

## An Aviation Case Study: Sorting Out Key Factor Leading An Airline Operator Above Safa Safety Limit

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**Abstract:** In aviation sector the Airline operators are earning from the number of routes they are operating. Larger routes earn more profit comparable to short domestic routes. If an airline is banned to operate to foreign routes, other carriers can take an opportunity to attract the passengers toward themselves during the ban period of that operator. The penalty of losing route, passengers and their trust becomes colossal when considered in terms of revenue and cost. European Union agency for aviation safety assessment has set standard procedures for inspection of aircraft operator's safety level and can put ban or limitation on the operators to operate in their territory. So keeping this fact in mind case study of Pakistan international Airline is taken, which came under the observation of European safety agency in 2006 and 2010 for degrading safety level. In this work possible contributing factors that can be a cause to leading of non-conformance are analysed. Main objective is to target out the main bottleneck through this case study and suggest the solutions to sort out that problem.

**Keywords:** European aviation safety agency (EASA), European Union (EU), Quality Assurance (QA), Safety assessment of foreign Aircrafts (SAFA).

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### I. Introduction

In aviation industry for safe operation of Airline industry, an Airworthy Aircraft is the foremost prerequisite. This is ensured by the Engineering Maintenance department of that airline, this is their duty to give the airworthy aircraft within in defined period of time. Sometime there is pressure of time shortage, pressure from higher management, spares shortage, nonprofessional attitude of maintenance personnel and many other factors involved that can lead the non-airworthy aircraft which can further result in an incident or accident. If there is loop hole in the first stage, then Quality Assurance (QA) department of the airline is the second line of defense to ensure the safe and airworthy operation. If QA department of airline fails to do so, then regulatory body of the country is responsible as third line of defense for safe and airworthy operation.

Safety Assessment of Foreign Aircrafts (SAFA) inspections are one of the part of safety program of European Union (EU) and it is carried out in standardized and consistent manner in all of the member states of EU, Norway, Iceland, Switzerland and all those states with whom the European Aviation Safety Agency (EASA) signed a SAFA working arrangement.

This aim of SAFA inspections are to keep looking the Third party Aircrafts operating, for any unsafe and hazardous operation that might lead to incident or accident in there region effecting their people lives and property damage. If the airline operating is found not meeting the set safety level, that airline can either get operating limitation or can be banned to fly to states where SAFA Ramp inspection are taking place.

As a part of research problem the case study of Pakistan International Airline is taken. As in 2006 PIA got an operation limitation ban for not operating its Boeing 747 and Airbus 310 Aircrafts on the stations that are SAFA based. This ban was due to the fact that PIA went above the critical ratio factor defined by EASA. Then by hardworking of maintenance along with QA maintenance the ban was lifted from the PIA fleet as a result of improved safety and airworthiness.

In 2010 the safety margin ratio again went above the critical level, and there was again chance of operating limitation. Regulatory body stepped in and asked the airline operator to get clearance of each aircraft from them before sending it on Europe based flight. QA maintenance again played the role by doing extensive type of inspections which is the job of maintenance personnel. Boeing 747 and Airbus A310 then flew to Europe based flight after the clearance from Pakistan civil aviation authority. Now again the ratio trend is seen to approach a critical level. So there is a need to sort out what is the main bottle neck leading to this problem.

## II. SAFA Inspection An Overview



Figure 1: SAFA Inspection

- The process of inspection contains various factors like to prepare for SAFA inspection, to determine which area and items to be inspected and the standard used during the inspection.
- When carrying out Ramp inspection, anything is found that is deviating from the standards and set procedures, it is stated as a finding.
- Finding is further classified into three categories, depending on the influence that a finding has on the safety / airworthiness of aircraft and/or its occupants.
- Follow up actions and classifications are defined on the basis of findings that are the outcome of inspections.

### 2.1. Items of SAFA Inspection

There are total of 54 items in the checklist of SAFA Ramp inspection. Are given as under


Insp. Item	Insp. Item Description		
 <p><b>SAFA Ramp Inspection Procedures</b> <i>Guidance material</i></p>		<b>A</b>	<b>Flight Deck</b>
		A01	General Condition
		A02	Emergency Exit
		A03	Equipment
		A04	Manuals
		A05	Checklists
		A06	Radio Navigation Charts
		A07	Minimum Equipment List
		A08	Certificate of Registration
		A09	Noise certificate
		A10	AOC or equivalent
		A11	Radio license
		A12	Certificate of Airworthiness
		A13	Flight Preparation
		A14	Weight and balance sheet
		A15	Hand fire extinguishers
		A16	Life jackets/flotation device
		A17	Harness
		A18	Oxygen equipment
		A19	Flash light
		A20	Flight crew license
		A21	Journey log book
		A22	Maintenance release
		A23	Defect notification and rectification
A24	Preflight inspection		
		<b>B</b>	<b>Safety/Cabin</b>
		B01	General Internal Condition
		B02	Cabin Attendant's Station/Crew Rest Area
		B03	First Aid Kit/Emergency Medical Kit
		B04	Hand fire extinguishers
		B05	Life jackets/Flotation devices
		B06	Seat belt and seat condition
		B07	Emergency exit, lightning and marking, Torchet
		B08	Slides/Life Rafts, ELT
		B09	Oxygen Supply
		B10	Safety instructions
		B11	Cabin crew members
		B12	Access to emergency exits
		B13	Safety of passenger baggage
		B14	Seat capacity
		<b>C</b>	<b>Aircraft Condition</b>
		C01	General External Condition
		C02	Doors and Hatches
		C03	Flight Controls
		C04	Wheels, tyres and brakes
		C05	Undercarriage, skids/floats
		C06	Wheel well
		C07	Powerplant and Pylon
		C08	Fan blades
		C09	Propellers, rotors (main/tail)
		C10	Obvious repairs
		C11	Obvious unrepaired damage
		C12	Leakage
		<b>D</b>	<b>Cargo</b>
		D01	General Condition of Cargo Compartment
		D02	Dangerous Goods
		D03	Safety of Cargo on Board
		<b>E</b>	<b>General</b>
		E01	General

Figure 2: SAFA Checklist

### 2.2. Standards Followed

The aim/ purpose behind the SAFA ramp inspection on the Aircrafts are to assess/ check the Air carriers for their defiance according to the standards in aviation sectors. Complying with the standards of the aviation regulatory body of the state in which the aircraft is operating. In addition to this, the standard requirements that are set by manufacturer of the aircraft are to be met. When the finding is raised in SAFA ramp inspection, a standard followed has to be mentioned along with it.

### 2.3. SAFA - Categorization

When carrying out inspections the inspector finds something that is not according the standards and requirements, then it is called finding.

Whenever there is deviation from the relevant standards it falls into any of the 3 categories defined. This categorization is done on the basis of its apparent effect on the safety of aircraft or peoples. A finding that comes under the category 1 has minor impact on safety. The finding the has significant influence on the safety comes under the category 2 finding. The findings that have major influence on safety are categorized as major finding. Any issue that do not come under any of the above categories is not considered as finding and given as General remark in the report, for example an electrical torch is found non-functional during a flight in day time.

If the finding is identical in the case of arrival and departure both are to be categorized same. As an example, improper sheet of mass and balance that is outside operational limitations found during the arrival of aircraft is given as category 3 finding. Understandably it cannot be corrected; however actions are taken to being that into controllable limits for outbound flights.

The situation may arise, when there are multiple findings that are interrelated with each other and together are having a more influence on safety, in this case the category of the finding is raised due to safety impact.

#### 2.4. SAFA Follow-Up Actions

After there is ramp inspection on the aircraft with category 2 and category 3 finding, there is need to follow up the remedial actions. Follow up action can be distributed into 2 stages. The first one that is directly that is resulting directly after the findings, the second is to monitor and do correspondence for follow up.

Class of action matrix

ACTIONS TO BE TAKEN AFTER INSPECTIONS <sup>2</sup>			Class of actions		
			Information to Captain (POI)	Information to responsible NAA and Operator's home base	Corrective actions
			Class 1	Class 2	Class 3
Category of findings	Category 1	Minor	Yes	No	No
	Category 2	Significant	Yes	Yes Note: Written communication to the operator and to the NAA and copy to operator's home base (findings of several inspections may be summarised in one communication)	No
	Category 3	Major	Yes	Yes Note: Written communication to the operator and to the NAA. In case of aircraft damage affecting airworthiness a direct communication with the responsible NAA should be established. The NAA in the State of registry decides about conditions regarding return to flight status. Confirmation afterwards with written communication to the NAA and copy to Operator's home base.	Yes Note: the specific actions consisting of operational restrictions, corrective actions before flight or at maintenance-base, grounding and/or entry permit repercussions have to be reported.

<sup>2</sup> No findings mean no cat 1, 2 or 3 findings but may include General Remarks

Figure 3: Class of action matrix

#### 2.5. Safa Database Analysis

EASA evaluates the outcomes of the ramp inspections from the SAFA centralized Database. EASA advise the EU Commission on instant actions or follow-up rule and report possible safety snags to them. Exploration of the consequence of the SAFA ramp inspections carried over a period of one year. Analysis based on the Operator review board (ORB) ratio.

Formula:  $(0.25 * F1 + 1 * F2 + 2 * F3) / I$ .

- n = category of findings, 1: minor, 2: significant, 3: major
- Fn = number of category n findings.
- I = number of inspections

A ratio of value 2 means that there is on average one category 3 major finding per Ramp inspection carried out. Operator has to keep its ratio below value 2 to be in safe margin. [1]

### III. SAFA And Pakistan International Airlines

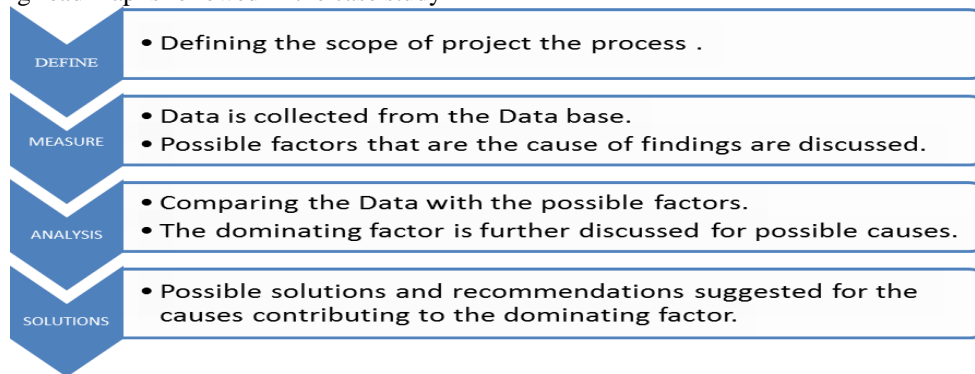
Subject to the SAFA cautioned listing in October 2006, Pakistan International airlines submitted remedial action plan to the commission that were meant to state those deficits which were highlighted in SAFA Ramp inspections. In addition to that regulatory body endorsed the remedial action plan of airline and has established a yearly strategy to observe the airline. From 12 to 16 February 2007, a group of European

specialists visited Pakistan to check the deployment of remedial action plan submitted. It was reported the action plan for the fleet type of Boeing B747 and Airbus A310 need to be amended. The fleet of Boeing B777 were reported satisfactory and not having those insufficiencies. [2]

Again in 2010 Pakistan was again under the circumstance to be banned. On 8<sup>th</sup> September the capable authorities of Pakistan were entered in to talks by Commission to sort out the airworthiness issues. These talks were the analysis of EASA on SAFA ramp inspection carried out by the French authorities on one of the A310 Aircraft with registration AP-BGO, which made a ferry flight back to Pakistan for remedial actions. On 12<sup>th</sup> September 2011, Pakistan civil aviation authority submitted the corrective actions taken against the nonconformities. Report submitted included the action plan given by PIA. Pakistan civil aviation authority gave 13 point action plan to address the safety culture of Pakistan International Airlines, to promote airworthiness of Aircrafts arrangements to accomplish universal enhancements in the airline. [3]

#### IV. Case Study Roadmap

Following road map is followed in the case study



##### 4.1. Define and Measure

Case study is of Pakistan international Airline and the process in focus is SAFA Ramp inspection of European aviation safety agency.

The prime data is collected from the SAFA database. The access to SAFA Database for particular Airline operator is given to the responsible person as nominated by Manager QA, for correspondence with SAFA coordinators for the closing of any open Non conformity by giving satisfactory corrective and preventive actions.

Due to confidentiality and company policy of organization the data related to inspection findings is not shared.

##### 4.1.1 Factors Leading to Findings

The factors that are leading towards the SAFA findings are derived from the discussion of the meetings carried out by management for the SAFA Ramp inspection status and the position of airline safety in terms of SAFA findings.

Following are the main factors that are derived:

- Shortage of spares.
- Poor Maintenance Practices (Maintenance carried out but is not according to the standards defined by Aircraft Manufacturer and regulatory documents followed).
- Ignorance from Maintenance personnel.
- Ignorance from Cockpit crew.
- Ignorant or untrained Cabin crew.
- Ignorant or untrained Cargo loaders.

The findings from the SAFA Database are the of sample size 148. The data from SAFA Database is analysed against the above mentioned factors and the main contributing factor is sorted out. That dominating factor is further analysed for the contributing causes. And finally the possible solutions are suggested.

##### 4.2 Analysing

The number of the times these factors contributed in the occurrence of a discrepancy in the SAFA Ramp inspection was found in percentages. The contribution for each factor is clear from the Fig. 4

The most dominating factor that is the cause of most of the non-conformities in SAFA Ramp inspection process is Ignorance from the maintenance personnel and its contribution percentage is about 40%.

The second factor that is contributing a big share is the ignorance of cockpit crew and contributed 31% approximately. Poor maintenance practices followed has a share of about 11.5% approximately. Ignorance from cabin crew shared a contribution of 9.5% approximately. A small share of contribution that is 3% approximately by shortage of spares and cargo loader ignorance contributed approximately 4.5%.

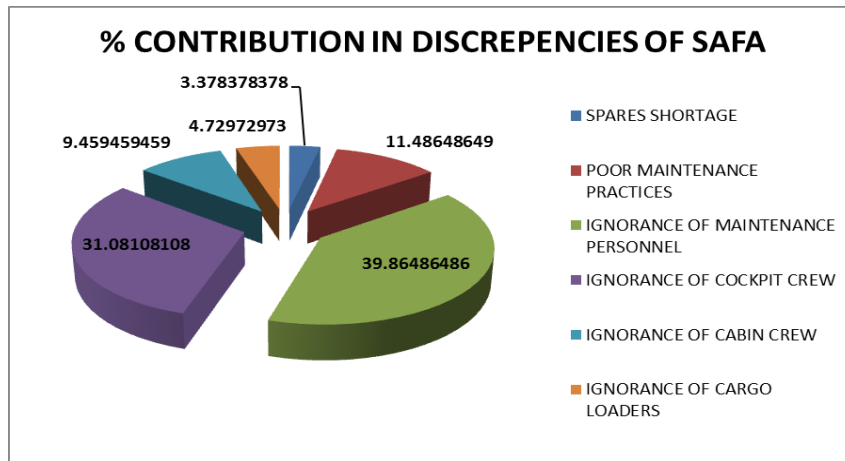


Figure 4: Percentage contribution of factors

#### 4.2.1 Pareto Analysis of data

Pareto is statistical technique of decision making used to sort out the vital few odd jobs that produce notable effect. Pareto Analysis is centered on 80/20 Pareto principle.

Data collected from comparison of factors against findings is analyzed on the basis of Pareto principle analysis. This analysis is used to sort out the most dominating problems in downward order to isolate the vital few through plotting.

Pareto analysis of the factors contributing for the occurrence of SAFA Ramp inspection is given Fig. 5

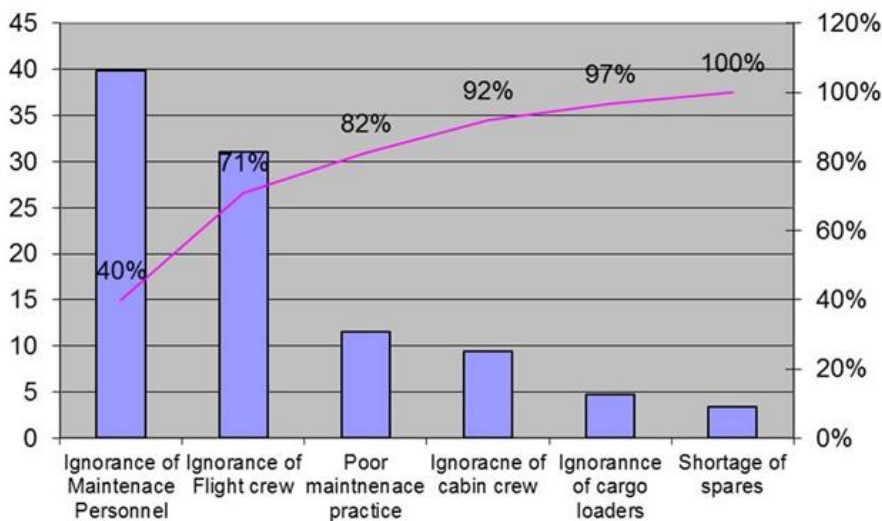


Figure 5: Pareto Analysis of Data

From Pareto analysis two obvious factors are Ignorance of Maintenance Personnel and Ignorance of cockpit crew. And among two of these Maintenance personnel that are coming under the umbrella of engineering department is our major focus and concern.

The main effects that are causing the ignorance of Maintenance personnel are shown in Fig. 6 as cause and effect diagram.

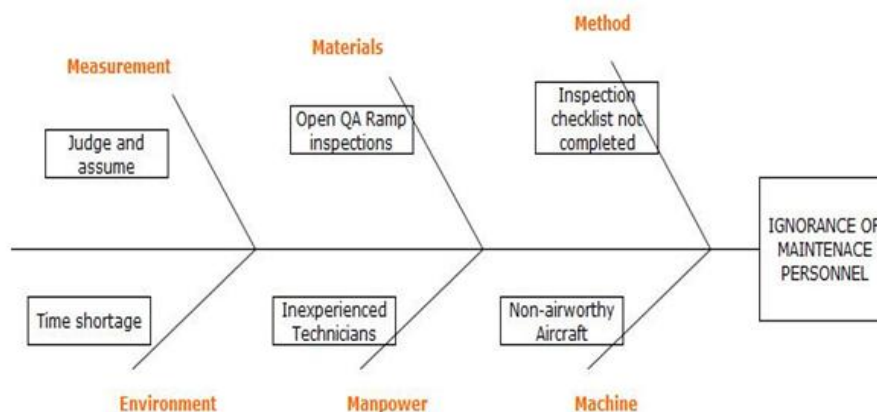


Figure 6: Cause and Effect Diagram

### 4.3 Improvement Recommendations

After the analysis, improvements are suggested to overcome the roots that are leading toward the major contributor of SAFA Ramp inspection findings.

#### 4.3.1 Short term Goals

Generally short term goals support as doorway to a long term vision. These are step by step stairs that turn your set targets into the real state. Airline Maintenance has to give an airworthy Aircraft in defined period of time. So all tasks are performed in religiously manner and are not based on the wishful thinking. Meetings are done to know the shortcomings and difficulties faced in achieving the goals. Additionally supervisor should assign the proper person as per job requirement. And always appreciate the person who is highlighting any flaw and non-conformity.

#### 4.3.2 Training

Most of skilled and trained persons are leaving organization as they are getting better opportunities. So new inductees are not skilled and trained enough. They do not know the importance of maintenance work in terms of SAFA. Firstly there is need to get them familiarized with the Aircraft and maintenance practices followed and then to familiarize them with SAFA Ramp inspections by a designed training program. Refresher courses for senior Engineers should also be conducted on periodic basis.

#### 4.3.3 Going by book

In Aviation there is no assumption and guess based maintenance, seeing the non-conformity and assuming it as alright leads to non- airworthy Aircraft, which can become a disaster. If anything is found not normal the maintenance manual is consulted for getting the clear picture of that abnormality and rectified accordingly.

#### 4.3.4 Effective Planning

Planning of time, team formation and activities distribution is done in effective manner. Not to leave all tasks on single person, teams are formed for different activities. Quality Assurance inspections that are open should be addressed properly in the available time.

#### 4.3.5 Inspections as Part of Maintenance

In aviation industry, inspection is first step before departure and after arrival of Aircraft. There is inspection checklist that is to be performed by the maintenance personnel. When SAFA ban was imposed on PIA, QA department was formed as per Regulatory body requirement for uplifting of SAFA ban, gave rise to lot of inspections that were done by QA for helping the maintenance department for that period of time. Meanwhile a wrong thought got promoted that inspection is task of QA department. There is need to change this thought as QA is only responsible for doing sampling inspections. So maintenance personnel must perform complete inspection in accordance with the defined checklist.

#### 4.3.6 Reward And Appreciation

A system is developed to appreciate the group doing good maintenance work. On yearly basis the SAFA Ramp inspections are analysed and the group that mostly released the Aircraft for SAFA based flight and it came with nil finding in SAFA Ramp inspection is to be awarded and appreciated.

#### **4.4 Sustaining**

After the above suggestions are brought into practice there will be need to sustain it. In every system there is need for improvement. So meetings are performed at periodic basis, trainings and refresher courses are imparted, self-discipline environment is created. Encourage the feedback, as it helps to bring improvement. Management must remain involved to keep the employees motivated.

#### **V. Conclusion**

After the analysis of findings of SAFA Ramp inspections with the possible factors involved for contribution of non-conformities, the most dominating factor that is having a big share is ignorance from maintenance personnel.

This is due to lack of trained persons, judge mental approach for abnormality, QA inspections are not taken seriously and finally the time is not managed properly.

There is need to change a culture by bringing a thought of ownership among the peoples. So they perform the inspections religiously as per checklist. Going by book for assessment of any abnormal situation. Supervisor must involve them self and encourage the feedback from the workers. Periodic meetings are done to analyze the performance of teams and there is appreciation and reward system to boost up the employees.

If above recommendations are made, it will help to avoid any SAFA ban as well as help to stay the Airline in safe margin of SAFA safety assessment analysis.

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