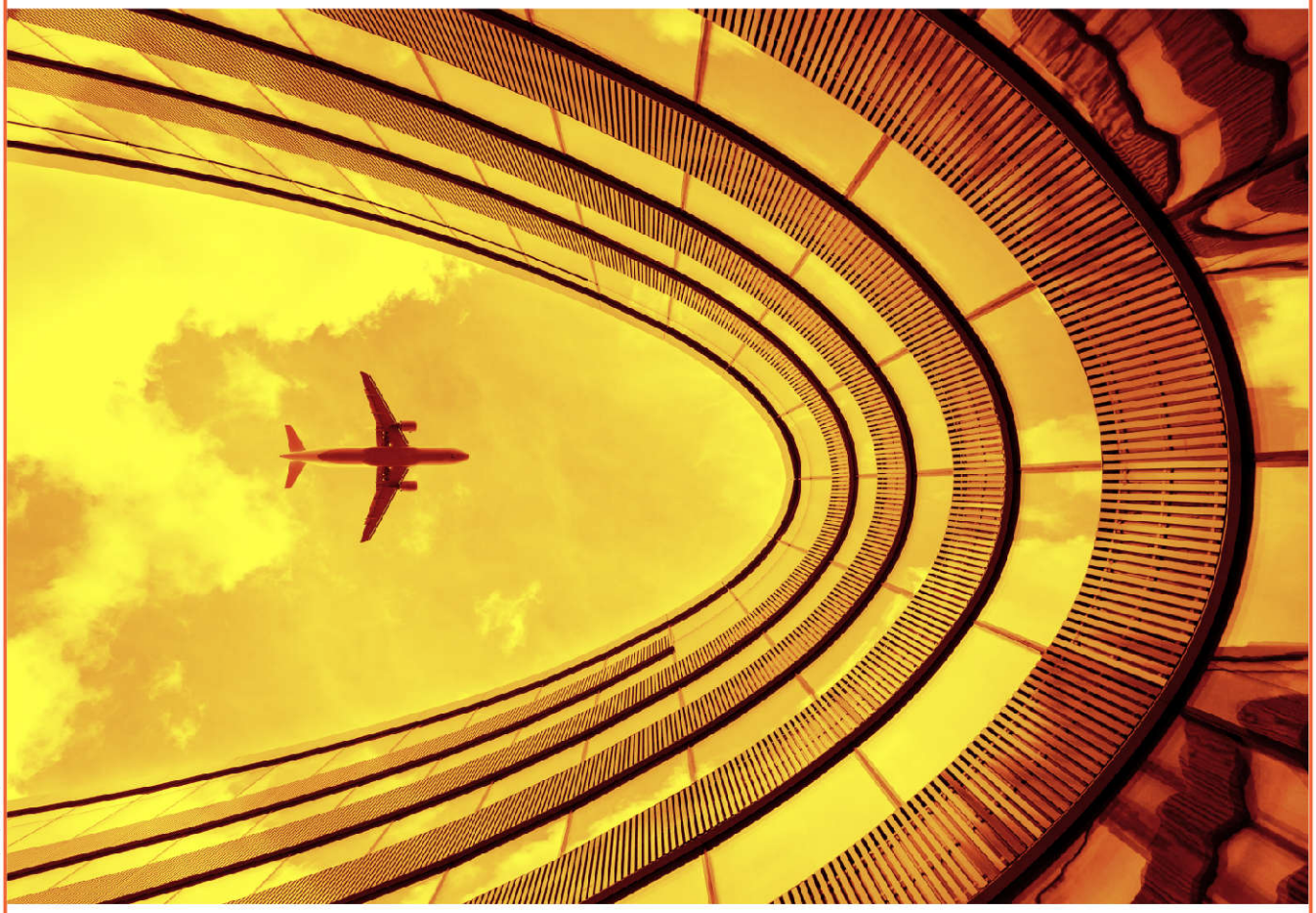
सत्यमेव जयते

DIRECTORATE GENERAL OF CIVIL AVIATION



ANNUAL SAFETY REVIEW - YEAR 2017

CONTENTS

REPRODUCTION OR USE OF CONTENT

The Data covering the Indian environment in this report is obtained from DGCA database and external references have been sourced from sources such as ICAO iSTARS, etc. No portion of this report shall be reproduced, copied or published in any form or manner except with the expressed permission of the DGCA.

DISCLAIMER

The data presented in this report is strictly for the information purposes only. While every care has been taken to prevent error in the content of the report, DGCA shall not be liable for any kind of damages, or other claims or demands as a result of incorrect, insufficient or invalid data, or arising out of or in connection with the use, copying or display of content. The information contained in this report should not be construed as legal advice.

FOREWORD

I am delighted to release the 2nd edition of the Annual Safety Report containing analysis of the safety data and globally significant safety events for the year 2016.

This document presents the safety performance of aviation in India which has witnessed improvements across all areas. It also serves as a benchmark for the aviation industry to measure their respective safety performance vis a vis the State aggregate data. The efforts being made by DGCA in association with the industry stakeholders has resulted in further strengthening the data driven approach for managing aviation safety.

The first edition was well received by the aviation industry, I have no doubt that each year this document will see improvement and become a valuable reference document.

(B S Bhullar)
Director General, Civil Aviation

EXECUTIVE SUMMARY

The Annual Safety Review presents the analysis of the aggregate safety data derived from the DGCA data base, and external sources such as ICAO iSTARS, stake holders. The safety review covers the period 2008-2016.

Performance of Key Safety Priorities

The report contains the performance review of state safety plans for year 2016 in terms of the safety priorities and the matrix of their performance indicators. The analysis indicates that numbers of risk bearing Airprox per million flights over Indian Air Space has breached the target. It also indicates that the Airprox attributable to ATC/System failure per million flights over Indian Air Space has breached the target. The major factor in this regard is conflict detection and resolution. This is an area of concern.
The number of unstabilised approaches which continue to land continues to be safety concern. The performance indicators of ground collision and Ramp Safety have also breached the targets. The detail analysis indicates that “loss of situation awareness by pilots, non-familiarization with the aerodrome layout” is the major contributory factor.

Analysis Of Worldwide And Indian Aircraft Accident Data (Schedule Commercial Transport And Aircraft With All Up Weight More Than 5700 Kgs)

The report contains details of fatal accidents which occurred worldwide during the year 2016 and the analysis of accident data with respect to growth in passenger traffic. A comparison between Indian Accident Data and Worldwide Accident Data indicates that the Indian Accident Rate per million departures is less than World Accident Rate. There was no fatal accident in the year 2016. Most of the accidents have resulted runway excursion.

Analysis Of Helicopter Accident Data

The report includes data on fatal worldwide helicopter and analysis of Indian helicopter accident data. The analysis indicates that most of the helicopter accidents have occurred during commercial operations and loss of control in flight is a major occurrence category. In addition there is rise in the accident due to CFIT. These are cause of concern.

State Safety Oversight

The finding for the year 2016 have been analysed using a group of factors. The analysis indicates deficiencies in company manual/procedure/SOPs. They were either holding obsolete information, procedure poorly defined or were not easily accessible.

CHAPTER 1

Safety Analysis and Indian State Safety Plan

1.1 Introduction

ICAO Annex 19 places responsibility on a State to implement State Safety Programmethat is commensurate with the size and complexity of the State's civil aviation system. As part of Sate Safety Programme states are required to ensure implementation of Safety Management System among the applicable service providers. ICAO through its standards and recommended practices, as contained in Annex 19, has adopted the concept of Acceptable Level of Safety (ALoS) in aviation. This provides a structured and balanced approach for managing the risks which are existing in a state/organisation.

An acceptable level of safety performance for the State can be achieved through the implementation and maintenance of the SSP as well as safety performance indicators and targets showing that safety is effectively managed and built on the foundation of implementation of existing safety-related SARPs.

India established its State Safety Programme in the year 2010 and published higher level document SSP-India. This document defines The SSP-India together with the relevant regulations provides a framework to meet the safety management provisions contained in ICAO Annexes and to progressively improve safety performance across all affected aviation service providers. The SSP-India requires measurement of safety performance by establishing safety performance indicators, their targets.

Based on the above requirements, India has identified seven "State Safety Priorities" along with associated performance indicators, their objectives, targets and the safety action plan in partnership with the stakeholders.

1.2 State Safety Plan and Acceptable level of Safety

DGCA-India has developed the State Safety Plan 2015-2016. It is an outcome of some of the activities described in the State Safety programme (SSP) and implemented in accordance with the phase-wise activities. It has been supported by the work undertaken by the stakeholders in development and implementation of their Safety Management System (SMS). It sets out the State's **safety priorities, objectives, safety performance indicators** and associated **action plans** with the sole aim of further improving safety across the civil aviation industry.

Our Key Safety Priorities

Taking in to consideration the global aviation safety plan, initiatives by other states and our own experience, supported by data from the State Safety Database, the DGCA has established seven **State Safety Priorities**. These are:

a) Airborne conflict
b) Controlled flight into terrain
c) Runway excursions and overruns
d) Wildlife and bird strikes
e) Loss of control in flight
f) Ground collisions and ramp safety
g) Deficient maintenance

These safety priorities provided a focus for the DGCA and the aviation fraternity during the year 2015 and 2016.

Each of these safety priorities is linked to the more detailed operational measures called “lead safety performance indicators” for a drill-down capability to provide the supporting details for effective monitoring.

1.3 Performance of State Safety Plan 2015-2016

Based on the data collected, safety performance with respect to the SPI for the year 2016 has been evaluated and presented in the subsequent paras.

1.3.1 Airborne Conflict

Safety objective is to reduce the risk of airborne conflict occurring through tracking and actively managing events that can lead to a collision.

Performance achieved alongwith targets set for the year 2016 is given in Table 1.1.

Table 1.1 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Number of risk bearing AIRPROX per 10,00,000 flights over Indian airspace	1.45	3.28
2	Number of TCAS RA in controlled airspace leading to breach of separation per 10,00,000 flight over Indian airspace	11.12	13.1
3	Number of aircraft not or incorrectly complying with ATC instructions (including level bust) per 10,00,000 flights over Indian airspace	5.32	1.64
4	Number of AIRPROX attributable to ATC/system failure per 10,00,000 flights over Indian airspace	8.71	11.5

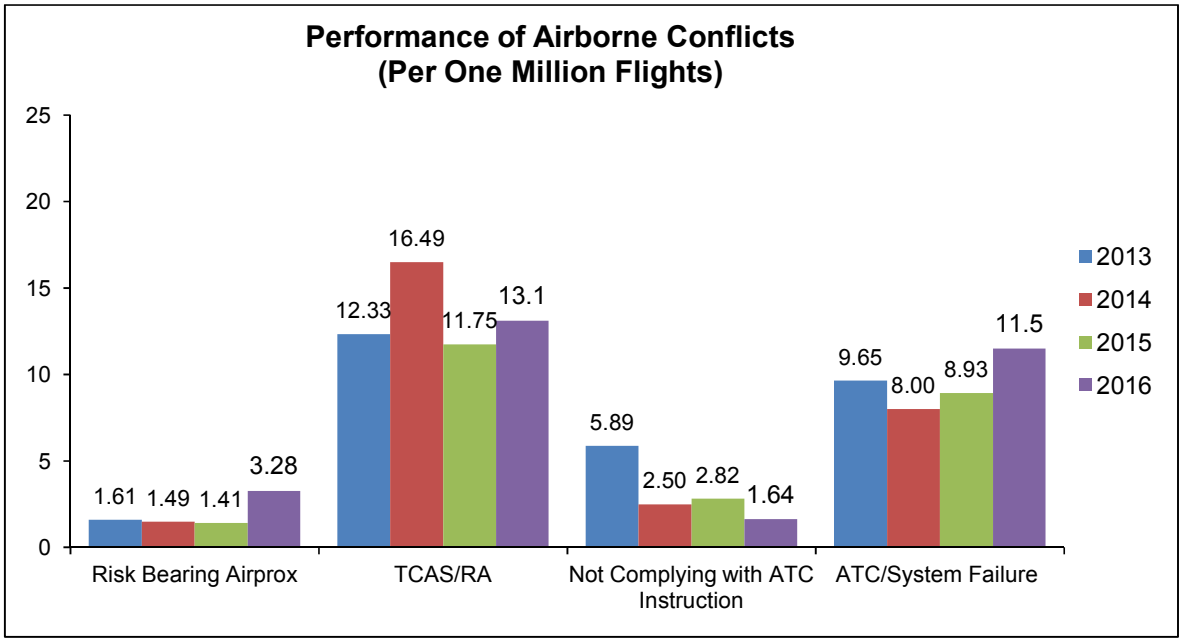


Fig 1.1

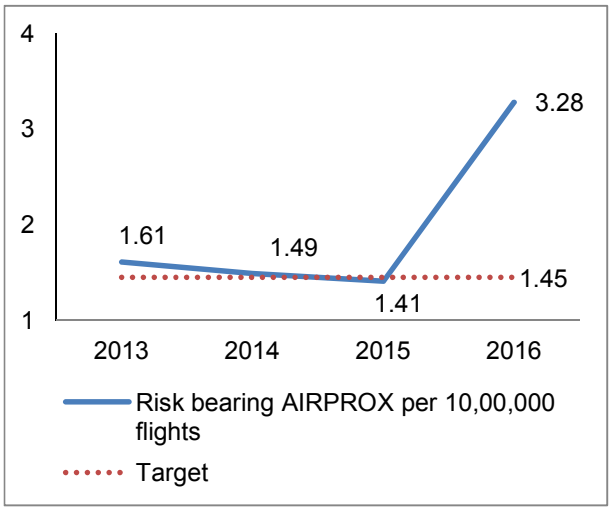


Fig 1.1(a)

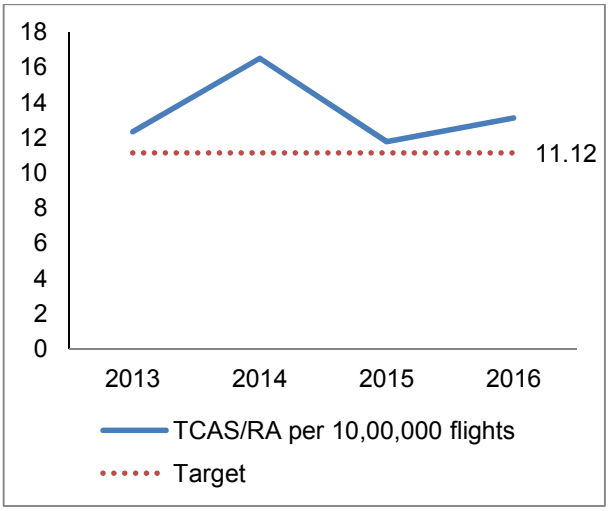


Fig 1.1(b)

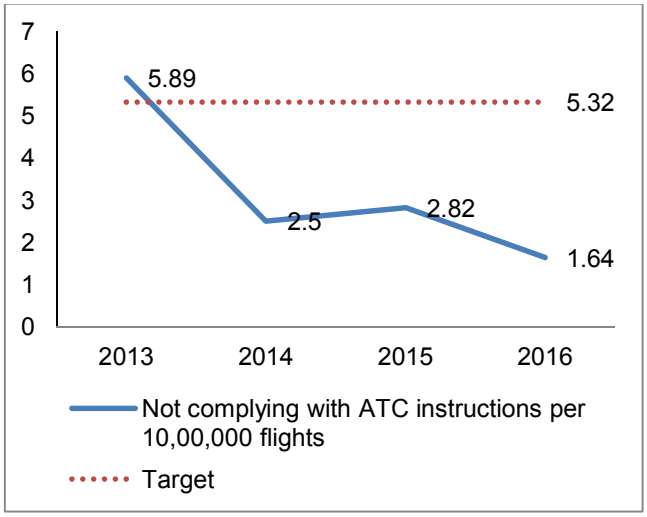


Fig 1.1(c)

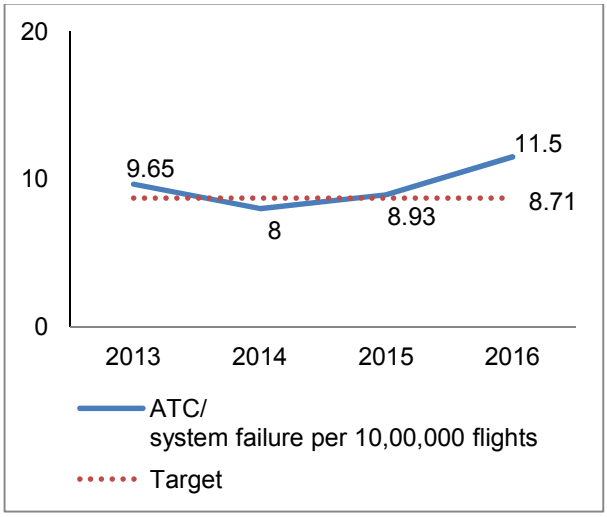


Fig 1.1(d)

1.3.2 Controlled Flight into Terrain

Safety objective was to further reduce the risk of CFIT events occurring through tracking and actively managing events that can lead to a collision. Performance achieved along-with targets set for the year 2016 is given in Table 1.2.

Table 1.2 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Number of GPWS/EGPWS warnings (Scheduled airlines)per 10,000 departures	0.068	1.87
2	Number of helicopter VFR flights that make emergency landing due to degraded visual environment per 10,000 departures	0.87	0.15

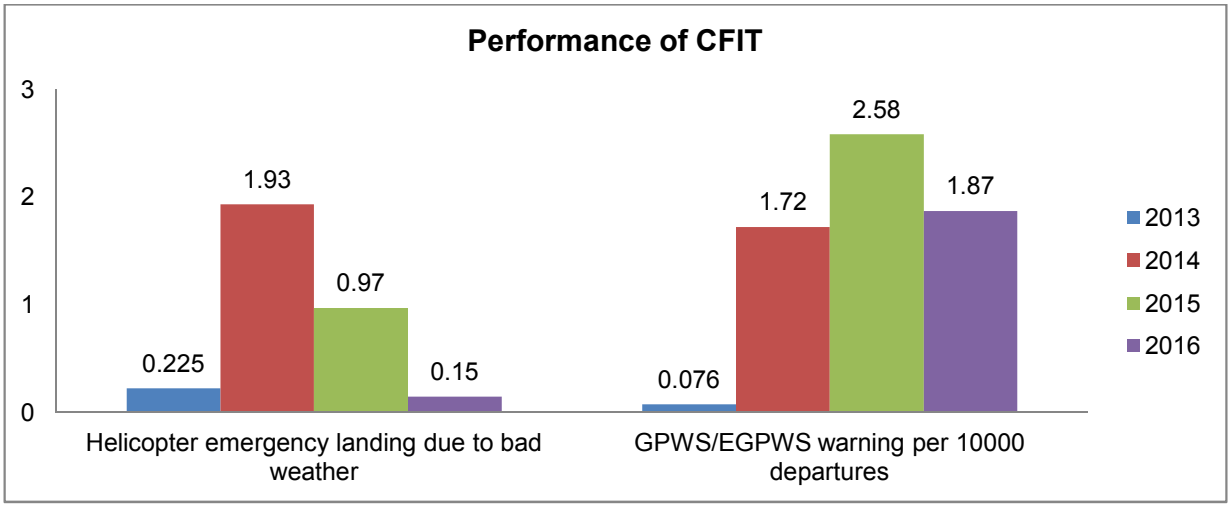


Fig 1.2

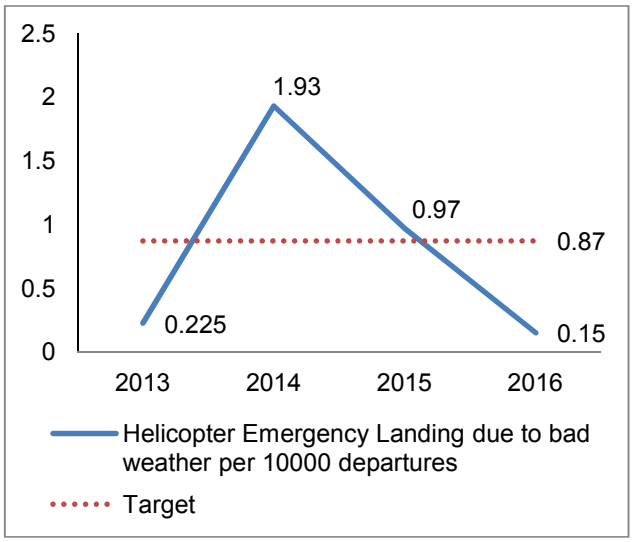


Fig 1.2(a)

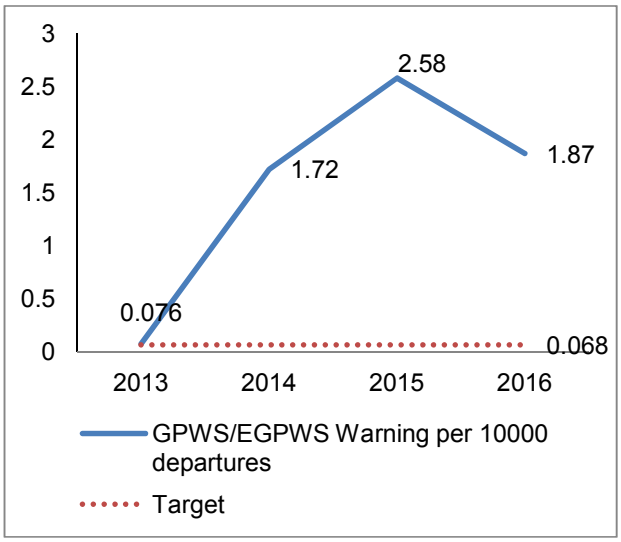


Fig 1.2(b)

Number of GPWS/EGPWS warnings have decreased in comparison with year 2015, which were due to unstabilised approaches.

1.3.3 Runway excursions and overrun

The safety objective was to reduce number of runway excursions at all India airports and at all times of the year. Performance achieved along-with targets set for the year 2016 is given in Table 1.3.

Table 1.3 Target Performance vs Achieved Performance			
No.	**Performance Indicators**	**Target**	**Achieved Performance**
1	Number of unstablised approaches per 10,000 approaches	9.03	8.61
2	Number of unstablised approaches that continue to land per 10,000 approaches	1.22	7.61
3	Number of unstablised approaches when performing a precision approach per 10,000 approaches.	4.73	5.4
4	Number of unstablised approaches when performing a non-precision approach (no vertical guidance) per 10,000 approaches.	1.48	1.73
5	Number of unstablised approaches when performing a visual approach per 10,000 approaches	2.82	1.5
6	Number of 'near' runway excursions per 10,000 approaches	0.039	0.01
7	Number of runway excursions per 10,000 approaches	0.068	0.033

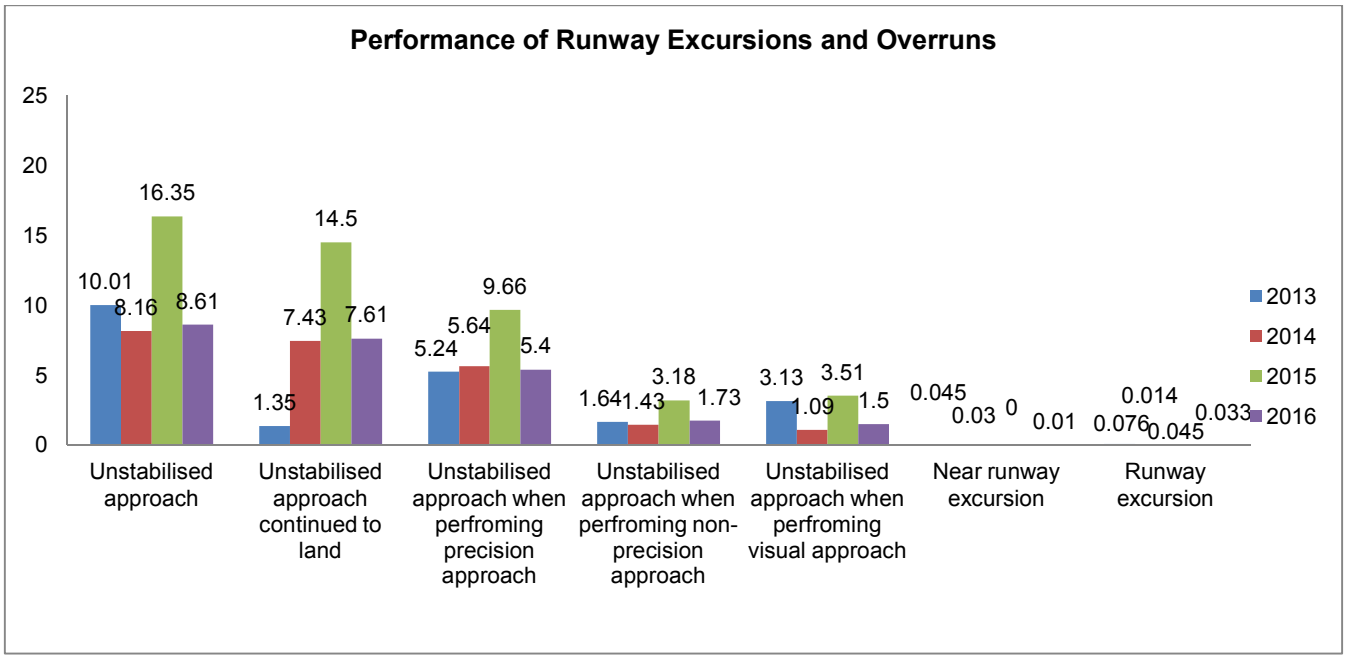


Fig 1.3

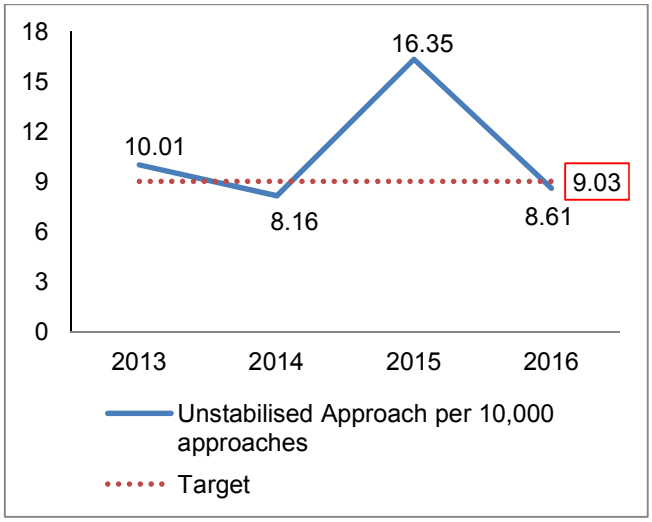


Fig 1.3(a)

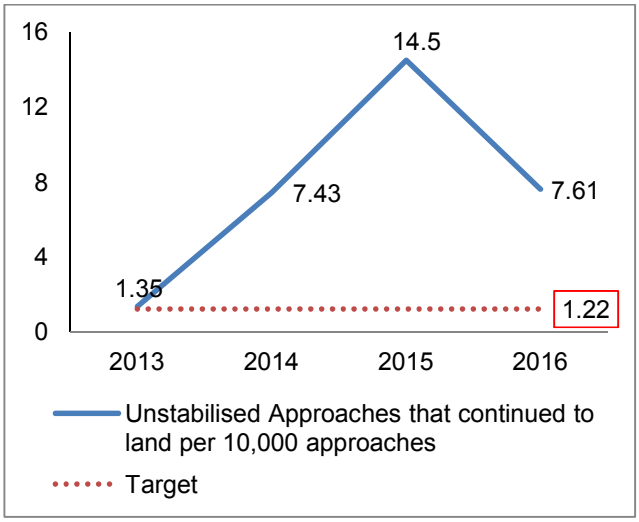


Fig 1.3(b)

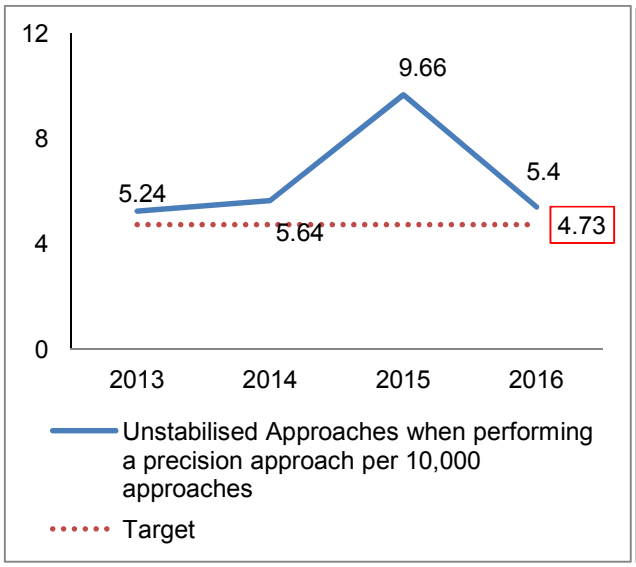


Fig 1.3(c)

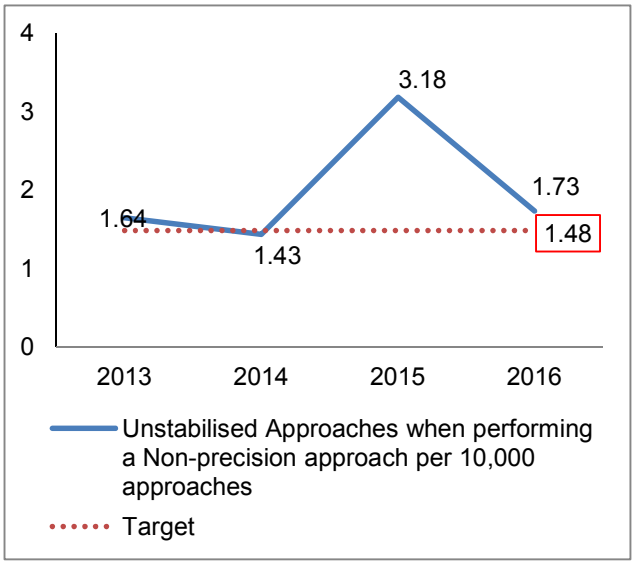


Fig 1.3(d)

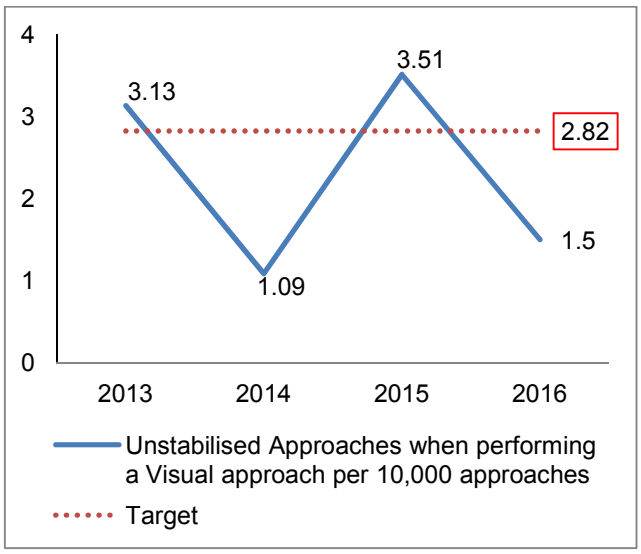


Fig 1.3(e)

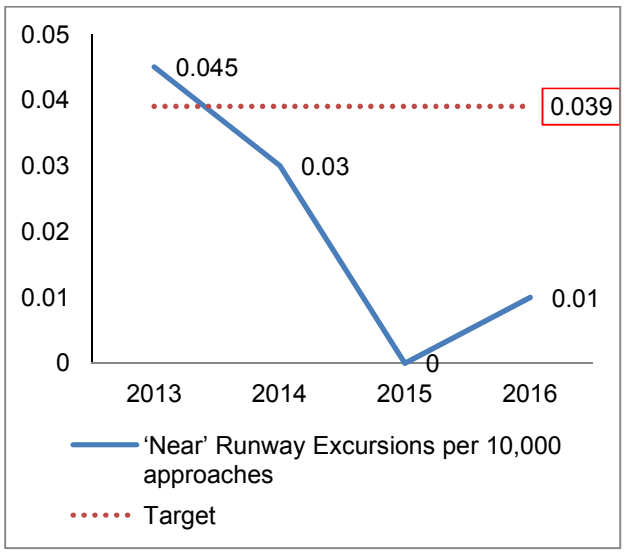


Fig 1.3(f)

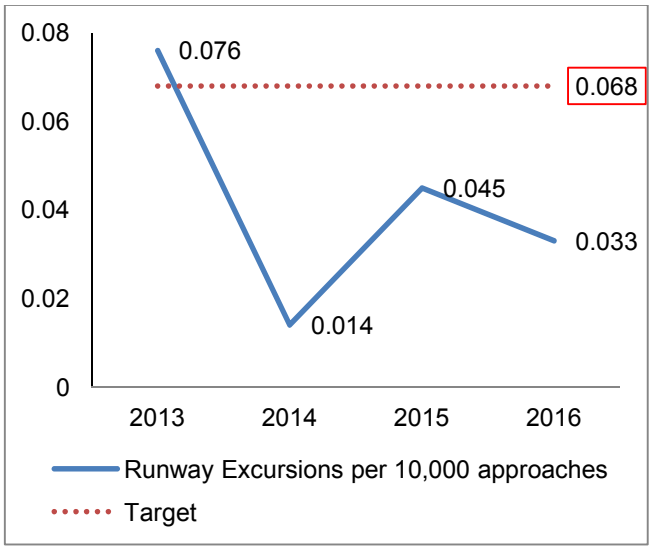


Fig 1.3(g)

It can be seen from the above graphs that the trend for unstablised approaches is increasing. But it has a shown decent decrease in comparison with year 2015 due to the enhanced efforts of the industry and the training imparted. However, it continues to be a concern for the State. Fig. 1.3 (c) shows decrease in the unstablised approaches when performing a precision approach, which was a concern in year 2015.

1.3.4 Wildlife and Bird strikes

The safety objectives was to reduce the number of wildlife and bird strike events at Indian airports. Performance achieved along-with targets set for the year 2016 is given in table 1.4

Table 1.4 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Number of reported bird strikes at Indian airports per 10,000 movements (movements only for 18 Major Airports in India)	4.44	3.75
2	Number of reported wildlife strikes at all Indian airports per day.	1.89	2.3
3	Number of runway incursions by wildlife at all Indian airports per day	0.071	0.011

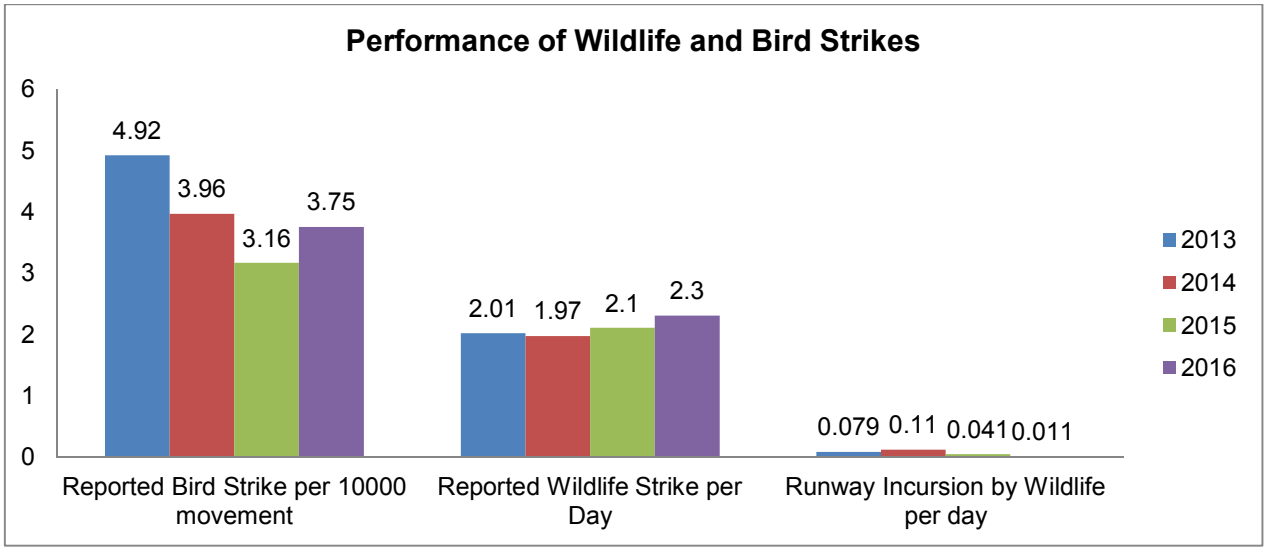


Fig 1.4

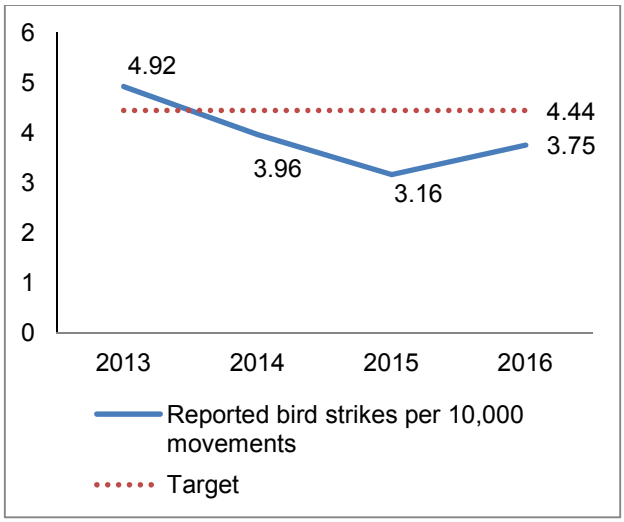


Fig 1.4a)

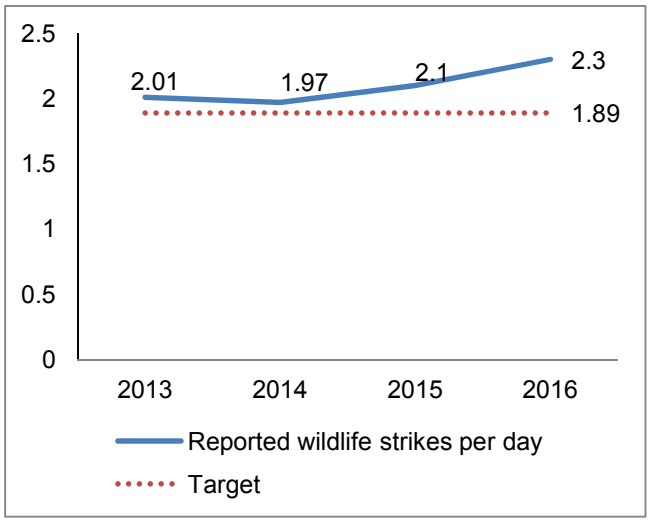


Fig 1.4(b)

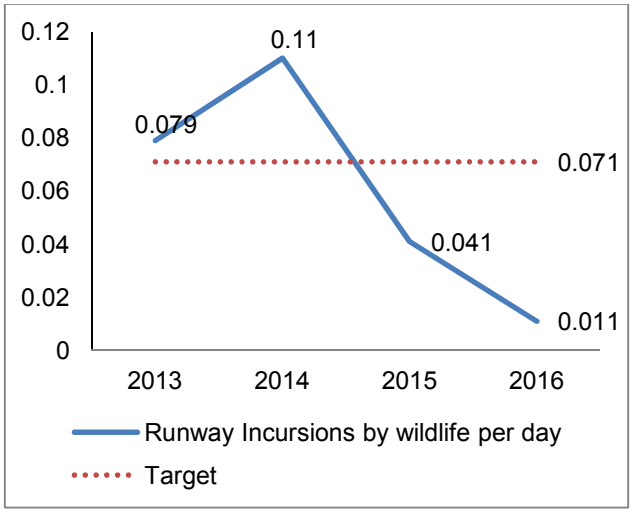


Fig 1.4(c)

Fig 1.4 (b) shows decrease in the rate of reported bird strike for the year 2016 when compared to earlier years, even though the reporting of bird strike has increased refer fig 1.4(a).

1.3.5 Loss of Control in Flight

Safety objective was to reduce the number of loss of control pre-cursor events. Performance achieved along-with targets set for the year 2016 is given in table 1.5

Table 1.5 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Loss of control precursor events per 10000 departures: ▪ Actual stick-shake and alpha floor ▪ Low speed during approach events ▪ Low speed during cruise events ▪ Bank angle exceeding maximum permitted as per AFM for aircraft type ▪ Wind shear below 500 feet	2.45	0.73
2	Proportion of aircraft operators that actively monitor loss of control precursor measures (Only Scheduled operators)	100%	100%
3	Number of operators that have implemented loss of control training	100%	100%

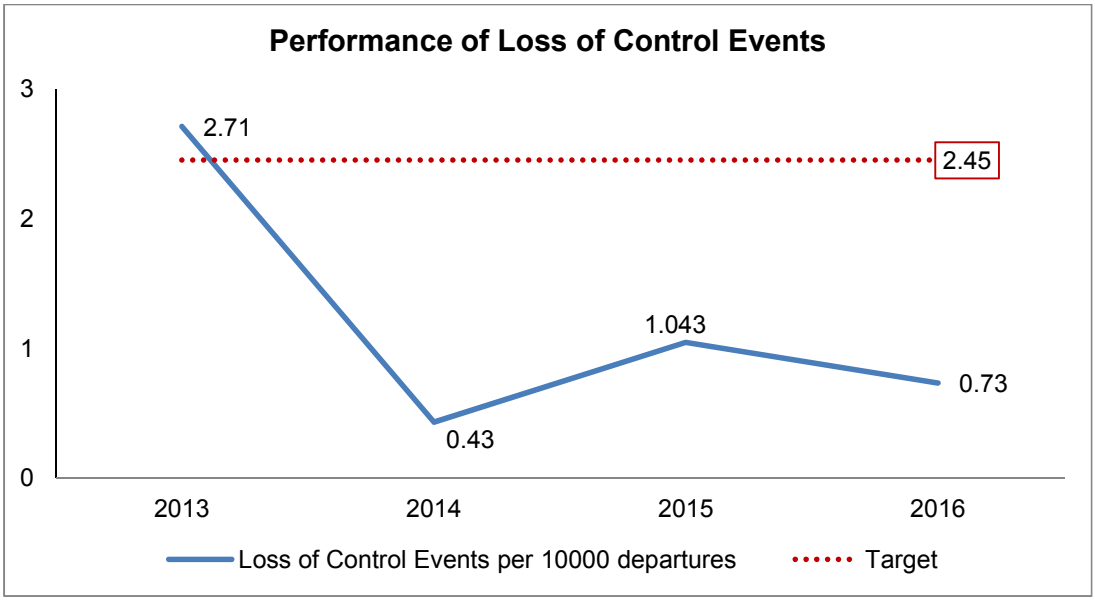


Fig 1.5

Fig. 1.5 shows a decreasing trend in the rate of loss of control events per 10000 departures as compared to the year 2015, and continues to remain well below the set target and under manageable limits.

1.3.6 Ground collision and Ramp Safety

The safety objectives were to reduce the number of ground collisions between aircraft, ground collisions between vehicles and aircraft and the number of fatalities and serious injuries occurring on the ramp. Performance achieved along-with targets set for the year 2016 is given in table 1.6

Table 1.6 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Number of runway incursions (aircraft)	(12)	(35)
2	Number of runway incursions (vehicle)	(0)	(6)
3	Number of runway incursions (person)	(3)	(2)
4	Number of ramp incidents that result in damage to aircraft, vehicles or loss of life/serious injury to personnel	(40)	(121)

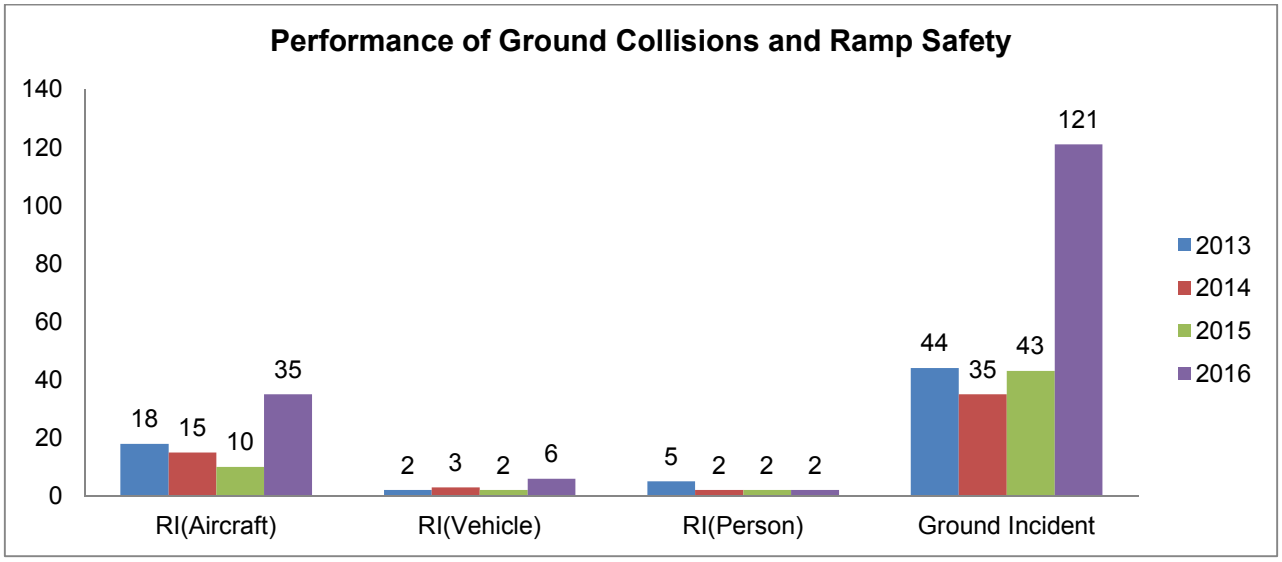


Fig 1.6

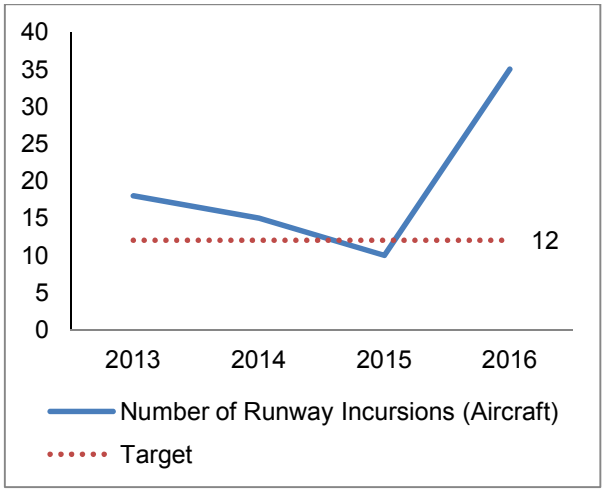


Fig 1.6(a)

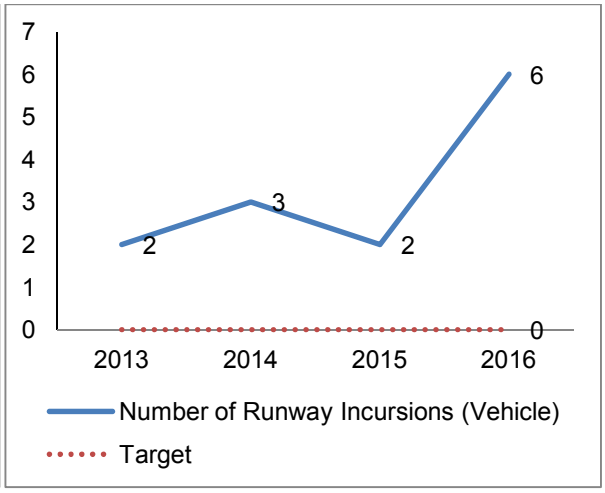


Fig 1.6(b)

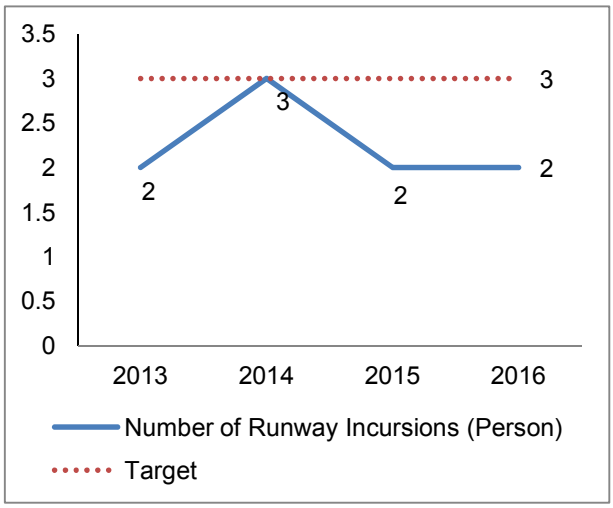


Fig 1.6(c)

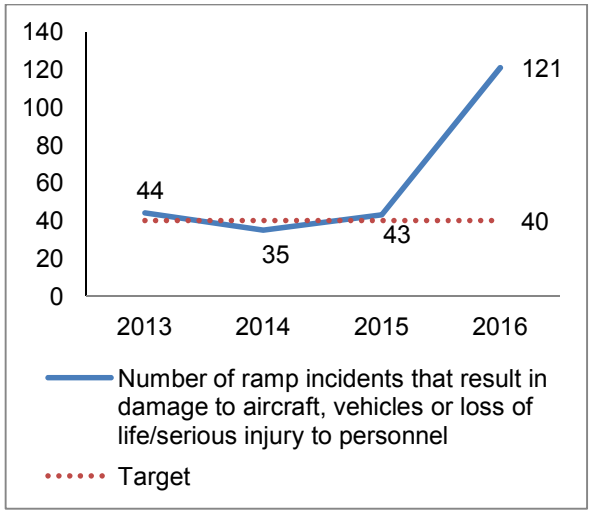


Fig 1.6(d)

1.3.7 Deficient Maintenance

The safety objective was to improve the maintenance of Indian registered passenger carrying aircraft, thereby reducing the number of incidents relating to maintenance issues. Performance achieved along-with targets set for the year 2016 is given in table 1.7.

Table 1.7 Target Performance vs Achieved Performance

No.	Performance Indicators	Target	Achieved Performance
1	Incident involving component/system failure	(378)	(438)
2	Number of Maintenance errors	(21)	(56)

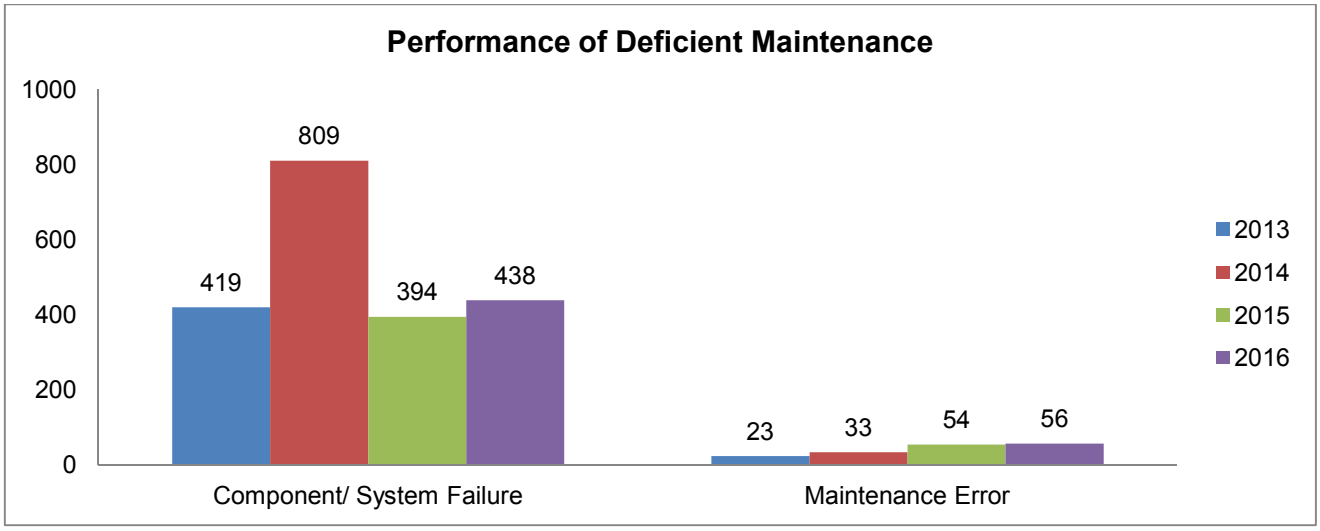


Fig 1.7

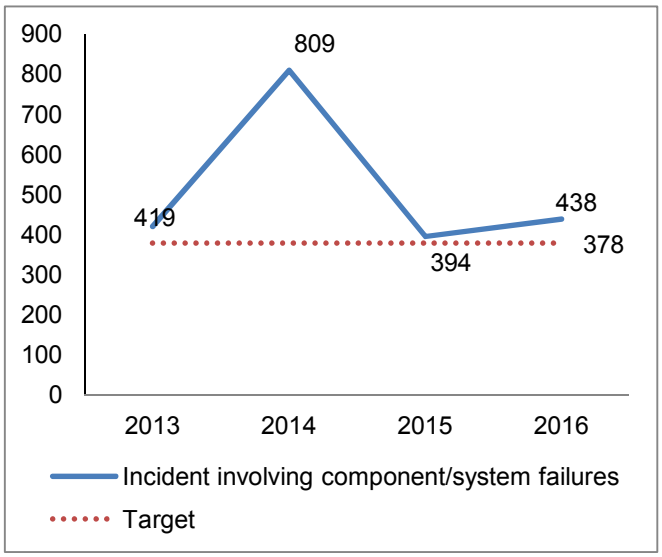


Fig 1.7(a)

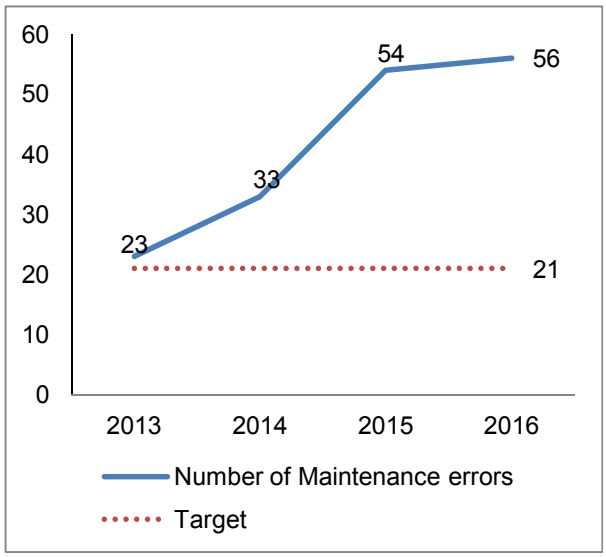
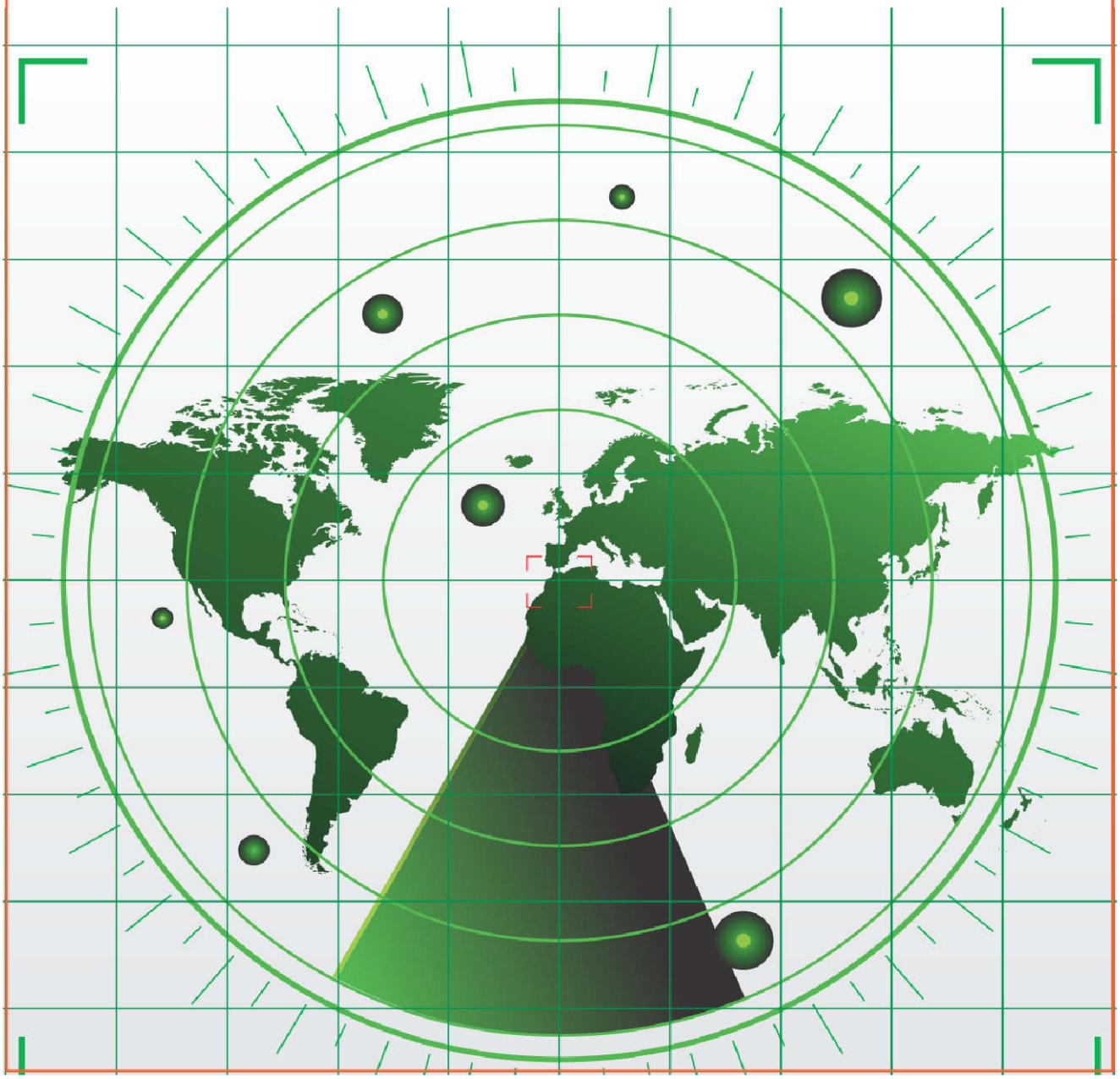


Fig 1.7(b)

- The unstablised approaches which continue to land together with ground collision and Ramp safety are issues of concern for India.

CHAPTER 2

Global Safety Scenario



2.1 Introduction

This Chapter covers the accident which took place elsewhere in the world involving commercial transport and aircraft with All Up Weight more than 5700 kgs. In the year 2016, a total of 134 accidents have taken place. This included 06 fatal accidents which resulted in 474 fatalities.

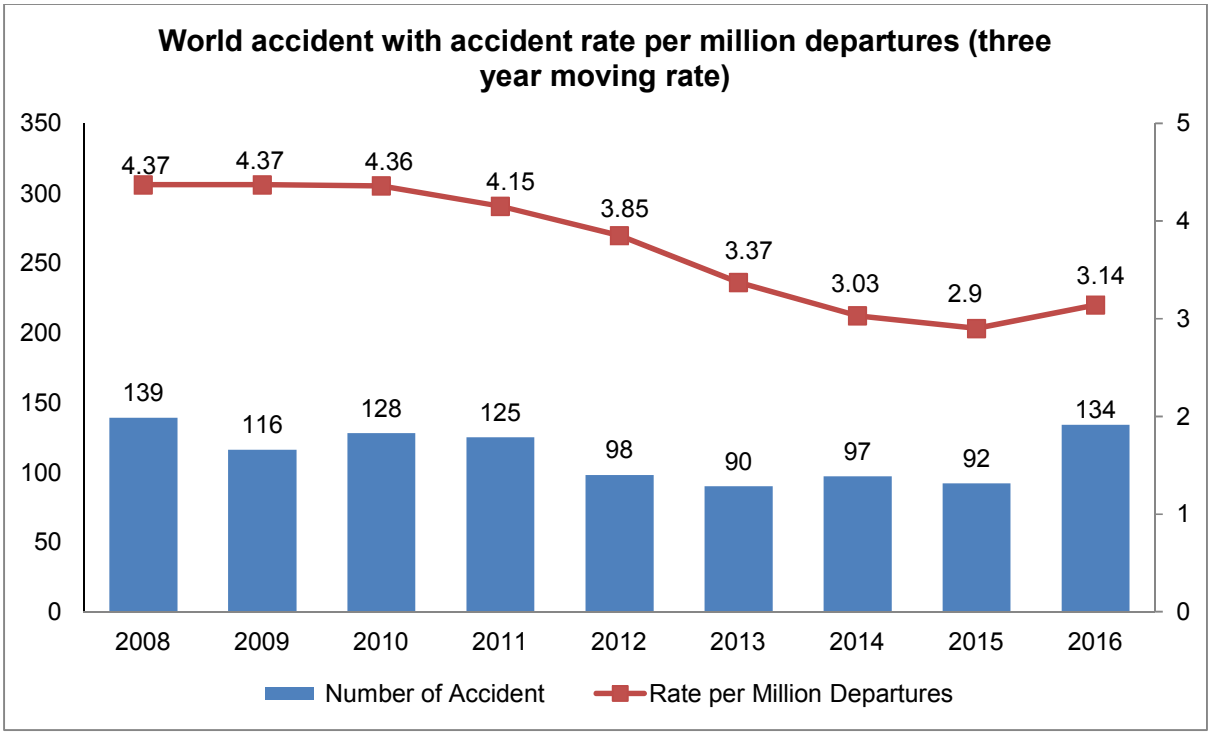


Fig2.1

2.2Review of Fatal Accident 2016

Table 2.1 Worldwide Fatal Accidents 2008-2016

Year	Accident	Fatal Accidents	Fatalities
2016	134	8	183
2008 to 2015 Average	111	15	544

From the year 2008-2016, there has been a gradual decrease in the number and rate of worldwide fatal accidents.

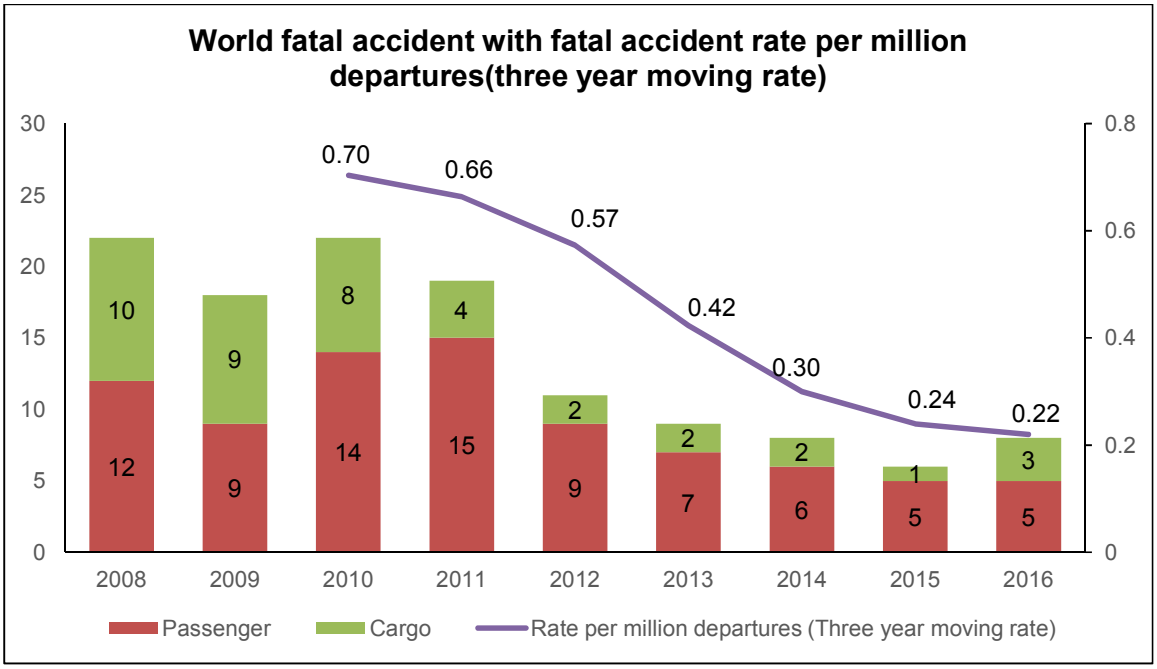


Fig2.2

2.3 World-wide commercial air transport fatal accident above 5700kgs

Table 2.2 Worldwide Fatal Accidents- Commercial Air Transport Above 5700Kgs

Date	Aircraft Type	Location	Fatalities	Description
07.12.2016	ATR 42	Pakistan	47	An ATR-42-500 aircraft while operating flight from Chitral to Islamabad with 42 passengers and 6 crew member on board, reported failure of the left hand engine (PW127E). The crew shut down the effected engine and continued towards Islamabad. During descend crew issued Mayday call. Shortly afterwards radio and radar contact with the aircraft was lost and it crashed at about 25nm north of Islamabad. All occupants of the aircraft perished in the crash.
05.12.2016	Fairchild SA227	USA	01	A Fairchild SA227 aircraft was operating on-demand cargo flight from Northwest Florida Beaches International Airport (ECP) Panama City, Florida to Southwest Georgia Regional Airport (ABY) Albany, Georgia. En route, the ATC advised the pilot of moderate to extreme precipitation along his planned route of flight and suggested a route of flight that would have had the pilot fly to the northeast for 70 nautical miles to avoid the most severe weather. The pilot responded that he had enough fuel for the diversion. Shortly thereafter, the pilot advised the controller that he intended to divert the flight to

				Tallahassee International Airport (TLH), Florida. The airplane then descended from 7,000 feet msl to 3,700 feet msl before radar and radio contact was lost. The aircraft was destroyed and the pilot, the sole occupant, was killed.
03.08.2016	B 777	UAE	01	A Boeing 777-300 aircraft, was operating flight from Thiruvananthapuram (India) to Dubai (United Arab Emirates) with 282 passengers and 18 crew. The aircraft attempted to go around after first ground contact at runway 12L at Dubai airport. The aircraft however did not climb, but after retracting the gear touched down on the runway and burst into flames. All occupants were evacuated via slides. The aircraft was destroyed due to fire. A firefighter attending to the aircraft lost his life
09.05.2016	A 320	Egypt	66	An Airbus A320-200 aircraft was operating flight from Paris Charles de Gaulle (France) to Cairo (Egypt) with 56 passengers and 10 crew members. En route, at FL370, about 130nm north of Alexandria (Egypt) and about 210nm north-west of Cairo a number of ACARS messages indicating cockpit window temperature sensors faults and optical smoke detector activations were received. The crew did not respond to a handover from Greek to Egypt ATC. The transponder signals of the aircraft ceased and according to primary radar data the aircraft tracked on its course at FL370, then flew a left hand turn of 90 degrees, started a descent doing a right hand orbit until reaching 15,000 feet and disappeared out of radar at 10,000 feet. No distress call was received. The aircraft crashed in the Mediterranean Sea, there were no survivors.
09.03.2016	B 737	Russia	62	A Boeing 737-800 aircraft, was operating a flight from Dubai to Rostov-On-Don Airport in Southern Russia. The aircraft impacted airport terrain after executing a second “Go Around” on runway 22 in bad weather. The second go-around was initiated at a height of about 720ft. subsequently the aircraft climbed to about 3,000ft and then begin to descend again. This descent was not arrested. The aircraft entered a steep dive and impacted the ground towards the left side of the runway about 120m beyond the threshold. The accident happened in darkness and in poor weather. The aircraft was destroyed, 55 passengers and 7 crew fatally injured

09.03.2016	AN 26 B	Bangladesh	03	An Antonov AN-26 was operating a cargo flight from Coxs Bazar to Jessore (Bangladesh) with 4 Ukrainian crew members and a load of shrimps. While it was climbing out of Coxs Bazar's runway 35, the left hand engine failed. Crew requested for immediate return back to Cox's Bazar Airport. He was advised by ATC to report left hand down wind. The crew decided to continue on a right hand downwind. The aircraft turned to finals. When fully configured for landing and stable, the captain decided to go around. When the aircraft was about to again join a left hand pattern for runway 35, the aircraft lost height and impacted the waters of the Bay of Bengal about 2nm from the aerodrome.
02.02.2016	A 321	Somalia	01	An Airbus A321-111 was operating a flight from Mogadishu International Airport, Somalia to Djibouti-Ambouli Airport (JIB/HDAM), Djibouti. The aircraft suffered an in-flight explosion about 15 minutes after takeoff when the aircraft was at about 12,000 feet. The explosion occurred just behind the R2 door. A large hole was blown in the fuselage and one passenger fell out of the aircraft and was killed. Two other passengers were injured. The aircraft returned back and safety landed at Mogadishu.
08.01.2016	CL 600	Sweden	02	A CL-600-2B19 aircraft was operating a commercial cargo flight from Oslo/Gardermoen Airport (ENGM) to Tromsø/Langnes Airport (ENTC). During the approach briefing in level flight at FL 330 due to erroneous IR input, a very fast increase in pitch was displayed on the left attitude indicator. Due to difference between the left and right PFD the autopilot got disconnected automatically. The aircraft was put in nose down pitch attitude and the aeroplane started to descend. the angle of attack and G-loads became negative. Bank angle warnings sounded and the maximum operating speed and Mach number were exceeded which activated the over speed warning. A distress call was transmitted and acknowledged by the air traffic. The cargo plane was destroyed when it impacted the terrain near Akkajaure, Sweden. Both pilots were killed.

CHAPTER 3

Indian Safety Scenario -Scheduled Operations

3.1 Introduction

This Chapter covers the accident which took place in India involving scheduled commercial transport and aircraft with all up weight more than 5700 kgs. In the year 2016, 3 accidents occurred. None was a fatal accident

3.2 Review of Accident 2016

Table 3.1 Indian Accidents 2008-2016			
Year	**Accident**	**Fatal Accidents**	**Fatalities**
2016	3	0	0
2008 to 2015	8*	2	159

* One includes accident to foreign aircraft in India

Year 2016- Classification based on Mode of propulsion			
Accident involving Jet Engines	2	0	0
Accident involving Turboprop Engines	1	0	0

Of the 03 accidents to Indian aircrafts, one accidents occurred due to the component failure (landing gear collapsed) and other two were runway excursions. The details areas follows:

3.3 Indian commercial air transport accident above 5700kgs

Table 3.2 Indian Commercial Air Transport Accidents above 5700kgs				
Date	**Aircraft Type**	**Location**	**Fatalities**	**Description**
03.03.2016	B737-900	India	Nil	After landing on runway 27 at Mumbai, cockpit crew heard a thud sound an aircraft started turning towards right. During investigation it was observed that trunnion pin sheared off during landing roll.

07-05-2016	ATR 72-600	India	Nil	An ATR 72-600 aircraft was operating flight from Delhi to Indore with 66 Passengers on board. The aircraft was cleared for VOR approach RWY 07, but due to tail wind conditions the approach was discontinued and aircraft carried out a go-around. Subsequently the aircraft made ILS VOR approach for Rwy 25. The touchdown was normal and during landing roll the aircraft started veering to the left of the runway and went into unpaved ground. There was no injury to passenger.
27.12.2016	B737-800	India	Nil	A B737-800 aircraft was operating flight from Goa to Mumbai with 154 Passengers on board. Aircraft was cleared for take-off from Rwy 26. The aircraft backtracked and after turning on the turn pad aligned to the runway 26 centerline center line. After take-off clearance from ATC and power was stabilized at 40% of N1 and TOGA was engaged. Immediately thereafter, aircraft started veering towards the right of centerline. Aircraft exited the runway on the right and stopped on the soft ground at 150mt from centerline of runway.

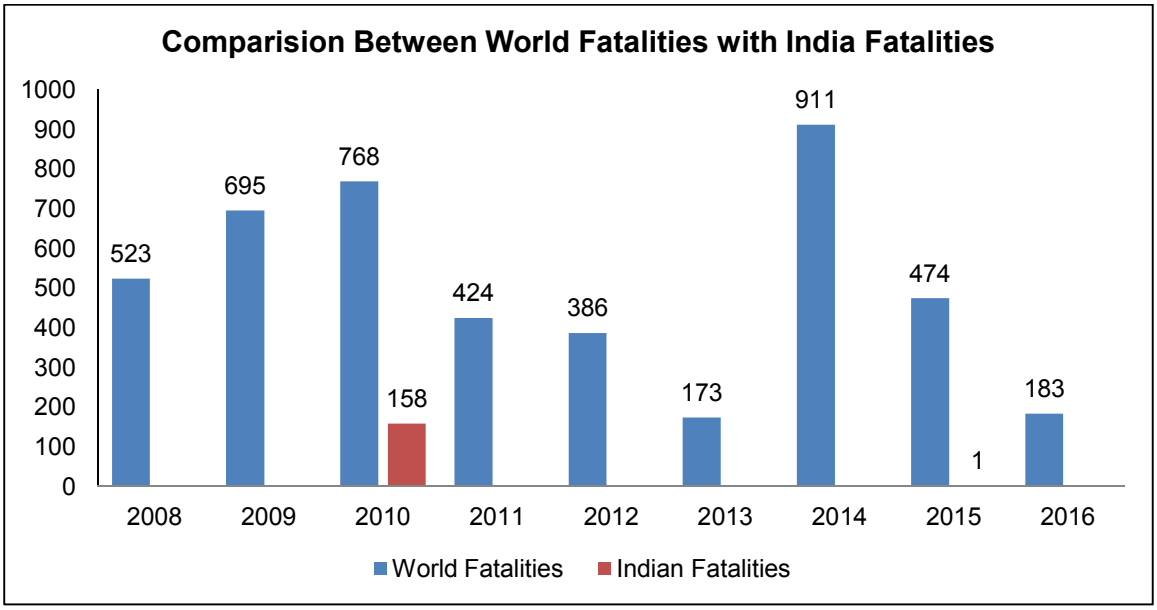


Fig3.1

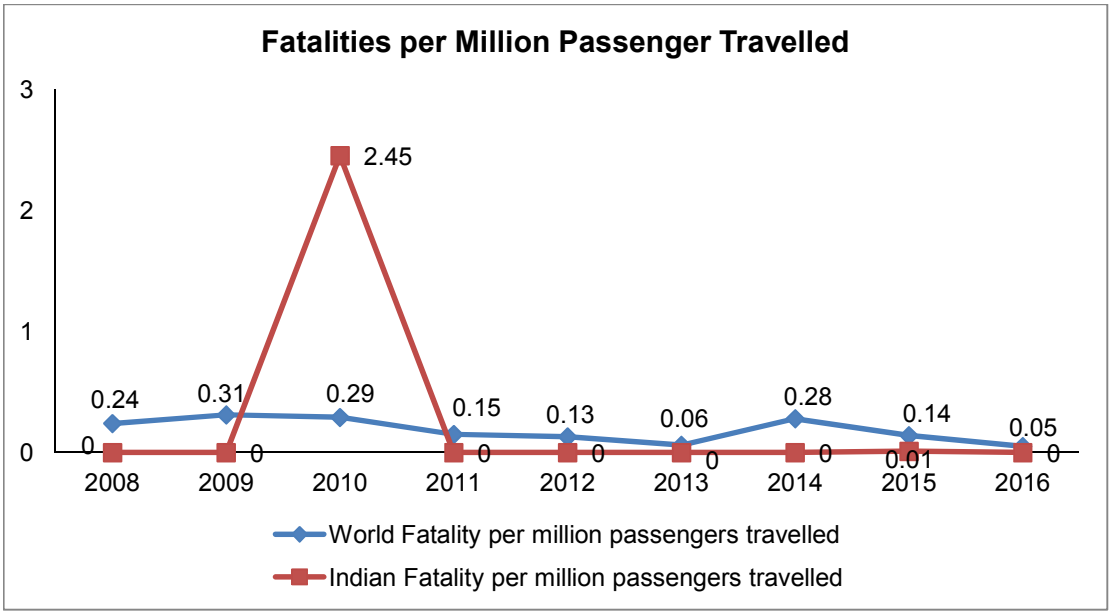


Fig3.2

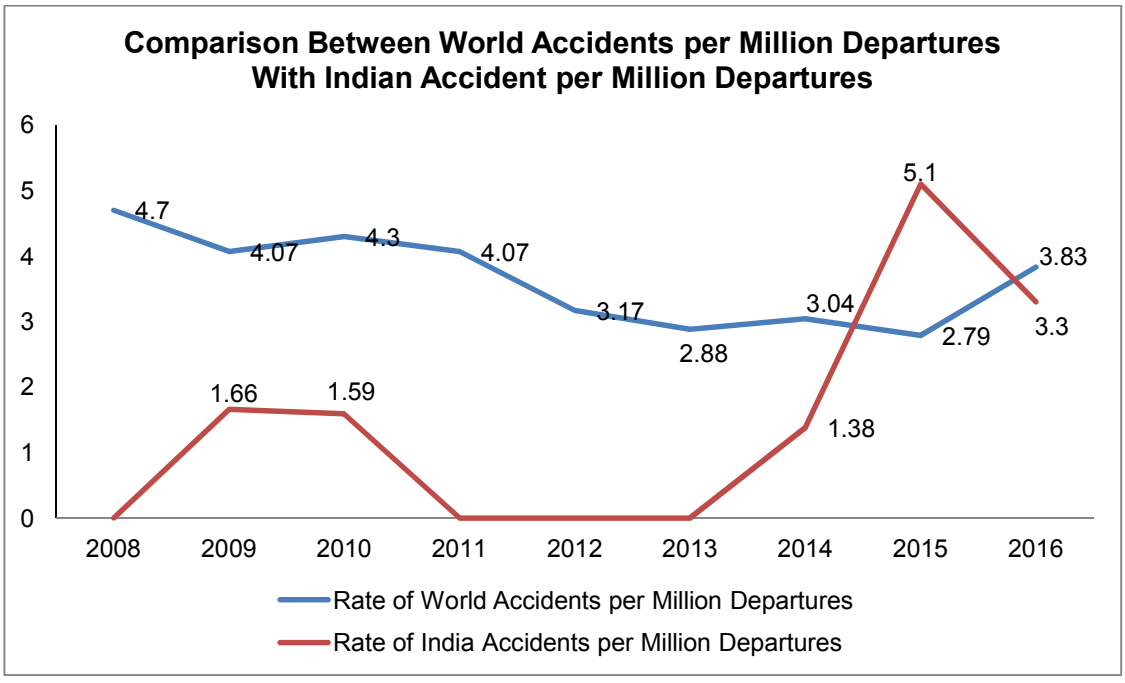


Fig3.3

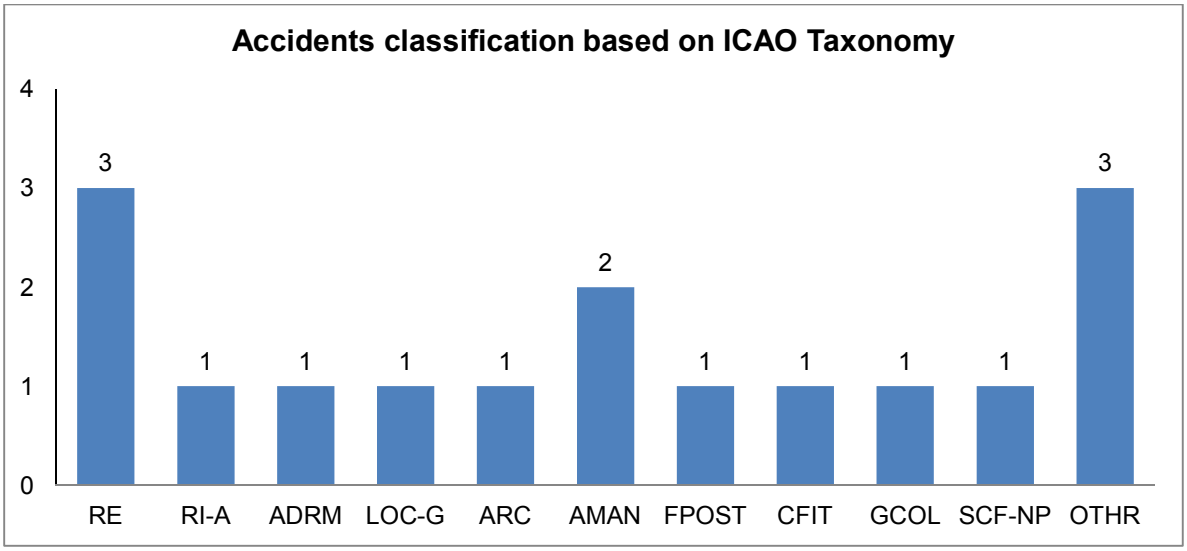
-The figure 3.1 & 3.2 shows safety performance of Indian aviation in occurrences of high consequences has improved and is better than the world average.

- After the tragic accident in year 2010 which resulted in 158 fatalities, efforts have been made to keep the fatal accident rate to the minimum possible .Due to these efforts, despite a drastic increase in the number of passengers travelling over a period of 09 years i.e. from 2008 to 2016, the fatalities count is at lower level than the world.

3.4. Classification of accidents as per ICAO taxonomy

Aircraft accidents in India for the period from the year 2008 to 2015 have been classified as per the CICTT values and is presented in fig. 3.4.

It is seen that Runway Excursion (RE) is the most commonly applied category, which is mainly due to the unstablised approaches which continued to land coupled with adverse weather conditions and runway conditions.



*OTHR includes Unstablised Approaches during landing.

Fig3.4

CHAPTER 4

Helicopter Analysis

4.1 Introduction

This Chapter covers the accident to helicopter which have occurred in Indian during the period from 2008 to 2016 (Fig. 4.1). Details of few significant helicopter accidents occurring world over are also covered in this chapter. In the year 2016, one accident occurred resulting in 03 fatalities.

For improving the safety in helicopter operation DGCA has adopted three pronged strategy as given below:

1. Regulatory Intervention
2. Audits/Surveillances
3. Interaction with stakeholders and operating crew

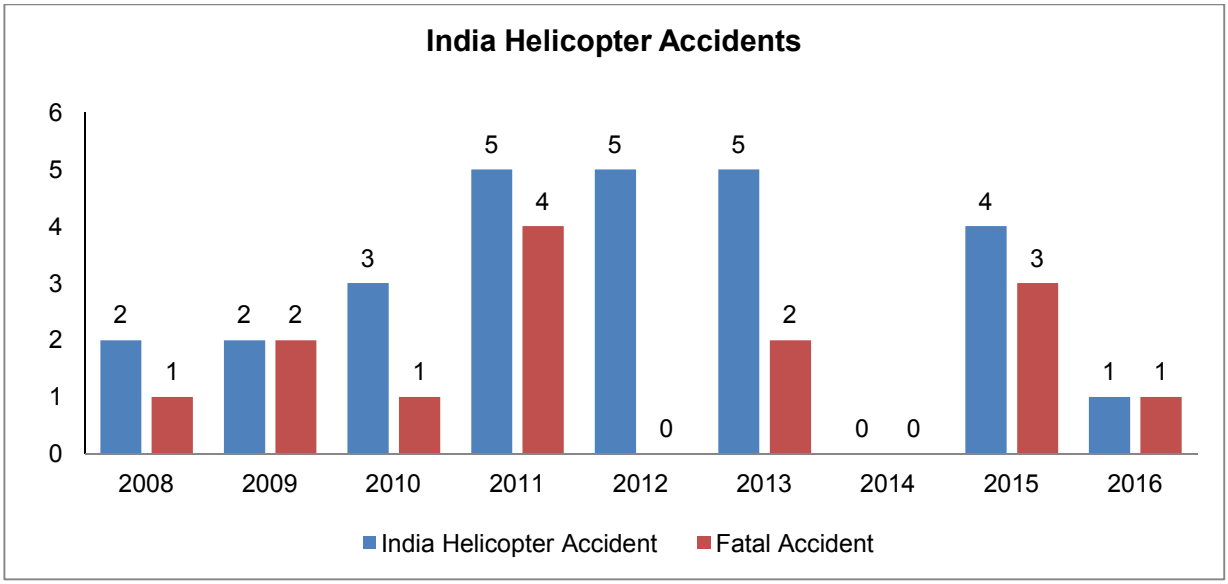


Fig4.1

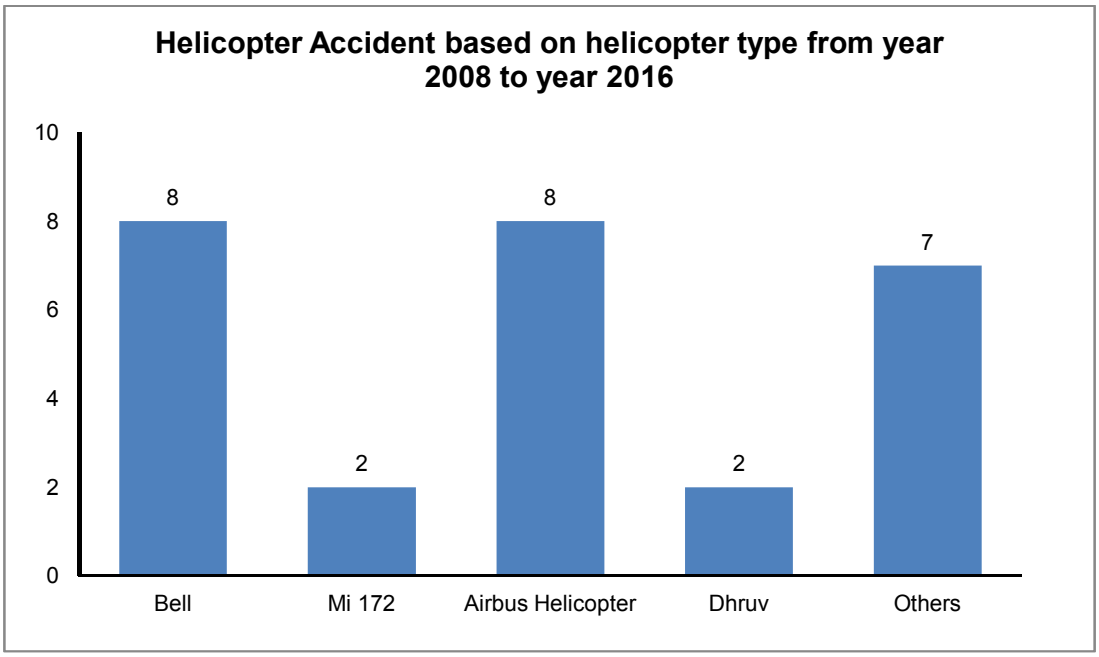
4.2 Indian Helicopter Accidents

Table 4.1 Indian Helicopter Accidents

Date	Aircraft Type	Location	Fatalities	Description
11.12.2016	R 44	India	03	R44 helicopter took-off from Juhu Aerodrome at 1139 IST for local flying. Pilot encountered clutch problem. During emergency landing helicopter crash landed and caught fire.

4.3 Analysis based on type of helicopter

Fig. 4.2 shows classification of helicopter accidents based on the major types of helicopter being flown in the country.



*others include Cheetah, Chetak, Schzweizer, Augusta and Robinson helicopter

Fig 4.2

4.4 Helicopter accidents according to type of operation

Fig 4.3 shows the distribution of accidents according to type of operations. More than 50 % of the accidents are to the helicopters involved in commercial operations.

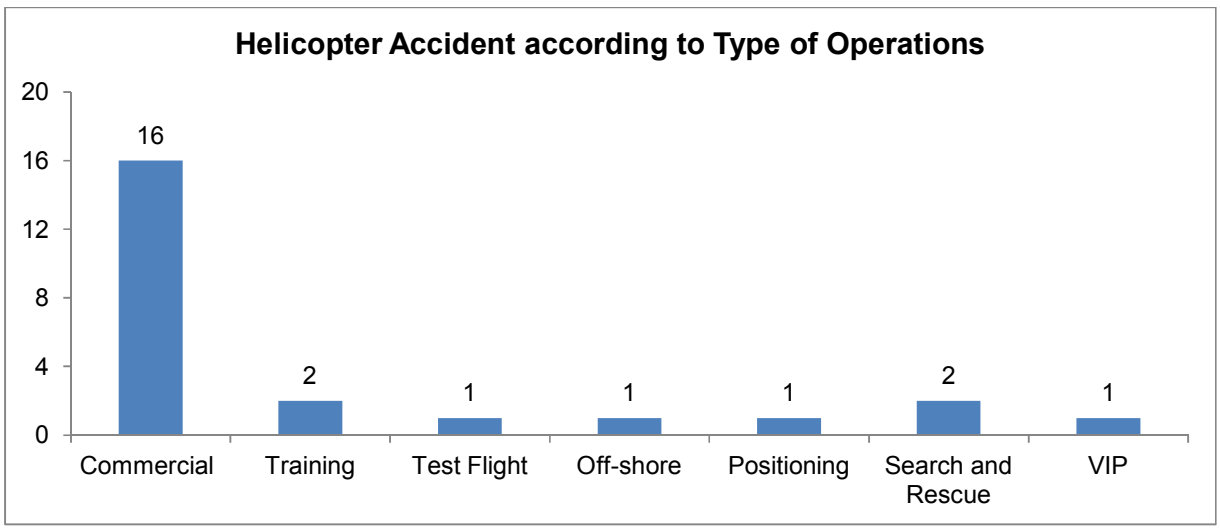
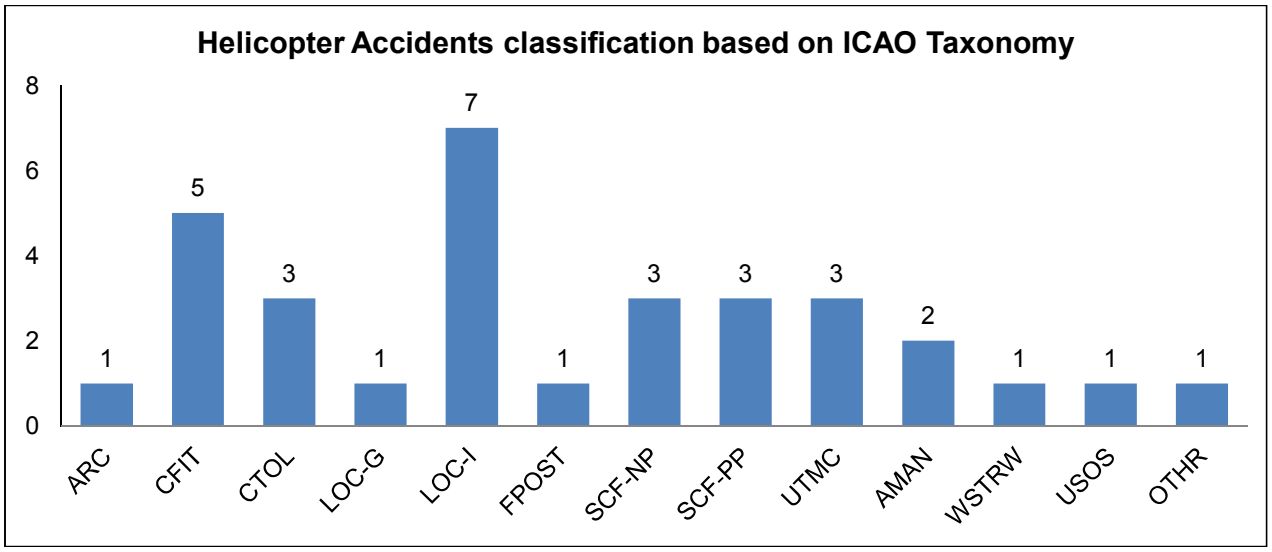


Fig 4.3

4.5 Classification of accidents as per ICAO taxonomy

Multiple Occurrence categories have been assigned to helicopter accidents from the year 2008-2015 for identification of particular safety issues. This was done using the ICAO CICTT occurrence categories.

Figure 4.4, shows the number of helicopter accidents as per ICAO defined Occurrence Category. The most common risk areas for accidents were Loss of Control Inflight (LOCI), followed by Controlled Flight into terrain, System/component failure or malfunction (power plant), Unintended Flight in IMC and Abrupt Maneuver.



*OTHR includes cabin crew fall from helicopter during flight.

Fig 4.4

Most of the helicopter accidents have occurred during commercial operations and loss of control in flight is a major occurrence category. In addition there is rise in the accident due to CFIT. These are cause of concern.

4.6 World-wide helicopter accidents

Table 4.2 Worldwide Helicopter Accidents				
Date	**Aircraft Type**	**Location**	**Fatalities**	**Description**
29.04.2016	EC 225	Norway	13	A Eurocopter EC225 Super Puma helicopter lost its main rotor in flight while carrying oil and crashed on Norway's Skitholmen islet, killing all 13 people on board.
21.10.2016	Mi 8T	Siberia	19	A Mi-8 helicopter with 19 passengers and a crew of 3 impacted terrain in poor weather conditions. The helicopter was flying from an oil and gas field in the Siberian region of Krasnoyarsk. The three crew died along with 16 passengers.
04.09.2016	Bell 206B	Canada	2	Two people died and another was injured after a Bell 206B helicopter collided with power lines in eastern Canada
06.12.2016	Bell 205	Iran	2	A rescue helicopter crashed into a lake. All the occupants were rescued. Six occupants were injured and were transported to a hospital. Two occupants, the pilot and copilot, died on their way to the hospital.
19.11.2016	A 109A	Italy	01	An Agusta 109A MkII helicopter with three people on board crashed in the woods near Induno Olona in Italy, close to the border with Switzerland. The helicopter crashed at an elevation of 800 meters on Monte Minisfreddo. One passenger died while the pilot and a passenger were injured.

CHAPTER 5

Non Scheduled Operator and General Aviation

5.1 Introduction

This Chapter covers the accidents which took place in India involving Non- Scheduled Commercial Transport (NSOP) and General Aviation (GA) aircrafts. In the year 2016, a total of 3 accidents have taken place in NSOP category and 01 in General Aviation Category.

5.2 Analysis of Accidents to Aircraft Under NSOP

Fig 5.1 shows accidents which occurred in the category of Non-Scheduled Operators compared to the number of fatal accidents.

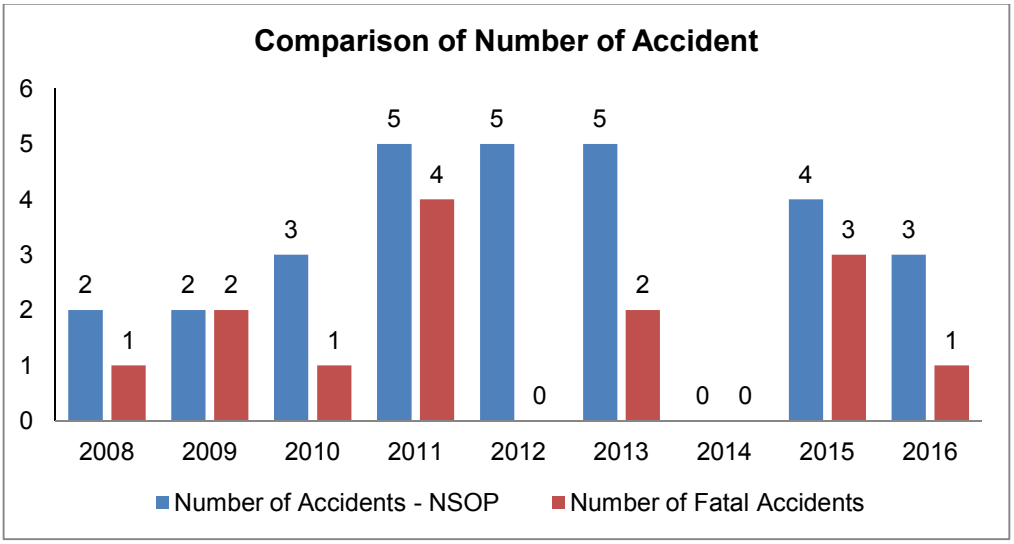
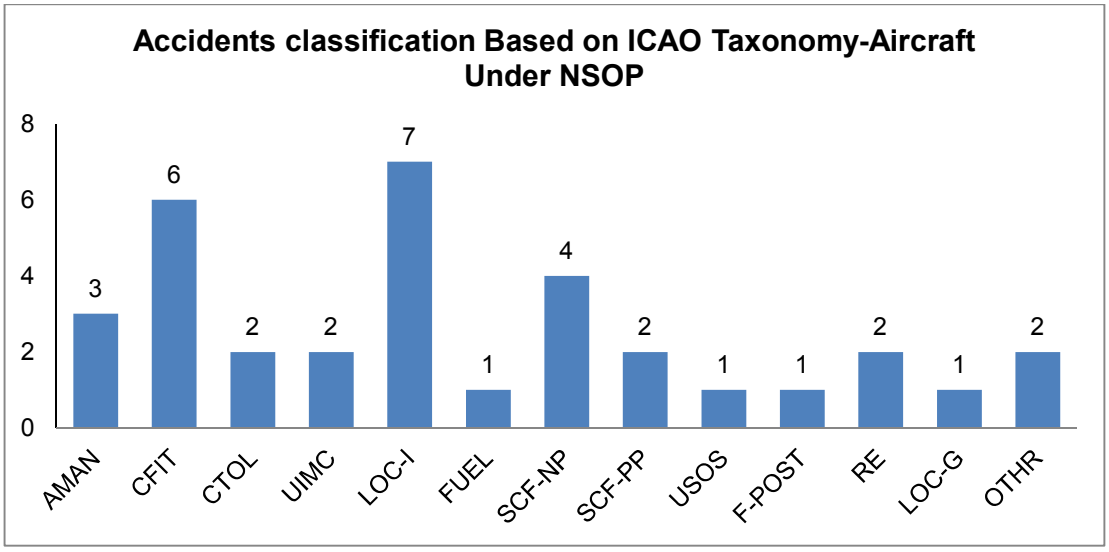


Fig 5.1

5.3 Classification of accidents as per ICAO taxonomy

Multiple Occurrence categories have been assigned to each of the NSOP accident from the year 2008-2015, for assisting in the identification of particular safety issues. This was done using the ICAO CICTT occurrence categories.

Figure 5.2, shows the number of NSOP accidents as per ICAO defined Occurrence Category. The most common risk areas for accidents were Loss of Control Inflight (LOCI) followed by Abrupt Maneuver, Controlled Flight into terrain and System/component failure or malfunction (non-power plant).



*OTHR includes cabin crew fall from helicopter during flight and Non-adherence to SOP.

Fig 5.2

5.4 General Aviation Accidents

General Aviation is small but forms an important part of the aviation community.

General Aviation in India is broadly classified into following 03 (three) categories:

a. State Governments
b. Flying Schools
c. Private

Fig 5.3 shows comparison of total accidents with fatal accidents in the General Aviation category. The trend indicates the decrease in the number of accidents in the General Aviation category which is certainly positive.

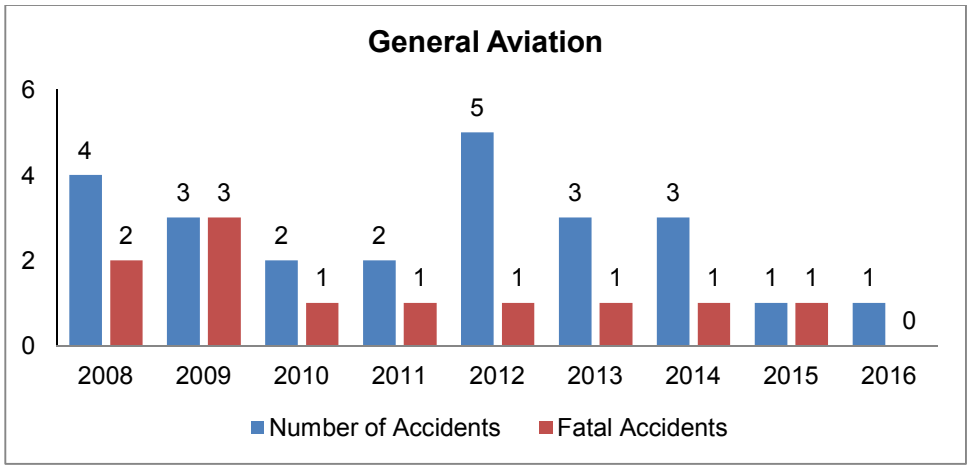


Fig 5.3

Fig. 5.4 shows the accidents as per the category of the operator for the years 2008 to 2016. Accidents in the General aviation category also indicate a deceasing trend.

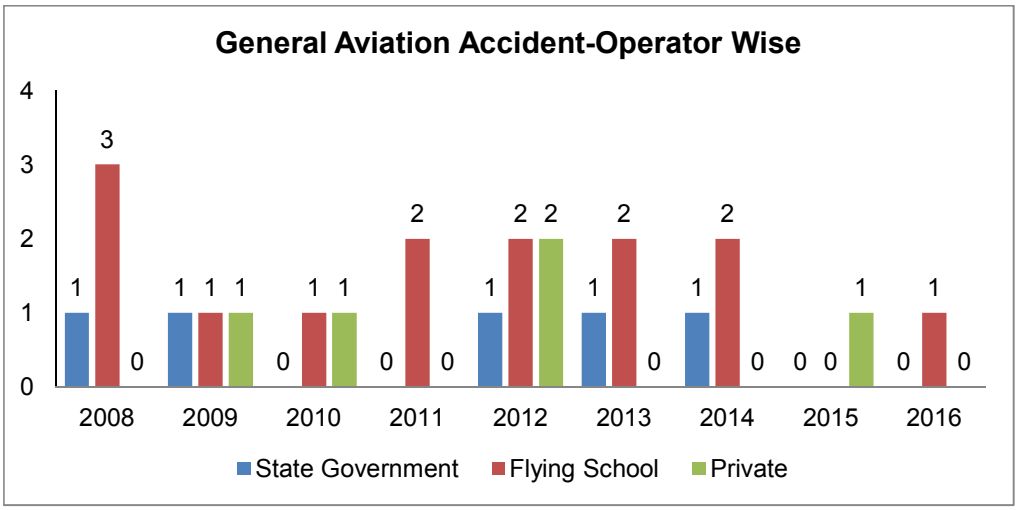


Fig 5.4

5.5 Classification of accidents as per ICAO taxonomy

Multiple Occurrence categories have been assigned to each of the General Aviation accidents from the year 2008-2016, for assisting in the identification of particular safety issues. This was done using the ICAO CICTT occurrence categories.

Figure 5.5, shows the number of General Aviation accidents as per ICAO defined Occurrence Category. The most common risk areas for accidents were Loss of Control Inflight (LOCI), Low Altitude Flying followed by Controlled flight into terrain, Abrupt Maneuver and System/component failure or malfunction (power plant).

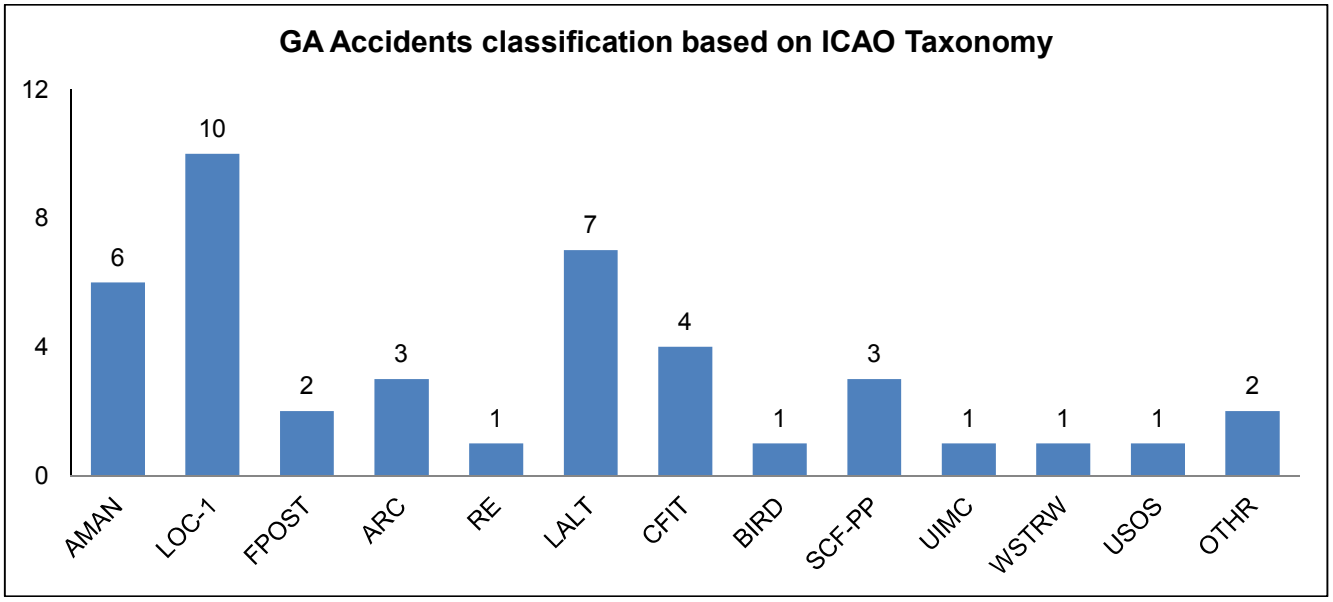


Fig 5.5

CHAPTER 6

Incidents Analysis

6.1 Introduction

This Chapter covers the incidents/occurrences involving Indian aircrafts. In the year 2016, a total of 2499 occurrences were reported to DGCA India which is itself a significant number but still needs improvement. Occurrences include all incidents, accidents and serious incidents.

6.2 Review and Analysis of Safety Database For The Year 2016

6.2.1 Mandatory Incidents Reporting

CAR Section 5 Series C Part I on "Notification of Incidents and Investigations thereof" requires reporting of occurrences to DGCA/AAIB.

DGCA has established ECCAIRS (European Coordination Centre for Accident and Incident Reporting Systems) for the recording/reporting of occurrences. The system has become effective from January 2015, and the database format is compatible with the ICAO requirements. Operators are encouraged to report the occurrences in the ECCAIRS format.

- A total of 2499 occurrences were reported to DGCA.
  - 7 were Classified as Accidents
  - 11 were Classified as Serious Incidents
  - 12 were classified as incidents and were investigated by DGCA under Rule 13 (1) of Aircraft Rules 2012.
  - 668 were classified as incidents and were investigated.

6.3 Analysis of incidents pertaining to Scheduled Airlines

For analysis, incidents are classified in following categories:

- Engineering Incidents
- Operational Incidents
- Ground Incidents
- Human Error Incidents
- Miscellaneous Incidents
  - Note: Miscellaneous incidents includes FOD damage, weather related incidents (i.e. wind shear, lightning strike and turbulence), cabin safety related incidents (passenger smoking in lavatories, injury while servicing etc).

Fig. 6.1 shows incidents to scheduled airlines classification on the basis of their area of occurrence. The major share among incidents is of engineering incidents followed by operational incidents.

6.4 Analysis of incidents pertaining to Scheduled Airlines

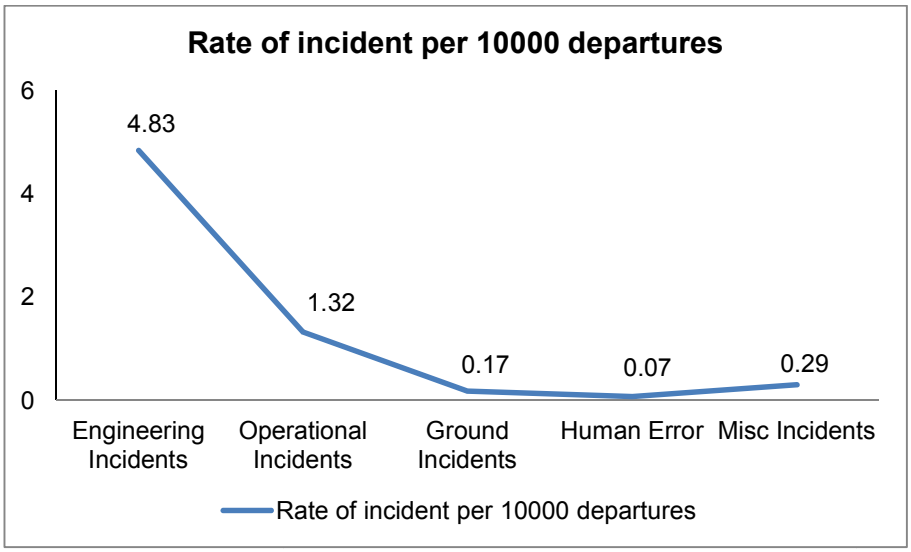


Fig 6.1

6.5 Analysis of Operational Incidents

Incidents are analysed as per phase of flight

- Take off
- Landing
- Approach
- En route
- Climb
- Taxi
- Standing/Push back

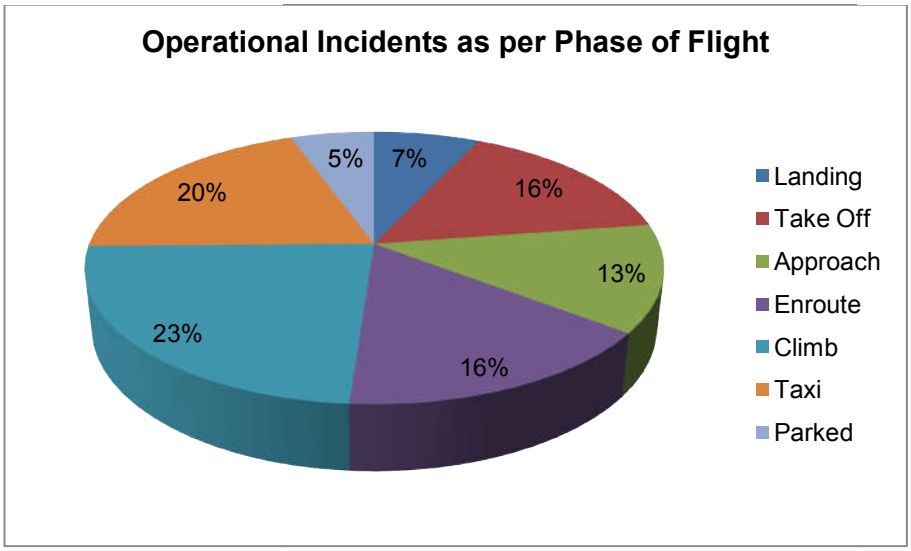


Fig 6.2

6.6 Fleet wise Engineering Incident Analysis

- Analysis of incidents as per type of Aircraft
- A 320
- B 737
- B 777
- B 787
- ATR
- Q400
- B757
- Other Aircraft types (A330, B747, CRJ)

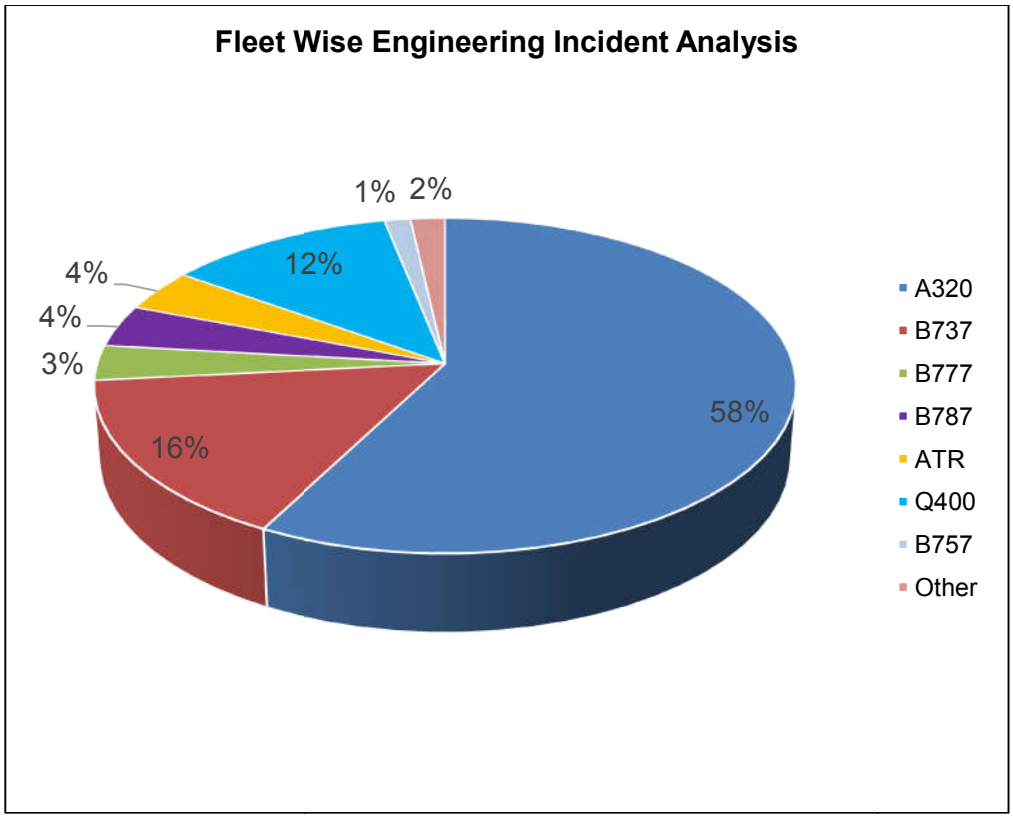


Fig 6.3

6.7 Incident Classification as per CICTT values

Multiple Occurrence categories have been assigned to each of the General Aviation accident, for assisting in the identification of particular safety issues. This was done using the ICAO CICTT occurrence categories, which are given in Glossary.

Figure 6.4, shows the number of incident as per ICAO defined Occurrence Category. The most common risk areas are System/component failure or malfunction (non-power plant), System/component failure or malfunction [power plant] followed by turbulence and aerodrome related. This can also be related to fig 6.1, as the majority of incidents are in the area of engineering.

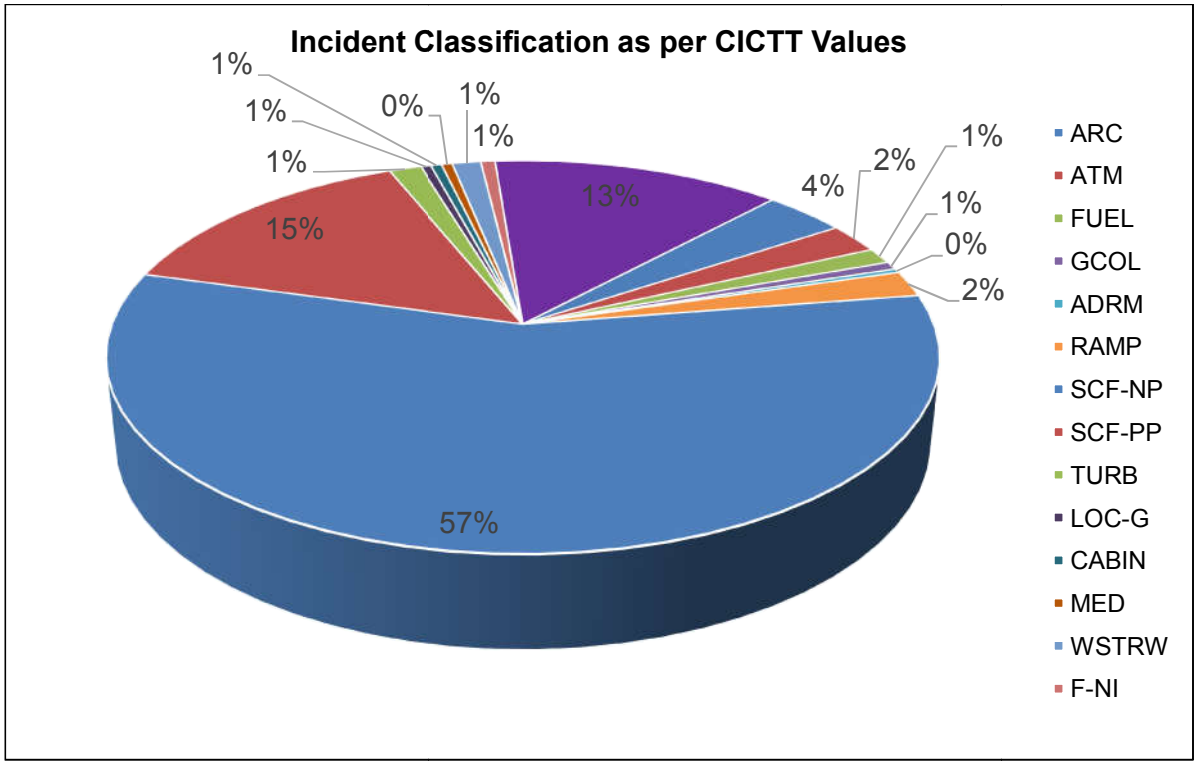

Incident Classification as per CICTT Values
1%
1%
0%
1%
1%
1%
13%
4%
2%
1%
1%
0%
2%
15%
57%
ARC
ATM
FUEL
GCOL
ADRM
RAMP
SCF-NP
SCF-PP
TURB
LOC-G
CABIN
MED
WSTRW
F-NI

Fig 6.4

CHAPTER 7

Aerodromes

7.1 Introduction

This Chapter covers the aerodrome related occurrences which took place to Indian aerodromes. Aerodrome related occurrences are broadly classified into three categories:

1. Wildlife Strikes
2. Ground Incidents
3. Runway Incursion

7.2 Study on Wildlife Strike

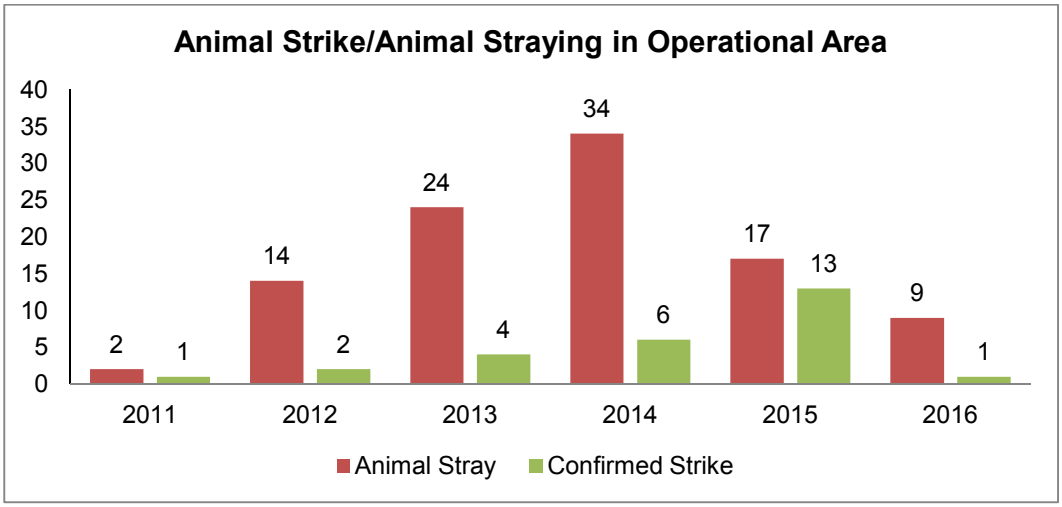


Fig 7.1

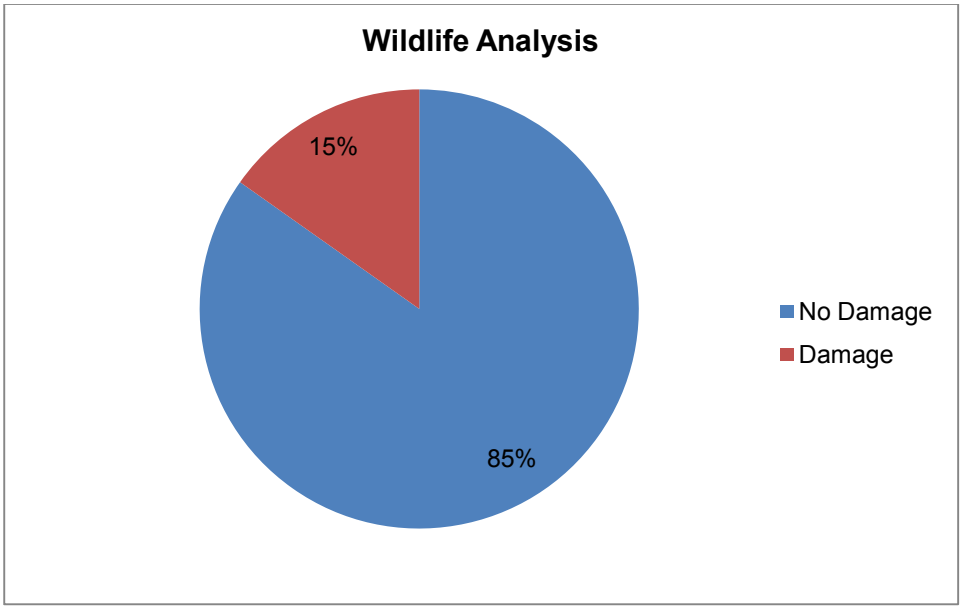


Fig 7.2

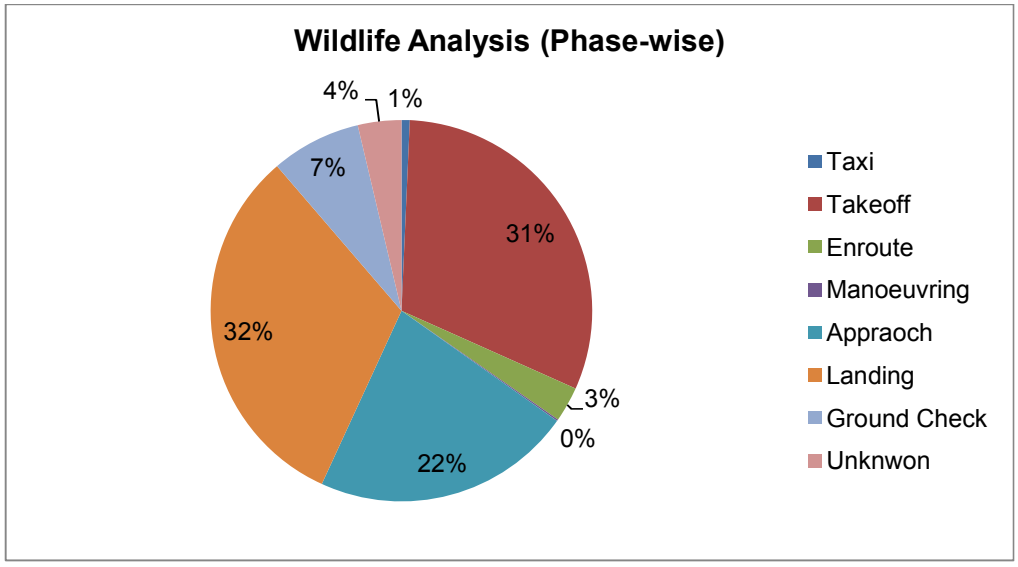


Fig 7.3

7.3 Ground Incidents

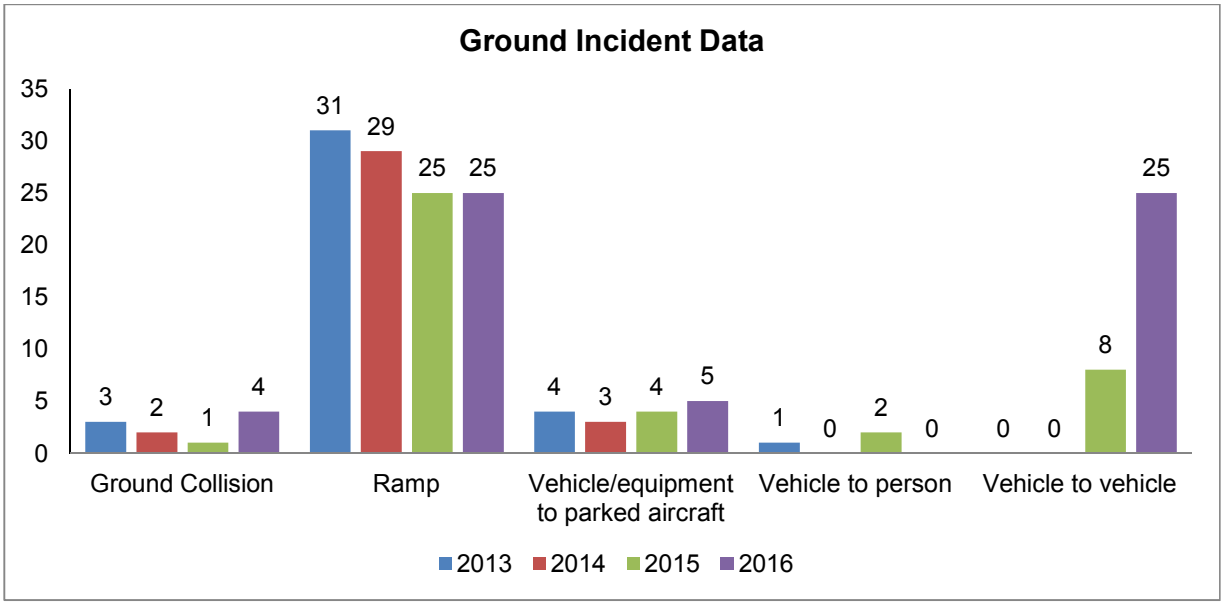


Fig 7.4

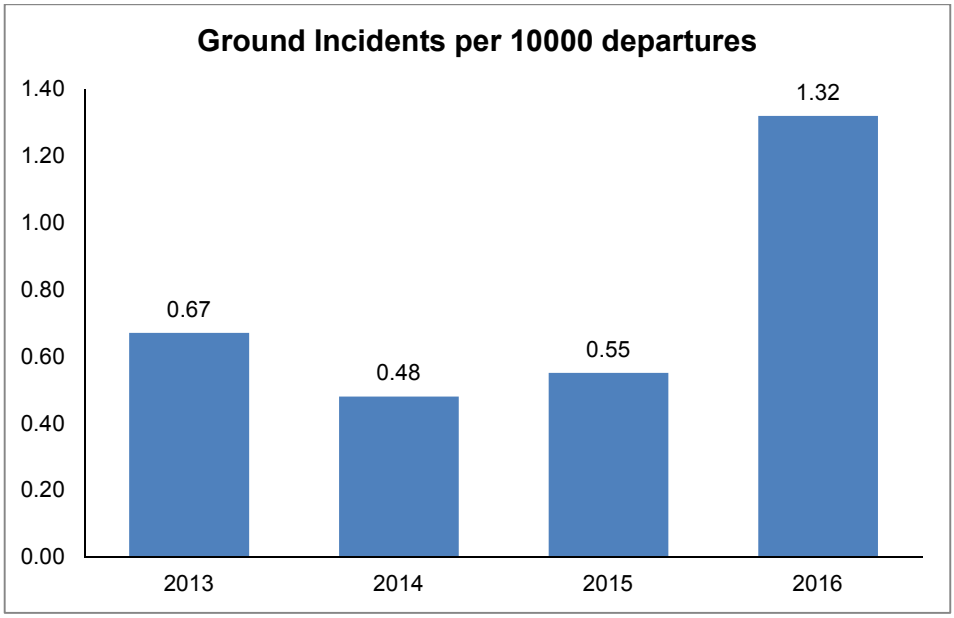


Fig 7.5

7.4 Runway Incursions

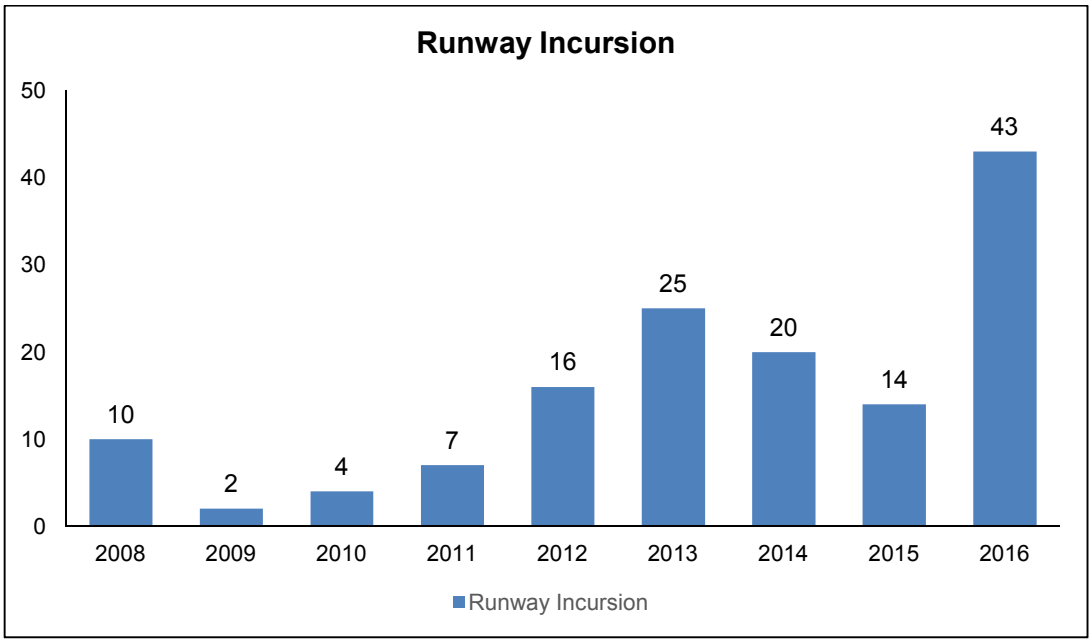


Fig 7.6

7.5 Causative factors of Runway Incursion

The major factors involved in the runway incursions are as listed below:

A. Use of non-standard phraseology.
B. The pilot and/or vehicle driver misunderstanding the controller's instructions.
C. The pilot and/or vehicle driver accepting a clearance intended for another aircraft or vehicle.

D. Loss of situational awareness by pilots, non-familiarization with aerodrome layout.
E. Inadequate signage and markings (particularly the inability to see the runway-holding position lines) or multiple holding position.
F. A complicated airport design/ taxiway.
G. Failure to obtain clearance to enter the runway by vehicle driver.
H. Vehicle driver non familiar with aerodrome layout.
I. Failure to obtain clearance to enter the runway by pilot
J. Unauthorized entry on runway by person

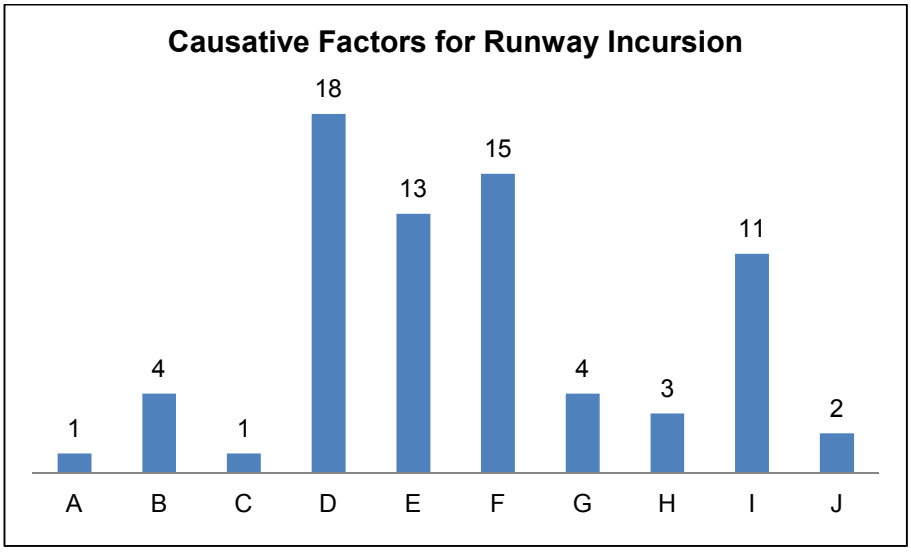
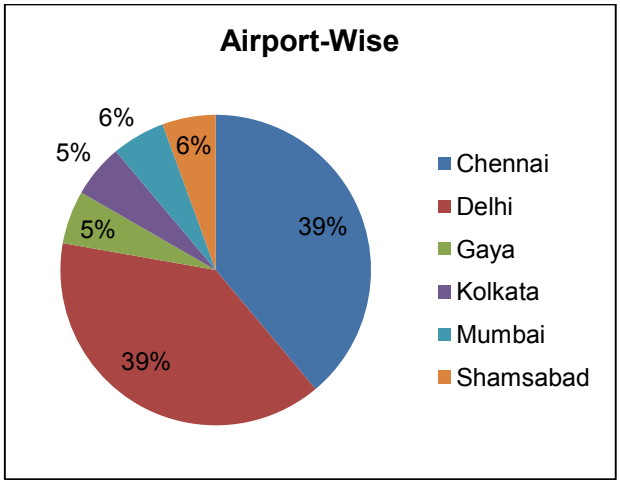
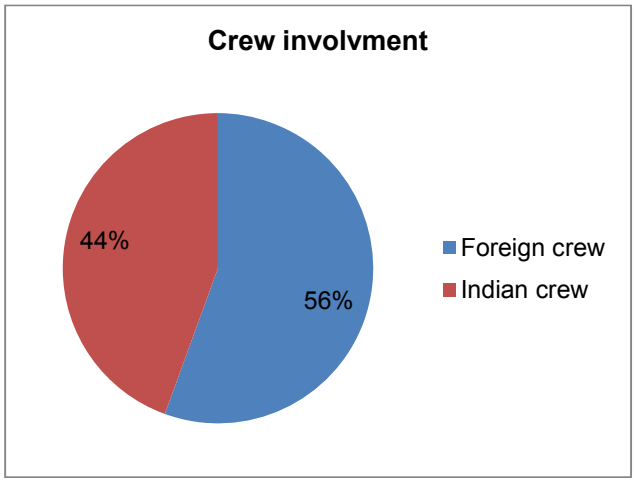


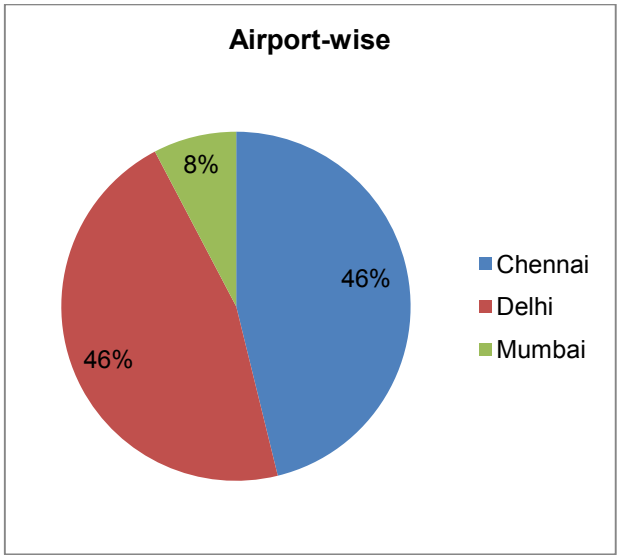
Fig 7.7

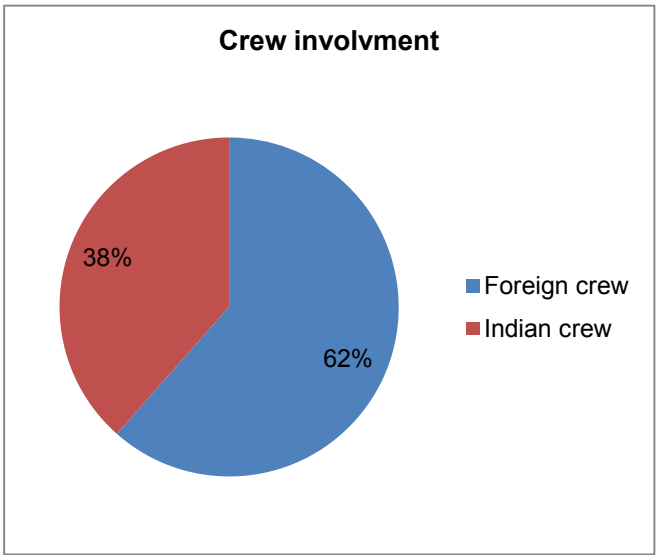
7.5.1 Loss of situational awareness by pilots, non-familiarization with aerodrome layout



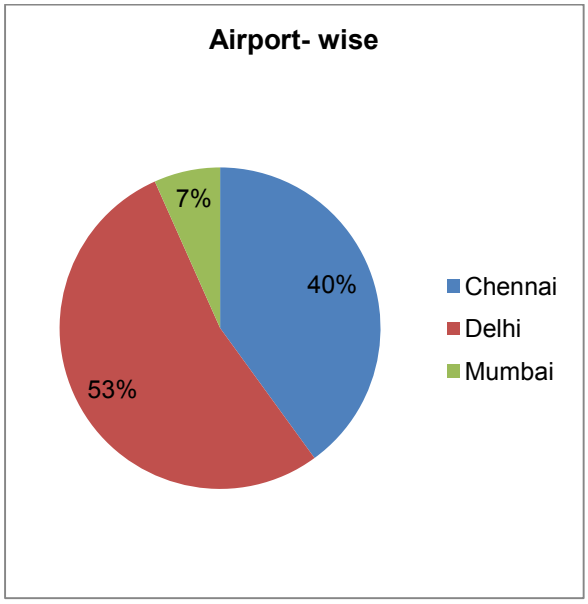


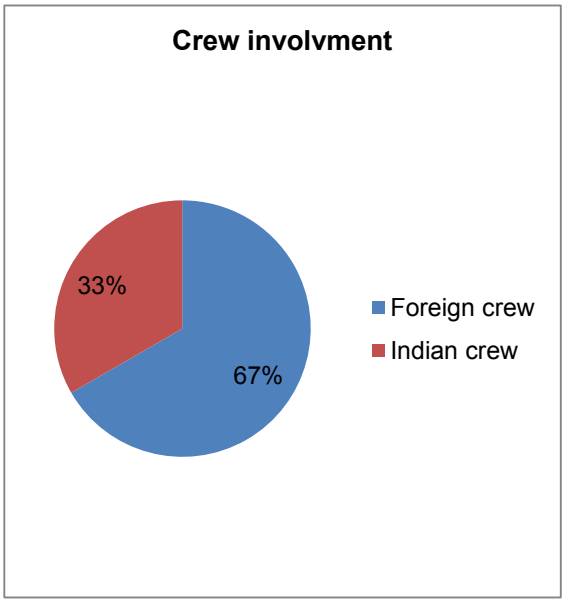
7.5.2 Inadequate signage and markings (particularly the inability to see the runway-holding position lines) or multiple holding position





7.5.3 A complicated airport design/ taxiway





CHAPTER 8

Air Traffic Management

8.1 Introduction

Airprox incidents are investigated by the board constituted for AIRPROX Incident Investigation. Based on the investigation various causative factors are ascertained. Fig. 8.1 shows a slightly increase of Airprox in the year 2016 when compared to the earlier years.

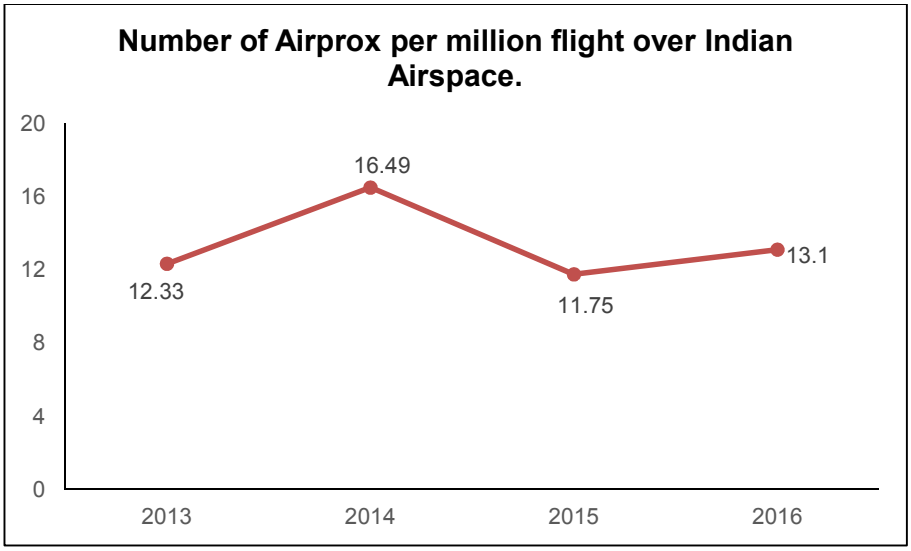
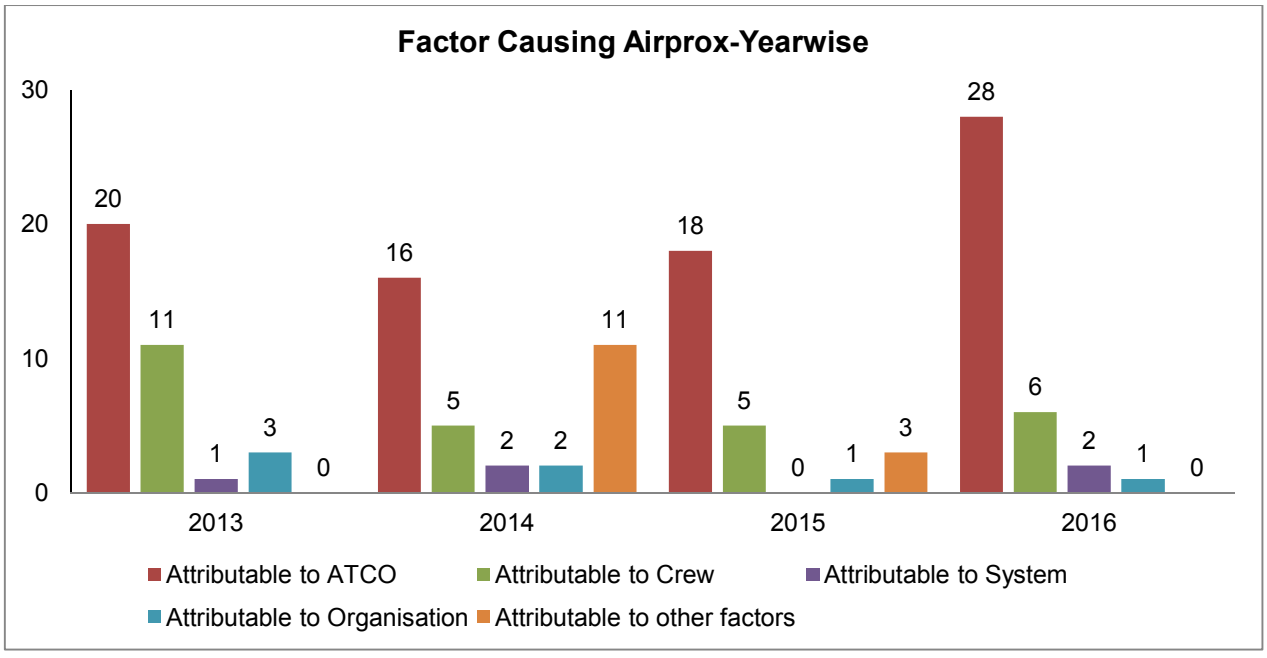


Fig 8.1

8.2 Year-wise graphical presentation of AIRPROX on the basis of above listed errors

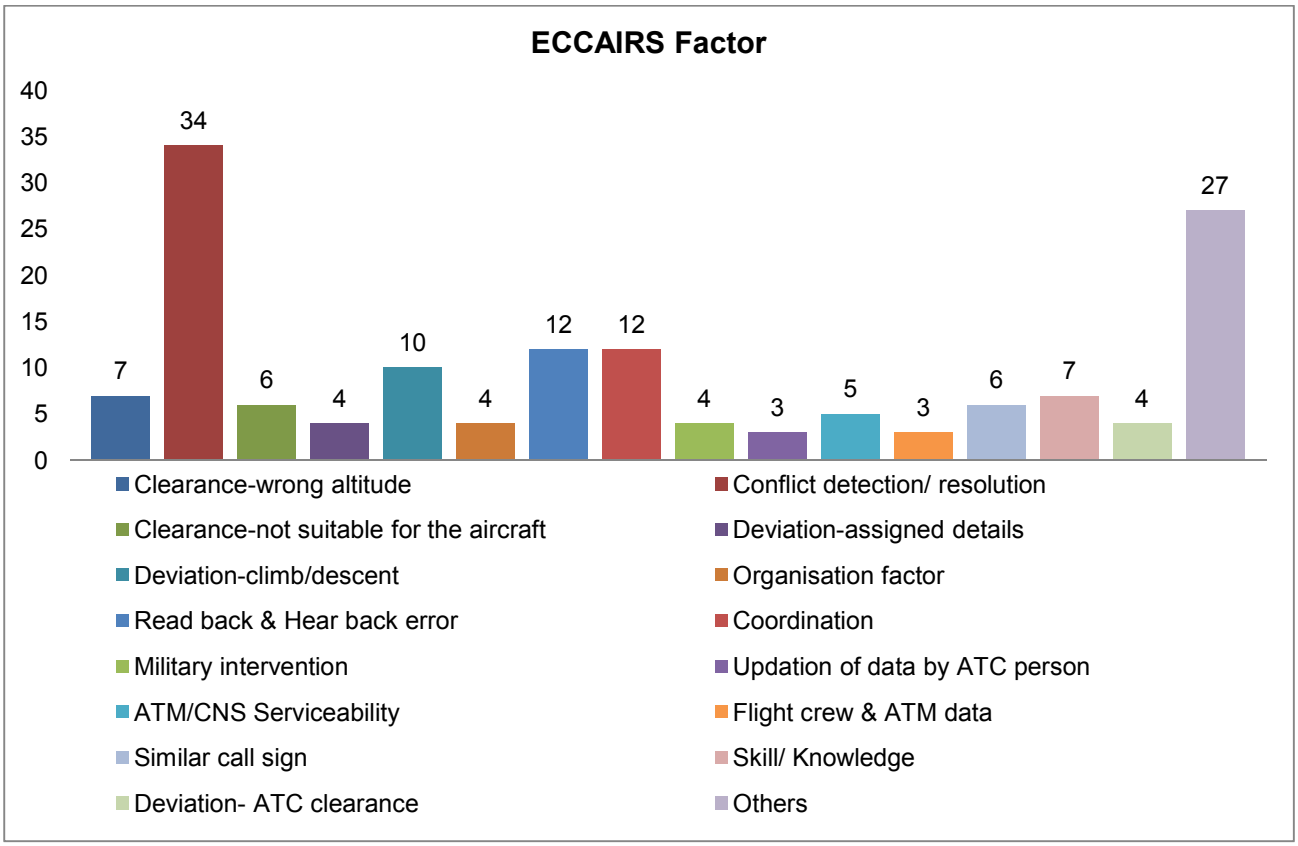


*Others includes AIRPROX attributable to Air Force/ Adjacent States

Fig 8.2

8.3 Classification in accordance with ECCAIRS taxonomy

A total of 28 contributory factor have been identified in accordance with ICAO ECCAIRS taxonomy during the analysis of the AIRPROX incidents. This includes incident data from 2013 to 2016.



***Others includes**: Deviation-approach, Approach on wrong rwy, Handing over procedure, Deviation-ATM regulations, Deviation- ATC clearance, System/crew mismatch,, Aircraft component failure, Failure of ATM, Deviation- landing, ATM procedure not defined, Non-use of aids, Provision of ANS traffic information, Deviation-flight level/altitude, Clearance- wrong heading.

Fig 8.3

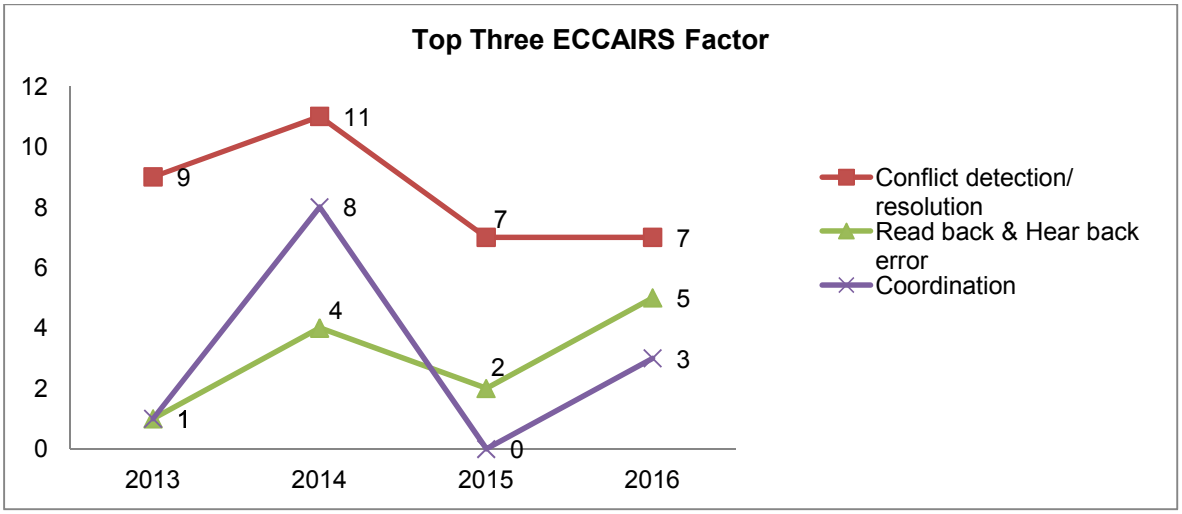

Top Three ECCAIRS Factor
12
10
8
6
4
2
0
2013
2014
2015
2016
9
11
7
7
1
4
2
5
8
0
3
Conflict detection/ resolution
Read back & Hear back error
Coordination

Fig 8.4

CHAPTER 9

State Safety Oversight

-Surveillance

9. 1 Introduction

DGCA had prepared an Annual Surveillance Programme (ASP) based on experiences gained during 2009 to 2014 comprising of safety oversight plan of all Directorates. The Annual Surveillance Programme (ASP) of 2015 was operationalized for safety oversight activities of the operator from January 1, 2015. The respective directorate carried out the surveillance activities as per plan and provided data to Headquarters regularly during the year.

9.2 Areas of safety oversight

The DGCA Safety Oversight Programme had been divided into 8 areas:

1. Surveillance Activities (Planned Inspection)
2. Regulatory Audit (Planned Audit)
3. SOFA
4. Spot Check (Unplanned Checks)
5. Night Surveillance
6. Ramp Checks
7. Surveillance of Foreign MRO
8. Inspections carried out under the directions of the DG.

9.3 Directorates participated in the Safety Oversight Program

1. Directorate of Airworthiness
2. Directorate of Air Safety
3. Flight Standards Directorate
4. Directorate of Aerodrome
5. Air Space & ANS Directorate
6. Directorate of Flying, Grant & Training
7. Ramp/SAFA Inspection
8. Cabin Safety Division
9. Dangerous Goods Division
10. Directorate of Aircraft Engineering

9.4 Overview of safety oversight

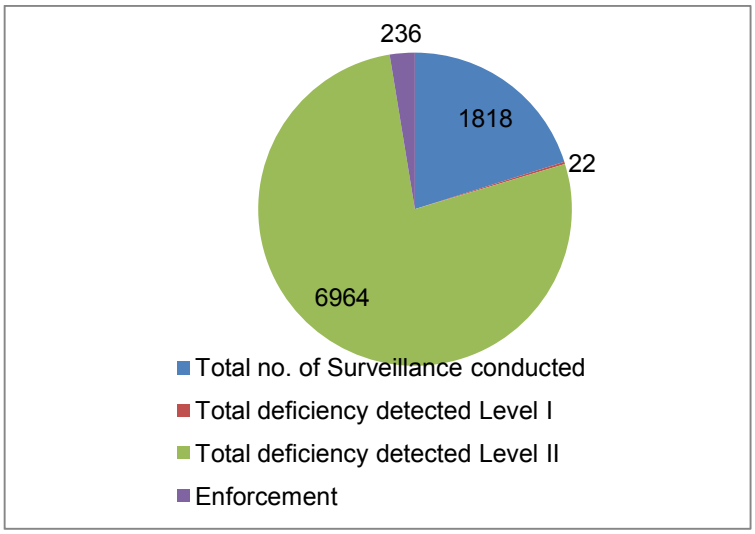


Fig 9.1

A total of 1818 surveillances were carried out in the year 2016 on the stakeholders in India. Deficiencies observed during the surveillance are classified as level I and level II findings.

Level I findings correspond to a significant non-compliance with the applicable requirement which lowers the safety standard and seriously hazards flight safety. In the year 2016, 22 level I findings were observed.

Level II findings correspond to any non-compliance with the applicable requirement which could lower the safety standard and possibly hazard flight safety. In the year 2016, 6964 level II findings were observed.

Based on the discrepancies observed while carrying out oversight of the various stakeholders in DGCA, a total of 236 enforcement actions were taken which consisted of warnings, suspensions, corrective actions, show cause notices, withdrawals, de-rostering, non-renewal of CPL, cancellations etc.

9.5 Areas of Safety Concern

Regulatory audit finding for the year 2016 have been analysed using following factors:

S. No.	Factor	Description of events involved
1.	Emergency Response Plan (ERP)	Procedure not defined, periodic drills not carried out
2.	Internal Quality Audit	Procedure not defined, Audit not carried out, records not maintained, Trained auditor not available
3.	Safety policy	Authority, accountability, responsibility not defined, deficiency in appointment of key safety personnel
4.	Documentation	Lack of training records, safety surveys, improper maintenance of records
5.	Equipment calibration	Equipment not calibrated

6.	Safety Risk Management	Reporting culture, Investigation not carried out, Safety Risk Assessment not carried out, Hazard Log not maintained
7.	Workplace Manual	• Includes all company manuals, procedure/SOPs • Manuals/documents out of date/obsolete, procedure poorly defined., Manual/documents not easily available
8.	Flight Safety Documentation System (FSDS)	Nodal officer not nominated, lack of information dissemination
9.	Safety promotion	Training not carried out, poor communication of safety information
10.	Procedure	Non-compliance of agreed/ approved procedure by responsible person/ organisation, system not established as per requirement
11.	Safety assurance	voluntary reporting system, mandatory reporting procedure
12.	Flight Data monitoring	Not carried out
13.	Knowledge	Lack of knowledge of regulatory requirements, Aeronautical charts, Aircraft systems knowledge, Knowledge of procedures
14.	Operational Control	Lack of operational control
15.	Facility	Non-availability/ Poor maintenance of Hanger, workshop, workspace

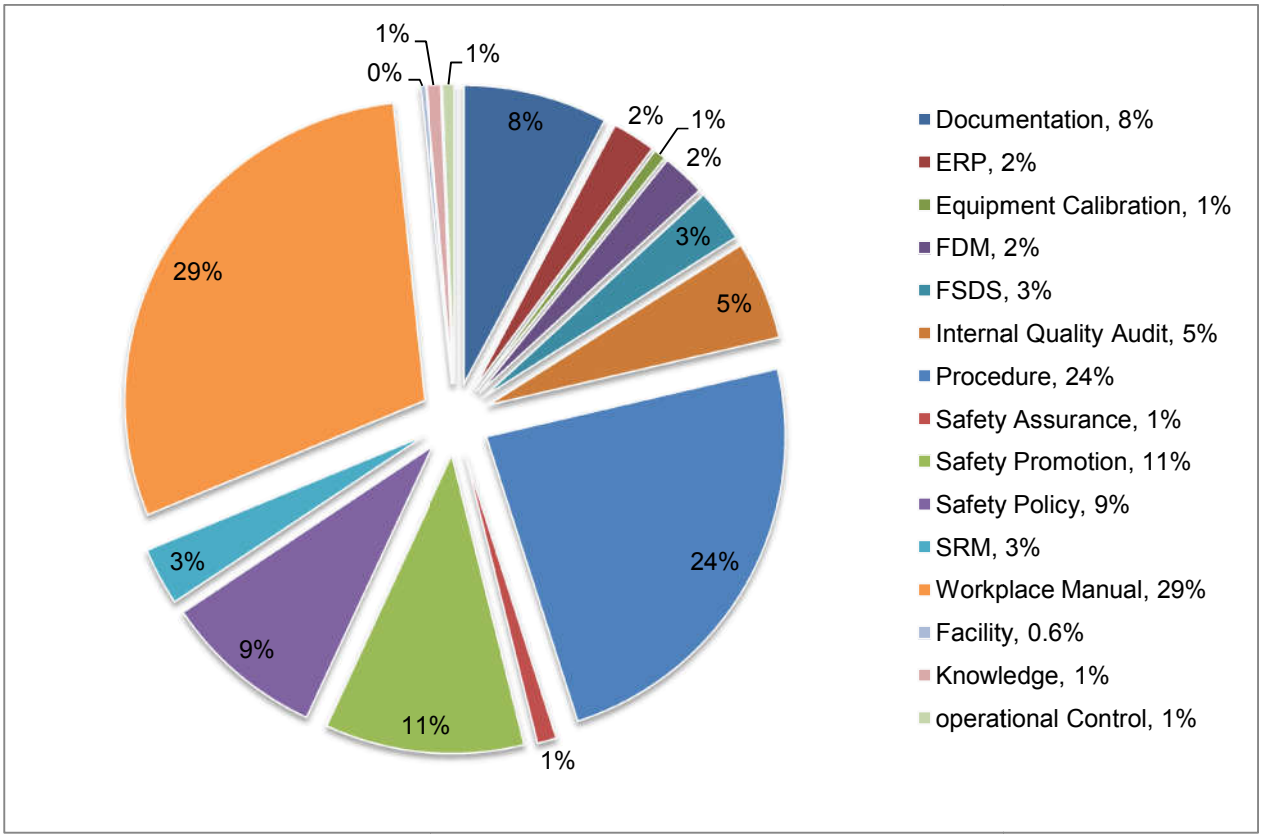


Fig 9.2

9.6 Areas of Safety Concern in Aerodrome

Aerodrome surveillance finding for the year 2016 have been analysed using following factors:

S. No.	Factor	Description of events involved
1.	Marking	Runway/taxiway markings, apron marking
2.	Procedure	Non-compliance of agreed/ approved procedure by responsible person/ organisation, system not established as per requirement
3.	Obstacle	Obstacle not marked
4.	Workplace manual	• Includes all manuals, procedure/SOPs • Manuals/documents out of date/obsolete, procedure poorly defined., Manual/documents not easily available
5.	Foreign Object Debris(FOD)	FODs found on runway/taxiways
6.	Instrument calibration	Equipment not calibrated , Calibration not carried out, Equipments unserviceable
7.	Flight Safety Documentation System (FSDS)	Lack of information dissemination
8.	Aerodrome environment	Garbage near/inside the aerodrome, pond, wildlife activity, wall broken
9.	Security	Breach of security
10.	Documentation	Lack of training records, safety surveys
11.	Safety Risk Management(SRM)	Reporting culture, Investigation not carried out, Safety Risk Assessment not carried out, Hazard Log not maintained
12.	Safety promotion	Training not carried out, poor communication of safety information
13.	Safety policy	Authority, accountability, responsibility not defined, deficiency in appointment of key safety personnel
14.	Signage	Signage not available
15.	Surface condition	Runway/taxiway surface not proper like pot holes, pebbles, rubber deposit on runway
16.	Internal Safety Audit	Procedure not defined, Audit not carried out, records not maintained, Trained auditor not available
17.	Emergency Response Plan (ERP)	Procedure not defined, periodic drills not carried out

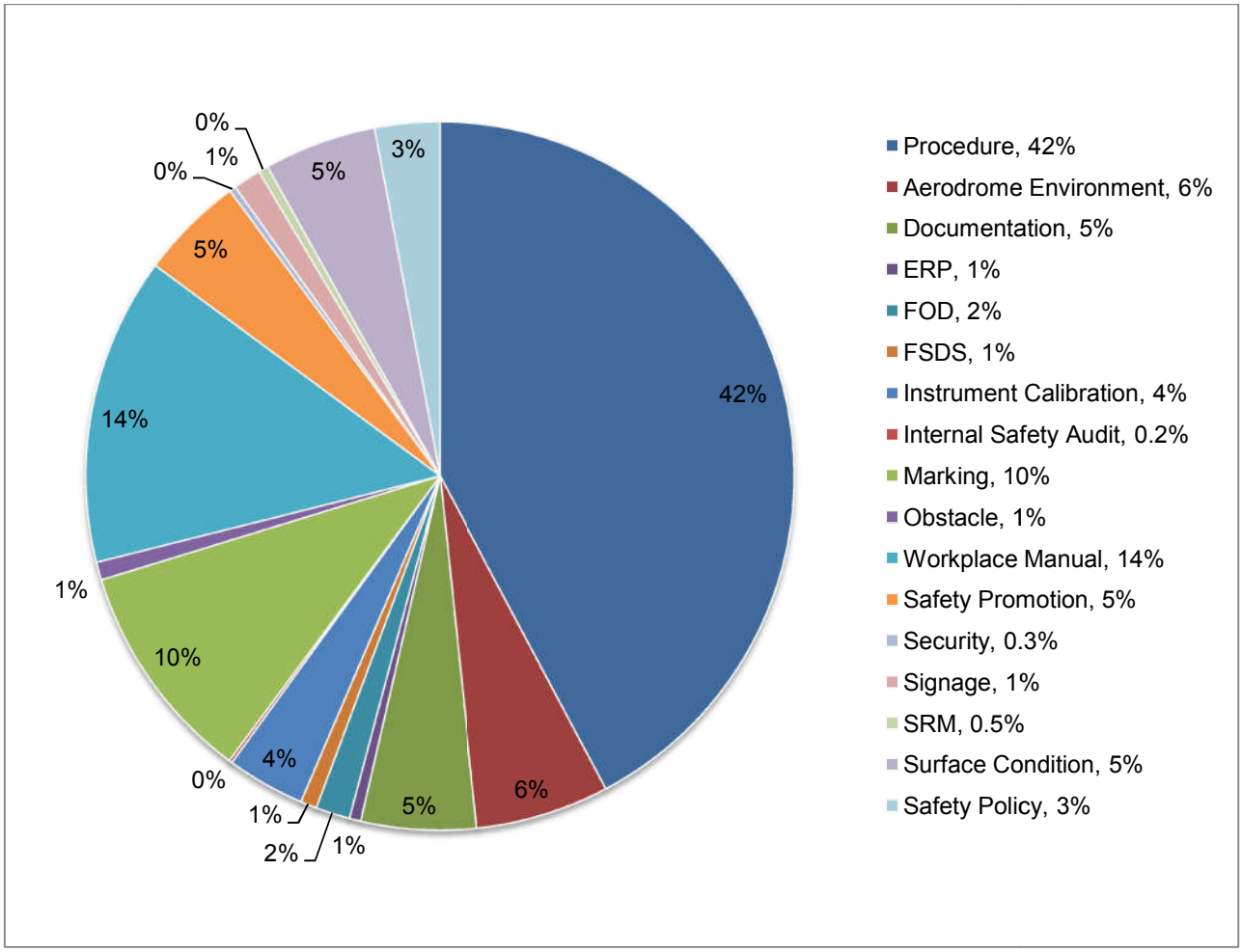

42%
6%
5%
2%
1%
0%
4%
10%
1%
14%
5%
0%
1%
0%
5%
3%
Procedure, 42%
Aerodrome Environment, 6%
Documentation, 5%
ERP, 1%
FOD, 2%
FSDS, 1%
Instrument Calibration, 4%
Internal Safety Audit, 0.2%
Marking, 10%
Obstacle, 1%
Workplace Manual, 14%
Safety Promotion, 5%
Security, 0.3%
Signage, 1%
SRM, 0.5%
Surface Condition, 5%
Safety Policy, 3%

Fig 9.3

CHAPTER 10

State Safety Promotion

10.1 Collection of Safety Information

10.1.1 Mandatory Occurrence Reporting

CAR Section 5 Series C Part I on “Notification of Incidents and Investigations thereof” requires reporting of occurrences to DGCA/AAIB.

DGCA has established ECCAIRS (European Coordination Centre for Accident and Incident Reporting Systems) for the recording/reporting of occurrences. The system has become effective from January 2015 onwards, and the database format is compatible with the ICAO requirements. All the operators have been encouraged to report the occurrences in the ECCAIRS format.

10.1.2 Voluntary/Confidential Reporting System

- Aeronautical Information Circular 03/2015 on “Voluntary Reporting System” has been issued.
- Air Safety Circular 02 of 2015 on “Voluntary Reporting System” has been issued which enhances aviation safety through the collection of reports on actual or potential safety deficiencies that would otherwise not be reported through other channel.

10.2 Internal Training, Communication and Dissemination of Safety Information

- The DGCA has established appropriate Training Programme for its officers. Each individual's development and training needs including SSP/SMS is being assessed upon induction at DGCA by Training Directorate. Both initial and recurrent training is provided to officials/inspectors. The trainings are being conducted at regular intervals as per the annual training programme developed by the Training Directorate in consultation with the concerned directorates.

- DGCA communicates and disseminates safety-relevant information within the DGCA through circulars, emails, DGCA website, DGCA intranet, Safety alerts, workshops etc.

10.3 External Training, Communication and Dissemination of Safety Information

- DGCA communicates with Stakeholders in many different ways. At a high level, safety is addressed in the MOCA's Annual Report. DGCA has developed a State Safety Plan which describes in more detail the high-level safety objectives and outline the DGCA's programme of work to achieve continuous safety improvement and is published on DGCA website.

- DGCA also provides/publishes guidance to support regulatory action in the form of case studies, circulars, public notices, seminars, meetings, etc.

10.4 Areas of Concern

10.4.1 Unstabilised Approaches

- Due to non-punitive policy of DGCA towards Go-Around and efforts made in this direction by all the airlines, year 2016 saw a decrease in the number of unstabilized approaches as compared to the year 2015

10.4.2 Wildlife Hazard Management

- As part of the State Safety Programme, one of the most important State Safety Priority and another area of concern was identified as Wildlife (Bird/Animal) Strike to the aircraft. The wildlife strike data of all the airports has been analysed and categorized for mitigation actions by domain Directorate, and concerned airport.
- DGCA has also conducted several seminars to educate the stakeholders on the management of wildlife hazards.

10.4.3 Ground Incidents

- Data for year 2016 shows an increased number in ground incidents, which has made it an area of safety concern.

10.4.4Similar/Confusing Call Signs

- The use of similar call signs by aircraft operating in the same area, at the same time, and on same frequency often give rise to potential and actual confusion leading to misunderstanding between pilots of different aircraft/pilots and controllers. As a result, one aircraft may act on the clearance meant for another aircraft.
- In India 3 percent of Airprox incidents have taken place due to call sign confusion
- To review the current practices in India regarding assigning of call signs and harmonizing them with the international best practices, DGCA, India constituted a committee while recognizing the hazards of similar call signs. Based on recommendations, India has issued AIC 02 of 2017 prescribing guidelines on avoiding Confusing/Similar Call-Signs by Airline Operators.

10.5 Way Forward

10.5.1 Appropriate State Safety Oversight- Performance Based Oversight

- Indian aviation is in a state of continuous change. The aviation sector is one of the fastest growing in the world and service providers are experiencing a number of operational, technical and financial challenges all of which can have an effect on safety. A key focus for the DGCA during the period of this Safety Plan will be on ensuring that it remains fit-for-purpose and continues to provide an appropriate and effective level of regulatory and safety oversight that balances needs of the industry, travelling public and the international community.
- DGCA will focus and provide training to the officers on the performance based oversight which focuses on achieving the desired performance. This will lead to a more active involvement and interaction of all players in managing the aviation safety system.

10.5.2 Review of State Safety Plan

The safety analysis has brought out areas of concern. The state safety plan and safety action plan will be reviewed to address the concern and achieve acceptable level of safety. DGCA India is in the process to publish State Safety Plan for the year 2017-2021.

10.5.3Progressive Adoption of Safety Culture

Adoption of an appropriate safety culture, which encourages reporting and helps to reduce risk across the aviation sector, is a challenge. Whilst the DGCA and many service providers (through their SMS) have initiated their own activities to develop a safety culture, it is likely to take a number of years before tangible benefits are realised. Therefore, DGCA aims at progressing the development of a safety culture amongst all service providers' staff, initially evidenced by increased reporting and a willingness to share more safety related information, and to develop a means of measuring the safety culture of an organisation.

10.5.4Safety Management System Implementation by Operators

- As part of State Safety Programme and State Safety Plan, major operators have developed their Safety Performance Indicators and associated targets and alert levels, which are congruent with the State SSP aggregate safety Indicators and are also pertinent with the service provider's aviation activities. DGCA is in the process of accepting the SPIs with the associated targets and alert levels.

- The revised CAR Section1 Series C Part 1 on "Safety Management System" provides guidance to applicable service providers on the phase-wise implementation of SMS as per ICAO Doc 9859.

- Based on the guidelines of ICAO Annex 19, DGCA has published SSP Circular 03 of 2017 which provides further guidance to operators in general aviation category on implementation of SMS.

- Operators are encouraged to carry out safety risk assessments for any major change viz. operations to new airport, induction of aircraft etc. for review of the safety risk assessments submitted by service provider, dedicated group has been created in DGCA.

GLOSSARY

Acronym	Definition
ADRM	Aerodrome
AIRPROX	Air Proximity incident
AMAN	Abrupt Maneuver
ARC	Abnormal Runway Contact
ATC	Air Traffic Control
ATM	ATM/CNS
CAR	Civil Aviation Requirement
CFIT	Controlled Flight Into Terrain
CTOL	Collision With Obstacle(s) During Takeoff and Landing
DGCA	Directorate General of Civil Aviation
EGPWS	Enhanced Ground Proximity Warning System
FL	Flight Level
F-NI	Fire/Smoke (non-impact)
F-POST	Fire/Smoke (Post- Impact)
FUEL	Fuel Related
GCOL	Ground Collision
GPWS	Ground Proximity Warning System
ICAO	International Civil Aviation Organization
ICE	Icing
LALT	Low Altitude Operations
LOC-I	Loss of Control-Inflight
LOC-G	Loss of Control-Ground
LVP	Low Visibility Procedure
MoCA	Ministry of Civil Aviation
MRO	Maintenance Repair and Overhaul
NSOPs	Non Scheduled Operator Permit
OTHR	Other
RA	Resolution Advisory
RAMP	Ground Handling
RE	Runway Excursion
RI-A	Runway Incursion- Animal
RI-VAP	Runway Incursion-Vehicle, Aircraft or Person

SCF-NP	System/Component Failure or Malfunction(Non-Power Plant)
SCF-PP	System/Component Failure or Malfunction(Power Plant)
SMS	Safety Management System
SOPs	Standard Operating Procedures
SPI	Safety Performance Indicator
SSP	State Safety Programme
TCAS	Traffic Collision Avoidance System
TURB	Turbulence Encounter
UIMC	Unintended flight in IMC
USOS	Undershoot/overshoot
VFR	Visual Flight Rules
WSTRW	Windshear or Thunderstorm

LIST OF TABLES

Chapter 1

Chapter 2

Chapter 3

Chapter 4

LIST OF FIGURES

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

END OF REPORT

ANNUAL SAFETY REVIEW - **YEAR 2017**