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TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

REPORT OF THE COMMITTEE TO THE CONFERENCE ON AGENDA ITEM 5

The attached report has been approved by the Committee for submission to the Plenary.

Captain John F. McCormick
Committee Chairman

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Agenda Item 5: Efficient flight paths – through trajectory-based operations

5.1 INTRODUCTION

5.1.1 A move from the present air traffic management (ATM) model, where the present location of the aircraft is known, to a trajectory-based management concept, where the future location of the aircraft is also known and shared, is fundamental to increasing efficiency of flight paths. By using shared dynamic trajectory information to facilitate wide area collaborative decision-making (CDM) between adjacent air navigation service providers (ANSPs) in the same and neighbouring flight information regions (FIRs), the ATM system will be able to analyze and accurately predict potential conflicts and other hazards based on three-dimensional and ultimately four-dimensional parameters.

5.1.2 Under this agenda item, the modules that support the key performance area of efficient flight paths – through trajectory-based operations were presented. These are Improved Traffic Synchronization and Initial 4D Trajectory-based Operation and Improved Flexibility and Efficiency in Descent Profiles. Flights will be accommodated in a manner that achieves the optimum system outcome with minimal deviation from the user preferred 4D flight trajectory. Automation, both in the air and on the ground will be used to create an efficient and safe flow of traffic while preserving the ability of the human operators to intervene when and as needed to preserve the overall safety of the system.

5.1.3 The Committee considered developments in regard to the synchronization of traffic flows at merging points in the en-route environment and in terminal control areas (TMAs) to optimize the landing sequence, by application of time-based metering at intermediate points. Departure and arrival procedures that take into account airspace and traffic complexity while facilitating flight via optimum profiles by enabling continuous climb operations (CCOs), continuous descent operations (CDOs) and optimized profile descents (OPDs) were also addressed. Supporting ATM procedures and arrangements such as conflict management, airspace organization and management, demand and capacity balancing and environmental management were an essential component of these discussions.

5.1.4 Under this agenda item, the modules that support the key performance area of efficient flight paths were introduced. These comprise the following:

a) B0-05, B1-05 and B2-05 – Improved flexibility and efficiency in descent profiles;

b) B0-20 – Improved flexibility and efficiency in climb profiles;

c) B0-40 and B1-40 – Data link surveillance and communications supporting TBO; and

d) B3-05 – 4D trajectory-based operations – 4D TRAD.

5.2 PBN-ENROUTE

5.2.1 Under this item, the Committee recognized that implementation of performance-based navigation (PBN) routes can have significant efficiency benefits on flight operations in the en-route environment. It was agreed that the development and implementation of the new specifications required navigation performance 2 (RNP-2) and Advanced-RNP with its added functionality will further contribute to reduced route spacing, greater application of user preferred routes and increased airspace utilization.

Consequently, the Committee supported the development of RNP-2 separation standards and recognized the importance of fixed radius turn (FRT) functionality of Advanced-RNP on reducing route spacing.

5.2.2 The Committee supported the importance of flight demonstrations and trials on achieving significant safety, efficiency and capacity benefits as well as the value they add as best practices/examples for aviation system block upgrade modules. These demonstrations could not be conducted without significant State and stakeholder collaboration which contributes to greater overall understanding of PBN. The Committee agreed that all States must learn from the positive results of these exercises and that ICAO should support and promote wider application of the demonstrations. In this regard, the Committee noted the success of the collaborative inter-regional coordination model, INSPIRE (Indian Ocean Strategic Partnership to Reduce Emissions) that was used with the implementation of User Preferred Routes (UPR) in the Indian Ocean, and promoted its application where feasible. The Committee, in general, supported the concept of the Indian Ocean Arabian Sea UPR Geographic Zone which may be adopted by other regions.

5.2.3 Regarding a globally harmonized transition altitude, the Committee recognized that a common global standard is preferred; however, a regional or subregional transitional basis was considered to be the necessary first step, as recommended in the *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168, PANS-OPS). The Committee agreed that a harmonized transition altitude, either on a national, sub-regional or a regional basis, can present significant operational, safety and financial challenges and that further assessment would be necessary before proceeding.

5.3 TRAJECTORY-BASED OPERATIONS

5.3.1 Under this item, the block upgrade modules related to trajectory-based operations (TBO) were presented which comprised: B0-40, B1-40 and B3-05 – Four Dimension Trajectory-based Operations. The Committee reviewed the overall strategy, the incremental development, the technology requirements and deployment considerations related to trajectory-based operations.

5.3.2 The Committee noted that in a trajectory-based scenario airspace users will agree with ANSPs and airport operators, to the preferred trajectory for the flight in four dimensions, from the early flight planning to the day of operations, where the various constraints of airspace and airport capacity are taken into account.

5.3.3 Four dimension (4D) trajectories will bring key performance benefits including better knowledge of the aircraft trajectories in the ground and en-route which will improve safety as well as flight predictability and reduce the need for tactical interventions. The more efficient resource planning which this allows will in turn enable a more efficient utilization of the available capacity both of airports and the airspace in general. For airspace users, 4D trajectories will allow the aircraft, with knowledge of the relevant constraints, to plan and fly the most optimal, cost-efficient flight profile, achieving better punctuality and flight efficiency as well as a reduction in emissions.

5.3.4 The Committee reviewed information regarding initial 4D (I-4D) which represents the first step for arrival airport time prioritization and en-route demand and capacity balancing. I-4D can be summarized as the capability to obtain from the aircraft, a reliable estimated time of arrival (ETA) window at a waypoint on the aircraft’s current route and also the capability to coordinate a controlled time over (CTO)/controlled time of arrival (CTA), within that reliable ETA window, with all interested actors, (ground or airborne) for the purpose of sequencing/spacing traffic at a specified waypoint.

5.3.5 Based on the discussions on trajectory-based operations, the Committee expressed its support for the modules associated with it.

5.4 CONTINUOUS CLIMB OPERATIONS/CONTINUOUS DESCENT OPERATIONS

5.4.1 Under this item, the Committee recognized that CCO and CDO were important aspects of the aviation system block upgrades. Both operations, which are supported by PBN, will offer significant benefits in safety and efficiency in the terminal area. It concluded that States should implement Block 0 modules regarding CCO and CDO where it makes operational and business sense to do so.

5.4.2 In discussing the point merge technique, the Committee agreed that this technique certainly has merit as proven in the Republic of Korea due to the improved safety, efficiency and capacity benefits it provides in the terminal areas; however, the Committee agreed that the application was not universal as the technique is not a full CDO and requires additional airspace that may not be available in all terminal areas. States need to assess the technique for the specific terminal area through appropriate trials and simulations that validate the benefits. As this is an existing application, the Committee also supported the inclusion of the point merge technique in the appropriate Block 0 upgrade module.

5.5 Based on the discussions, the Committee agreed to the following recommendations:

Recommendation 5/1 – Improved operations through enhanced airspace organization and routing

Considering that performance-based navigation (PBN) is one of ICAO's highest air navigation priorities and the potential benefits achievable through creation of additional capacity with PBN:

That States:

a) implement performance-based navigation in the en-route environment;

b) fully assess the operational, safety, performance and cost implications of a harmonization of transition altitude and, if the benefits are proven to be appropriate, undertake further action on a national and (sub) regional basis a first step towards a globally harmonized transition altitude;

c) take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through the airspace;

d) through the planning and implementation regional groups improve their methods of coordination to increase implementation of en-route performance-based navigation in order to achieve more optimum routes through the airspace;

That ICAO:

e) encourage the planning and implementation regional groups to support the early deployment of performance-based navigation in accordance with Assembly Resolution 37-11;

f) support, through development of a framework that capitalizes, builds on, and promotes demonstration activities which confirm the benefits of performance-based navigation as an enabler of more efficient operations in the en-route phase of flight; and

g) that avionics providers incorporate fixed radius transition functionality to support closer spacing of performance-based navigation routes and improve airspace capacity.

Recommendation 5/2 – ICAO aviation system block upgrades relating to trajectory-based operations

That States:

a) support development by ICAO of Standards and Recommended Practices and guidance material related to trajectory-based operations;

b) implement, according to their operational needs, the aviation system block upgrade module relating to trajectory-based operations included in Block 0;

c) endorse the aviation system block upgrade module relating to trajectory-based operations included in Block 1 and that ICAO use it as the basis of its work programme on the subject;

d) agree in principle with the aviation system block upgrade module relating to 4D trajectory-based operations included in Block 3 as the strategic direction for this subject; and

That ICAO:

e) include, following further development and editorial review, the aviation system block upgrade module relating to 4D trajectory-based operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP).

Recommendation 5/3 – Increased flexibility and efficiency in descent and departure profiles

That States:

a) as supported by their operational requirements and a positive business case, implement according to their operational needs as a matter of urgency, the aviation system block upgrade modules relating to continuous climb operations and continuous descent operations included in Blocks 0 and 1;

b) as supported by their operational requirements and a positive business case, use point merge technique as an application towards achieving full continuous descent operations, when developing performance-based navigation standard instrument arrivals (STARs);

c) endorse the aviation system block upgrade module relating to continuous descent operations included in Block 1;

d) agree in principle to the aviation system block upgrade module relating to continuous descent operations included in Block 2;

That ICAO:

e) include, following further development and editorial review, the aviation system block upgrade modules relating to continuous climb operations and continuous descent operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); and

f) incorporate the point merge technique as an interim CDO measure in Block B0-05.

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