International Civil Aviation Organization

The Twentieth Meeting of the APANPIRG ATM/AIS/SAR Sub-Group (ATM/AIS/SAR/SG/20)

Singapore, 05 – 09 July 2010

Agenda Item 6: Review of ATS coordination group meetings

SUMMARY REPORT OF THE FIRST THREE MEETINGS OF THE BAY OF BENGAL REDUCED HORIZONTAL SEPARATION TASK FORCE

(Presented by the Secretariat)

SUMMARY

This Working Paper presents a summary report of meetings 1, 2, and 3 of the Bay of Bengal Reduced Longitudinal Separation Task Force. A further meeting of the task force is being planned in October 2010.

The paper relates to

Strategic Objectives:

A: Safety – Enhance global civil aviation safety
D: Efficiency – Enhance the efficiency of aviation operations

Global Plan Initiatives:

GPI-1 Flexible use of airspace
GPI-5 Performance based navigation
GPI-8 Collaborative airspace design and management

1. INTRODUCTION

1.1 The meeting is invited to note that, at the Nineteenth Meeting of the Bay of Bengal ATS Coordination Group (BBACG/19), it was observed that the potential existed for a reduction to 50/50 NM with DCPC and to 30/30 NM when full data-link services are available in the Bay of Bengal. It was also BBACGs view that a Task Force should be established as a matter of priority, to assist the States to plan for the implementation of 50/50 NM longitudinal separation and at the same time, conduct the associated safety assessments as an immediate outcome of the CRA work, with the objective of 30/30 NM reduced separations in the medium term.

1.2 Subsequently, during the BBACG/20 meeting, Oman expressed strong support for the concept implementation of 50 NM longitudinal separation in the Arabian Sea at the same time as the Bay of Bengal. The meeting recognized that this would enhance overall capacity and a simultaneous implementation in Arabian Sea and Bay of Bengal appeared to be a very efficient way to proceed.

1.3 The BBACG/20 meeting endorsed the establishment of the ICAO Bay of Bengal Reduced Horizontal Separation Implementation Task Force (BOB-RHS/TF), noting that final Terms of Reference (TOR) and initial action plans would be agreed by the first meeting of the Task Force.

1.4 An agenda was agreed upon by the Task Force and is displayed in **Attachment 1** to this working paper

1.5 Noting previous discussions made at the BBACG/20 meeting, the first meeting of the task force decided to amend the Terms of Reference of the BOB-RHS/TF to include those portions of the Arabian Sea within the Oceanic portion of the Mumbai FIR to ensure a harmonized approach to implementation in both areas

1.6 The task force was reminded that the Terms of Reference had also been tasked to look at other features within the scope of the area under consideration. Under paragraph i) of the TORs, it is stated that the task force should "Explore possibilities for further enhancement to operational efficiency of routes through configuration and/or enhanced surveillance."

1.7 In this context, whilst taking into consideration the major thrust in reducing the longitudinal separation to 50 NM on present RNAV routes in the area, other initiatives should also be explored that would enhance operational efficiency and safety of aircraft to the benefit of the users and providers of the ATS service alike. The agreed revised Terms of Reference are described in A**ttachment 2.**

2. DISCUSSION

2.1 The task force also noted that, as this group was the only ICAO meeting dealing with airspace within the Bay of Bengal and westwards beyond at the moment, it was decided to use this forum where necessary to discuss other important items which would have significant efficiencies in this and adjacent airspace.

Proposed implementation of RNP4 PBN

2.2 The meeting was advised that, under the Objectives and the Terms of Reference, the Task Force shall adopt a phased implementation programme of work to be accomplished. The first phase is to implement widespread 50NM longitudinal separation using CPDLC communications in the Bay of Bengal and the Mumbai FIR.

2.3 Notwithstanding the present commitment to implement 50NM longitudinal separation,, the task force was encouraged to analyse the area of the Bay of Bengal and the Mumbai Oceanic FIR to see where it could also be rewarding to concentrate on RNP 4 PBN for future operations, taking into account the present and pending ADS/CPDLC programmes of States concerned. The meeting also recalled that in the Regional PBN Plan, RNP4 is the preferred solution in the short term (2009-2012).

Implementation of Longitudinal RNAV 10 RNP10 (50NM) in the Bay of Bengal and Mumbai FIR

2.4 The task force recalled that the ATS route structure across the Bay of Bengal includes a main parallel route structure as well as some important crossing routes. For ease of operation, especially with regard to ACC management, it was agreed that these crossing routes should also be taken into consideration within the designated areas in the planning for 50NM longitudinal separation.

2.5 As an example, RNAV route P762 is a major route for aircraft operating to/from Bangkok/Colombo, as well as aircraft overflying Colombo to Southern African destinations. It is considered that this route and other similar routes should also be examined for inclusion to 50NM longitudinal separation criteria.

ATS routes linking India/Pakistan with the Middle East via the Arabian Sea

2.6 The task force noted that many of the ATS routes now present over the Bay of Bengal continue their journey into the Middle East region across the Arabian Sea through to the Muscat FIR and beyond. These routes are under Oman radar coverage within the Muscat FIR, as is most if not all of the Gulf Peninsular. The meeting therefore appreciated the difficulty for Oman in managing eastbound traffic from other Gulf States transiting the Muscat FIR. These flights are radar spaced at 5 – 10NM apart at the same level entering the Muscat FIR which causes the Muscat ACC to either expand the separation to 80NM or to change aircraft levels or divert the aircraft on another available ATS route prior to entry into Mumbai FIR. When this separation requirement is reduced to 50NM, Muscat ACC would have less workload to achieve a satisfactory solution at the Muscat/Mumbai FIR crossing point.

Application of Direct Controller-Pilot Communications (DCPC)

2.7 The task force noted that ICAO PANS-ATM (Doc 4444) states that DCPC shall be maintained while applying distance-based separation minima. DCPC shall be by voice or Controller-Pilot Data Link Communications (CPDLC). The communications criteria necessary for CPDLC to satisfy the requirement for DCPC shall be established by an appropriate safety assessment.

2.8 It was also recalled that, prior to and during the application of a distance-based separation minimum, the controller would determine the adequacy of the available communication link, considering the time element required to receive replies from two or more aircraft, and the overall workload/traffic volume associated with the application of such minima.

2.9 PANS-ATM also mentions in part that, when aircraft are at or are expected to reduce to, the minimum separation applicable, speed control techniques, including assigning Mach number, shall be applied to ensure that the minimum distance exists throughout the period of application of the minima.

Effect of 50NM Horizontal Separation in the Bay of Bengal on ATFM/BOBCAT Operations

2.10 The task force recalled that, with respect to operations across the Bay of Bengal and India/Pakistan through Afghanistan during the westbound night-time ATFM/BOBCAT period, special arrangements have been devised and agreed to which strategically ensures that aircraft entering the Kabul FIR are adequately spaced by a minimum of 10 minutes during the stipulated 4 hour period of 2000 -2359UTC.

2.11 In order to introduce RNP10 50NM longitudinal minima into the Bay of Bengal area, it will be necessary to assess what effect this proposed initiative would have on the present ATFM/BOBCAT system and whether there may need to be some adjustments instituted so that both ATFM and RNP10 longitudinal of 50NM are able to operate in harmony.

2.12 It was further understood that work will be required to ensure that no or little disruption will apply to either initiatives. AEROTHAI gave the meeting an assurance that they will work on any issues envisaged to maintain harmony between both procedures.

Conducting Safety Assessments and reporting results- En-route Monitoring Agency (EMA)

2.15 The meeting was advised that, in order to conduct a safety assessment, an Enroute Monitoring Agency (EMA) will need to acquire an in-depth knowledge of the use of the airspace, within the area where the reduced horizontal-plane separation will be implemented.

2.16 A safety assessment conducted by an EMA consists of estimating the risk of collision associated with the horizontal-plane separation standard and comparing this risk to the established Target Level of Safety (TLS). Further, RASMAG will determine the safety reporting requirements (e.g. format and periodicity) for the EMA.

Establishing the Competence Necessary to Conduct a Safety Assessment

2.17 The task force recognized that conducting a safety assessment is a complex task requiring specialized skills which are not practiced widely. As a result, prior to receiving RASMAG approval to operate as an EMA, the organization concerned will need to demonstrate to RASMAG the necessary competence to complete the required tasks.

Assembling a sample of traffic movements from the airspace

2.18 Samples of traffic movement data should be collected for the entire airspace where reduced horizontal-plane separation will be implemented. As a result, ANSPs providing services within the airspace are required to cooperate in providing this data.

2.19 An EMA should take into account the importance of capturing periods of heavy traffic flow which might result from seasonal or other factors. The duration of any traffic sample should be at least 30 days, with a longer sample period left to the judgment of an EMA.

The Twelfth Meeting of the FANS Implementation Team for the Bay of Bengal (FIT-BOB/12)

2.20 The Twelfth Meeting of the FANS Implementation Team for the Bay of Bengal (FIT-BOB/12) was held on 22 and 23 February 2010, prior to the BOB-RHS/TF/2 meeting.

Bay of Bengal Central Reporting Agency(BOB-CRA)

2.21 The meeting reviewed the TOR of BOB-CRA listed as follows:

Objective

1) The objective of the Bay of Bengal Central Reporting Agency (BOB-CRA) operated by BOEING is to assist the members of the FANS Implementation Team for the Bay of Bengal (FIT-BOB) to plan and implement FANS 1/A based ADS and CPDLC systems in the Indonesian, Bay of Bengal and Arabian Sea FIRs (including ASIOACG member States) in accordance with the TOR of FIT-BOB.

Terms of Reference

2) To meet the above objective the BOB-CRA shall:

a) share technical and operational information with the FIT-BOB members on the planning and implementation of ADS and CPDLC systems;

b) process the ADS/CPDLC problem reports (PR) received from the FIT-BOB members in the manner prescribed in the *FANS 1/A Operations Manual (FOM)* and the *Guidance Material for End-to-End Safety and Performance of ATS Data Link Systems in the Asia and Pacific Region;*

c) disseminate de-identified information on individual problem reports to the FIT-BOB members to enable airborne and ground system enhancement/ remediation; and

d) prepare periodic reports for the FIT-BOB and RASMAG.

Area of Responsibility

3) The area of responsibility of the BOB CRA is defined as follows:

The BOB CRA will provide CRA services for the international oceanic airspace of the FIT-BOB member States, where implementation of ADS/CPDLC technologies is undertaken to enhance surveillance and communications capability, leading to significant benefits for operational efficiency and regularity of flights.

Boeing assistance to States on Bench-testing of ADS/CPDLC equipage

2.22 Boeing advised that they would coordinate with States to arrange "virtual test flights" on selected routes using avionics test benches. The purpose to these tests is to confirm necessary CPDLC and ADS capability along the routes selected for RNP 10 trials. Since these are "virtual flights" non normal operating conditions can be simulated allowing ANSPs to confirm necessary triggers and alerts are working as designed.

ADS/CPDLC Trial Progress in the Kuala Lumpur FIR over the Bay of Bengal Area

2.23 After some initials issues, the task force was informed that the ADS/CPDLC systems in Kuala Lumpur ACC were currently working satisfactorily, with confidence increasing amongst controllers and pilots. They are confident that, with further training by ATCs on the new equipment, they will be ready to implement 50Nm longitudinal separation in the KL FIR by the commencement of operations in the Bay of Bengal.

ADS/CPDLC Trial Progress in the Male FIR

2.24 Maldives informed that they commenced implementation of ADS-C and CPDLC data link services in the Male' FIR in 2009. In early September 2009, training for controllers was conducted and trials commenced in October 2009 on oceanic routes between Mumbai, Maldives and Australia with Emirates Airline aircraft.

2.25 The task force was advised however that there had been some equipment problems identified in late 2009 but these issues have now been rectified and all systems are now working satisfactorily as well as controller training completed.

Report on Boeing ADS-C/CPDLC Bench Testing with Chennai and Mumbai Centres

2.26 Since January 2010, three bench tests had been conducted with both Chennai and Mumbai FIRs. The first phase of testing was focused on automatic connection transfers between Chennai and Mumbai centres. Future auto-handoff tests will be conducted with neighbouring FIRs.

2.27 During bench testing, the CRA looked at all the message traffic between the aircraft and the ATSU in near real time. The CRA monitored the raw message traffic and also decoded each message as it is received by the aircraft. By reviewing both the raw or encoded message traffic and the decoded message traffic the CRA can monitor for encoding errors, bad CRC calculations and adherence to proper procedures as defined in the GOLD document.

Data collection to provide a business case supporting reduced horizontal separation decisions

2.28 The task force was advised that traffic demand through the airspace involved in this project would be the key criteria in providing a business case supporting a reduced horizontal separation implementation timeline. This traffic demand information should include items such as aircraft types and planned entry and exit time from the concerned airspace. Based on traffic demand, possible simulation could be performed on how various horizontal separation standards would affect traffic demand involved.

2.29 It was noted that this traffic sample data is the record of actual traffic and it could be argued that the data collected may include other factors such as current separation standards as well as uncertainties like weather phenomena. This traffic sample data would also become useful in post-implementation safety monitoring such as those carried out by RMAs and EMAs.

2.30 The task force noted that that another potential source of traffic demand data could be as simple as flight plans. Since it is required that flight plans include estimated elapsed time when crossing FIR boundary and planned routing, it is possible to construct a list of FIR boundary crossings of a particular flight simply by processing flight plan information. This crossing information would then form a basis of traffic demand useful for reduced horizontal separation implementation decisions.

2.31 Taking into consideration the usefulness of business case data, it was agreed that flight plans and related ATS messages transiting the Bay of Bengal and/or the Oceanic Mumbai FIR would be forwarded to the Bangkok ATFMU at its AFTN Address, VTBBZDZX. In this respect, AEROTHAI would coordinate follow up actions with States and airlines involved regarding this issue.

2.32 The meeting considered that data that could be extracted easily to produce a business case for reduced longitudinal separation had merit, and could easily give the States and airlines a predicted traffic growth for effective planning purposes.

Impact of reduced longitudinal separation in the Kabul FIR

2.33 The meeting was advised that Afghanistan is willing to address the meeting proposals for reduced longitudinal separation and would review requirements for implementation of 50 NM longitudinal separation in the Kabul FIR.

2.34 It was noted that major international routes traversing the Kabul FIR from South and Southeast Asia are RNAV RNP 10, although at the present time, RNP longitudinal separation of 50 NM is not applied. The task force was advised that on average, approximately 55 to 60 aircraft operate through the Kabul FIR in a westerly direction between 2000 to 2359 UTC each night, with a similar number transiting eastbound. At present, these aircraft are operating on a 10 minute spacing.

2.35 The introduction of 50 NM longitudinal separation through the Kabul FIR, would significantly enhance the capacity of aircraft entering, leaving or overflying this airspace.

Implementation Strategy for use of 50 NM longitudinal separation in the Bay of Bengal and Arabian Sea

2.36 After many discussion over the three task force meetings, it was finally agreed that 3 Phases would be used in the implementation process of 50Nm longitudinal separation as follows:

Phase 1: N571, P628 and P762

Phase 2: L301, L510, L759, M300, M770, N563, N877, P570 and P574

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

2.37 The proposed timetable for all three Phases are:

Phase 1 - to commence on AIRAC Date 13 January (or 10 February) 2011.

Phase 2 - to commence on AIRAC Date 28 July (or 25 Augus)t 2011.

Phase 3 - to commence either with Phase 2 or at a date to be identified prior to January 2012

2.38 It should also be noted that RNP10 ATS route P762 may be considered for 50 NM longitudinal separation on an opportunity basis provided the remote VHF site within the Yangon FIR becomes operational or CPDLC is introduced, as well as datalink being available in the Colombo FIR before the introduction of Phase 1.

Exclusive route and/or flight levels for data link equipped aircraft or mixed air traffic on an opportunity basis

2.39 A small working group (SWG) was formed involving States concerned as well as IATA to find an appropriate solution of mixed traffic operating through the Bay of Bengal. The SWG had considerable discussion in trying to come to a satisfactory agreement on the procedures for the three routes of N571, P628 and the crossing route P762, the latter being the subject of further discussions with Myanmar.

2.40 The SWG was advised that RNP10 50 NM longitudinal separation has been implemented in many parts of the world. In all cases, there is no implementation of exclusive use by data link aircraft on any route using a 50 NM longitudinal separation procedure. It was also noted that, with the implementation of 50 NM longitudinal separation, no levels were exclusive and the application of 50 nm separation was achieved on an opportunity basis between data link equipped aircraft. In case where one aircraft was non-data link, 10 minutes (80 NM) separation was used.

2.41 The task force was asked to consider whether these specific routes would be available only to data link equipped aircraft or available to all aircraft during Phase 1 of operations. In considering this matter, the meeting recall that in the implementation of 50 NM longitudinal separation on two routes in the South China Sea (L642 and M771), it was agreed that these routes would be available to all aircraft, as long as direct controller pilot communications, either DCPC or CPDLC could be established.

2.42 The task force recalled that several compromises had been suggested in earlier meetings such as sharing particular levels and reserving other levels for 50 NM longitudinal operations.

2.43 It was noted however that the purpose of the task force is to introduce an RNAV RNP 10 50 NM longitudinal separation procedure in the defined area. Therefore, it was considered that this is the main objective of the task force and as such, it should be kept in mind when making decisions in regard to procedures to be applied.

2.44 Taking into consideration that there were only a maximum of three RNAV routes involved in Phase 1 of the implementation strategy, the task force was asked to consider that this project should follow the same path of previous implementations of 50 NM separations which have used an opportunity basis.

2.45 It was mentioned that there were some ATC concerns in the adoption of this procedure due to the difference between data link to data link separation compared to data link to non-data link separation on the same route and same level, especially in regard to N571.

2.46 After considerable discussion, it was finally agreed that during the Phase 1 trial period, reduced horizontal separations would be applied on an opportunity basis. However to enable ATC to become accustomed to the provision of reduced separations, priority handling could be applied to data link equipped aircraft on N571 for a period of two AIRAC cycles after implementation of Phase 1.

Items of interest from the ASIOACG/5 Meeting

2.47 IATA gave a summary of discussions at the Arabian Sea – Indian Ocean ATS Coordination Group (ASIOACG/5) meeting, which was held in Dubai, UAE in 19-21 April 2010. The ASIOACG meeting focused on the region to the south of the main route structure in the Bay of Bengal and the Arabian Sea and as such the work generally overlapped and complimented the ongoing program of the BOB-RHS/TF.

2.48 At this meeting, Maldives presented the "Male Free Route Airspace Concept." This will enable aircraft to transit freely within the Male FIR although they will be required to cross specified FIR entry/exit points. In the short term this would entail an extension of the AUSOTS Flex Tracks into the Male FIR for flights operating between the Middle East and Australia. Mumbai and Sri Lanka are considering the establishment of "connector routes" within their own FIRs to link with the proposed entry/exit points.

Letter of agreement for monitoring of aircraft navigation errors in the Bay of Bengal area

2.49 The task force recalled that the implementation of reduced horizontal separation minima requires continuous monitoring of aircraft navigation errors. This includes the identification and reporting of any Large Lateral Deviations (LLD) or Large Longitudinal Errors (LLE), to ensure that the target level of safety (TLS) of the operations within the airspace in question meets the regionally established TLS.

2.50 The first step in the monitoring process would be to identify suitable designated areas where monitoring can be done by means of surveillance. This is usually from the point an aircraft leaves the surveillance coverage till the point where it will again enter surveillance coverage. There are also occasions that the monitoring is done within total surveillance coverage. On day-to-day basis, air traffic controllers carrying out their ATC duties should be the front line first person to initiate the report should they encounter any aircraft with navigational errors.

2.51 There is also a need to collect the traffic movement count for each route portion in the area. This will make up the figures required for the analysis to compute the Target Level of Safety (TLS). The traffic movements along with any occurrences of navigational errors are computed on a monthly basis. As such there's a need to collect monthly traffic movement counts.

2.52 The task force agreed that an LOA should be put in place by the relevant States to ensure that the procedures for reporting of navigation errors and traffic movement counts are clearly spelt out.

En route monitoring agency to support reduction of horizontal separation

2.53 It was recalled that 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 in question has been met. Additionally, periodic safety reviews must be performed in order to permit continued safe operations.

2.54 An EMA is an organization providing international airspace safety assessment, monitoring and implementation services to support the introduction and continued safe use of en-route horizontal-plane separation minima. It comprises a group of specialists who carry out specific functions to provide these services. The services provided by an EMA are to support the States towards implementation and continued safe use of reduced separation minima. The responsibility of safe implementation and continued operations, rest with States, ANSPs and users.

Duties and responsibilities of EMA

2.55 Apart from the EMA's function of carrying out the safety assessment and periodic safety reviews to support implementation of reduced horizontal separation, the other duties and responsibilities can be broadly categories as, information management, analysis and communications with the various stakeholders.

2.56 The duties and responsibilities of an EMA are:

a) to establish and maintain a database of operational approvals specific to the horizontal-plane separation applied in the EMA's area of responsibility;

b) to coordinate monitoring of horizontal-plane navigational performance and the identification of large horizontal-plane deviations;

c) to receive reports of large horizontal-plane deviations identified during monitoring; to take the necessary action with the relevant State authority and operator to determine the likely cause of the horizontal-plane deviation and to verify the approval status of the relevant operator;

d) to analyze data to detect horizontal-plane deviation trends and, hence, to take action as in the previous item;

e) to undertake data collections as required by RASMAG to:

1. investigate the navigational performance of the aircraft in the core of the distribution of lateral deviations;

2. establish or add to a database on the lateral navigational performance of:

- the aircraft population
- aircraft types or categories
- individual airframes;

3. examine the forecast accuracy of aircraft-provided times at future (i.e next position) required reporting points

f) to archive results of navigational performance monitoring and to conduct periodic risk assessments in light of agreed regional safety goals;

g) to contribute to a regional database of monitoring results;

h) to initiate necessary remedial actions and coordinate with specialist groups as necessary in the light of monitoring results;

i) to monitor the level of risk as a consequence of operational errors and inflight contingencies as follows:

1. determine, wherever possible, the root cause of each horizontal plane deviation together with its size and duration;

2. calculate the frequency of occurrence;

3. assess the overall risk in the system against the overall safety objectives; and

4. initiate remedial action as required;

j) to initiate checks of the approval status of aircraft operating in the relevant airspace where horizontal-plane separation is applied, identify non-approved operators and aircraft using the airspace and notify the appropriate State of Registry/State of the Operator accordingly; and

k) to submit reports as required to APANPIRG through RASMAG.

Horizontal Enroute Monitoring Agency for the Bay of Bengal and Mumbai FIR

2.57 There was presently no dedicated safety monitoring agency established to perform the important task of processing traffic data analysis in this area to ensure that the Target Level of Safety (TLS) in the longitudinal-plane could be met. In addition, it would appear that, notwithstanding the implementation of lateral separation implementation of 50NM in EMARSSH, safety monitoring has not been continuous.

2.58 India advised the task force that, taking into consideration the amount of airspace within their FIRs in both the Bay of Bengal and the Arabian Sea, they are prepared to establish an Enroute Monitoring Agency in accordance with ICAO provisions to cover all routes which will change to 50NM separations. Singapore, who is responsible for the EMA service for the South China Sea area, offered to share their experience on the setting up of SEASMA with India in the establishment of an EMA service.

2.59 In an endeavour to acquire Safety Monitoring Capabilities, AAI has sought FAA‘s guidance. The meeting noted that the Federal Aviation Administration (FAA), U.S. Department of Transportation has offered to assist India by providing suitable guidance and software tools. AAI is forming a team comprising of experts from ATC, Safety, Avionics and also a member with Mathematical/Statistical expertise. FAA has further proposed that the team should visit the existing Technical centre in Atlantic City, USA to understand the safety monitoring establishment and its operation. The visit is tentatively scheduled at the end of July, 2010.

2.60 During the small working group discussion, India informed the meeting of their progress towards establishing an Indian EMA and that they will strive to work towards the October meeting with the aim of presenting the safety assessment for phase 1 to progress the implementation

of reduced longitudinal separation. They also advised that that were aware that a presentation to RASMAG on their proposed EMA would need to be undertaken to allow RASMAG to approve the initiative in the formulation of the India EMA. RASMAG is scheduled to meet on 2 – 5 August 2010.

2.61 India also expressed their sincere thanks to SEASMA/CAAS for making the required arrangements during the task force meeting to visit the Singapore ACC to monitor the procedures of ATC in handling reduced longitudinal separation in areas of the South China Sea, as well as assisting India in preliminary arrangements for the introduction of the India EMA.

Safety Assessment

2.62 One of the fundamental principles for the conduct of the safety assessment is to determine the core navigational performance of the flights that operates in the area. This can be achieved through the cooperation between States and ANSPs to monitor aircraft navigational performance and report any navigational errors. With this information, the probability of an occurrence of a lateral overlap of two aircrafts can be determined.

2.63 Navigation errors can be classified into 2 categories as follows:

a) *Large lateral deviation (LLD)*

Any deviation of 15 NM or more to the left or right of the current flight-plan track;

b) *Large longitudinal error (LLE)*

Any unexpected change in longitudinal separation between an aircraft pair, or for an individual aircraft the difference between an estimate for a given fix and the actual time of arrival over that fix, as applicable, in accordance with the criteria set out below:

Category of Error	Criterion for Reporting
Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Aircraft-pair (Distance-based separation applied)	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

2.64 The LLDs and LLEs reports would have a significant influence on the outcome of the safety assessment. A program to collect this information, assess the occurrences and initiate remedial action to correct systemic problems should be established as appropriate. This could be achieved by means of a Letter of Agreement between the States involved.

2.65 The collection of Traffic Sample Data (TSD) is a necessary component towards providing the parameters for the collision risk modeling. The provision of annual TSD serves to provide not only the EMAs but also the RVSM Monitoring Agencies (RMAs) in conducting the safety reviews for RVSM operations.

Operational Letter of Agreement for monitoring of Aircraft Navigation Errors in the Bay of Bengal, Arabian Sea and Indian Ocean Airspace

2.66 The meeting reviewed the draft LOA proposed by India and agreed that both India and Singapore will revise the draft LOA to harmonize with the ICAO Asia Pacific En-route Monitoring Agency Handbook. The LOA would be circulated through ICAO to all the States concerned for their comments and targeted for signing during at the ATM/AIS/SAR/SG meeting in June 2010. The meeting also agreed that the collection of the aircraft navigation errors would commence from 1 July 2010. The draft LOA that will be used for the monitoring of aircraft navigation errors is shown in **Attachment 3.**

Note. *The Draft LOA submitted by India has been subsequently modified and further changes may take place before circulation to ICAO and States concerned.*

Background on the Functions, Duties and Responsibilities of

2.67 Singapore presented an information paper and a PowerPoint presentation, which gave a general background of the functions of an En-route Monitoring Agency (EMA) and its duties and responsibilities in supporting the introduction and continued safe use of en-route horizontal-plane separation minima. This PowerPoint presentation is shown in **Attachment 4** to this WP.

Unidirectional Routes over the Bay of Bengal and the Arabian Sea

2.68 It was suggested to the meeting that there may be an opportunity for this type of procedure to be considered for RNAV routes crossing the Bay of Bengal and the Arabian Sea. A procedure similar to the South China Sea example would also take into consideration the crossing aircraft, as well as allowing a flexible and more efficient use of the present airspace for the majority of aircraft operating on the major East/West/Northwest traffic flows.

2.69 The meeting noted the proposal however it was considered that more time was required to study this initiative and would be left till after the Phase one implementation.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) Support the work being undertaken by the BOB-RHS Task Force in the introduction of RNAV 10 50NM Separation in the Bay of Bengal and Arabian Sea, as well as certain RNAV routes in the Indian Ocean linking the Asia Region with African FIRs;

b) In the absence of BBACG meetings for 2010, agree to change the Terms of Reference of the Task Force by extending the coverage of RNP longitudinal separation to additional routes which cross the Bay of Bengal to the Male and/or Melbourne FIRs to/from the Maldives and/or South Africa within the Asia and Pacific Region;

c) Agree with a 3 phased approach on implementation of RNAV 10 50NM separation procedures mentioned in the Draft Revised Terms of Reference;

d) Support the initiative of the Airports Authority of India (AAI) in the introduction of an Enroute Monitoring Agency (EMA), to supply the necessary safety monitoring procedures and assessments for the work of the Task Force where necessary;

e) Encourage States to sign a Letter of Agreement with the India EMA in the provision of traffic data on RNAV 10 50NM separation routes

f) Note the PowerPoint presentation on the Functions, Duties and Responsibilities of an Enroute Monitoring Agency (EMA)

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PROVISIONAL AGENDA

(Presented by the Secretariat)

Agenda Item 1: Adoption of Agenda

Agenda Item 2: Review Outcomes of Related Meetings

Agenda Item 3: Operational Issues

Agenda Item 4: Safety Analysis and Airspace Monitoring Issues

Agenda Item 5: Post-Implementation Management Considerations

Agenda Item 6: Future Direction and Arrangements

Agenda Item 7: Preparation of BOB-RHS/TF Task List

Agenda Item 8: Any Other Business

Agenda Item 9: Date and Venue for BOB-RHS/TF/4

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DRAFT Terms of Reference

Bay of Bengal Reduced Horizontal Separation Implementation Task Force (BOB-RHS/TF)

1) The objective of the ICAO BOB-RHS Task Force is:

   In collaboration with affected stakeholders and ensuring inter-regional harmonization, develop and implement strategic, benefits-driven plans to improve en-route airspace efficiency by means of the implementation of reduced horizontal separation (lateral and longitudinal) based on the ICAO RNAV 10 (RNP 10) and RNP 4 PBN navigation specifications within the Bay of Bengal area.

2) To meet this objective the Task Force shall:

   a) Review the existing Bay of Bengal route structures and examine suitability's for implementation of reduced horizontal separation.

   b) Identify areas/routes where the implementation of reduced horizontal separation would bring immediate operational efficiency

   c) Determine the reduced horizontal separation required, taking into account traffic volumes and disposition, approval status of the aircraft operating on the relevant routes, user expectations and the communication and surveillance capabilities of ATS providers involved.

   d) Examine the possibility of a step-by-step or phased implementation of reduced horizontal separation and detail the phases required and the areas/routes concerned.

   e) Develop and action the necessary strategic plans with appropriate timelines to implement reduced horizontal separations based on the APANPIRG Regional PBN Implementation Plan and ICAO Standards and Recommended Practices, whilst taking into account the need for inter-regional harmonization and user requirements.

   f) Ensure the conduct of Annex 11 compliant pre-implementation safety assessments and make arrangements for States to conduct ongoing post-implementation safety monitoring in accordance with ICAO provisions.

   g) Consider setting up appropriate teams/groups which might but not necessarily, include the entire Task Force, to address and implement specific agreed measures within specific airspaces.

   h) Cooperate with other Task Forces and groups which are involved with similar work in adjacent airspaces in order to achieve harmonized inter-regional solutions.

   i) Explore possibilities for further enhancements to operational efficiency of route structures through reconfiguration and/or enhanced surveillance.

3) Scope of work:

The Task Force shall adopt a phased implementation programme, as follows:

Phase One: implement 50NM longitudinal separation using CPDLC communications in the Bay of Bengal, Mumbai Oceanic FIR on RNAV routes N571, P628 and P762 on AIRAC Date 13 January 2011;

Phase Two: implement 50NM longitudinal separation using CPDLC communications in the Bay of Bengal, Mumbai Oceanic FIR on RNAV routes L301, L510, L759, M300, M770, N563, N877, P570 on AIRAC Date 28 July 2011.

Phase Three: implement 50NM longitudinal separation using CPDLC communications in the Bay of Bengal and Indian Ocean on G465, M512, P627, L774, N633within the Asia/Pacific region to commence either with Phase 2 or at a date to be identified prior to January 2012

The Task Force reports via the ICAO Bay of Bengal ATS Coordination Group (BBACG) to the ATM/AIS/SAR Sub Group of APANPIRG.

……..

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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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	Yangoon 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 the following all RNAV routes over Bay of Bengal, Arabian Sea and Indian Ocean

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.

Operational Letter of Agreement

Overview, continued

Effective Date	This letter of agreement becomes effective on 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 the following designated routes: <u>Phase 1*</u> N571, P628 & P762 <u>Phase 2*</u> L301, L510, L759, M300, M770, N563, N877, P570 & P574 <u>Phase 3*</u> 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.

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.

Category of Error	Criterion for Reporting
Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Aircraft-pair (Distance-based separation applied)	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

- Notification, in accordance with **Appendix A**, shall be submitted in all cases of error

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. 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 A**) requiring the operator to complete the Navigation Error Investigation Form and to provide reasons for the error.

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 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 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 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 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 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),

a. 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 for that month and

b. Data on the number of movements on the routes being monitored as recorded by the relevant Flight Data Processing System, or other auditable means.

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

AAI should prepare an assessment schedule setting out the results of the monitoring for the preceding twelve-month period and forward a copy of this schedule to:

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

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:

Type of Error	Category of Error	Criterion for Reporting
Lateral deviation	Individual-aircraft error	15NM or greater magnitude
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	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

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.

Type of Error	Category of Error	Criterion for Reporting
Lateral deviation	Individual-aircraft error	15NM or greater magnitude
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	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

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: ***[bobasma@aai.aero]***
Fax: ***[Fax of EMA +91 11 24610776]***

[Address of EMA]

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

NAVIGATION ERROR INVESTIGATION FORM

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

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 relating to the monitoring letter of agreement, and the monitoring areas identified in paragraph 4, shall be Malaysia, Indonesia, Oman, Sri Lanka, Thailand, Maldives, Myanmar, Seychelles and Pakistan.

2.2 Data gathering requirements are detailed in paragraph 5.

3. Enroute Monitoring Agency

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

4. Designated Monitoring Areas

4.1 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.

4.2 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 "up-date" using ground-based navigation aids, such as DME/DME, or VOR/VOR.

4.3 In assessing navigation errors on the routes –

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 The 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 are specified as follows;

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

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

Phase 2 – **Monitoring commence TDB**

Route	Segment	FIRs Involved
L301	AKTIV & RASKI	MUMBAI, MUSCAT
	LARIK & BKK	KOLKATA, BANGKOK
L510	GIVAL & DOGEM	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 – **Monitoring commence TDB**

Route	Segment	FIRs Involved
TBD	TBD	

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

4.6 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 7.

5. Collection and Forwarding of Data

5.1 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 the Letter of Agreement on the Monitoring of Navigation Errors; 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.

5.2 After collection, the required data should be forwarded to the Monitoring Authority (AAI), 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.

5.3 In respect of paragraph 5.1.a), if there have been no error reports submitted, a "Nil Return" should be submitted to the Monitoring Authority.

6. Assessing of Navigation Errors

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

6.2 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 Appendix B).

6.3 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.

6.4 If a trend is identified, which indicates that the required parameter is being exceeded regularly, or the cumulative assessment indicates a upwards trend, the Enroute Monitoring Agency should notify, though 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.

6.5 An example of an assessment schedule is shown at Appendix B.

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

7.1 The Letter of Agreement on the Monitoring of Navigation Errors required all participating States to notify all appropriate navigation errors to the Enroute Monitoring Agency. This data should be collated and assessed in the following manner.

7.2 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, the error should be assessed and processed in accordance with paragraph 6 above.

7.3 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.

8. Reporting Procedures

8.1 The Enroute Monitoring Agency should prepare an assessment schedule (refer to Appendix B), and forward a copy of this schedule, at least every 12 months, to:

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

8.2 In addition, a report should be prepared on those errors reported in accordance with paragraph 7.3 above.

9. Attachments

Appendix A – Assessment Schedule Process
Appendix B – Sample Assessment Schedule

Attachment A

Assessment Schedule Process for Designated Monitoring Areas

STEP 1.

Malaysia, Indonesia, 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:

Phase 1 – **Commences on 1 July 2010**

Route	Segment	FIRs Involved
N571	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
L301	AKTIV & RASKI	MUMBAI, MUSCAT
	LARIK & BKK	KOLKATA, BANGKOK
L510	GIVAL & DOGEM	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	

STEP 2.

Malaysia, Indonesia, 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 Agency (AAI).

STEP 4.

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

STEP 5.

Each 12 months, the assessment schedule is sent to:

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

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.

Attachment B

Example of Navigation Error Assessment Schedule For Designated Monitoring Areas

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 => 15NM Category 2 = 25 – 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

c. Example of Monthly Total – All 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

d. Example of Cumulative Monthly Total – All 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

SEASMA
South East Asia Safety Monitoring Agency

Introduction
En-route Monitoring Agency

Presented By:
SEASMA
2010

Agenda

- Background
- Roles & Responsibilities
- Safety Assessment

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Background

- ICAO Annex 11 provisions

  - Safety Assessment (SA) must be carried out based on Collision Risk Model (CRM) before the implementation of reduced separation minima such as the 50 NM longitudinal separation based on RNP10.

  - To ensure regionally established TLS has been met.

  - Periodic safety reviews must be performed in order to permit safe continued operations.

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Background

Safe Implementation of Separation Standard

- Responsibility lies with States, ANSPs and users
- EMA is not directly responsible for safe implementation of separation standard
- EMA supports implementation and continued safe use of reduced separation minima

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Background

What is an EMA?

- An organization providing international airspace **SA**, **monitoring** and **implementation** services to support the introduction and continued safe use of en-route horizontal-plane separation minima.

Background

What is an En-route Monitoring Agency?

- It comprises a group of specialists who carry out specific functions to provide these services.

Roles and Responsibilities

- Establish and maintain a database of operational approvals specific to the horizontal-plane separation applied in the EMA's area of responsibility;
- Coordinate monitoring of horizontal-plane navigational performance and the identification of large horizontal-plane deviations;

Roles and Responsibilities

- Receive reports of large horizontal-plane deviations identified during monitoring; to take the necessary action with the relevant State authority and operator to determine the likely cause of the horizontal-plane deviation and to verify the approval status of the relevant operator;

Roles and Responsibilities

- Analyze data to detect horizontal-plane deviation trends and, hence, to take action as in the previous item;

Roles and Responsibilities

- Undertake data collections as required by RASMAG to:
  - investigate the navigational performance of the aircraft in the core of the distribution of lateral deviations;
  - establish or add to a database on the lateral navigational performance of:
    a) the aircraft population
    b) aircraft types or categories
    c) individual airframes;
  - examine the forecast accuracy of aircraft-provided times at future (i.e next position) required reporting points

Roles and Responsibilities

- Archive results of navigational performance monitoring and to conduct periodic risk assessments in light of agreed regional safety goals;
- Contribute to a regional database of monitoring results;
- Initiate necessary remedial actions and coordinate with specialist groups as necessary in the light of monitoring results;

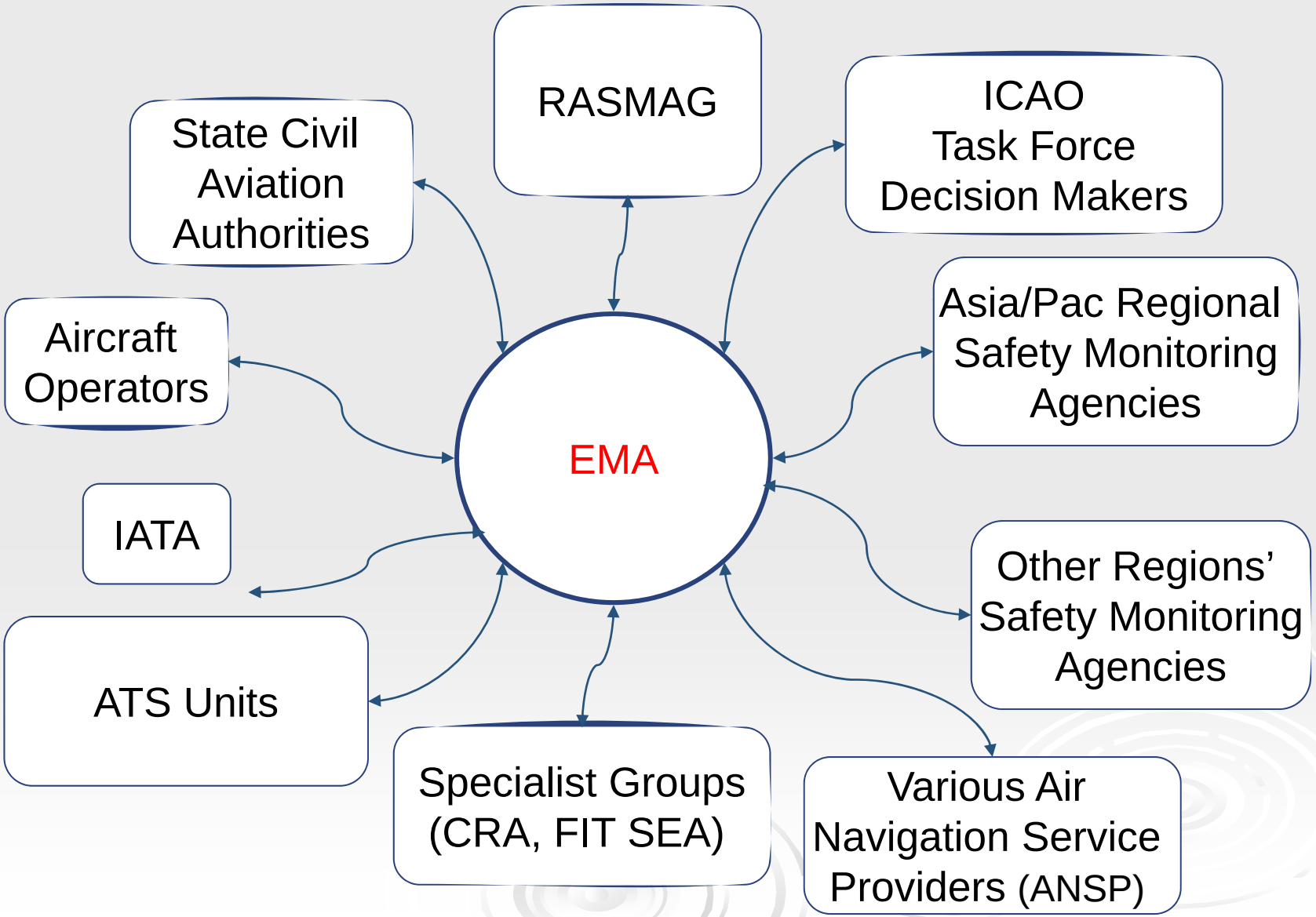
Roles and Responsibilities

- Monitor the level of risk as a consequence of operational errors and in-flight contingencies as follows:
  - determine, wherever possible, the root cause of each horizontal plane deviation together with its size and duration;
  - calculate the frequency of occurrence;
  - assess the overall risk in the system against the overall safety objectives;
  - initiate remedial action as required;

Roles and Responsibilities

- Initiate checks of the approval status of aircraft operating in the relevant airspace where horizontal-plane separation is applied, identify non-approved operators and aircraft using the airspace and notify the appropriate State of Registry/State of the Operator accordingly; and
- to submit reports as required to APANPIRG through RASMAG.

Roles and Responsibilities
Communication With Stakeholders



Roles and Responsibilities
Information Management Databases

- List of States/Operator Contacts
- Airframe details
- Details of PBN and data link Approval
- ICAO Documents
  - Doc 7910, airport designators
  - Doc 8585, airline codes
  - Doc 8643, aircraft types
- Reports of Large Lateral Deviation (LLD) and Large Longitudinal Error (LLE)

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Safety Assessment

What is needed?

- Data on core navigational performance
- Data on LLDs and LLEs
- TSD

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Safety Assessment

- Core Navigational Performance

  - Determine lateral overlap probability
  - Enlist the cooperation of States and ANSPs through the use of secondary surveillance radar or other appropriate surveillance systems.

Safety Assessment

Large lateral deviation (LLD)

- Any deviation of 15 NM or more to the left or right of the current flight-plan track

Note: Where an aircraft is off-track as the result of ATC approved diversion (e.g. due weather), no notification need be submitted.

Safety Assessment

Large longitudinal error (LLE)

- Any unexpected change in longitudinal separation between an aircraft pair, or for an individual aircraft the difference between an estimate for a given fix and the actual time of arrival over that fix, as applicable, in accordance with the criteria set out below:

Safety Assessment on Reduced Longitudinal Separation

Type of Error	Category of Error	Criterion for Reporting
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report

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Safety Assessment on Reduced Longitudinal Separation

Type of Error	Category of Error	Criterion for Reporting
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	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

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Safety Assessment

- LLDs and LLEs

  - Significant influence on the outcome of SA

  - Programme to collect this information, assess the occurrences and initiate remedial action to correct systemic problems.

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Safety Assessment

- Traffic Sample Data

  - ‘Know Your Airspace’ Analysis
  - Provides parameter values for CRM
  - Airspace Monitoring

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Thank You