International Civil Aviation Organization

The First Meeting of the South Asia/Indian Ocean ATM Coordination Group (SAIOACG/1)

Bangkok, Thailand, 22 – 23 September 2011

Agenda Item 4:   Implementation of New CNS/ATM Systems

AIRSPACE CONCEPT OF OPERATIONS

(Presented by the Secretariat)

SUMMARY

This paper highlights a need for collaboration among States and stakeholders in their efforts to promote their vision or concept of operations in the airspace of concern to SAIOACG in order to achieve seamless ATM. There are many initiatives being pursued, some with collaboration within sub-regions in this overall airspace, and many on an individual basis. There is a need to discuss and establish common requirements that support the Seamless ATM concept.

1.   INTRODUCTION

1.1   This paper highlights the efforts to improve ATM in the airspace spanning the Bay of Bengal, the Indian Sub-continent and westwards, and the Arabian Sea, and the requirement for collaboration among the States and stakeholders in order to avoid duplication of efforts and resources, a mismatch of expectations, and to ensure an overall coherent plan.

1.2   A significant amount of work had taken place in the last decade to improve Asian route structures and airspace. This included the EMARSSH plan in 28 November 2002, RVSM implementation on 27 November 2003, ATFM implementation on 5 July 2007 concurrent with several enhancements to the EMARSSH plan, and recent introduction of RNP10 50/50NM horizontal separation on some routes. On 17 November 2011 the upcoming introduction of RVSM in Afghanistan and westwards will also be a significant operational improvement.

2.   DISCUSSION

India's airspace restructuring

2.1   At APANPIRG/22, India presented a Working Paper (**Appendix A**) outlining India's efforts in restructuring their airspace and ATS route structure and their future plan for ATM automation to provide for greater efficiency and regularity of aircraft operations.

2.2   As part of the restructuring, 11 ACCs will be amalgamated into 4 ACCS and eventually 2 ACCs. The entire continental airspace will be covered by overlapping surveillance by radar/ADS-B/Multilateration combined with matching seamless air-ground communications and AIDC. Uniform application of radar separation across the Indian FIRs will be the outcome. The plan also included possible ADS-B sites offshore to allow the delivery of seamless ADS-B services.

IATA Asia Pacific Concept of Operations

2.3   IATA also outlined its own Asia Pacific Concept of Operations (**Appendix B**) at APANPIRG/22, which stressed that, *inter alia*, FIR boundaries should not limit the delivery of surveillance and separation services and appropriate letters of agreement and data sharing would facilitate seamless transfer of control.

BOB-SEA ADS-B Implementation W/G

2.4   APANPIRG/22 endorsed the extension of the scope for the ADS-B Implementation Work Group to cover the Bay of Bengal area, to expedite ADS-B implementation and data-sharing. This Work Group would benefit from a universal set of ATM requirements for the use of ADS-B in terms of coverage, and performance that supported ATS surveillance-based operations.

AIDC

2.5   ATS Inter-facility Data-link Communications (AIDC) was a key enabler for Seamless ATM and was very beneficial in reducing ATC coordination errors as a result of human factors. It was important to consider the implementation schedule of SAIOACG States and identify any actions that could facilitate AIDC, especially in priority locations where ATC coordination issues were evident.

CANSO's Seamless ATM Operations

2.6   CANSO's vision of the future of air navigation services is one that is technically interoperable, procedurally harmonised, universally safe and affordable. It encompassed the key areas of safety, security, people focus, the environment, appropriate regulation, optimised ATM system, civil military cooperation, and a 'business- like' approach and customer focus.

2.7   Seamless airspace was defined by CANSO as contiguous airspace that is technically and procedurally interoperable, universally safe, and in which all categories of airspace users transition between Flight Information Regions, or other vertical or horizontal boundaries, without requiring a considered action to facilitate that transition and without any noticeable change in:

    (a) Type or quality of service received
    (b) Air navigation and communications performance standards
    (c) Standard practices to be followed

2.8   CANSO also highlighted its role in a collaborative effort in extending surveillance coverage in the South China Sea through ADS-B implementation and data sharing among a few states. For the Bay of Bengal airspace, CANSO conducted an ADS-B seminar in Yangon for Myanmar in February 2011 and a potential ADS-B coverage plan for high traffic density routes over the Bay of Bengal was discussed.

Seamless ATM

2.9   If Seamless ATM was to be achieved, there had to be a much greater collaborative effort among States, ANSPs and stakeholders than ever before. Harmonization, standardization, and interoperability cannot be achieved in isolation.

2.10   APANPIRG/22 endorsed the establishment of a Seamless ATM Task Force, which was expected to develop the framework for Asia/Pacific Seamless ATM as a high-level body, provide guidance to States, and assess State plans for Seamless ATM.

3.   ACTION BY THE MEETING

3.1   The meeting is invited to:

     a)   note the information contained in this paper;

     b)   note the importance of Seamless ATM development, using the plans and concepts from CANSO and India as an example; and

     c)   discuss how the development of ADS-B and AIDC can be supported and expedited; and

     d)   discuss the implications of the Asia/Pacific Air Navigation Concept of Operations regarding the SAIOACG area of interest.

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

**TWENTY-SECOND MEETING OF THE
ASIA/PACIFIC AIR NAVIGATION PLANNING AND
IMPLEMENTATION REGIONAL GROUP (APANPIRG/22)**

Bangkok, Thailand, 5-9 September 2011

Agenda Item 3:	**Performance Framework for Regional Air Navigation Planning and Implementation**
3.2	**ATM/AIS/SAR**

ATM ENHANCEMENTS THROUGH IMPROVED AUTOMATION

(Presented by India)

SUMMARY

The paper presents India's effort in restructuring the airspace and ATS routes to make them more efficient to save fuel, time, reduction in emission of aviation of gases, enhance the efficiency and regularity of flight operations through improved ATS Automation system.

Strategic Objectives:
  *A: **Safety** – Enhance global civil aviation safety*
  *C: **Environmental Protection and Sustainable Development of Air Transport** – Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

Global Plan Initiatives:
GPI-6   Air traffic flow management
GPI-7   Dynamic and flexible ATS route management
GPI-8   Collaborative airspace design and management
GPI-9   Situational awareness

1.   INTRODUCTION

1.1   India, an emerging global economic power, has witnessed a tremendous growth in air traffic in the last decade, poised to grow at a rate much higher than the world average in the next five years. Additional capacity will need to be delivered, flight efficiency improved and environmental impact reduced, while maintaining or improving safety of operations. To achieve this Indian airspace will have to become more flexible and adaptable, allowing an effective balance between capacity, flight efficiency and environmental requirements on one hand, and the diversity of user requirements on the other, while maintaining or improving the safety of operations. The solution for meeting the diversity of user requirements is the effective and dynamic management of the pre-designed airspace structures through a highly flexible and integrated Collaborative Decision Making (CDM) process at network, regional, national and local level. Faced with these realities, India has taken the initiative to review the existing Indian airspace structure and develop a new Airspace Management Strategy to

cope with the predicted impressive future growth of air traffic through the state of the art ATM Automation. India is constantly working to restructure the airspace and ATS routes to make them more efficient to save fuel, time, reduction in emission of aviation of gases, enhance the efficiency and regularity of flight operations.

1.2   India took a landmark decision to modernize ATC system at Delhi and Mumbai airport in 1999 under MATS-BD project, the new integrated automation system was equipped with MSAW and STCA to enhance safety and efficiency of flights operations. This system has been further upgraded with features like advance Safety nets and arrival managers (AMAN).

1.3   ATC automation system has also been implemented at Hyderabad, Bangalore and is being upgraded at Chennai airport with advance features. Similar ATC automation system is planned for Kolkata also.

1.4   In addition to automation of ATC system at six Metro airports, India has also undertaken an ambitious plan for automation of ATC system at 38 Non-Metro airports which will be completed by March 2012. The automation system will provide alerts and warning in the form of short term conflict alert, minimum sector altitude warnings, and medium term conflict alerts etc to enhance the safety.

2.   DISCUSSION

2.1   As per the existing plan for restructuring of entire Indian airspace, 11 ACCs will be amalgamated into 4 ACCs initially and finally into 2 centres. Each FIR will have only one Upper ACC centre with multiple sectors to be operated from four major cities. Entire airspace will have overlapping surveillance cover through Radar/ADS-B/Multilateration combined with matching seamless air-ground communication to facilitate efficient air traffic management and AIDC for ground to ground communication. The surveillance data from Radar/ADS-B/Multilateration will be networked and electronically processed with relevant flight data from the Flight data processor to provide an integrated track data output correlated with flight plan so as to enable application of uniform radar separation throughout the FIRs.

2.1   With the introduction of improved ATS automation system and installation of additional Radars /ADS-B/Multilateration, the entire continental airspace will permit seamless surveillance and in addition to the existing ADS-C over Oceanic airspace. India has successfully integrated all Radars in Chennai FIR in the first phase thus enabling seamless upper airspace with lower limit as FL 260.The newly introduced technique of cross coupling of VHF would facilitate creation of multiple sectorization over continental airspace. AIDC enabled through Automation will substantially reduce ATS coordination.

2.2   As a pilot project re-sectorization of Chennai FIR has been completed. Chennai FIR will have one Upper ACC centre with five sectors to be operated from Chennai. Lateral jurisdiction of existing ACC centers at Hyderabad, Mangalore and Trivandrum has been re-designated as Lower ACC centre with revised lateral and vertical jurisdiction up to FL255. Tower and approach will be operated from individual airport as per present lateral and vertical jurisdiction.

2.3   Similar concept of integrating Radars and upper ACC is also planned for Delhi, Mumbai and Kolkata FIRs. This will facilitate to merge present 11 ACCs into 4 ACCs initially and finally into 2 ACCs.

2.4   India has also planned ADS-B stations at 14 locations to cover Radar gaps and as redundancy surveillance system.

2.5   Complete integrated Radar / ADS-B surveillance will provide seamless operations and will help in reducing separations, provide better situational awareness, implementation of Dynamic and flexible ATS route management and smooth implementation of regional integrated Air Traffic Flow Management.

Restructuring of ATS routes in India

2.6   Airports Authority of India is constantly working to restructure the Airspace and ATS routes to make them more efficient to save fuel, time, reduction in emission of aviation of gases, enhance the efficiency and regularity of flight operations.

2.7   ATS route L 509 from GGC VOR to ASARI and M 875 from KAKID to BUTOP were promulgated through military areas under flexible use of airspace. These routes were further extended up to SAMAR and GUGAL to provide connectivity through Pakistan airspace thereby saving of 33NM and 64 NM respectively.

DESIGNATOR	SEGMENT	Saving in distance (NM)	Remarks
L 899	Trivandrum - Hanimadhoo	237	New route in coordination with Male
L 516	KITAL - ELKEL	41	New route designed under UPR
L 626	Kathmandu - Delhi	21	New route in coordination with Nepal
M 875	Delhi – DI VOR	64	Extension of route in coordination with Pakistan
R 457	Trivandrum - Chennai	112	Extension of route to provide connectivity to Intl flights
W 134	SG – Pune	24	New route
W 136	Hyderabad - Raipur	152	New route

- India has agreed for ten connector routes between Mumbai and Male FIR to facilitate Male to implement flexible routes in Male FIR for which safety assessment is being carried out. Shortly these routes will be promulgated.

- India has also agreed to implement UT 383 (VUTAS- ANODA - CIA VOR - W 46 – MDI VOR – DOGOS – P 761 to provide direct connectivity from Addis Ababa to Bangkok and UT 387 (CLAVA – MALE) to provide direct connectivity from Nairobi to Bangkok. Safety assessment is being carried out for these routes and a proposal to amend Basic ANP will be sent to ICAO shortly.

- A coordination meeting was held with Bangladesh from 20-22 July 2011 in Kolkata to discuss the feasibility of direct routes through Bangladesh airspace to/ from NE part of India. In the meeting Bangladesh desired that a new route may be established below the lower limit of L 507 for flights operating below the lower limit. India agreed with the proposal and the route will be designed.

- India has taken initiative to promulgate RNAV5 routes between Metro cities, eight RNAV5 routes are to be implemented by the end of this year i.e. Dec 2011. First RNAV5 route is to be implemented between busiest corridor of Delhi and Mumbai.

3.   ACTION BY THE MEETING

3.1   The meeting is invited to:

    a) note India's effort in restructuring the airspace enabled through ATS Automation in India;

    b) collaborate with India in bringing out an effective ATS route network that will benefit the stake holders across the borders;

    c) consider sharing of Radar and ADS-B data for seamless airspace in the region to facilitate reduction of separation; and

    d) encourage the States to have AIDC in place.

— END —

INTERNATIONAL CIVIL AVIATION ORGANIZATION

**TWENTY-SECOND MEETING OF THE
ASIA/PACIFIC AIR NAVIGATION PLANNING AND
IMPLEMENTATION REGIONAL GROUP (APANPIRG/22)**

Bangkok, Thailand, 5-9 September 2011

Agenda Item 3:   **Performance Framework for Regional Air Navigation Planning
                          and Implementation**

   3.2   **ATM/AIS/SAR**

          ASIA PACIFIC AIRSPACE CONCEPT OF OPERATIONS

          (Presented by IATA)

SUMMARY

This paper presents a concept for Asia/Pacific (APAC) airspace. The concept has been endorsed by ATM/AIS/SAR/SG 21 & CNS/MET/SG 15 and is included in each Sub Groups reports to APANPIRG 22.   This paper outlines the concept and requests endorsement by APANPIRG of the CNS/MET conclusion 21/8 (containing minor rewording from the ATM/AIS/SAR/SG 21 version).

This paper relates to **Strategic Objectives:**
A: ***Safety*** *– Enhance global civil aviation safety*
C: ***Environmental Protection and Sustainable Development of Air Transport*** *–*
Foster harmonized and economically viable development of international civil
aviation that does not unduly harm the environment

Global Plan Initiatives:
GPI-1 Flexible use of airspace
GPI-3 Harmonization of level systems
GPI-4 Alignment of upper airspace classifications
GPI-5 RNAV and RNP (Performance-based navigation)
GPI-6 Air traffic flow management
GPI-7 Dynamic and flexible ATS route management
GPI-8 Collaborative airspace design and management
GPI-9 Situational awareness
GPI-10 Terminal area design and management
GPI-11 RNP and RNAV SIDs and STARs
GPI-12 Functional integration of ground systems with airborne systems
GPI-16 Decision support systems and alerting systems
GPI-17 Data link applications
GPI-21 Navigation systems
GPI-22 Communication infrastructure
GPI-23 Aeronautical radio spectrum

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1.   INTRODUCTION

1.1   This paper presents the Asia Pacific Airspace Concept of Operations.

1.2   The premise for the Concept is that many of the operational enhancements today are reliant on technical capabilities in particularly in CNS. New aircraft today are delivered with many of these capabilities as standard fit, however, enablement of many of the benefits relies on the ground CNS/ATM capability.

1.3   The Concept of Operations builds on the IATA User Expectations that were adopted by APANPIRG/19.

1.4   Also, following concerns raised by States regarding the definition of Oceanic and continental type airspace, particularly with regard to PBN based implementation, IATA sought clarification from ICAO during ATM/AIS/SAR/20 in 2010.

1.5   ICAO confirmed that application of procedures/specifications and separations should be based on CNS/ATM capability and not simply geography.

1.6   With this in mind at SEACG/18 IATA was tasked by ICAO to develop a concept of Operations for the provision of CNS/ATM.

1.7   IATA presented WP 22 to ATM/AIS/SAR/SG/21 that proposed "The Future APAC Airspace Concept of Operations"

1.8   ICAO requested IATA present a similar paper to CNS/MET/SG/15

2.   DISCUSSION

2.1   The Concept of Operations, which was intended as a planning tool for ANSP and airlines. The Concept was not intended to compel States, although this framework was expected to be followed unless there were compelling reasons to do otherwise. The Concept was likely to be iterative, although it was written in a generic fashion to minimize the need for updates.

2.2   IATA presented WP 22 to ATM/AIS/SAR/SG/21 that proposed "The Future APAC Airspace Concept of Operations". The Sub-Group meeting agreed to the following Draft Conclusion:

> **Draft Conclusion SG 21/8   −   Asia/Pacific Air Navigation Concept of**
> **Operations**
>
> That, the Asia/Pacific Air Navigation Concept of Operations be included on the APAC website as guidance for State air navigation service facility and airline equipage planning, and States be advised of the Concept of Operations accordingly

2.3   ICAO requested IATA present a similar paper to CNS/MET/SG/15

2.4   CNS/MET/SG 15 endorsed the ATM/AIS/SAR conclusion with the following:

             While supporting a draft regional air navigation concept of operations presented by IATA (WP58) and endorsed by of ATM/AIS/SAR SG/21 (WP/53), the CNS/MET SG/15 meeting noted that use of SATCOM Voice in the draft needed to be in line with existing regional agreements adopted by APANPIRG. As a result of discussion, the meeting endorsed a revised version of the draft

Asia/Pacific Air Navigation Concept of Operations as provided in the **Appendix D** to this Report which included additional editorial changes. The meeting suggested a revised Draft Conclusion as follows:

> ***Draft Conclusion SG 21/8 − Asia/Pacific Air Navigation Concept of Operations***
>
> *That, the Asia/Pacific Air Navigation Concept of Operations provided in Appendix D to this report be adopted and published on the APAC website as a regional guidance material for air navigation facility, service and avionics equipage planning.*

2.5   **Appendix D to the CNS/MET/SG 15 report is copied for reference:**

Reference: WP/53 and WP/58 – On Regional Airspace Operation Concept

While discussing a draft Conclusion (WP/53 of CNS/MET SG/15) formulated by ATM/AIS/SAR SG/21 and WP58 presented by IATA on the proposed concept of operations, following suggested changes were endorsed by CNS/MET SG/15 the meeting:

> **Draft Conclusion SG 21/8 − Asia/Pacific Air Navigation Concept of Operations**
>
> That, the Asia/Pacific Air Navigation Concept of Operations be adopted and published on the APAC website as a regional guidance material for ~~air~~ navigation facility, service and avionics equipage planning.

2.6   **Draft Asia/Pacific Air Navigation Concept of Operations**

The following principles supporting an APAC Concept of Operations are intended to be the 'default' operations environment so that States can specify implementation requirements for the expected facilities, services and standards in accordance with a specified timeframe to enable,~~so~~ airspace users airlines could plan for the appropriate equipage.

1.1   The following principles supporting an APAC Concept of Operations are intended to be the 'default' operations environment so that States can specify expected facilities and standards in accordance with a specified timeframe, so airlines could plan for the appropriate equipage.

- The delivery of CNS/ATM services should be based primarily on the CNS/ATM capability. It is understood that a transition period for the enablement of capabilities and or enhancements may be necessary.

- **Flight Information Regions**: FIR boundaries should not limit the delivery of surveillance separation services (this requires Letters of Agreement and data sharing to facilitate seamless Transfer of Control). Where possible the number of FIRs should be minimized particularly along traffic flows. FIRs should not necessarily be based strictly on the boundaries of sovereign territories.

- **Special Use Airspace:** SUA should only be established [1] after due consideration of the impact on civil air traffic, and must be regularly reviewed by the appropriate State Airspace Authority to ensure that it is:

  o being used for the purpose that it was established;

  o being used regularly;

  o as small as possible; and

  o activated only when it is being utilised in accordance with the Flexible Use Airspace concept.

- **Communication**: areas where VHF (Very High Frequency) communications are not possible must be provided with a minimum communications services based on CPDLC (Controller Pilot Datalink Communications) capability, backed up by HF (High Frequency) or SATVOICE (Satellite Voice Communications).

- **Navigation**: air-routes above FL195 and within terminal controlled airspace (CTA and CTR) associated with major international aerodrome must be PBN based with an appropriate specification determined by the Airspace Authority (such as en-route RNP2, terminal RNP1/0.3) based on the GANP and the Regional Navigation Strategy.

- **Surveillance**: in areas where the provision of direct ATS surveillance is possible, ATC separation must be based on these surveillance systems (i.e. radar, multilateration and ADS-B). In areas where direct surveillance is not possible, ADS-C surveillance (and associated CPDLC capability) must be enabled providing reduced horizontal separations (i.e. RNP4 30/30 and planning for RNP2).

- Establishing equipage mandates requiring operators to equip with a specific technology is an acceptable concept provided the timeline for compliance is developed after due consultation and the benefits in equipage are clearly identified and agreed[2].

- **Safety Nets**: powered aeroplanes operating above FL195 and within terminal controlled airspace (CTA and CTR) associated with major international aerodrome must have an operable mode S transponder, ACAS (airborne collision avoidance system), and the ATS surveillance systems must be fitted with STCA (Short Term Conflict Alert) and MSAW (Minimum Safe Altitude Warning).

- **Priority**: in each case where a minimum aircraft equipage is specified for this Concept, any aircraft that does not meet these requirements should receive a lower priority, except where prescribed (such as for State aircraft). States should require State aircraft to conform with the Concept of Operations wherever possible.

- **ATM Systems:** ATM system design should enable appropriate ATC capabilities including Conflict Prediction and Resolution (CPAR), AIDC (ATS Inter-facility Datalink Communications), and A/D-MAN (Arrival/Departure Management).

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[1] Restricted areas must not be established over the high seas or over waters of undetermined sovereignty (reference: Annex 11 definition of restricted areas).

[2] Examples of this concept are the ADS-B mandate established by Australia, and those being established by Hong Kong China and Singapore.

• **ATFM**: flow management requirements to enhance capacity should be implemented for all major traffic flows and major aerodrome terminal operations, using bi-lateral and multi-lateral agreements, as well as CDM (Collaborative Decision-Making) procedures.

1.2   The APAC Concept of Operations should be applied against the Major Traffic Flows identified in the GANP (Global Air Navigation Plan). The following table is not part of the Concept of Operations itself but is an example of how concepts could be applied with the expectation that the navigation specification would deliver appropriate separation standards.

Areas (AR)	Homogeneous ATM areas/ Major Traffic Flows/Routes	Operational Concept
AR1	Asia/Australia and Africa	RNP4 based on ADS-C/CPDLC and planned RNP 2
AR2	Asia (Indonesia north to China, Japan and the Republic of Korea), Australia/New Zealand	RNAV5/RNAV2 based on direct surveillance/ VHF and planned RNAV1/RNP2
AR3	Asia and Europe via north of the Himalayas	RNAV5/RNAV2 based on direct surveillance/ VHF and planned RNAV1/RNP2
AR4	Asia and Europe via south of the Himalayas	Combination of: • RNP4 based on ADS-C/ CPDLC and planned RNP 2 • RNAV5/RNAV2 based on direct surveillance/ VHF and planned RNAV1/RNP2
AR5	Asia and North America via the Russian Far East and the Polar Tracks via the Arctic Ocean and Siberia	RNP4 based on ADS-C/CPDLC and planned RNP 2
AR6	Asia and North America via the Central and North Pacific	RNP4 based on ADS-C/CPDLC and planned RNP 2
AR7	New Zealand/Australia and South America	RNP4 based on ADS-C/CPDLC and planned RNP 2
AR8	Australia/New Zealand, the South Pacific Islands and North America	RNP4 based on ADS-C/CPDLC and planned RNP 2
AR9	South-East Asia and China, Republic of Korea, and Japan	RNAV5/RNAV2 based on direct surveillance/ VHF and planned RNAV1/RNP2

3.   ACTION BY THE MEETING

3.1   The meeting is invited to:

a)   note the endorsement of the Concept of Operations by ATM/AIS/SAR/SG/21;

b)   note the support of the Concept of Operations by CNS/MET/SG 15; and

c)   adopt the APAC Concept of Operations by endorsing the CNS/MET/SG 15 draft conclusion.

— END —