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INDIAN AIR NAVIGATION SERVICES IMPROVEMENT PROGRAMMES

(Presented by India)

EXECUTIVE SUMMARY	
The paper highlights India's major air navigation services (ANS) initiatives in enhancing safety, efficiency and increasing airports and airspace capacity, and providing a seamless air traffic management (ATM) capability across the crucial airspace connecting Asia to Mid-East and Africa.	
Strategic Objectives:	This working paper relates to all Strategic Objectives.
Financial implications:	Nil.
References:	

1. INTRODUCTION

1.1 The unprecedented growth in air traffic witnessed in India in the last decade and the forecast growth has put enormous pressure on capacity of airspace and airports and efficient delivery of services while maintaining and enhancing safety.

1.2 The ICAO Global Plan initiative and recommendations of various high level national committees have served as a guide to India's air navigation services (ANS) improvement programmes to manage the traffic growth safely and efficiently.

1.3 Some of the notable initiatives undertaken by India are; air space safety monitoring activities by the Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA) in the sub-region of the Asia and Pacific Office, Bangkok (APAC), improved air traffic services (ATS) surveillance coverage with the installation of additional radars/automatic dependent surveillance-broadcast (ADS-B) ground receivers, data link clearance for departure, performance-based navigation (PBN) required navigation performance (RNP) 10, area navigation (RNAV) 5 city pair ATS routes, RNAV1 standard instrument departures (SIDs) and standard instrument arrivals (STARs), and establishment of a single continuum of upper airspace for uniform application of rules and procedures.

1.4 Recognizing that efficient service delivery requires appropriately trained and motivated manpower, India has focused on improving the communications, navigation, and surveillance/air traffic management (CNS/ATM) training infrastructure including skill development and air traffic control officer (ATCO) licensing.

1.5 Adopting technology to meet the unique demands locally has always been challenging. India has moved rapidly in the last two decades to assimilate globally recognized technology in communication, surveillance and navigation. To facilitate the process of continuous and seamless adoption of required technological solutions, India has embarked upon developing indigenous capability for research and development.

2. ASIA PACIFIC AIRSPACE SAFETY MONITORING — BOBASMA INDIA

2.1 BOBASMA was established in 2010 to support the implementation of 50 NM reduced horizontal separation (RHS) in the Bay of Bengal, Arabian Sea and Indian Ocean airspace to provide monitoring services for international oceanic airspace of the Bay of Bengal member States. BOBASMA was endorsed as an En-route Monitoring Agency by the Twenty-second Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/22).

2.2 The flight information regions for which BOBASMA is conducting safety assessments to support implementation of reduced horizontal separation are Chennai, Mumbai, Kolkata, Delhi, Dhaka, Yangon, Colombo, Male, Lahore, Kabul and Karachi flight information regions (FIRs) for the international oceanic airspace.

2.3 The estimation of collision risk based on the TSD of December 2012 and the listing of large lateral deviation and large longitudinal error reports received by BOBASMA for the period from 1 January 2012 to 31 December 2012 provides the Bay of Bengal Arabian Sea Indian Ocean airspace horizontal risk estimates. The horizontal safety monitoring report of BOBASMA for the year 2012 was submitted to the Eighteenth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/18).

2.4 Such periodic safety assessments are conducted by BOBASMA to confirm that the continued use of 50 NM RHS introduced on sixteen RNP10 routes (L301, L507, L509, L510, L759, M300, M770, N563, N571, N877, N895, P570, P574, P628, P762 and P646) in 2011 to 2012 is safe.

3. ENHANCEMENT OF SURVEILLANCE COVERAGE

3.1 The Indian ADS-B plan is aimed at providing complimentary surveillance in areas where radar coverage exists and also fill in the surveillance gaps particularly in remote areas.

3.2 In line with the ICAO Global Plan initiative and Aviation System Block Upgrades (ASBU) and consistent with the ICAO APAC Regional implementation plan in terms of augmentation of surveillance coverage and adherence to time lines, India has taken the initiative to provide seamless surveillance coverage by augmenting the existing radar coverage through the installation of fourteen ADS-B ground stations at strategic locations.

3.3 In addition to the fourteen stations, India plans to install seven additional ADS-B ground stations. This augmentation of surveillance sensors is consistent with the upper airspace harmonization

plan of Kolkata and Delhi FIRs, and to supplement surveillance coverage in the Kolkata and Chennai FIRs.

3.4 The ground ATS automation systems are capable of processing ADS-B data and providing the information on situation data displays either as standalone ADS-B tracks or reinforced position symbols (fused with radar tracks).

3.5 Stakeholder meetings were conducted in December 2012 and January 2013 to detail the business case and to spread the awareness about the mutual benefits that will accrue to both the air navigation service providers (ANSP) and the airline operators by their participation.

3.6 With increased participation of ADS-B equipped aircraft, improved service levels and more efficient accessibility to airports, increased safety and efficiency in the en-route airspace are the expected benefits to the airspace users.

3.7 India supports seamless ATM and has expressed its willingness for resource sharing at ICAO meetings. In the SITF/11 as well as APANPIRG 22 and 23, India has expressed willingness to share ADS-B data with Myanmar, Maldives, Sri Lanka, Malaysia and Indonesia.

4. IMPLEMENTATION OF DATA LINK

4.1 Considering the need for enhanced surveillance and communication particularly in the oceanic areas, Airports Authority of India (AAI) has implemented controller-pilot data link communications (CPDLC) and automatic dependent surveillance — contract (ADS-C) services in Chennai, Kolkata, Delhi and Mumbai FIRs for future air navigation systems (FANS) 1A equipped aircraft. Having realized significant benefits of CPDLC in the oceanic air space, as part of its major CNS/ATM initiatives, AAI is deploying air to ground and ground to air data link communication based on the existing aircraft communications addressing and reporting system (ACARS) network. The three services that are being offered through such communication platforms are departure clearance (DCL), data link — automatic terminal information service (D-ATIS) and VOLMET data link service (D-VOLMET), via ACARS data link. The intent of this data link service is to provide efficient and reliable DCL services at Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad, D-ATIS messages from more than fifty-five operational airports and D-VOLMET messages from Mumbai and Kolkata airport, thereby reducing the workload for both pilots and air traffic controllers.

5. UPPER AIRSPACE HARMONIZATION

5.1 India has reviewed the existing Indian airspace structure and developed a new airspace management strategy to cope with the future growth of air traffic by establishing a single continuum of upper airspace for uniform application of rules and procedures through the state of the art ground ATM automation, the integration of a number of radars and ADS-B sensors and cross coupling of very high frequency (VHF). This will also enable enhanced implementation of PBN ATS routes structure. Seamless surveillance through radar and ADS-B will facilitate reduction in separation, thereby optimizing airspace capacity.

5.2 As per the master plan for the restructuring of the entire Indian airspace, each FIR will have only one upper area control centre (ACC) with multiple sectors to be operated from four major cities thereby amalgamating twelve ACCs into four ACCs initially and subsequently into two ACCs.

5.3 Considering the complexity and magnitude of the task, India has decided to proceed in a phased manner and has embarked on the project to restructure Chennai FIR in the first phase. Accordingly, the upper airspace of Chennai FIR above 26 000 feet was restructured as a single continuum of airspace with the introduction of advanced ATS automation systems along with the integration of ten radars and ADS-B data from Port Blair. The new technique of cross coupling VHF facilitated the creation of multiple sectors to be operated from a single centre at Chennai and enabled consolidation/deconsolidation of sectors dynamically. The introduction of ATS interfacility data communications (AIDC) permits automatic exchange of aeronautical data among air traffic control (ATC) units thereby reducing ATS coordination significantly.

5.4 Having successfully implemented the establishment of upper airspace harmonization in Chennai FIR, AAI has prepared a time bound action plan to implement the upper airspace harmonization in Kolkata and Delhi FIRs which would be operated from Kolkata and Delhi and would permit consolidation/deconsolidation of sectors by these ATC centres.

6. IMPLEMENTATION OF CITY PAIR ATS ROUTES

6.1 India submitted its PBN implementation plan to ICAO APAC which has been accepted as a robust plan.

6.2 In accordance with the PBN implementation plan, India has implemented RNAV5 city pair route Delhi-Mumbai-Delhi, Chennai-Mumbai-Chennai, Kolkata-Chennai-Kolkata, Mumbai-Trivandrum-Mumbai. Further, India is keen to cooperate and support its neighbouring States to jointly develop PBN RNAV5 routes and arrival/departure procedures to form a seamless network of PBN routes and arrival/departure procedures in the sub-continent.

6.3 India is also considering implementation of RNAV2 routes between Delhi and Kolkata and Kolkata and Mumbai.

7. IMPLEMENTATION OF PBN SIDS AND STARS

7.1 PBN SIDs and STARs are being designed to facilitate continuous climb operations (CCO) and continuous descent operations (CDO); such procedures are expected to provide significant improvement in operational efficiency for aircraft. Design work on a number of barometric vertical navigation (baro-VNAV) approaches has been completed and the regulatory process for the approval of the procedures has been initiated.

7.2 To date, RNAV-1/RNP-1 SIDs and STARs have been implemented at nine international airports. It has been possible to streamline traffic flows, avoid delays due to holding and enable effective management of airspace. The reduction in track miles achieved through these procedures has provided significant fuel savings and reduction in emissions.

7.3 RNAV-1/RNP-1 SID & STAR are under development at Guwahati, Mangalore, Calicut, Coimbatore, Nagpur and Varanasi airport with implementation planned by the end of 2013/beginning of 2014.

8. FLEXIBLE USE OF AIRSPACE; CIVIL — MILITARY COOPERATION

8.1 The airspace of the nation is a finite sovereign asset, which is used by civil, military and aerospace authorities. Flexible utilization of airspace is important from the view point of efficiency of operation, viability of airlines and minimizing damage to the environment. This can be achieved by the introduction of the concept of flexible use of airspace (FUA).

8.2 As a first step for implementation of the FUA in India, a National High Level Airspace Policy Body (NHLAPB) for airspace use will be set up to take up the job of strategic planning and assess/reassess the national airspace requirements of various stakeholders. It will establish flexible airspace use structure/committee's and introduce procedures for allocation of these airspace structures.

8.3 It is estimated that with the implementation of FUA, fuel savings of 20,29,380 kg per annum and a reduction of carbon dioxide emissions by 63,93,600 kg per annum will be achieved with the availability of direct routing between seven city pairs of Delhi-Mumbai, Delhi-Kolkata, Delhi-Chennai, Delhi-Hyderabad, Delhi-Bengaluru, Kolkata-Chennai and Chennai-Mumbai .

8.4 By adopting the FUA in close coordination with military authorities, as many as eleven international routes have been realigned/routed through reserved airspaces resulting in fuel savings of 802,33,570 kg per annum and corresponding reduction in emission. Similar successful results have been achieved by designing domestic conditional routes through defence areas.

9. SBAS IMPLEMENTATION

9.1 The GPS aided geo augmented navigation or GPS and geostationary earth orbit augmented navigation (GAGAN) is a planned implementation of a regional satellite-based augmentation system (SBAS) by the Indian government.

9.2 GAGAN signal-in-space is currently undergoing an operational testing and evaluation process and is available for non-aviation users. It will be available for aviation use after certification activities are completed by the end of 2013.

9.3 GAGAN, when certified by Director General of Civil Aviation (DGCA) India, will authorize the use of global navigation satellite system (GNSS) services augmented by GAGAN as a navigational facility for aircraft suitably equipped to operate to such airports where ground navigation aids are not available or cannot be installed due to local constraints.

9.4 With the implementation of GAGAN, India will be able to provide approach with vertical guidance (APV) 1.0 services (baro-VNAV/SBAS) in order to meet the ICAO resolution of approach with vertical guidance to each runway ends to increase safety, enhance efficiency and capacity.

9.5 The GAGAN system will enhance the PBN plan of India and will ensure a planned programme of moving from Block "0" to Block "1" of the ASBU.

9.6 GAGAN is located between the European Geostationary Navigation Overlay Service (EGNOS) and the multifunctional transport satellite-based augmentation system (MSAS) and effectively fills the gap to provide a seamless SBAS coverage. GAGAN is interoperable with EGNOS, MSAS & the wide area augmentation system (WAAS) providing harmonization that will ensure effective air space utilization and leading to the "one sky" vision of ICAO.

9.7 States within the APAC region can take the advantage from GAGAN signal-in-space to enhance the availability of approaches with vertical guidance for aircraft using SBAS avionics. This flexibility provides benefits when conventional aids are out of service due to system failures or for maintenance. Such approaches can be designed for runways with or without conventional approaches, thus providing benefits to PBN-capable aircraft, encouraging equipage and supporting the planning for decommissioning of some conventional aids.

9.8 GAGAN would enable the Indian sub-continent to meet international obligations for PBN. Shared benefit will be possible if States within the region harmonize the resources that will redefine the navigation of the future leading to increased airspace capacity, reduced separation, increased fuel efficiency and reduced emissions, meeting the objectives of seamless ATM.

10. TRAINAIR PLUS — CATC

10.1 The Civil Aviation Training College (CATC), Allahabad, is the premier training organization of AAI for training CNS/ATM professionals and achieved the TRAINAIR PLUS full membership status on 10 June 2013 after successfully completing all the requirements including production of a standardized training package (STP).

10.2 TRAINAIR PLUS full membership status will play a vital role in the development and sharing of valuable course materials permitting CATC Allahabad to meet its mandate and challenges with regard to training activities. The competency acquired by CATC's course developers and use of standardized training methodology contained in the ICAO TRAINAIR PLUS Training Development Guide Doc 9941 — *Competency-based Training Methodology*, which embraces the members of ICAO competency-based approach, will surely enhance the quality of training courses developed by the college.

10.3 The TRAINAIR PLUS full membership will provide the required impetus in grooming the next generation aviation professionals of India to meet the challenges of the aviation industry.

11. DEVELOPING INDEGENOUS R&D CAPABILITY

11.1 Despite handling challenging air traffic growth, the much-needed research and development capability in ATM did not exist in AAI and hence had to heavily depend on foreign ANSPs and vendors for ATM and automation related systems and solutions.

11.2 With a view to developing innovative and self-reliant ATM solutions and implementing new technology based on sound research compatible with our requirements, AAI is setting up a research and development (R&D) facility in Hyderabad.

11.3 The R&D centre would also exploit the readily available expertise and talent of the current ATCOs as most of them have either research or engineering background.

11.4 The proposed technical centre would provide comprehensive laboratory capabilities to support AAI's daily air traffic management operations and maintenance, besides carrying out performance analysis and R&D.

11.5 The capability will provide AAI access to the latest technological advancement in the field of ATM, CNS and automation equipment and software development to cope with the challenging ASBU requirements and contribute to safe and seamless ATM.

12. CONCLUSION

12.1 The States are invited to note India's ANS improvement initiatives in enhancing safety, efficiency and increasing airports & airspace capacity and providing a seamless ATM capability across the crucial airspace connecting Asia to Mid-East and Africa.

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