वैमानिकी दर्पण

8th Edition

DGAQA MAGAZINE ON AVIATION QUALITY ASSURANCE

MAKE IN INDIA

ENSURING FLIGHT SAFETY THROUGH QUALITY ASSURANCE

आज़ादी का अमृत महोत्सव

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.

सम्पादकीय

With the publication of this 8th edition, Vaimaniki Darpan completes two years of its existence. Its publication began as a result of the vision and endeavour of Sh. Sanjay Chawla, Director General AQA to institute a periodic DGAQA Technical magazine that could serve as a platform of knowledge and experience sharing amongst DGAQA officers and staff. Sh. Jitendra Kumar, ADG (HQrs) aptly coined the nomenclature "Vaimaniki Darpan" in our Rajbhasha for the magazine that was conceptualized to reflect and radiate our valuable experience and knowledge in the highly specialized field of Aeronautical Quality Assurance.

On this occasion of completion of two years of our journey, the editorial board acknowledges the enthusiasm and valuable contribution made in the form of articles as well as ideas by, not only the serving personnel but also our esteem veterans, amongst whom Sh. P K Sethi, Director General (Retd.) has been a regular in sharing his invaluable experience and wisdom.

Since our officers have unparalleled exposure to all domains of technical and procedural activities in the field of Defence Aviation ranging from Development, Production and ROH of aircrafts, radars, missiles, UAVs etc to participation in TEC, CNC, PDI, JRI etc., the articles published in Vaimaniki Darpan have high technical content elaborating practical aspects of technology implementation and QA in Defence Aviation, for which we have been receiving complements and appreciation from various quarters.

Another important facet of our Magazine for which we have been receiving accolades from one and all, is our regular feature 'Photo Gallery of DGAQA', a showcase of events of National and organizational importance. Azadi ka Amrit Mahotsav, Defence Public Exhibitions, Shifting of DGAQA HQrs to its new location, activities conducted at various FEs etc. are some examples of the events showcased through our photo gallery in these two years.

With the active participation of DGAQA fraternity, we are sure Vaimaniki Darpan shall continue to enrich all professionals in Defence Aviation with the practical aspects of Aeronautical Quality Assurance.

राजेश यादव
निदेशक

THE IMPORTANCE OF EFFICIENT CONFIGURATION MANAGEMENT IN AERONAUTICAL INDUSTRY

Shri P K Sethi
DG (Retd.), DGAQA

Configuration management is the key to achievement of quality and reliability in the aeronautical industry. The concept is vigorously implemented by the OEM industries dealing in aeronautics all over the world. Efficient configuration management is all the more important by those industries who are involved in production under transfer of technology. Gaps in implementation of up-dation can have serious consequences as was the experience in India. This article discusses two such cases and also recommends some necessary measures to introduce checks and balances in the existing system.

Introduction:- The Indian aviation industry is even today heavily dependant on manufacture under transfer of technology from the western countries or Russia. The technology is revised or changes incorporated in design or manufacture or performance or any other configuration related information based on the experience of the Original Equipment Manufacturer. Experience has shown that undue delays in upgradation of product configuration information can have serious repercussions. This article discusses two such cases wherein inefficiency in configuration management indeed affected the confidence in the equipment under production.

CASE 1 : Main Fuel Pump of Jaguar Aircraft : The Jaguar project under licence manufacturing started in early eighties. Gradually the project moved towards phase 4 production around late eighties. However, problems were encountered during indigenous production. In early 1990s a decision was taken at the highest levels of DGAQA, CEMILAC and HAL that one pump assembled with indigenously manufactured components would be subjected to 500 hrs qualification test. The qualification test proceeded with DGAQA following up the performance every 05 hrs. The test was satisfactory upto 50 hrs of operation. Thereafter the pump developed problem of pressure and flow fluctuation in the night. The pump was thereafter removed from the rig.

The next day the pump was stripped open. One spring in the rotor was found broken and the carbon liner of that particular bore was found to be badly damaged. Since the defect had occurred during a Qualification Test the flight safety committee was also asked to participate in the investigation. Initially it was opined by a number of members that the failure was probably an isolated case of spring failure. The configuration documents of the pump however showed that the springs were supplied by the OEM and that the springs were expected to last for 10million cycles. It was therefore necessary to look for other causes of failure.

The configuration documents of the OEM were then compared with the configuration of the pump undergoing Qualification testing. It was found that one modification issued by the OEM was not marked on the mod plate. An examination of the original modification leaflet showed that the above modification was introduced by the licensor based on a

failure encountered which was described as “the spring guide was working loose and subsequently tipping over causing damage to the carbon liner alum bronze rotor bore and piston spring”. The spring guide was subsequently redesigned to ensure specified an interference fit in the bore. In addition use of Loctite of a particular grade was introduced. Thereafter a requirement that the spring guides were to be subjected to a proof push load was introduced. This was an assembly level load check to ensure that the spring guide does not work loose during usage.

A detailed audit was carried out and it was revealed that the configuration change was carried out by the OEM and the modification leaflet was ratified by Local Modification Committee.

The assembly of the pump to undergo qualification test was without the modification implemented. The subsequent failure was attributed to non implementation of the above modification. Timely and efficient configuration management would have avoided the failure encountered and all the time and effort spent. The failure also resulted in limited recall of pumps in service to ensure that other pumps would not be similarly affected.

CASE 2: Main Fuel pump of R-25 Engine- Main Fuel pump is one of the most important fuel accessory of R-25 engine which supplies the requisite fuel as per the demand. One important subsystem of the pump is the rotary slide valve wherein a slide moves in the sleeve and thereby controls the fuel supplied according to its position. The reliability of the R-25 is therefore heavily dependent on the satisfactory functioning of the main fuel pump which in turn is dependent on the satisfactory performance of the rotary slide valve(RSV).

One of the technical defects of R-25 has been 'Fuel System Malfunction'. In certain cases, RSV got seized. The matter was discussed with OEM and they opined that the presence of particulate contamination in the Indian fuel as responsible for the malfunctions in the fuel system. Efforts were then directed to improve the fuel quality. The issue was again raised with the OEM representatives during their visit to HAL Lucknow. It was pointed out by the OEM representatives that further to a modification of silver plating, they were proposing another modification in the design of the slide and sleeve of the RSV. In the earlier design the hole was in the sleeve and the slide was solid. In the revised design the hole was made in the slide while removing the hole in the sleeve. The aim was to provide more flow to reduce rise of temperature.

Subsequently, further in house discussions revealed that though the modification of silver plating was received, it was not implemented for some time. The reason of introducing silver plating on the slide and sleeve was to facilitate heat removal due to three body abrasion which could occur in service.

RSV suffered from seizures were sent for metallurgical investigations. RSV seizures were reported during engine testing at HAL Koraput and even from rig testing at HAL Lucknow (manufacturer of Main Fuel Pump under licence). Metallurgical investigation had identified the presence of high retained austenite during X-ray diffraction. It was pointed out that in the course of three body abrasion the retained austenite would change to martensite in case rise in temperature was adequately high. This would in turn result in volumetric expansion which in turn could result in seizure of RSV. Hence the percentage of retained austenite was critical to prevent seizure of RSVs.

The studies revealed that the seized RSVs had retained austenite of upto 15%. Two

unseized RSVs removed from pumps received for overhaul had retained austenite of 4.3% and 6.0% and had completed around 1600hrs and 1500 hrs of service respectively. One RSV manufactured at HAL Lucknow strictly as per technology and the sub-zero treatment done at HAL Bangalore (due to non- availability of facility at HAL Lucknow) was then subjected to check for retained austenite. The retained austenite was found to be less than 1%.

It was opined that the presence of high retained austenite could be due deviations from the laid down procedure of cold treatment. It could also occur if the cold treatment was done at a different temperature. The RSV manufactured strictly as per technology was testimony to the fact that the percentage of retained austenite would be much lower than that seen in the seized RSVs.

It was thus apparent that there was inadequacy in the product configuration information implementation since a) the modification of silver plating was not implemented for some time b) The presence of high retained austenite in the seized RSV which could be a result of not following the laid down technology of manufacture. Both the above lapses could result in excessive rise in temperature leading to seizure.

The necessary corrective measures were then discussed, debated in length and thereafter finalised. The decided actions were then implemented. There were no cases of Rotary slide valve failure since then.

Conclusion: The above two examples have illustrated the importance of effective configuration management especially while producing aircraft items under licence. The gap between receipt of a configuration change and its implementation in our production units must be minimised and defined in the configuration management system. This is all the more important in case of East European nations and Russia since the documents have to be first translated and then put up for discussion to the configuration change control board.

It would be worthwhile introducing configuration audits in case of Su-30 and Hawk aircraft which are under license manufacture.

For bought out aircraft like Rafale, a system for configuration status accounting needs to be put in place after discussion with the supplier.

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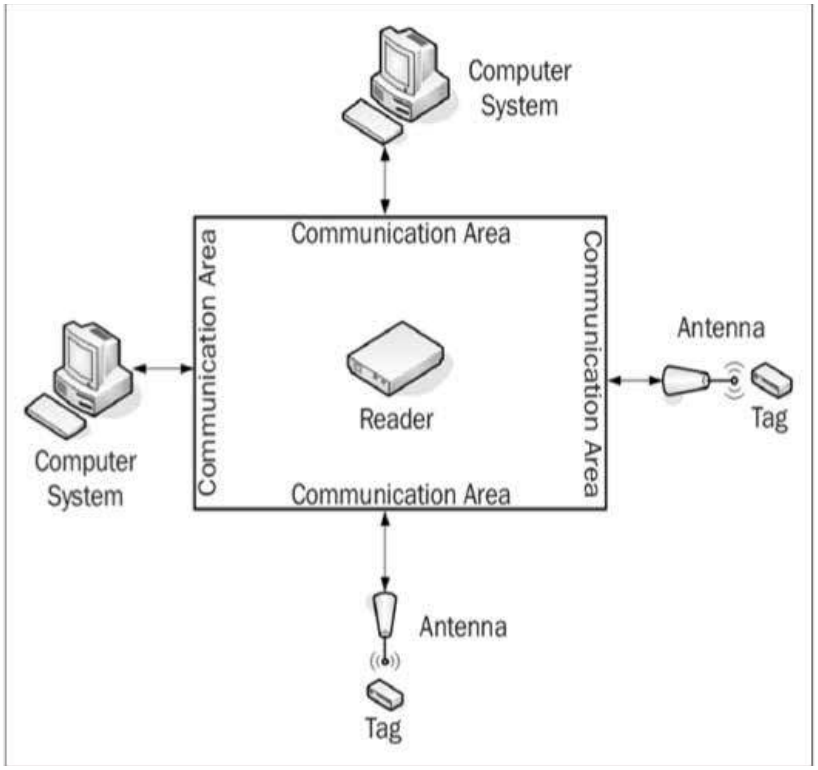
विचार:

जिस उद्योग में गुणवत्ता का ज्ञान,
उसी उद्योग को मिलता है दुनिया में सम्मान

SMART TOOL MANAGEMENT SYSTEM FOR MRO

Shri Rajesh Pandita
JSO, OADG Koraput



Introduction: Nothing is worse than wasting time looking for something you know you have. Digging through a pile of tools in search of the right size socket wrench when work is waiting can delay turnover and hurt production, not to mention increase your frustration. Leaving a tool behind can be worse than simply lost money and inconvenience, if that tool ends up in a sensitive area of the aircraft and creates FOD. FOD (Foreign Object Damage) is a serious problem in aviation and you don't want to be a cause of it. Damage by tools left inside aircraft is one of the most preventable types of FOD.

"When you're working on a plane, fix it to the degree you would if the most important person in your life is flying on it next."

Tool management has been identified as a critical weakness that affects the efficiency of the MRO process. Therefore, implement a smart tool management system based on Internet of Things (IoT) technologies, to improve the efficiency of aircraft MRO processes. Internet of Things (IoT) is rapidly gaining ground in the emerging world. The term IoT was firstly coined by Kevin Ashton in 1999. He defined IoT as a network that connects anything in anytime and anyplace in order to identify, locate, manage and monitor smart objects. Furthermore, the development of mobile computing has also supported many applications, which combine between

visual tagging of physical objects and Radio Frequency Identification (RFID) or Near Field Communication (NFC) devices that contributed to the boost of the IoT. Hence, IoT creates platforms that are able to transmit wide range types of data using a participatory sensing system. In the context of tool management for aircraft maintenance, IoT technologies have the potential to avoid human errors, automate documentation, increase the level of usability and resource use, and provide more reliable and accurate information about tool management for decision making.

Tool Management system supports an organisation in giving visibility on the handling of tools and enforces accountability down to individual level.

What is tool control in aviation?

At a minimum tool control is a method to quickly determine that all tools are accounted for at the end of a maintenance task. This can be done if each tool has a specific place where it is stored that allows for quick identification if the tool is missing.

Methods of Tool Control

In order to successfully keep track of company tools, one of the following methods should be used:

a) Tool Labelling: A clear system of labelling all tooling, equipment, and test equipment is, therefore, necessary to give information on when the next inspection or service or calibration is due and if the item is unserviceable for any other reason where it may not be obvious.

b) Tool shadow boards: A tool shadow board is a simple way to control and track tools. A tool shadow board consists of either a wooden board or cupboard that has been painted a light color, preferably white, and has a black outline of each tool hanging within it.

c) RFID Control: Radio Frequency Identification (RFID) is the smart tool management way of tracking. This method uses RFID tags and readers to help identify the use and movement of each individual tool.

Smart Tool Management System: The smart tool management system is based on latest IoT technologies in general, RFID and Web Services technologies in particular.

RFID is a way to identify a person/object using radio frequency transmission. An RFID system includes tags, readers, and an application system. Information is exchanged wirelessly between a tagged object and a reader when they are tuned to the same radio frequency. Tags are small items with various shapes, attached/imprinted on papers and attached to larger items for identification. There are two types of tags: Active and Passive.

Active tags contain a small power source, that is, a battery, and have both an on-tag power source and an active transmitter. When an RFID tag attached to a person/object passes through an electromagnetic field generated by a reader and detects a signal from the reader, it identifies itself. Each tag includes a serial number, a model number, color, place of assembly, or other data. A reader picks up the radio frequencies of tags to communicate. Readers are devices that read/interrogate tags, and each reader is equipped with antennas, a transceiver, and a processor. Active tags and passive tags are supported by different kinds of readers. An application system is the main component of an RFID system, and makes sense of the data read from tags. In our case, the application system will be our proposed smart tool management system substantially reduce or eliminate entrapment and migration

of tools into the final product.

Benefits and Challenges: The proposed smart tool management system will bring many benefits to the aircraft MRO practice in India: Firstly, human errors during the MRO process may be prevented. The system will make sure the right parts and tools are used, and no tools get misplaced and forgotten in the aircraft.

Secondly, the documentation process can be automated. Most of the documents during the tool management of MRO process, like tool checkout record, tool return record, and completeness checks are documented automatically. This ensures accuracy and completeness while reducing cumbersome manual tasks caused by paper-based documentation.

Thirdly, the tools and parts can be automatically tracked and monitored which helps to minimize unproductive tasks like searching, waiting, and doing paperwork.

What's more important here is that the proposed system can automatically collect information required for tool resources planning to achieve tool management intelligence. Tools and parts can be prepared in advance, which reduces time for procurement. Delays because of broken tools are avoided by preventive maintenance of tools. As tool usage is tracked and tools are returned immediately after usage, the stocks in the tool inventory can be optimized which helps to cut costs for tools that are used infrequently.

In a word, the smart tool management system for aircraft maintenance can lead to a more efficient and reliable MRO process compared to the traditional process. However, there are still many challenges to deploy such system in MRO process.

One of the challenges comes from the physical conditions of the tools being used by aircraft maintenance. Most of the tools and parts are constructed from metal, but RFID tags, especially passive tags, have difficulty operating in close proximity to metal. Therefore, the types of tags and corresponding readers should be carefully tested and selected in practice. Secondly, RFID tags must be attached to a tool or a part. However, in the sensitive world of aircraft maintenance, some tools and parts are specially shaped and it is inconvenient to attach tags. Last, but not the least, due to the metallic environment of aircraft maintenance, the location of the reader and antennae may be critical for tag reading and writing. The signal interferences may cause great changes in reading distance and times.

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विचार :

नवाचार एवं स्वदेशीकरण ही गुणवत्ता का

प्रमाणपत्र प्राप्त करने की मुख्य कुंजी है।

WEBINAR ON RECENT QA INITIATIVES IN THE FIELD OF MILITARY AVIATION

Shri V K Mishra
Dy. Director (Aircraft)
HQrs New Delhi

A series of webinar have been organized by DEO, MoD/DDP as part of DefExpo-2022. DGAQA also participated in the event and as QA being our domain expertise a topic **"Recent QA Initiatives in the Field of Military Aviation"** was chosen. Eminent speakers from DGAQA delivered the talk.

2. Hon'ble Director General, AQA Shri Sanjay Chawla has delivered Key note address and given oversight of the DGAQA organisation and provided full details of the activities being under taken by DGAQA. He touched upon the following during his brief address:

(a) He brought out that, DGAQA was established in 1954 under Dept of Defence Production, Ministry of Defence and was initially called as DTD&P (Air). Over the years, the roles and responsibilities were redefined and now DGAQA is primarily focused as Regulatory body for Quality Assurance and Final Inspection of military aviation stores for use by Indian Air Force, Army Aviation, Naval Aviation, ICG Aviation, BSF and ARC etc.

(b) There are 47 DGAQA Field Establishments primarily residents at Various DRDO Labs, Ordnance Factories, DPSUs, and Private Firms covering various Aero stores viz. Aircraft, Helicopters, UAVs, Aero engines, Aero materials, Air armament stores, Guided Weapons, Radars / communication system, FOL etc.

(c) DGAQA have developed its own QMS document - AFQMS (Approval of Firm & its Quality Management System) based on our experience and the best practices being followed in Aero Industry and it includes the International Aerospace Standards viz. AS9100D. Under AFQMS system guidelines, DGAQA carries out re-verification of 10-15% of built stages which are CTQ (Critical to Quality stages) and additionally conducts Quality audits (System, Process and Product), Surveillance and Spot Audits. Further, product improvements are done based on analysis of defects reported and user feedback (through R&M studies). At present about 78 organizations have DGAQA-AFQMS and we are now encouraging Pvt Industry to take DGAQA-AFQMS approval on the similar lines. In addition to DGAQA-AFQMS, we do carry out direct inspections for certain stores viz. GSE, Flying clothing etc. In case of foreign procurements, DGAQA rep is part of the PDI & JRI team along with User services.

(d) DGAQA has always been in forefront to support Indian Defence Industry through various initiatives. Some of recent initiatives by DGAQA towards improving quality culture, empowering industry, ease of business towards achieving Atmanirbhar Bharat are:

(i) Release of revised DDPMAS-2021 (jointly prepared by DGAQA & CEMILAC) by Hon'ble RM during aero India-2021 in line with International Standards.

(ii) Updation of AFQMS documents in line with best international practices. Present version is issued in 2018. Post issue of DDPMAS-21, DGAQA-AFQMS is now being further updated

Introduction of Third Party Inspection (TPI) system for outsourced products by Main Contractor. With this, HAL

trained QC manpower can focus more on final products within HAL premises.

(iv) Introduction of new concept of Quality Performance Indicators (QPI) which is presently under trial implementation at three divisions of HAL.

(v) Capacity assessment and registration of Pvt Firms and Test labs towards expansion of Indian defence industry. As of now about 86 Firms and 13 Test labs have been accorded registration by DGAQA.

(vi) Assessment & providing certificate of "Fit for Military use" and "Testing and Certification" to prospective Indian defence exporters for their products as per MoD guidelines.

(vii) DGAQA is continuously supporting Industry through involvement during various activities in indigenous design and development, indigenization, material substitution, life extension studies etc.

(viii) DGAQA is extending its outreach with opening of 5 new Field Offices at Chennai, Kasargod, Panchkula, Mamun and Missamari (in north-east) so as to expand our foot prints all across our great nation.

(e) He added that Indian D&D Projects such as LCA, ALH, LUH, LCH, HTT-40 etc are progressing well however the Quality & Reliability of products needs to be demonstrated in Design & Development phase itself so as to achieve optimum user satisfaction.

(f) In the present era, the quality of the products are being compared at world market. Also, Indian products are in a way to find its place in global market. At this stage, the quality of the products are paramount along with its technological characteristics to prove supremacy in Air Defence.

(g) DGAQA is continuously updating its QA process in Indian Military aviation by adopting best global QA practices adopted by USA, France, UK, Spain, Russia and committed for best quality products for Indian Defence forces. We recently had discussions with our counterpart DCMA, USA and are working towards having an International bilateral agreement for providing mutual QA services at our respective countries.

(h) In the end, he urged one and all to put our best efforts and be committed for producing best Quality products for Atmanirbharta and also for Global market. Let us ensure safety of flight at all times.

3. Further, Shri A Chandrasekaran, Director (Aircraft & Aero Med) delivered detailed presentation on the history, role and function of DGAQA with initiatevs taken towards atmanibharta.

4. Also, Shri Rajesh Yadav, Director (Tech-Coord) delivered presentation on Registration of Firms and Test Labs. During the session, there were numerous queries from participating Industry partners which he replied in detail to their satisfaction.

5. The video link to the webinar is available on www.defexpo.gov.in under defexpo events/ webinar Schedule/Sl.no. 06 and also on youtube.

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INSTRUMENT LANDING SYSTEM (ILS)

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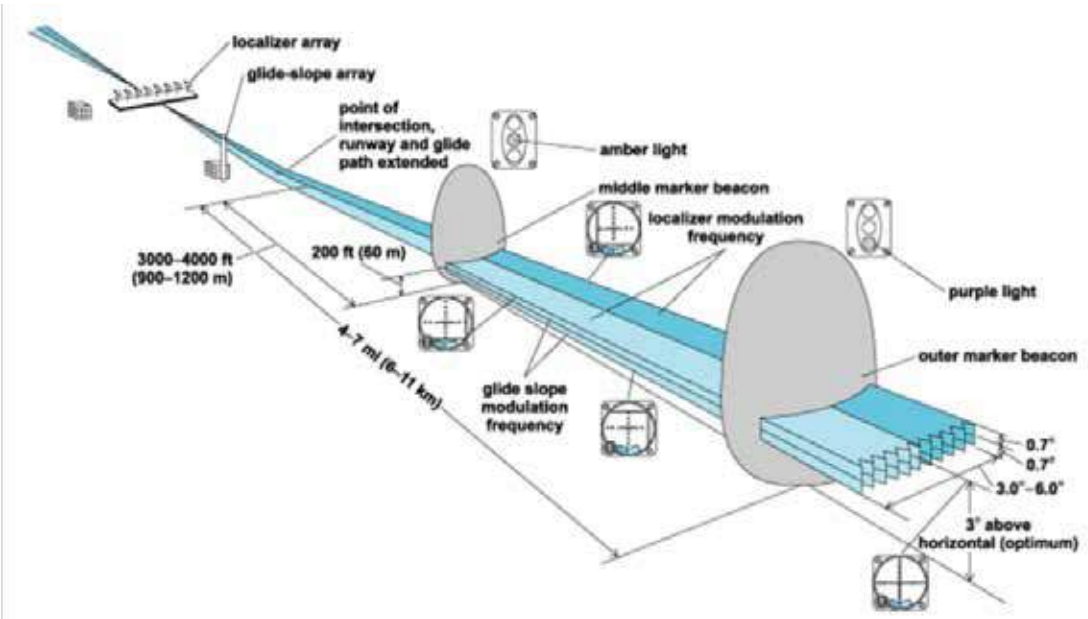

Have you ever thought how the aircraft or helicopter lands precisely during heavy Fog, snowfall, rain and during night flying, where there is zero or less visibility? The system designed to perform this trick is called Instrument Landing System and it is an International standard precision landing aid that is used to provide accurate azimuth and descent guidance signals for guidance to aircraft for landing on the runway under normal or adverse weather conditions using a combination of high frequency Radio signals (VHF-UHF). Instrument landing system (ILS) facility is a highly accurate and dependable means of navigating to the runway in Instrument flight rules (IFR) conditions. The ILS provides the lateral and vertical guidance necessary to fly a precision approach. When all components of the ILS system are available, including the approved approach procedure, the pilot may execute a precision approach.

The following are the subsystems of ILS:

Localizer:- The primary component of the ILS is the localizer, which provides lateral guidance. The transmitter and antenna (Shown above) are on the centre line at the opposite end of the runway from the approach threshold.

Glide Path:- The glide path component of ILS provides vertical guidance to the pilot during the approach. Glide path is located 750 to 1,250 feet (ft) down the runway from the threshold (shown above), offset 400 to 600 ft from the runway centre line.

Markers:

i) Outer marker; (OM): The outer marker (if installed) is located 3 1/2 to 6 NM from the threshold within 250 ft of the extended runway centreline to provide the pilot with the ability to make a positive position fix on the localiser.

(ii) Middle Marker (MM): The middle marker (if installed) is located approximately 0.5 to 0.8 NM from the threshold on the extended runway centreline. The middle marker crosses the glide slope at approximately 200 to 250 ft above the runway elevation.

DME : Distance Measuring Equipment (DME) is normally collocated with glide path and provides slant distance to the aircraft with respect to touch down point.

The approach lighting system:- Various runway lighting systems serve as integral parts of the ILS system to aid the pilot in landing. Any or all of the following lighting systems may be provided at a given facility: approach light system (ALS), sequenced flashing light (SFL), touchdown zone lights (TDZ) and centerline lights (CLL-required for Category II & III operations).

Runaway Visual Range (RVR) : In order to land, the pilot must be able to see appropriate visual aids not later than the arrival at the decision height (DH) or the missed approach point (MAP).

ILS are categorized according to their capability to provide for approach to height above touchdown (HAT)/decision (DH) and RVR (runway visual range).

The special conditions which apply for Category II and III ILS operation cover aircraft equipment; pilot training and the airfield installations. In the latter case, function, reliability and operating procedures are involved. An example of the latter is the designation of runway holding points displaced further back from the runway so as to ensure that aircraft on the ground do not interfere with signal propagation. Reliability requirements for Category II and III ILS include a secondary electrical power supply which should be fully independent of the primary one.

The transmission of ILS signals is continuously monitored for signal integrity and an installation is automatically switched off leading to the immediate display of inoperative flags on aircraft ILS displays selected to the corresponding frequency if any anomaly is detected. The reliability of this monitoring function is increased where all ILS systems are subject to regular calibration flights to check that signals are being correctly transmitted. These checks only validate that the ILS is performing as intended. It is very important to note that only a full ILS with Localizer and Glide scope signals gives a precision approach.

In aviation, both Civil and Military, all modern aircrafts are equipped with ILS system. So next time you experience some adverse weather conditions onboard an aircraft, do not worry, just enjoy the landing.

ILS Category	Height above Touch down (HAT)/ Decision Height (DH)	Runway Visual Range
CAT I	HAT not less than 200 ft	Not less than 1800 ft.
CAT II	HAT not less than 100 ft	Not less than 1200 ft.
CAT III A	No decision height	Not less than 700 ft.
CAT III B	No decision height	Not less than 150 ft.
CAT III C	No decision height	No RVR Minimum

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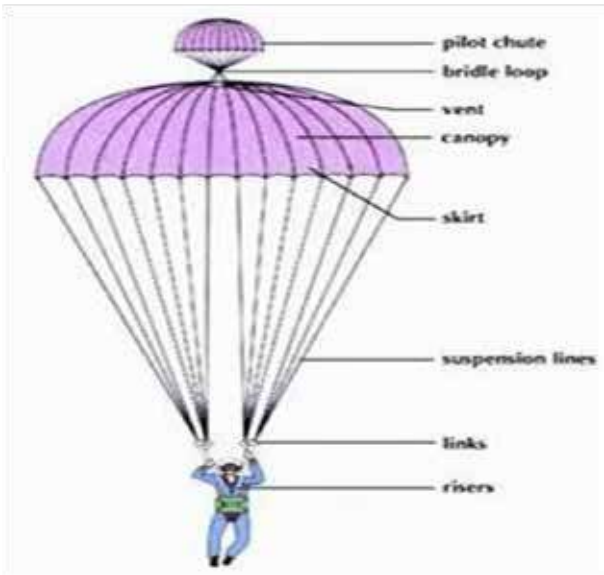
THE PARACHUTE: A LIFE CRITICAL MECHANISM FOR THE PILOT

Dr U S Yadav
PScO, ORDAQA Kanpur



A Parachute is a device, which is used for ascending and descending of the object through an atmosphere by creating the Drag or the Lift in ram-air. Ascending Parachutes are built specially for the purpose of ascending and staying aloft to the possible extent whereas the descending Parachutes are used to slow down the motion of the object through creation of the Drag in atmosphere. In this article, author has only covered the basic Fundamental and the requirements of Parachute, which is intended for better understanding/ appreciation in the deliberation/discussion on the Parachutes.

Bailout : On bailing out from the aircraft, the crew body speeds up by 9.81 m/s every single second of fall i.e. basically the application of acceleration due to gravity. Imagine, after around 100 seconds of fall, theoretically one will be falling at about 981.0 m/s (around 3 Mach), which is the speed of very superior jet fighters. In reality, it does not happen so, because after about 12 second, the crew gains the speed where the force of air resistance and gravity almost becomes equal. And at that point, there is no net acceleration resulting to fall into steady speed known as Terminal Velocity. But unfortunately, crew falling with arms stretched gains the speed of around 55 m/s, which is still enough to kill the crew especially in the cases of falling form aircraft.

Parachutes are designed to dramatically lower the Terminal Velocity. It does that by opening envelope of large area behind crew in pre-defined volumetric shape which induces the huge amount of drag. It reduces the Terminal Velocity by around 90%, thereby reducing the crew's hitting velocity to ground to 05-06 m/s. This is considered to be safer landing/hitting speed for the crew and crew can land on feet safely and can walk away without any harm.

Basic Types of Parachute

(i) Pilot Parachute,

(ii) Brake Parachute and

(iii) Supply Dropping Parachute

On the basis of shape, Parachutes are of two types:

Round or Dome Shape: It is provided with vent hole on the top portion, which is meant for the escaping of trapped cum compressed air from the round shaped canopy. The vent hole also facilitates to prevent the rocking about on moving down.

Rectangular Shape: It is often termed as ram-air design. These parachutes have a large number of cells which inflate upon entering of

ram-air into them. These inflated cells form the fairly rigid and curved airfoil wing. Steering of this parachute is quite easier and controllable than Round shaped.

Main Components of Pilot Parachute :

- **Pilot Chute/Auxiliary Parachute:** A smaller parachute to pull-out the Canopy
- **Bridle :** Connects the main chute to Pilot Chute
- **Vent:** Provides the escaping of air
- **Canopy:** Main part of the Parachute
- **Skirt:** Lower part of the Canopy
- **Rigging/Suspension Lines:** Load sharing and Directional control
- **Link:** Protective Cover for the Rigging Lines
- **Riser/Harness:** Part of Wearer
- **Pack Cover:** Stowing of Rigging Lines and Canopy Strength, Elasticity, Porosity, Abrasion, Shear resistive and most important is its Sewability.

Main Consideration During Design

- The Canopy must be easily operated within 03 Seconds of its automatic or manual mode of operation and controllable alongwith withstanding of initial inflation shock load as well as operational load during automatic/bail-out of the crew.
- Harness should smoothly transfer the operating shock load without any physical injury to wearer or dropped stores.
- Selection of materials such as Fabric, Webbings, Cords as well as Tapes its properties with minimum weight and packed volume restraint from the crew safety aspect and Aircraft Design Aspects.
- Fabric design as well as Manufacturing Design should be considered for Safe-Fail system.

Quality Assurance:

Since there is no any other redundancy left to crew life after bail-out from the aircraft, followings are strictly ensured by Quality Assurance Agency in addition to other general requirements:

- Use of only recommended Fabric, Webbings, Cords, Tapes, threads and Needles.
- No's of stitches required per centimetre/ inch length.
- Reparability in terms of re-stitching not recommended view Fabric Strength gets lowered on the first stitching/piercing of the needle in the Fabric.
- All metallic components should be free from any operative and functional defects.
- Parachutes are manufactured with stores (components) which are well within its prescribed Shelf-Life, view Fabrics are degradable in nature with time-span.

Conclusion: Apparently, the Parachute seems to be very simple, but it's manufacturing is very critical view inclusion of both Fail Safe and Safe to Fail principle in its Engineering Design.

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विचार :

गुणवत्ता पर प्रथम विचार,
भरोसे के निर्माण का सही आधार

नई सोच एक पहल

(श्रीमती उमेश कुँवर) व वै अ–।
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क्षेत्रीय निदेशक का कार्यालय गाजियाबाद मे निम्न प्रकार के परिवर्तन नई सोच नई पहल के अंतर्गत किए गए है:–

1. आंतरिक प्रशिक्षण कार्यक्रमः–

मानव संसाधन के क्षेत्र मे ज्ञान सहभाजन की पहल के तहत सभी अधिकारियों/कर्मचारियो द्वारा अपने चुनिंदा विषयो पर लेक्चर देने की शुरुआत की गयी हैं। इससे जहां एक तरफ ज्ञान एवं अनुभव का विस्तार, प्रस्तुतीकरण, विचार–विमर्श की क्षमता में वृद्धि होती है, साथ ही साथ अधिकारियों मे Public Speaking, Stage Fear जैसी भावनाओं पर नियंत्रण पाने का आत्मविश्वास बढ़ता है। इसी क्षेत्र में एक कदम और बढ़ाते हुये Workshop का आयोजन भी किया जा रहा है। Class Room Lectures को रोचक बनाते हुये Case Studies का विश्लेषण भी इसमें शामिल किया गया है, जिससे सभी की भागीदारी और रुचि को बढ़ावा दिया जा सके।

2. महिला यौन उत्पीड़न कानून (POSH ACT) 2013 के अंतर्गत ICC का संघटनः–

ORDAQA (गाजियाबाद) ने महिला यौन उत्पीड़न कानून (POSH ACT) 2013 के दिशा निर्देशों का पालन करते हुए ORDAQA (गाजियाबाद) में ICC (Internal Complaint Committee) का गठन किया है। इसमे 04 सदस्यो को नामांकित किया गया है, जिसमें से "लक्षयम" NGO संस्था से एक स्वयं सेविका को External member के रूप में नियुक्त किया गया है। इससे कार्यालय में शिकायत निवारण की निष्पक्ष अनुपालन मे मदद मिलेगी। यह कार्यालय से जुड़ी हुई महिलाओं के लिए शिकायत निवारण की दिशा में एक उत्कृष्ट पहल है।

3. अनावश्यक रिपोर्ट अग्रेषित करने पर रोकः–

ORDAQA (गाजियाबाद) ने यह अनुभव किया कि कई ऐसी Monthly/Quarterly रिपोर्ट्स हैं जिन्हें CGHS, रोजगार कार्यालय, CPWD जैसे विभिन्न विभागों को अग्रेषित किया जा रहा था, जो कि बहुत साल पहले शुरू की गयी थी परंतु अब बदलते समय के साथ यह अपना महत्व खो चुकी थी परंतु यह आज भी भेजी जा रही थी। ऐसी रिपोर्ट्स की पहचान की गई और समीक्षा के पश्चात उनका अग्रेषण रोक दिया गया। इस पहल से इन्हें तैयार करने में शामिल कर्मचारियों का समय और प्रयास अधिक उपयोगी व मूल्य संवर्धन कार्यो मे किया जा सकेगा।

4. स्वच्छता अभियानः–

स्वच्छ भारत लक्ष्य के अंतर्गत ORDAQA (गाजियाबाद) ने पुरानी और अनुपयोगी वस्तुओ को हटाने के लिए कई कदम उठाए है। इस लक्ष्य को प्राप्त करने के लिए चरणबद्ध दृष्टिकोण का उपयोग किया गया है। सर्वप्रथम सभी इनवेंटरी (जैसे परीक्षण उपकरण/कार्यालय फर्नीचर consumable/non consumable स्टोर, फाइल/दस्तावेज/तकनीकी दस्तावेज/पुस्तके/पत्रिकाए आदि) के जांच और सत्यापन के लिए विभिन्न बोर्डो का गठन किया गया। तीसरे चरण मे कार्यालय के फर्नीचर, खराब समान, कपड़े, पर्दे के गद्दे आदि का निस्तांतरण किया गया। आखिरी चरण मे सभी प्रयोगशाला उपकरणो और कम्प्युटर बाह्य उपकरणो का गहन विश्लेषण किया गया उपकरणो से अधिकतम उपयोगिता प्राप्त करने के लिए सभी विकल्पो का पता लगाने के लिए समिति का गठन किया गया। अनुपयोगी होने के कारण (चूंकि 40 वर्ष से अधिक पुराने थे) समिति ने उपकरणो के नीलामी करने की सिफारिश की। GeM (गवर्नमेंट ई–मार्केट प्लेस) पोर्टल का उपयोग करते हुए इस कार्यालय ने सफलतापूर्वक नीलामी की जिससे 30,000 रुपए इस कार्यालय को प्राप्त हुए। इस पहल के साथ हमारे कार्यालय ने 100 वर्ग फुट क्षेत्र को साफ किया जो कई वर्षो से स्क्रेप से अवरुद्ध था।

5. पेपरलेस (Paper Less) कार्यशैली का विकास तथा यूज्ड पेपर का पुन उपयोगः–

नई तकनीकी के प्रयोग को बढ़ावा देने तथा कार्बन फुटप्रिंट को कम करने के लिए ORDAQA (गाजियाबाद) ने पेपरलेस कार्य शैली की अहमियत पर जोर दिया है। इसके तहत अब पत्रों के ड्राफ्ट सरकारी E-mails के माध्यम से उच्च अधिकारियों को प्रेषित किए जाते हैं। कार्यालय स्टेशनरी (office stationery) की कोस्ट को कम करने एवं पेपर वेस्टेज रोकने के लिए ORDAQA (गाजियाबाद) ने 249 पुरानी Files/Doc- को weed out किया तथा Files को पारंपरिक तरीके से नष्ट ना करके उसकी जगह सूक्ष्म परीक्षण द्वारा गैर जरूरी एवं मामूली पत्राचार जो कि किसी तरह की technical information का ब्योरा नही रखते हैं, को One sided pages की तरह उपयोग मे लाने हेतु एकत्र किया। ऐसे छोटे–छोटे कदमों से कार्यालय में सभी को पर्यावरण संरक्षण एवं प्रबंधन के प्रति जागरूक किया गया है।

6. Slogan का White Board पर प्रकाशनः

आजदी के 75वी सालगिरह पर DGAQA मुख्यालय द्वरा चयनित slogan ORDAQA (गाजियाबाद) कार्यालय मे सभी कमरों मे White Board पर लिख कर प्रकाशित किये गए। इन slogan के द्वरा सभी मे स्वतंत्रता आंदोलन के विचारों, उपलब्धियों, कार्यों और संकल्पों के बारे मे जागरूकता का विकास किया गया। साथ ही कार्यालय मे समय–समय पर विभिन्न अवसरों जैसे हिन्दी सप्ताह, Vigilance Week, गुणवत्ता माह, अंतर्राष्ट्रीय महिला दिवस, सुरक्षा सप्ताह इत्यादि पर भी इसी परम्परा के उंतर्गत कमरों मे White Board पर Slogan अधिकारियों द्वारा स्वयं लिखे गये। इससे कागज, प्रिंटर, इंक, ओर अन्य स्टेशनरी सामग्रियों पर खर्चा बचाने के साथ–साथ अवसरों के महत्व पर व्यक्तिगत रुझान एवं ध्यान आकर्षित किया गया।

7. बिजली ऊर्जा का संरक्षणः–

बिजली आज के समय में बहुत आवश्यक संसाधन है। इसका संरक्षण करके हम पर्यावरण संसाधनों को संरक्षित करने के कर्तव्य का पालन कर सकते हैं। इसी भावना के मद्देनजर ORDAQA (गाजियाबाद) मे खाली कमरों में भोजनावकाश इत्यादि में बिजली के उपकरणो को बंद करने की परंपरा अपनाई गयी है। इस तरह ORDAQA (गाजियाबाद) द्वारा ऊर्जा संसाधन के संरक्षण के उपायों को देखकर हमसे जुड़े अन्य कार्यालय एवं कर्मचारी भी प्रेरित हो रहे हैं तथा इसे अपनी कार्य शैली का हिस्सा बना रहे हैं। कंप्यूटर मॉनिटर की जीवन वृद्धि (life enhancement) के लिए स्क्रीन सेवर और कंप्यूटर सेटिंग के स्लीप मोड को अनिवार्य रूप से सक्रिय करने पर हमारे कार्यालय मे जोर दिया जा रहा है।

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MYTHS ABOUT QUALITY ASSURANCE

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Quality has been used as a generic term by every one without understanding, what quality means to them. Everyone talks about quality in every walk of life but no one clearly understands the quality concepts in totality so is the case for Quality Assurance. The term 'quality' is often used in a vague, blurred way. It means different things to different people. So the definition of quality varies from person to person. This Blurred vision about Quality and Quality Assurance gives birth to various Myths which are everywhere in our lives and in our work. We face them, we argue them in day to day activity during various phases of production and we are used to them. Today we will speak about the most annoying myths about QA and the Facts:

Myth # 1: QA is Simple, anybody can do it

People can be divided into three groups: those who find Quality Assurance easy (high tech humankind), those who find Quality Assurance hard (non-tech people) and professional QA engineers. As we mainly deal with the first group of people being QA specialists. We face the common myth about QA being the easiest job than any others. You hear many connotations such as “Anyone can do it”; “You don’t need any special education”; People think that Quality Assurance is easy because it does not require a lot of technical skills. Seriously? Can you be a doctor without knowing the full anatomy i.e. where the leg is and where the head is? The importance of quality assurance professionals is often under-estimated and under-appraised. This may happen because of the lack of understanding of their role and values for the project in general.

Actually good QA engineers have loads of knowledge both of quality standards and products they are testing/Inspecting. QA activity requires knowledge of Product operational and Functional requirements right from the Design & Development stage, Defect Trends/ Patterns, Critical to Quality (CTQ) control Parameters, databases, user experience etc. The quality assurance team brings a broader perspective to the project which comes from a deep understanding of both development and product process requirements. Hence, QA profession is an Expert Profession with thorough knowledge of Quality requirements and not the job which anybody can do. Here are some of the responsibilities which QA engineer does during a workday:

- Planning
- Creating test scenarios
- Analyzing
- Reviewing
- Executing tests/Re-verification
- Inspecting
- Reporting
- Prioritizing

- Assessing risks
- Finding root causes and its analysis
- Suggesting improvements & corrective actions
- Retesting and verify the adequacy of corrective actions.

Myth # 2: QA engineer is just an error hunter.

It is generally assumed that QA specialist are only error mongering people and do not see the positive aspects. “Are QA engineers just people who find defects before the end-users?” A big bold NO. We hate defects/rejections of product as any other specialist and user do. We simply love preventing them, controlling them and making sure they are found and safely fixed and do not occur again. That’s why we can’t sleep if the product is not tested according to requirements and every known issue is fixed as required. Here comes the main difference between the inspector/tester and QA engineer. The inspector/tester is responsible for just finding defects/faults (as many as possible). QA specialist, on the other hand, is responsible for planning how to prevent defects/issues, how to correctly analyse the faults more efficiently, how to make sure they are fixed successfully, how to raise quality knowledge of the other team members and how to improve quality by eliminating system defects. Inspection/ Testing is a process of system exploration and defect finding, while quality assurance is about ensuring good customer experience. Quality is the whole team approach where everyone is equally responsible to assure Quality in every walk of life, and it is impossible to reach the ultimate milestone of defect free product without a Designer, developer, Manufacturer, project manager, support team, etc. Yes, we do error hunting. But it is just a tiny part of our job and responsibilities.

Myth # 3: Quality Assurance is same as Testing/Inspection

If someone starts using “testing/Inspection” and “quality assurance” as interchangeable terms, it should be a serious cause for worrying. Testing/Inspection can be done by anyone, but a strategic, measured approach informed by years of experience in QA is only achievable with the right people and expertise domain knowledge of QA. In reality, testing is just one step of quality assurance. Good quality assurance should enclose the entire development process, i.e. from the very beginning of requirements gathering to realisation of product & its maintenance. QA activities not only involve the knowledge of different test/Inspection techniques but it requires the knowledge of standards, effective QMS, documentation, processes, Control Procedures, Strategy & trend analysis and sign-off gates that are used throughout the whole development life-cycle. QA walks alongside every layer of the product to ensure that every phase passes testing assurance and that the final product is worth releasing.

Myth # 4: QA Job is to control the Quality

It is the general perception that the Quality is to be controlled and it's the job of only QC & QA Engineers, instead the quality is to be built in the product right from inception. For any quality product it is mandatory that the quality is built in the design itself. Quality should be the inherent part of the product. The design should be robust to meet the specified as well as implied end use requirements. The deficiency of the incorrect design may be revealed during the manufacturing and processing of the design. The deficiency of the incorrect manufacturing & incorrect design may be revealed, if it has been subjected to stringent inspection & testing. Thus the most important link down the line for realisation of any successful product is stringent inspection & testing by QC & QA which acts as filter. The QC & QA filters out every undesirable/deviated/ poor element and allows only the correct & quality product towards successful realisation of the product/ mission/target/goal. But, when it comes to giving credit for any successful mission, quality is put at the back foot and designers & manufacturers are applauded for the success. Because in the end everyone talks about the sweetness of the juice, but forgets the contribution of the filter which avoids the soar seeds, unwanted pulp , going to the juice, so that it tastes sweet.

Myth # 5: Quality Assurance can be left to the final stage.

A new concept has been incepted into the mind of various stake holder that the Quality Assurance is be done only at the Final Stage of production or at the end of development. This may seem reasonable broadly as it gives you a chance to test entire system through a number of quality assurance cycles and fix the whole system in its integrity. The point is that the time assigned for these quality assurance cycles tends to diminish as the project finishes. The occurrence of inevitable delays can make the later stages of development a rushed thing which gives chances for inherent defects to seep into the system to be revealed only at the time of operation in actual conditions which may prove to be catastrophic. With such a faulty approach of FAI (Final Acceptance Inspection) at the final stage allow most if not all inherent defects left to rot in the system until the final stages of the project. Moreover, It is emphasised that the Quality of the product has to be built in, through stringent process control and regular Quality checks at various stages of production and cannot be completely derived at final stage inspection.

Myth # 6 : Quality Assurance is expensive & add on to the cost.

QA testing from the start of the project comes with a cost, but that cost shouldn't be the at the cost of the product performance or the reputation of the organisation. The judicious decision has to be taken what is needed "Quality or Low cost". QA is committed to detecting, removing and addressing any flaws found in the early stages of its realisation and through effective corrective action ensures that the defect do no re-occur. To ensure the success and seamless functioning of any

project, QA is critical. It is more than just Inspection/Testing, more than just seeking/ fixing fault/defect, it is a strategic approach that ensures the final product delivers exactly what it should be. Hence, the effective QA in long term becomes cost effective because of less rejection, scrap reduction, repetition of job, & delighted customer.

Myth # 7 : Quality Assurance causes delay in production timeline

There is always blame on the quality personnel that they are delaying the work and takes lot of time to give their decision. For this, it may be appreciated that No-rush attitude and reasonable time taking does not mean doing less or having a lower productivity. It means working and doing things with great quality, perfection, & productivity with complete attention to the minute details which contributes to quality & reliability of the product.

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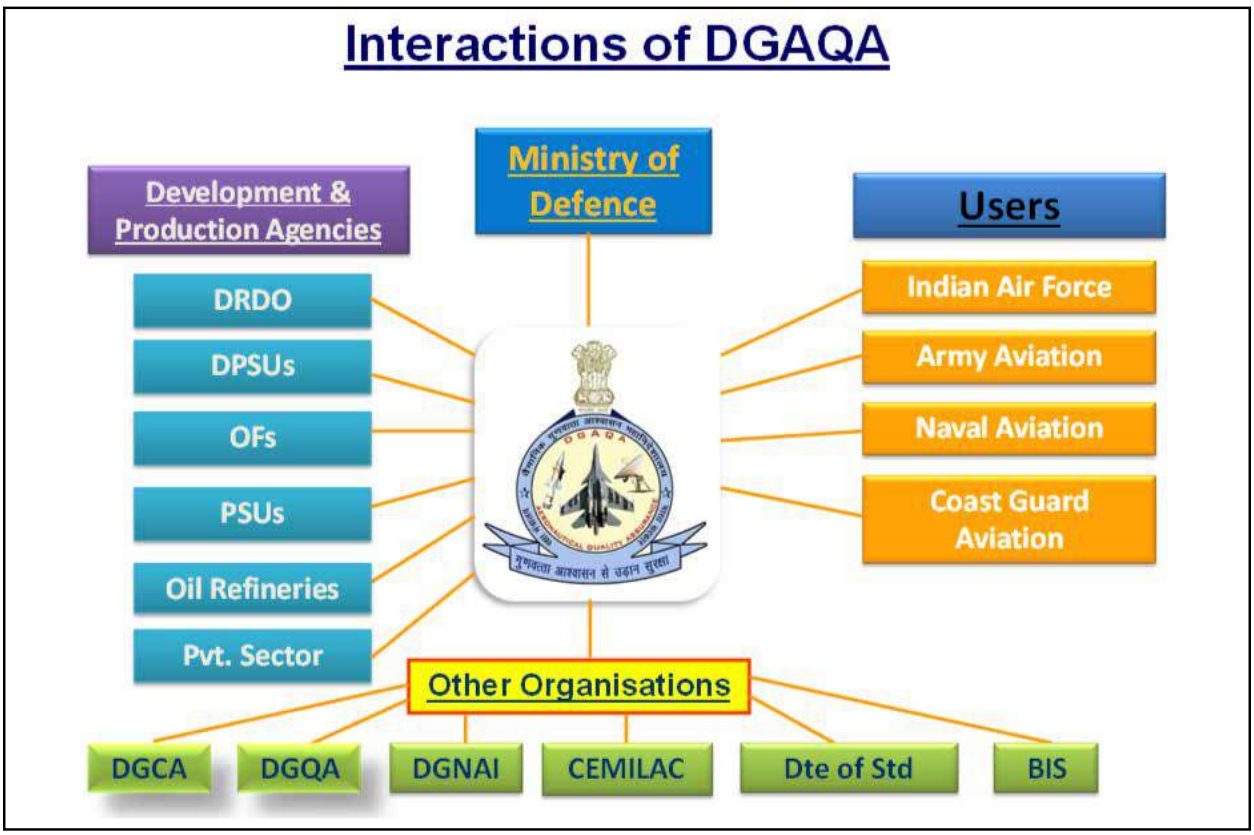

25 YEARS (1996-2021) REWIND 3.... MY QA PATH

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AJT Hawk MK 132(2006-2013)

Hope you would have enjoyed my previous articles, let me continue further in Hawk Project.

After getting good exposure to Production Jaguar DARIN-II and Strike programs, I had been deputed to M/s BAE Systems, UK for Familiarisation Training on AJT HAWK Mk 132 along with Officers, technicians of HAL and five fellow DGAQA Officers before commencement of Licence built production at M/s HAL, Bengaluru.

As part of the Familiarisation Training, UK-DQAFF (Defence Quality Assurance Field Force), an organisation with a mandate similar to DGAQA conducted a 5-day training program comprising of Classroom and Shop floor visits. During one of the visits to the shop floor, DQAFF QA specialist demonstrated the equipping process on the aircraft main undercarriage area in the equipped Wing Assembly at Buy Off stage. I noticed some equipping stage snags such as butting and less clearances between pipeline-pipeline, pipeline-structure and pipeline-looms based on my experience in Jaguar Trainer/Strike Aircraft at Bengaluru. I raised a question at this deficiency as it is not allowed as per standard aeronautical practises. He was shocked to see those snags at Buy-off stage. He immediately informed the previous stage fellow QA specialist without suppressing the finding to me. I couldn't believe that their quarterly report to the Govt of India complimented the DGAQA team - "GOI DGAQA personnel hosted from 27 Nov to 01 Dec 2006 were found to be highly inquisitive, attentive and understanding of their role in the Govt Quality Assurance (GQA)." I was impressed by their approach to fix snags by sharing information openly and addressing the problems immediately.

After series of trainings for HAL personnel from different fields, the licence-built hawk program kicked off at M/s HAL. The DGAQA team carried out First Article Inspection/ Verification alongwith QC reps of HAL in the beginning of the project and we saw that the first LB Hawk flew without any major issues. Our team was appreciated by then DG, AQA for the committed QA approach taken to quality issues in this prestigious production project of Advanced Jet Trainer (AJT) Hawk Mk 132. There were many issues observed during the production of Hawk over the years. highlighted the major issues which affect product quality for enforcement action to the contractor, based on Spot Checks/ Surveillance inspection, Quality Audits and reverification memo stages, to avoid diluting the impact with minor issues. I'm happy to share few of those interesting observations over the years.

Structural deficiency in Hawk fuselage

During the second working shift, Shop and QC staff, requested me to verify and clear a stage in fuselage so that they can carry out primer coating in the night shift, as they have already completed the off-jig work. I have a habit of being more vigilant in approving reverification (which may not be required as far as executive inspection is concerned), if anything is offered after normal working hours. I started verifying the riveting quality over the longer on (load bearing member) and found that the placement of rivets was not equal, and I also suspected that there were more gaps between the rivets. The QC inspector checked the other fuselages which passed that stage and verified that they are also in same condition. Then I instructed him to show the drawing to verify the parameters that I suspected. He said that the drawing will be shown in the next day as they are unable to access the drawing in the night shift. The stage couldn't be cleared that night. Interestingly, the next day as suspected, there was a serious deficiency in the rivets. Rivets were missing at critical frames which take fuselage loads. This was missed by the operator during Off Jig work and QC inspectors couldn't bring it out as they didn't carry out adequate inspection. The message was sent to HQ DGAQA and Air HQ to ground all Hawk Aircrafts at Bidar for one time check and structural repair action. Subsequently, the approval granted to one of the QC inspectors was withdrawn. The main contractor was also instructed to give adequate time for inspection at Off Jig structural work. I strongly feel that inspection lapses are always due to inadequate time given for QC inspection.

Crack in flap shroud panel

An unauthorized steel sim built in the flap shroud can cause major flight safety hazards. I noticed a lengthy crack in flap shroud panel near aileron during the 1090 stage for first flight test. The crack had developed due to unauthorized steel sim built in the structure. During my check, I snagged this crack with some more observation, hence the first 1090 was not issued on the day planned for flight test by Test Pilot (TP). I also asked the contractor to investigate the reason for the crack developed in the new panel. While the contractor was investigating, test pilots were very much concerned about the delay in offering the aircraft. Since I have a good rapport with the test pilots, I explained the delay to one of the pilots and he was shocked to know the reason. He asked me to fax the letter to office of Chief Test Pilot (CTP) and he explained everything to CTP(FW). After investigation, the contractor revealed that the unauthorized sim was the culprit adding tension to the shroud and once the Aircraft was off the jack, the panel in the wing assembly got tensed and cracked. The QC didn't notice the cracks during their final checks. If the crack went unnoticed, this would have developed serious flight safety hazard by restricting flap movement while landing. A warning letter was issued to the shop personal for unauthorized work and QC approval suspended to the concerned inspector. After the corrective action was taken on the structure, the 1090 was issued and the aircraft was cleared to fly. But, the CTP called Shop and QC personnel and investigated the issue for few days before flying the aircraft. The CTP recognised

the contribution to quality by DGAQA and I received an appreciation letter from then CTP(FW) Squadron Leader (Retd) Baldev Singh. Unauthorized work is usually needed to cover up quality deficiencies elsewhere, but they can have unintended consequences and must always be discouraged.

G Testing

I generally take the pilot's snag sheet remarks seriously and check with the pilots for clarifications. One such incident was related to g pulling test performed by the pilot. After carrying out G check, the pilot reported in the snag sheet that 8g pulling has been done. The contractor will then send the aircraft to Fatigue Monitoring System (FMS) rig for strain gauge calibration. But I discussed with QC, and we decided to verify with the G pulling data recorded on the FDR. QC consulted with the BAE specialist to verify if pilot's statement is sufficient. BAE specialist confirmed that FDR data must also be checked in addition to the pilot's statement. The FDR data had recorded it as 7.8g only. The pilot agreed to fly another sortie to record G pulling data of more than 8g on the FDR. Human error is the easiest mistake that can occur. It is often good to cross-check the data with an automated recording system (wherever possible) to serve as a second verification.

Angle of Attack snag

There is a System Safety Cell (SSC) in every division to resolve serious flight snags, repeated snags and serious ground incidents. There was a repeated snag Angle of Attack (AoA) stuck at 5 deg in one of the aircrafts from the first flight onwards for three sorties. Shop and QC finished ground checks, rectified the snag and offered the aircraft for 1090 clearance. I was not convinced about AoA snag rectification, since it repeated thrice and referred to SSC in the 1090 memo. Interestingly, the fuselage structural area mistake was uncovered during a step-by-step investigation conducted by SSC. AoA bracket made by jig setting was mistakenly used in another fuselage which led to flight snag. Without the involvement of SSC, the problem would have been identified after wasting some more flight tests by the contractor.

Foreign Object Debris/ Damage (FoD)

During the Jaguar project, I advised HAL to display the FoDs in a board for awareness about FOD but this did not yield much improvement in the shop while manufacturing Hawk. There were a lot of FoD observations that were raised before the initial flight test (1090 stage). So, I asked them to display the FoD collected aircraft wise in the shop floor to create more awareness among shop and QC personnel. Further, FoD checking procedures were revised in-line with MIL Std and FoD cautionary signs were displayed at the flight hangar to create more awareness. This helped the operator to understand the most common FoDs that are found during the manufacturing process, this resulted in an improvement in the workmanship.

Quality Audits

As a Project Officer, I identified grey areas to carry out Quality Audits. Once, the audit is completed, I segregate the non-conformities into major and minor issues. The attention is mainly given to major issues such as inadequate infrastructure, overdue calibration, improper documentation etc. which are uncovered

post audit. I strongly feel that, committed involvement of shop and QC with DGAQA in the quality audits will definitely help improve the process and product quality.

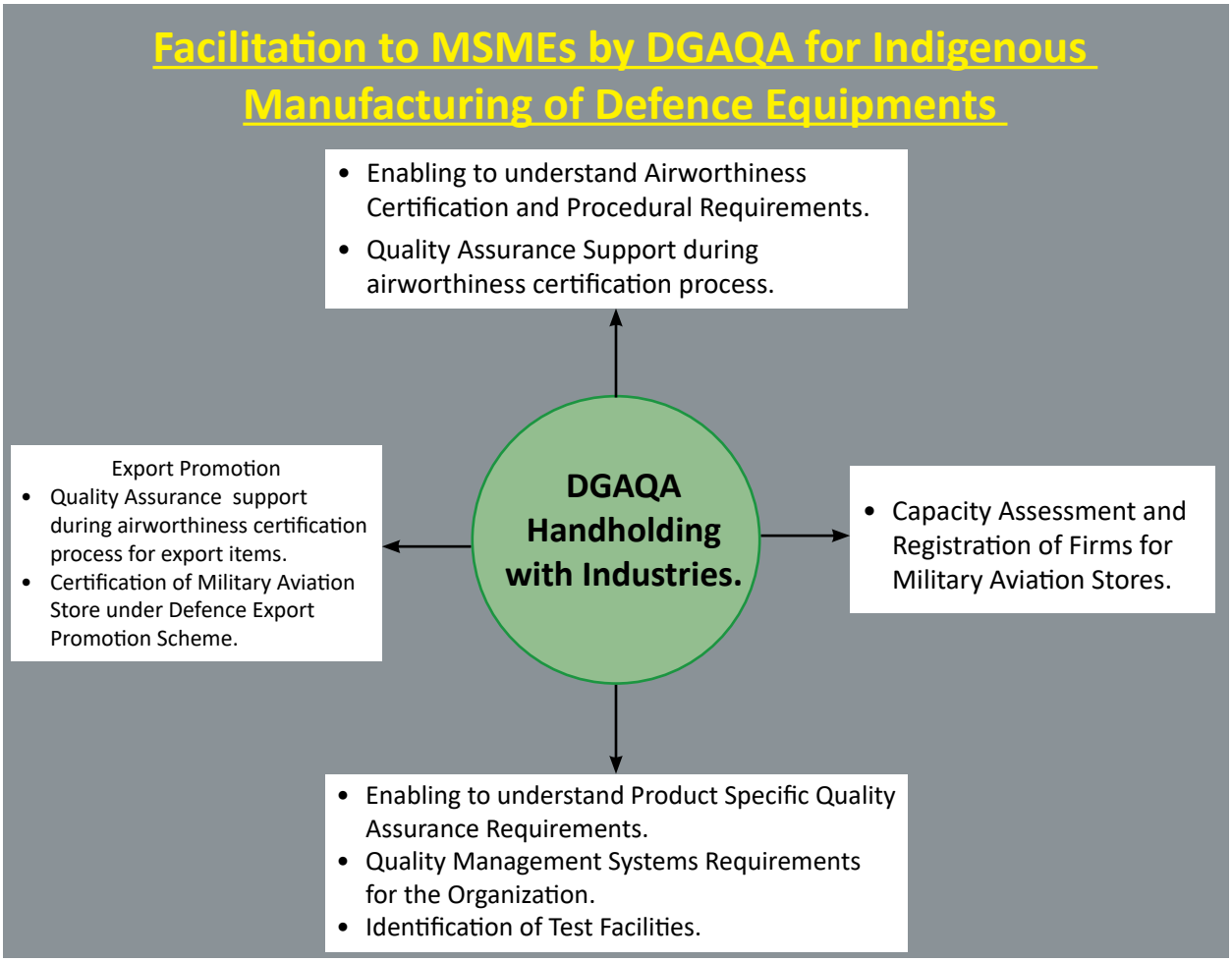
I had a great experience interacting with Test pilots of HAL, ASTE and Ferry pilots from Air Force bases. I also had good rapport with customer at operating base (Bidar) and Air HQ (VB) and insisted to get all feedbacks on the product delivered which was very much helpful to correct the faults in the system wherever required. Regular interaction with stakeholders at different meetings and receiving direct feedback on issues faced in airbase helped to improve the built Quality of License-Built Hawk.

In some of the production Hawk Aircrafts, the CTP (FW) commented that the aircraft is fully dynamically stable in the first sortie itself. It gave me an immense satisfaction that the contractor team has shown their best workmanship.

It was a good exposure working in BAe projects (Jaguar and Hawk) to get more acquainted with western systems.

About the Author:- Shri A Chandrasekaran Dir (A/c & AeroMed) is posted at HQrs New Delhi and joined service in Nov 1996.

Facilitation to MSMEs by DGAQA for Indigenous Manufacturing of Defence Equipments



ROOT CAUSE ANALYSIS OF SNAGS IN TAIL ROTOR HEAD (TRH) OF CHETAK/CHEETAH HELICOPTERS

Shri Satyananda Swain
Dy. Dir (PP & FOL)
HQrs New Delhi

The Office of Aeronautical quality assurance (OAQA) Barackpore is a field establishment of DGAQA which provides quality assurance coverage during overhaul/repair of Chetak and cheetah helicopters at HAL-Barrackpore. Once there was a critical snag in rudder system which was observed by the pilots during air tests of helicopters after repair /overhaul. This peculiar snag in rudder system was "pilot unable to turn the helicopter on either side as desired in air and rudder control of sticky/step/hard/ grinding" This quality issue occurred in many helicopters during flight tests. Accordingly, as per the Overhaul/Repair Manual and other relevant documents, many corrective actions were tried but the above quality issue persisted. Field Service Personnel tried to resolve the issue by replacement of various components in the Rudder Control System. But they could not succeed in resolving the quality issue. However, with the replacement of Tail Rotor Head (TRH), the issue got resolved in a few helicopters. But in some helicopters even the replacement of TRH did not help in resolving the issue.

During this period, I was assigned the additional duties of providing QA coverage at transmission bay where tail rotor heads (TRH) were overhauled/repaired. As issuance of 'Certificate of Safety of Flight' i.e. F-1090 was one of my responsibilities since I was looking after the field service section also, I was aware of the snags/issues encountered in the Rudder Control System of Helicopters. I thought to try and find out if there was any deficiency/ shortcoming in TRH Repair/Overhaul Process which could be the cause of the Rudder Sticky/ Hard/ Grinding Snag in the helicopters. My study/approach was to find out the gap and resolving it through quality technique (fish bone diagram).

The major categories of possible causes of the snag with respect to men, machines, materials, methods, measurements and environments etc. were taken to analyse "Why did this happen?". Again continued to ask further "why" to generate deeper level understanding of possible causes. The layers of branches indicate causal relationships. The details are mentioned in the Fishbone diagram in Fig. No. 1.

Accordingly the quality issue was analyzed/ examined with respect to the major causes and sub-causes with the support of QC team. As a result, it was found that the root cause of failure was due to the non-conformance of interference fit between sleeve and Angular Contact bearings. As per the requirement, interference fit be maintained before push fit. Since the QC/Inspection documentation did not have the provision for measurement and recording of ID of Sleeve and OD of Angular Contact Bearings before Assembly/ Fitment of Angular Contact Bearings in to the

sleeve, the measurement and maintenance of interference fit was not being ensured, it resulted in relative motion/sliding of bearings w.r.t sleeve which caused the stated Rudder Snag and consequent inability to turn the helicopter in air as desired by Pilot.

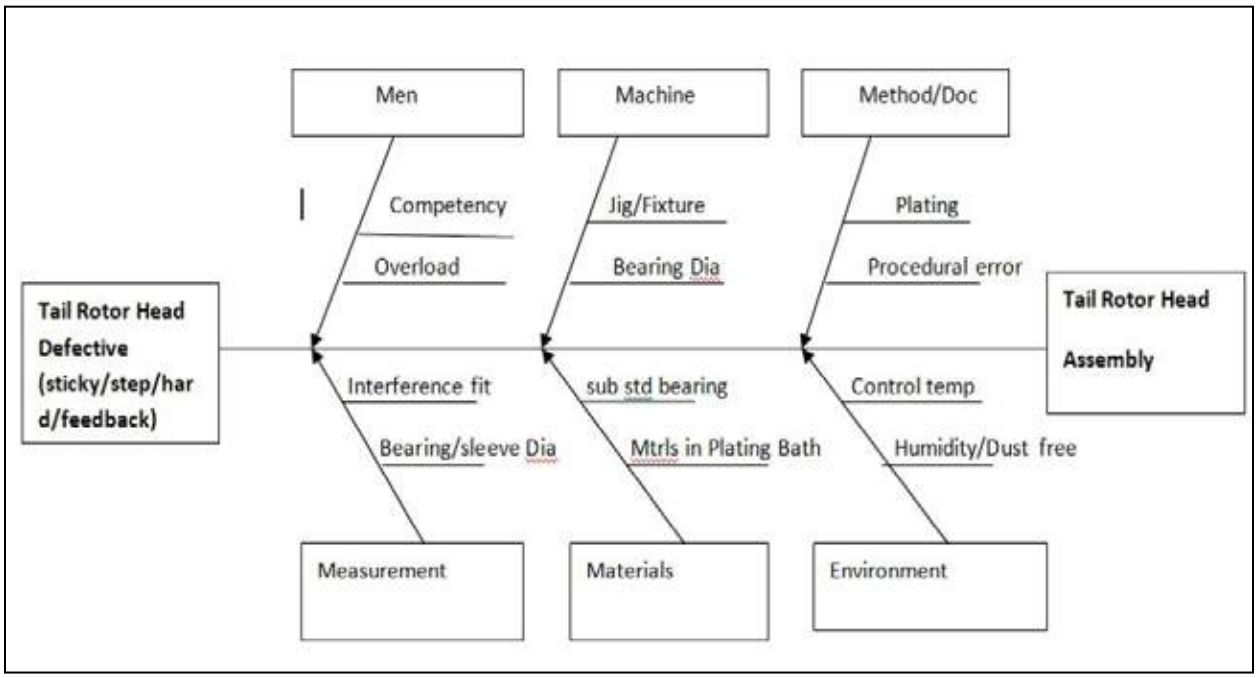
As a result of this study for further improvement, it was suggested to HAL to i) replace old static balancing jig and sim computation jig with new one ii) recording of all dimensional measurements of sleeve and bearing before fitment. iii) To ensure plating and de-plating of sleeves, further preventive/remedial measures were taken accordingly.

Preventive/Remedial Measure :

The following measures were taken by the QC department:

- Matching and pairing of sleeves and bearing to ensure the interference fit between paired set.
- Dimensional measurements of all Cat-A bearings were carried out before use.
- Old static balancing jig and sim computation jig were replaced with new one
- Extra care taken during plating and de-plating of sleeves with anodizing.

Conclusion: After the implementation of above preventive/remedial measures, the quality issue of rudder sticky/step/hard during air test was eliminated drastically thereby saving the cost &time and timely delivery of helicopter was ensured which in turn met customer satisfaction.



About the Author:- Shri Satyananda Swain, Dy. Dir PP & FOL is posted at HQrs New Delhi and joined DGAQA in DAQAS Cadre in July 2014.

PHOTO GALLERY OF DGAQA

Visit of DG, AQA to MSQAA Hyderabad

PHOTO GALLERY OF DGAQA

Farewell of Shri S C Badola, Dy. Director (Admin) at DGAQA HQrs

Superannuation of Shri Sher Singh Kakar, SSO-II (MSQAA Cell) at HQrs

Celebration of International Women's Day on 8th March 2022 at DGAQA HQrs

PHOTO GALLERY OF DGAQA

Visit of Shri Chandraker Bharti, JS (Aero) to HQrs DGAQA

Appointments, Promotions and Superannuations during Jan-Mar 2022

Shri Y K Sharma

Shri Y K Sharma ADG(SZ) Bengaluru superannuated on 31 Jan 2022. He joined DGAQA in DAQAS Cadre in Aug 1991.

Shri D B Bhangale

Shri D B Bhangale took over the charge of ADG(SZ), Bengaluru on 04 Mar 2022. He joined DGAQA in DAQAS Cadre in Oct 1992.

Shri R G Dikkar

Shri R G Dikkar took over the charge of Director ORDAQA, Kirkee Pune on 01 Jan 2022. He joined DGAQA in DAQAS Cadre in Feb 2002.

Shri J S Prajapati

Shri J S Prajapati took over the charge of Director ORDAQA(MSQAA) Bengaluru on 01 Jan 2022. He joined DGAQA in DAQAS Cadre in Mar 2001.

Shri G P Sahu

Shri G P Sahu took over the charge of Regional Director, ALISDA Bengaluru on 01 Feb 2022. He joined DGAQA in DAQAS Cadre in Jan 2001.

Shri Joginder Kumar

Shri Joginder Kumar took over the charge of Director at HQrs New Delhi on 30 Mar 2022. He joined DGAQA in DAQAS Cadre in April 2001.

SUPERANNUATIONS:

Sl. No.	Name of the Officer	Designation and FE/ Unit	Retired on
1	Shri Sachi Kanta Sarangi	PScO (NFSG), ORDAQA Bengaluru	31 Jan 2022
2	Shri B P Gautam	SSO-II, ORDAQA Lucknow	31 Jan 2022
3	Shri B T Pendor	SSO-II, OADG Nasik	31 Mar 2022
4	Shri N Vasudeva Raju	SSO-II, MSQAA Hyderabad	31 Jan 2022
5	Shri M M Bhandari	SSO-II, ORDAQA Bengaluru	31 Jan 2022
6	Shri Har Govind Mishra	JSO, ORDAQA Kanpur	28 Feb 2022

PROMOTIONS:

Sl. No.	Name of officer	From	To
1	Shri M M Bhandari	JSO, ORDAQA Bengaluru	SSO-II, ORDAQA Bengaluru
2	Shri S Rajendran	JSO, OADG Nasik	SSO-II, OADG Nasik
3	Shri Santanu Kanjilal	JSO, ALISDA Bengaluru	SSO-II, ALISDA Bengaluru

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