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12th Edition

DGAQA MAGAZINE ON AVIATION QUALITY ASSURANCE

ENSURING FLIGHT SAFETY THROUGH QUALITY ASSURANCE

आत्मनिर्भर भारत

आज़ादी का अमृत महोत्सव

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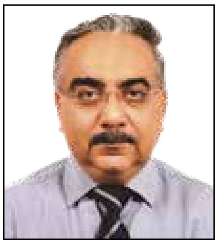
Inside

Articles/ suggestions may be sent to Senior Editor on email ID- dirtc.dgaqa@gov.in.
Every Article forwarded may be accompanied by a brief bio data and passport size photograph of the author.

सत्यमेव जयते

संजय चावला
महानिदेशक

S. Chawla
Director General



भारत सरकार
रक्षा मंत्रालय
वैमानिक गुणवत्ता आश्वासन महानिदेशालय
डिफेंस ऑफिस काम्प्लेक्स, सातवीं मंजिल,
'ए' ब्लॉक, के. जी. मार्ग, नई दिल्ली-110001

GOVT OF INDIA
MINISTRY OF DEFENCE
DIRECTORATE GENERAL OF
AERONAUTICAL QUALITY ASSURANCE
DEFENCE OFFICE COMPLEX, 7TH FLOOR,
'A' BLOCK, K. G. MARG, NEW DELHI-110001
Tele: 011-21411801 Fax: 011-21411892
Website: www.dgaeroqa.gov.in
E-mail: dg.dgaqa@gov.in

04th May 2023

MESSAGE

This edition of 'Vaimaniki Darpan' showcases the organization's participation in the 14th Aero India-2023 held at Bengaluru from 13th to 17th Feb 2023. The event provided an opportunity for the organization to disseminate DGAQA's role, function and responsibility in Quality Assurance of Military Aviation Stores and the whole ambit of the organization's activities was on show. The DGAQA stall was visited by Dignitaries, Senior Functionaries, Foreign and Indian OEMs, MSMEs as well as common public making the endeavor more participative and highly successful.

2. The inspiration to uphold the organizational ethos and achieve DGAQA objectives was the fulcrum that provided exceptional energy and motivation to all the officers and staff. An emphasis was given to spread quality consciousness and upgrade the knowledge of MSMEs and private industries in Quality Management Systems since they are essential partners in realizing the goal of self reliance in Military Aviation.

3. Coming to the present edition of 'Vaimaniki Darpan', the articles in the magazine provide a rainbow of technical subjects e.g. Process Capability Analysis, Corrosion, AS-9145 Standard Requirements, Drogue Light and Artificial Intelligence Applications in Defence. The participation of the DGAQA fraternity in providing inputs to the magazine is also commendable.

Wishing all the DGAQA fraternity all the best for their future endeavors to keep the DGAQA flag flying high.

Jai Hind!

(S.Chawla)

PROCESS CAPABILITY ANALYSIS

Joginder Kumar
Director
HQ DGAQA

''If you can't describe what you are doing as a process, you don't know what you're doing'' an quote by renowned quality guru W. Edwards Deming. So process capability indicates that if your process is not capable enough then it will cause defect. In this context we need to understand the difference between effectiveness and efficiency. Effectiveness means doing right things and efficiency means doing the things correctly. So if someone is efficient but not effective, then it hasn't any value. Because we do a thing correctly which is itself wrong. Hence, first question will arise whether my process is correct or not and then whether we are performing the process correctly or not. Hence first we have to see how my process is capable enough to meet the specification limit of product or service and if it is not then we have to take some corrective steps to make my process capable.

What is Process Capability

Process capability is defined as the inherent variability of a characteristic of a process. It represents the performance of the process over a period of stable operations. Process Capability is expressed as 6 σ, where σ is the sample standard deviation of the process under a state of statistical control. A process is said to be capable when the output always conforms to the process specifications. 1st it should be confirmed whether the process is under statistical control or not (by the means of QC tools like control chart, bar chart etc) and then we only can go for process capability analysis. If my process is not under statistical control then 1st task to bring back the process under statistical control.

Need of process capability study

i) Predicting so as to hold tolerances.

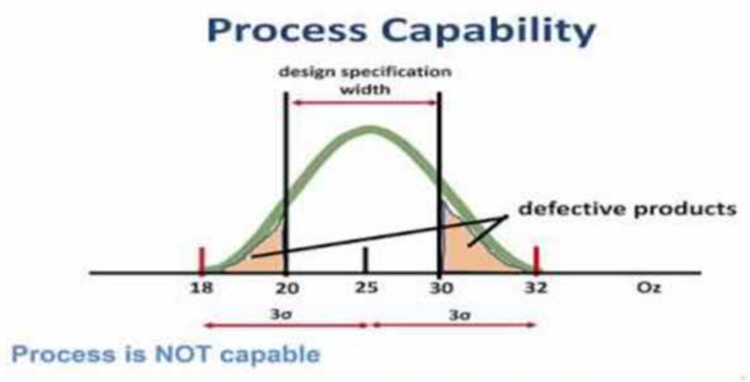
ii) Assisting designers in selecting or designing processes.

iii) Establishing an interval between sampling.

iv) Specifying requirement of new equipment.

v) Selecting between vendors (Process capability of vendors must be analyzed)

vi) Reducing variability in manufacturing process.



When to conduct process capability study

i) Prior to taking delivery of new process equipment or developing new process. (ii) Before approving newly installed process equipment for production use.

(iii) On an ongoing basis to verify continuing capability.

(iv) when out of specification conditions are found.

Process Control

Sources of variation in a process occurs due to Common cause and Special Cause. Variation arises due to Common cause is part and parcel of the process, hence it can not be fully eliminated and should not be bothered about. Where as corrective action is taken to identify and eliminate special causes.

Whether my process is under statistical control or not can be analyzed by control chart as given in figure (i) :-

Once it is established that the process comes under statistically controlled, then we need to reduce the variation in the process, because as we reduce the variation then it will reduce defects and will ultimately achieve six sigma quality control [Table (i) and (Fig (ii)]

Measurement of Process Capability (CP & CPK)

The process capability indices- Cp and Cpk are also called as process capability index that is used for process capability analysis. Process capability analysis is carried out to measure the ability of a process to meet the specifications.

Process capability – Cp: This is defined as the tolerance width divided by the total spread of

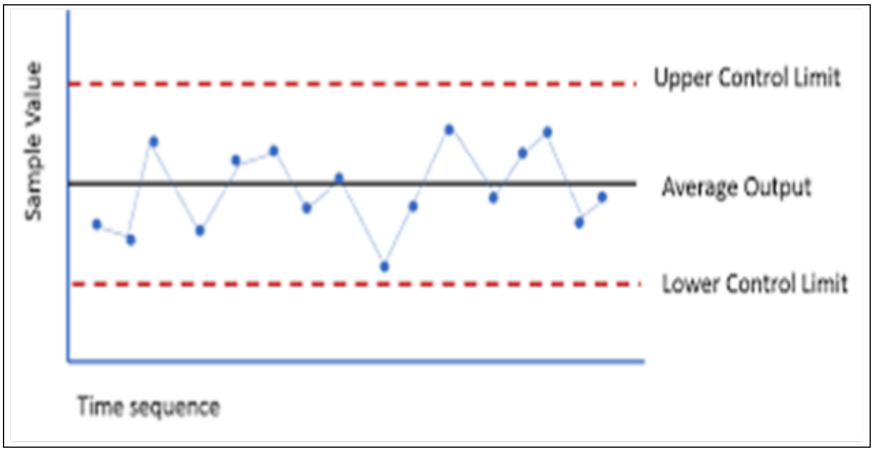


Fig. (i) (a) Process is under statistical control

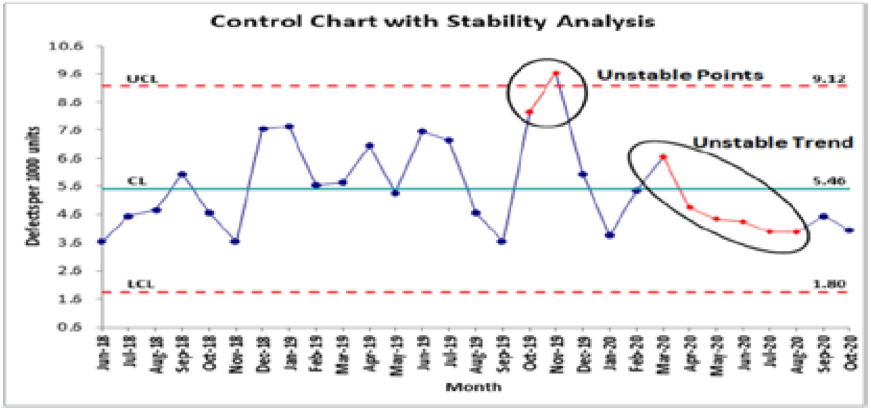
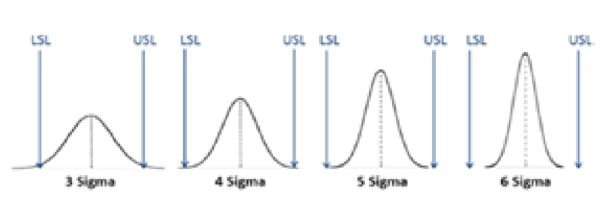


Fig (i) (b) Process is not under statistical control

Sl. No.	Sigma Level	Defect Rate (DPMO)	Yield% Goods	CP Value
1	1σ	691462	30.9	0.33
2	2σ	308770	69.10%	0.67
3	3σ	66811	93.33%	1
4	4σ	6210	99.40	1.33
5	5σ	233	99.98%	1.67
6	6σ	3.44	99.99967%	2.0

Table (i)



process (6 Sigma). **Cp indicates the spread of variation present in a process.**

CP = USL-LSL (Where USL= Upper Specification limit & LSL= Lower Specification limits, σ= Std dev)

Here USL and LSL is specified by customer, hence represent voice of the customer where as σ represents variation in the process, hence voice of the process.

So, CP= Voice of the customer/ Voice of the process.

Interpretation of CP value

When the Cp value is greater than 1 (Cp value >1): The process spread is less and all products fall within the specification limit. Here the process is said to be quite capable of meeting the specification limit.

When the Cp value is equal to 1 (Cp value =1): The process spread is little wide but running within the designed specification limit. Here the process is said to be just capable of meeting the specification limit.

When the Cp value is less than 1 (Cp value <1): The process spread is large and most of the products fall outside the specification limit. Here the process is said to be incapable.[Figure (iii)]

Process Capability Index – Cpk:

This is the process capability index that accounts for the centering of the process and is defined as the Cpk upper and Cpk lower. Cpk is a measure of process performance capability.

Cpk indicates shifting or closeness of process average from the target or mean value (µ).

Cpk = min (USL -µ/ 3 σ, µ-LSL/ 3 σ) (Where µ= mean)

CPK defines shifting of mean and shifting of mean may produce defect.

Interpretation of CPK value

When the Cpk value is less than 1 i.e. Cpk value <1:Indicates that the mean of the process is shifted from target and defects will be produced. When the Cpk value is greater than 1 i.e. Cpk value >1: The center or mean of the process may be shifted from target but still the process is capable of meeting design specification.

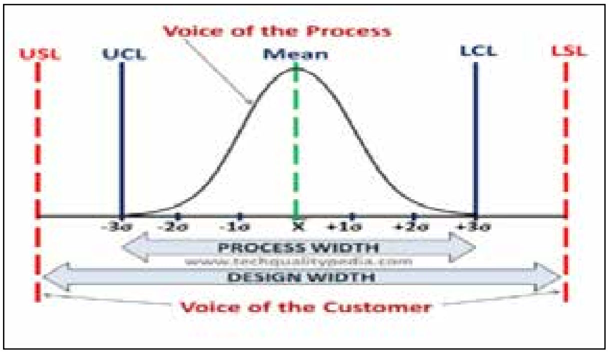


Fig (iii) UCL= Upper Control limit within process & LCL= Lower Control limit within process

Calculation of CP and CPK value with example

Food served at a restaurant should be between 38 0C and 49 0C when it is delivered to the customer. The process used to keep the food at the correct temperature has a process standard deviation of 1 0C and the mean value for these temperatures is 40. Now what will be capability index CP and CPK of the process?

USL (Upper Specification Limit) =49 and LSL (Lower Specification Limit) =39

Standard Deviation =1

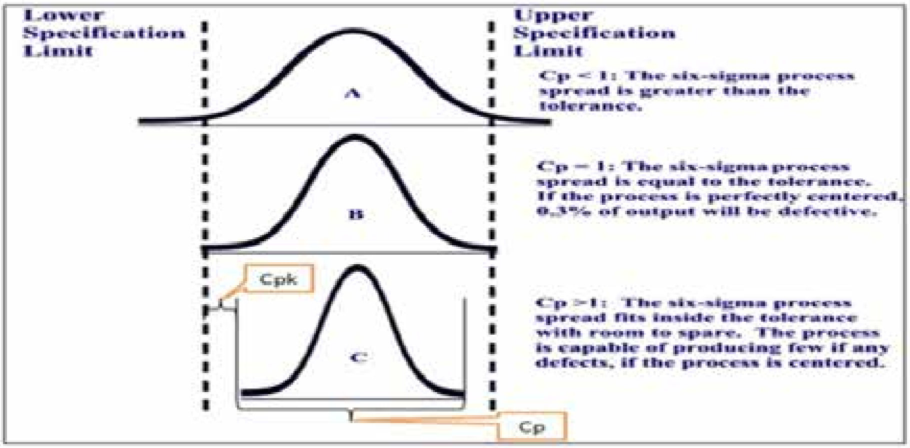


Fig (iv)

Mean = 40

Cpk formula is:

Cpk=min(USL−mean3σ,mean−LSL3σ)

=min {(49–40)/3, (40–39)/3}

=min(9/3,1/3)

= min (3, 0.33)

Hence CPK=0.33

CP=USL-LSL/6σ = (49-39)/6 = 10/6 = 1.66

Hence in this case Mean shifted towards Lower Specification Limit i.e LSL as given in Fig (v).

Relationship between CP and CPK

When Cp value equal to Cpk (Cp=Cpk) : The Process means is said to be at center. When Cp is not equal to Cpk it indicates shifting of mean.

In the Fig (vi)

i) CP value= 2 means process have minimal variation to meet six sigma certification and and CPK Value is 2 means mean is exactly in centre.

ii) CP=2 and CPK= 1.0 means process is capable however mean is shifted. Hence local action is required to shift the mean to centre.

iii) CP=2 and CPK≤0 then mean is shifted so much hence management intervention is required to bring back the mean to centre.

Note:- When mean of the process = Upper Specification Limit i.e USL , in that case CPK will become Zero and when mean of the process > USL , in that case CPK will become negative.

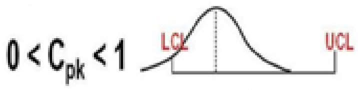
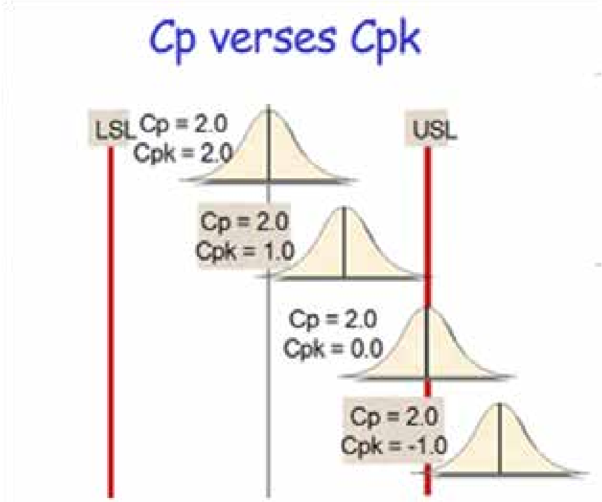


Fig (v)



About the Author:- Shri Joginder Kumar, Director is posted at HQrs, New Delhi and joined DAQAS Service in April 2001.

CORROSION
AN INEVITABLE "DEMON"

Sanjay Gaur
Dy. Director
HQ DGAQA

Corrosion is considered as the most inevitable demon for the Aviation industry and creates havoc by catastrophic structural failure without warning, leading to loss of costly machines and men. Few examples of drastic tragedy due to evil effect of corrosion causing loss to human beings are given below:

"US Air force F-16 Crashed due to electrical Connector Corrosion which led to closure of main fuel shutoff Valve uncommanded."

"In July 2017, US Navy Transport Plane KC-130T crashed due to corroded propeller blade came off during mid flight resulting into death of all crew members onboard"

"How can one forget the largest Industrial disaster of Bhopal Gas Tragedy in 1984, due to Toxic gas leakages from the corroded pipelines resulting in to death of more than 10000 people."

While the aerospace industry is continuously developing new prevention techniques and better materials to overcome this maniac, but the progress is offset partly by a more aggressive operational environment in which the aviation sector especially Military Aviation has to operate and partly by the complexity of the corrosion phenomenon, which can take many different forms. From above, it may be inferred that the Demon i.e. corrosion is inevitable but the detrimental toothing of the demon can be neutralised through an effective corrosion control techniques. This article is an attempt to make aware the readers about the phenomena of corrosion and various techniques to effectively counter these detrimental phenomena in the aviation industry.

What is Corrosion

In order to deal with the corrosion maniac, it is paramount to have the clear understanding about the phenomena and complexity of corrosion and its effects. Corrosion is a natural phenomenon which attacks metal by chemical or electrochemical action and converts it into a metallic compound, such as an oxide, hydroxide, or sulphate. Corrosion is different from erosion, which causes destruction by mechanical action. The corrosion occurs because metals tend to return to their natural state. Four conditions must exist before corrosion can occur

1. Presence of an anode, or a metal that will corrode;
2. Presence of a cathode, a dissimilar conductive material which has less tendency to corrode;
3. Presence of an electrolyte, a conductive liquid or environment
4. Electrical contact between the anode and cathode, which is usually by metal-to-metal contact, or through a fastener.

Corrosion is considered most often a slow process of material deterioration, taking place over a long period of time. Examples are general corrosion, pitting, stress-corrosion cracking, environmental embrittlement, and corrosion fatigue and exfoliation. But once the corrosion process has initiated the degradation can occur very quickly, in days or even hours, and with catastrophic results.

Development of Corrosion.

All corrosive attack begins on the surface of the metal and gradually penetrates deep into the metal core. The corrosion process involves two chemical changes: 1) the metal that is attacked or oxidized undergoes an anodic change, and 2) the corrosive agent is reduced or undergoes a cathodic change. The corrosion occurs because metals tend to return to their natural state particularly where adverse environmental or weather conditions exist.

Factors Influencing Corrosion.

Some of the factors which influence metal corrosion and the rate of corrosion are as follow:

1. **Type of metal**. Metals have a wide range of corrosion resistance properties depending upon the chemical constituents and its chemical and physical behaviour when exposed to adverse weather condition. The most chemically active metals (which tend to lose electrons easily, such as magnesium and aluminum) corrode easily while the most noble metals (which do not lose electrons easily, such as gold and silver) do not corrode easily.

2. Heat treatment and grain direction cause stress corrosion and intergranular corrosion.

3. **Presence of a dissimilar metals**, less corrodible metal (galvanic corrosion) as per the position in the element table

4. **Anode and cathode surface areas (in galvanic corrosion)** When areas such as between faying surfaces or in deep crevices partially confine an electrolyte on a metal surface, that surface corrodes more rapidly than other metal surfaces which are outside this area. This area of corrosion is called an oxygen concentration cell. The reduced oxygen content of the confined electrolyte causes adjacent metal to become anodic to other metal surfaces immersed in electrolyte and exposed to air on the same part.

5. **Temperature.** High-temperature environments accelerate corrosion by increasing chemical reaction rates and retention of moisture content in saturated air.

6. **Presence of electrolytes** or electrically conductive solutions (such as hard water, salt water, or battery fluids) Electrolytes, or electrically conducting solutions, form when condensation, salt spray, rain, or rinse water accumulate on surfaces. Dirt, salt, acidic gases, and engine exhaust gases can dissolve on wet surfaces, increasing electrolyte conductivity and also the rate of corrosion.

7. Presence of different concentrations of the same electrolyte

8. **Presence of biological organisms** (microorganism). Slimes, moulds, fungi, and other living organisms, some of which are microscopic, can grow on damp surfaces. The area where such organisms become established tends to remain damp, increasing the possibility of corrosion.

9. **Mechanical stress on the corroding metal**. Manufacturing processes, such as machining, forming, welding, or heat treatment, can leave stresses in aircraft parts. This residual stress can cause

cracking in a corrosive environment when the threshold for stress-corrosion is exceeded.

10. **Time of exposure to a corrosive environment**. In some cases, corrosion progresses at the same rate no matter how long the metal has been exposed to an environment. In other cases, corrosion can decrease with time because of a barrier formed by corrosion products, or increase with time if a barrier is breaking down.

Different Forms of Corrosion:- The extend and type of corrosive attacks on the metal or structure will vary with the metal concerned, operating environment, corrosive media location, and the exposure time. Accordingly following types of corrosion generally occurs depending on the metal and corrosive media;

(i) Uniform Itech corrosion

(ii) Pitting Corrosion

(iii) Galvanic Corrosion

(iv) Crevice Corrosion

(v) Inter-granular Corrosion

(vi) Exfoliation Corrosion

(vii) Stress Corrosion

(viii) Fretting Corrosion

Corrosive Prone Areas In Aircraft

(a) **Exhaust Trail Area**:- Engine exhaust gas deposits are very corrosive. Gaps, seams, hinges, and fairings are areas where exhaust trail deposits may be trapped and normal cleaning methods cannot reach these areas.

(b) **Battery Compartments and Battery Vent Openings:** In spite of protective paint systems and extensive sealing and venting, battery compartments continue to be corrosion problem areas. Fumes from overheated battery electrolyte and spill over of electrolyte are difficult to contain and can spread to internal structures where unprotected surfaces can come under corrosive attack.

(c) **Wheel Wells and Landing Gear.** The wheel well area probably receives more punishment than any other area of the aircraft. It is exposed to mud, water, salt, gravel,and other flying debris from runways during Taxiing, Landing and takeoff .

(d) **Steel, Titanium, Corrosion Resistant Steel (CRES), and Nickel Alloy Fasteners.** Fasteners, and areas around these fasteners, are trouble areas. These areas are subject to high operational loads, moisture intrusion, loss of protective surface treatment due frequent tightening & loosening and dissimilar metal skin corrosion.

(e) **Faying Surfaces and Crevices.** Similar to corrosion around fasteners, corrosion in faying surfaces, seams, and joints results from intrusion of moisture and other corrosive agents. The effect of this type of corrosion is usually detectable by bulging of the skin surface.

(f) **Spot-Welded Skins**. Corrosion of this type is mainly the result of the entrance and entrapment of moisture or other corrosive agents between layers of metal and non treated weld zone areas.

(g) **Organic Composites.** Organic composites used in aircraft can cause different corrosion problems than all-metal structures. Composites such as graphite/ epoxy act as a very noble, or cathodic, material, creating the electrical potential for galvanic corrosion. The galvanic corrosion potential, coupled with different attachment methods, such as adhesive bonding, stepped structures, or locking mechanical fasteners, leads to multicomponent galvanic couples aggravated by high humidity and salt water environments

(h) **Water Entrapment Areas.** Corrosion will result from entrapment of moisture. Except for sandwich structures, design specifications usually require that the aircraft have low-point drains in all areas where moisture and other fluids can collect

(i) Engine Frontal Areas and Cooling Air Vents. Constant abrasion by airborne dirt and dust, bits of gravel from runways, and rain all tend to remove protective surfaces from engine frontal areas and cooling air vents.

(j) **Electrical Connectors:** Fretting corrosion between the contacts and ingress of moisture causes the intermittent operation of electrical function.

Corrosion Control Programme

In order to neutralised the evil effect of corrosion, certain corrosion Control programme are to be devised at all level, some of the critical areas where this can be effectively applied are as follows:-

Corrosion Control through Design: Since corrosion is the deterioration of metal resulting from a reaction between a metal and its environment, it is indispensable that some form of corrosion control or means to minimize corrosion should become part of an aircraft's design phase before the aircraft enters operational service. Corrosion control should be included in an aircraft's preliminary design phase as early as possible. The Type & nature of a material is a fundamental factor in corrosion. High-strength, heat-treatable aluminium and magnesium alloys are very susceptible to corrosion, while titanium and some stainless steel alloys are less susceptible in atmospheric environments. The aircraft manufacturer selects material for the aircraft based on material strength, weight, and cost, while corrosion resistance is often a secondary consideration for the designer. It is mandatory that the designer selects the right material & protective surface treatment during the design phase itself by striking a balance between strength, weight, cost and considering the long term effect on material due to aggressive environment.

Aluminium copper alloys (2000 series) are known to have better stress-corrosion resistance and better fatigue strength properties than aluminium zinc alloys (7000 series), so aircraft designers use them more often as the primary structural materials. Other corrosion resistance material used in aviation industry includes Titanium and Nickle alloy, Stainless steel, Composite etc.

Corrosion Control During Manufacturing/ Processing: During the production and processing, care should be taken to avoid machining stress, deformation during cold working and assembly operation, rough surfaces, cracks, chips, burrs, sharp corners, etc. to the extent possible as these becomes the probable areas for incipientation of corrosion, if not addressed properly. In addition special care should be taken during heat treatment of the parts to prevent overheating/unequal cooling and improper stress relieving. Stringent Process control to be ensured during surface treatment, Passivation, Coating, painting etc. to avoid entrapment of moisture, dirt/dust, foreign particles. Proper care in handling of surface platted/Coated finished parts to avoid damage to the Surface coating, specially the Oxidised/Anodized aluminium parts.

Corrosion Control during Operation: In-service stresses and field repairs may affect rates and types of corrosion during prolonged operation. Aircraft structures under high cyclic stresses, dynamic running movement, such as helicopter main rotors, Actuators, Connecting rods, Fasteners etc are particularly subject to stress-corrosion cracking. During the operation of the aircraft it should be noted that the overloading of the parts is avoided. During the base repair of the aircraft, OEM recommended repair practices should only be followed specially during weld repair because areas next to weld-repaired items often have corrosion due to insufficient weld flux removal or build up of a magnetic field. These stress prone areas should be closely inspected for any signs of corrosion and be properly treated, when noticed.

Corrosion Control through periodical Preventative Maintenance:

Corrosion prevention of aircraft structure depends on a comprehensive corrosion prevention and control plan, implemented from the start of operation of an aircraft. Operators must follow a constant cycle of cleaning, inspection, operational preservation, and lubrication to prevent corrosion. Prompt detection and removal of corrosion will limit the extent of damage to an aircraft and its components. The basic philosophy of a Corrosion Preventive programme should consist of:

1. Adequately-trained personnel in:
    - Recognition of corrosion-inducing conditions
    - Corrosion identification techniques
    - Corrosion detection, cleaning, and treating
    - Lubrication and preservation of aircraft structure and components.
2. Scheduled inspection for corrosion.

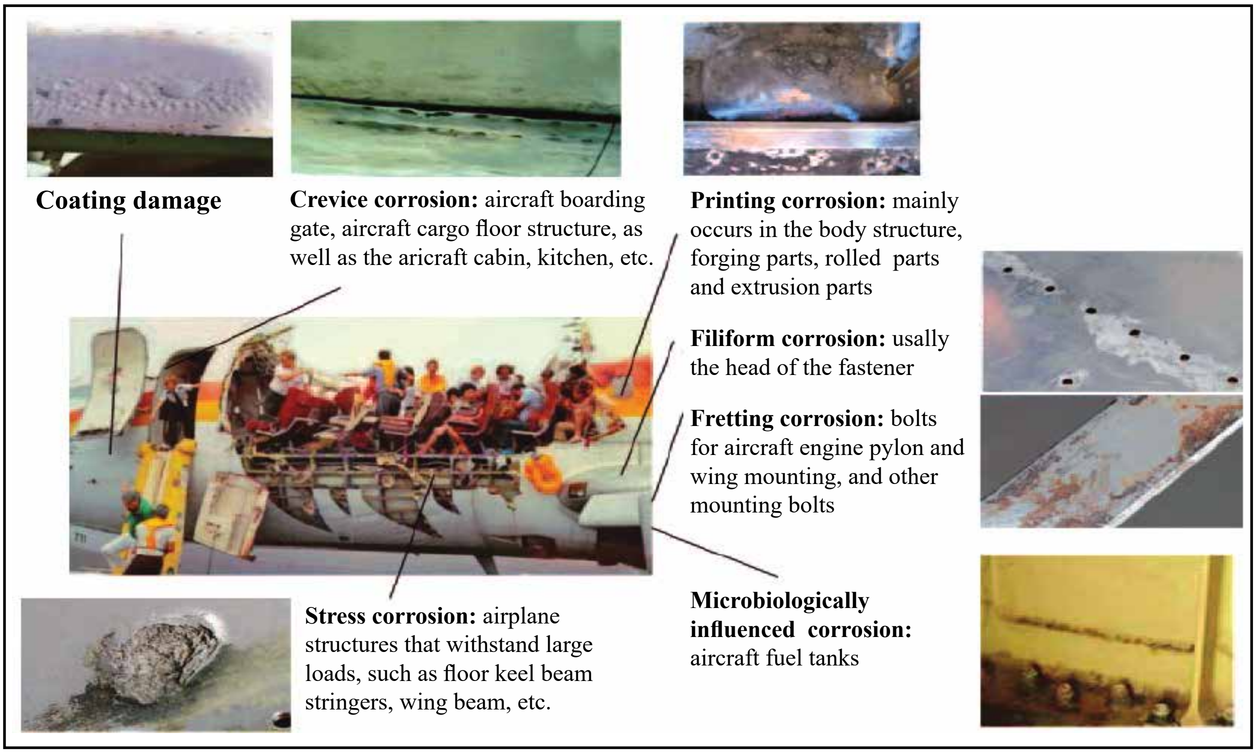
Periodic, thorough cleaning, inspection, lubrication, and preservation. Suggested intervals based on operating environment as per FAA are:

- Mild zones : every 90 calendar-days
- Moderate zones: every 45 calendar-days
- Severe zones : every 15 calendar-days.

3. Proper emphasis on the concept of all-hands responsibility for corrosion control
4. Aircraft washing at regularly scheduled intervals;
5. Routine cleaning or wipe down of all exposed unpainted surfaces
6. Keeping drains holes and passages open and functional
7. Scheduled inspections, removals, and reapplications of preservation compounds
8. Early detection and repair of damaged protective coatings
9. Periodic thorough cleaning, lubrication, and preservation
10. Prompt corrosion treatment after detection
11. Accurate recordkeeping and reporting of material or design deficiencies to the manufacturer and the Designer and regulatory agencies.
12. Replacing deteriorated or damaged gaskets and sealants, using noncorrosive type sealants, to avoid water intrusion and entrapment which leads to corrosion
13. Minimizing aircraft exposure to adverse environments, such as hangar storage away from salt spray
14. Paint coatings can mask initial stages of corrosion. Since corrosion products occupy more volume than the original metal, paint surfaces should be inspected often for such irregularities as blisters, flakes, chips, and lumps.

15. Use of appropriate materials, equipment, and technical publications.

The tendency of most metals to corrode creates one of the major problems in aircraft maintenance, particularly where adverse environmental or weather conditions exist. The evil effect of corrosion is well known to all in the Military Aviation and only way to overcome this problem is to have an effective CPCP in place at all levels. The possibility of an in-flight mishap or excessive down time for structural repairs mandates an active and stringent corrosion prevention and control program (CPCP) which is to be followed in letter and spirit in order to prevent the Financial loss and losses to human lives.



Corroded Propeller Blade Caused KC-130T Crash

About the Author:- Shri Sanjay Gaur, Dy. Dir Armt. is posted at HQrs, New Delhi and joined DAQAS Service in Aug 2009.

AS9145 - APQP & PPAP REQUIREMENTS FOR THE AEROSPACE & DEFENCE INDUSTRY

Gokulraj K
Senior Scientific Officer – I
ORDAQA(Engine), Bengaluru

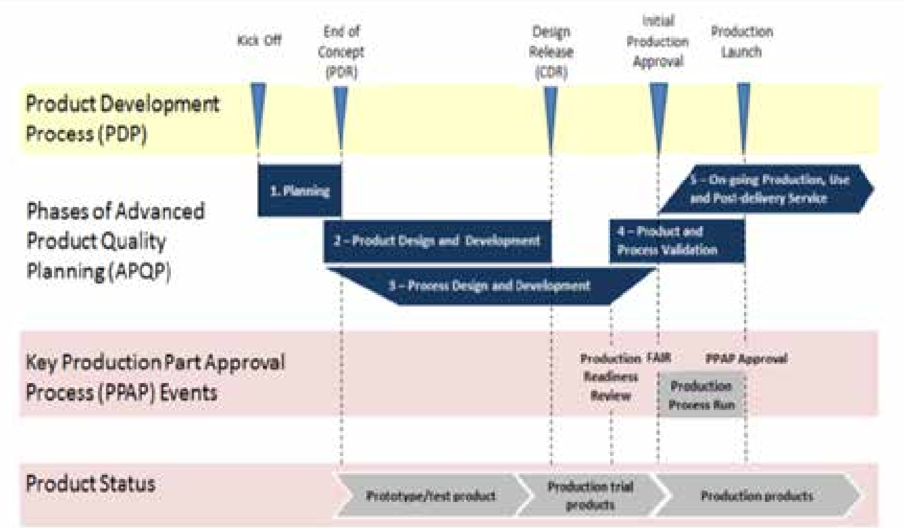
AS9145 is a standard specific to the aerospace & defence industry and applies to new product development or existing product changes. It is a structured process which includes advanced product quality planning (APQP) and production part approval process (PPAP) as part of its requirements.

The International Aerospace Quality Group (IAQG) established the AS9145 standard in response to the aggressive customer and regulatory requirements predominant in the aerospace and defence industry. Customers in this space often expect suppliers to exceed their requirements. AS9145 provides a framework for suppliers to meet these vigorous demands through best practices.

APQP is a process that happens during the product development lifecycle to facilitate transparent communication and feedback throughout the supply chain. This process allows suppliers to detect errors early on, incorporate customer feedback, and deliver high quality products. PPAP is an output of APQP. As the last step in the APQP process, PPAP demonstrates if a supplier can replicate the production of parts with consistency to a customer's standards.

What is PPAP?

The Production Part Approval Process (PPAP) is a standardized process in the automotive and aerospace industries that helps manufacturers and suppliers communicate and approve production designs and processes before, during, and after manufacture. PPAP is an output of APQP. Created in hopes to promote a clearer understanding of the requirements of manufacturers and suppliers, PPAP helps ensure that the processes used to manufacture parts can consistently reproduce the parts at stated production rates during routine production runs.



For those in the automotive industry, the PPAP process is currently governed by the PPAP manual published by the Automotive Industry Action Group (AIAG). PPAP is one of the 5 core tools of quality of the IATF 16949:2016 standard for the automotive sector quality management systems.

What's included in a PPAP?

The PPAP manual is the ultimate resource for those in automotive supplier quality management. The manual contains the PPAP checklist which includes all the requirements, called elements, for a complete PPAP package. The checklists identify different PPAP levels (from 1 to 5). For those in the automotive industry, there are 18 possible elements that must be checked off. The aerospace industry has a similar set of elements to be completed during the development, planning, and design of the production process.

Each PPAP level determines the specific requirements for each element and indicates which elements should be submitted to the customer. It is important to note, however, that the supplier, regardless of PPAP level, must complete every applicable element no matter what level the PPAP is.

What are the required PPAP elements?

Aerospace Elements

1. Released Production Drawings or Definition
2. Supplementary Product Requirement Documents
3. Production Purchase Order
4. DFMEA
5. Process Flow Diagram
6. PFMEA
7. Process Control Plan
8. Process Readiness Study
9. Initial Process Studies
10. Measurement System Analysis
11. Engineering Frozen Planning/Engineering Source Approval
12. Dimensional Reports
13. Functional Testing Approval
14. Special Process Approval & NDT
15. Material Certification Documentation
16. Raw Material Approval
17. Part Marking Approval
18. Packaging, Preservation and Labelling Approval
19. Review and Sign-Off

Why is PPAP negotiation necessary?

The Production Part Approval Process (PPAP) is similar to a work plan or strategy; it is the direct negotiation between the customer and

PPAP SUBMISSION LEVELS

LEVEL 1	Warrant only (and for designated appearance items, an Appearance Approval Report) submitted to customer.
LEVEL 2	Warrant with product samples and limited supporting data submitted to the customer.
LEVEL 3	Warrant with product samples and complete supporting data submitted to the customer.
LEVEL 4	Warrant and other requirements as defined by the customer.
LEVEL 5	Warrant with product samples and complete supporting data reviewed at the organization's manufacturing location.

supplier that confirms how each PPAP element is satisfied. Not every PPAP is the same, therefore negotiation must take place before the requirement is accepted and the process put into motion. This ensures that both parties have the same expectations. In many cases, the supplier will have an established report, like a control plan, FMEA, or MSA that will help guide the customer through the supplier's process. If found acceptable to the customer, many times these documents are duplicated and used by the supplier again.

When is a PPAP required?

A Production Part Approval Process (PPAP) is required anytime a new change to an existing part or process is being planned. A customer may request a PPAP at any time during the life of a product.

AS9145through APQP Phases

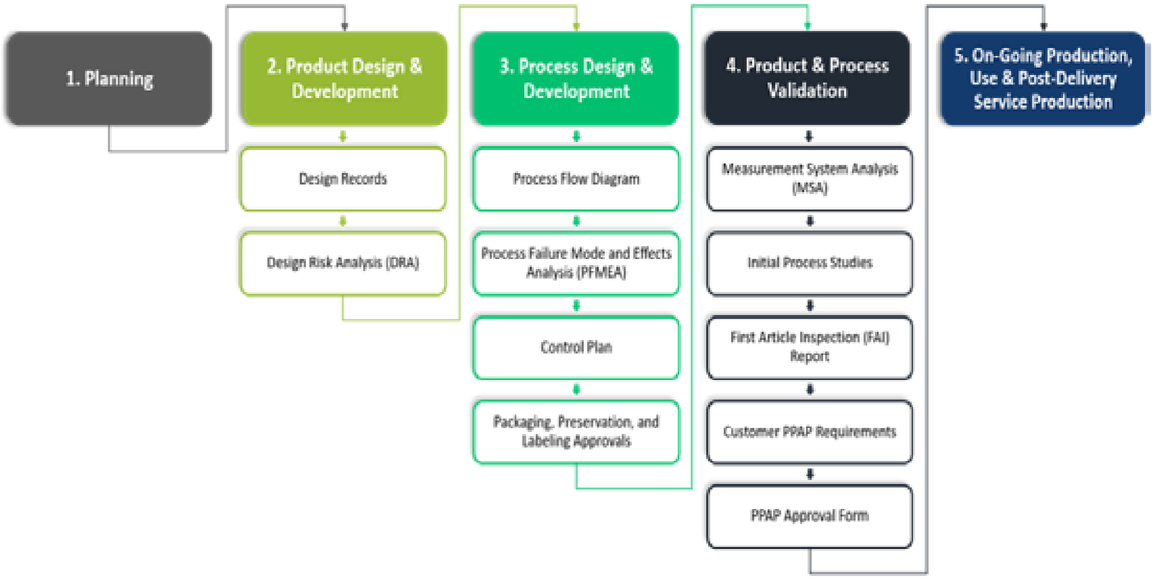
There are 5 phases of APQP which run concurrently:

1. **Planning** – identify project scope with consideration of time, budget, quality, and technical requirements.
2. **Product Design & Development** – design products in accordance with requirements.
3. **Process Design & Development** – design manufacturing processes in accordance with identified requirements and risks.
4. **Product & Process Validation** – verify the ability of the processes to produce products at a given rate in conformance with the quality requirements.
5. **On-Going Production, Use & Post-Delivery Service Production** – reduce variation with regular control checks, continuous improvement, and lessons learned to ensure ongoing customer satisfaction.

AS9145 - PPAP Requirements

The AS9145 standard specifies which PPAP elements to maintain through the product development lifecycle and serves as evidence of conducting APQP. The assembling of PPAP elements occurs during APQP.

The generated PPAP file submission is comprised of the 11 required elements specific to the aerospace &defence industry and any additional documentation that the customer requires. The PPAP submission also includes a PPAP approval form for the customer to record its disposition. Once reviewed, the customer dispositions the PPAP form with one of the following submission statuses:



AS9145 PPAP Requirements through APQP phases

Approved – the submission meets the PPAP and customer requirements, and the product can be shipped.

Interim Approval – the submission does not fully meet the PPAP and customer requirements, and the product can be shipped only under customer specified conditions.

Rejected – the submission does not meet the PPAP and customer requirements, and the product cannot be shipped.

The AS9145 standard provides advantages for aerospace &defence sectors during new product development and existing product change processes. It helps strengthens validity with early detection of defects and elimination of risks. Also, AS9145 provides structured control processes for suppliers to deliver safe, reliable products that meet customer quality requirements.

International quality standards for manufacturing continue to increase and many industrial companies are requiring that their suppliers use PPAP, which stands for production part approval process. Created and utilized first by the automotive industry, PPAP is a risk identification and mitigation process used to provide evident to the customer that there is a reliable and repeatable process. PPAP helps to ensure better communication between a customer and supplier in hopes that there will be fewer turn backs and revisions to the product or process.

Application of these standards during aerospace product Design & Development, prototype & bulk production may help government quality assurance agencies in optimising the quality requirements and timelines with fixed deliverables. Also helps QA agencies in moving from physical inspection based strategy to process driven audit based strategy.

Takeaways for Government Quality Agency

This technique/standard can improve

DGAQA functioning in the following ways:

This methodology further helps

DGAQA in migrating from physical inspection (QC) to system audit approach (QA).

This practice helps Government QA

agency providing systematic approach towards deciding when to engage during production for re-verification compared to conventional subjective approach.

This practice can be adapted for QA

memo stage optimisation during production of aero part sat main contractor's premises.

This practice helps assessing not only

the product quality but also the maturity level of production line, facility, and measurement system.

This model helps DGAQA during of revision/ enhancement of the firm approval for more scopes.

Based on the PPAP maturity level and output assessment by DGAQA, the suppliers/ contractors can be given enhanced delegation. This helps supplier/contracts meeting the supply order delivery timelines without any delays.

PPAP being an essential requirement of majority aerospace OEMs, Adoption of these modern practice by Indian MSME's would render them to future ready for export markets.

This is a well proven decade old robust model in automotive industry meeting the high volume production with zero defects. Integration of these good practises into GQA system shall go a long way in realising vision and mission of organisation with leaner Human resources.

About the Author:- Shri Gokulraj K, SSO-I is posted at ORDAQA (Engine), Bengaluru and joined DAQAS service in Feb 2018.

CYBER SECURITY BASICS

Pawan Kumar
SSA
HQ DGAQA

Cyber security is the protection of internet-connected systems such as hardware, software and data from cyber threats against unauthorized access to data. Cyber Security is a process that's designed to protect networks and devices from external threats. The world of Cyber Security revolves around the industry standard of confidentiality, integrity, and availability (CIA triad).

Importance of cyber Security

With an increasing number of users, devices and programs in the modern enterprise, combined with the increased deluge of data, much of which is sensitive or confidential, the importance of cyber security continues to grow.

Areas of cyber Security Domain

The cyber security domain can be classified into several different sections that are listed below:

(i) Application security

(ii) Information or data security

(iii) Network security

(iv) Disaster recovery/ business continuity planning

(v) Operational security

(vi) Cloud security

(vii) Critical infrastructure security

(viii) Physical security

(ix) End-user education

Maintaining cyber security in a constantly evolving threat landscape is a challenge for all organizations.

Benefits of cyber security

The benefits of implementing and maintaining cyber security practices are follows as:

(i) Business protection against cyber attacks and data breaches

(ii) Protection for data and networks Prevention of unauthorized user access

(iii) Improved recovery time after a breach Protection for end users and endpoint de Vices

(iv) Regulatory compliance

(v) Business continuity

(vi) Improved confidence in the company's reputation and trust for developers, partners, customers, stakeholders and employees

Cyber security best practices

The key mechanism to be followed for implementing cyber security policy and guidelines are as follows:

(i) Using two-way authentication

(ii) Securing passwords

(iii) Installing regular updates

(iv) Running antivirus software

(v) Using firewalls to disable unwanted services

(vi) Avoiding phishing scams

(vii) Employing cryptography, or encrypttion

(viii) Securing domain name servers, or DNS

Different types of cyber security threats

Threat intelligence is a challenging task with new technologies, security trends. It is necessary to protect information and other assets from cyber threats. Types of cyber threats are:

Malware: It is a form of malicious software in which any file or program can be used to harm a computer user. Different types of malware include worms, viruses, Trojans and spyware.

Ransomware: It is another type of malware that involves an attacker locking the victim's computer system files typically through encryption and demanding a payment to decrypt and unlock them.

Social Engineering: It is an attack that relies on human interaction. It tricks users into breaking security procedures to gain sensitive information.

Phishing: It is a form of social engineering where fraudulent email or text messages that resemble those from reputable or known sources are sent. Often random attacks, the intent of these messages is to steal sensitive data, such as credit card or login information.

Insider threats: These are security breaches or losses caused by humans (employees, contractors or customers).

Distributed denial-of-service (DDoS): Multiple systems disrupt the traffic of a targeted system, such as a server, website or other network resource. By flooding the target with messages, connection requests or packets, the attackers can slow the system or crash it, preventing legitimate traffic from using it.

Advanced persistent threats (APTs): These are prolonged targeted attacks in which an attacker infiltrates a network and remains undetected for long periods of time with the aim to steal data.

Man-in-The-middle (MITM): These attacks are eavesdropping and involve an attacker intercepting and relaying messages between two parties who believe they are communicating with each other.

Other common attacks include botnets, drive-by-download attacks, exploit kits, malvertising, vishing, credential stuffing attacks, cross-site scripting (XSS) attacks, SQL injection attacks, business email compromise (BEC) and zero-day exploits.

Challenges of Cyber security

Cyber security is continually challenged by hackers, data loss, privacy, risk management and changing cyber security strategies. The number of cyber attacks is not expected to decrease in the near future.

Major challenges that must be continuously addressed include evolving threats, data deluge, cyber security awareness training, workforce shortage and skills gap and supply chain attacks & third-party risks.

Automation in cyber security

Automation has become an integral component to keep companies protected from the growing number and sophistication of cyber threats. Artificial Intelligence and Machine Learning can help improve cyber security in threat detection, threat response, human augmentation, attack classification, malware classification, traffic analysis, compliance analysis and more.

About the Author:- Pawan Kumar, SSA joined service in June 2018 and is presently posted at HQ DGAQA.

ARTIFICIAL INTELLIGENCE (AI): IN DEFENCE PRODUCTION & QUALITY ASSURANCE

Mohd Saqib
Foreman (Computer Science)
Dett.AQAW(A), Itarsi (MP)

Introduction:

Artificial Intelligence (AI) is the field that attempts to make machines intelligent and imitate humans.

According to the father of Artificial Intelligence, John McCarthy, it is "the science and engineering of making intelligent machines, especially intelligent computer programs."

Artificial Intelligence (AI) has the capability to revolutionize all fields, including the defence sector. It can help by giving new ways for the collection and analysis of data, providing intelligent decision support, and exploring new possibilities.

Artificial Intelligence (AI) can also transform the defence production and quality assurance fields with the help of AI-powered machines and robots. The defence industry can improve the quality and reliability of its outputs, minimising the risk of defects and failures.

Domains and Key Components of AI:

Expert Systems

Natural Language Processing

Neural Network

Robotics

Machine learning, deep learning, etc.

Advantages of Artificial Intelligence (AI) in Defense Production and Quality Assurance:

One of the main advantages of AI in defence production and quality assurance is the use of machine learning algorithms for analysis and optimization of outputs.

Information gathering using intelligent systems makes it faster.

2. Intelligent systems can provide analysis of required improvements in production, which can mitigate the risk of defects and improve production quality.

3. Explores and suggests new possibilities by analysing and drawing conclusions from various data sources (big data, sensors, etc.).

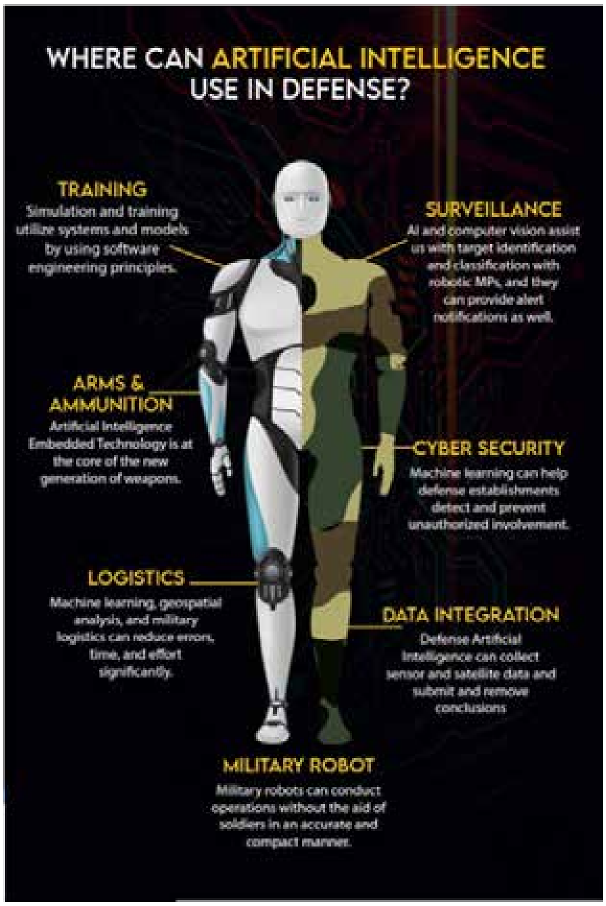
4. The AI algorithm can be derived as per the requirements for different stages of defence production and quality assurance.

5. Predict patterns and threats to avoid hazards.

6. Optimization of resources, time, and cost. Reliability and accuracy with minimum human intervention.

7. AI can also be used in quality control by using machine learning algorithms to inspect the final output against standards.

Challenges for Artificial Intelligence (AI) in Defense Production and Quality Assurance:



1. Security of data and information due to potential cyber attacks and malware.
2. High-skilled professionals are required to handle AI-based technologies.
3. Specialized training is needed to maintain the standard in this rapidly growing field.
4. High-standard infrastructure is required.

Most importantly, we need vision to compete with future technologies and AI.

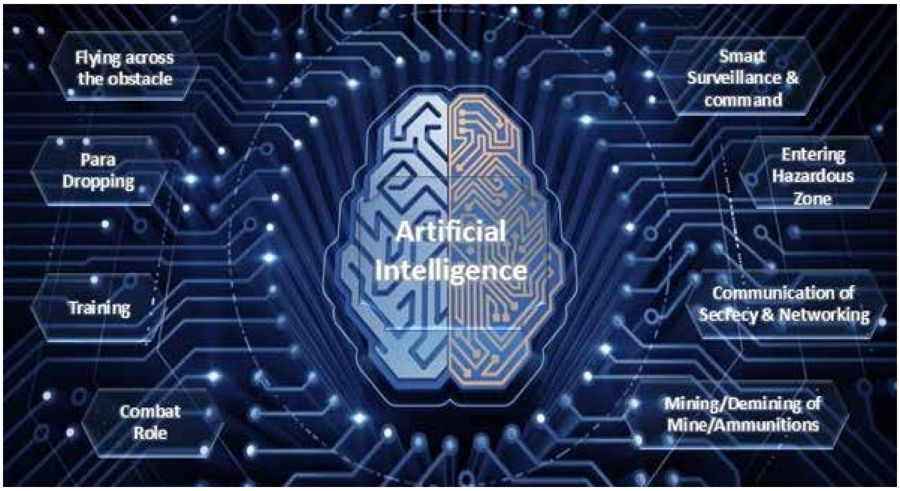
Conclusion:

Despite a few challenges, we cannot ignore the benefits of AI in defence production and quality assurance. It is expected to grow in the future to match the new era of technologies.

Every industry is continuously searching for new and innovative ways to improve the quality and reliability of its products while minimising the cost and time needed to produce them.

However, as with any new technology, there are also challenges and concerns to evolve, and it will be important to ensure that these challenges are addressed in a responsible and transparent manner.

Therefore, the use of AI-powered technologies is likely to become important in the defence industry's efforts to maintain a competitive edge in a rapidly evolving world.



About the Author:- Mohd Saqib, Foreman (Computer Science) joined service in Jan 2023 and is presently posted at Dett. AQAW (A) Itarasi (M.P.)

ड्रॉग लाइट

बिप्रेश मणि
वैज्ञानिक सहायक,
ओ.ए.क्यू.ए., देहरादून

ड्रॉग लाइट एक बाह्य प्रकाशीय उपकरण है। यह रात्रि में हवा–से–हवा में रिफ्यूलिंग करते समय मुख्य वायुयान को प्रकाश प्रदान करता है।

ड्रॉग लाइट में नीचे दिये गये चार तरह के एकल इकाई उपस्थित होते हैं:–

(1) खींचने एवं विस्तार करने योग्य प्रकाश उत्सर्जक (प्रकाश स्रोत) इकाई

(2) सुरक्षा यंत्र के साथ ऊर्जा आपूर्ति इकाई

(3) खींचने एवं विस्तार करने हेतु यंत्र

(4) वायुयान के संरचनात्मक आवरण में ड्रॉग लाइट के फिट होने के लिए प्रावधान

ड्रॉग लाइट में प्रयोग में लाये जाने वाले प्रकाश स्रोत प्रकाश उत्सर्जक डायोड तकनीकी पर आधारित होते हैं। यह तकनीकी नाईट विजन इमेजिंग प्रणाली के अनुकूल होते हैं। इस उपकरण का भीतरी भाग वायुरोधक है। ड्रॉग लाइट कॉकपिट में उपलब्ध एक स्विच के द्वारा नियंत्रण किया जाता है। जब एक्सटेंड स्थिति के स्विच का चयन किया जाता है, ड्रॉग लाइट का प्रकाश उत्सर्जक इकाई बाहर की ओर विस्तार होकर संचलन स्थिति में आ जाता है। पूर्ण रूप से बाहर आने के पश्चात् प्रकाश के स्रोत चालू हो जाते हैं। इस स्थिति में ड्रॉग लाइट रात्रि में हवा–से–हवा में रिफ्यूलिंग के समय पर्याप्त प्रकाश प्रदान करते हैं। कार्य समाप्त हो जाने के बाद रिट्रैक्ट स्थिति के स्विच का चयन करने पर प्रकाश बंद हो जाता है और प्रकाश उत्सर्जक इकाई अन्दर की ओर वापस अपने ढांचे में समाहित हो जाती है। ड्रॉग लाइट एयरक्राफ्ट की फ्लाइट एनवलप की विभिन्न आवश्यकताओं, जैसे कि ऊंचाई, गति, संचालन का समय आदि, को भली भांति पूर्ण करता है।

ड्रॉग लाइट अपनी अभिकल्पन और विकास की प्रक्रिया में विभिन्न प्रकार के चरणों से होकर गुजरता है जैसे कि उपयोगकर्ता की आवश्यकताओं का पुनरीक्षण, टेक्निकल स्पेसिफिकेशन (टीएस), मास्टर ड्राइंग इंडेक्स (एमडीआई), बिल ऑफ मेटेरियल (बीओएम),स्टैन्डर्ड ऑपरेटिंग प्रोसिजर (एसओपी), क्वालिटी एस्यूरेंस प्लान (क्यूएपी), क्वालिफिकेशन टेस्ट प्लान (क्यूटीपी), सेफ्टी ऑफ फ्लाइट टेस्ट (सॉफ्ट), ईनवाइरोन्मेंटल स्ट्रेस स्क्रीनिंग (ईएसएस), एक्सेप्टेंस टेस्ट प्लान (एटीपी) आदि दस्तावेजों को तैयार करना, विभिन्न प्रकार के परीक्षणों, जैसे कि क्वालिफिकेशन जांच, सॉफ्ट जांच, ईएसएस जांच आदि, से होकर गुजरना आदि। ड्रॉग लाइट को किस तरह के परीक्षणों से होकर गुजरना होगा, इसका निर्णय स्वीकृत सॉफ्ट एवं क्यूटीपी के आधार पर लिया जाता है। इसी क्रम में इस उपकरण की उड़ान की सुरक्षा के लिए परीक्षण (सॉफ्ट) किया गया है। इस चरण में विभिन्न प्रकार के परीक्षण होते हैं जैसे कि भौतिक परीक्षण, विद्युत और कार्यात्मक परीक्षण, सामान्य तापमान पर बर्न–इन परीक्षण, यादृच्छिक कंपन, थर्मल चक्रीय परीक्षण, ऊर्जा आपूर्ति परीक्षण, विद्युत चुंबकीय हस्तक्षेप एवं विद्युत चुंबकीय अनुकूलता

परीक्षण, ज्यावक्रीय कंपन परीक्षण, धीरज यादृच्छिक कंपन परीक्षण, ऊंचाई (निम्न दाब) परीक्षण, निम्न तापमान (भंडारण सह परिचालन) परीक्षण, उच्च तापमान (भंडारण सह परिचालन), आर्द्रता परीक्षण, त्वरण परीक्षण (संरचनात्मक), यांत्रिक आघात परीक्षण, संरचनात्मक भार परीक्षण, ईंधन रिसाव परीक्षण। इन परीक्षणों के पूर्ण होने के बाद ड्रॉग लाइट का कार्यात्मक कुशलता का परीक्षण किया जाता है। ड्रॉग लाइट के सफल परीक्षण के बाद इसे उड़ान परीक्षण के लिए भेजा जाता है। उड़ान परीक्षण के सफल होने के बाद अगर पायलट की कोई प्रतिक्रिया आती है तो इस विषय पर उचित कार्यवाही की जाती है। इस चरण के बाद उपकरण का योग्यता परीक्षण होता है। योग्यता परीक्षण के सफलतापूर्वक पूर्ण होने के बाद उपकरण वायुयान में प्रयोग में लाने हेतु सक्षम होता है।

ड्रॉग लाइट की रात्रि में हवा से हवा में रिफ्यूलिंग करने की कार्यक्षमता वायुयान को रात्रि के समय अपने कार्यों को बेहतर तरीके से निष्पादित करने में सक्षम बनाता है। यह हमारे रक्षा बलों के कार्यक्षमता को उच्च स्तर पर ले जाती है। इस उपकरण का सफलतापूर्वक विकास हमारे राष्ट्र के रक्षा उत्पादन क्षेत्र को आत्मनिर्भर होने के लिए उत्प्रेरित करता है।

About the Author:- Shri Bipresh Mani, SA is posted at OAQA, Dehradun and joined service in May 2019

DGAQA AT AERO INDIA 2023

Inauguration of DGAQA Stall by Director General, AQA

DG, DGAQA explaining DGAQA Documents to Shri Pankaj Agarwal, DG (Acquisition)

DG discussing with Shri L V P S Prasad, CE (A) CEMILAC on DGAQA Documents

DGAQA AT AERO INDIA 2023

DG, DGAQA briefing about AFQMS to Air Chief Marshal V R Choudhari, PVSM, AVSM, VM ADC at DGAQA Stall

Visit of Air Marshal C R Mohan, AVSM, VSM, SMSO, MC at DGAQA Stall

DG, DGAQA Explaining DGAQA Documents to Air Marshal N Tiwari, AVSM, VM, DCAS

DGAQA AT AERO INDIA 2023

DG, DGAQA briefing Shri G Satheesh Reddy, SA to RM

Release of Certificate on successful Indigenisation of High pressure turbine Nozzle Guide Vanes for Adour 811 Aero Engines to M/s HAL by CE (A) CEMILAC & DG, DGAQA

Release of Photo Essay book on maiden repair of RD 33 MK Aero Engine of MiG29 K Aircraft without formal ToT by Chief of Naval Staff, CMD HAL & DG, DGAQA

DGAQA AT AERO INDIA 2023

Officials attending Release of Photo Essay book on Maiden repair of RD 33 MK Aero Engine of MiG29 K Aircraft without formal ToT

Interaction of DG, DGAQA & ADG (HQ) with Dy CDS, Air Marshal B Radha Krishna, PVSM, CISC & AVM S.K. Jain, PVSM, AVSM, VM, ADC, ACAS (MP)

Interaction of DG, DGAQA with Air Marshal Vibhas Pande, AVSM, VSM, SC, ADC, AOC-in-C (MC) during Inaugural Ceremony

DGAQA AT AERO INDIA 2023

Interaction of DG, DGAQA with DG (Asero) DRDO, Shri A K Sharan, Dy Secy & Shri K K Bhardwaj US, MoD / DDP during Inaugural Ceremony

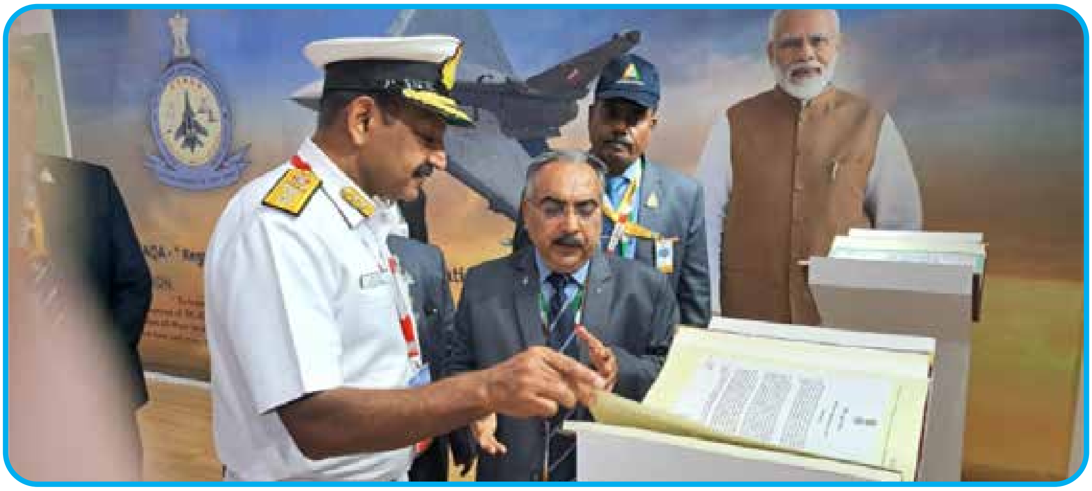
DG, DGAQA interacting with DG, Army Aviation at DGAQA stall

Reps of DPSUs & Pvt Industries after receiving AFQMS Certificate & Registration Certificate at DGAQA stall

DGAQA AT AERO INDIA 2023

Interaction meeting of DGAQA team with Airbus Team for C-295 Project

DGAQA & Airbus DS Team at DGAQA Stall



DG, DGAQA briefing Rear Admiral Deepak Bansal, VSM,
ACNS (Air Material) on DGAQA documents

DGAQA PHOTO GALLERY

Inauguration Lighting Ceremony on the event of handing over of AHSP of Akash Weapon System by DRDO to MSQAA

Handing over of AHSP of Akash Weapon System (AWS) for Indian Army Version by DRDO to MSQAA in presence of Secy. (R&D) and DG, MSS, DRDO

Ribbon cutting ceremony of OADG(KPT) in presence of ADG(KPT), RD RCMA, Dir (SED), GM HAL (SED) and GM HAL (ED)

Appointments, Promotions and Superannuations during Jan-Mar 2023

Shri Mahendra Prasad superannuated on 31 Mar 2023 as Director. He joined DAQAS service in Mar 2001.

Shri Achyut Kr. Choudhury superannuated on 31 Jan 2023 as Director. He joined DAQAS service in Feb 2002.

Shri K Periyasamy took over the Charge of Director, ORDAQA, Bengaluru. He joined DAQAS service in April 2002.

Superannuations

Sl. No.	Name of officer	Designation	Date of Superannuation
1.	Rama Krishna Sarma Tangrila	P.Sc.O, ORDAQA (LCA-TD), Bengaluru	31 Mar 2023
2.	Prasanta Kumar Garai	SSO-I, SSQAG, Hyderabad	31 Jan 2023
3.	S.K. Yadav	TMSG, Dett. AQAW(A), Kanpur	31 Jan 2023
4.	Rajdev Ram	TMSG, Dett. AQAW(A), Kanpur	31 Jan 2023

Promotion

Sl. No.	Name of officer	From	To
1.	Ram Prakash Yadava	SSO-II , ORDAQA, Lucknow	SSO-I, ORDAQA, Lucknow
2.	K Sambath	SSO-II, SSQAG,Hyderabad	SSO-I, SSQAG, Hyderabad
3.	Ashita M	SA, ALISDA, Bengaluru	SSA, ALISDA, Bengaluru
4.	Remya R J	SA, ORDAQA, Bengaluru	SSA, ORDAQA, Bengaluru
5.	D A Khamkar	Chargeman, ORDAQA, Pune	Foreman, ORDAQA, Pune
6.	Subith P	SA, ORDAQA, Bengaluru	SSA, ORDAQA, Bengaluru
7.	Sushil Kumar Yadav	MTDG-II, OADG(N&CZ), Lucknow	MTDG-I, OADG(N&CZ), Lucknow

New Joining/Appointments

Sl. No.	Name of officer	Designation	Date of Joining	FE/Unit
1.	Sumit Raj	SSA	20 Jan 2023	ORDAQA(GW&M), Hyderabad
2.	Ankit Asiwal	SSA	14 Feb 2023	OADG, Koraput
3.	Devender Kumar Meena	SSA	16 Feb 2023	ORDAQA, Bengaluru
4.	Joshi Ram	SSA	17 Feb 2023	MSQAA, Hyderabad
5.	Arvind Chandra	SSA	20 Feb 2023	ORDAQA, Bengaluru
6.	Md.Saqib	Foreman	30 Jan 2023	ORDAQA, Gaziabad
7.	Vishal Sapatla	Foreman	01 Feb 2023	MSQAA, Hyderabad

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Director General of Aeronautical Quality Assurance, Ministry of Defence
7th Floor, 'A' Block , Defence Offices Complex, K.G. Marg, New Delhi-110001
e-mail: hq.dgaqa@gov.in, Ph-011 21411807.