DIRECTORS GENERAL OF CIVIL AVIATION-MIDDLE EAST REGION

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Agenda Item 5: Air Navigation

GACA ATM INNOVATION PROGRAM

(Presented by Saudi Arabia)

SUMMARY

The information provided in this paper presents the on-going ATM innovation program being undertaken by the General Authority of Civil Aviation (GACA) in the Kingdom of Saudi Arabia. The program will enhance CNS/ATM and Aeronautical Information Management capabilities.

The paper may provide the foundation whereby the ICAO MID Regional States, through the various Working and Sub Group meetings adopts ATM seamless Principles using a common set of ICAO Aviation System Block Upgrades. In addition, the paper encourages ICAO MID States to study the opportunities of exchange of surveillance data on aircraft capabilities and performance

1. INTRODUCTION

1.1 Based on ICAO Global Air Navigation Plan (Doc 9750) and the ICAO Global Air Traffic Management Concept (Doc 9854) and GASP and proven world-wide best practices, GACA has established a Strategic Plan for the innovation of ATM applications covering the timespan 2005-2015. The plan took into account the Regional planning activities and the need for a performance based approach.

1.2 The ATM innovation program has covered the implementation of:

- a new surveillance infrastructure based on a network of Radars, ADS-B covering Jeddah FIR and Multilateration and three Advanced Surface Movement Guidance and Control Systems (A-SMGCS) for the main International Airports;
- transition from AIS to AIM with digital applications for information provision and management;
- a new Air Traffic Management System that utilizes last tracking technology and data fusion;

- a set of ATC tools to enhance the capabilities and performance of ATS Units which includes but is not limited to eSTRIP, AMAN/DMAN..etc.
- new ATC facilities and introduction of approach services within the major regional airports;

1.3 With respect to Regulatory and Safety oversight functions, GACA has also undertaken a major re-organization to establish a clear separation between the Regulatory and the Service Provision Functions. Two organizations have been established (GACA-S&ER as the Regulatory body and GACA-ANS as the Service provider)

1.4 Based on ICAO requirements and guidance, all the technical and operational regulations and requirements covering aircraft operations, airworthiness, air navigation services and airports are under revision and it is expected a new set of Regulations will be applied by the third quarter 2013. All ICAO amendments will be tracked through a web-based application with an automatic management of 'Differences'. (Strategic planning calls for the number of these Differences to be minimal).

2. PBN IMPLEMENTATION

2.1 Based on the ICAO PBN concept, GACA-ANS has developed a PBN strategy which includes the navigation specifications and applications that will be implemented for en-route and terminals areas.

2.2 This strategy stipulates that ground infrastructure should remain to serve non equipped aircraft. The removal of the NAVAIDs will be the subject of comprehensive consultation with stakeholders and users. GACA-ANS strategy is aligned with the PBN applications that were adopted at Regional level and coordinated by ICAO MID office.

2.3 The radio navigation coverage was assessed using flight checks and the EUROCONTROL Tool – Demeter which has shown that GACA-ANS radio navigation infrastructure performance (DME-DME) meets all ICAO requirements for the implementation of RNAV-5 and RNAV-1 in Jeddah FIR. Based on traffic figures and scheme, GACA-ANS has already introduced RNAV-5 and has initiated an implementation plan to introduce RNAV-1 on selected ATS routes. For terminal areas, GACA-ANS has adopted various PBN applications which include implementation of RNP-APCH, Basic RNP-1, and A-RNAP-1 for medium and long terms as defined in the PBN strategy.

3. AERONAUTICAL CIVIL RADAR CONSTELLATION (ACRC)

3.1 GACA-ANS is in the process of upgrading the surveillance system through a fully state of the-art radar aeronautical civil radar constellation (ACRC) that incorporates the latest technologies into a surveillance radar system. This constellation is composed of:

- 16 dual channel Mode-S Monopulse Secondary Surveillance Radars (MSSR) for en-route service,
- 1 Single Channel Mode-S MSSR Training System at the Jeddah Training School and,
- 4 Co-Mount PSR / Mode-S MSSR systems for Terminal Maneuvering Area Radar (TMAR) operations at Jeddah, Riyadh and Dammam.

3.2 The constellation is covering the whole KSA Airspace including Jeddah FIR with a very high and reliable radar detectability, solid-state, programmable, signal generation and demodulation, processors and communications technology.

3.3 The Mono-pulse Secondary Surveillance Radar Mode S radar includes full international capabilities as enhanced surveillance performances and complies with the requirements stated by the International Civil Aviation Organization (ICAO) and with the performance required by EUROCONTROL to the surveillance and navigation Mode S systems.

3.4 The ACRC will allow the air traffic controller to monitor all airborne aircraft in KSA airspace, clearly, simultaneously and without interference. In February 2013, 4 MSSR Stations were declared operational ready for use after conducting flight trials and radar performance monitoring.

4. NEW GENERATION OF AIR TRAFFIC MANAGEMENT SURVEILLANCE SYSTEMS

4.1 GACA-ANS is introducing an Automatic Dependent Surveillance Broadcast (ADS-B) network system which incorporates the latest technologies as a second surveillance layer for the whole KSA Airspace. The high performance and reliability system will provide coverage and enhance services within the following areas:

- Non-radar airspace (Empty Quarter –Ar-Rub Al-Khali),
- Air traffic control surveillance in radar airspace and on the airport surface.

4.2 GACA-ANS ADS-B network is to be established based on the actual international requirements and recommendations for the Automatic Dependent Surveillance Broadcast as part of an air traffic control system. The ADS-B network will consist of stations sited at 22 locations throughout the Kingdom. Each station will consist of a source of electricity (mains or solar), an antenna mounted on the top of a building or tower and a building containing the receiving and interface core equipment. It is expected that the ADS-B coverage will be declared operational by the end of 2014.

5. ADVANCED ATM SYSTEM FOR ACC, APP AND TWR ATC CENTRES

5.1 The PRISMA/MSTS Project (PRISMA/MSTS-SA) includes an advanced, fully-featured ATM system that autonomously processes Flight Plan Data and Surveillance Data for Air Traffic Service (ATS) for the two Area Control Centres and four approach Units (Jeddah, Riyadh, Madinah and Dammam). The air situation picture that will generated is based on fused and multi-sensor surveillance data. It is expected that this system will be introduced for Air Traffic Management by ~~the~~ Mid-2014.

6. ADVANCED SURFACE MOVEMENT SURVEILLANCE SYSTEM

6.1 In order to enhance the safety of ground movement at King Abdulaziz International Airport (Jeddah) and King Khaled International Airport (Riyadh) and King Fahd International Airport (Dammam) three Advanced Surface Movement Guidance and Control Systems (A-SMGCS) will be implemented in 2014. It is planned that these systems will provide the capability and functionality for: Surveillance, Control, Routing and Guidance.

6.2 GACA-ANS has opted for an Advanced Surface Movement Guidance and Control System based on an open and flexible architecture offering high performance~~s~~. Each A-SMGCS system uses multiple surveillance sources such as PSR, SSR, SMR, a transponder multi-lateration system (MLAT), an ADS-B tracking system and an advanced multi-sensor fusion processor to provide a comprehensive surveillance picture of the aerodrome surface taking into account all possible visibility and weather variables and time of day. Data is presented on an integrated display that features an HMI developed in full consultation with Air Traffic Controllers.

6.3 GACA-ANS has specified for the situational displays a full-colour display~~s~~ that presents the fused, multi-sensor surveillance data for accurate, reliable surveillance in all weather conditions. The displays can also support additional functionality including data recording/playback, system status monitoring and decision support tools.

7. ATM ENHANCEMENT TOOLS

7.1 By the end of 2014, GACA-ANS will introduce the following ATC support tools:

- **The Digital Flight Strip System** is an Electronic Flight Strip System that has a fully digital representation of paper flight strips on a touch-pen display. The main design goal of DIFLIS was to keep the flight strip representation and workflow similar to what controllers are used to in a 'paper strip' environment, while automating everyday tasks as much as possible. The system is designed to be deployed as a standalone system or integrated as part of the KAIA, KKIA and KFIA Advanced Surface Movement Guidance and Control System.

- **The Integrated Tower Information System** which incorporates various meteorological information such as wind, RVR, QNH, TAF, METAR, METEOSAT images, weather radar images, etc. All this information is displayed on a single screen that allows a controller to additionally monitor the lighting system and NAVAIDs.

- **The integrated Arrival and Departure Manager (AMAN/DMAN)** is a multi-runway arrival and departure management system. It is able to optimize the runway usage for segregated and mixed mode operations subject to different objectives of different airport stakeholders. To achieve this, the runway sequence for trajectories of arriving aircraft are predicted once they enter radar coverage, with the planned route and characteristics of different aircraft models being reflected in the trajectory prediction. For departing aircraft the taxi route and time from stand to holding point are calculated to provide a target start up approval time that guarantees efficient runway usage without long holding queues.

8. ADVANCED AERONAUTICAL INFORMATION MANAGEMENT (AIM)

8.1 With the Quality Management System implemented in accordance with the ICAO Annex 15 SARPs and certified ISO 9001-2008 by TUV NORD, GACA-ANS (AIS Department) is collating, assembling, editing, formatting, publishing/storing and distributing aeronautical information/data concerning the entire territory of the Kingdom of Saudi Arabia. The Aeronautical information is published as an Integrated Aeronautical Information Package using an aeronautical central Database and advanced software tools and applications for AIP management and Charts production.

8.2 Considering the ICAO framework on AIM, GACA-ANS has adopted an innovative program to evolve from the paper product-centric aeronautical information service to the data-centric aeronautical information management (AIM) with a different method of information provision and management. This program is structured around the ICAO Roadmap phases and steps. Since 2009, an initial Web service (www.ans.gov.sa) is available where the AIP, AIP supplements, AIP amendments and Aeronautical information circulars are made available to all ATM stakeholders and users.

9. MAPPING GACA ATM INNOVATION TO ICAO ASBU BLOCK 0 MODULES

9.1 The ICAO framework is set through the Global Air Navigation Plan (Doc 9750), which comprises the "Aviation System Block Upgrades" (ASBU) initiative, developing a set of ATM solutions or upgrades that exploits current equipage, establishes a transition plan and enables global interoperability. ASBUs adopted during the 12th Air Navigation Conference held in November 2012 at ICAO HQ, comprise a suite of modules organized into flexible and scalable building blocks where each module represents a specific, well bounded improvement.

9.2 The ASBU initiative describes a way to apply the concepts defined in the ICAO Global Air Traffic Management Concept (Doc 9854) with the goal of implementing regional performance improvements.

9.3 As the development of ATM innovation program was based on known global and regional interoperability requirements, GACA ATM operational enhancements are consistent with the elements in the ASBUs. The mapping between GACA operational changes and ICAO's ASBU – Block 0 is provided in Appendix A to this paper.

10. DISCUSSION & CONCLUSION

10.1 The ICAO Aviation System Block Upgrade (ASBU) modules, including those related to PBN should be considered as the driving factors for initiatives of cooperation and data exchange in the MID region. ASBU modules should be prioritized in a manner that is compatible with the application of the Performance Based Approach and that, whilst fostering harmonization and interoperability, recognizes the diversity of performance-problems within the MID region.

10.2 It is very important that ICAO MID states align their plans and implementation on the most common ASBU modules to bring the MID Region States and ANSPs at the same level of ATM capabilities which will be a key factor for Regional harmonization and data exchange.

10.3 As ICAO ASBU Modules are aiming regional and global harmonization and interoperability, it is necessary that ICAO MID states identify a set of seamless ATM Principles and the related ASBU modules and elements that should be developed and implemented to support a regional and inter-regional data exchange.

10.4 The implementation of new surveillance technologies (ADS-B, MLAT) across the MID Region will offer new opportunities of data surveillance exchange between MID States. The Data provided via the new surveillance sensors could be used to enlarge the surveillance coverage and services and to monitor aircraft capabilities and performance.

10.5 Moreover, the data on aircraft performance can be checked using the various surveillance data collected and MID States may explore the possibilities to exchange these data between their regulatory authorities. This will help to monitor the overall fleet used in the MID region and to timely inform the State of operator and the State of Registry of any degradation on aircraft capabilities and performance.

Appendix A - Mapping of main ICAO ASBU modules Block 0 and GACA-ANS ATM Innovation Program