

# Accidents in Airports and Prevention

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**Abstract**— Airways had undergone a drastic evolution in the past decade, with aircrafts becoming the most widely used means of transport across the globe. But there are still many cases of unforeseen accidents that happen in airports, which could lead to the degradation of entire airways sector. This paper aims to provide a comprehensive knowledge on the diverse accidents that occur in airports; discuss about their causes and propose feasible preventive measures and or solutions to reduce the damage caused by some unavoidable disasters. This work will aid in construction and maintenance of some much safer and secured airports in the world.

**Keywords**— Airport Accidents, Precautions, Maintenance, Foreign Object Damage, Human factor, Safety Management System.

## I. INTRODUCTION

In our modern era, Aircrafts are the most preferred means of transport, across the world. This is primarily because of the higher reliability, least travel time and a better cost effectiveness of the airways over other modes of transport. In addition to that, airports are traditionally considered as the country's signature monuments. It showcases to an outsider, the first and the last impression of the country. So, it is of great importance for the government and the private supporters to invest into the safety and security of the airport infrastructures.

But even with all the precautions taken, the airport's working architecture is extremely delicate and fragile. Hence, even a small mistake caused by one of the sub-process can greatly affect the holistic system, to the extent of both life loss and materialistic loss. Since airport is such a vital architecture of the country, such accidents can have a great impact on the reputation of our country. It may also shatter the faith of the common people, who all believe that airport is one of the safest and the most secured zones in the world.

## II. TYPES OF ACCIDENTS

Accidents are not limited to the incidents that causes damage to people and materials. It also includes events that causes mental or physical distress to people; and potential damage to the normal working procedures of managerial activities. There are numerous ways to classify accidents. The most effective way is to propose the arch types based on key locations where these accidents can occur. And further sub-list all the potentially possible kind of accidents in accordance with the reason behind the accident and/or the resulting significance of

the accident in terms of damage related scales. There are also additional arch types of accidents, which do not come under any of the above category and are thus mentioned separately. Also, some feasible solutions and precautions to avoid these kind accidents are suggested and elucidated.

## III. RUNWAY ACCIDENTS

Despite all the advanced safety protocols and navigation aids, we still occasionally witness a plane crash on the runway. Some accidents even happen during the take-off. These kinds of accidents are usually caused by improper maintenance of the aircraft or runway. But there are also cases related to improper supervision, faulty equipment, etc.

### 3.1 Improper Maintenance of Aircraft

In August 2015, an US aircraft in Washington, got into a serious fire accident during its take-off. Fortunately, all the passengers were rescued without any life-threatening injury. But the material loss was nearly 65 mil dollars. Later that week, aircraft crash investigation team, found the cause to be inadequate fastening of a bolt in oxygen chamber, post maintenance. This caused oxygen leak and subsequently explosion on the runway, just before take-off.

These kinds of mistakes could have been avoided if the maintenance team were more conscious during work and had a proper supervision. A step by step check list of maintenance work, updated in real time must be implemented and put into practice. The development and implementation of such an IOT system would be much cheaper than the loss, otherwise caused due to ignorance.

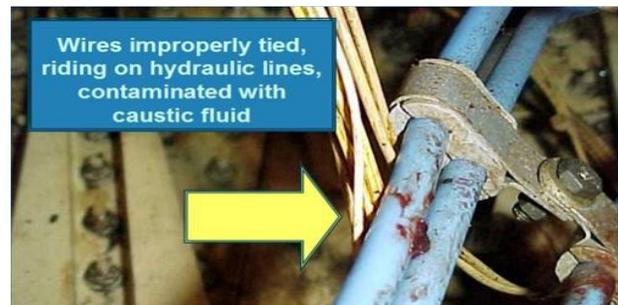


Fig. 1. Improper maintenance

### 3.2 Improper Runway Supervision

Runway monitoring is one of the most crucial and very responsible jobs in airports. Especially international airports,

and airports in major cities have a lot of traffic whole day long. These are monitored and directed by highly trained personnel, constantly working at their peak condition. But, as a human, possibility of errors is never zero. Runway and taxiway crashes are very much prone with heavy vehicles which does not have sudden brake facilities. So, a better idea would be to have a well written algorithm to navigate the aircrafts and ground vehicles. The runway traffic control personnel should also act as supervisors to act in emergency situations. This kind of management would also take some load off the personnel and have them concentrate more on situations that cannot be handled by an AI.

### 3.3 Foreign Object Damages

Foreign object damage (FOD) is responsible for one of the most dangerous kind of accidents in airport runway. Foreign object damages are damages caused to or malfunctions occurring in an airplane, which are caused by an object that does not belong to that area or system. It also includes damage by alien objects which are ingested by or lodged into a mechanism of the aircraft. Foreign object damages can cause both materialistic damages, as well as causing a system or equipment to be unstable, unusable, unsafe, and or less efficient. Some examples of FOD are ingestion or misplacement of loose hardware or grass into an engine, flight control equipment jammed by some hardware or tools, propellers and or tail rotors damaged by debris on the ramp or taxiway.

This kind of accidents can also be a secondary effect of improper maintenance. For instance, there has been cases where a loose fastener fell on the runway during the plane's take-off. And a subsequent flight that followed on into the runway exploded because of fuel leak. This fuel leak was actually caused due to bombardment of this fastener onto the fuel tank, by propeller air currents. A separate Foreign Object Damage prevention team with a FOD prevention officer should be formed as a part of foreign object damage prevention program to avoid such accidents and damage caused by foreign objects.



Fig. 2. Foreign Object Damages

### 3.4 Misread Communication Or Faulty Equipments

Misleading information can be another major cause of runway accidents, especially during take-off and landing. This is usually caused by incompatible transmitter and receiver. Such accidents have been reported in the airways. Also, during landing, automated waypoint guidance system is widely used. This can cause an issue if one of the transceiver is faulty. This kind of accidents can be prevented only by proper manual supervision. But there are also cases where, the sensors and radars at the airport terminal were faulty. And the control centre gave misinterpreted commands to the aircraft pilot, which causes accidents.

### 3.5 Environmental Influence

Environmental phenomenon causes wide range and variety of accidents. This includes runway surface covered by snow, which can cause imbalance and insufficient friction for landing. Another problem is icing of wing and tail surface, resulting in lesser available power for take-off. Heavy rain, floods and thunder storms can cause material damage to runway infrastructures and ground vehicles. These types of effects cannot be avoided. But with proper countermeasures, the damage can be minimized and accidents avoided. Countermeasures include double checking the frictional coefficient of runway before having it as active; using engine heat to channel under the aircraft wings and tails to reduce or avoid icing; using sufficient materials for waterproofing, add corrosion resistance and installing proper lightning rods in necessary places.



Fig. 3. Environmental Influence

## IV. ACCIDENTS WITHIN AIRPORT BUILDING

Accidents that happen inside airport main building or an airport terminal can be a lot more catastrophic than accidents in runway. This is primarily because most of the accidents in airports cause distress to passengers. And this panic, which in turn has a ripple effect of further chance to create a second accident. This effect is not seen much in aircraft disasters, as the passengers do not have mobility inside an aircraft.

#### 4.1 Fire Accidents

Airport, as we know, is made of many delicate electronic systems. Even with all the safety measures, chances of one of them blowing up are not zero. Especially in airport stores and restaurants, where culinary equipment goes hand in hand with electronic components. If such electrical wires are not insulated properly, the results can be catastrophic. There is also a chance of cooking gas explosion and minor fire accidents through 'Class A' to 'Class K'. To manage such situations, necessary firefighting tools must be readily available at airports. In addition, the airport personnel, both security team and private representatives should be well trained to use those tools.



Fig. 4. Fire Accidents

#### 4.2 Building Collapse

In recent years, there are many such occurrences where the airport building roof collapses. We can only speculate that; the reason is due to improper design and use of under quality materials for construction. It should be understood that building a strong quality structure 'once' is much cheaper than rebuilding the broken building again and again. And it is mandatory to put the safety of the lives prior to fancy architectures, profit or anything else that could potentially cause building collapse.

#### 4.3 Atmospheric Effects and Faulty Equipments

There are certain standards of numbers in atmosphere of the airport, which should be maintained at all costs. This includes oxygen levels, atmospheric pressure, temperature and humidity inside the airport. One may think that these are arbitrarily maintained by the atmosphere outside, but that is not true. Most of the time, airports are constructed outside the city zone, in barred lands, or in high mountain altitudes, where there is insufficient oxygen constitution in the air. So, it is highly likely that the atmosphere has a changed stat in that region. This might not affect the locals, but airports are always flooded with diverse people across the globe. Many of them cannot immediately adapt the local atmosphere. So, in most airports, the building is isolated from outer atmosphere

and has a machine to regulate the conditions inside. These machines should be scheduled to periodic maintenance without any compromise. If anything goes wrong, the passengers can result in multiple distressing situations and grave biological injuries. Every airport should also have a proper medical team with highest mobility across the landside zone.

#### V. NATURAL AND MAN-MADE CALAMITY

Airports are situated in a wide range of areas from deserts to ocean shores. Some are even constructed in high mountain zones and near wildlife reserves. So apart from the above-mentioned accidents, the airport is also susceptible to unique natural calamities related to their situational zone. This can include floods from ocean shores, dams, heavy rain, etc. or attack by wildlife from nearby forests and dens. Mountain ranges can cause sudden dip in the atmospheric conditions and landslides over and under the airports. Hence, efforts should be taken to identify and avoids such instances or come up with measures to reduce the impact of such accidents.



Fig. 5. Landslide accident at Yeager Airport.

#### VI. SECURITY BREACH

Security breach need not necessarily refer to terrorist attack. Even unintentional activities like smuggling a cigarette lighter inside, or childish pranks like bringing fireworks and other toy weapons can cause unpredictable disasters. The airports are usually flooded with a variety of people with a variety of mind sets and intensions. It is not possible to intercept each and every one of them. And if a childish prank of a kid holding toy weapon gun meets an old person with heart problems, it can end with severe trauma for that person or immediate health conditions. But if the security guards take it seriously and end up harming the kid, the result can cost the international reputation of that airport. So, the only way to overcome such problems is to have a deep analyser in the security personnel, who can perfectly grasp the magnitude of

the situation, and come up with the most effective way to suppress it. Hence, such education should be taught to the airport personnel and must also be included during recruitment process for such posts.

## VII. HUMAN FACTOR AND SAFETY MANAGEMENT SYSTEM

Airport management architecture is a holistic system, where any single flaw in one of the subsystem can gravely affect the overall performance and working of the entire process. So, no mistakes or flaws should be ignored in any way. Practice should be such that, all working conditions must be reported in detail to the immediate higher official for perusal. This act is a part of the Safety Management Systems (SMS), a systematic approach to managing airport safety. It includes organizational structure, manager accountability, policy and procedures related to the safety system and is considered as a constituent part of the holistic managerial system. This further contributes to the effectiveness of Safety Investigation and *increasing* the human factor for prevention of airport accidents. The key elements of safety management system are safety related policies and objectives, risk management involving safety, assurance for safety and activities promoting safety. Big data analysis is also suggested to advance predict the possible things that could go wrong and come up with tactics to prevent the kind of accidents, before it could happen.

## VIII. AIR CRASHES DUE TO HUMAN ERROR

### 8.1 Adam Air Flight 574(2007)

When the crew of this aircraft were preoccupied with trying to correct a malfunctioning internal reference system, the autopilot of the aircraft was disabled on its own and the plane began to descend. The pilot tried to correct a slow right roll. But, it turned out to be a failure when the complete control was lost. All 102 passengers and crew aboard died when the plane crashed terrifyingly into the ocean. Following the crash, large-scale reforms to Indonesia's transportation industry were formed.



Fig. 6. Adam Air flight 574

### 8.2 Air France Flight 447 (2009)

As per a standard procedure in France for flights that cruise for more than three hours, the pilot of Air France 447 had put one of his co-pilots at the helm before heading to the rest cabin for a break. The aircraft hit turbulence and in a short span of time, the autopilot turned off and the plane started rolling to the right slightly. The co-pilot overcompensated for this and his action eventually led to the increase in the plane's angle of attack to a great extent. This action also made the plane stall 3 times and later it started falling out of the sky. It eventually plummeted into ocean and led to the death of all 228 people on board.



Fig. 7. Air France Flight 447 wreckage

### 8.3 Transasia Flight 235(2015)

Very few minutes after the TransAsia 235 took off, one of the engines had suffered from flameout. Normally, this phenomenon would not cause a catastrophe as modern aircraft are manufactured after ensuring that they can run on one engine if necessary. But in this case, the pilot pre-assumed the perfect engine for the defective one and shut it down. Hence, the plane was flying without thrust when the pilots tried to save the people who were on the ground in a very populated city. One of the wings hit a bridge and caused the plane to crash into a nearby river.



Fig. 8. TransAsia flight 235 before crash

## IX. AIR CRASHES CAUSED DUE TO WEATHER

### 9.1 Tam Airlines Flight 3054 (2007)

TAM Airlines (a Brazilian carrier) was on a domestic cruise when it hydroplaned upon landing and also it overshot the runway eventually making its way across a warehouse and a gas station. During the post-crash investigation, the case of mechanical failure was dismissed and the wet runway was determined to be the reason. None of the people on board survived (187 passengers and crew) and 12 on the ground were killed accounting to 199 fatalities.



Fig. 9. TAM Airlines Flight 3054 wreckage

### 9.2 American Airlines Flight 331 (2009)

American Airlines Flight 331 operating with American Airlines Boeing 737-800, that was carrying one hundred forty eight passengers and 6 crew, had over ran from the runway on landing at the destination airport that was experiencing poor weather conditions. Even after landing, the plane continued to travel outside the airport perimeter and eventually broke apart on the adjacent beach and led to many injuries. The chief reasons why the crash occurred include the excess speed of the aircraft on touchdown and it also touched about 4000 feet ahead of the runway.



Fig. 10. American Airlines Flight 331 wreckage

### 9.3 United Nations Bombardier Crj-100 (2011)

Georgian Airways Canadair Regional Jet (CRJ 100 ER), crashed during Go Around at Kinshasa Airport. At the time when the aircraft landed, the airport was experiencing an intense thunderstorm.

The aircraft had touched the ground about 170 meters (560 ft) to the left of the desired orientation. At the time of impact, aircraft was heading at 220 degrees and its speed was 330 km/h. After the intense impact, the aircraft had started breaking up and also skid along the ground. It eventually rolled over before it halted. The consequence of the catastrophe was that whole aircraft had disintegrated completely and all parts sheared off. A total of 32 people died and a Congolese journalist was the only survivor.



Fig. 11. United Nations Bombardier CRJ-100

## X. CONCLUSION

With all the advanced safety and security features implemented to avoid accidents, the airports stand as one of the safest places on earth. Yet, airports are still prone to accidents in one way or the other. This also suggests that there is always room for improvement in the field of airport safety. So, many such research should be done on this field to continually improve the safety features of the airways. A unique procedure should be comprised to tackle the different accidents that may occur in respectively diverse airports across the world. And specialization for the same is recommended while simultaneously implementing big data analysis for arbitrary results.

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