical industry, where product quality can greatly affect consumer health and safety.

Here are the Five Essential Steps of a Risk Management Process

- Identify the Risk.
- Analyse the Risk.

- Evaluate or Rank the Risk.
- Treat the Risk.
- Monitor and Review the Risk.

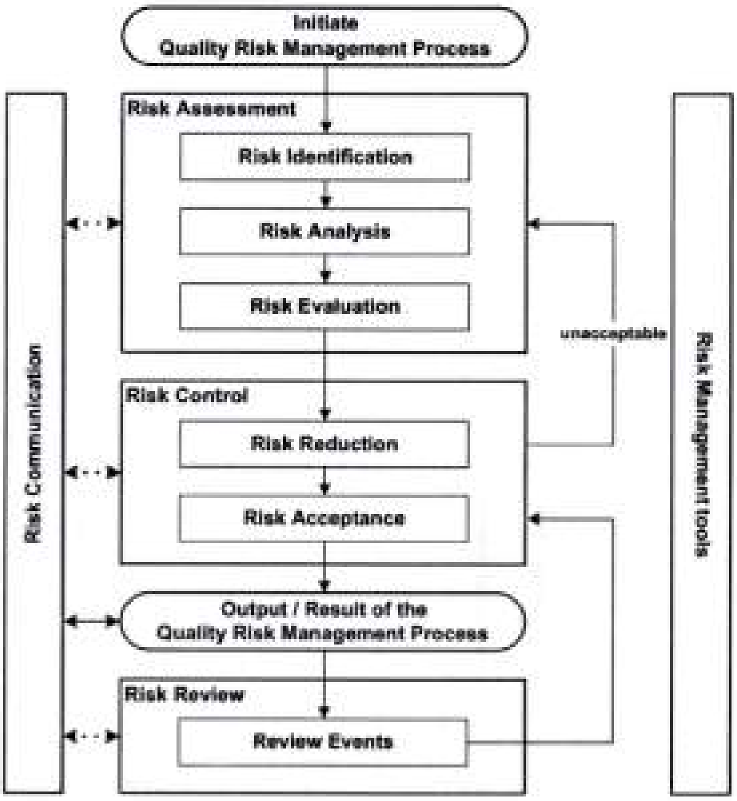

Figure 3.6. Flow chart of Risk Management

CHAPTER – 4 QUALITY CONTROL

Quality control popularly abbreviated as QC. It is a Software Engineering process used to ensure quality in a product or a service. It does not deal with the processes used to create a product; rather it examines the quality of the "end products" and the final outcome.

The main aim of Quality control is to check whether the products meet the specifications and requirements of the customer. If an issue or problem is identified, it needs to be fixed before delivery to the customer.

QC also evaluates people on their quality level skill sets and imparts training and certifications. This evaluation is required for the service-based organization and helps provide "perfect" service to the customers.

- Quality control (QC) is a process through which a business seeks to ensure that product quality is maintained or improved.
- Quality control involves testing units and determining if they are within the specifications for the final product.
- The quality control used in a business is highly dependent on the product or industry, and several techniques exist for measuring quality.
- The food industry uses quality control methods to ensure customers do not get sick from their products.
- Quality control creates safe measures that can be implemented to make sure deficient or damaged products do not end up with customers.

Quality control means how a company measures product quality and improves it if need be. Quality control can be done in many ways, from testing products, reviewing manufacturing processes, and creating benchmarks. This is all done to monitor significant variations in a product.

Figure 4.1. Quality Control Process Flow Diagram

Quality control and quality assurance are terms often used to define the same thing, but there are distinct differences. Quality control focuses on quality requirements, such as ensuring a part meets specifications. In aircraft manufacturing, quality control and assurance is of the utmost importance. Manufacturers are required to document, track, and inspect, and reinspect all items and phases of a build to build evidence that everything is completed to very strict standards.

CHAPTER – 5 INSPECTION

A Quality Inspection involves measuring, examining, testing, or gauging various characteristics of a product and comparing those results with specified requirements to determine whether there is a conformity. Quality Control (QC) is critical to build and deliver products that meet or exceed customers' expectations.

The prospect of a QA inspection is too often cause for alarm. With the right quality assurance inspection software, there's no need to panic. Our quality management solutions integrate related processes and connect quality data across the product life cycle. All your quality documents and data are centrally located. Auditors and inspectors can access the information they want on demand and hassle free.

Quality control experts visit factories on behalf of customers to ensure the manufacturing process and products meet the standards agreed upon before the merchandise leaves the factory. Quality control services include on-site factory inspections and testing with detailed reports to help ensure that your products meet your specifications and manage product quality in your supply chain.

One of the fundamental pillars of achieving continuous improvement is the quality inspection process. Depending upon where the product is in the manufacturing lifecycle, criteria-based inspection plans enable meeting specific regulatory requirements and workflows. Online visuality and real-time monitoring of incoming parts, raw materials, and sub-units are important for successful inspections.

An effective quality management solution can streamline inspection-related processes within your organization such as receiving, in-process, shipment, and product returns, and thus deliver a unified view of inspection criteria and results to the company personnel. Quality Inspection is an activity of checking, measuring, or testing one or more product or service characteristics and comparing the results with the specific requirements to confirm compliance. This task is executed by skilled personnel, not by production workers. An efficient inspection process standardizes quality, eliminates paper documents, and increases efficiencies on the floor.

Quality Inspection is concerned with the post-production check of products. It doesn't have a direct influence on the production process. Quality inspector checks the products so that no poor-quality products leave the factory. As there is no feedback loop in quality inspection, information about failures and their causes is not moved to workers or managers. As a result, this system cannot improve itself.

The Inspection Process used are:

- Heat Treatment
- Brazing
- Welding
- Electrical Discharge Machining

- Thermal Spray
- Air Flow Test
- Spark Erosion Grinding (SEG)

5.1 Heat Treatment

All heat treatments involve heating and cooling metals, but there are three main differences in process: the heating temperatures, the cooling rates, and the quenching types that are used to land on the properties you want. In a future blog post, we'll cover the different types of heat treatment for ferrous metals, or metal with iron, which consist of annealing, normalizing, hardening, and/or tempering.

To heat treat metal, you'll need the proper equipment so that you can closely control all of the factors around heating, cooling, and quenching. For example, the furnace must be the proper size and type to control temperature, including the gas mixture in the heating chamber, and you need the appropriate quenching media to cool metal correctly.

5.1.1 Stages of Heat Treatment

There are three stages of heat treatment:

- Heat the metal slowly to ensure that the metal maintains a uniform temperature
- Soak, or hold, the metal at a specific temperature for an allotted period of time
- Cool the metal to room temperature

5.1.2 The Heating Stage:

During the heating stage, the foremost aim is to make sure that the metal heats uniformly. You get even heating by heating slowly. If you heat the metal unevenly, one section may expand faster than another, resulting in a distorted or cracked section of the metal. You choose the heating rate according to the following factors:

The heat conductivity of the metal. Metals with high heat conductivity heat faster than those with low conductivity. The condition of the metal. Tools and parts that have been hardened, or stressed, previously should be heated slower than tools and parts that haven't. The size and cross-section of the metal. Larger parts or parts with uneven cross sections need to be heated more slowly than small parts to allow the inside temperature to be close to the surface temperature. Otherwise, there's a risk of cracking or excessive warping.

5.1.3 The Soaking Stage:

The purpose of the soaking stage is to keep the metal at the appropriate temperature until the desired internal structure takes shape. The "soaking period" is how long you keep the metal at the appropriate temperature. To determine the correct length of time, you will need the chemical analysis and mass of the metal. For uneven cross-sections, you can determine the soaking period using the largest section.

Generally, you shouldn't bring the temperature of the metal from room temperature to the soaking temperature in one step. Rather, you'll need to heat the metal slowly to just below the temperature where the structure will change, and then hold it until the temperature is consistent throughout the metal. After this step of "preheating", you more quickly heat the temperature to the final temperature that you'll need. Parts with more complex designs may require layers of preheating to prevent warping.

5.1.4 The Cooling Stage:

In the cooling stage, you'll want to cool metal back to room temperature, but there are different ways to do this depending on the type of metal. It may need a cooling medium, a gas, liquid, solid, or combination thereof. The rate of cooling depends on the metal itself and the medium for cooling. It follows that the choices you make in cooling are important factors in the desired properties of the metal.

Quenching is when you rapidly cool metal in air, oil, water, brine, or another medium. Usually quenching is associated with hardening because most metals that are hardened are cooled rapidly with quenching, but it is not always true that quenching or otherwise rapid cooling results in hardening. Water quenching, for example, is used to anneal copper, and other metals are hardened with slow cooling.

Not all metals should be quenched – quenching can crack or warp some metals. Generally, brine or water can rapidly cool metal, while oil mixtures are better for a slower cooling. The general guidelines are that you can use water to harden carbon steels, oil to harden alloy steels, and water to quench nonferrous metals. However, as with all treatments, the rate and medium of cooling you choose must fit the metal describing about its GD&T specifications. I had worked on MES Software which basically helps to create manufacturing orders and track the Production Execution. It provides functions and processes to prepare, plan and execute factory floor operations uniformly, track progress at real-time and increase agility to align as the day demands.

I used to prepare various Inspection plans on different operations done for different ring & case parts of aircraft. I also prepared Inspection Plans for Heat Treatment, Brazing, Welding, Electrical Discharge Machining (EDM), Thermal Spray and Spark Erosion Grinding too. I worked on ballooning drawings which helps to identify a part or assembly listed in the parts list by labelling them in the drawing.

Figure 5.1. Heat Treatment

5.1.5 The Benefits

- There are various reasons for carrying out heat treatment. Some procedures make the metal soft, while others increase hardness. They may also affect the electrical and heat conductivity of these materials.

- Some heat treatment methods relieve stresses induced in earlier cold working processes. Others develop desirable chemical properties to metals. Choosing the perfect method really comes down to the type of metal and the required properties.

- In some cases, a metal part may go through several heat treatment procedures. For instance, some superalloys used in the aircraft manufacturing industry may undergo up to six different heat-treating steps to optimise them for the application.

5.2 Brazing

Brazing joins metal surfaces together with a filler metal which has a low melting point. The process uses capillary action wherein the homogenous liquid flow of the filler material bonds with the base metals.

A unique quality in the brazing process is that it keeps the mechanical properties of the metals which are useful in applications such as silver brazing or other similar metals. One of the most crucial steps in the metal joining process is the cleaning of the base metal surfaces. Emery cloth or wire brush are both great tools to remove contaminants.

Having calculated joint gaps for the liquid filler metal to achieve surface tension with the workpiece, the brazing operation begins with properly positioning the assembly. A torch is normally used to slowly heat the workpiece's metal surface and filler metal into its brazing temperature.

As the filler metal liquefies, capillary action lets it pass through the tight spaces, thus forming a bond between the surface of the base metals. The brazed joints are formed as it cools down with the assembly.

5.2.1 Materials

These are the metals that are often joined by brazing:

1. Aluminium
2. Cast iron
3. Magnesium
4. Copper and copper alloys
5. Silver

5.2.2 Filler metal requirements

- Once the molten flux and filler metal solidify, the brazed joint should possess the expected mechanical properties.
- Brazing temperatures must efficiently achieve a proper liquid flow from the molten braze alloy into the joints.
- Filler metals must achieve proper wetting conditions in order to create strong bonds.

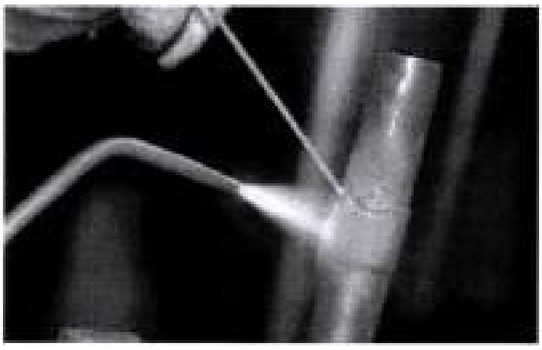

Figure 5.2. Brazing Process

Unless brazing operations are contained within an inert or reducing atmosphere environment (i.e. Nitrogen), a flux such as borax is required to prevent oxides from forming while the metal is heated. The flux also serves the purpose of cleaning any contamination left on the brazing surfaces. Flux can be applied in any number of forms including flux paste, liquid, powder or pre-made brazing pastes that combine flux with filler metal powder. Flux can also be applied using brazing rods with a coating of flux, or a flux core.

In either case, the flux flows into the joint when applied to the heated joint and is displaced by the molten filler metal entering the joint. Excess flux should be removed when the cycle is completed because flux left in the joint can lead to corrosion, impede joint inspection, and prevent further surface finishing operations. Phosphorus-containing brazing alloys can be self-fluxing when joining copper to copper. Fluxes are generally selected based on their performance on particular base metals. To be effective, the flux must be chemically compatible with both the base metal and the filler metal being used. Self-fluxing phosphorus filler alloys produce brittle phosphides if used on iron or nickel. As a general rule, longer brazing cycles should useless active fluxes than short brazing operations.

A variety of alloys are used as filler metals for brazing depending on the intended use or application method. In general, braze alloys are composed of three or more metals to form an alloy with the desired properties. The filler metal for a particular application is chosen based on its ability to: wet the base metals, withstand the service conditions required, and melt at a lower temperature than the base metals or at a very specific temperature.

Braze alloy is generally available as rod, ribbon, powder, paste, cream, wire and preforms (such as stamped washers). Depending on the application, the filler material can be pre-placed at the desired location or applied during the heating cycle. For manual brazing, wire and rod forms are generally used as they are the easiest to apply while heating. In the case of furnace brazing, the alloy is usually placed beforehand since the process is usually highly automated.

The easiest way to categorize brazing methods is to group them by heating method. Here are some of the most common:

- Torch brazing
- Furnace brazing
- Induction brazing
- Dip brazing
- Resistance brazing
- Infrared brazing
- Blanket brazing
- Electron beam and laser brazing
- Braze welding

5.2.3 Advantages:

- Brazing has many advantages over other metal-joining techniques, such as welding. Since brazing does not melt the base metal of the joint, it allows much tighter control over tolerances and produces a clean joint without the need for secondary finishing.

- Additionally, dissimilar metals and non-metals (i.e. metalized ceramics) can be brazed. In general, brazing also produces less thermal distortion than welding due to the uniform heating of a brazed piece.
- Complex and multi-part assemblies can be brazed cost-effectively. Welded joints must sometimes be ground flush, a costly secondary operation that brazing does not require because it produces a clean joint. Another advantage is that the brazing can be coated or clad for protective purposes.
- brazing is easily adapted to mass production and it is easy to automate because the individual process parameters are less sensitive to variation.

5.2.4 Disadvantages:

- One of the main disadvantages is the lack of joint strength as compared to a welded joint due to the softer filler metals used.
- The strength of the brazed joint is likely to be less than that of the base metal(s) but greater than the filler metal.
- Another disadvantage is that brazed joints can be damaged under high service temperatures.
- Brazed joints require a high degree of base-metal cleanliness when done in an industrial setting. Some brazing applications require the use of adequate fluxing agents to control cleanliness.
- The joint colour is often different from that of the base metal, creating an aesthetic disadvantage.

5.3 Thermal Spray

Thermal spraying techniques are coating processes in which melted (or heated) materials are sprayed onto a surface. The "feedstock" (coating precursor) is heated by electrical (plasma or arc) or chemical means (combustion flame).

Thermal spraying can provide thick coatings (approx. thickness range is 20 microns to several mm, depending on the process and feedstock), over a large area at high deposition rate as compared to other coating processes such as electroplating, physical and chemical vapor deposition. Coating materials available for thermal spraying include metals, alloys, ceramics, plastics and composites.

They are fed in powder or wire form, heated to a molten or semi-molten state and accelerated towards substrates in the form of micro-meter size particles. Combustion or electrical arc discharge is usually used as the source of energy for thermal spraying. Resulting coatings are made by the accumulation of numerous sprayed particles. The surface may not heat up significantly, allowing the coating of flammable substances.

Coating quality is usually assessed by measuring its porosity, oxide content, macro and micro-hardness, bond strength and surface roughness. Generally, the coating quality increases with increasing particle velocities.

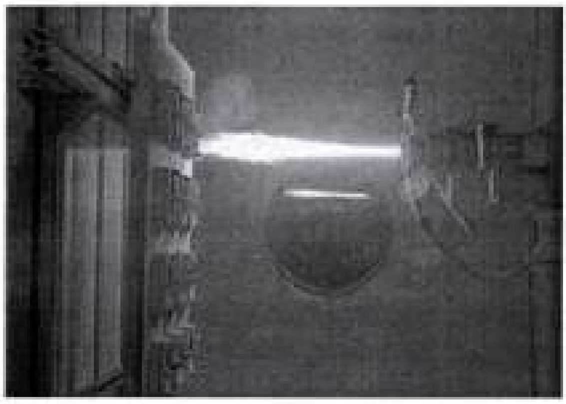

Figure 5.3. Thermal Spray

Thermal spraying need not be a dangerous process if the equipment is treated with care and correct spraying practices are followed. As with any industrial process, there are a number of hazards of which the operator should be aware and against which specific precautions should be taken. Ideally, equipment should be operated automatically in enclosures specially designed to extract fumes, reduce noise levels, and prevent direct viewing of the spraying head.

Such techniques will also produce coatings that are more consistent. There are occasions when the type of components being treated, or their low production levels, require manual equipment operation. Under these conditions, a number of hazards peculiar to thermal spraying are experienced in addition to those commonly encountered in production or processing industries.

The atomization of molten materials produces a large amount of dust and fumes made up of very fine particles (ca. 80–95% of the particles by number <100 nm). Proper extraction facilities are vital not only for personal safety, but to minimize entrapment of re-frozen particles in the sprayed coatings. The use of respirators fitted with suitable filters is strongly recommended where equipment cannot be isolated.[13] Certain materials offer specific known hazards:

1. Finely divided metal particles are potentially pyrophoric and harmful when accumulated in the body.
2. Certain materials e.g. aluminium, zinc and other base metals may react with water to evolve hydrogen. This is potentially explosive and special precautions are necessary in fume extraction equipment.

5.4 Spark Erosion Grinding

The SEG system has been used to machine honeycomb seals and rings for jet engines. Instead of replacing these expensive components, the SEG system can reshape the honeycomb at a fraction of the cost of new replacement parts.

The SEG process is efficient and superior to the mill-type remanufacturing process- typically reducing machine time by 30 to 50%. The process is simple. For cylindrical parts, the SEG-125 system is easily adapted to an existing processing center; typically a lathe or turning center is used to secure the honeycomb part and provide part rotation.

The SEG spindle is mounted to the cross slide and fed into the part for stock removal. AC Electrical current is fed through the spindle arbor to form a controlled arc between electrode wheel and the metallic honeycomb. As the SEG spindle is fed into part the electric arc erodes away the honeycomb to machine the part to finished diameter.

Technically, when two current carrying dissimilar metals are in contact, a sparks travels at the point of contact which erodes the small metal by making a cavity. In a Vessel, different metals are used to building propeller, hull, bedplate, crankshaft, bearing etc.

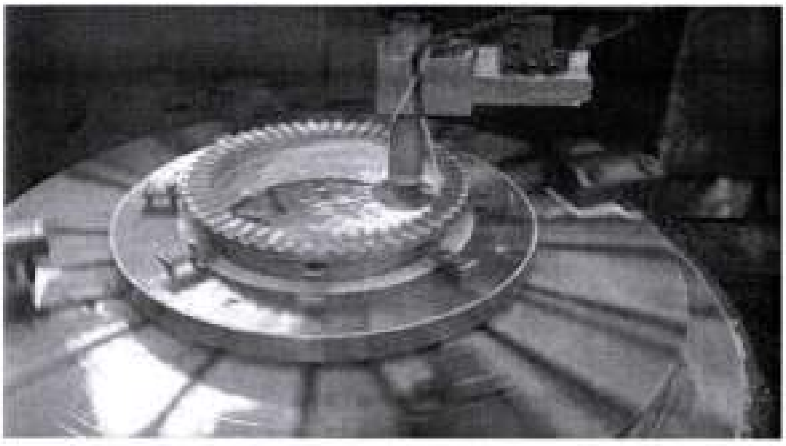

Figure 5.4. Spark Erosion Grinding

The piece being worked on is soaked in a dielectric liquid. The machine is fitted with state of the art motion electronics and hydraulics. These allow the electrode to move closer to the workpiece. This produces sparks that move between the workpiece and the electrode gently cutting through the workpiece.

A puddle is created by the spark (also known as the hot plasma) as a result of the workpiece being melted by the electrical discharge produced by the electrode. The small amount of dielectric is vaporised which creates bubbles around the spark. On average, this process is repeated over 10,000 times per second.

5.5 Air Flow Test

The movement of air through a complex electronic product, or through a simple duct, results in the air flow being restricted compared to air flow in free space. The product therefore has an impedance to airflow. This impedance can be measured by forcing air to flow through the product, using a calibrated airflow test chamber, and measuring the pressure difference between the inlet and outlet of the product.

This pressure difference (typically measured in the USA in units of "inches of water") increases as the quantity of air (typically measured in the USA in units of cfm, cubic feet per minute) increases. One thereby obtains the product "impedance curve" showing the pressure difference increasing from zero at zero airflow and increasing with increasing cfm. This curve typically increases faster than linearly at low airflow rates and in the typical intended operating range.

The airflow performance curve is also measured using a calibrated airflow test chamber. Here we are measuring the performance of an air moving device such as a fan or blower. When the fan is operated in a free field, its airflow performance is high. As the impedance to airflow increases, the amount of airflow decreases. The airflow performance curve is also typically plotted as pressure versus airflow. In the USA this is again typically in units of inches of water versus cfm.

Figure 5.5. Air Flow Test

The air flow test tubes can be used until the "white smoke" has completely disappeared. If the test is completed before all the smoke disappears, the tube can be sealed again using the rubber cap provided. Smoking sulfuric acid is located in the tubes. When the top of the tube is opened, a small rubber ball is used to pump air through the tube. This creates visible white smoke, which is carried on any existing air flows.

In many fields, such as mining or industry, it is very important to detect even the smallest air flows, in order to quickly and reliably evaluate the possible diffusion of dangerous substances. With the air flow test tubes, the source, direction and speed of the air flow are visible immediately.

5.6 Welding

Welding is a fabrication process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool, causing fusion. Welding is distinct from lower temperature techniques such as brazing and soldering, which do not melt the base metal (parent metal).

In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material. Pressure may also be used in conjunction with heat or by itself to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized.

Many different energy sources can be used for welding, including a gas flame (chemical), an electric arc (electrical), a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding may be performed in many different environments, including in open air, under water, and in outer space. Welding is a hazardous undertaking and precautions are required to avoid burns, electric shock, vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radiation.

The process is versatile and can be performed with relatively inexpensive equipment, making it well suited to shop jobs and field work. An operator can become reasonably proficient with a modest amount of training and can achieve mastery with experience. Weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag, the residue from the flux, must be chipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though special electrodes have made possible the welding of cast iron, stainless steel, aluminium, and other metals.

Figure 5.6. Welding Process

5.7 Electrical Discharge Machining

Electrical discharge machining (EDM), also known as spark machining, spark eroding, die sinking, wire burning or wire erosion, is a metal fabrication process whereby a desired shape is obtained by using electrical discharges (sparks). Material is removed from the work piece by a series of rapidly recurring current discharges between two electrodes, separated by a dielectric liquid and subject to an electric voltage. One of the electrodes is called the tool-electrode, or simply the *tool* or *electrode*, while the other is called the workpiece-electrode, or work piece.

The process depends upon the tool and work piece not making physical contact. When the voltage between the two electrodes is increased, the intensity of the electric field in the volume between the electrodes becomes greater, causing dielectric break down of the liquid, and produces an electric arc. As a result, material is removed from the electrodes.

Once the current stops (or is stopped, depending on the type of generator), new liquid dielectric is conveyed into the inter-electrode volume, enabling the solid particles (debris) to be carried away and the insulating properties of the dielectric to be restored. Adding new liquid dielectric in the inter-electrode volume is commonly referred to as flushing. After a current flow, the voltage between the electrodes is restored to what it was before the breakdown, so that a new liquid dielectric breakdown can occur to repeat the cycle.

Electrical discharge machining is a machining method primarily used for hard metals or those that would be very difficult to machine with traditional techniques. EDM typically works with materials that are electrically conductive, although methods have also been proposed for using EDM to machine insulating ceramics. EDM can cut intricate contours or cavities in pre-hardened steel without the need for heat treatment to soften and re-harden them. This method can be used with any other metal or metal alloy such as titanium, hastelloy, kovar, and inconel. Also, applications of this process to shape polycrystalline diamond tools have been reported.[13]

EDM is often included in the "non-traditional" or "non-conventional" group of machining methods together with processes such as electrochemical machining (ECM), water jet cutting (WJ, AWJ), laser cutting and opposite to the "conventional" group (turning, milling, grinding, drilling and any other process whose material removal mechanism is essentially based on mechanical forces).

Ideally, EDM can be seen as a series of breakdown and restoration of the liquid dielectric in-between the electrodes. However, caution should be exerted in considering such a statement because it is an idealized model of the process, introduced to describe the fundamental ideas underlying the process. Yet, any practical application involves many aspects that may also need to be considered. For instance, the removal of the debris from the inter-electrode volume is likely to be always partial.

Thus, the electrical properties of the dielectric in the inter-electrodes volume can be different from their nominal values and can even vary with time. The inter-electrode distance, often also referred to as spark-gap, is the result of the control algorithms of the specific machine used. The control of such a distance appears logically to be central to this process. Also, not all of the current between the dielectric is of the ideal type described above: the spark-gap can be short-circuited by the debris.

The control system of the electrode may fail to react quickly enough to prevent the two electrodes (tool and workpiece) from coming into contact, with a consequent short circuit. This is unwanted because a short circuit contributes to material removal differently from the ideal case. The flushing action can be inadequate to restore the insulating properties of the dielectric so that the current always happens in the point of the inter-electrode volume (this is referred to as arcing), with a consequent unwanted change of shape (damage) of the tool-electrode and workpiece. Ultimately, a description of this process in a suitable way for the specific purpose at hand is what makes the EDM area such a rich field for further investigation and research.

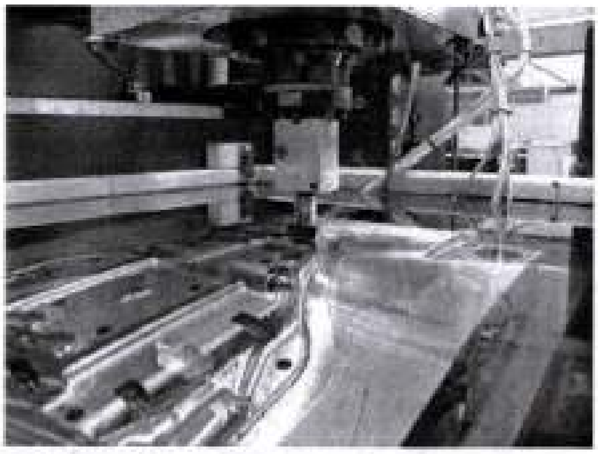

Figure 5.7. Electrical Discharge Machining

EDM is an important process in the field of micro machining. However, a number of issues remain to be solved in order to successfully implement it in an industrial environment. One of these issues is the processing time. This paper investigates the optimisation of machining parameters for rough and fine machining in micro EDM. In one case, the parameters are selected to achieve the highest material removal rate (MRR).

In the other case, the best surface roughness is targeted. Some of the main difficulties linked with micro EDM are caused by the high wear occurring on the electrode. The study focuses on a specific combination of electrode and workpiece material and proposes a typical method for micro EDM process optimisation.

CHAPTER – 6 TASKS DONE DURING INTERNSHIP PERIOD

I found my internship to be fulfilling, challenging, and enjoyable. For me, it was enjoyable to participate in Quality Department. I learnt many aspects of the quality process from start to finish-activities such as Statistical Process Control (SPC) Data, Mini Tab, Ecav Software, Manufacturing Execution System (MES), Inspection Plans, Ballooning Drawings. My internship had a duration of six months. the internship gave me opportunities to learn and participate in aspects of the production process. I had the opportunity to develop a routine and a work process that I could practice. It was also very exciting and interesting to interact with so many people who collaborate to make the news happen.

6.1 Statistical Process Control (SPC)

Statistical process control (SPC) is defined as the use of statistical techniques to control a process or production method. SPC tools and procedures can help you monitor process behaviour, discover issues in internal systems, and find solutions for production issues.

I had collected the Least Square Centring (LSC) & Datum Values and of different ring and case parts of the aircraft from Quality Control Laboratory and worked on the statistical control charts. I have also identified the type of machines on which the specific operation is done for that part.

- SPC tools help monitor process behaviour, find issues in internal systems, and discover solutions for production problems. SPC charts are one of the starting points for any Lean Six Sigma project. As such, it is important to understand these statistical control charts well to keep a process under control.
- One of the popular software for data analysis and quality improvement is Minitab. Real-Time SPC powered by Minitab provides real-time capabilities and trusted analysis for process monitoring in a comprehensive solution.

6.2 Mini Tab

Minitab has been the leading software for data analysis and quality improvement. real-time SPC powered by Minitab has the real-time capabilities and trusted analysis you need to take your process monitoring to the next level all in one convenient and comprehensive solution.

I used Mini Tab software to analyse the Statistical Process Control Data Analysis. I learnt t tests, one and two proportions, normality test, chi-square, and equivalence tests of Mini Tab and applied it on the SPC Data collected. It is easier to learn and helps to solve large data sets. It can help you to identify patterns and trends and to make predictions about future events.

6.3 Ecav Software

I had learnt Ecav Software on various applications of aircraft parts. Generally, Ecav is used for assigning the characteristic number to an operation done on that specific part and also describing about its GD&T specifications. It is a tool designed with an awareness of industry methods and requirements to rapidly deliver concise AV documents for their organizations.

It focuses on drawings first and takes a very specific approach to engineering documentation-based user testing, review, experience, and refinement. It provides a host of integrated features and the ability to quickly visualize a project's size and scope and wiring infrastructure either before or after choosing products.

6.4 Manufacturing Execution System (MES) Software

I had acquired skills regarding MES Software which basically helps to create manufacturing orders and track the Production Execution. It provides functions and processes to prepare, plan and execute factory floor operations uniformly, track progress at real-time and increase agility to align as the day demands.

Here, I worked on created various work orders of aircraft ring and case parts and tracked its production execution. MES is critical for Smart Digital Transformation. It provides the layer for direct execution of production orders and dynamic response to changing situations in orders, machine statuses, quality checks and more for the self-organised plant.

Figure 6.1. Manufacturing Execution System Software Methodology

The process starts with procuring the raw material from certified vendors and is followed by a process of machining-heat treatment-welding- heat treatment- thermal coating and Inspection processes of Fluorescent

Penetrating Inspection and radiography apart from stage and final dimensional inspection. Parts will have a specific flow with the defined combination processes and shall be documented in the PFD / Route.

The processes at TASL are grouped into specific areas and follow a specific pattern which includes:

- Receive and schedule the order on the machines
- Raise tool request in Tool Crib 24 hours prior to the initiation of the operation

Order is received and scheduled on machines for the machining operations, tool request is raised to Tool Crib at least 24 hours in advance to the start of operation. Part fixture is prepared in parallel. Once the Fixture and tools are received and verified, and the respective machining operation is started by the operator. The in-process inspection is carried out by the operator and the final inspection is completed by QA after the machining operations. The job can go through one or multiple machines for different operations and then routed for Heat Treatment after inspection.

Heat treatment follows a batch operation, where parts with similar heat treatment requirements are grouped together in a batch. After successful completion of Heat Treatment, specific parts undergo Welding and Thermal Spray for coating. Inspection processes of Fluorescent Penetrating Inspection and radiography apart from stage and final dimensional inspection are complete on parts before they are Okayed for dispatch.

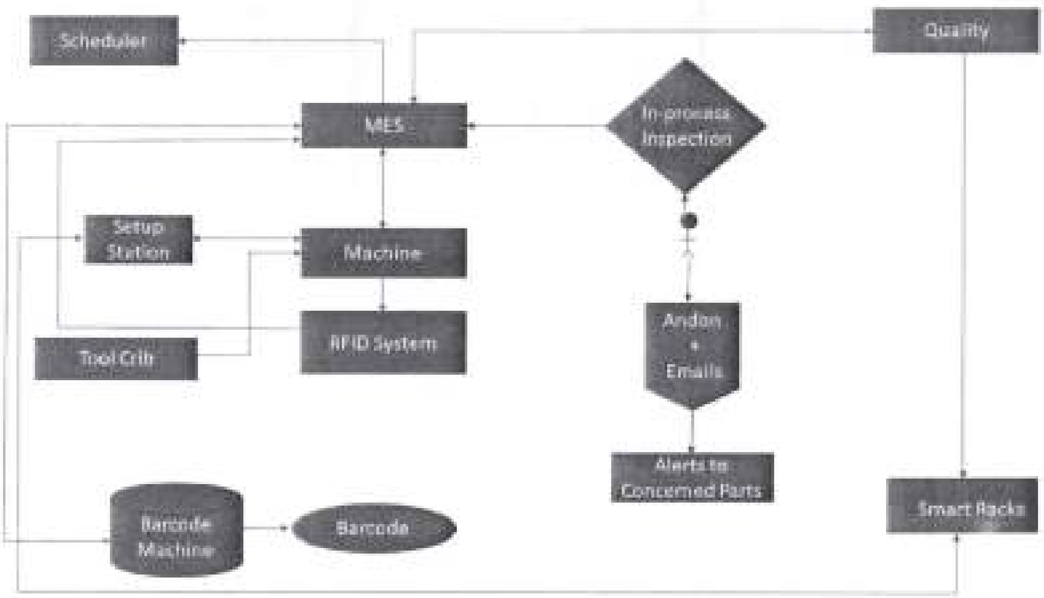

Figure 6.2. MES Flow Chart Representation

6.5 Inspection Plans

I used to prepare various Inspection plans on different operations done for different ring & case parts of aircraft. I also prepared Inspection Plans for Heat Treatment, Brazing, Welding, Electrical Discharge Machining (EDM), Thermal Spray and Spark Erosion Grinding too.

These Inspection plans are necessary and helps to ensure that there are no defects and thus availing plane to fly safely. These Inspections Plans give information regarding the Inspections that indicate any possible problems that may exist before take-off, allowing the pilot-to-be assess.

The Inspection Plans generally consists of Part number, Character Number, Sheet Zone & Number, Engineering Specifications, Drawing Items, character class, Results of Inspection, Equipment/ Instrument used and Acceptance Plan with Remarks. So, from this Inspection plans we can able to analyse its acceptance and any remarks given for specific operation of that part.

6.6 Ballooning Drawings

I worked on ballooning drawings which helps to identify a part or assembly listed in the parts list by labelling them in the drawing.

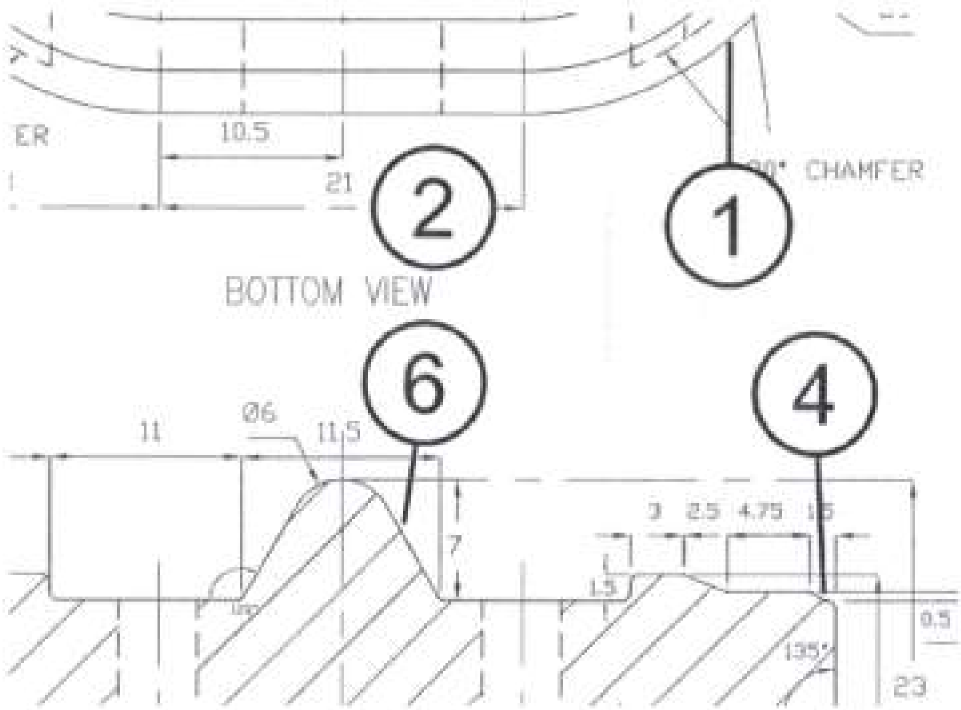

Figure 6.3. Ballooning Drawing

6.6.1 Steps to create Ballooning for Engineering Drawing

Step:1 Open a Drawing File.

Step:2 Move the Mouse Pointer to where you want to bubble.

Step:3 Using the ballooning symbol, place the balloon in the drawing with required characteristic number.

Step:4 Repeat the process for ballooning all the characteristic numbers of the Engineering drawing.

CHAPTER – 7 LEARNING EXPERIENCE

During the internship period, I realized that collaboration and cooperation are things which are absolutely crucial to quality work happening. Quality Assurance is definitely a group effort. Having social and communication skills are just as important as having quality skills. If a person cannot get along well with others, that person will have a short-lived and likely unfulfilling career in Quality Department.

I learned about just how much patience and discipline are required for research, creating plans and using software applications. I am fortunate that I already retain some of the qualities necessary to do well in such activities and processes. I am also a person whose has the ability to achieve and maintain focus. When I have a task at hand, I know how to achieve and maintain focus from the start of the task until the task is completed.

From my internship I learned that I have strong time management skills. I had no problems completing my work within a specific time frame or by a specific deadline. I also was able to utilize the resources provided to me very well and on time. On the other hand though, there were things that I learned in the internship that I would have never been able to learn just from the classroom experience. I learned much more intensely about my strengths and weaknesses personally and professionally. Now I have my own real-life experience with the quality process of Aircraft Manufacturing Those are things I could not learn from a book or in a classroom. This is one way in which my internship proved valuable.

As a student, it is fairly unknown how one would fair in the real professional world. We never know which qualities about ourselves will help us or hurt us professionally. My experience as a Quality intern gave me a clearer sense of what about me lends itself to this kind of work as well as what about me should be improved upon to be a better professional whenever my next Quality Department opportunity may be.

In this way, the internship in Quality Department, TASL gave me confidence in myself as well as motivation to be better. Quality Assurance is already a challenge in of itself; lacking personal traits that lend themselves to the work only makes the work all the more arduous. These are some ways the internship connected to my personal and professional lives.

7.1 Contribution to the Company

During my Internship as a Quality Intern for 6 months, I had worked on Statistical Process Control (SPC) Data, Mini Tab, Ecav Software, Manufacturing Execution System (MES), Inspection Plans, Ballooning Drawings. I had collected the Least Square Centring (LSC) & Datum Values and of different ring and case parts of the aircraft from Quality Control Laboratory and worked on the statistical control charts. I have also identified the type of machines on which the specific operation is done for that part.

I used Mini Tab software to analyse the Statistical Process Control Data Analysis. I works on t tests, one and two proportions, normality test, chi-square, and equivalence tests of Mini Tab and applied it on the SPC Data collected. It can help you to identify patterns and trends and to make predictions about future events.

I had learnt Ecav Software on various applications of aircraft parts. Generally, Ecav is used for assigning the characteristic number to an operation done on that specific part and also describing about its GD&T specifications. It is a tool designed with an awareness of industry methods and requirements to rapidly deliver concise AV documents for their organizations. I had acquired skills regarding MES Software which basically helps to create manufacturing orders and track the Production Execution. It provides functions and processes to prepare, plan and execute factory floor operations uniformly, track progress at real-time and increase agility to align as the day demands.

I used to prepare various Inspection plans on different operations done for different ring & case parts of aircraft. I also prepared Inspection Plans for Heat Treatment, Brazing, Welding, Electrical Discharge Machining (EDM), Thermal Spray and Spark Erosion Grinding too. I worked on ballooning drawings which helps to identify a part or assembly listed in the parts list by labelling them in the drawing.

CHAPTER – 8 CONCLUSION

From this Internship, I learned that I would have never been able to learn just from the classroom experience. I learned much more intensely about my strengths and weaknesses personally and professionally. The internship was a useful experience. I have found out what my strengths and weaknesses are; I gained new knowledge and skills and met many new people. I have boosted my Skills during the internship period.

After years of studying Aeronautical Engineering, I have my own real-life experience with the Quality process of different ring & case parts. I come across the process how the industry work as union where each department has its individual importance. This is one way in which my internship proved invaluable.

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