



International Civil Aviation Organization

**The Thirteenth Meeting of the Regional Airspace Safety Monitoring
Advisory Group (RASMAG/13)**

Bangkok, Thailand, 02 – 05 August 2010

Agenda Item 5: Airspace safety monitoring activities/requirements in the Asia/Pacific Region

**INDIA'S PROGRESS TOWARDS ESTABLISHMENT OF ENROUTE
MONITORING AGENCY (EMA) - BOBASMA**

SUMMARY

This paper aims to provide an update on India's preparedness and progress on establishment of En-route Monitoring Agency (EMA) for airspace over Bay of Bengal, Arabian Sea and Indian Ocean.

1. INTRODUCTION

1.1 ICAO Annex 11 provisions require that safety assessments be carried out based on collision risk modelling before the implementation of reduced separation minima such as the 50 NM longitudinal separation based on RNP10 operations. This is to ensure that the regionally established target level of safety (TLS) for the airspace question has been met. Additionally, periodic safety reviews must be performed in order to permit continued safe operations.

1.2 In 2004, the Regional Airspace Safety Monitoring Advisory Group (RASMAG) of APANIRG recognized the need for such safety monitoring activities to be carried out to support improvements to air traffic management for the region in a safe and systematic manner. Safety Monitoring Agency (SMA) was then adopted to identify the organization(s) that would be providing airspace safety assessment and monitoring services. In 2009, APANPIRG adopted the change in name from SMA to En-route Monitoring Agency (EMA) to better reflect the duties and responsibility of the EMA.

1.3 India is providing Air Traffic service over the large airspace in Bay of Bengal, Arabian Sea and Indian Ocean and in RASMAG/11 India accepted the proposal for establishing En-route Monitoring Agency for airspace under its jurisdiction.

2. PROGRESS MADE TOWARDS ESTABLISHMENT OF EMA

2.1 India is progressing in establishment of Enroute monitoring Agency for airspace over Bay of Bengal, Arabian Sea and India Ocean with assistance and guidance of FAA

2.2 Airports Authority of India has formed a Team of experts from Air Traffic Management, Safety, avionics and mathematical/statistical background. The team is visiting the FAA technical Centre, Atlantic City, USA this month to understand the safety monitoring establishment and its operation.

2.3 During the BOB-RHS/TF/3 meeting held in Singapore in May, 2010, the Indian delegates visited Singapore ACC and the Enroute monitoring Agency for South China Sea (SEASMA) for understanding the functions of EMA. Singapore presented a power point presentation to Indian delegates which gave a general background of functions of an Enroute Monitoring Agency and its duties and responsibilities in supporting the introduction and continued use of Enroute horizontal-plane separation minima.

2.4 The collection of GNE data has commenced in all Indian FIRs on selected routes w.e.f 01st July, 2010.

2.5 Draft Letter of Agreement proposed by India in line with EMA Handbook & identifying various FIRs/ACCs (States) to be the Signatory in this LOA has been modified as suggested in the ATM/AIS/SAR/SG meeting in July, 2010.

2.6 Commencement of GNE data analysis by Indian EMA for Indian FIRs likely by 01st September, 2010 so as to submit the first safety analysis report in the forthcoming FIT-BOB-13 & BOB-RHS/TF/4 meetings.

3. Action by the meeting

3.1 Meeting is invited to take note of this and concerned states to consider signing of LOAs.

3.2 Timely forwarding of the GNEs by the states concerned to BOBASMA to facilitate safety analysis.

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OPERATIONAL LETTER OF AGREEMENT

BETWEEN

Airports Authority of India	India
Directorate General of Civil Aviation	Indonesia
Department of Civil Aviation	Malaysia
Civil Aviation Department Ministry of Transport and Civil Aviation	Maldives
Department of Civil Aviation	Myanmar
Directorate General of Civil Aviation and Meteorology	Oman
Pakistan Civil Aviation Authority	Pakistan
The Seychelles Civil Aviation Authority	Seychelles
Civil Aviation Authority of Singapore	Singapore
The Civil Aviation Authority of Sri Lanka	Sri Lanka
Aeronautical Radio of Thailand Ltd	Thailand

FOR

MONITORING OF AIRCRAFT NAVIGATION ERRORS

IN THE

BAY OF BENGAL, ARABIAN SEA AND INDIAN OCEAN

AIRSPACE

Operational Letter of Agreement

Document Management

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Appendix A Navigation Error Report	A1 – 136	TBA
Appendix B: Template for Covering Letter to Aircraft Operator	B1 – 2	TBN
Appendix C: Summary of Navigation Error Reports	C1 – 2	TBN
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Operational Letter of Agreement

Overview

Introduction

The following document is a Letter of Agreement (LOA) between those Air Traffic Service (ATS) authorities shown on page one of this document. The letter of agreement details monitoring procedures between the following ATS units:

Bangkok ACC	Chennai OCC
Colombo ACC	Delhi ACC
Jakarta ACC	Karachi ACC
Kolkata OCC	Kuala Lumpur ACC
Lahore ACC	Maldives ACC
Male ACC	Mangalore ACC
Mumbai OCC	Muscat ACC
Nagpur ACC	Seychelles ACC
Singapore ACC	Trivandrum ACC
Yangon ACC	

Objective

The objective of this LOA is to define agreed procedures for the monitoring, notification, investigation, analysis and reporting of aircraft navigation errors in respect of aircraft to which reduced horizontal separation minima is applied when operating on any the following designated RNAV/RNP routes:

Phase 1, 2 & 3 are to be finalized by FIT-BOB.

Phase 1

N571, P628 & P762

Phase 2

L301, L510, L759, M300, M770, N563, N877, P570 & P574

Phase 3

All other RNAV NP 10 routes over Bay of Bengal, Arabian Sea and Indian Ocean [airspace](#).

* Phase 1, 2 & 3 are to be finalized by FIT-BOB.

Scope

The procedures contained in this LOA implement the performance monitoring requirements associated with the introduction of the reduced horizontal separation standard, and for the reporting and monitoring of gross lateral and longitudinal navigational errors.

For the purposes of this LOA, the term 'Service Providers' refers to organizations which are responsible for the provision of Air Traffic Control (ATC) services.

The term 'Regulatory Authority' refers to those organizations responsible for the investigation of navigational errors. In some cases, the Regulatory Authority may be the same as the Service Provider.

The term 'En-route Monitoring Agency' (EMA) refers to the organisation endorsed by the ICAO Asia Pacific Regional Airspace Safety Monitoring Advisory Group for providing airspace safety assessment and monitoring services to support the introduction and continued safe use of en-route horizontal-plane separation minima.

The designated EMA for the Bay of Bengal, Arabian Sea and Indian Ocean airspace is the [BOBASMA].

Operational Letter of Agreement

Overview, continued

Effective Date This letter of agreement becomes effective on (TBA) 1 July 2010

Background The use of these horizontal separation standards is restricted to aircraft which meet the requirements detailed in the respective States' AIP Supplements. This includes a requirement for RNP 10 / RNP 4 Performance Based Navigation (PBN) approval and it is the responsibility of the operator to ensure that such requirements are satisfied when so declared.

PBN approval includes operators meeting certain requirements with regard to crew training and in-flight operating procedures. The responsibility for approval for such operations rests with the State of Registry of the Operator.

Monitoring navigation errors is a joint responsibility between the aircraft operators, the States of Registry, and the ATC providers. There are established requirements for the operators to monitor navigation performance under the terms of their PBN Approval. This document sets out the responsibilities and procedures to be followed by staff of the signatory organizations to this LOA.

**Area of
Applicability**

The procedures outlined in this LOA shall be applied to all aircraft operating on any RNAV routes the following designated RNAV/RNP routes in the Bay of Bengal, Arabian Sea and Indian Ocean airspace.

Phase 1, 2 & 3 are to be finalized by FIT-BOB.

Phase 1*
N571, P628 & P762

Phase 2*
L301, L510, L759, M300, M770, N563, N877, P570 & P574

Phase 3*
All other RNP 10 routes over Bay of Bengal, Arabian Sea and Indian Ocean.

* Phase 1, 2 & 3 are to be finalized by FIT-BOB.

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Operational Letter of Agreement

Monitoring Procedures

Lateral Deviations

Monitoring shall be based on radar observations. When the radar controller observes a lateral deviation of 15NM or more, the controller shall:

- Immediately advise the pilot in command; and
- Provide the 'Duty Supervisor' with the necessary information to enable Part 1 of the Navigation Error Investigation Form (as shown in **Appendix A**) to be completed.

Where an aircraft is off-track as the result of ATC approved diversion (e.g. due weather), no notification under the terms of this Letter of Agreement need be submitted.

Longitudinal Deviations

Monitoring of longitudinal errors shall be accomplished by reporting occurrences where the observed longitudinal separation, following a check, is either less or more than the expected longitudinal separation as detailed in the table below.

<u>Category of Error</u>	<u>Criterion for Reporting</u>
<u>Aircraft-pair (Time-based separation applied)</u>	<u>Infringement of longitudinal separation standard based on routine position reports</u>
<u>Aircraft-pair (Time-based separation applied)</u>	<u>Expected time between two aircraft varies by 3 minutes or more based on routine position reports</u>
<u>Individual-aircraft (Time-based separation applied)</u>	<u>Pilot estimate varies by 3 minutes or more from that advised in a routine position report</u>
<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report</u>
<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report</u>

~~Where a time standard is being used, this check will follow the receipt of a routine position report.~~ Notification, in accordance with **Appendix A**, shall be submitted in all cases of error where:

- ~~The separation standard is infringed; or~~

-
- ~~The expected time between two aircraft varies by 3 minutes or more, even if the applicable separation standard is not infringed; or~~
 - ~~A pilot estimate varies by 3 minutes or more from that advised in a routine position report.~~

~~Where a distance standard is being used, the check may be based on ADS, radar observations, or it may be the result of a specific request for RNAV distance reports. Notification, in accordance with **Appendix A**, shall be submitted in all cases where:~~

- ~~The separation standard is infringed; or~~
 - ~~The expected distance between two aircraft varies by 10NM or more, even if the applicable separation standard is not infringed.~~
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Operational Letter of Agreement

Notification Procedures

Action by ATC Unit

The duty supervisor, when advised of the deviation, shall be responsible for completion and submission of a Navigation Error Investigation Form (as provided in **Appendix A**).

A copy of the aircraft's flight plan shall be attached to the Navigation Error Investigation Form, and forwarded to the Chief of ATC.

The Chief of ATC shall forward copies of the Navigation Error Investigation Form (Parts 1 to 4) to the aircraft operator and the State of Registry of the aircraft or the State of the Operator, as considered appropriate.

In addition, the copy for the aircraft operator shall be sent with a covering letter (as provided in **Appendix BA**) requiring the operator to complete the Navigation Error Investigation Form and to provide reasons for the error.

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Operational Letter of Agreement

Investigation Procedures

The investigation of errors notifiable under this Letter of Agreement is a joint responsibility of the operator, the Regulatory Authority of the airspace in which the error occurred, and the State of Registry or State of the Operator of the aircraft involved.

The initial investigation shall be undertaken by the aircraft operator, who is responsible for supplying all data and comments needed to complete the form at **Appendix A**. The completed ~~reports-forms~~ are to be returned by the operator to the originating Regulatory Authority. For aircraft registered in States not included in this LOA, these ~~reports-forms~~ are also to be forwarded to the State of Registry of the aircraft or the State of the operator.

Further action by States other than signatories to this LOA is outside the scope of this agreement, and shall be at the discretion of that State.

On receipt of the completed ~~report-forms~~ from the aircraft operator, the relevant Regulatory Authority will first check that all information required has been supplied and, if necessary, the Regulatory Authority shall request ~~and-for~~ further information from either the operator, the State of the Operator, or the State of Registry of the aircraft.

If the completed form from the aircraft operator is not received within 14 days of the date of dispatch, the Regulatory Authority will contact the operator and request ~~for~~ the completed form.

Once the completed ~~information-form~~ has been received, the Regulatory Authority will complete Part 5 of the Navigation Error Investigation Form as detailed in **Appendix A**. The cause of the error is to be classified in accordance with the criteria specified in Part 5.

The decision as to whether any further investigation is warranted will be taken by the Regulatory Authority based on their assessment of the seriousness of the error.

Operational Letter of Agreement

Analysis of Errors & Reporting

At the end of each month, Service Providers shall forward to ~~the Aviation Safety Directorate, Airports Authority of India (AAI), BOBASMA~~ the Summary of Navigation Error Reports (provided in **Appendix C**) including 'NIL' returns together with a copy of all completed Navigation Error Investigation Forms Parts 1 to 5 (provided in **Appendix A**) covering reported errors for that month and

For States with designated monitoring areas as stipulated in the Procedures for the Assessment of Aircraft Navigation Errors, **Appendix D**, shall in addition to the above, also provide data on the number of movements on the routes being monitored as recorded by the relevant Flight Data Processing System, or other auditable means.

~~A summary of Navigation Error received including 'NIL' returns together with a copy of all completed Navigation Error Investigation Forms (Parts 1 to 5) covering reported errors or nil reports for that month and~~

~~a. , together with dData on the number of movements on the routes being monitored as recorded by the relevant Flight Data Processing System, or other auditable means.~~

~~BOBASMA AAI~~ shall be responsible for calculation of the frequency of the errors, in accordance with Doc 7030.

~~Each six months, the Monitoring Authority BOBASMA AAI~~ should prepare an assessment schedule setting out the results of the monitoring for the preceding ~~twelve~~six-month period and forward a copy of this schedule to:

~~a. All signatory States to the Monitoring Letter of Agreement;~~

~~And~~

a. The Chairman of the APANPIRG ATM/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

b. The Chairman of RASMAG through the ICAO Bangkok Office

Permitted Error Rate Exceeded

Where the summary statistics show a long term trend which could

result in the Permitted Error Rate being exceeded, ATC Authorities of the States concerned, in conjunction with the ICAO Regional Office, will jointly consider the causes, to determine if the problems can be eliminated, and to take appropriate remedial action.

Revision

This LOA shall remain in force until it is cancelled or superseded.

For any reason, which might make it advisable to change this agreement and its associated attachments, the interested State shall propose the pertinent revision.

Operational Letter of Agreement

Authority

India	Name Designation Department
Indonesia	Name Designation Department
Oman	Name Designation Department
Pakistan	Name Designation Department
Malaysia	Name Designation Department

Maldives	Name Designation Department
Myanmar	Name Designation Department
Seychelles	Name Designation Department

Operational Letter of Agreement

Authority, continued

Singapore	Name Designation Department
Sri Lanka	Name Designation Department
Thailand	Name Designation Department

Operational Letter of Agreement

APPENDIX A

NAVIGATION ERROR REPORT

Dear [Aircraft Operator]

~~Air Traffic Control service providers are monitoring traffic on routes in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace, as part of the implementation of reduced separation minima on those routes.~~

~~These procedures require the reporting and investigation of:~~

~~Lateral tracking errors of 15NM or more;~~

~~Variations of longitudinal separation of three minutes or more; or~~

~~Variations of longitudinal separation of 10NM or more.~~

~~(does the 3 points above covers all the new categories?)~~

~~A Navigation Error Investigation Form relating to one of your aircraft is enclosed.~~

~~An investigation of this occurrence is required. A detailed explanation should be provided within 10 days, using the attached Navigation Error Investigation Form. In your reply, you are also requested to indicate any corrective action taken to prevent future occurrences.~~

~~Yours faithfully,~~

~~[Regulatory Authority]~~

[NAME OF MONITORING AGENCY]

Report of Large Lateral Deviation or Large Longitudinal Error

Report to the **[Name of EMA]** of a large lateral deviation (LLD) or a large longitudinal error (LLE), as defined below:

***Note: Do not include ATC-approved deviation due to weather or other contingency events.**

<u>Type of Error</u>	<u>Category of Error</u>	<u>Criterion for Reporting</u>
<u>Lateral deviation</u>	<u>Individual aircraft error</u>	<u>15NM or greater magnitude</u>
<u>Longitudinal deviation</u>	<u>Aircraft pair (Time-based separation applied)</u>	<u>Infringement of longitudinal separation standard based on routine position reports</u>
<u>Longitudinal deviation</u>	<u>Aircraft pair (Time-based separation applied)</u>	<u>Expected time between two aircraft varies by 3 minutes or more based on routine position reports</u>
<u>Longitudinal deviation</u>	<u>Individual aircraft (Time-based separation applied)</u>	<u>Pilot estimate varies by 3 minutes or more from that advised in a routine position report</u>
<u>Longitudinal deviation</u>	<u>Aircraft pair (Distance-based separation applied)</u>	<u>Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report</u>
<u>Longitudinal deviation</u>	<u>Aircraft pair (Distance-based separation applied)</u>	<u>Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report</u>

Appendix A

Name of ATC unit:

Please complete Section I or II as appropriate

SECTION I:

There were no reports of LLDs or LLEs for the month of

SECTION II:

There was/were [number] report(s) of LLD for the month of [MONTH]

There was/were [number] report(s) of LLE for the month of [MONTH]

Details of the LLDs and LLEs are attached.

(Please use a separate form for each report of lateral deviation or longitudinal error).

SECTION III:

When complete, please return to the following email (preferably), fax or mailing address:

Email: [Email of EMAbobasma@aai.aero]

Fax: [Fax of EMA +91 11 24610776]

[Address of EMA]

THE EXECUTIVE DIRECTOR
AIRPORTS AUTHORITY OF INDIA
RAJIV GANDHI BHAWAN,
NEW DELHI -110003
INDIA

Instructions for Service Provider responsible officer:

Please ensure that Part 1 of this form has been completed to the maximum extent possible, and distribute according to the requirements of the Letter of Agreement on monitoring of aircraft navigation errors in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace

Instructions for aircraft owner/operator:

Please supply any details required in Part 1 of this form which have not already been completed, together with the information requested in Parts 2, 3 and 4 (if applicable), and return to:

[Appropriate Regulatory Authority]

Instructions for Investigating Agency (Regulatory Authority):

Please complete Part 5 of this form and return to:

[Appropriate Service Provider]

NAVIGATION ERROR INVESTIGATION FORM

PART 1 - To be completed by responsible officer in the Service Provider (and aircraft owner/operator if need)		
ATC Unit Observing Error:		
Date/Time (UTC):		
Duration of Deviation:		
Type of Error: (tick one) <input type="checkbox"/> LATERAL <input type="checkbox"/> LONGITUDINAL		
Details of Aircraft		
	First Aircraft	Second Aircraft (when longitudinal deviation observed)
Aircraft Identification:		
Name of owner/Operator:		
Aircraft Type:		
Departure Point:		
Destination:		
Route Segment:		
Cleared Track:		
Position where error was observed: (BRG/DIST from fixed point or LAT/LONG)		
Extent of deviation – magnitude and direction: (NM for lateral, min/NM for longitudinal)		
Flight Level:		
Approximated Duration of Deviation (minutes)		
For All Errors		
Action taken by ATC:		
Crew Comments when notified of Deviation:		
Other Comments:		

**** (Please Attach ATS Flight Plan)**

NAVIGATION ERROR INVESTIGATION FORM

PART 2 - Details of Aircraft, and Navigation and Communications Equipment Fit (To be completed by aircraft owner/operator)			
LRNS	Number of Systems (0, 1, 2 etc.)	Make	Model
INS			
IRS			
GNSS			
FMS			
Others (please Specify)			
COMS			
HF			
VHF			
SATCOM			
CPDLC			
Which navigation system was coupled to the autopilot at the time of observation of the error?			
Which Navigation Mode was selected at the time of observation of the error?			
Which Communication System was in use at the time of observation of the error?			
Aircraft registration			
Aircraft model/series			
Was the aircraft operating according to PBN requirements?		<input type="checkbox"/> Yes	<input type="checkbox"/> No

NAVIGATION ERROR INVESTIGATION FORM

PART 3 Detailed description of incident (To be completed by owner/operator – use separate sheet if required)
Please give your assessment of the actual track flown by the aircraft, and the cause of the deviation:
Corrective action proposed:

PART 4 To be completed by owner/operator, only in the event of partial or total navigation equipment failure.			
Navigation System Type	INS	IRS/FMS	Others (Please specify)
Indicate the number of units of each type which failed			
Indicate position at which failure(s) occurred			
Give an estimate of the duration of the equipment failure(s)			
At what time were ATC advised of the failure(s)?			

NAVIGATION ERROR INVESTIGATION FORM

PART 5 <u>To be completed by investigating agency</u>		
<u>Have all required data been supplied?</u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<u>Is further investigation warranted?</u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<u>Will this incident be the subject of a separate report?</u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<u>Description of Error:</u>		
Classification: (please tick) <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> I		
<u>CLASSIFICATION OF NAVIGATION ERRORS</u>		
Cause of Deviation		
<u>Operational Errors</u>		
<u>A</u>	<u>Flight crew deviate without ATC Clearance;</u>	
<u>B</u>	<u>Flight crew incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.);</u>	
<u>C</u>	<u>Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position;</u>	
<u>D</u>	<u>ATC system loop error (e.g. ATC issues incorrect clearance, Flight crew misunderstands clearance message etc);</u>	
<u>E</u>	<u>Coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility;</u>	
<u>Deviation due to navigational errors</u>		
<u>F</u>	<u>Navigation errors, including equipment failure of which notification was not received by ATC or notified too late for action;</u>	
<u>Deviation due to Meteorological Condition</u>		
<u>G</u>	<u>Turbulence or other weather related causes (other than approved);</u>	
<u>Others</u>		
<u>H</u>	<u>An aircraft without PBN approval;</u>	
<u>I</u>	<u>Others (Please specify)</u>	

PART 5 — To be completed by investigating agency		
Have all required data been supplied?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is further investigation warranted?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Will this incident be the subject of a separate report?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Description of Error:		
Classification: (please tick) — <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> H <input type="checkbox"/> I		
CLASSIFICATION OF NAVIGATION ERRORS		
Cause of Deviation		
Operational Errors		
Flight crew deviate without ATC Clearance;		
Flight crew incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.);		
Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position;		
ATC system loop error (e.g. ATC issues incorrect clearance, Flight crew misunderstands clearance message etc);		
Coordination errors in the ATC-unit to-ATC-unit transfer of control responsibility;		
Deviation due to navigational errors		
Navigation errors, including equipment failure of which notification was not received by ATC or notified too late for action;		
Deviation due to Meteorological Condition		
Turbulence or other weather related causes (other than approved);		
Others		
An aircraft without PBN approval;		
Others (Please specify)		

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Procedures for the Assessment of Aircraft Navigation Errors In Support of the Implementation of
Reduced Horizontal Separation Minima in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace
Template for Covering Letter to Aircraft Operator

Template for Covering Letter to Aircraft Operator

Dear [Aircraft Operator]

Air Traffic Control service providers are monitoring traffic on RNAV routes in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace, as part of the implementation of reduced separation minima on those routes.

These procedures require the reporting and investigation of:

<u>Type of Error</u>	<u>Category of Error</u>	<u>Criterion for Reporting</u>
<u>Lateral deviation</u>	<u>Individual-aircraft error</u>	<u>15NM or greater magnitude</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Time-based separation applied)</u>	<u>Infringement of longitudinal separation standard based on routine position reports</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Time-based separation applied)</u>	<u>Expected time between two aircraft varies by 3 minutes or more based on routine position reports</u>
<u>Longitudinal deviation</u>	<u>Individual-aircraft (Time-based separation applied)</u>	<u>Pilot estimate varies by 3 minutes or more from that advised in a routine position report</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report</u>

A Navigation Error Investigation Form relating to one of your aircraft is enclosed.

An investigation of this occurrence is required. A detailed explanation should be provided within 10 days, using the attached Navigation Error Investigation Form. In your reply, you are also requested to indicate any corrective action taken to prevent future occurrences.

Yours faithfully,

[Regulatory Authority]

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SUMMARY OF NAVIGATION ERROR REPORT**[NAME OF MONITORING AGENCY]**Report of Large Lateral Deviation or Large Longitudinal ErrorReport to the [BOBASMA] of a large lateral deviation (LLD) or a large longitudinal error (LLE), as defined below:*Note: Do not include ATC-approved deviation due to weather or other contingency events.

<u>Type of Error</u>	<u>Category of Error</u>	<u>Criterion for Reporting</u>
<u>Lateral deviation</u>	<u>Individual-aircraft error</u>	<u>15NM or greater magnitude</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Time-based separation applied)</u>	<u>Infringement of longitudinal separation standard based on routine position reports</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Time-based separation applied)</u>	<u>Expected time between two aircraft varies by 3 minutes or more based on routine position reports</u>
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<u>Longitudinal deviation</u>	<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report</u>
<u>Longitudinal deviation</u>	<u>Aircraft-pair (Distance-based separation applied)</u>	<u>Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report</u>

Name of ATC unit:Please complete Section I or II as appropriate**SECTION I:**There were **no** reports of LLDs or LLEs for the month of [MONTH]

SECTION II:

There was/were [number] report(s) of LLD for the month of [MONTH]

There was/were [number] report(s) of LLE for the month of [MONTH]

Details of the LLDs and LLEs are attached.

(Please use a separate form for each report of lateral deviation or longitudinal error).

SECTION III:

When complete, please return to the following email (preferably), fax or mailing address:

Email : [bobasma@aai.aero]

Fax: [Fax of EMA +91 11 24610776]

[Address of EMA]

THE EXECUTIVE DIRECTOR (AIR TRAFFIC MANAGEMENT)
AIRPORTS AUTHORITY OF INDIA
RAJIV GANDHI BHAWAN,
NEW DELHI -110003
INDIA

**Procedures for the Assessment of Aircraft Navigation Errors
In Support of the Implementation of
Reduced Horizontal Separation Minima
In the Bay of Bengal, Arabian Sea and Indian Ocean Airspace**

1. Introduction

1.1 This document provides guidance on the methodology to be adopted in the assessment of navigation errors associated with the implementation of reduced horizontal separation minima in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace.

~~1.2 This document should be read in conjunction with the Letter of Agreement between States of the Bay of Bengal, Arabian Sea and Indian Ocean Airspace, entitled "Letter of Agreement for the Monitoring of Aircraft Navigation Errors in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace".~~

2. Data Gathering Responsibility

~~2.1 The States responsible for the gathering and onwards forwarding of data to [BOBASMA] for the designated monitoring areas identified in paragraph 3, shall be~~

- ~~a) Indonesia relating to the monitoring letter of agreement, and the monitoring areas identified in paragraph 4, shall be Malaysia,~~
- ~~b) Indonesia, Malaysia,~~
- ~~c) Maldives, Singapore, Oman,~~
- ~~d) Myanmar, Sri Lanka,~~
- ~~e) Oman, Thailand,~~
- ~~f) Pakistan, Maldives,~~
- ~~g) Seychelles, Myanmar,~~
- ~~h) Seychelles, Sri Lanka, and~~
- ~~i) Thailand, Pakistan.~~

2.2 Data gathering requirements are detailed in paragraph 45.

~~3. Enroute Monitoring Authority Agency~~

~~3.1 Airports Authority of India (AAI) shall be responsible for the collection and reporting of navigation error.~~

4.3. Designated Monitoring Areas

~~4.3.1~~ In order to validate the monitoring requirements supporting the reduction in horizontal separation minima, it is necessary to assess the track keeping ability of aircraft operating on the route structure, whilst they have been using

on-board RNAV navigation systems only, for a maximum period of time, relative to the route being flown.

4.23.2 It is also essential that observation of the navigation of the aircraft, using radar, occurs before the on-board navigation systems have been able to “update” using ground-based navigation aids, such as DME/DME, or VOR/VOR.

4.33.3 In assessing navigation errors on the routes—

~~Phase 1, 2 & 3 are to be finalized by FIT-BOB.~~

Phase 1*

N571, P628 & P762

Phase 2*

L301, L510, L759, M300, M770, N563, N877, P570 & P574

Phase 3*

~~All other RNP 10 routes over Bay of Bengal, Arabian Sea and Indian Ocean.~~

*Phase 1, 2 & 3 are to be finalized by FIT-BOB.

4.4 There are twenty appropriate areas at which the required monitoring may be undertaken based on, the extensive ground-based navigation aid coverage in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace in two phases as mentioned below are specified as follows:

4.1 These areas are the route segments for

***Phase 1 – Monitoring commences on 1 July 2010**

<u>Route</u>	<u>Segment</u>	<u>FIRs Involved</u>
N571	IDASO & VAMPI	CHENNAI, KUALALUMPUR
	SUGID & PARAR	MUMBAI, MUSCAT
P628	URKOK LARIK & VATLA	KOLKATA, CHENNAI,
P762	ESPAP & BKK	COLOMBO, BANGKOK

<u>Route</u>	<u>Segment</u>	<u>FIRs Involved</u>	<u>ACCs involved[#]</u>
N571	IDASO & VAMPI	CHENNAI, KUALALUMPUR	CHENNAI
	SUGID & PARAR	MUMBAI, MUSCAT	MUMBAI
P628	LARIK & VATLA	CHENNAI, KOLKATA	CHENNAI, KOLKATA
P762	ESPAP & BKK	COLOMBO, CHENNAI, YANGOON	CHENNAI
	DUGOS & LULDA	CHENNAI	CHENNAI

Procedures for the Assessment of Aircraft Navigation Errors, ~~In Support of the Implementation of Reduced Horizontal Separation Minima in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace~~

*Phase 2 – Monitoring commence TDB

<u>Route</u>	<u>Segment</u>	<u>FIRs Involved</u>	<u>ACCs involved[#]</u>
<u>L301</u>	<u>AKTIV & RASKI</u>	<u>MUMBAI, MUSCAT</u>	<u>MUMBAI</u>
	<u>LARIK & BKK</u>	<u>KOLKATA, BANGKOK</u>	<u>KOLKATA</u>
<u>L510</u>	<u>GIVAL & DOGEM</u>	<u>KUALALUMPUR, KOLKATA</u>	<u>KOLKATA</u>
<u>L759</u>	<u>TAVUN & LEMEX</u>	<u>BANGKOK, KOLKATA</u>	<u>KOLKATA</u>
<u>M300</u>	<u>ESPAP & BULVA</u>	<u>COLOMBO, JAKARTA</u>	
	<u>IGAMA & LOTAV</u>	<u>CHENNAI, MUSCAT</u>	<u>MANGALORE</u>
<u>M770</u>	<u>PADET & BUBKO</u>	<u>BANGKOK, KOLKATA</u>	<u>KOLKATA</u>
<u>N563</u>	<u>MEMAK & AKMIL</u>	<u>JAKARTA, CHENNAI</u>	<u>CHENNAI</u>
	<u>KAKIB & REXOD</u>	<u>CHENNAI, MUSCAT</u>	<u>MANGALORE</u>
<u>N877</u>	<u>ORARA & RIBRO</u>	<u>KOLKATA, MUMBAI</u>	<u>NAGPUR, KOLKATA</u>
<u>P570</u>	<u>MABIX & TEBIT</u>	<u>JAKARTA, COLOMBO</u>	
	<u>POMAN & KITAL</u>	<u>CHENNAI, MUSCAT</u>	<u>MANGALORE</u>
<u>P574</u>	<u>ANSAX & GIRNA</u>	<u>JAKARTA, CHENNAI</u>	<u>CHENNAI</u>
	<u>TOTOX & BISET</u>	<u>MUSCAT, MUMBAI</u>	<u>MUMBAI</u>

<u>Route</u>	<u>Segment</u>	<u>FIRs Involved</u>
<u>L301</u>	<u>NOBAT AKTIV & RASKI</u>	<u>MUMBAI, MUSCAT</u>
	<u>LARIK & BKK</u>	<u>KOLKATA, BANGKOK</u>
<u>L510</u>	<u>GIVAL & DOGEM</u>	<u>KUALALUMPUR, KOLKATA</u>
<u>L759</u>	<u>TAVUN & LEMEX</u>	<u>BANGKOK, KOLKATA</u>
<u>M300</u>	<u>ESPAP & BULVA</u>	<u>COLOMBO, JAKARTA</u>
	<u>IGAMA & LOTAV</u>	<u>CHENNAI, MUSCAT</u>
<u>M770</u>	<u>PADET & BUBKO</u>	<u>BANGKOK, KOLKATA</u>
<u>N563</u>	<u>MEMAK & AKMIL</u>	<u>JAKARTA, CHENNAI</u>
	<u>OPIRA KAKIB & REXOD</u>	<u>CHENNAI, MUSCAT</u>
<u>N877</u>	<u>ORARA & RIBRO</u>	<u>KOLKATA, MUMBAI</u>
<u>P570</u>	<u>MABIX & TEBIT</u>	<u>JAKARTA, COLOMBO</u>
	<u>POMAN & KITAL</u>	<u>CHENNAI, MUSCAT</u>

P574	ANSAX & GIRNA	JAKARTA, CHENNAI
	TOTOX & BISET	MUSCAT, MUMBAI

***Phase 3 – Monitoring commence TDB**

Route	Segment	FIRs Involved	ACCs involved [#]
TBD	TBD		

* Phase 1, 2 & 3 are to be finalized by FIT-BOB.

Respective States shall include concerned ACCs before issuing the amended LOA to all the States for their signature.

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4.53.4 Monitoring of aircraft on these route segments should be undertaken as soon as possible after the aircraft enters radar coverage.

4.63.5 It should be noted that navigation error reports relating to areas other than those stated above, should also be processed and reported on, in order to support data gathering for future reductions in lateral and longitudinal separation. Details on the processing of these reports are given at paragraph 67.

45. Collection and Forwarding of Data

5.14.1 Those States identified in Paragraph 2, are required, at the end of each month, to collect the following data:

- a) Recorded navigation errors at the required monitoring areas, by way of the "Navigation Error Investigation Form", as detailed in Appendix A of the Letter of Agreement for the Monitoring of Aircraft Navigation Errors in the Bay of Bengal, Arabian Sea and Indian Ocean airspace; and
- b) Total monthly movement statistics relating to air traffic passing the designated monitoring areas within the designated monitoring height band.

Note: The recording of monthly traffic movement statistics in the monitoring areas should be auditable – in other words, some formal method of recording the movements – eg copies of flight progress strips or data from Flight Data Processing Systems – should be available for audit if required.

5.24.2 After collection, the required data should be forwarded to the Monitoring Authority (AAI) [BOBASMA], for assessment, to arrive not later than 15 days from the end of the month within which the data was collected. This will allow time for the Navigation Error Investigation Forms relating to occurrences near the end of a month, to be processed and returned as detailed in that form.

5.34.3 In respect of paragraph 45.1.a), if there have been no error report receiveds submitted, a "Nil Return" should be submitted to the [BOBASMA] Monitoring Authority. Using the form in Appendix C.

56. Assessing of Navigation Errors

6.15.1 The monitoring requirements associated with the introduction of the reduced horizontal separation minima will be in accordance with the requirements for RNP10 / (RNP4-PBN PBN), i.e. aircraft navigation performance shall be such that the standard deviation of lateral track errors shall be in accordance with the PBN requirement.

~~6.25.2~~ The requirements will be met, if the number of navigation errors by approved flights, measured in the monitoring area, divided by the total number of approved flights over those monitoring points, is less than the required parameters, over a period of time for the PBN requirement. (See **Attachment Appendix B**).

~~6.35.3~~ The assessments for each month should be recorded separately, and also cumulatively, on a month-to-month basis. If the assessment in any particular month exceeds the required parameter, a check should be made to ensure that the cumulative assessment does not also exceed the required parameter.

~~6.45.4~~ If a trend is identified, which indicates that the required parameter is being exceeded regularly, or the cumulative assessment indicates an upwards trend, the ~~Enroute Monitoring Authority Agency~~ [BOBASMA] should notify, through the ICAO Bangkok Office, the APANPIRG ATM/AIS/SAR Sub-Group and RASMAG, which should then investigate the need for a review of the applicable procedures.

~~6.55.5~~ An example of an assessment schedule is shown at **Appendix Attachment B**.

67. Processing of Navigation Error Reports Relating to Areas Other Than Required Monitoring Areas

~~7.16.1~~ All participating States to this LOA shall notify all appropriate navigation errors to [BOBASMA]. This data should be collated and assessed in the following manner. ~~The Letter of Agreement on the Monitoring of Navigation Errors required all participating States to notify all appropriate navigation errors to the Enroute Monitoring Authority Agency. This data should be collated and assessed in the following manner.~~

~~7.26.2~~ If the navigation error report relates to aircraft tracking on RNAV routes L301, L510, L759, M300, M770, N563, N571, N877, P570, P574, P628 and P762 subsequently for RNP10 routes to be implemented in Phase 3, as specified in para 3.3 the error should be assessed and processed in accordance with paragraph 56 above.

~~7.36.3~~ If the report relates to aircraft tracking on other routes, the errors should be assessed, and recorded separately. This information should be assessed by the APANPIRG ATM/AIS/SAR Sub-Group meeting and RASMAG, for appropriate action.

87. Reporting Procedures

~~8.17.1~~ The ~~Enroute Monitoring Authority Agency~~ [BOBASMA] should prepare an assessment schedule (refer to **Appendix Attachment B**), and forward a copy of this schedule, at least every 126 months, to:

- a) ~~All signatory States to the Monitoring Letter of Agreement; and~~

- a) The Chairman of the APANPIRG ATM/AIS/SAR Sub-Group, through the ICAO Bangkok Office, and-
- b) The Chairman of RASMAG through the ICAO Bangkok Office

8-27.2 In addition, a report should be prepared on those errors reported in accordance with paragraph 67.3 above.

98. Attachments to Appendix D

Appendix Attachment A – Assessment Schedule Process

Appendix Attachment B – Sample Assessment Schedule

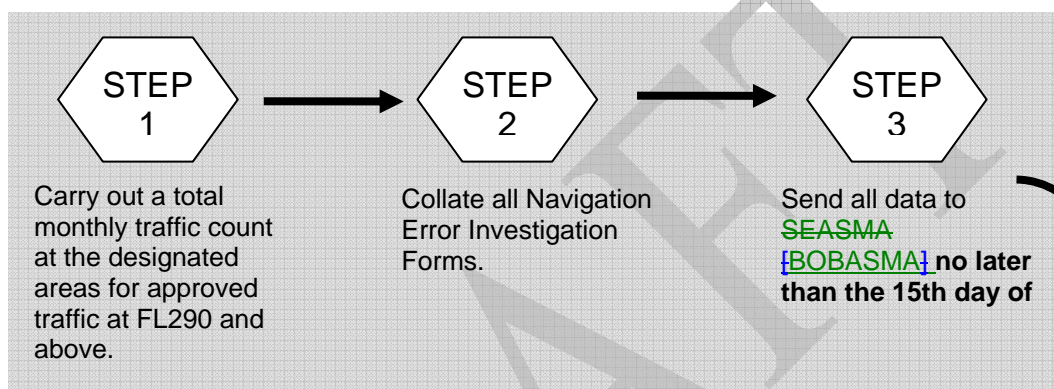
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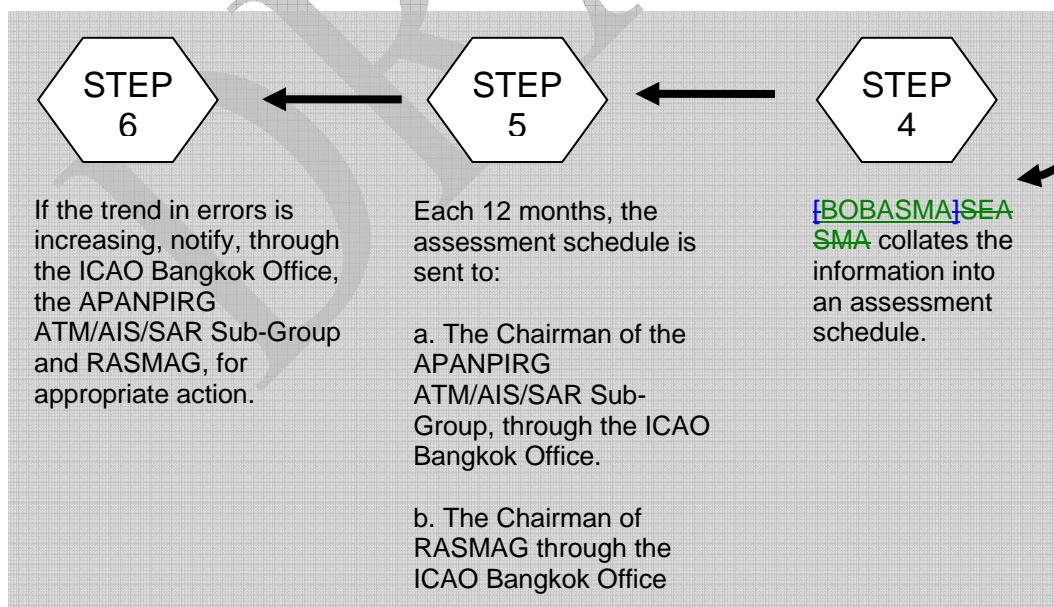
Attachment A

Assessment Schedule Process for Designated Monitoring Areas

ACTIONS BY: INDONESIA
MALAYSIA
MALDIVES
MYANMAR
OMAN
PAKISTAN
SEYCHELLES
SRI LANKA
THAILAND
HONG KONG



ACTIONS BY:



STEP 1.

Malaysia, Indonesia, Singapore, Oman, Sri Lanka, Thailand, Maldives, Myanmar, Seychelles and Pakistan carry out a total monthly traffic count for approved traffic at FL290 and above, over the following route segments points:

4.7 These areas are the route segments for

Phase 1 – Commences on 1 July 2010

Route	Segment	FIRs Involved
N574	IDASO & VAMPI	CHENNAI, KUALALUMPUR
	SUGID & PARAR	MUMBAI, MUSCAT
P628	LARIK & VATLA	CHENNAI, KOLKATA
P762	ESPAP & BKK	COLOMBO, CHENNAI, YANGOON

Phase 2 – Commencement TDB

Route	Segment	FIRs Involved
L304	AKTIV & RASKI	MUMBAI, MUSCAT
	LARIK & BKK	KOLKATA, BANGKOK
L510	GIVAL & DOGEMAOGEM	KUALALUMPUR, KOLKATA
L759	TAVUN & LEMEX	BANGKOK, KOLKATA
M300	ESPAP & BULVA	COLOMBO, JAKARTA
	IGAMA & LOTAV	CHENNAI, MUSCAT
M770	PADET & BUBKO	BANGKOK, KOLKATA
N563	MEMAK & AKMIL	JAKARTA, CHENNAI
	KAKIB & REXOD	CHENNAI, MUSCAT
N877	ORARA & RIBRO	KOLKATA, MUMBAI
P570	MABIX & TEBIT	JAKARTA, COLOMBO
	POMAN & KITAL	CHENNAI, MUSCAT
P574	ANSAX & GIRNA	JAKARTA, CHENNAI
	TOTOX & BISET	MUSCAT, MUMBAI

Phase 3 – Commencement TDB

Route	Segment	FIRs Involved
TBD	TBD	FIR

STEP 2.

Malaysia, Indonesia, Singapore, Oman, Sri Lanka, Thailand, Maldives, Myanmar, Seychelles and Pakistan collate all Navigation Error Investigation Forms.

STEP 3.

Not later than the 15th day of each month, send the statistics gathered in Steps 1 and 2, to the Enroute Monitoring Authority Agency (AAI).

STEP 4.

The Enroute Monitoring Agency Authority(AAI) collates the information into an assessment schedule.

STEP 5.

Each 126 months, the assessment schedule is sent to:

The Chairman of the APANPIRG ATM/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

The Chairman of RASMAG through the ICAO Bangkok Office

- a) All signatory States to the Monitoring Letter of Agreement; and
- b) The Chairman of the APANPIRG ATM/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

STEP 6 (if required).

If the trend in errors is increasing, notify, through the ICAO Bangkok Office, the APANPIRG ATM/AIS/SAR Sub-Group and RASMAG, for appropriate action.

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Attachment B

Example of Navigation Error Assessment Schedule For Designated Monitoring Areas

a. Example of Monthly Total – Single RNP 10 route

<u>Month/ 2009</u>	<u>Total traffic at (Relevant waypoint) (Ex. IDASO)</u>	<u>Errors Category 1 (LLD)</u>	<u>Errors Category 2 (LLD)</u>	<u>Errors Category 3 (LLE)[#]</u>	<u>Errors Category 4 (LLE)[*]</u>
April	3105	1	0		
May	3042	2	0		
June	2810	0	0		
July	2995	1	1		

Category 1 = >15NM Category 3 = Estimate varies by 3 mins or more

Category 2 = 25 – 35NM Category 4 = Distance varies by 10 Nm or more

[#] - Category 3 to be recorded for the entry and exit waypoints of RNP 10 routes over Oceanic airspace applicable to the ACCs in the respective States.

^{*} - Category 4 to be recorded if the 80 Nm RNAV distance based separation is in force.

b. Example of Cumulative Monthly Total – Single RNP 10 route

<u>Month/ 2009</u>	<u>Total traffic at (Relevant waypoint) (Ex. IDASO)</u>	<u>Errors Category 1 (LLD)</u>	<u>Errors Category 2 (LLD)</u>	<u>Errors Category 3 (LLE)[#]</u>	<u>Errors Category 4 (LLE)[*]</u>
April	3105	1	0		
May	6147	3	0		
June	8957	3	0		
July	11952	4	1		

Category 1 = >15NM Category 3 = Estimate varies by 3 mins or more

Category 2 = 25 – 35NM Category 4 = Distance varies by 10 Nm or more

[#] - Category 3 to be recorded for the entry and exit waypoints of RNP 10 routes over Oceanic airspace applicable to the ACCs in the respective States.

^{*} - Category 4 to be recorded if the 80 Nm RNAV distance based separation is in force.

c. Example of Monthly Total – All RNP 10 routes within ACC

<u>Month/ 2009</u>	<u>Total traffic at (Relevant ACCs) Ex. Chennai ACC</u>	<u>Errors Category 1 (LLD)</u>	<u>Errors Category 2 (LLD)</u>	<u>Errors Category 3 (LLE)[#]</u>	<u>Errors Category 4 (LLE)[*]</u>
April	7852	2	0		
May	8311	2	0		
June	8263	1	0		
July	7678	1	1		

Category 1 = >15NM Category 3 = Estimate varies by 3 mins or more

Category 2 = 25 – 35NM Category 4 = Distance varies by 10 Nm or more

[#] - Category 3 to be recorded for the entry and exit waypoints of RNP 10 routes over Oceanic airspace applicable to the ACCs in the respective States.

^{*} - Category 4 to be recorded if the 80 Nm RNAV distance based separation is in force.

d. Example of Cumulative Monthly Total – All RNP 10 routes within ACC

<u>Month/ 2009</u>	<u>Total traffic at (Relevant ACCs) Ex. Chennai ACC</u>	<u>Errors Category 1 (LLD)</u>	<u>Errors Category 2 (LLD)</u>	<u>Errors Category 3 (LLE)[#]</u>	<u>Errors Category 4 (LLE)[*]</u>
April	7852	2	0		
May	16163	4	0		
June	24426	5	0		
July	32104	6	1		

Category 1 = >15NM Category 3 = Estimate varies by 3 mins or more

Category 2 = 25 – 35NM Category 4 = Distance varies by 10 Nm or more

[#] - Category 3 to be recorded for the entry and exit waypoints of RNP 10 routes over Oceanic airspace applicable to the ACCs in the respective States.

* - Category 4 to be recorded if the 80 Nm RNAV distance based separation is in force.

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a. ~~Example of Monthly Total Single Area~~

Month/ 2009	Total traffic at IDASO	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	3105	1	0	3.22×10^{-4}	0
May	3042	2	0	6.57×10^{-4}	0
June	2810	0	0	0	0
July	2995	1	1	3.34×10^{-4}	3.34×10^{-4}

~~Category 1 => 30NM 15NM~~ ~~Category 2 = 50 25 70NM 35NM~~

b. ~~Example of Cumulative Monthly Total Single Area~~

Month/ 2009	Total traffic at IGAMA	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	3105	1	0	3.22×10^{-4}	0
May	6147	3	0	4.88×10^{-4}	0
June	8957	3	0	3.35×10^{-4}	0
July	11952	4	1	3.34×10^{-4}	8.36×10^{-3}

~~Category 1 => 15NM~~ ~~Category 2 = 25 35NM~~

~~Category 1 => 30NM~~ ~~Category 2 = 50 70NM~~

c. ~~Example of Monthly Total All Six Areas~~

Month/ 2009	Total traffic at Areas	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	7852	2	0	2.55×10^{-4}	0
May	8311	2	0	2.41×10^{-4}	0
June	8263	1	0	1.21×10^{-4}	0
July	7678	1	1	1.30×10^{-4}	1.30×10^{-4}

~~Category 1 => 15NM~~ ~~Category 2 = 25 35NM~~

~~Category 1 => 30NM~~ ~~Category 2 = 50 70NM~~

d. ~~Example of Cumulative Monthly Total All Six Areas~~

Month/ 2009	Total traffic at Areas	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	7852	2	0	2.55×10^{-4}	0
May	16163	4	0	2.47×10^{-4}	0
June	24426	5	0	2.05×10^{-4}	0
July	32104	6	1	1.87×10^{-4}	3.11×10^{-3}

~~Category 1 => 15NM~~ ~~Category 2 = 25 35NM~~

~~Category 1 => 30NM~~ ~~Category 2 = 50 70NM~~