AIRPORTS AUTHORITY OF INDIA

ANNUAL SMS PERFORMANCE OF AIRPORT AUTHORITY OF INDIA YEAR 2018

Executive Director (Aviation Safety)

Aviation Safety Directorate, CHQ

AVIATION SAFETY DIRECTORATE, CHQ, NEW DELHI

Introduction

Safety Performance Indicator (SPI) package of Airports Authority of India (AAI) for the year 2019 (1st January to 31st December) is drawn from three mainstream operational sectors of AAI. These safety critical sectors are Aerodrome Operations; Air Traffic Management (ATM) & Communication/Navigation/Surveillance (CNS).

Safety critical elements from these sectors are identified and established as Safety Performance Indicator (SPI) of AAI. These SPI are congruent with State's SSP aggregate safety indicators and are comprising of both high level as well as low level consequences SPIs.

Safety Performance Targets (SPTs) of corresponding Safety Performance Indicator (SPIs), of which historical data is available is set. Safety Performance Targets (SPTs) are based on percentage of improvement over last year safety performance (average), as agreed upon by respective directorates. Three Alert levels are also established based on the preceding period's (i.e. 2018) performance, namely average and standard deviation (SD). Three Alert lines are average + 1SD / 2SD / 3SD. An alert trigger (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for current monitoring period (2019) :

- Any single point is above the Alert level 3 line
- 2 consecutive points are above the Alert Level 2 line
- 3 consecutive points are above the Alert level 1 line

Source of Data

Traffic data is derived from Airport Information Management System (AIMS). This includes total number of Arrivals, departures and over flights. An over flights means an aircraft entering Indian airspace, over flying Indian airspace and exiting Indian airspace.

Incidents data is derived from the AAI control room messages, reports of pilots, controllers, WSOs, Airport-in-charges, Airlines, AFTN messages and various reporting forms of DGCA / AAI.

Annual SMS performance summary

Annual SMS performance summary shall be compiled as per the format attached in Annexure-2, at the end of each monitoring period i.e. by 31st December of every year. Summary will be based on respective Target & Alert level outcomes annotated. At the end of current year 2019, if the average rate for the current year is at least equal to or lower than the set Target, then the set Target of improvement is deemed to have been achieved.

Sunil Kumar Oberoi
Executive Director(Aviation Safety)

Annexure-1

AAI SMS Performance Summary – 2018

High Consequence SPIs

SPI Description	SPI Alert Level Criteria (for 2019)	Alert Level Not breached [Yes/ No] in 2018	SPI Target Level Criteria (for 2019)	Target Achieved [Yes/No] in 2018
Aerodrome Operations				
Number of reported bird strikes per 10,000 arrivals / departures	Avg.+1SD= **3.91** Avg.+2SD= **4.88** Avg.+3SD= **5.86**	Yes	**3.63*** (i.e. 5% improvement from mean rate of last year, 2018)	Yes
Number of reported wildlife strikes per 10,000 arrivals / departures	Avg.+1SD=0**.45** Avg.+2SD=0**.70** Avg.+3SD=0**.95**	No	**0.19***	No
Air Traffic Services (ATS)				
Number of infringement of separation minimum per 100,000 aircraft movements	Avg.+1SD=**1.31** Avg.+2SD=**1.61** Avg.+3SD=**1.91**	Yes	**0.95***	No
Number of runway incursions per 10,000 arrivals & departures	Avg.+1SD= 0**.18** Avg.+2SD=0**.23** Avg.+3SD=0**.28**	Yes	0.129 i.e. 1% improvement from mean rate of last 2 years (2017& 2018)	Yes
Communication, Navigation & Surveillance (CNS)				
Mean time between failures (MTBF) of Landing / Navigational aids per year	The reliability of CNS equipment depends upon the MTBF, if MTBF is high, reliability is more. As per the calculation $R=100\ e^{-t/m}$ Where R is the reliability (Probability that the facility will be operative within the specified tolerance for time t), e is base of natural logarithms, t is the time period and m is the MTBF. If the MTBF of equipment is 1000 hrs or more for 24hrs operations the reliability is more than 97.5%% as per annexure 10 vol-1 attachment F. In 2018 the total MTBF for Navigational aids and Surveillance aids are more than 1000 hrs. We should maintain the same serviceability of our equipment's for the year 2019			
Mean time between failures (MTBF) of Surveillance aids (AIDS/ MSSR/ TAR/ RSR/ ASMGCS) per year				

*** As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target and alert levels for 2019 is same as the target for 2018.**

Low Consequence SPIs				
SPI Description	**SPI Alert Level Criteria (2019)**	**Alert Level Not breached [Yes/ No]**	**SPI Target Level Criteria for 2019**	**Target Achieved [Yes/ No]**
Aerodrome Operations				
Number of Runway Excursion per 10,000 arrivals & departures	Avg.+1SD=**0.17** Avg.+2SD=**0.25** Avg.+3SD=**0.30**	----	0.08	-----
Number of reported incident of Foreign Object Debris (FOD) in the movement area of major aerodrome per 10,000 arrivals & departures	Avg.+1SD=**.185** Avg.+2SD=**.210** Avg.+3SD=**.230**	----	0.90	-----
Air Traffic Services				
Number of level bust per 100,000 aircraft movements	Avg.+1SD=**0.34** Avg.+2SD=**0.45** Avg.+3SD=**0.56**	Yes	0.22	NO
Number of safety occurrences due Communication errors (SOCE) per 100,000 aircraft movements	Avg.+1SD=**0.74** Avg.+2SD=**0.96** Avg.+3SD=**1.18**	Yes	0.44	NO
Communication, Navigation & Surveillance (CNS)				
Number of VCCS (VHF) failures per year	118+3=121	-		-
Number of degradation in ATS Automation system per year	4	-		-

Aerodrome Operations

Safety Performance Indicators (SPIs) 2019

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SAFETY PERFORMANCE INDICATORS (SPIs) FOR AERODROME OPERATIONS

A. High Consequence Indicators

1. Number of reported bird strikes per 10,000 Arrivals and Departures

1.1 Definition

As per DGCA CAR 2017, Wildlife (bird/ animal) strike is defined in following two categories:

Confirmed Strikes

a) Any reported collision between a bird or other wildlife and an aircraft for which evidence in the form of a carcass, remains or damage to the aircraft is found.

b) Any wildlife (bird/animal) found dead on an airfield where there is no other obvious cause of death (e.g. strike by vehicles in the operational area, etc.).

Unconfirmed Strike

Any reported collision between a bird or other wildlife and an aircraft for which no physical evidence is found.

1.2 Source of Data

a) Traffic data is derived from Airport Information Management System (AIMS) data Base.

b) Reports of bird strikes are extracted from source of AAI control room messages, which includes reports of pilots, controllers, WSOs, Airport-in-charges, Airlines, AFTN messages and Wildlife (Bird/Animal strike forms).

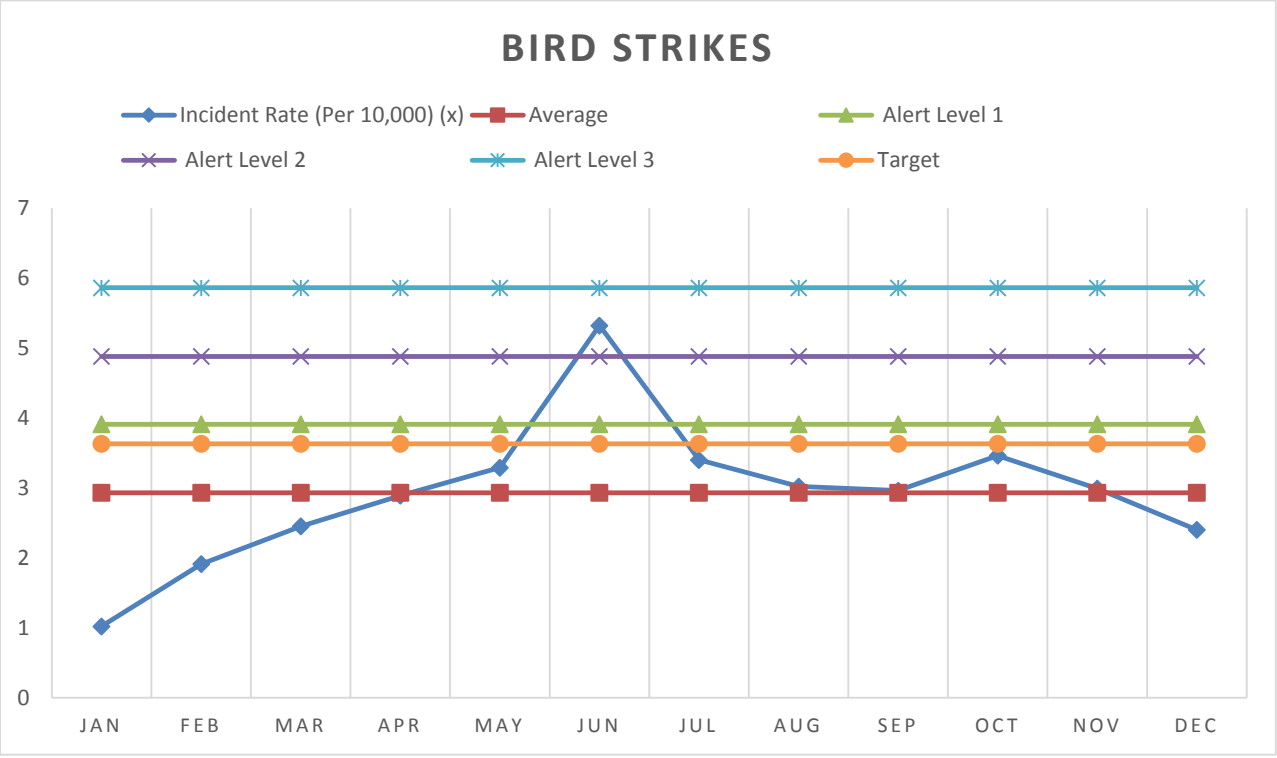
1.3 Data Analysis:

Number of reported bird strikes per 10,000 Arrivals and Departures during last year i.e. 2018 and detailed analysis is appended below (Annexure A):

Annexure 'A'

No. of Bird strikes per 10,000 Aircraft movements (Departure + Arrival) Year 2018 (1st Jan to 31st Dec)

Month	Total Aircraft Movements (Dep + Arr)	No. of Reported Bird Strikes	Incident Rate (Per 10,000) (x)	Average μ	μ + 1 SD	μ +2 SD	μ +3 SD	Target
January	107333	11	1.02	2.93	3.91	4.88	5.86	3.63
February	99380	19	1.91	2.93	3.91	4.88	5.86	3.63
March	110015	27	2.45	2.93	3.91	4.88	5.86	3.63
April	107177	31	2.89	2.93	3.91	4.88	5.86	3.63
May	112470	37	3.29	2.93	3.91	4.88	5.86	3.63
June	109109	58	5.32	2.93	3.91	4.88	5.86	3.63
July	108968	37	3.40	2.93	3.91	4.88	5.86	3.63
August	112643	34	3.02	2.93	3.91	4.88	5.86	3.63
September	111578	33	2.96	2.93	3.91	4.88	5.86	3.63
October	118406	41	3.46	2.93	3.91	4.88	5.86	3.63
November	117194	35	2.99	2.93	3.91	4.88	5.86	3.63
December	120739	29	2.40	2.93	3.91	4.88	5.86	3.63



1.4 **Safety Performance Target (SPT):**

1.5 As the target set for 2018 (3.82) has been achieved. It has been decided that the target for 2019 is set as. 3.63 (i.e. 5 % Reduction on 3.82)

1.6 Alert Level:

a) **Alert level setting:** -

Alert level for 2019 is set as below,

- Alert level 1 - Avg.+1SD = 2.93 + 1 x 0.98 = 3.91
- Alert level 2 - Avg.+2SD = 2.93 + 2 x 0.98 = 4.88
- Alert level 3 - Avg.+3SD = 2.93 + 3 x 0.98 = 5.86

b) **Alert Level Trigger:** -

An alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for current monitoring period (2018):

- Any single point is above the Alert level 3 line
- 2 consecutive points are above the Alert Level 2 line
- 3 consecutive points are above the Alert Level 1 line

When Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine the source and root cause of the abnormal incident rate and any necessary action to address the unacceptable trend.

1.7 Target Achievement at the end of monitoring period (i.e. 2019)

At the end of the current year 2019, if the average rate for the current year is equal to or less than the target set for the year, then the set target is deemed to have been achieved.

1.8 Safety Action Plan

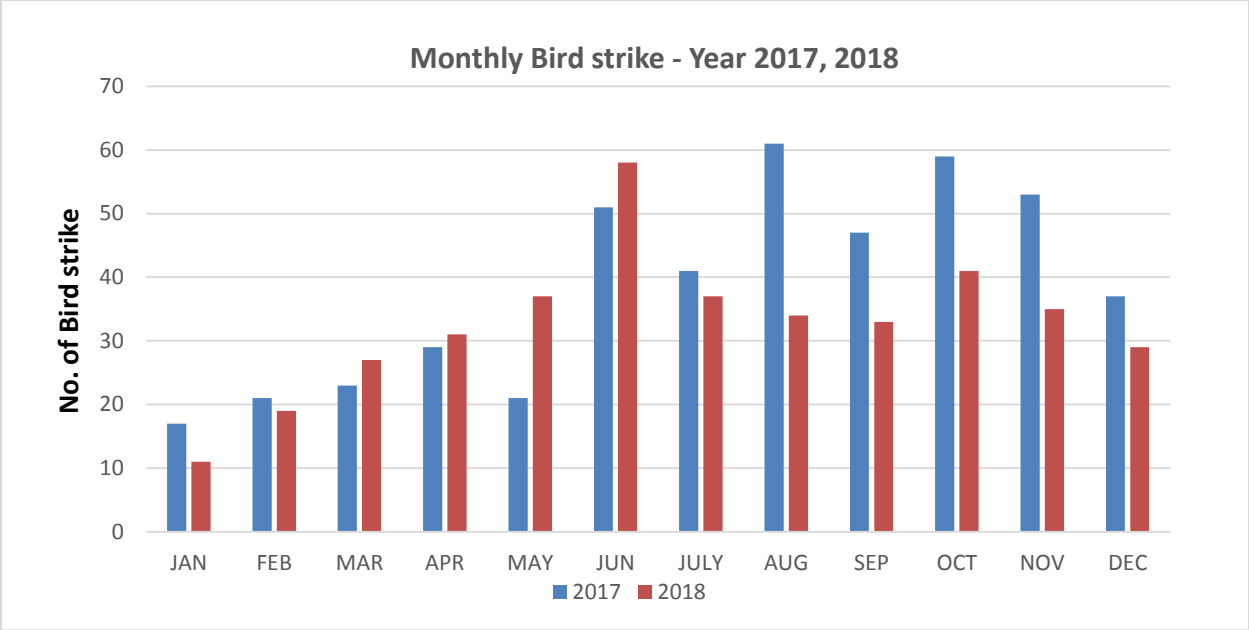
Safety Measures Already in Place:

Operation Directorate References	**Safety Measures Already in Place**
Operational circular 2 of 2014 dated 24th December 2014	Constitution of Airfield Environment Management Committees to check bird strike hazard near the

	airfields
Operational circular 2 of 2014 dated 3rd February 2015	Perimeter wall / Fencing check
Rule 91, Aircraft Rules 1937	Primary legislation (Aircraft Rules) preventing dumping of garbage and de-skinning of animals within a 10 km radius around airport
DGCA Order No. AV-15023/1/2009-AS (NBCC) dated 02.12.2013	National Bird Control Committee
Recommendation of NBCC (National Bird Control committee)	Education and outreach programs
Recommendation of NBCC (National Bird Control committee)	Extensive audits and inspections

Safety Action Plan:

Safety objective(s)	Action
Reduce the number of wildlife strikes (ground) Reduce the number of bird strikes	1. In AEMC meeting, discussed and reviewed implementation of the measures to reduce bird hazards around/ near Airport. 2. Runway inspected frequently for bird activities and bird chasers deployed. 3. Water concentration avoided in Operational Area. 4. Grass trimmed and insecticide sprayed. 5. Regular Garbage disposal carried out. 6. Entry of stray animals to Ops area checked. 7. Action Taken for clean environment around airport in association with local Municipalities. 8. Perimeter fencing checked regularly. 9. Iron grill/ net fixed in the drains passing out from ops area to prevent animal entry. 10. Proper coordination ensured with Forest dept./ State govt.



As per the analysis of Data: In the month of June, Bird strike per 10000 aircraft movements are more than the Alert level 1

Name of Airport	Total Bird Hits	Confirmed Bird Hit	UN Confirmed Bird Hit
Patna	5	4	1
Ahmedabad	9	5	4
Kolkata	5	2	3
Calicut	8	4	4
Chennai	11	7	4
Trivandrum	5	5	0
Lucknow	4	3	1
Indore	5	4	1
Coimbatore	6	4	2

2. Number of reported wildlife strikes per 10,000 Arrivals and Departures

2.1 Definition

As per DGCA Air safety circular 02/2011, Wildlife (bird/animal) strike is defined in following two categories:

Confirmed Strikes

a) Any reported collision between a bird or other wildlife and an aircraft for which evidence in the form of a carcass, remains or damage to the aircraft is found.

b) Any wildlife (bird/ animal) found dead on an airfield where there is no other obvious cause of death (e.g. strike by vehicles in the operational area, etc.).

Unconfirmed Strike

Any reported collision between a bird or other wildlife and an aircraft for which no physical evidence is found.

2.2 Source of Data

a) Traffic data is derived from Airport Information Management System (AIMS) data Base.

b) Reports of bird strikes are extracted from source of AAI control room messages, which includes Reports of pilots, controllers, WSOs, Airport-in-charges, Airlines, AFTN messages and Wildlife (Bird/ Animal strike forms).

2.3 Data Analysis:

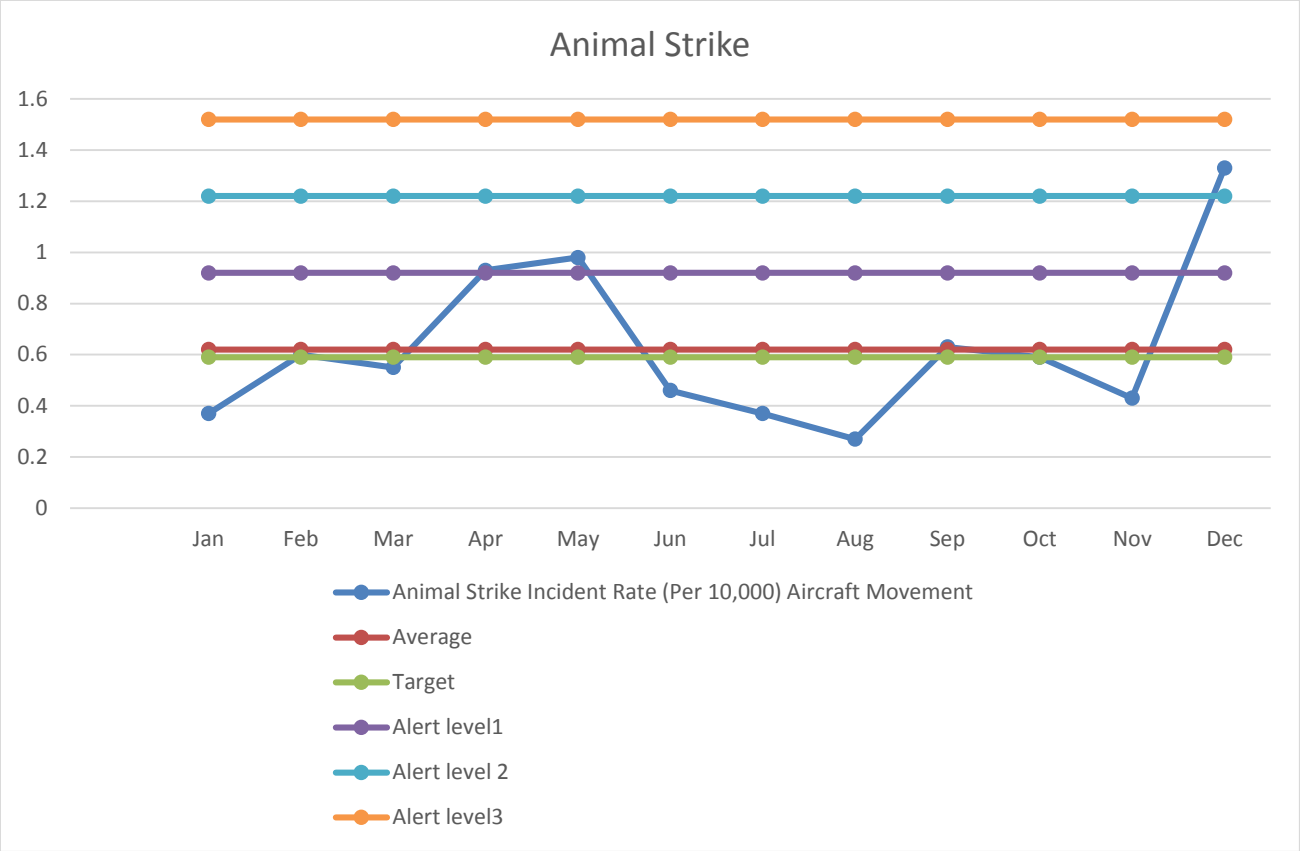
Number of reported wildlife strikes per 10,000 Arrivals and Departures during last year i.e. 2018 and detailed analysis is appended below (Annexure B):

Annexure 'B'

No. of Animal strikes per 10,000 aircraft movements (Departure + Arrival)

Year 2018 (1st Jan to 31st Dec)

Month	Total Aircraft Movements (Dep + Arr)	No. of Reported Animal Strikes	Incident Rate (Per 10,000) (x)	Average (μ)	$(x-\mu)^2$	Alert level1 Mean+ 1SD	Alert level 2 Mean+2 SD	Alert level3 Mean+ 3SD
Jan	107333	4	0.37	0.62	0.06	0.92	1.22	1.52
Feb	99380	6	0.60	0.62	0.00	0.92	1.22	1.52
Mar	110015	6	0.55	0.62	0.01	0.92	1.22	1.52
Apr	107177	10	0.93	0.62	0.10	0.92	1.22	1.52
May	112470	11	0.98	0.62	0.13	0.92	1.22	1.52
Jun	109109	5	0.46	0.62	0.03	0.92	1.22	1.52
Jul	108968	4	0.37	0.62	0.06	0.92	1.22	1.52
Aug	112643	3	0.27	0.62	0.13	0.92	1.22	1.52
Sep	111578	7	0.63	0.62	0.00	0.92	1.22	1.52
Oct	118406	7	0.59	0.62	0.00	0.92	1.22	1.52
Nov	117194	5	0.43	0.62	0.04	0.92	1.22	1.52
Dec	120739	16	1.33	0.62	0.50	0.92	1.22	1.52
		TOTAL	0.62	$\Sigma(x-\mu)^2$	1.08			
				$\Sigma(x-\mu)^2/12$	0.09			
			SD=	$\sqrt{\Sigma(x-\mu)^2/12}$	0.30			



2.4 Safety Performance Target (SPT):

a) As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 i.e. **0.19**

2.5 Alert Level:

a) Alert level setting: -

Alert level for 2019 is also same as set in preceding Year (i.e. 2018)

- Alert level 1 - **0.45**
- Alert level 2 - **0.70**
- Alert level 3 - **0.95**

b) Alert Level Trigger: -

An alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for current monitoring period (2018):

- Any single point is above the Alert level 3 line
- 2 consecutive points are above the Alert Level 2 line
- 3 consecutive points are above the Alert Level 1 line

When Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine the source and root cause of the abnormal incident rate and any necessary action to address the unacceptable trend.

2.6 Target Achievement at the end of monitoring period (i.e. 2019)

At the end of the current year 2019, if the average rate for the current year is at least 5% lower than the preceding year 2018's average rate **or lower**, then the set target of 5% improvement is deemed to have been achieved.

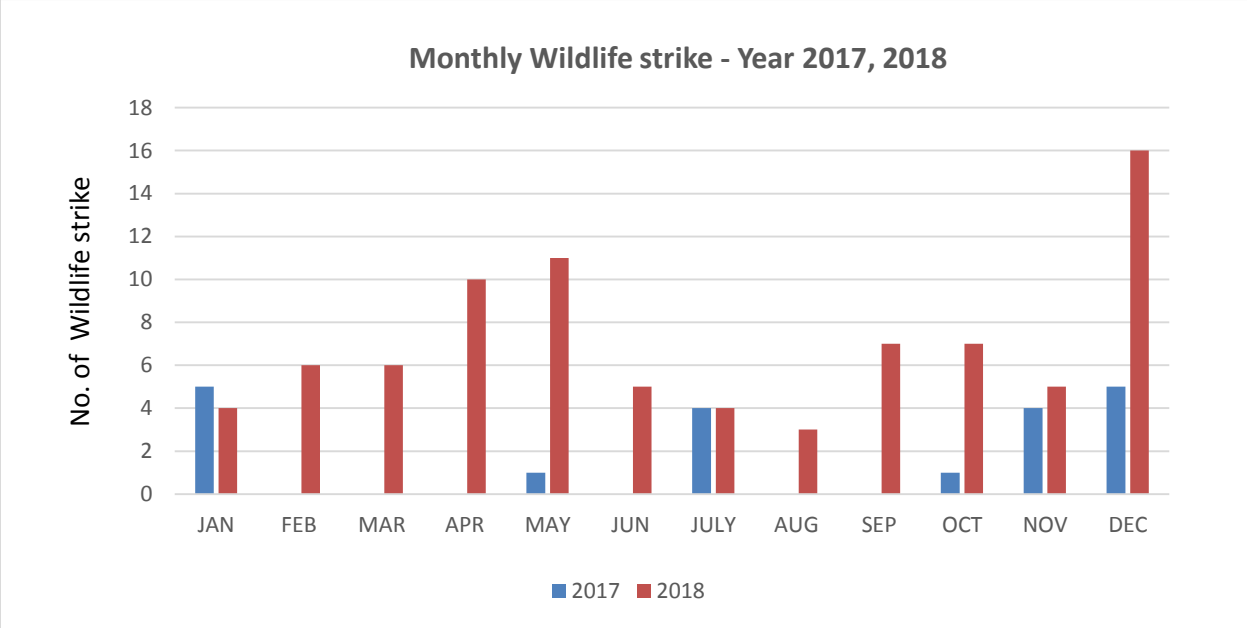
2.7 Safety Action Plan

Safety Measures Already in Place:

Operation Directorate References	Safety Measures Already in Place
Operational circular 2 of 2014 dated 24th December 2014	Constitution of Airfield Environment Management Committees to check bird strike hazard near the airfields
Operational circular 2 of 2014 dated 3rd February 2015	Perimeter wall / Fencing check
Rule 91, Aircraft Rules 1937	Primary legislation (Aircraft Rules) preventing dumping of garbage and de-skinning of animals within a 10 km radius around airport
DGCA Order No. AV-15023/1/2009-AS (NBCC) dated 02.12.2013	National Bird Control Committee
Recommendation of NBCC (National Bird Control committee)	Education and outreach programs
Recommendation of NBCC(National Bird Control committee)	Extensive audits and inspections

Safety Action Plan:

Safety objective(s)	Action
Reduce the number of wildlife strikes (ground) Reduce the number of bird strikes	1. In AEMC meeting, discussed and reviewed implementation of the measures to reduce bird hazards around/ near Airport. 2. Runway inspected frequently for bird activities and bird chasers deployed. 3. Water concentration avoided in Operational Area. 4. Grass trimmed and insecticide sprayed. 5. Regular Garbage disposal carried out. 6. Entry of stray animals to Ops area checked. 7. Action Taken for clean environment around airport in association with local Municipalities. 8. Perimeter fencing checked regularly. 9. Iron grill/net fixed in the drains passing out from ops area to prevent animal entry. 10. Proper coordination ensured with Forest dept./ State govt.



Air Traffic Services

Safety Performance Indicators (SPIs) 2019

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SAFETY PERFORMANCE INDICATORS (SPI) FOR ATM-2018

1 Separation Minima Infringements (SMI) with Direct/ Indirect ATC Contribution: Number Of occurrences per 100,000 Aircraft Movements:

1.1. Scope:

a) Separation minima infringement means infringement of applicable separation minima between two IFR flights in AAI administered airspace. Applicable separation minima are as given in Chapters 5, 6, 7 and 8 of Manual of Air Traffic Services-Part1.

b) Only those occurrences of separation minima infringements will be considered in which ATC has directly or indirectly contributed to the incident which has occurred in AAI administered airspace. However, this does not include those occurrences of separation minima infringements which were caused by the ANSPs other than AAI, pilots, Military ATC Units or any other agency.

1.2 Source of Data

a) Traffic data will be derived from AIMS data base

b) Number of aircraft movements means total number of arrivals, departures and over-flights. Number of overflights will not be counted based on number of Indian FIRs, it has flown. An over-flight means an aircraft entering Indian airspace, over-flying Indian-airspace and existing Indian airspace.

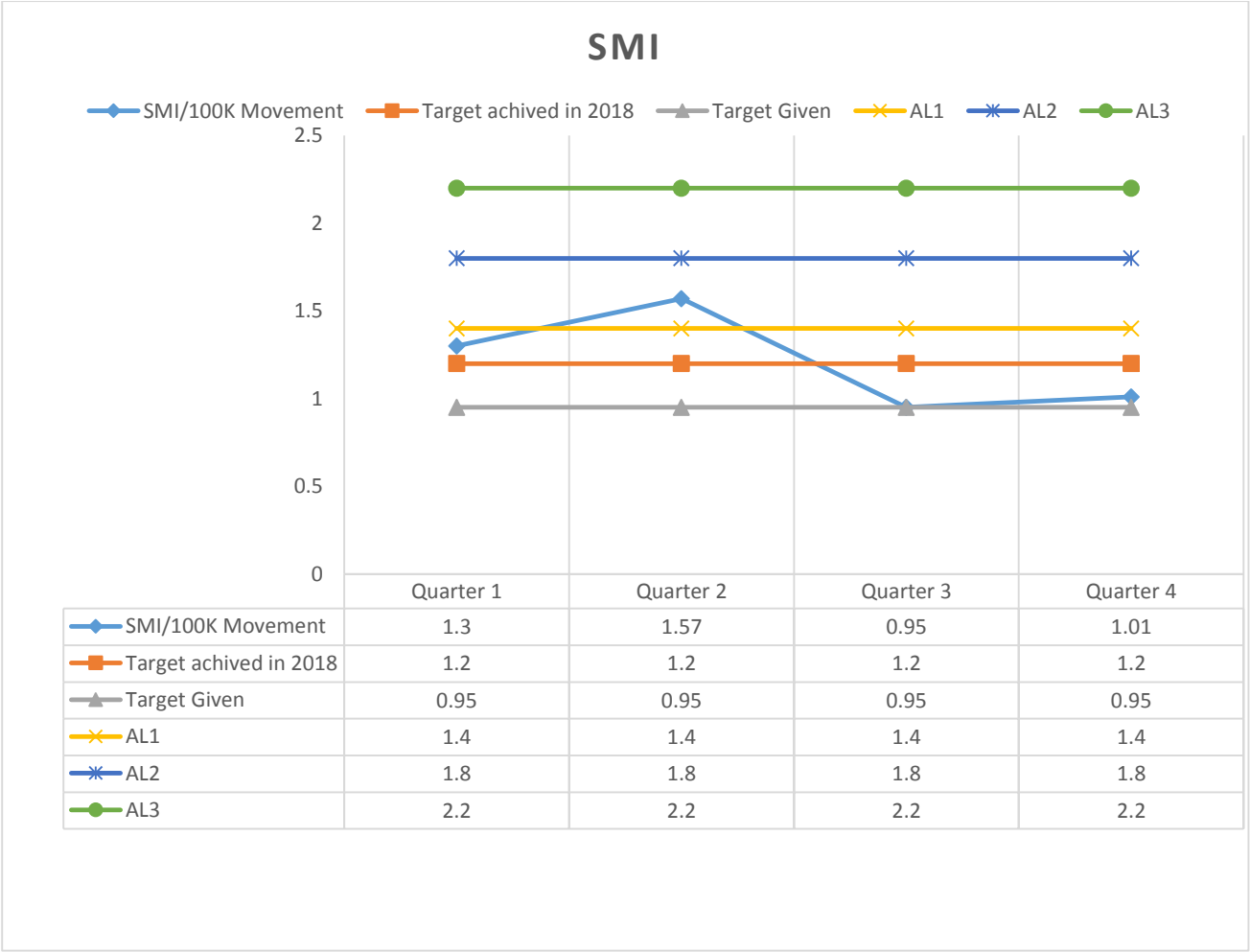
c) Reports of Separation Minima Infringement (SMI) are received from sources such as pilots, controllers, WSOs, ATS Incharges, DGCA, other ANSPs, Airlines, ATS Incharges, Air Safety Reports, AAI Control Room messages, AFTN messages. Only those separation minima infringements will be accounted which have been validated by ATM Directorate of AAI.

1.3 Analysis of Data:

a) Data of number of occurrences of Separation Minima Infringements per 100,000 aircraft movements during last two years is as appended below:

	1st Quarter (Jan-Mar)	2nd Quarter (Apr-Jun)	3rd Quarter (Jul-Sep)	4th Quarter (Oct-Dec)	Annual value	
Year 2016						
Number of occurrences	8	6	3	10	27	
Number of movements	579008	598046	604292	646705	2428051	
SMI/100K movements	1.38	1.00	0.50	1.55	1.11	
Year 2017						
Number of occurrences	3	7	5	7	22	
Number of movements	645773	655373	669712	718236	2689094	
SMI/100K movements	0.46	1.07	0.75	0.97	0.82	
Mean of Quarterly SMI/100 K aircraft movements for 2016 & 2017	0.90	1.04	0.63	1.26	**0.96**	
Two yearly aggregate (Mean) SMI						**0.96**
SD						**0.42**
Mean + 1 SD						**1.4**
Mean + 2 SD						**1.8**
Mean + 3 SD						**2.2**
Safety Target for 2018 = Aggregate of SMI for 2016 and 2017 - 1% of (Aggregate of SMI for 2016 and 2017)						**0.95**
Year 2018						
Number of occurrences	09	11	07	08	**35**	
Number of movements	692268	700056	736258	792305	2920887	
SMI/100K movements	1.30	1.57	0.95	1.01	1.198	

Mean of Quarterly SMI/100 K aircraft movements for 2017 & 2018	0.88	1.32	0.85	0.99	1.01	
Two yearly aggregate (Mean) SMI						**1.01**
SD						**0.30**
Mean + 1 SD						**1.31**
Mean + 2 SD						**1.61**
Mean + 3 SD						**1.91**
Safety Target for 2019 = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 i.e. 0.95						**0.95**



	Quarter 1	Quarter 2	Quarter 3	Quarter 4
SMI/100K Movement	1.3	1.57	0.95	1.01
Target achived in 2018	1.2	1.2	1.2	1.2
Target Given	0.95	0.95	0.95	0.95
AL1	1.4	1.4	1.4	1.4
AL2	1.8	1.8	1.8	1.8
AL3	2.2	2.2	2.2	2.2

1.4 Safety Performance Target:

a) 1% improvements on two-year average (mean) of number of occurrences of separation minima infringements per 100,000 aircraft movements.

Safety Target for 2019 = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 i.e**. 0.95**
= 0.95 per 100K

1.5 Alert Level Setting:

a) *Alert level for 2019* is based on the preceding period's performance (aggregate of preceding two year) and Standard Deviation (SD)

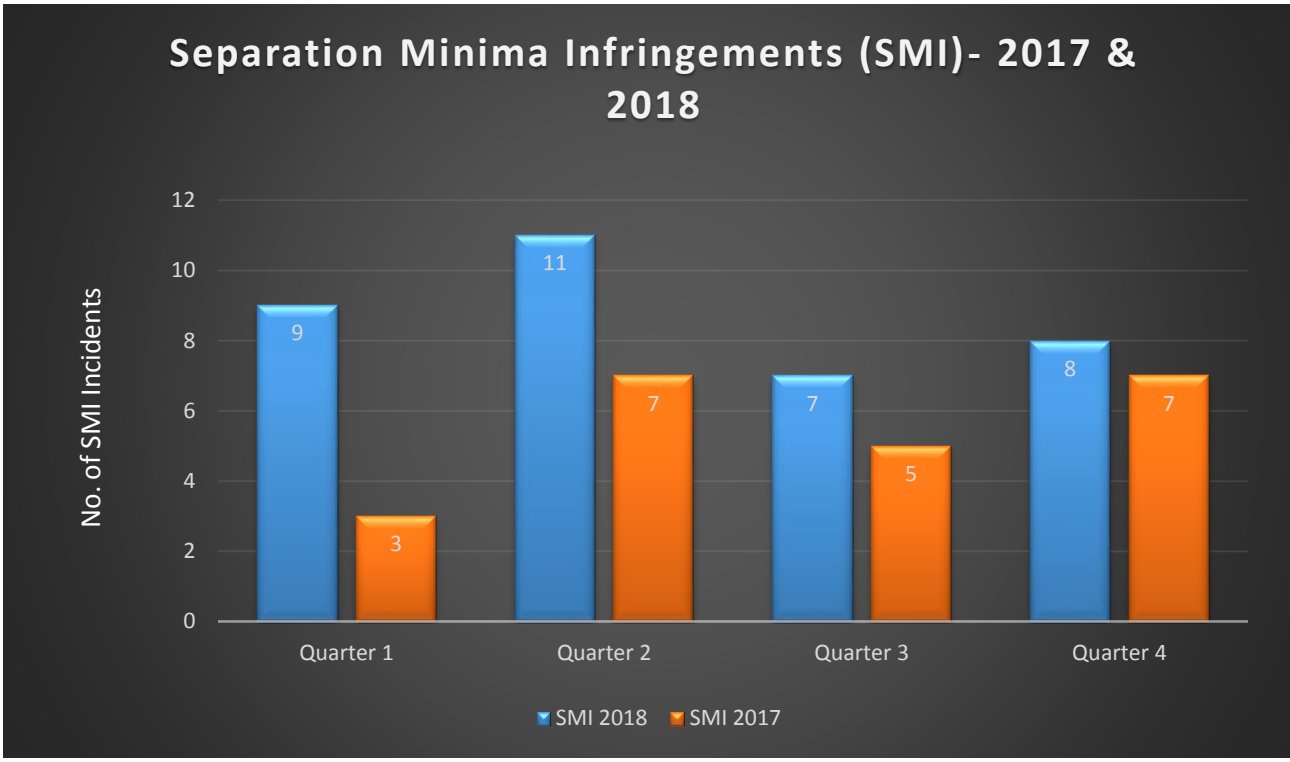
b) *Alert Level Trigger*: An Alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for the current monitoring period (current year):

- Any single point is above 3 SD line
- 2 consecutive points are above 2 SD line
- 3 consecutive points are above 1 SD line

When an Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine source and root cause of the abnormal

1.6 *Target Achievement:*

At end of the current year, if the Average rate for the current year is at least 1% or more lower than the preceding year's Average rate, then the set Target of 1% improvement is deemed to have been achieved.


Separation Minima Infringements (SMI)- 2017 & 2018
No. of SMI Incidents
12
10
8
6
4
2
0
9
3
11
7
7
5
8
7
Quarter 1
Quarter 2
Quarter 3
Quarter 4
SMI 2018
SMI 2017

2 Runway Incursions (RI): Number of Runway Incursions Per 10,000 Arrivals and Departures:

2.1. Scope:

a) Runway Incursion means any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

2.2 Source of Data

a) Traffic data will be derived from AIMS data base.

b) For total number of arrivals and departures, only those airports would be considered where ATC is provided by AAI.

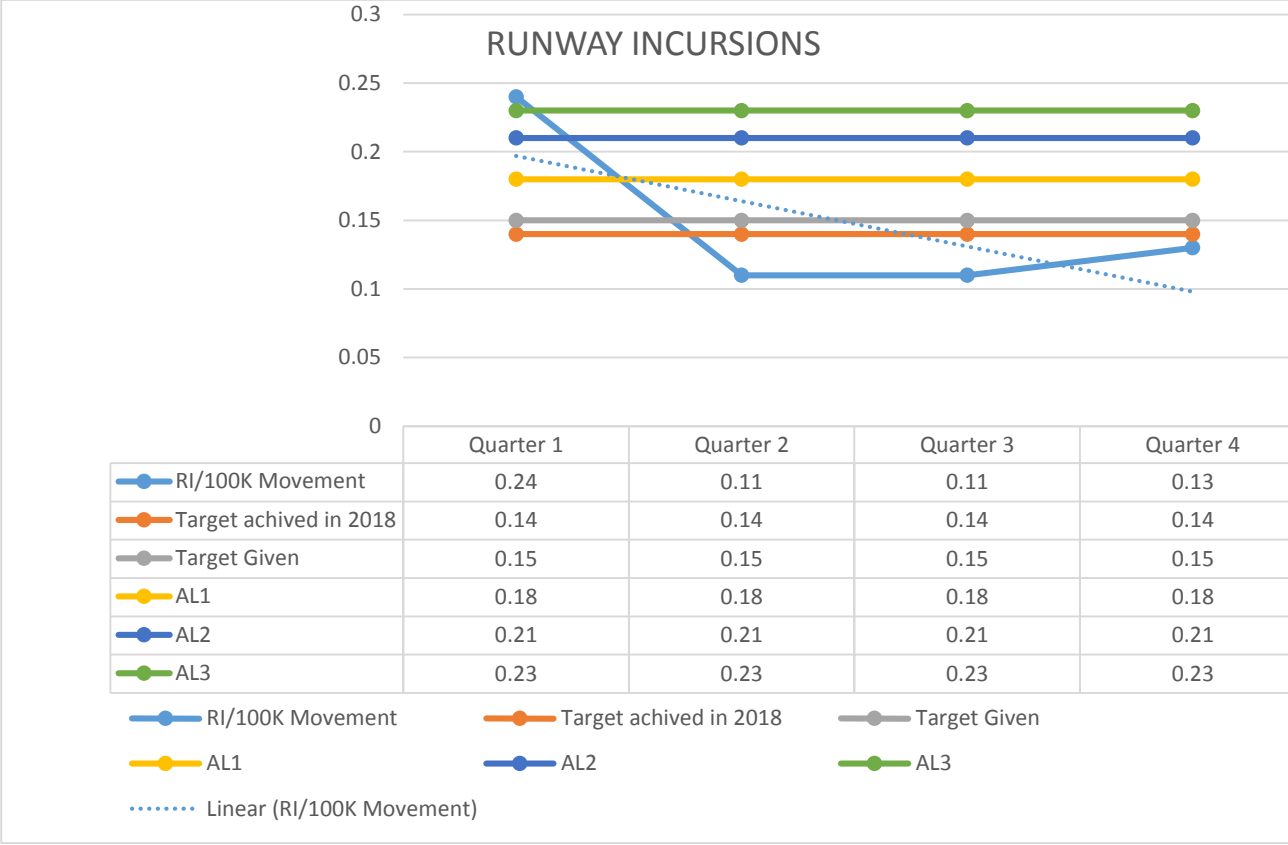
c) Reports of RIs are received from sources such as pilots, controllers, Airlines, ATS Incharge, DGCA, aerodrome operators, Air Safety Reports, AAI Control Room messages, AFTN messages. Only those RIs will be accounted which have been validated either by ATM Directorate of AAI or Runway Safety Team.

2.3 Analysis of Data:

a) Data of number of occurrences of RIs per 10,000 arrival and departures during last two years is as appended below:

	1st Quarter (Jan-Mar)	2nd Quarter (Apr-Jun)	3rd Quarter (Jul-Sep)	4th Quarter (Oct-Dec)	Annual value	
Year 2016						
Number of occurrences	6	10	14	10	40	
Number of arrival & departures	460855	479088	483094	518225	1941262	
RI/10K movements	0.13	0.21	0.29	0.19	0.21	
Year 2017						
Number of occurrences	10	6	5	4	25	
Number of arrival & departures	514106	524794	535382	578466	2152749	
RI/10K movements	0.19	0.11	0.09	0.07	0.12	
Target achieved in 2017						**0.12**
Mean of Quarterly RI/100 K aircraft	0.16	0.16	0.19	0.13	0.16	

movements for 2016 & 2017						
Two yearly aggregate (Mean) RI						**0.16**
SD						**0.02**
Mean + 1 SD						**0.18**
Mean + 2 SD						**0.21**
Mean + 3 SD						**0.23**
Safety Target for 2018 = Aggregate of RI for 2016 and 2017 - 1% of (Aggregate of RI for 2016 and 2017)						**0.15**
Year 2018						
Number of occurrences	13	6	7	09	**35**	
Number of arrival & departures	547628	560293	655740	709165	**2472826**	
RI/10K movements	0.23	0.10	0.11	0.12	**0.142**	
Target achieved in 2018						0.142
Mean of Quarterly RI/100 K aircraft movements for 2017 & 2018	0.21	0.11	0.20	0.95	0.13	
Two yearly aggregate (Mean) RI						0.13
SD						0.05
Mean + 1 SD						0.18
Mean + 2 SD						0.23
Mean + 3 SD						0.28
Safety Target for 2019 = Aggregate of RI for 2017 and 2018 - 1% of (Aggregate of RI for 2017 and 2018)						0.129



	Quarter 1	Quarter 2	Quarter 3	Quarter 4
RI/100K Movement	0.24	0.11	0.11	0.13
Target achived in 2018	0.14	0.14	0.14	0.14
Target Given	0.15	0.15	0.15	0.15
AL1	0.18	0.18	0.18	0.18
AL2	0.21	0.21	0.21	0.21
AL3	0.23	0.23	0.23	0.23

2.4 Safety Performance Target:

a) 1% improvements on two year average (mean) of number of occurrences of Runway Incursions per 10,000 arriving and departing aircraft.

b) Safety Target for 2019 = Aggregate of RIs for 2017 and 2018-1% of (Aggregate of RIs for 2017 and 2018)

= **0.129**

2.5 Alert Level Setting:

a) Alert level for 2019 is based on the preceding period's performance (aggregate of preceding two year) and Standard Deviation (SD)

b) *Alert Level Trigger:* An Alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for the current monitoring period (current year):

- Any single point is above 3 SD line

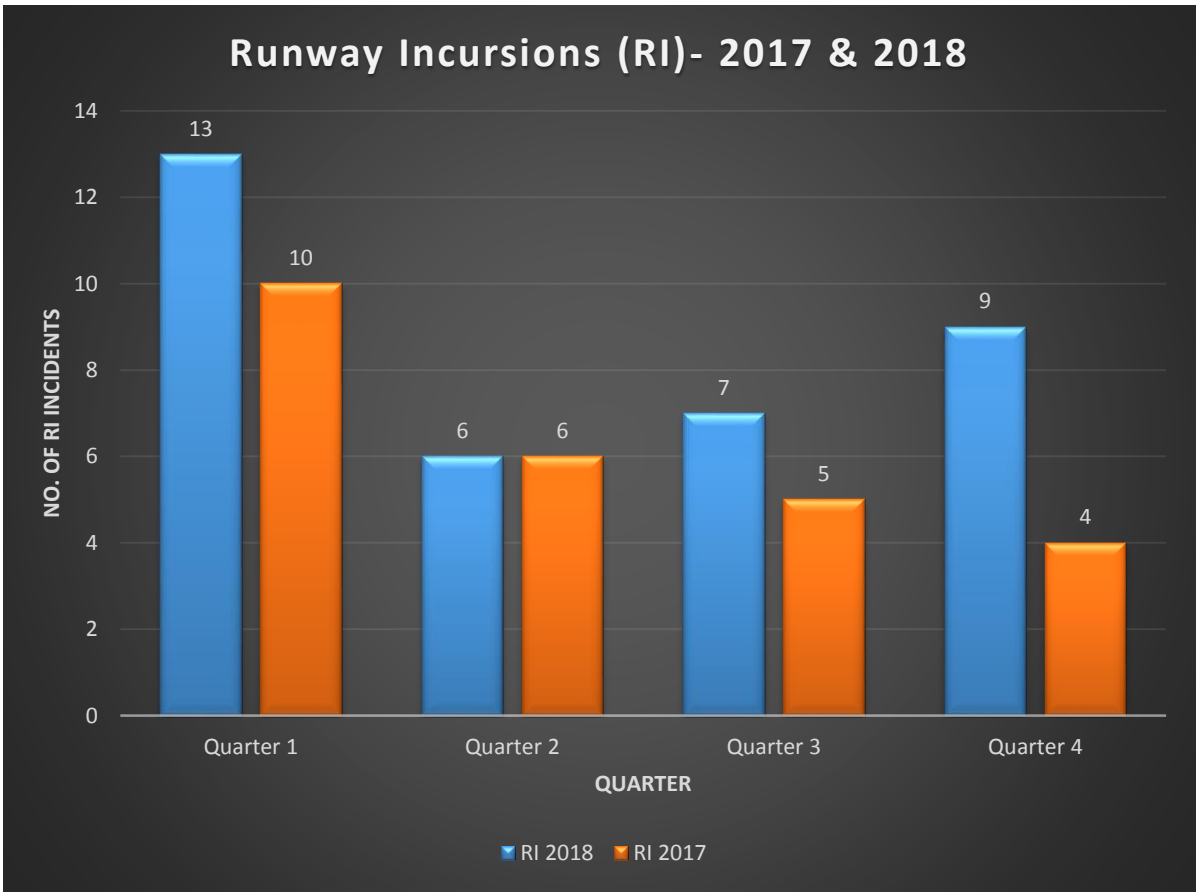
- 2 consecutive points are above 2 SD line

- 3 consecutive points are above 1 SD line

When an Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine source and root cause of the abnormal.

2.6 *Target Achievement:*

At end of the current year, if the Average rate for the current year is at least 1% or more lower than the preceding year's Average rate, then the set Target of 1% improvement is deemed to have been achieved.



3 Number of Level Bust (LB) per 100, 000 Aircraft Movements:

3.1 Scope:

a) A level bust is defined as an unauthorized deviation from the ATC assigned altitude (or flight level) equal to or greater than 300 FT in Non-RVSM airspace and 200 ft in RVSM airspace. Occurrences in which ATC gave the aircraft clearance for an incorrect altitude are not included.

b) All such Level Busts which occurred in AAI administered airspace, will be considered. However, this will not include those Level Busts which were caused by the ANSPs other than AAI. This also does not include those Level Busts which caused by Military ATC Units e.g. IAF and Indian Navy.

3.2 Source of Data:

a) Traffic data will be derived from AIMS data base. Number of aircraft movements means total number of arrivals, departures and over-flights.

b) Reports of Level Busts are received from pilots, controllers, WSOs, ATS Incharge, DGCA, Air Safety Reports, voluntarily reports, Proficiency Assessors, analysis of random tape transcripts, AAI Control Room messages, AFTN messages. Only those Level Busts will be accounted which have been validated by ATM Dte of AAI.

3.3 Analysis of Data:

a) Data of number of occurrences of level bust per 100,000 aircraft movements during last Four years is as appended below:

	1st Quarter (Jan-Mar)	2nd Quarter (Apr-Jun)	3rd Quarter (Jul-Sep)	4th Quarter (Oct-Dec)	Annual value	
Year 2015						
Number of occurrences	3	3	0	1	7	
Number of movements	504980	526829	529399	566745	2127953	
LB/100K movements	0.59	0.57	0.00	0.18	0.33	
Year 2016						
Number of occurrences	0	1	1	2	4	
Number of movements	579008	598046	604292	646705	2428051	
LB/100K movements	0.00	0.17	0.17	0.31	0.16	
Year 2017						
Number of occurrences	0	2	1	2	5	
Number of movements	645773	655373	669712	718236	2689094	
LB/100K movements	0.00	0.31	0.15	0.28	0.19	
Mean of Quarterly LB/100K aircraft movement for 2015,2016&2017	0.19	0.35	0.11	0.26	0.22	
Three yearly aggregate (Mean) LB						0.22
SD						0.08
Mean +1 SD (Alert Level 1)						0.31
Mean + 2SD (Alert Level 2)						0.38
Mean + 3 SD (Alert Level 3)						0.46
Safety target for 2018 = Aggregate of LB for 2015, 2016 & 2017-1% of (Aggregate of LB for 2015, 2016 & 2017)						**0.217**
Year 2018						
Number of occurrences	2	5	2	1	10	
Number of movements	692268	700056	736258	792305	2920887	
LB/100K movements	0.29	0.71	0.27	0.12	0.342	
Mean of Quarterly LB/100K aircraft movement for 2016,	0.097	0.397	0.197	0.237	0.232	

2017 & 2018						
Three yearly aggregate (Mean) LB						0.232
SD						0.11
Mean +1 SD (Alert Level 1)						0.34
Mean + 2SD (Alert Level 2)						0.45
Mean + 3 SD (Alert Level 3)						0.56
Safety target for 2019 = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 **i.e. 0.217**						**0.217**

3.4 Safety Performance Target:

1% improvements on three year average (mean) of number of level busts per 100,000 aircraft movements.

Safety Target for **2019** = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 i**.e. 0.217**

3.5 Alert Level Setting:

a) Alert level for 2019 will be based on the preceding period's performance (aggregate of preceding three year) and Standard Deviation (SD)

b) *Alert Level Trigger:* An Alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for the current monitoring period (current year):

- Any single point is above 3 SD line
- 2 consecutive points are above 2 SD line
- 3 consecutive points are above 1 SD line

When an Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine source and root cause of the abnormal

3.6 *Target Achievement:*

At end of the 2019 year, if the Average rate for that year is at least 1% or more lower than the preceding year's Average rate, then the set Target of 1% improvement is deemed to have been achieved.

4 Number of Safety Occurrences due to Communication Errors (SOCE) per 100, 000 Aircraft Movements:

4.1 Scope:

a) Communication errors means errors due to miscommunication in ATC on account of absent mindedness and complacency; incorrect phraseologies or inappropriate use of plain English that results in ambiguity; call sign confusion due to call sign similarity; improper enunciation and articulation of voice; hearing expectancy; not hearing a transmission at all; confused instructions due to similarity in SIDs/STARs or waypoints; High rate of speech or unnecessary pauses; read back/hear back error etc.

b) Safety Occurrences due communication errors (SOCE) include air and ground occurrences such as separation minima infringements, runway incursions, level bust, aircraft vacating runway via wrong taxiway, aircraft entering closed runway, taxiway, apron, go around, cancellation of takeoff, rejected takeoff, landing & taking off without ATC clearance etc. due communication error.

c) Communication Error due to non functioning of Equipment

4.2 Source of Data

a) Traffic data will be derived from AIMS data base

b) Number of aircraft movements means total number of arrivals, departures and over-flights. Number of over flights will not be counted based on number of Indian FIRs, it has flown. An over-flight means an aircraft entering Indian airspace, over-flying Indian-airspace and existing Indian airspace.

c) Reports of SOCE are received from sources such as pilots, controllers, WSOs, ATS In charges, DGCA, Air Safety Reports, voluntarily reports, Proficiency Assessors, analysis of random tape transcripts, AAI Control Room messages, AFTN messages. Only those SOCE will be accounted which have been validated by ATM Dte of AAI

4.3 Analysis of Data:

a) Data of number of occurrences of SOCE per 100, 000 aircraft movements during last three years is as appended below:

	1st Quarter (Jan-Mar)	2nd Quarter (Apr-Jun)	3rd Quarter (Jul-Sep)	4th Quarter (Oct-Dec)	Annual value	
Year 2015						
Number of SOCE	2	3	0	4	9	
Number of aircraft movements	504980	526829	529399	566745	2127953	
SOCE/100K aircraft movements	0.40	0.57	0.00	0.71	0.42	
Year 2016						
Number of SOCE	5	4	1	7	17	
Number of aircraft movements	579008	598046	604292	646705	2428051	
SOCE/100K aircraft movements	0.86	0.67	0.17	1.08	0.70	
Year 2017						
Number of occurrences	3	2	0	1	6	
Number of Movement	645773	655373	669712	718236	2689094	
SOCE/100K movement	0.46	0.31	0.00	0.14	0.22	
Mean of Quarterly SOCS/ 100K aircraft movement for 2015, 2016 & 2017	0.57	0.51	0.05	0.64	0.45	
Three yearly aggregate (Mean) RI						0.45
SD						0.23
Mean + 1 SD						0.68
Mean + 2 SD						0.91
Mean + 3 SD						1.14
Safety Target for 2018 = Aggregate of SOCE for 2015, 2016 & 2017 - 1% of (Aggregate of SOCE for 2015, 2016 & 2017)						**0.44**
Year 2018						
Number of occurrences	8	2	4	4	18	
Number of Movement	692268	700056	736258	792305	2920887	
SOCE/100K movement	1.16	0.29	0.54	0.50	0.616	
Mean of Quarterly SOCS/ 100K aircraft movement for 2016, 2017 & 2018	0.83	0.42	0.24	0.57	0.52	

Three yearly aggregate (Mean) RI		0.52
SD		0.22
Mean + 1 SD		0.74
Mean + 2 SD		0.96
Mean + 3 SD		1.18
Safety target for 2019 = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 **i.e. 0.44**		**0.44**

4.4 Safety Performance Target:

a) 1% improvements on three year average (mean) of number of occurrences of SOCE per 100,000 arriving and departing aircraft.

b) Safety Target for 2019 = As the target set for 2018 in 2017 was not achieved in 2018. It has been decided that the target for 2019 is same as the target for 2018 **i.e. 0.44**)

4.5 Alert Level Setting:

a) Alert level for 2019 is based on the preceding period's performance (aggregate of preceding three year) and Standard Deviation (SD)

b) *Alert Level Trigger:* An Alert (abnormal/ unacceptable trend) is indicated if any of the conditions below are met for the current monitoring period (current year):

- Any single point is above 3 SD line
- 2 consecutive points are above 2 SD line
- 3 consecutive points are above 1 SD line

When an Alert is triggered (potential high risk or out of control situation), appropriate follow-up action is expected, such as further analysis to determine source and root cause of the abnormal

4.6 *Target Achievement:*

At end of the current year, if the Average rate for the current year is at least 1% or more lower than the preceding year's Average rate, then the set Target of 1% improvement is deemed to have been achieved.

Communication, Navigation & Surveillance

Safety Performance Indicators (SPIs) 2019

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SAFETY PERFORMANCE INDICATORS (SPI) FOR CNS

A. High Consequence Indicators

1. Mean Time Between Failures (MTBF) of Landing/ Navigational aids (ILS, DME, VOR, & NDB) per year

1.1 Definition

ICAO Annex 10 Volume –I Attachment F- GUIDANCE MATERIAL CONCERNING RELIABILITY AND AVAILABILITY OF RADIO COMMUNICATIONS AND NAVIGATION AIDS provides methodology and guidance in calculating MTBF of the facilities. Relevant extract from Attachment F is given as under:

Mean time between failures (MTBF): The actual operating time of a facility divided by the total number of failures of the facility during that period of time.

Note: the operating time is in general chosen so as to include at least five, and preferably more, facility failures in order to give a reasonable measure of confidence in the figure derived.

Calculation formula defined as:

$$\text{MTBF} = \frac{\text{Actual operating time of the facility}}{\text{Number of failures*}}$$

(* number of failures does not include scheduled shutdown period)

It may be seen that the reliability increases as the MTBF increases. For a higher degree of reliability, we must have a large MTBF.

1.2 Source of Data

a) Source of data is daily/ monthly reports sent by each Airport/ CNS station to CHQ. Stations will be further advised to refine the data.

b) The Data for each facility will be collected on monthly basis and will be averaged on Quarterly/ Annual basis.

1.3 Data Analysis:

Available consolidated data of the year 2018 on ‘Total hours of operations’; ‘Total unserviceable hours’ and ‘Number of failure’ with MTBF of each Landing/ Navigational aids have been appended as under:

CONSOLIDATED MTBF STATISTICS OF NAVIGATIONAL AIDS FOR 2018						
Sl. No.	**Facility**	**Number of facilities**	**Total hours**	**No. of failures**	**Hours of failure**	**MTBF**
1.	**LOC (CAT-I ILS)**	**56**	333797.6	18	499.97	**18516.54**
2.	**LOC (CAT-II ILS)**	**1**	8760	0	0	**Infinite**
3.	**LOC (CAT-III ILS)**	**7**	61320	2	0.8	**30659.6**
4.	**GP (CAT-I ILS)**	**55**	328810.12	9	472.5	**36481.96**
5.	**GP (CAT-II ILS)**	**1**	8760	0	0	**Infinite**
6.	**GP (CAT-III ILS)**	**7**	61320	7	99.95	**8745.721**
7.	**DME-LP**	**64**	403360.78	17	470.05	**23699.45**
8.	**VOR**	**86**	588028.52	52	449.67	**11299.59**
9.	**DME-HP**	**88**	591091.05	47	512.95	**12565.49**
10.	**NDB/OL/OM**	**50**	291914.3	18	178.45	**16207.55**

1.4 Safety Performance Target (SPT):

It has been seen from the above data that the target achieved in the year 2018 is much more than the maximum requirement of reliability given in Annexure 10. The existing target should be maintained for the year 2019.

1.5 Factors which affect MTBF and hence facility reliability are:

a) Inherent equipment reliability;
b) Degree and type of redundancy;
c) Reliability of the serving utilities such as power and telephone or control lines
d) Degree and quality of maintenance;
e) Environmental factors such as temperature and humidity

2. Mean Time Between Failures (MTBF) of Surveillance aids (ADS-B, MSSR, TAR, RSR and ASMGCS) per year

2.1 Definition

ICAO Annex 10 Volume –I Attachment F- GUIDANCE MATERIAL CONCERNING RELIABILITY AND AVAILABILITY OF RADIOCOMMUNICATIONS AND NAVIGATION AIDS provides methodology and guidance in calculating MTBF of the facilities. Relevant extract from Attachment F is given below:

Mean time between failures (MTBF): The actual operating time of a facility divided by the total number of failures of the facility during that period of time.

Note: the operating time is in general chosen so as to include at least five, and preferably more, facility failures in order to give a reasonable measure of confidence in the figure derived.

Calculation formula defined as:

$$\text{MTBF} = \frac{\text{Actual operating time of the facility}}{\text{Number of failures*}}$$

(* number of failures does not include scheduled shutdown period)

It may be seen that the reliability increases as the MTBF increases. For a higher degree of reliability, we must have a large MTBF.

2.2 Source of Data

a) Source of data is daily report sent by each Airport/ CNS station to CHQ. Stations will be further advised to refine the data.

b) The Data will be collected on monthly basis and will be averaged on Quarterly/ Annual basis.

2.3 Data Analysis:

Available consolidated data of the year 2018 on ‘Total hours of operations’; ‘Total unserviceable hours’ and ‘Number of failure’ with MTBF of each Surveillance aids have been appended as under:

CONSOLIDATED MTBF STATISTICS OF SURVEILLANCE FACILITIES FOR 2018

Sl. No.	Facility	Number of facilities	Total hours	No. of failures	Hours of failure	MTBF
1.	**ASR (PSR)**	**16**	124252.59	16	106.27	**7759.145**
2.	**ASR (MSSR)**	**16**	124252.59	12	100.1	**10346.04**
3.	**ARSR (PSR)**	**2**	17520	0	0	**Infinite**
4.	**ARSR (MSSR)**	**2**	17520	0	0	**Infinite**
5.	**MSSR ENROUTE**	**12**	107280	19	37.96	**5644.318**
6.	**ADS-B**	**20**	165676.49	3	0	**55225.5**
7.	**ASMGCS (SMR)**	**18**	91303.17	19	5002.07	**4542.163**
8.	**ASMGCS (MLAT)**	**144**	95719.17	8	79.65	**11954.94**

2.4 Safety Performance Target (SPT):

It has been seen from the above data that the target achieved in the year 2018 is much more than the maximum requirement of reliability given in Annexure 10. The existing target should be maintained for the year 2019

2.5 Factors which affect MTBF and hence facility reliability are:

a) Inherent equipment reliability;
b) Degree and type of redundancy;
c) Reliability of the serving utilities such as power and telephone or control lines
d) Degree and quality of maintenance;
e) Environmental factors such as temperature and humidity

B. Lower Consequence Indicators

1. Number of VHF/VCCS failures per year

1.1 Definition

"VHF failure" may be reported, if any of the following occurs:

- Failure of J-control system or controller work station
- Failure of remote lines
- Failure of main or standby frequency
- Failure to change over to backup system
- Change of position of antenna connected to Transmitter / Receiver.

"VCCS failure" may reported, if any of the following occurs:

- Failure of data or control lines
- Failure of main or standby system
- Failure to change over to backup system
- Failure of VCCS work station

1.2 Source of Data

a) Source of data is daily report sent by each Airport/ CNS station to CHQ. Stations will be further advised to refine the data.

b) The Data will be collected on monthly basis and will be averaged on Quarterly/Annual basis.

1.3 Data Analysis:

Data in respect of number of reported incident of VHF during last year i.e. 2018 was collected from **64** AAI airports and only **118** incidents of VHF failures were reported. For VCCS during 2018 data was collected from 44 Airports and only 3 incidents of VCCS degradation(s)/ failures reported.

Sl.No.	Facility	Number of Facilities	Annual Failure(s) / Degradation(s)	Remark(s)
1.	***VHF***	**64**	**118**	
2.	***VCCS***	***44***	**3**	
3.	***AUTOMATION***	***44***	**4**	

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