INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA AND PACIFIC OFFICE

REPORT OF THE THIRD MEETING OF THE BAY OF BENGAL REDUCED HORIZONTAL SEPARATION IMPLEMENTATION TASK FORCE (BOB-RHS/TF/3)

SINGAPORE

18 – 21 MAY 2010

The views expressed in this Report should be taken as those of the Task Force and not of the Organization

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History of the Meeting

Report of the Meeting

Appendices

1.1 Introduction

1.1.1 The Third Meeting of the Bay of Bengal Reduced Horizontal Separation Task Force (BOB-RHS/TF/3) was held at the Singapore Aviation Academy, Singapore from 18 to 21 May 2010.

1.2 Attendance

1.2.1 BOB-RHS/TF/3 was attended by 32 participants from India, Indonesia, Malaysia, Maldives, Nepal, Singapore, Thailand, United States, IATA, ARINC and SITA. A complete list of participants is at **Appendix A** to this Report.

1.3 Officers and Secretariat

1.3.1 The meeting was chaired by Mr. Edmund Heng, Deputy Chief of Singapore ATC Centre, CAAS. Mr. John E. Richardson, ATM Expert, ICAO Asia and Pacific Office acted as Secretary to the meeting.

1.4 Opening of BOB-RHS/TF/3

1.4.1 Mr. Kuah Kong Beng, Chief Air Traffic Control Officer, welcomed all participants to Singapore on behalf of the Civil Aviation Authority of Singapore (CAAS). He understood the circumstances for relocating the task force meeting from Bangkok, Thailand and hoped that the conditions in Bangkok would soon return to normal. He expressed his wish that the meeting held at the Singapore Aviation Academy (SAA) would be successful and would lead to the desired results of implementation of enhanced ATM procedures in the defined area under consideration.

1.4.2 Mr. John Richardson welcomed all the participants on behalf of Mr. Mokhtar A. Awan, Regional Director, ICAO Asia and Pacific Office. He stated that the ICAO Regional Office was grateful to CAAS in accepting to hold this meeting in Singapore at short notice.

1.4.3 Mr. Richardson suggested to the meeting that, due to the important work to be accomplished over the next few meetings in order to complete the work of Phase 1 of the task force by the proposed target date, as well as the additional requirements to implement RNAV RNP 10 50NM longitudinal separation on all other routes within the Bay of Bengal and the Mumbai Oceanic FIR, it was considered necessary to appoint a Chairman of the task force to oversee the running of the meeting which would in turn allow the Secretariat to properly carry out its functions.

1.4.4 Consequently, it was proposed by Thailand and seconded by Sri Lanka that Mr. Edmund Heng be nominated as Chairman of the task force. As there were no other nominations, the meeting unanimously agreed that Mr. Heng occupy the position of Chairman of the BOB-RHS Task Force.

1.4.5 In his opening remarks, Mr. Heng thanked the meeting for their confidence in his selection as Chairman. He considered that there was still considerable work to be accomplished to meet the target dates agreed to by previous meetings of the task force. Amongst these necessary items to be discussed and completed were the establishment Gross Navigational Error procedures, Traffic Sample Data Collection and the establishment of an EMA for the area under consideration.

1.5 **Documentation and Working Language**

1.5.1 The working language of the meeting as well as all documentation was in English.

1.5.2 Nine (9) Working Papers and three (3) Information Papers were presented to BOB-RHS/TF/3. A list of papers is included at **Appendix B** to this Report.

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Agenda Item 1: Adoption of Agenda

1.1 The meeting reviewed the provisional agenda proposed by the Secretariat for BOB-RHS/TF/3, and adopted the following agenda:

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

Agenda Item 2: Review Outcomes of Related Meetings

2.1 Two meetings, FIT-BOB/12 and BOB-RHS/TF/2, were held during the period 22 to 26 February 2010. The FITBOB/12 meeting was held between 22 to 23 February, followed by the BOB-RHS/TF/2 meeting on 23 to 26 February.

Review of FITBOB/12

2.2 The meeting appraised one significant meeting and one seminar which were relevant to the task force. They were:

a) A Data Link Seminar which was held at ICAO Asia and Pacific Office, Bangkok, Thailand on 24 and 25 August 2009 in conjunction with FIT-BOB/11;

b) The First Satellite Data Link Operational Continuity Meeting (SOCM/1) also held in the ICAO Bangkok Office in August 2009

2.3 India provided the Seminar with information of their Data Link Operations in the Chennai, Kolkata and Mumbai Flight Information Regions (FIRs). It was noted that there were many weather deviations during the monsoon period from June to September each year over the Arabian Sea and the Bay of Bengal. It was also advised that the data link systems at the ACCs within the these FIRs are capable of deviation contracts.

2.4 From information supplied, there were approximately 400 flights operating per day through the oceanic airspace of the Mumbai FIR, of which approximately 160 of these flights were data link capable.

2.5 The meeting was also advised that approximately 230 flights operate per day in the oceanic airspace of the Chennai FIR with around 120 of those flights being data link capable. Nevertheless, for reasons unknown, an average about 10% of the flights did not log on to the ADS/CPDLC system.

2.6 With regard to the Kolkata FIR, approximately 248 flights operate per day through their oceanic airspace, with 148 of those flights being data link capable and provided with data link services.

Roles and Functions of the Data Link Central Reporting Agency (CRA)

2.7 SOCM/1 was presented the status of development of Global Operational Data Link Document (GOLD). SOCM/1 expressed full support for the (GOLD) and recommended a Conclusion to distribute form(s) for submission of information by States and international organizations for adoption by APANPIRG.

Central Reporting Agency (CRA)

2.8 The meeting noted the TOR of BOB-CRA 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.

Review Bay of Bengal ADS/CPDLC Operations

2.9 Malaysia advised the meeting on trials of their ADS/CPDLC systems which had been operating during a limited timeframe between 1500-1900 UTC since July 2008 on seven oceanic ATS routes, i.e. P628, L510, L645, L627, N571, B466 and P574 within the Kuala Lumpur FIR. Software upgrades are in the process of being installed and are expected to be completed by May 2010.

ADS/CPDLC Trial Progress in the Male FIR

2.10 Maldives advised 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.

2.11 At the outset the system performance was satisfactory. However, after a month the downlink performance was poor and the trials had to be discontinued after experiencing some equipment problem. The equipment supplier had been contacted and was expected to fix the problem by end of February 2010. If all went well, the trials were scheduled to re-commence again in March 2010.

Data Link Environment of the Arabian Sea and the Bay of Bengal

2.12 Data Link trials were performed by Emirates Airlines over a 14 day period in January 2010 The report from the airline indicated an overall improvement in Data Link capability and procedures with ACCs involved, however further improvement is still required. It was further noted that, from the Emirates data, occurrences of the unstable connections or unusable functionality had increased since the last survey.

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

2.13 Boeing advised that the avionics suite or "bench" simulates full aircraft systems capabilities for ADS and CPDLC. Once connected to either the ARINC or SITA's ACARS network, the bench can logon to any FANS ground automation system around the world. Once connected, test bench aircraft appear just like any other flight operating in that airspace.

Overview of Testing Conducted and of the CPDLC Connection Transfer Process

2.14 Since January 2010, three bench tests were conducted by Boeing 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. Boeing provided a detailed methodology of the connection transfer process, also explaining that ADS connections are managed by the FIRs themselves and the GOLD document provides detailed guidelines on ADS connection etiquette. The results of ADS/CPDLC Bench Testing with Chennai and Mumbai Centres was also provided and explained.

ADS/CPDLC Problem Reports (PRs) in the Bay of Bengal

2.15 88 PRs were received by Boeing and actioned. It was recommended that ATSUs automate the connection sequence. If the connections must be managed manually, ATSUs are encouraged to develop and document local procedures to help ensure the connection handoff steps are followed correctly.

Review of BOB-RHS/TF/2 Meeting

Operational Issues

Letters of Agreement on 50NM Longitudinal Separation

2.16 It was noted that, in the planning and implementation process, letters of agreement (LOA) are to be developed between ACCs regarding the use of 50 nm longitudinal separation along designated ATS routes where CPDLC will be required. The first phase of the project will concentrate on two or possibly three RNAV routes i.e. N571, P628 and perhaps P762, these LOAs may also be the model for other RNAV routes when the second phase of the project is considered. The LOA could also be part of present LOAs already agreed to by ACCs concerned. The decision to use either option rests with the ACCs concerned.

2.17 All LOAs should take into account a section dealing with Gross Navigation Errors (GNEs) which will be required to be produced for the Enroute Monitoring Agency (EMA).

India's progress towards implementation of 50 NM separation using CPDLC

2.18 It was observed that data link services are provided on 12 international routes over the Bay of Bengal within Chennai FIR i.e. routes N877, L510, P628, L759, N571, N563, P762, P574, L896, N564, P761 & L645.

2.19 Data-link services are also provided by the Mumbai FIR on 15 international routes over Arabian Sea and Indian Ocean i.e. routes M638, P518, L301, N571, P574, N563, M300, P570, R456, G465, A451, A474, A214, B459, G450, and G424.

Implementation of 50 NM on ATS route N571 with level band restriction

2.20 It was suggested that, if a specific level band is provided for exclusive ADS/CPDLC operations on N571 route, operations on RNAV (RNP 10) routes P762, N877 and P761 can be made possible below and above the specified level band. The specific level band will also make it possible for the operations of non ADS/CPDLC equipped aircraft on N571.

Problems identified on ADS/CPDLC ground system during ATS Interoperability Test by Boeing

Chennai ground system

2.21 Transfer of control with Mumbai ATS unit on data link for aircraft call sign with 7 characters was not successful. The default setting for lateral and vertical deviation did not trigger any event change and the values incorporated in the ground system is not being acknowledged by the aircraft in the event contract.

Mumbai ground system

2.22 The meeting noted that when End Service message (no.161) is uplinked, the error message (no.159) is also automatically uplinked. The Mumbai system engineers are working to resolve this problem.

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

2.23 The meeting 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. Based on traffic demand, possible simulation could be performed on how various horizontal separation standards would affect traffic demand involved.

2.24 It was noted 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.

2.25 Taking into consideration the usefulness of business case data, it was agreed that AEROTHAI would collect flight plans and related ATS messages transiting the Bay of Bengal and/or the Oceanic Mumbai FIR. This data would be forwarded to the Bangkok ATFMU at its AFTN Address, VTBBZDZX.

Impact of reduced longitudinal separation in the Kabul FIR

2.26 It was noted that Afghanistan was willing to address reduced longitudinal separation and would review requirements for implementation of 50 NM longitudinal separation in the Kabul FIR, which is presently at 10 minutes (80 NM).

Future Direction and Arrangements

Route proposals for Phase 1 of the project

2.27 It was agreed to include 2 additional RNAV routes in Phase 1 of the project. In addition to N571, the meeting agreed RNAV route for Phase 1 were P628 and P762. P762 would be subject to Yangon FIR having satisfactory CPDLC capability by the scheduled commencement of Phase 1. The purpose of this increase was to give a wider spread of issues which may be encountered prior to all routes being considered.

Additional routes to be considered entering the Indian Ocean

2.28 Discussions took place regarding additional routes which leave the Bay of Bengal and extend into the Indian Ocean, especially the routes used by aircraft operating to/from South Africa.

2.29 Although traffic is comparably light, P627 is a popular route for aircraft operating from Hong Kong to South African destinations depending on forecast winds. P627 originates in Phuket (Bangkok FIR) and then traverses Kuala Lumpur, Jakarta, Colombo and Melbourne FIRs before entering Johannesburg Oceanic FIR. It was noted that Jakarta does not presently have DCPC capability for their airspace West of Sumatra to the Colombo FIR. Nevertheless, action is in hand to increase the range of their VHF coverage as well as introducing ADS/CPDLC into the Jakarta ACC. The concept of RNP 50 NM separation was agreed to awaiting further advice from Indonesia on this matter. The necessary coordination requirements between Jakarta, Colombo and Melbourne FIRs would then take place including AIP requirements.

Upgrading ATS routes to RNAV routes in the India Ocean

2.30 It was further suggested that other ATS routes leaving Malaysia, Singapore and Indonesia into the Indian Ocean should be upgraded to RNAV routes as soon as possible. It would be preferable if the complete section of these routes within the Asia/Pacific region be jointly coordinated with all FIRs involved so that a common date for change to RNAV RNP 10 was agreed to. Where possible to do so, this action would be commenced so as to have all of these routes concurrently upgraded to RNAV RNP 10 capability.

Timetable for implementation of RNP 10 50 NM longitudinal separation in the Bay of Bengal and Mumbai Oceanic

2.31 It was finally agreed that, based on this timetable for implementation for Bay of Bengal and Mumbai Oceanic areas, and taking into consideration that Malaysia will be testing their updated CPDLC equipment in May 2010, the following programme for Phase 1 of the project was decided:

a) Kuala Lumpur ACC is scheduled to resume trialing CPDLC within the KL FIR in May 2010 between 1500-1900UTC and is scheduled to have CPDLC available H24 in October 2010b)

b) FIT-BOB is again expected to convene in October to study and approve the data supplied by all FIRs concerned in Phase 1 of this project They are KL FIR, Chennai FIR, Kolkata FIR, Mumbai FIR. It may also be possible to receive data from Colombo and Yangon ACCs;

c) FIT-BOB/BOB-RHS/TF/4 − GO-No Go meeting is programmed to convene in October;

d) Phase 1 of the project involving N571, P628 and possibly P762 would commence on AIRAC Date 13 January (or 10 February) 2011

e) BOB-RHS/TF/5 Post Implementation Meeting in April 2011together with Go/No Go for Phase 2 of the project

f) Stage 2 of the Project involving all other BOB and Mumbai Oceanic FIR routes, including Indian Ocean routes crossing Male FIR commence on AIRAC Date 28 July or 25 August 2011

Note: *P627 and other Indian Ocean routes to be described could be included subject to coordination with neighboring FIRs and safety criteria requirements.*

Establishment of an India EMA

2.32 Discussion took place with regard to the establishment of an Indian EMA. A pathway was suggested to be used by India and, in addition, it was noted that India would coordinate with SEASMA (CAAS) to assist in this project.

2.33 A sample of an Operational Letter of Agreement (LOA) between Air Traffic Service (ATS) authorities for Monitoring of Aircraft Navigation Errors in the South China Sea Area was presented. It was suggested that this sample could be modified for use in the Bay of Bengal and Mumbai Oceanic area and be available to States concerned.

BOBCAT Data Collection Analysis

2.34 The meeting was given a detailed analysis and overview of operational data by Thailand on westbound flights operating into the Kabul FIR from the commencement of full ATFM operations in July 2007 to December 2009.

Agenda Item 3: Operational Issues

Results of traffic analysis on RNAV Route N571, P628 and L510

Report by Malaysia

3.1 Malaysia advised the meeting that they had conducted a survey and data collection between 15 March and 15 April 2010 H24 on the three RNAV routes, RNAV route N571, P628 and L510, for implementation of reduced longitudinal separation where applicable to 50 NM in their applicable airspace.

3.2 A total of 2245 aircraft were recorded using these routes during the one month period. From the analysis result shown in **Figure 1**, 74.3% of traffic eastbound and westbound were using N571 whereas only 25.7% are operating on P628/L510 (uni-directional routes).

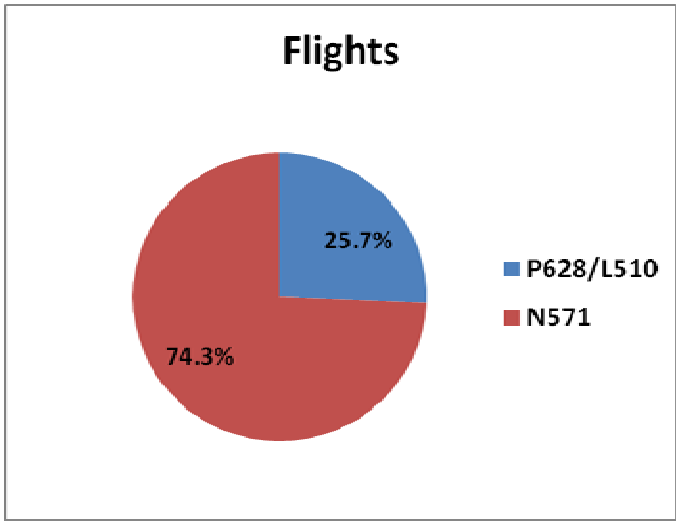

Figure 1: *P628/N510 and N571 Traffic Distribution (15 March 2010 and 15 April 2010)*

3.3 The meeting was advised that, of the N571 traffic in **Figure 1**, 55.3% were data link equipped aircraft in comparison to 44.7% of the aircraft who did not register data link equipment onboard as shown in **Figure 2**.

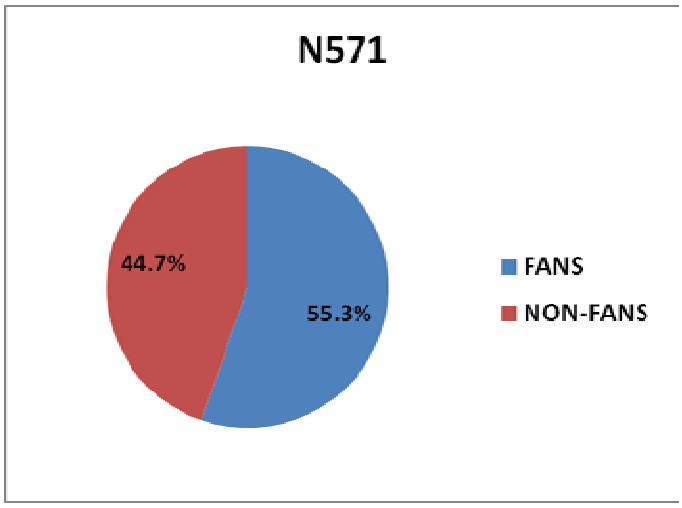

Figure 2: *Data Link Capability of Aircraft Using N571 (15 March – 15 April 2010)*

3.4 In respect to uni-directional RNAV routes P628/L510, 84.9% of aircraft were data link equipped aircraft with 15.1% without data link as shown in **Figure 3**.

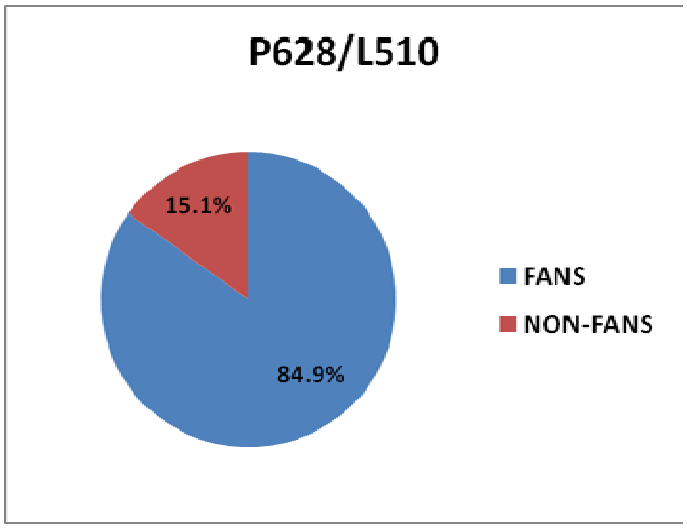

Figure 3: *Data Link Capability of Aircraft Using P628/N510*

Studies on mix separation environment in Kuala Lumpur FIR

3.5 Malaysia advised the meeting that, during the data analysis, they concluded that there may be additional workload for ATC in the Bay of Bengal sector/area when using a mix of longitudinal separation between data link and non data link aircraft. This included:

a) *Increase of ATC workload and possible delay* – westbound traffic movement are from several airports located nearby as shown in **Figure 4**. 29.8% westbound traffic departed from Singapore (WSSS), 15.1% westbound traffic departed from Kuala Lumpur (WMKK) and another1.2% westbound traffic from other airports. The remaining 53.9% were eastbound traffic.

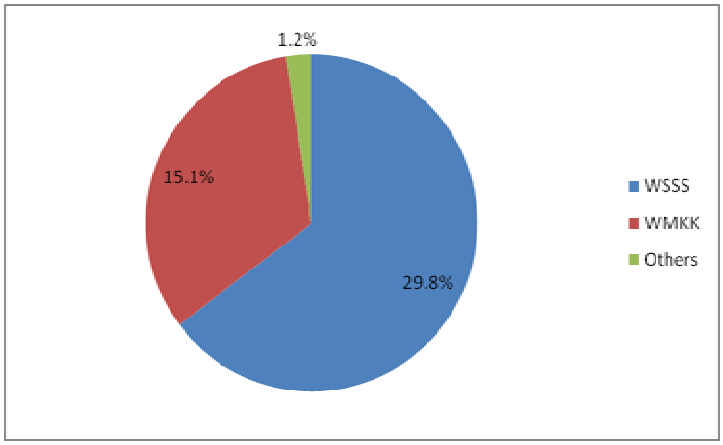

Figure 4: Westbound Traffic

b) 10mins MNT (80nm) longitudinal separation is needed between non-data link equipped aircraft and between non data link and data link equipped aircraft. Meanwhile 50 nm (7 minutes) longitudinal separation is needed between data link equipped aircraft in the Non-RADAR area within Bay of Bengal.

c) *Unable to climb to a higher level* - Most of the westbound non data link aircraft are short range and able to climb directly to a higher level whereas most of the westbound data link equipped aircraft are long range and too heavy to climb to a higher preferred level in the initial stage of the flight as shown by the chart in **Figure 5** and **Figure 6** below.

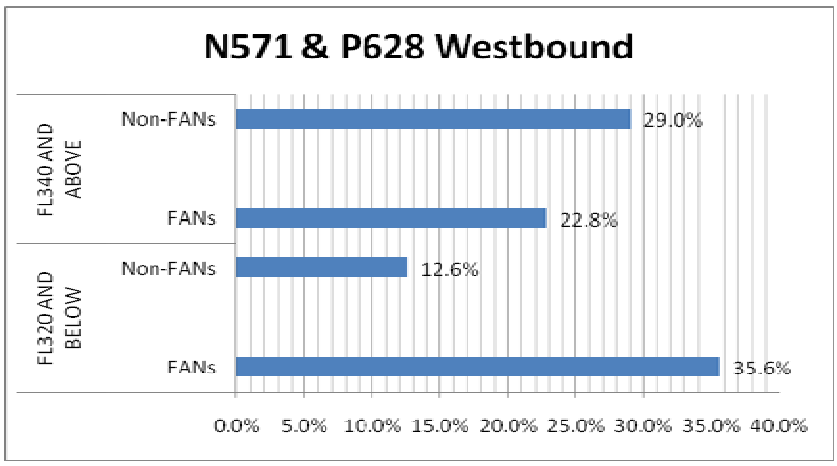

Figure 5: *Majority of Data Link Aircraft were at lower levels in the initial stage of flight whereas most of non data link were at higher levels*

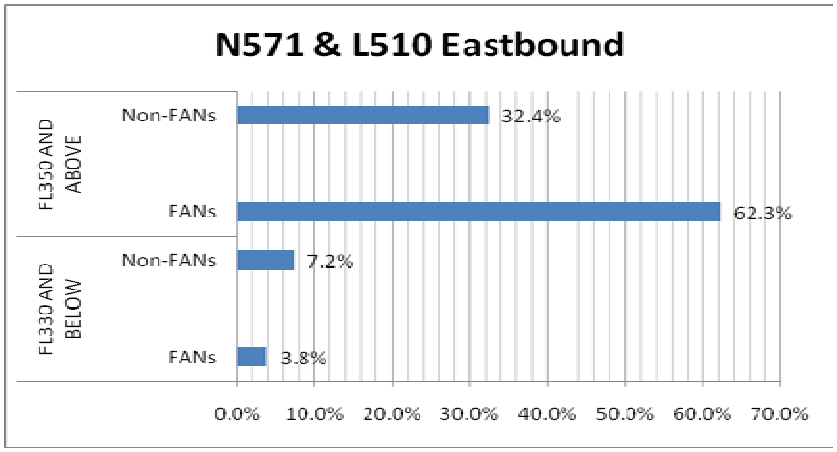

Figure 6: *Most of Data Link aircraft were at higher levels while most of non data link aircraft were at lower levels*

d) With the different occupancy of flight levels for data link and non data link aircraft flying westbound and eastbound, the same level band allocation may penalize aircraft if both RNAV route (N571 and P628/L510) were to be selected for the implementation trial.

e) The westbound data link aircraft usually will climb to a higher level outside radar and VHF coverage area which are 24mins (192 nm) for P628 and L510 and 17mins (136nm) for N571 as shown in **Figure 7**.

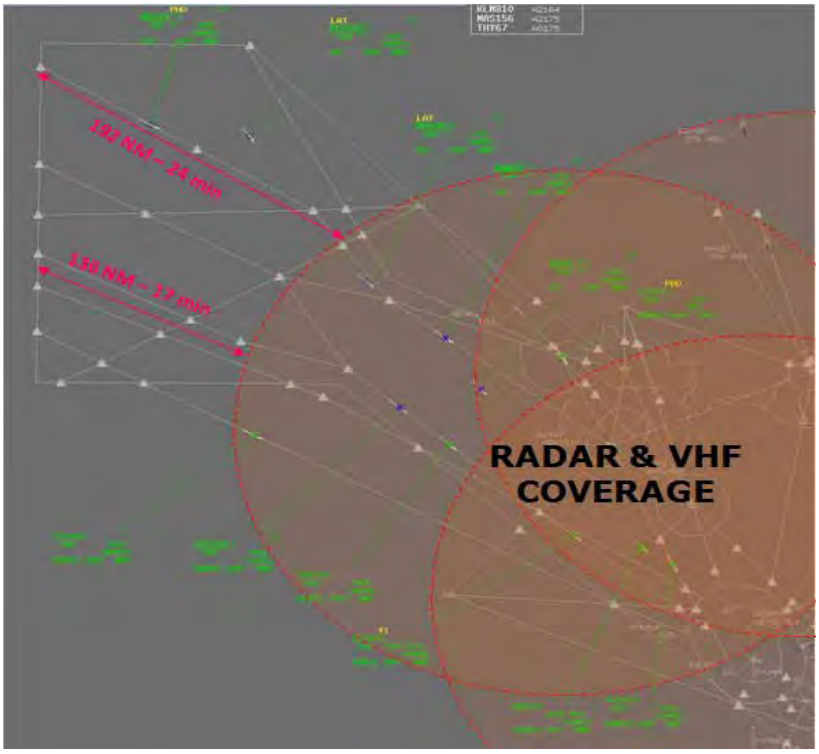

Figure 7: *Radar and VHF Coverage for P628 and L510*

3.6 The meeting was also advised that upgrade of their ADS/CPDLC system was completed on 7 May 2010. A joint system test with Boeing Lab and Chennai OCC was undertaken on 29 April as well as a system test in cooperation with Malaysia Airlines was performed on 27 and 29 April 2010. The ADS/CPDLC system is now working satisfactorily while limited time trial has resumed according to plan. Further, it was advised that ADS/CPDLC training course continue to progress as scheduled. The target date for H24 data link services in October 2010 remains as planned.

India's view on the implementation of BOB-RHS RNP10 Routes

3.7 India proposed the following phases:

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

3.8 RNP 10 ATS route N571 may be considered for 50 NM separation with level band restriction (F340 – F390)

3.9 RNP10 ATS route P628 may be considered for 50 NM separation on an opportunity basis (Since the route is unidirectional(West Bound flights) and controllers may gain experience handling mixed environment traffic)

3.10 RNAV route P628 has VHF and/or CPDLC coverage over the Bay of Bengal. This route is a very popular especially in regard to the heavy traffic movements during the ATFM/BOBCAT period for westbound aircraft. However the route P628 converges with other RNP routes beyond waypoint 'TIGER'. Creation of parallel route through Pakistan's airspace and RVSM and RHS implementation by Afghanistan may help India to reduce the congestion over the point especially in the light of RHS implementation.

3.11 The meeting was advised that, during the heavy westbound traffic period where the ATFM/BOBCAT system is employed to manage the aircraft through the Kabul FIR, the issue of too many aircraft operating over position TIGER should not occur due to the BOBCAT allocations which are metered out to aircraft prior to departure. The meeting also recalled that Afghanistan has stated that they will also be looking positively at reducing the longitudinal spacing of aircraft to 50 NM within the Kabul FIR. When this has been agreed to, AEROTHAI will adjust the BOBCAT mechanism to meter aircraft at a faster rate where possible.

3.12 RNP10 ATS route P762 may be considered for 50 NM longitudinal separation on an opportunity basis provided the remote VHF site becomes operational or CPDLC is available within the Yangoon FIR as well as datalink is made available in the Colombo FIR before the introduction of Phase 1.

SSR radar and VHF Communications Coverage within the Bay of Bengal and Arabian Sea

3.13 The meeting noted that it has been some time since a request for SSR radar and VHF communications coverage has been asked for. The meeting was requested to provide SSR radar and VHF communications coverage chart to assist in planning future initiatives in relation to reduction of longitudinal separation in these areas. Charts were supplied by India, Indonesia, Malaysia, Maldives, Singapore, Sri Lanka and Thailand and are shown in **Appendix C** to the Report.

3.14 Thailand advised that they would be prepared to investigate the possibility of combining all these charts showing both radar and VHF coverage over the entire area of the Bay of Bengal and Arabian Sea at FL290, which could prove useful for regional planning in the introduction of new ATM initiatives throughout this part of the region. The meeting thanked Thailand for their support on this matter.

Summary of Discussions of the ASIOACG/5 Meeting

3.15 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.

3.16 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.

3.17 IATA presented to this meeting IATA's vision for the establishment of a User Preferred Routes (UPR) geographic area. This would not interfere with the major route structures where the traffic is low-medium density with two primary flows, Middle East - Australia and South/ South East Asia - Africa. The meeting agreed that UPRs was the primary objective for this part of the region and would be specified as part of the work program for the CNS/ATM sub group of ASIOACG. The sub group has already done some work in this regard and will develop a strategy for implementation.

3.18 Australia presented to this meeting a summary of the principles and work undertaken by the ASPIRE partnership. An Indian Ocean specific partnership was proposed dubbed INSPIRE (Indian Ocean Strategic Partnership to Reduce Emissions). The proposal called for 3 or 4 partners initially who committed to undertake proving flights followed by the establishment of a work program that would enable regular use of the environmental initiatives.

3.19 IATA reminded the meeting about the role of the CRA and asked how it should function in the Indian Ocean region noting the increasing availability of data link capabilities throughout the region. They noted the existence of the FIT-BOB and that Melbourne FIR were covered by the FIT as part of ISPACG. IATA questioned where other States would conform and what mechanism existed for trans-regional arrangements. As a result, the meeting asked IATA to prepare a paper summarizing the issue for presentation at the appropriate ICAO regional meetings in ASPAC, MENA and AFI.

3.20 Finally IATA advised the meeting that from November 2009, RNP4 30/30 separations were available within the Melbourne FIR on an opportunity basis. Melbourne now provided separations dependent on aircraft capabilities including 10 minutes (or 80nm), RNP10 50/50 and RNP4 30/30 separations. At this stage they provided these services without the aid of a conflict probe although they expect that this facility would be operational later this year.

Exclusive or non-exclusive use of 50 NM longitudinal separation

3.21 The meeting noted that the question as to whether to mandate for exclusive or non-exclusive use of 50 NM separation between aircraft operating on defined RNAV routes have been discussed at previous BOB-RHS/TF meetings. It was mentioned to the meeting that a solution to this issue needs to be addressed so that planning for the implementation of RNAV 10 50 NM longitudinal separation on RNAV routes in the area under consideration can move forward in Phase 1 of the project within the timeframe agreed to at the BOB-RHS/TF/2 meeting.

Aircraft population on specific routes and percentage of Data Link Capability

3.22 The task force was reminded that in considering the use of exclusive or non-exclusive levels on particular routes, the following items should be taken in consideration:

a) the present population of aircraft and forecast growth; and,
b) the number of present aircraft with data link capability.

Exclusive routes for data link aircraft or mixed air traffic

3.23 Working Papers were presented by States on this matter highlighting their own positions and various options available to the meeting. It was decided that a small working group (SWG) be formed involving the Bay of Bengal States concerned and 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 three primary routes of N571, P628 and the crossing route P762, the latter being the subject of further discussions with Myanmar.

3.24 The meeting 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 advised that, with the implementation of RNP10 50 NM longitudinal separation, no levels were exclusive and the application of 50 nm separation was achieved on opportunity basis between data link equipped aircraft. In case where one aircraft was non-data link, 10 minutes (80 NM) separation was used.

3.25 The meeting 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.

3.26 The meeting recalled that in both BOB-RHS/TF/1 and BOB-RHS/TF/2, several compromises were suggested such as sharing particular levels and reserving other levels for 50 NM longitudinal operations. It is considered that all options should be once again discussed in looking for an equitable solution.

3.27 The meeting 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, as such it should be kept in mind when making decisions in regard to procedures to be applied.

3.28 The meeting accepted that is Phase 1 of the task force, which plans to implement 50 NM longitudinal separation on three RNAV routes mentioned in para 3.23 above. The meeting was advised that there were ATC concerns in the adoption of this procedure due to the difference between data link to data link separation vis-à-vis data link to non-data link separation on the same route especially in regard to N571. 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 would be applied to data link equipped aircraft on N571 for a period of two AIRAC cycles after implementation of Phase 1.

Agenda Item 4: Safety Analysis and Airspace Monitoring Issues

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

4.1 The meeting 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). This is to ensure that the target level of safety (TLS) of the operations within the airspace in question meets the regionally established TLS.

4.2 Monitoring of aircraft navigation errors is a joint responsibility between the aircraft operators, the States of Registry, and the air navigation services providers of the FIRs concerned. An established program by means of a Letter of Agreement (LOA) could clearly spell out the responsibilities and procedures to be followed by respective States and FIR authorities.

4.3 The meeting noted that currently, there is no established regional reporting framework for aircraft navigation errors over the Bay of Bengal area since the implementation of the EMARRSH routes in 2002. Moving forward, to further improve safety and efficiency for flights traversing across the Bay of Bengal area, there is a need to the commencement of monitoring of aircraft navigation errors in the area.

4.4 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.

4.5 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.

4.6 The meeting was advised that an LOA should be put in place as agreed 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

4.7 The meeting 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.

4.8 In 2004, the Regional Airspace Safety Monitoring Advisory Group (RASMAG) of APANPIRG 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.

4.9 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

4.10 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.

4.11 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.

Safety Assessment

4.12 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.

4.13 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

4.14 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.

4.15 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

4.16 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 attached as **Appendix D**.

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

4.17 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 Atlanta, USA to understand the safety monitoring establishment and its operation. The visit is tentatively scheduled at the end of July, 2010.

4.18 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.

4.19 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.

4.20 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. The PowerPoint presentation is shown in **Appendix E** to this Report

Agenda Item 5: Post-Implementation Management Considerations

5.1 There was no discussion on this agenda item.

Agenda Item 6: Future Direction and Arrangements

6.1 It was mentioned to the meeting that air traffic has continued to grow in the Bay of Bengal and Arabian Sea areas, necessitating ongoing solutions to manage this expansion of air traffic.

6.2 It was also mentioned that, due to an upsurge of traffic between Southeast/ Southern Asia and Europe, especially during the westerly peak period at night, as well as substantial growth by flights operating between Southeast/Southern Asia and the Middle East, changes in ATM procedures have been introduced to cope with this increase of aircraft. Two larger projects were successfully implemented in the EMARSSH route structure and the introduction of RVSM in the Asia and Pacific regions as well as the Middle East region.

6.3 Another more recent example was when the ATFM/BOBCAT procedures were introduced on an operational trial basis in 2006. The number of aircraft using the system during the four hour period transiting the Kabul FIR then averaged 37 movements per night. That figure has increased over the past 4 years to averaging 62 movements during the same 4 hour period; a percentage increase of over 80%.

Terms of Reference of the BOB-RHS/TF

6.4 The meeting was reminded that the Terms of Reference for the Bay of Bengal Reduced Horizontal Separation Task Force (BOB-RHS/TF) 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."

6.5 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.

Unidirectional Routes already established within the APAC region

6.6 The meeting noted that in other areas of this region unidirectional routes have been established. For example, in the South China Sea (SCS), 6 RNAV unidirectional routes have been operational for some years. They are:

Figure 8: Unidirectional Routes Implemented in the APAC Region

Route designator	Direction
L642	Southwest
M771	Northeast
N892	Southwest
L625	Northeast
N884	Northeast
M767	Southwest

6.7 Each RNAV route mentioned above now use unidirectional procedures for managing aircraft. Aircraft on designated southwest routes may choose any level, except levels reserved for crossing aircraft. Similarly, aircraft operating on designated northeast routes may choose any level except levels reserved for crossing aircraft. In summary, aircraft operating on the designated routes described in the Table above, which have a minimum of 60 NM lateral spacing, have the opportunity of using even or odd flight levels in either direction. This ability of a wider range of levels gives more flexibility and efficiency to their operations.

Proposed procedures for aircraft crossing the major traffic flow in the SCS

6.8 The meeting was also informed that, in regard to the crossing routes, which have less traffic than the north/south flow, the South East Asia Route Review Task Force (SEA-RR/TF) is presently looking at a single crossing route being divided into a pair, appropriately spaced by not less than RNAV RNP 10 requirements to allow aircraft to use the same level in either direction crossing the major traffic flow. This would increase level usage on these routes and at the same time, may allow some of these levels to be used for the busier major traffic flow.

6.9 Once aircraft are within radar coverage on the crossing routes, the distance between these two routes is decreased so that they would eventually come together as one route using normal ATC procedures regarding flight level allocation and separation requirements.

Unidirectional Routes over the Bay of Bengal and the Arabian Sea

6.10 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 SCS 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.

6.11 In considering whether there is merit in pursuing this topic further, there were some additional factors which should be taken into account. Amongst these are:

a) Whether any proposed changes should be looked at on a route by route case or all together;

b) Changes to the longitudinal and vertical elements of any present ATM procedure, especially with regard to aircraft involved in the ATFM/BOBCAT system through Kabul FIR; and

c) Agreement with all States concerned.

6.12 The meeting [was advised that the unidirectional route concept has been implemented in other parts of the Asia and Pacific region as well as other regions where there is a safe, operational and efficiency benefit to do so. By the name “unidirectional”, it indicates that this concept would have two criteria:

a) that no aircraft can flight plan nor proceed in the opposite direction on this classified unidirectional route; and,

b) where necessary to do so, specific flight levels required for routes crossing the unidirectional route would be allocated for these aircraft and may not be used for aircraft operating on the unidirectional route. As an example:

i) unidirectional route A (high traffic density) – levels allocated are FL,300, 310, 330, 350, 360, 380, 400.

ii) crossing route B (low traffic density) – levels allocated are FL 290, 320, 340, 370.

6.13 There may also be the case where, to allow the major traffic flow to have additional flight levels, the crossing route could be split into 2 routes laterally separated outside radar coverage, which would allow this pair of routes to use the same flight levels. This procedure would allow the major traffic flow to have additional flight levels previously delegated in the example above.

6.14 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.

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

7.1 The meeting reviewed the draft Task List as shown in **Appendix F.**

Agenda Item 8: Any Other Business

8.1 The meeting was advised that since the BOBCAT system becoming fully operational in July 2007, there have been no software changes apart from minor configuration changes to enable usage of B466 (SERKA-PAROD) and UL333 (SERKA-SOKAM) route segments in August 2008.

8.2 The meeting was advised that AEROTHAI had purchased additional hardware in 2009 with the plan to migrate the BOBCAT software to the new servers, which would enhance energy-efficiency of the system as well as flexibility in managing operations of BOBCAT.

8.3 In cooperation with IATA, AEROTHAI conducted a BOBCAT Airline Satisfaction Survey (BASS) between January and March 2010. The results are presented in **Appendix G** to this report.

8.4 Based on results of the BASS, the following features were favored by the airlines in order of preference:

a) *Slot Swapping:* assisted swapping of slots between two aircraft managed by the same airline ensuring that swapping aircraft's slots are retained;

b) *Smart Slot Allocation Refresh:* slot allocation page refreshes more frequently when slot allocation times presented in the page are approaching;

c) *Pop-Out Slot Allocation Sections:* sections of slot allocation pages such as "recently used slot allocation" can be popped out to another window to enhance ease of monitoring;

d) *Adjustable Slot Allocation Refresh Interval:* slot allocation page refresh intervals can be adjusted from the current default of 180 seconds (3 minutes);

e) *Automatic Slot Compression:* automatic delay reduction when opportunity occurs some set time ahead of AWUT when requested by airlines on an opt-in mechanism; slot compression can be programmed not to take place some certain time ahead of AWUT;

f) *Flexible Standard Taxi Time:* different standard taxi times within various airports based on airlines and/or gate/runway involved;

g) *Integration of Data Collection and Analysis:* integration of slot allocation with one-week-per-month ATFM data collected from ANSPs involved in respect to waypoint, time and flight level used in entering the Kabul FIR; and,

h) *Gate Delay Calculation:* automated calculation of "Gate Delay" based on last submitted slot request prior to initial slot allocation and AWUT in last accepted slot allocation

i) *Integrate actual traffic situation into "waypoint allocation":* This could be reviewed in conjunction with integration of data collection and analysis feature. Since flight plans contain routing information as well as elapsed time of entry into various en-route FIRs, flight plans sent to the Bangkok ATFMU can be analyzed in order to obtain traffic demand in the form of planned handover times between various FIRs based on flight plan and departure messages similar to current "waypoint allocation" page based on flight plan and departure messages.

8.5 In addition to items mentioned in para 8.4, there were additional requests from some of the airlines to be reviewed by AEROTHAI.

8.6 IATA supported the overall concept of the enhancements. However, due to current issues with AWUT compliance in some airports, they considerd that flexible taxi times should be implemented on a phased approach.

8.7 In general, States had no disagreement with the overall concept of the enhancements. However, they indicated that more time is needed to consider operational impact of flexible taxi time mentioned in para 8.4 f due to the apprehension of the aircraft to make their AWUT from these gates if this procedure was implemented.

8.8 Any changes will need dedicated coordination between the BOBCAT Development Team and States as well as IATA.

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

9.1 The meeting agreed that the Fourth meeting of the BOB-RHS/TF would be held on 18-22 October 2010 in Bangkok, Thailand. This meeting has been designated as the Go/No Go meeting for Phase 1 of the project.

Closing of the Meeting

9.2 In his closing remarks, the Chairman, Mr. Edmund Heng, thanked all participants for their positive attitude in discussions during the meeting. Particular thanks was given to India who has a major share of airspace under discussion with 3 FIRs involved in proposed changes to the present system in operation. They were also commended for their agreement to operate an Enroute Monitoring Agency (EMA) which would be responsible to assist all States concerned on each phase of implementation.

9.3 The Chairman also mentioned that, as part of the process of implementation, States would need to carefully plan their training requirements so that ATCs involved could have a smooth transition from the present arrangements to the new procedures which was a key area to ensure success of the project.

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	32 Mr. John Richardson	ATM Expert ICAO Asia & Pacific Office 252/1 Vibhavadi Rangsit Road Ladyao, Chatuchak Bangkok 10900 Thailand	Tel: 66-2-5378189 ext 151 Fax: 66-2-5378199 E-mail: jrichardson@bangkok.icao.int

LIST OF WORKING PAPERS (WPs) AND INFORMATION PAPERS (IPs)

WORKING PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
WP/1	1	Provisional Agenda	Secretariat
WP/2	2	Summary of Outcomes of the BOB-RHS/TF/2 Meeting	Secretariat
WP/3	3	Exclusive or Non-exclusive Use of 50NM Longitudinal Separation	Secretariat
WP/4	6	Uni-directional Routes over Bay of Bengal and Arabian Sea	Secretariat
WP/5	8	BOBCAT Airlines Satisfaction Survey Result	Thailand
WP/6	4	Letter of Agreement for Monitoring of Aircraft Navigation Errors in the Bay of Bengal Area	Singapore
WP/7	7	Update BOB-RHS/TF Task List	Secretariat
WP/8	3	Volume Analysis Report on RNAV Routes N571, P628, L510 and Consequential Actions	Malaysia
WP/9	3	India's Views on the Implementation of BOB-RHS on Exclusive/Opportunity Basis	India

INFORMATION PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
IP/1	-	List of Working Papers (WPs) and Information Papers (IPs)	Secretariat
IP/2	3	SSR Radar and VHF Communications Coverage within the Bangkok FIR	Thailand
IP/3	4	Enroute Monitoring Agency to Support Reduction of Horizontal Separation	Singapore

……

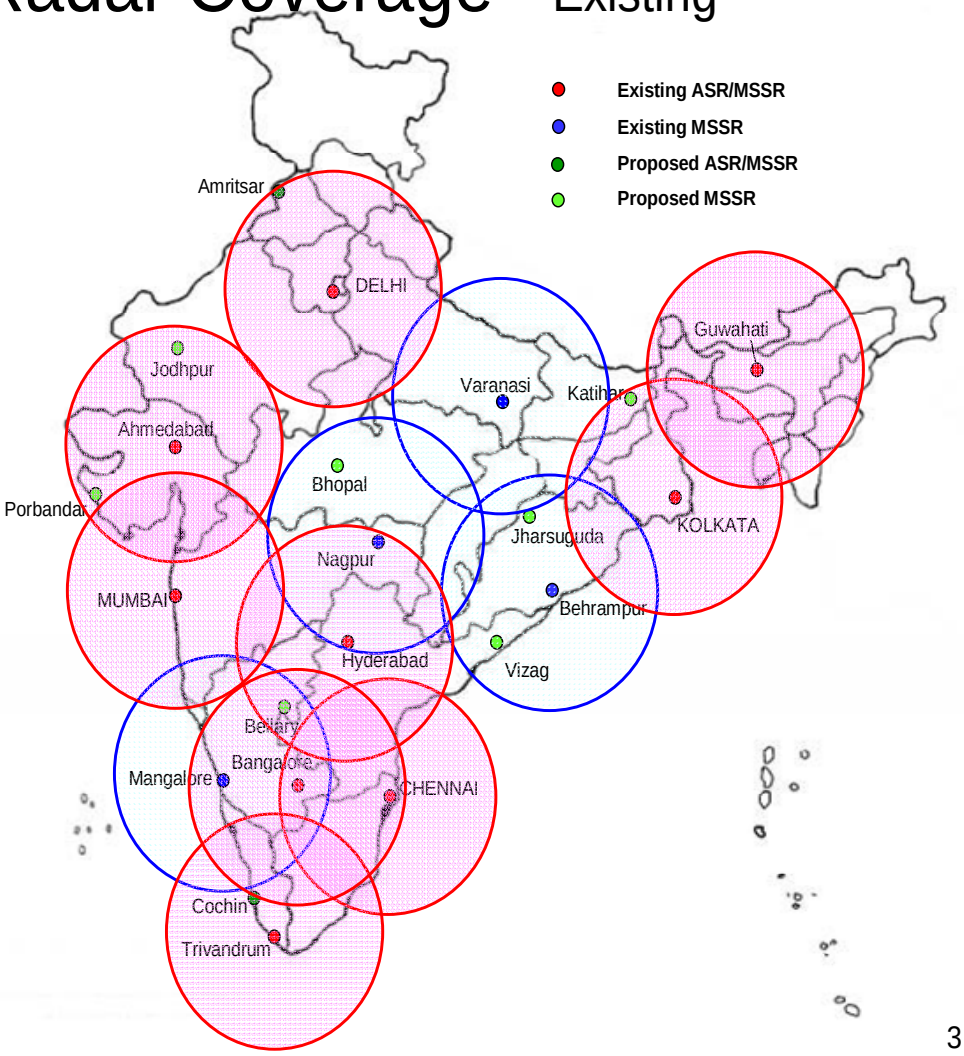
Radar Coverage- "Existing"

Existing ASR/MSSR

1. Delhi
2. Mumbai
3. Chennai
4. Kolkata
5. Ahmedabad
6. Hyderabad
7. Guwahati
8. Trivandrum
9. Bangalore

Existing MSSR only

1. Varanasi
2. Nagpur
3. Mangalore
4. Behrampur



Radar Coverage- “Proposed”

Existing ASR/MSSR

1. Delhi
2. Mumbai
3. Chennai
4. Kolkata
5. Ahmedabad
6. Hyderabad
7. Guwahati
8. Trivandrum
9. Bangalore

Existing MSSR only

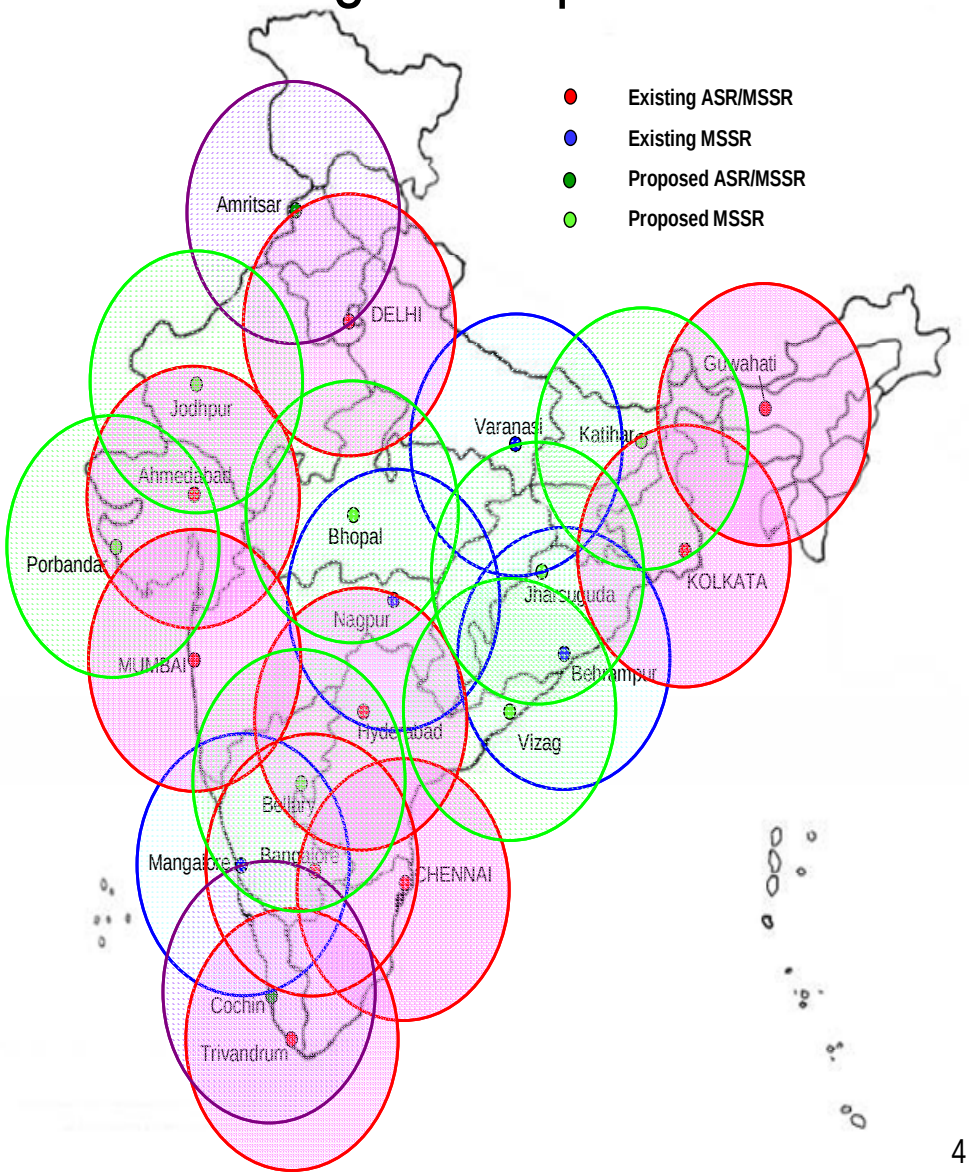
1. Varanasi
2. Nagpur
3. Mangalore
4. Behrampur

Proposed ASR/MSSR

1. Cochin
2. Amritsar

Proposed MSSR only

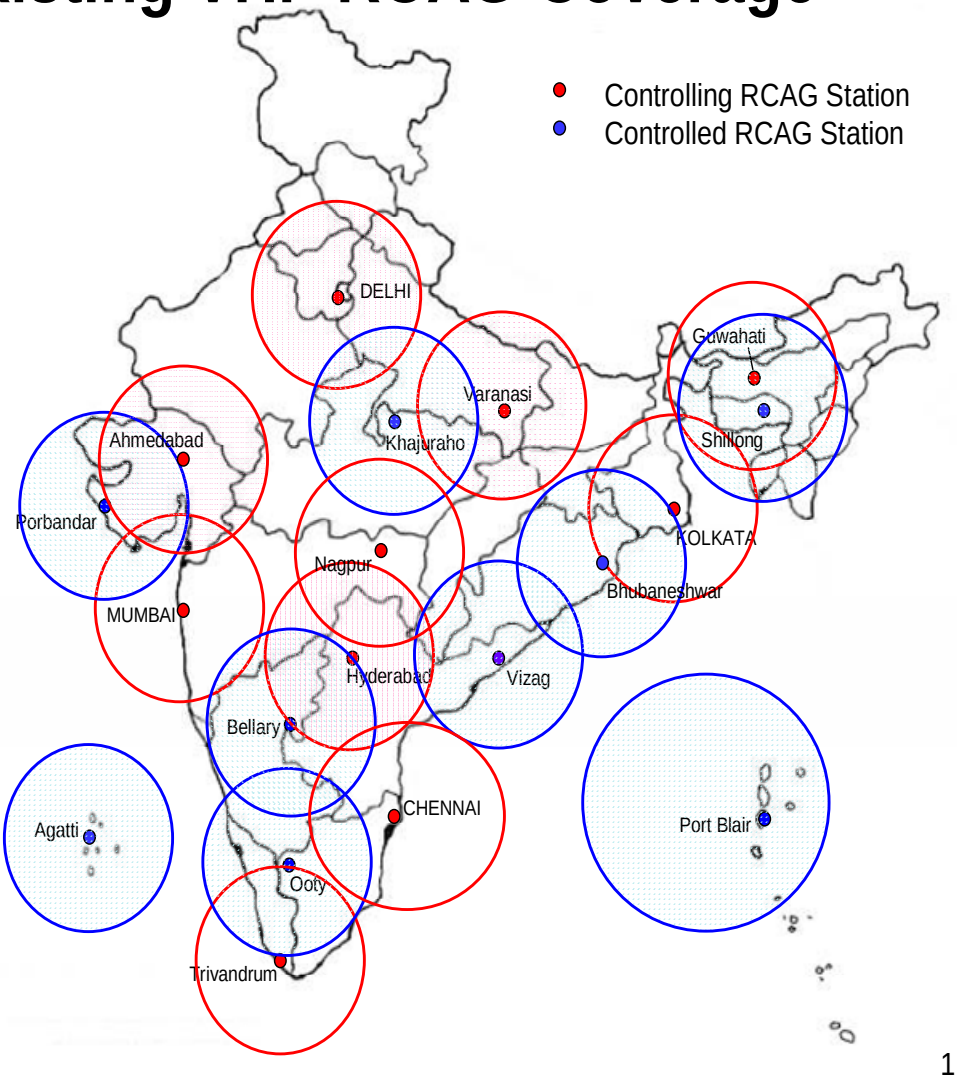
1. Jodhpur
2. Porbandar
3. Bhopal
4. Bellary
5. Vizag
6. Jharsuguda
7. Katihar



VHF/RADAR COVERAGE DIAGRAM FOR INDIAN FIRS

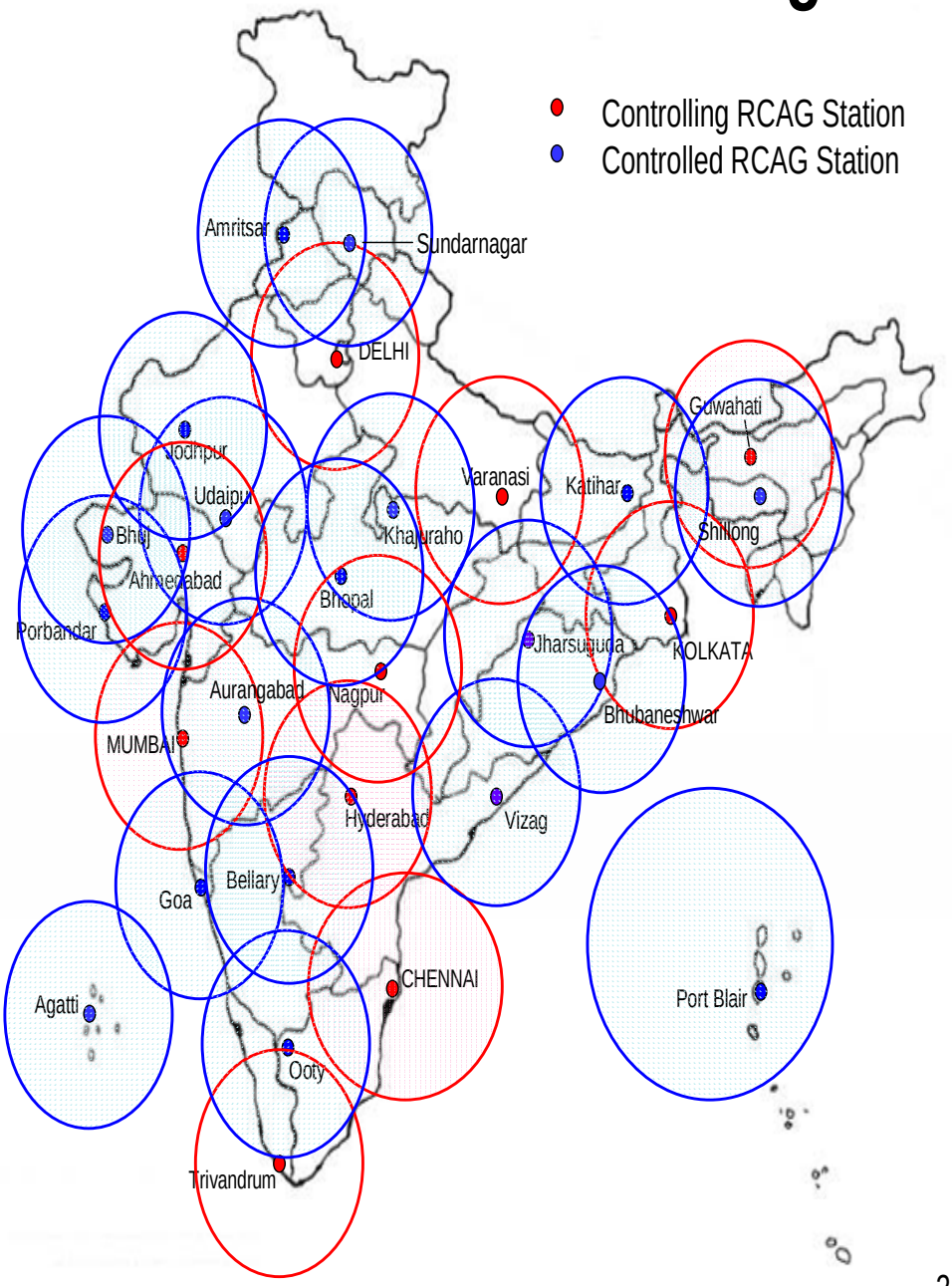
Existing VHF-RCAG Coverage

CONTROLLING	CONTROLLED
Delhi	Khajuraho
Chennai	Port Blair
	Bellary
	Vizag
	Ooty
Mumbai	Porbandar
Kolkata	Vizag
	Port Blair
	Bhubaneshwar
Guwahati	Shillong
Trivandrum	Agatti
	Ooty



Augmented VHF-RCAG Coverage

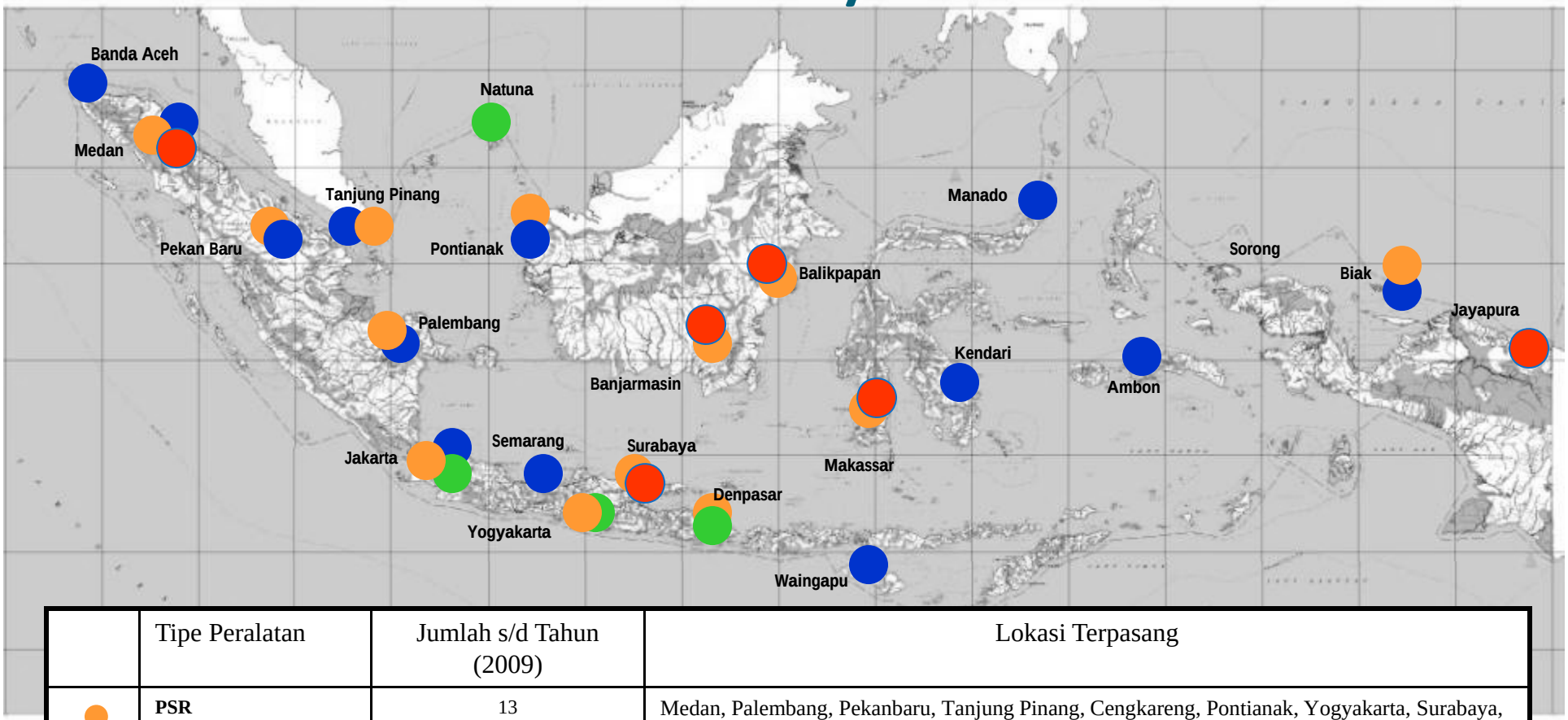
CONTROLLING	CONTROLLED
Delhi	Khajuraho
	Amritsar
	Jodhpur
	Sundarnagar
Chennai	Port Blair
	Bellary
	Vizag
	Ooty
Mumbai	Porbandar
	Aurangabad
	Goa
Kolkata	Vizag
	Port Blair
	Bhubaneshwar
	Jharsuguda
	Katihar
	Shillong
Guwahati	Shillong
Trivandrum	Agatti
	Ooty
Ahmedabad	Bhuj
	Udaipur
Nagpur	Bhopal



RADAR AND VHF FACILITIES LOCATION & COVERAGE

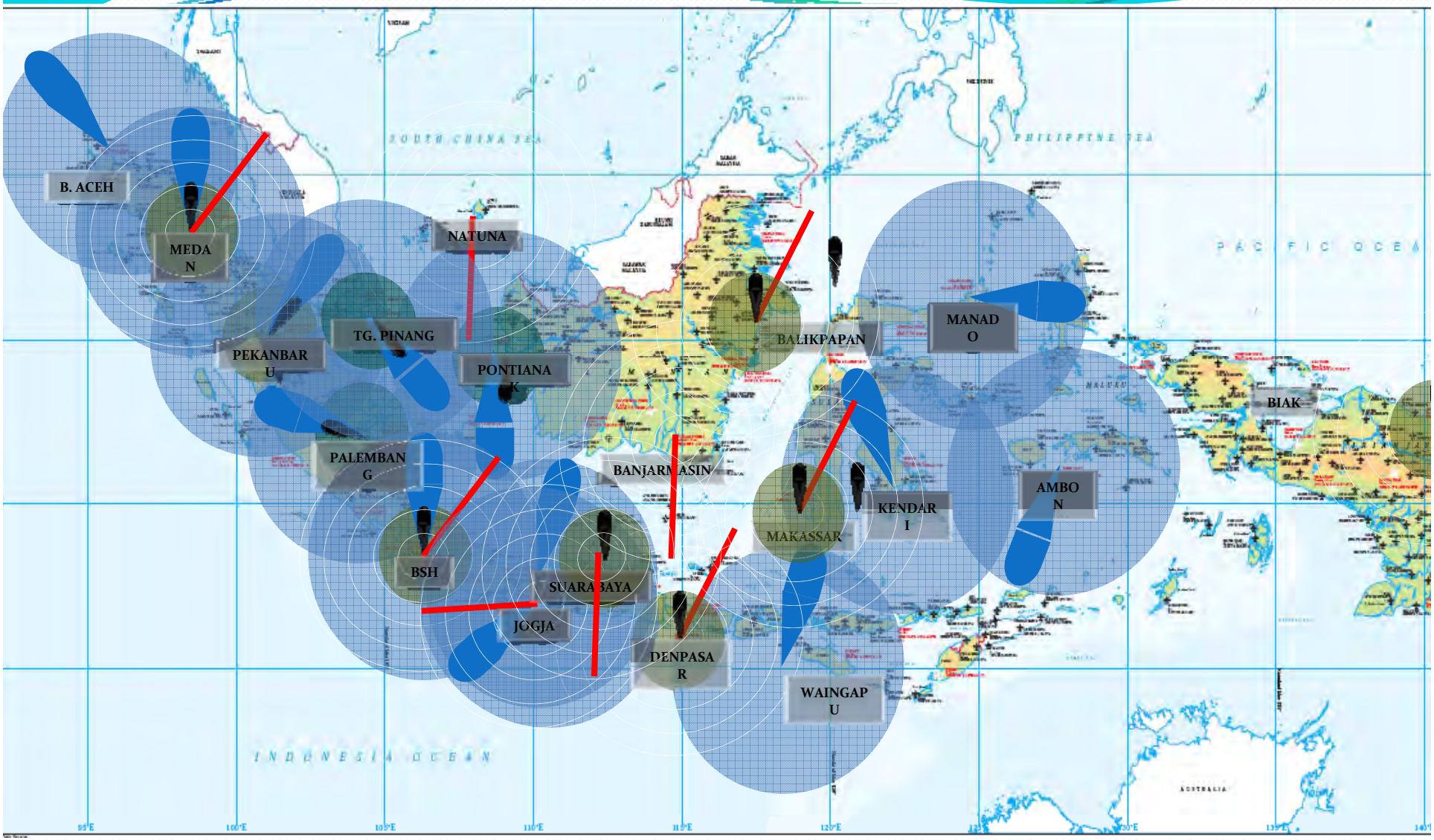
WITHIN INDONESIA AIRSPACE

36 Radar to year 2010



	Tipe Peralatan	Jumlah s/d Tahun (2009)	Lokasi Terpasang
	PSR	13	Medan, Palembang, Pekanbaru, Tanjung Pinang, Cengkareng, Pontianak, Yogyakarta, Surabaya, Denpasar, Makassar, Banjarmasin, Balikpapan dan Biak
	SSR	13	Banda Aceh, Medan, Palembang, Pekanbaru, Tanjung Pinang, Cengkareng, Semarang, Waingapu, Pontianak, Kendari, Manado, Ambon dan Biak
	MSSR	4	Natuna, Cengkareng, Yogyakarta dan Denpasar
	MSSR MODE-S	6	Medan, Makassar, Banjarmasin, Balikpapan, Surabaya dan Jayapura

RADAR COVERAGE



PSR

1. Jakarta
2. Medan
3. Pekanbaru
4. Palembang
6. Tg. Pinang
7. Ujung Pandang
8. Surabaya
9. Balikpapan
10. Biak
11. Denpasar
12. Jogyakarta
13. Jayapura

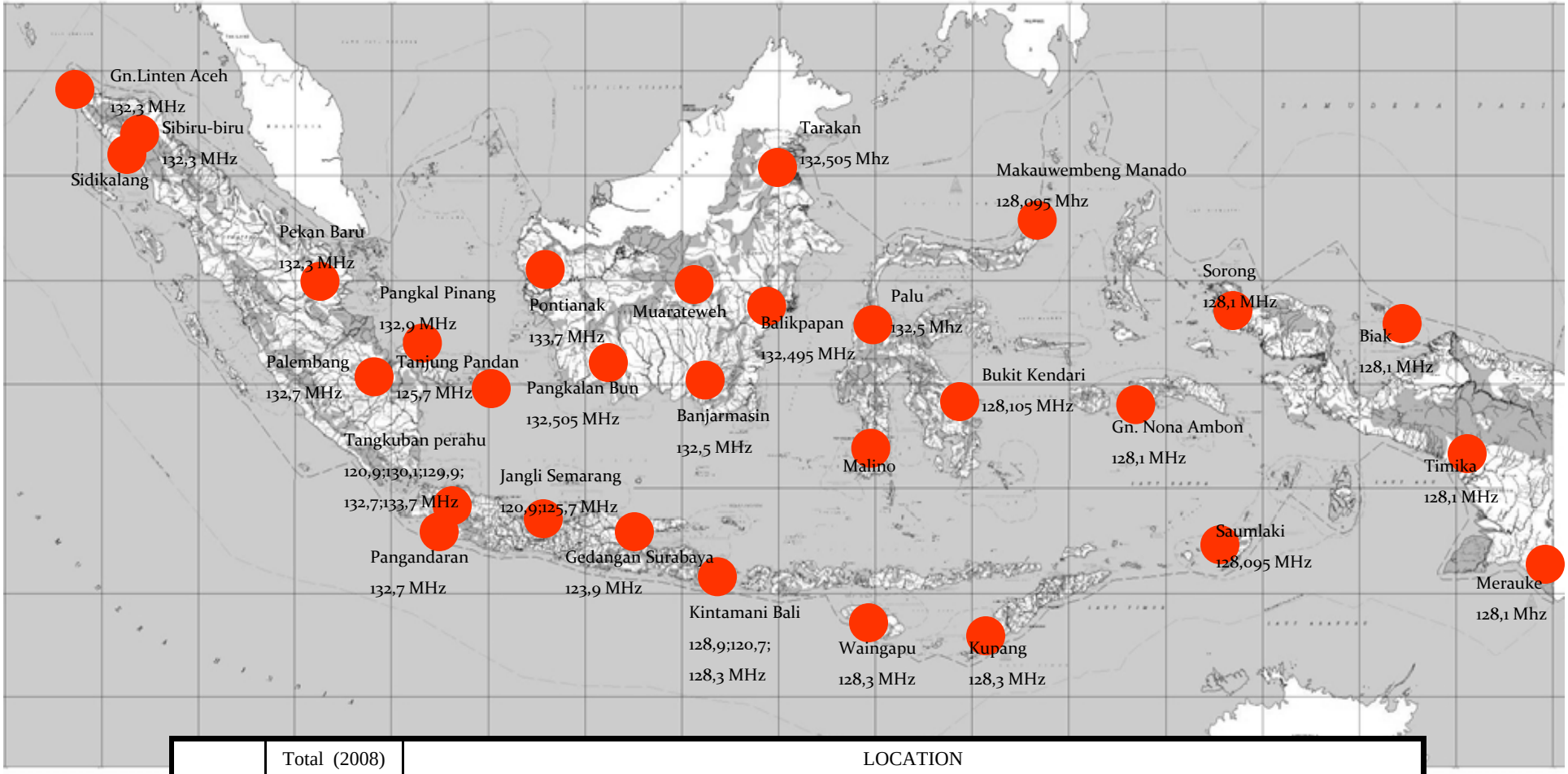
SSR

1. Jakarta
2. Medan
3. Pekanbaru
4. Palembang
5. Pontianak
6. Tg. Pinang
7. Banda Aceh
8. Semarang
12. Biak
13. Waingapu
14. Ambon
15. Menado
16. Kendari

MSSR

1. Natuna
2. Medan
3. Jakarta
4. Surabaya
5. Balikpapa
6. Yogyakarta
7. Denpasar
8. Jayapura
9. Banjarmasin
10. Makassar

VHF -ER IN INDONESIA

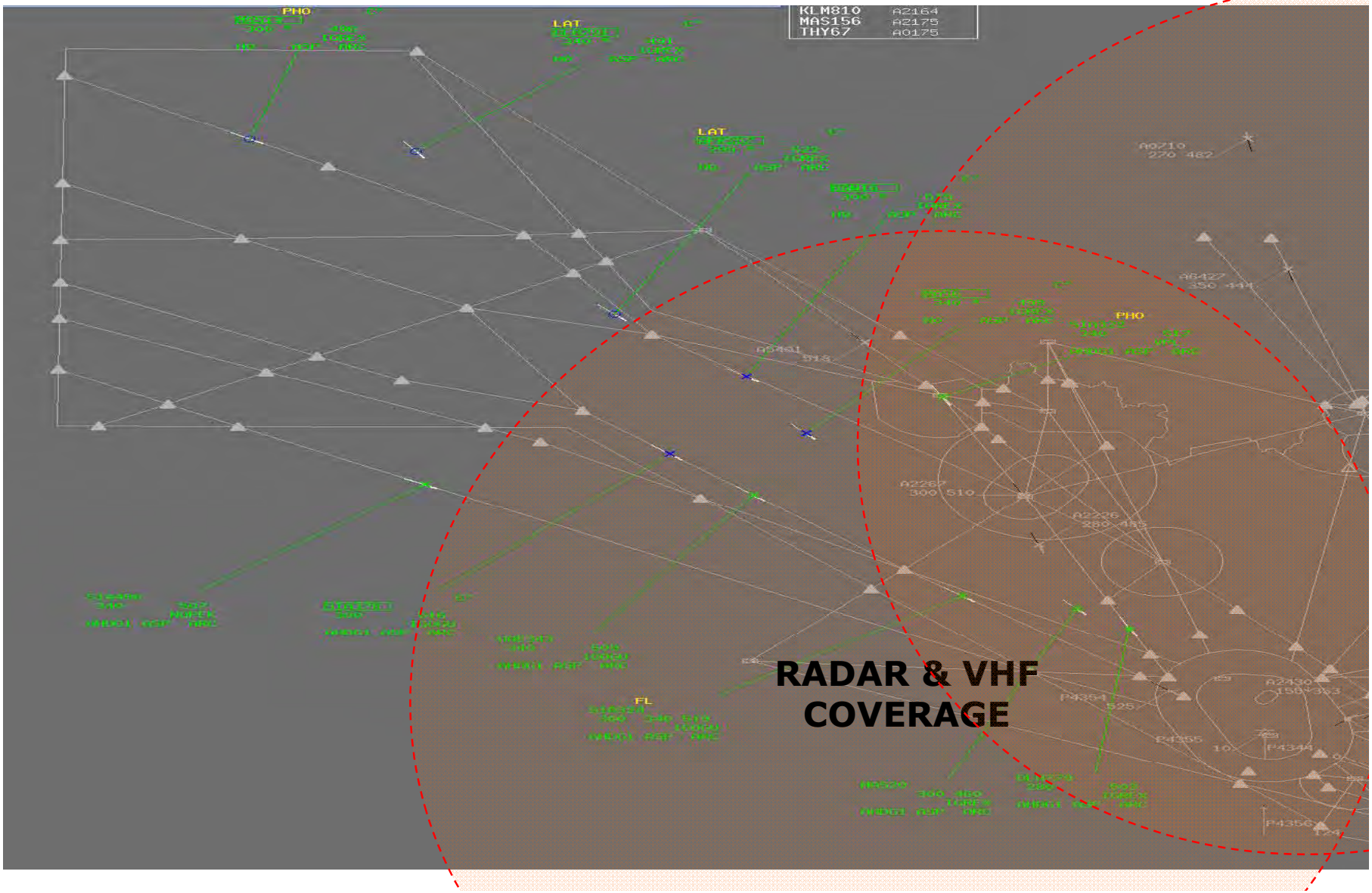


	Total (2008)	LOCATION
●	30	Gunung Linten Aceh, Pekan Baru, Sidikalang, Sibiru-biru, Pangkal Pinang, Palembang, Tanjung Pandan, Tangkuban Perahu, Pangandaran, Jangli Semarang, Gedangan Surabaya, Kintamani Bali, Pontianak, Banjarmasin, Pangkalan Bun, Tarakan, Muara teweh, Balikpapan, Palu, Malino,Bukit Kendari, Waingapu, Kupang, Makauwembeng Manado, Gunung Nona Ambon, Sorong, Saumlaki, Biak, Timika, Merauke

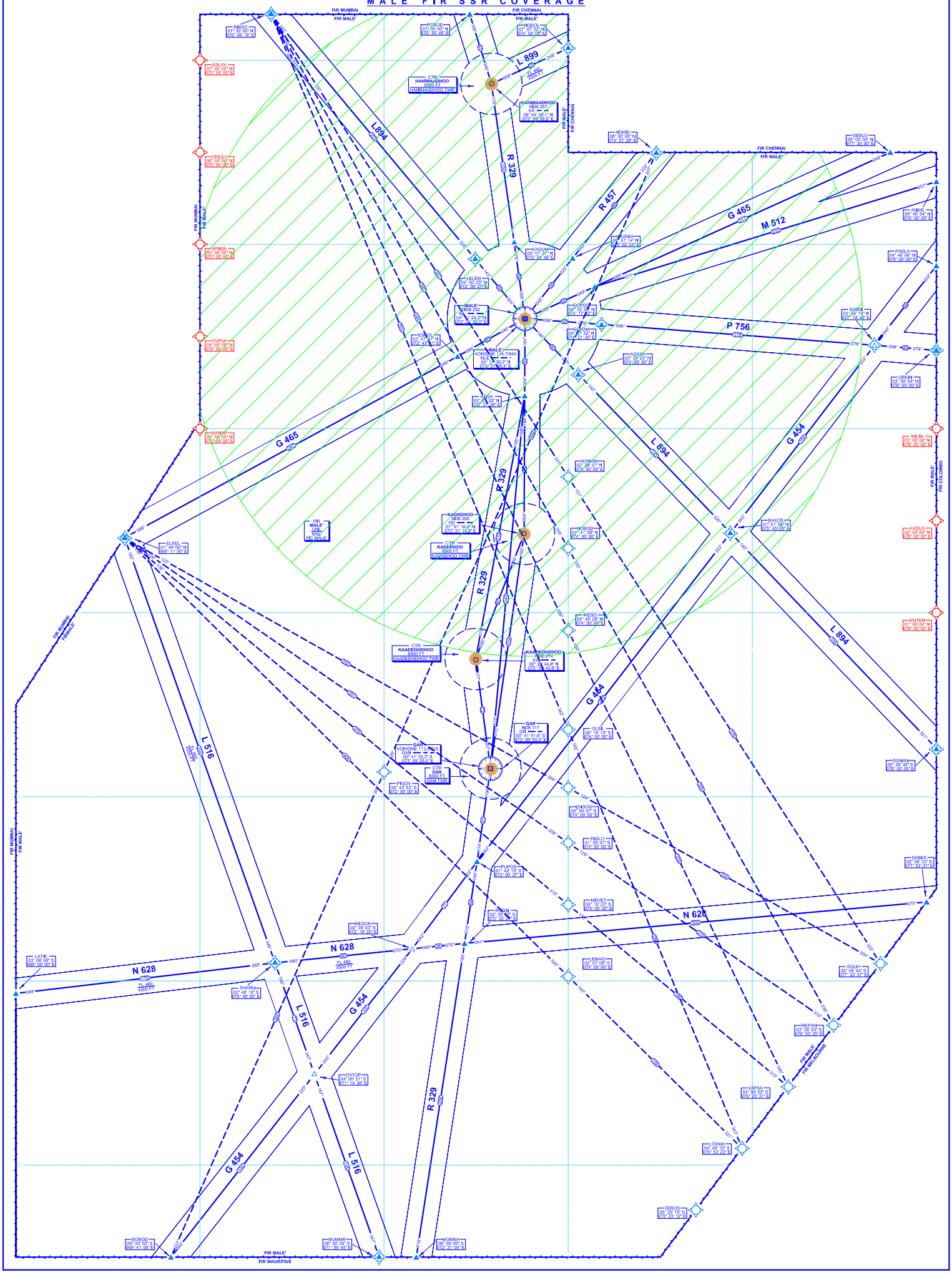
Coverage VHF – ER Indonesia

- VHF coverage in Upper Control Area (UTA) from FL245 to FL460. Total 78 units.

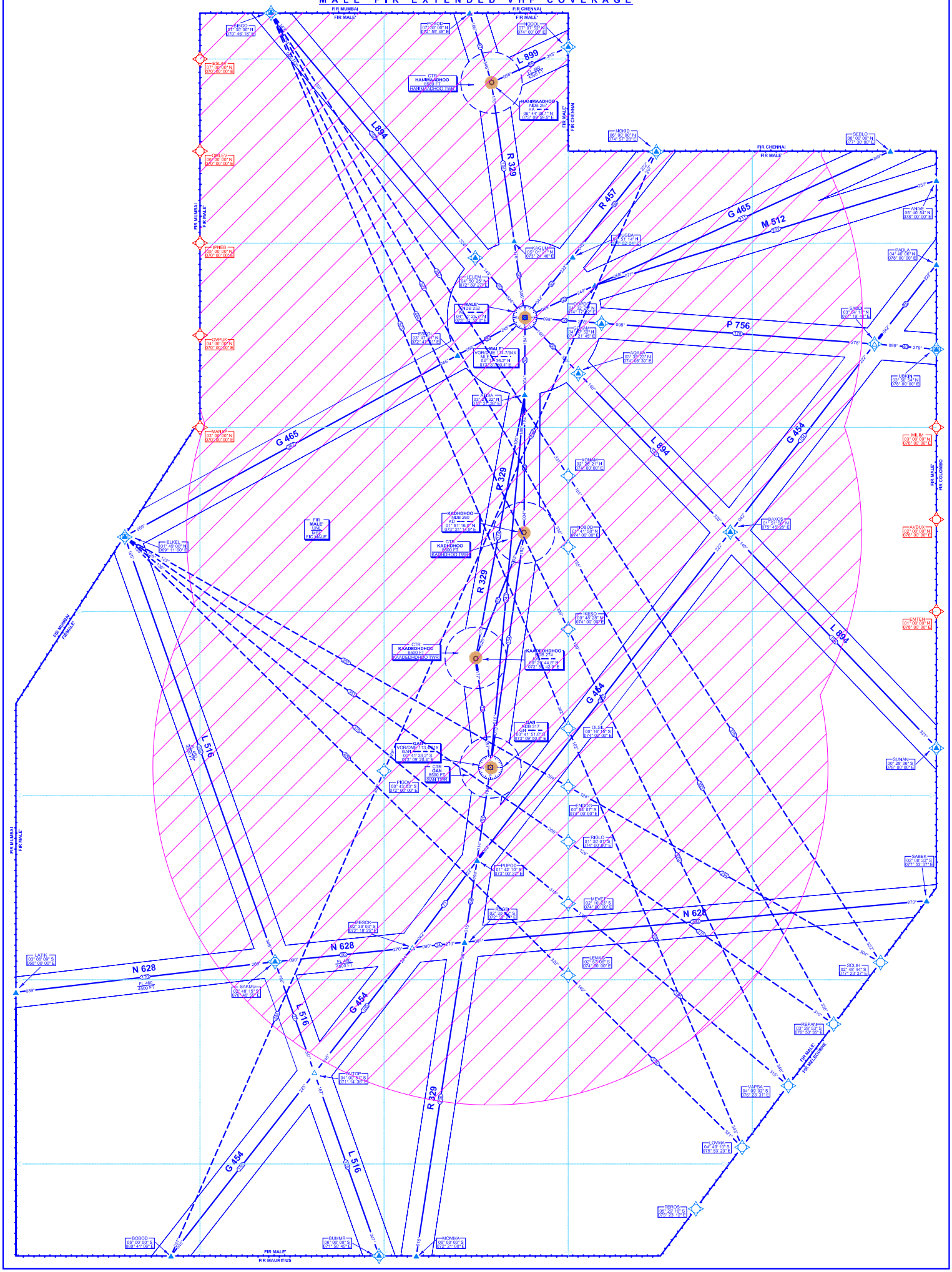
GENERAL RADAR PICTURE (GRP)



MALE' FIR SSR COVERAGE

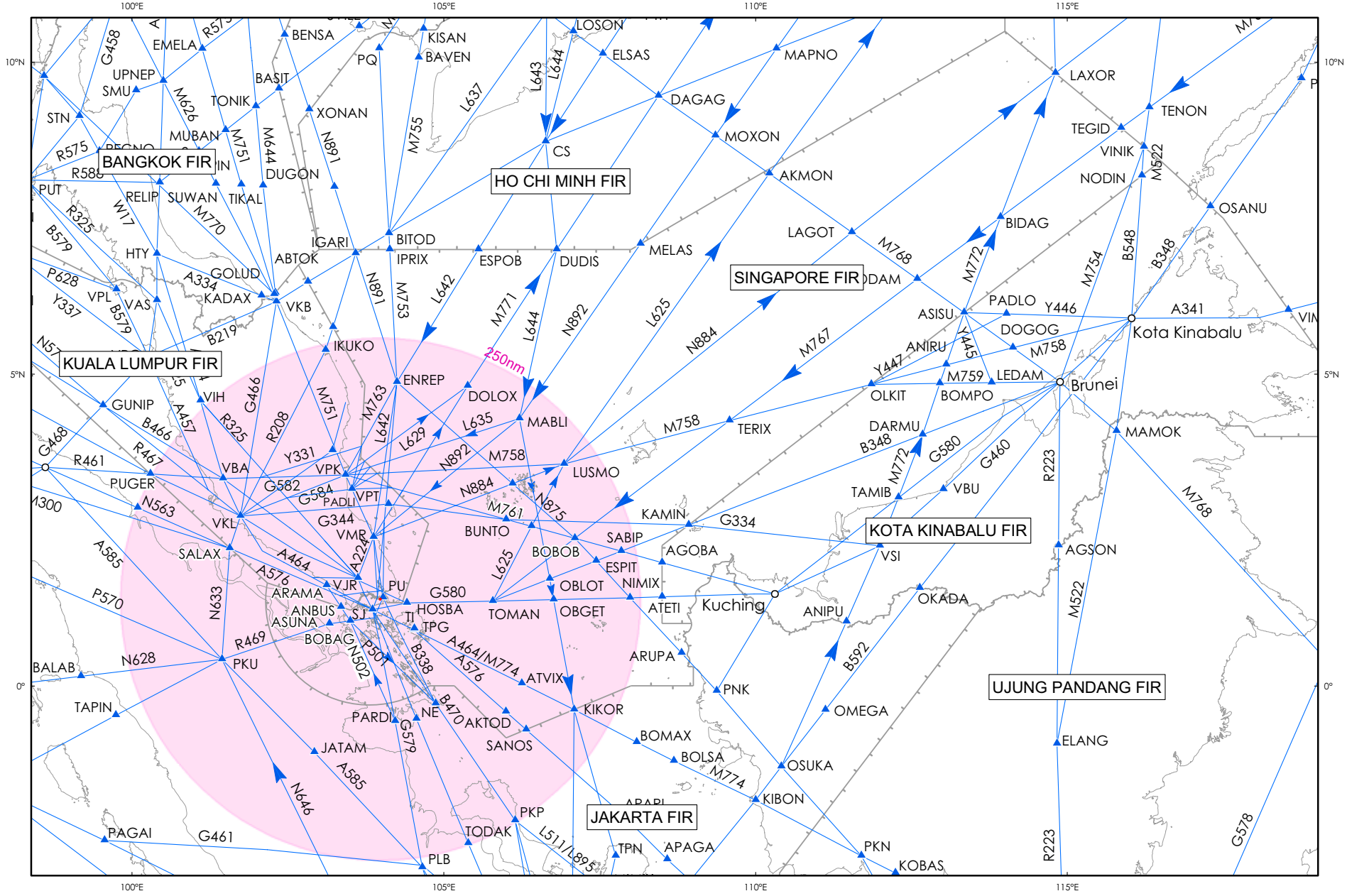


MALE' FIR EXTENDED VHF COVERAGE

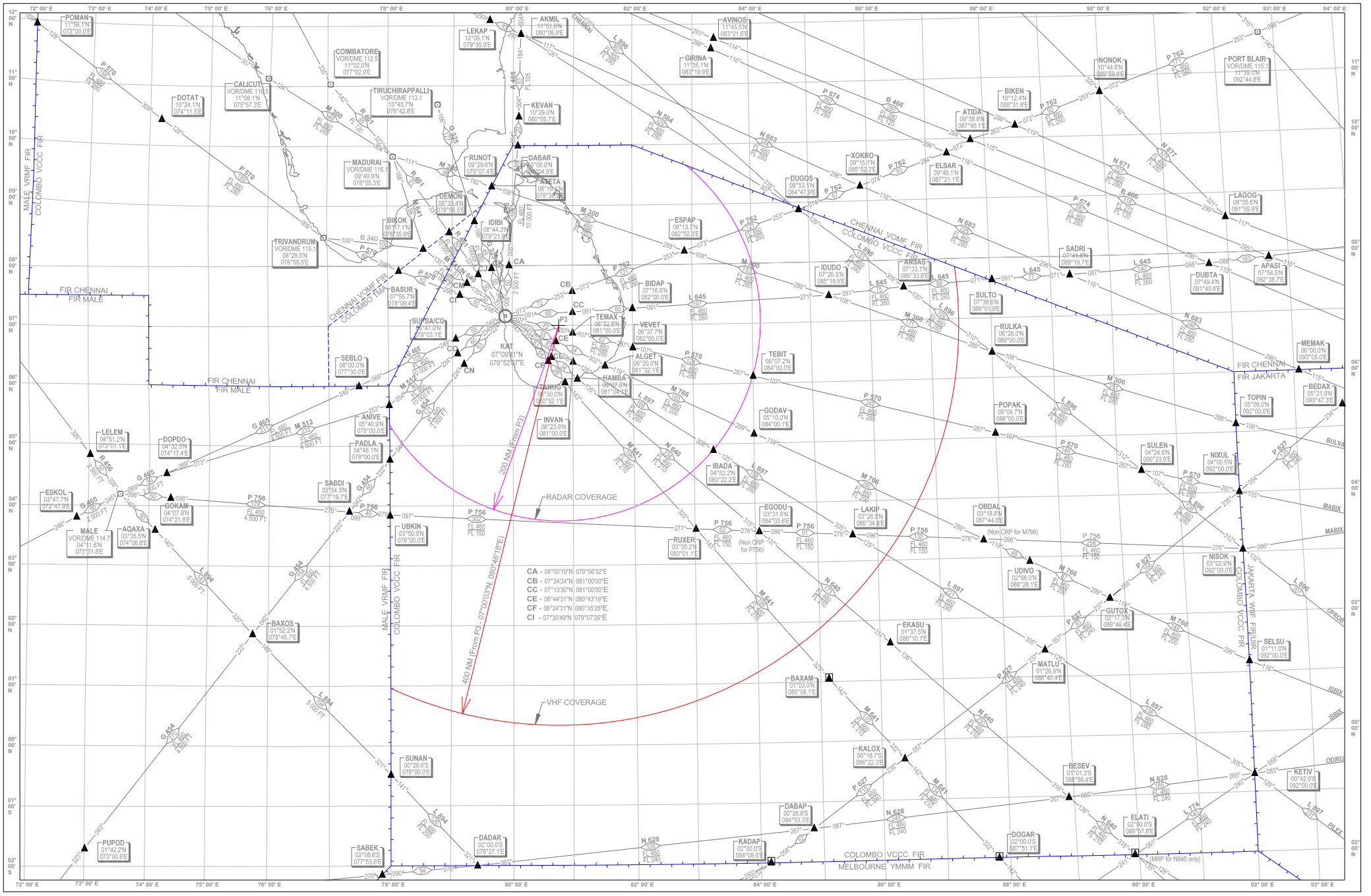


RADAR and VHF Coverage for SINGAPORE ACC

Theoretical Coverage Range of 250 NM



SRI LANKA


POMAN 11°56.1'N 072°00.0'E
DOTAT 10°24.1'N 074°11.5'E
CALICUT VOR/DME 116.5 11°08.1'N 075°57.3'E
COIMBATORE VOR/DME 112.5 11°02.0'N 077°02.9'E
TIRUCHIRAPPALLI VOR/DME 113.1 10°45.7'N 078°42.8'E
MADURAI VOR/DME 116.1 09°49.9'N 078°05.3'E
TRIVANDRUM VOR/DME 115.1 08°26.5'N 076°55.5'E
DEMON 08°33.4'N 078°56.5'E
BIKOK 08°17.1'N 078°35.9'E
BASUR 07°55.7'N 078°09.4'E
SUPSA/CG 07°47.0'N 079°03.1'E
SEBLO 06°00.0'N 077°30.0'E
LELEM 04°51.2'N 073°01.1'E
DOPDO 04°32.5'N 074°17.4'E
ESKOL 03°47.7'N 072°47.9'E
GOKAM 04°07.9'N 074°21.8'E
MALE VOR/DME 114.7 04°11.6'N 073°31.8'E
AQAXA 03°35.5'N 074°06.6'E
BAXOS 01°52.2'N 075°45.7'E
PUPOD 01°42.2'N 073°00.6'E
SABDI 03°54.3'N 077°19.7'E
ANIVE 05°40.9'N 078°00.0'E
PADLA 04°46.1'N 078°00.0'E
UBKIN 03°50.9'N 078°00.0'E
SUNAN 00°26.6'S 078°00.0'E
SABEK 02°08.6'S 077°53.6'E
DADAR 02°00.0'S 079°27.1'E
AKMIL 11°51.6'N 080°06.9'E
LEKAP 12°05.1'N 079°35.9'E
KEVAN 10°29.0'N 080°05.7'E
RUNOT 09°29.6'N 079°07.4'E
DABAR 08°00.0'N 079°34.9'E
KASETA 08°19.1'N 079°39.3'E
IDIBI 08°44.3'N 079°21.9'E
KIK
CA
CB
CC
CD
CE
CF
CI
CJ
CK
CL
CM
CN
CO
P3
KAT 07°09'41"N 079°52'07"E
TEMAX 06°52.6'N 081°00.0'E
VEVET 06°37.7'N 082°00.0'E
ALGET 06°20.0'N 081°32.1'E
HAMBA 06°07.0'N 081°04.1'E
TANUG 06°30.0'N 080°52.1'E
INVAN 06°23.9'N 081°00.0'E
BIDAP 07°16.6'N 082°00.0'E
ESPAP 08°13.7'N 082°52.8'E
AVINOS 11°45.5'N 083°21.6'E
GIRINA 11°35.1'N 083°19.9'E
TEBIT 06°07.2'N 084°00.0'E
GODAV 05°10.0'N 084°00.1'E
IBADA 04°52.2'N 083°22.2'E
RUXER 03°35.2'N 083°01.1'E
EGODU 03°31.8'N 084°03.6'E
BAXAM 01°03.0'N 085°08.1'E
KALOX 01°18.7'S 086°22.3'E
DABAP 00°26.6'S 084°53.3'E
KADAP 02°00.0'S 084°09.6'E
EKASU 01°37.5'N 086°10.1'E
LAKIP 03°26.5'N 085°34.9'E
OBDAL 03°18.8'N 087°44.8'E
UDIVO 02°56.0'N 088°28.1'E
MATLU 01°26.9'N 088°40.4'E
DOGAR 02°00.0'S 087°51.1'E
BESEV 01°01.3'S 088°56.4'E
ELATI 02°00.0'S 089°57.8'E
NONOK 10°44.6'N 089°59.8'E
BIKEN 10°12.4'N 088°31.8'E
ATIDA 09°58.6'N 087°45.1'E
ELSAR 09°46.1'N 087°21.1'E
XOKRO 09°15.1'N 085°52.3'E
DUGOS 08°53.1'N 084°47.8'E
ANSAS 07°33.1'N 086°33.8'E
IDUDO 07°26.5'N 085°18.5'E
SULTO 07°36.8'N 088°01.9'E
RULKA 06°26.0'N 088°00.0'E
POPAK 05°04.7'N 088°00.0'E
GUTOX 02°17.3'N 089°46.4'E
SADRI 07°44.6'N 089°19.7'E
LAGOG 08°35.6'N 091°59.8'E
DUBTA 07°49.4'N 091°40.6'E
SULEN 04°24.6'N 092°23.9'E
NISOK 03°02.9'N 092°00.0'E
PORT BLAIR VOR/DME 115.1 11°39.0'N 092°44.8'E
APASI 07°54.5'N 092°38.7'E
MEMAK 06°00.0'N 093°05.0'E
BEDAX 05°21.9'N 093°47.3'E
TOPIN 05°09.0'N 092°00.0'E
NIXUL 04°00.5'N 092°00.0'E
SELSU 01°11.0'N 092°00.0'E
KETIV 00°42.0'S 092°00.0'E
ISBIX
ODIRU
PILEX
MABIX
BULVA
UPROB
CHENNAI VOMF FIR
COLOMBO VCCC FIR
MALE VRMF FIR
FIR CHENNAI
FIR MALE
FIR JAKARTA
JAKARTA WIF FIR/UIR
MELBOURNE YMMM FIR
RADAR COVERAGE
VHF COVERAGE
200 NM (From P3)
400 NM (From P3 - 07°00'03"N 080°46'18"E)
(Non CRP for P756)
(Non CRP for M766)
(MRP for N640 only)

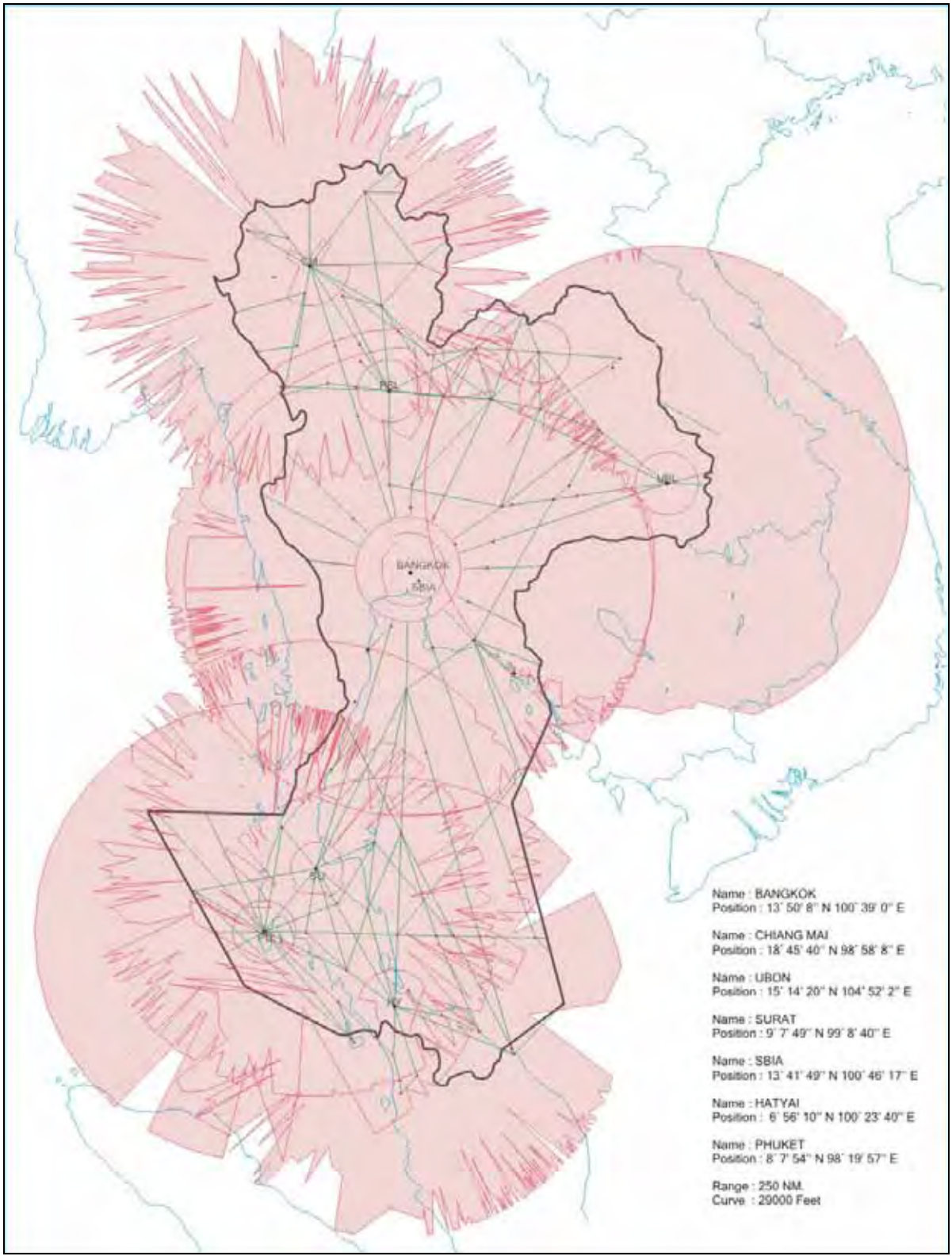


Figure 1: SSR Radar Coverage within the Bangkok FIR at FL290

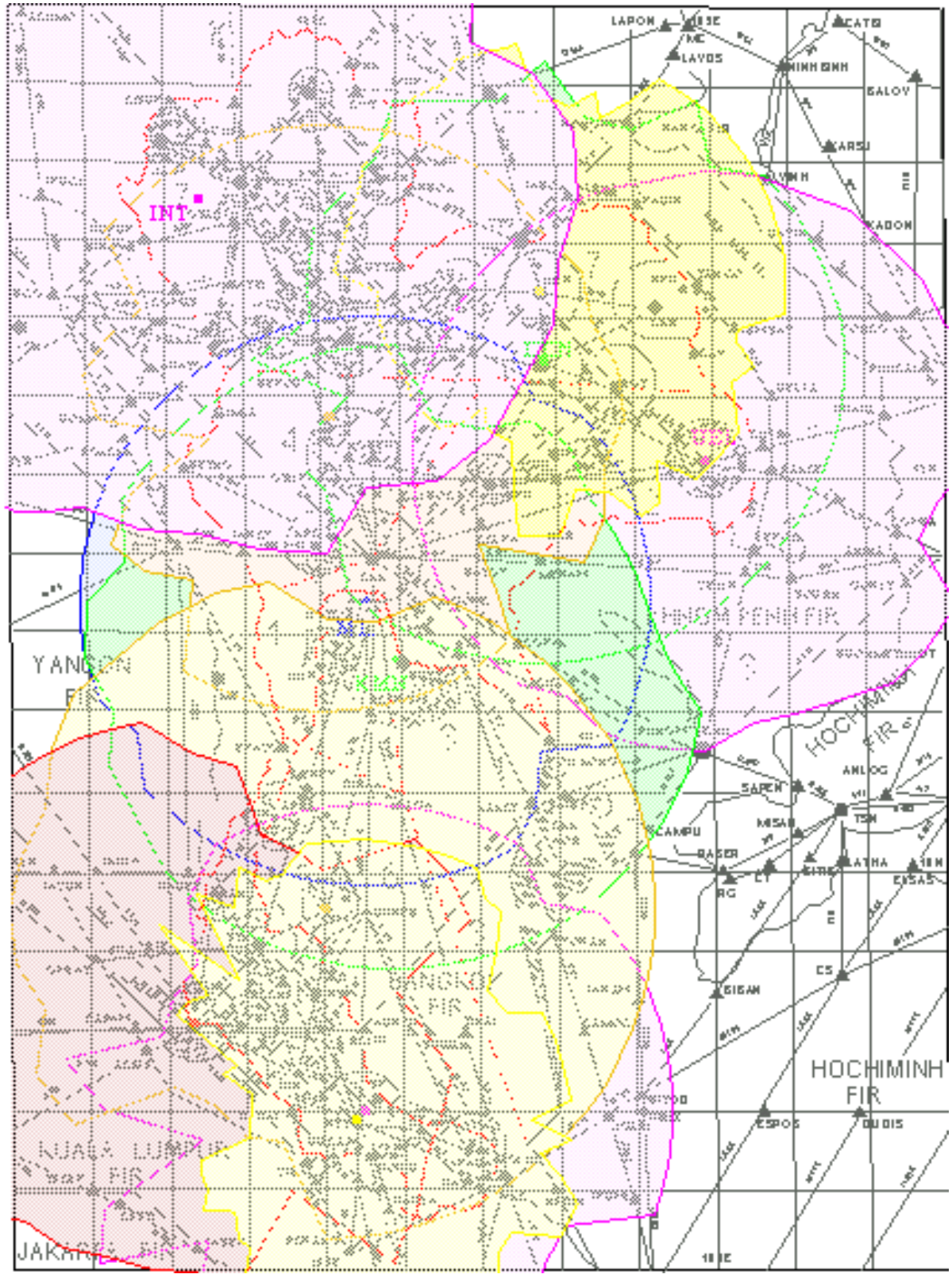


Figure 1: VHF Communications Coverage within the Bangkok FIR at FL250

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

Table of Contents

Checklist of Effective Pages

Subject	Pages	Issue Date
Letter of Agreement	1 – 10	TBA
Appendix A Navigation Error Report	A1 – 13	TBA

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.

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

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.

SEASMA

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

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;

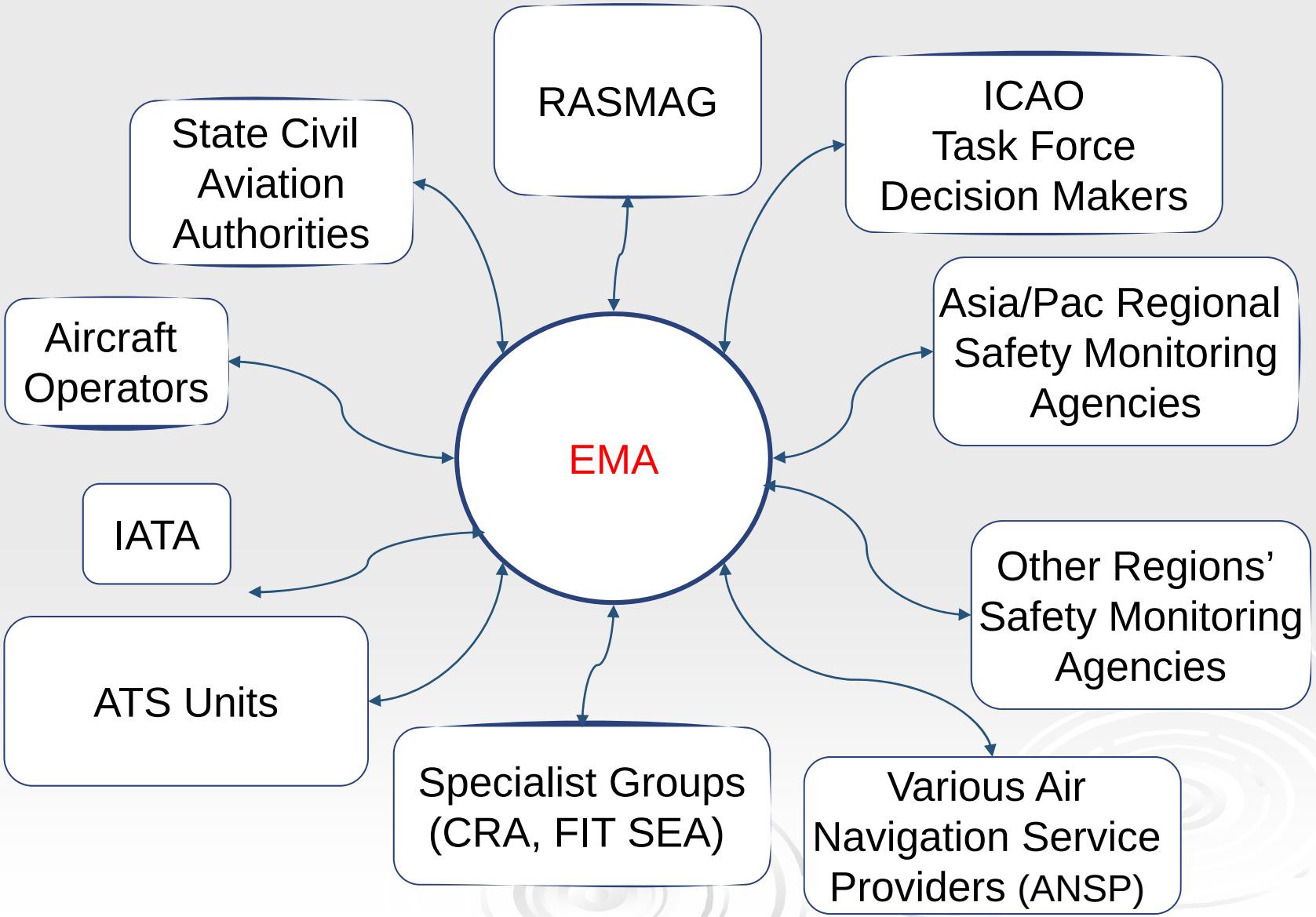
Roles and Responsibilities

- 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)

SEASMA

Safety Assessment

What is needed?

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

SEASMA

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

SEASMA

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

SEASMA

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.

Safety Assessment

- Traffic Sample Data

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

SEASMA

Thank You

TASK LIST

SN	Activity	Start Date	Completion Date	Present Status	Group Responsible
	Identify Operational Need				
1	Agree that an operational needs for a 50 NM horizontal separation in the Bay of Bengal and Oceanic Area of the Mumbai FIR	November 2009	November 2009	Agreed	All delegates at the BOB-RHS/TF/1
	Safety Assessment				
2	Appointment of a Bay of Bengal and Mumbai Enroute Monitoring Agency	November 2009	October 2010 (BOB-RHS/TF/4)	Ongoing	India has accepted the responsibility to establish an EMA. Until formally endorsed by RASMAG, India will continue to coordinate with SEASMA (CAAS)
3	States to continue to collect and provide traffic data	1 July 2010	December 2010	Ongoing	States
4	States to provide additional data as required by the EMA	1 July 2010	December 2010	Ongoing	States
5	Examine history of navigational errors and assess possible impact on safety	1 July 2010		Ongoing	States/EMA
6	Confirm collision risk model assumptions/parameters are consistent with airspace where the 50 NM horizontal separation is to be applied	October 2010	October 2010 (BOB-RHS/TF/4)	Ongoing	India/States - part of safety assessment
7	Report monthly navigational errors (including operational errors)	1 July 2010	October 2010 (BOB-RHS/TF/4)	Agreed by BOB-RHS/TF/3 to collect data	States/EMA
	Feasibility Analysis				
8	Examine the operational factors and workload associated with the 50 NM longitudinal separation implementation in BOB/Mumbai FIRs	February 2010		To be completed by completion of Phase 1	EMA/States
9	Complete feasibility analysis on the 50NM longitudinal separation implementation on N571, P628 (and possibly P762)	May 2010	October 2010 (BOB-RHS/TF/4)	Lateral/longitudinal requires attention	EMA/States
	Determination of Requirements (airborne & ground systems)				
10	States assess the impact of the 50 NM longitudinal separation implementation on controller automation systems and plan for upgrades/modifications	November 2009	October 2010 for Phase 1 June 2011 for Phase 2		States
	Perform Necessary Industry & International Co-ordination				
11	Establish target implementation date on the 50NM horizontal separation on N571, P628 (and possibly P762)	May 2010	January 2011	15 January 2011	States
12	Report to ATM/AIS/SAR/SG	November 2009	July 2010		ICAO
13	States to coordinate with Boeing Lab for bench testing ADS/CPDLC system and ADS/CPDLC data collection and problem report to Boeing Lab	November 2009		Ongoing	Boeing/States
14	States to report the status and updates on ADS/CPDLC system and personnel training programme	October 2010	January 2011 for Phase I	Ongoing	States

TASK LIST

SN	Activity	Start Date	Completion Date	Present Status	Group Responsible
15	Prepare and submit draft amendment proposal to amend Doc 7030	May 2010	1-Jun-11		BOB-RHS/TF
16	Assess need to publish AIP Amendment/Supplement/NOTAM containing the 50 NM longitudinal separation policy/procedures	December 2010	October 2010		BOB-RHS/TF
17	Review inter-facility coordination procedures	December 2010	October 2010	Revised present LOA between States	States
18	Finalize changes to Letters of Agreement	December 2010	December 2010 for Phase 1		States
	Approval of Aircraft & Operators				
19	Establish approved operations readiness targets	BOB-RHS/TF/2		Ongoing	
20	Assess operator readiness	BOB-RHS/TF/2		Ongoing	
	Develop ATC Procedures				
21	States to develop procedures for handling non-compliant aircraft in ATS documentation due to equipment failures in their ATS documentations	October 2010	January 2011	Singapore will share their procedures	States
	ATC Training				
22	Complete training for air traffic controllers on the application of 50 NM horizontal separation	October 2010	30 December 2011 (Phase 1)	Ongoing	States
23	Collect weather and turbulence data for analysis and provide to EMA for safety assessment and monitoring analysis	Jul-10	December 2010 for Phase 1		States/EMA
	Complete Safety Assessment				
24	Review and accept safety assessment	October 2010	October 2010		BOB-RHS/TF/4
	Final Implementation Decision				
25	Go/No-Go Decision	October 2010	October 2010		BOB-RHS/TF/4
26	Implementation	13 January 2011	13 January 2011		States
	Post Implementation Review - 90 Day Review				
27					
28					
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BOBCAT Airlines Survey Result

In cooperation with IATA, AEROTHAI conducted a satisfaction survey of the airlines between January 2010 and March 2010. The total of 8 airlines replied to the survey, together contributing approximately 40 percent of total traffic.

Survey result can be summarized as follows:

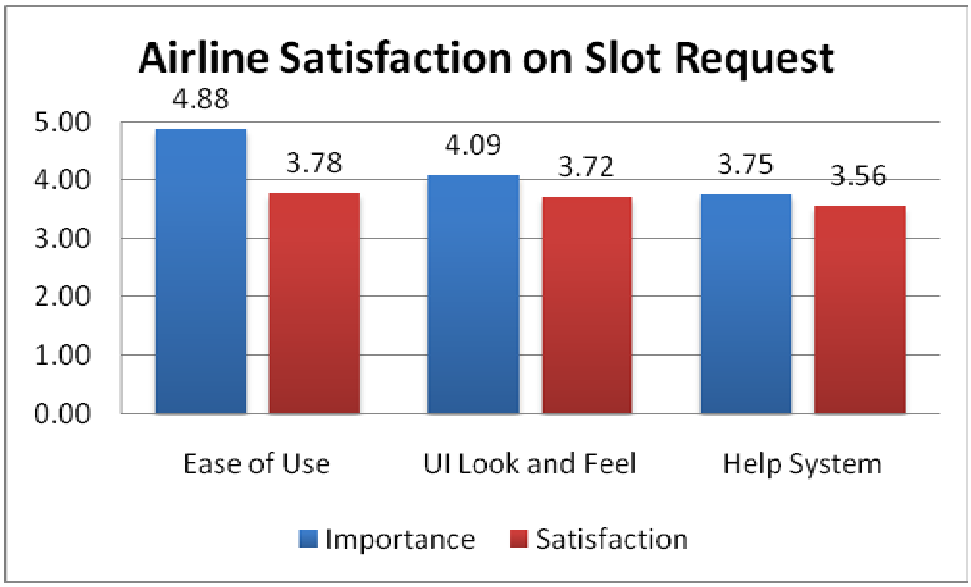
1. Customer Satisfaction Index (CSI)

Satisfaction Level:
5 = Most important / Most satisfied
4 = Very important / Very satisfied
3 = Somewhat important / Somewhat satisfied
2 = Not very important / Not very satisfied
1 = Least important / Least satisfied

1.1 Airlines Satisfaction on Slot Request Functionality

Topic	Importance			Satisfaction Level	
	Average	**Standard Deviation**	**Weight (%)**	**Average**	**Standard Deviation**
1. Ease of Use	**4.88**	0.35	38.33%	**3.78**	0.90
2. User Interface Suitability (look and feel)	**4.09**	1.10	32.19%	**3.72**	0.70
3. Help System	**3.75**	1.16	29.48%	**3.56**	0.73

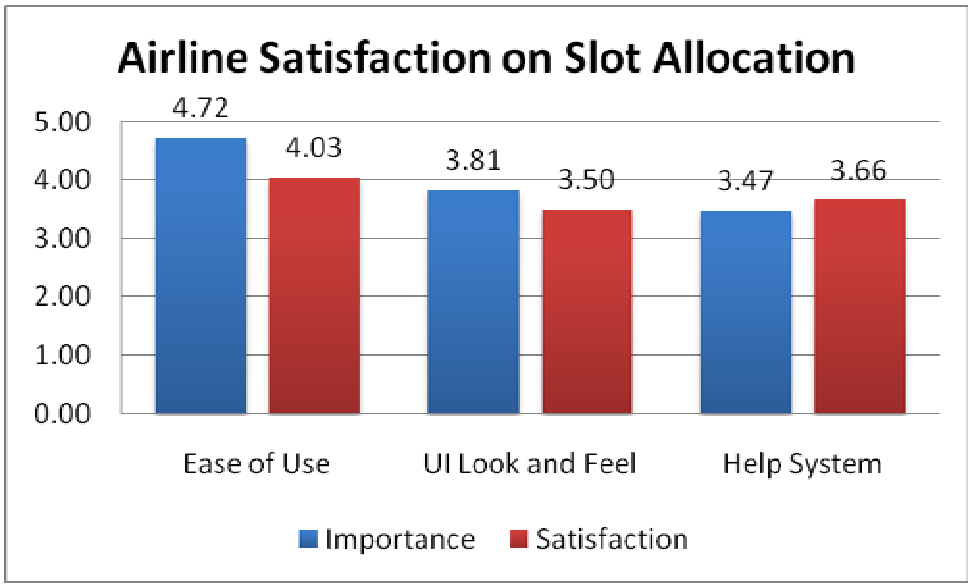
CSI = 73.93



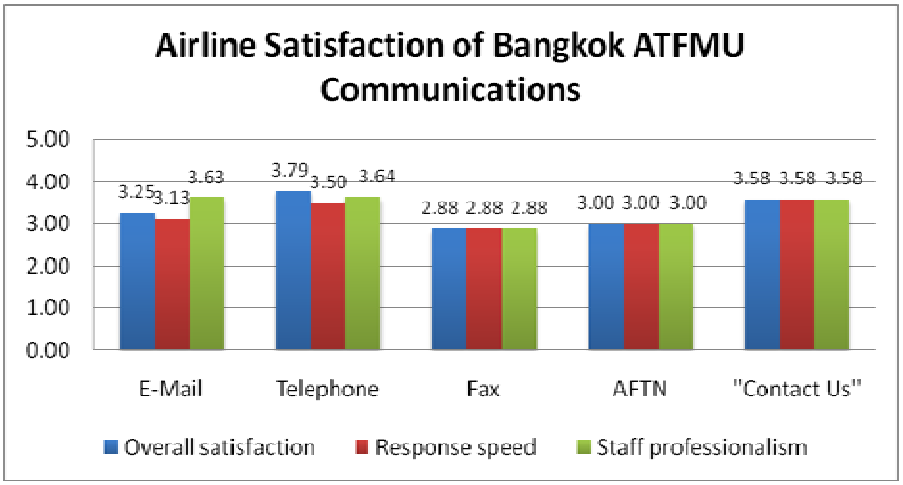
1.2 Airlines Satisfaction on Slot Allocation Functionality

Topic	Importance			Satisfaction	
	Average	Standard Deviation	Weight (%)	Average	Standard Deviation
1. Ease of Use	**4.72**	0.53	39.32%	**4.03**	1.07
2. User Interface Suitability (look and feel)	**3.81**	1.36	31.77%	**3.50**	0.93
3. Help System	**3.47**	1.18	28.91%	**3.66**	0.77

CSI = 75.08

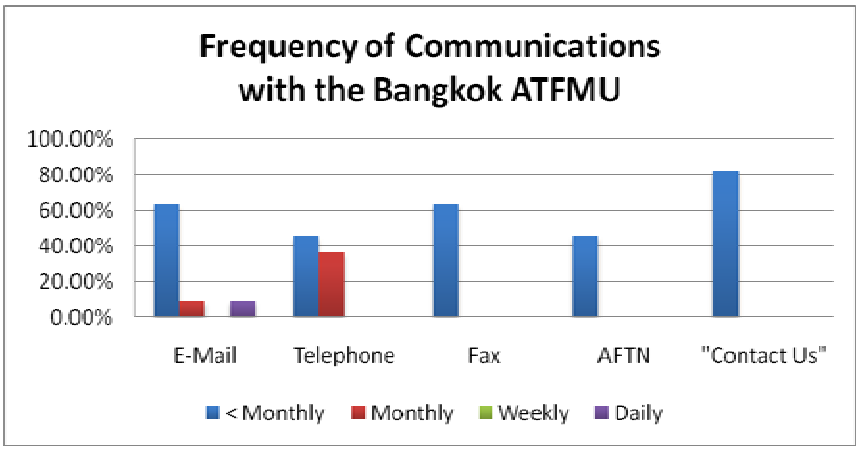


1.3 Airlines Satisfaction of Communications with the Bangkok ATFMU

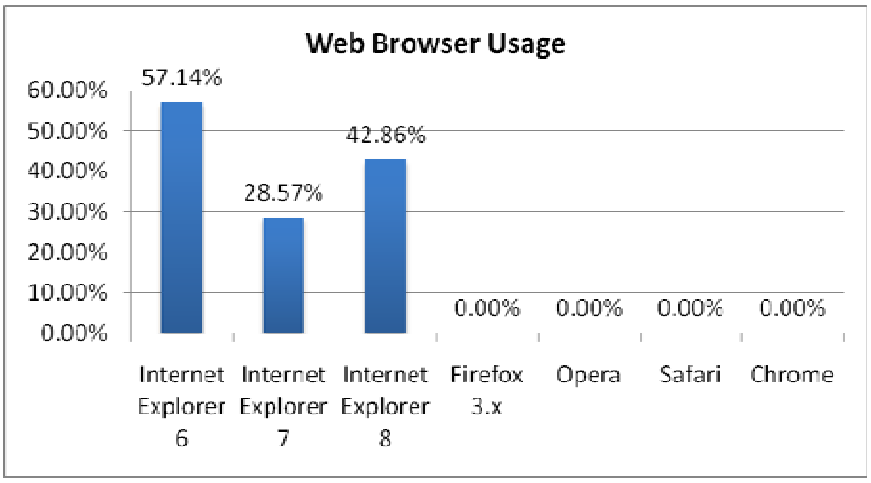


2. System Usage Information

2.1 Frequency of communications with the Bangkok ATFMU by Airlines



2.2 Percentage of Airlines Accessing the BOBCAT System using Various Web Browsers



3. Summary of Suggestions

3.1 Suggestions Related to Slot Request Functions

- Slot Request of call sign following an alphabet such as QFA31D should be possible
- Some form of "traffic demand" should be available during slot request phase

3.2 Suggestions Related to Slot Allocation Functions

- "Waypoint Allocation" should be modified to include actual traffic, which may come from processing of flight plan or departure messages
- Mechanisms used to select new slot should be adjusted so that airlines can input multiple routes' EET and select from multiple options simultaneously

3.3 General Suggestions

- Password resets via e-mail should be possible without the use of forms mailed to the Bangkok ATFMU
- Airlines should be able to give priority level to their slot requests

3.4 Popularity of Potential New Features