



WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 3: Interoperability and data – through globally interoperable system-wide information management (SWIM)

3.2: Improved operational performance through flight and flow – information for a collaborative environment (FF-ICE)

AVIATION SYSTEM BLOCK UPGRADE MODULES RELATING TO FLIGHT AND FLOW – INFORMATION FOR A COLLABORATIVE ENVIRONMENT (FF-ICE)

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The 37th Session of the ICAO Assembly directed ICAO to increase its efforts to meet global needs for airspace interoperability while maintaining its focus on safety. To this end, a planning framework for global harmonization and interoperability named the aviation system block upgrade (ASBU) is proposed to the Conference for incorporation into the Fourth Edition of the *Global Air Navigation Plan*.

The ASBU framework includes modules over a series of blocks, supported by technology roadmaps, which serve to progressively enhance many aspects of civil aviation operations. This paper presents the modules relating to improving operational performance through flight and flow – information for a collaborative environment (FF-ICE), which comprise:

- a) B0-25, B1-25, B2-25 and B3-25 – Flight and flow – information for a collaborative environment.

Action: The Conference is invited to agree to the recommendations in paragraph 3.

<i>Strategic Objectives:</i>	This working paper relates to the Safety Strategic Objective.
<i>Financial implications:</i>	The cost impact for FF-ICE related modules is expected to be moderate and will be primarily borne by the air navigation service providers (ANSPs) who may need to undertake investment. However, based on preliminary indications, the benefits of implementing these modules could be substantial for individual ANSPs and global system performance, and when implemented the benefits are expected to far outweigh the costs.
<i>References:</i>	Doc 9965, <i>Manual on Flight and Flow – Information for a Collaborative Environment</i> Doc 9958, <i>Assembly Resolutions in Force (as of 8 October 2010)</i> Doc 9854, <i>Global Air Traffic Management Operational Concept</i> Doc 9750, <i>Global Air Navigation Plan</i> AN-Conf/12-IP/9

1. INTRODUCTION

1.1 The next edition of the *Global Air Navigation Plan* (Doc 9750, GANP) will be presented to the next ICAO Assembly in 2013 for approval. The draft GANP, and the aviation system block upgrade (ASBU) strategy it establishes, proposes that future air navigation technology and procedure improvements are organised and based on a consultative strategic approach that coordinates specific global performance capabilities and the flexible upgrade timelines associated with each.

1.1 The ASBU modules are organized into flexible and scalable building blocks that can be implemented depending on the operational needs, while recognizing that implementation of a particular module is not mandatory in all areas or circumstances. The approach adopted is not limiting and recognizes that deployment in addition to the material described in the ASBUs may also take place or be necessary. The broad timescales associated with the ASBU framework (Block 0 = 2013, Block 1 = 2018, Block 2 = 2023, Block 3 = 2028) are intended only to depict the initial readiness of all components, including ICAO Standards and Recommended Practices (SARPs), needed for deployment and do not imply a mandated State or regional implementation timeframe. The ASBU framework with supporting technology roadmaps ensures that State and regional implementation planning and deployment activities can be undertaken with the confidence that all components necessary for a particular deployment will be available within the ASBU dates mentioned.

1.2 Global system-wide information management (SWIM) requires system-level information management solutions rather than individual solutions to develop an integrated air traffic management (ATM) network – a global aviation intranet. As one of the fundamental components of SWIM, the aircraft's flight plan plays a pivotal role in the data chain. In this context, a planning thread describing the phased deployment of an advanced flight planning and information sharing concept known as “flight and flow – information for a collaborative environment”, as described in the appendices to this paper and illustrated in the attached Figure 1, is proposed for inclusion in the ASBU framework.

2. FLIGHT AND FLOW – INFORMATION FOR A COLLABORATIVE ENVIRONMENT (FF-ICE)

Overall Strategy

2.1 The Global ATM Operational Concept envisages an integrated, harmonized and globally interoperable system for all users in all phases of flight. The aim is to increase user flexibility and maximize operating efficiencies while increasing system capacity and improving safety levels in the future ATM system. As one component of this system, FF-ICE addresses the many limitations in the current flight planning, flow management, trajectory management and information sharing processes.

2.2 Dynamic flight information and associated 4D trajectories are the principal mechanisms by which ATM service delivery will meet operational requirements. The exchange of flight and flow information will result in an integrated picture of the past, present and future ATM situation. FF-ICE defines information requirements for flight planning, flow management and trajectory management and will form a cornerstone of the performance-based air navigation system. FF-ICE emphasizes the need for information sharing and coordination in a collaborative decision-making (CDM) environment to achieve significant operational benefits and will have global applicability in order to support all members of the ATM community in carrying out strategic, pre-tactical and tactical performance management. FF-ICE ensures that definitions of data elements are globally standardized and also provides mechanisms for their exchange.

2.3 Detailed information on the FF-ICE concept and how the transition from the present system to the future one could occur, taking into account the performance objectives of the different participants and regions, is given in AN-Conf/12-IP/9.

Incremental development

2.4 The ASBU concept facilitates the step by step deployment of operational improvements within the boundaries of an overall planning framework. Looking towards the FF-ICE end state following the deployment of the FF-ICE elements of Block 3, an aircraft should be capable of exchanging information with air traffic service (ATS) ground systems regarding its 4D trajectory and should be able to adhere fully to an agreed, user preferred 4D trajectory. Ground systems would support management of flights by setting time constraints and applying integrated sequencing as well as augmented surveillance capabilities. The flight-object, which represents the flight in the FF-ICE environment, will be implemented in ground systems and will support the sharing of flight information and trajectory through SWIM between air and ground during all phases of flight. All messages exchanged between air and ground systems will use the XML format to facilitate development and evolution. Following Block 3, the next challenge will be to implement FF-ICE in airborne systems and use SWIM for airborne access to ATM information. Future requirements for the sharing of information between SWIM and other specific data-communications media will continue to evolve, meaning that, for example, usage of automatic dependent surveillance — contract (ADS-C) needs further definition including consideration of security, safety and technical performance requirements.

2.5 At the first stage, Block 0 includes the usage of automated ATS interfacility data communications (AIDC) messages as the basis of ground-ground coordination between neighbouring ATS units. Use of ATM automation in this way increases the reliability of information and reduces ATC workload associated with routine flight coordination and transfer. This contributes directly to safety improvements such as reductions in coordination errors and supports performance improvements such as reduced separation and enhanced efficiency. Widespread use of AIDC is an initial step towards 4D trajectory exchanges and could be readily implemented on ATS systems with flight data processing functionality.

2.6 Following the implementation of the ICAO FPL 2012 in November 2012, the Block 1 phase proposes deployment of a subset of FF-ICE, known as FF-ICE/1, to increase pre-departure flexibility in flight data submission, amendment, sharing and publishing as well as supporting pre-flight air traffic flow management (ATFM). FF-ICE/1 and SWIM will also support CDM activities by facilitating sharing of information and the use of information services.

2.7 A significant objective of FF-ICE/1 is to establish the basis for transition towards a full FF-ICE deployment by introducing:

- a) a globally unique flight identifier (GUFI);
- b) a common data format (flight information exchange model (FIXM)); and
- c) basic roles, rules and procedures for submission and maintenance of FF-ICE information including provisions for the early sharing of trajectory information

2.8 Block 2 drives the extension of FF-ICE/1 towards the full capability of FF-ICE, both pre and post departure, with the capacity to support trajectory-based operations. The technical specifications for FF-ICE will be implemented in ground systems, allowing dynamic exchange of flight-object information. At this stage, aircraft access to SWIM will be introduced.

Technology requirements

2.9 Although FF-ICE could be simply considered as a modern means of exchanging flight and flow information, FF-ICE is an integral part of SWIM and the operational improvements enabled by FF-ICE depend on the technologies deployed for SWIM, particularly those supporting information exchange within and between ground and airborne systems. As such, the stages of FF-ICE deployment are related to the progressive levels of maturity of the necessary technology supporting SWIM, as well as related aircraft and ground system equipage.

2.10 The deployment of ground systems is expected to be complex and it is the reason why a progressive development and implementation of FF-ICE is proposed. Technology requirements and the linkages between the various blocks and modules of the ASBU framework are detailed in the technology roadmaps that constitute part of the draft Fourth Edition of the *Global Air Navigation Plan* (GANP) (AN-Conf/12-WP/3 refers).

Deployment considerations

2.11 Most operational improvements from FF-ICE relate initially to coordination processes between ATS units, followed in the later stages by coordination processes between aircraft and ground systems. Although useful as an implementation within a single State, greater benefits will result from regional deployments across a number of States. To access full FF-ICE benefits, including 4D trajectory, global implementation is necessary. It is anticipated that, with appropriate transition planning, progressive implementations of FF-ICE will be well tolerated; however conversion capabilities between FPL 2012 and FF/ICE/1 are expected to be necessary. Full implementation of AIDC between automated ATS ground systems is recommended to be pursued. Implementation of FPL 2012 needs to be followed as soon as possible by a step-by-step transition path to FF-ICE, noting that implementation of FF-ICE would be facilitated by concurrent stages of SWIM implementation.

2.12 Development of ICAO SARPs for FF/ICE/1 and FF/ICE are necessary, with FF/ICE/1 SARPs expected to be developed between 2012 and 2015. Arrangements to support Time Based Operations and then Trajectory based operations are necessary in the Block 2 timeframe. FF-ICE deployments will need to take into account the relationships with SWIM development and overall CDM progression, ensure backwards compatibility with both ground and airborne systems and accommodate the respective roles of data-communication and SWIM for air ground applications.

2.13 States are urged to give due consideration to the potential added benefits which could result from the integration of a number of modules across a number of threads. Aspects of the integration of several supporting systems at an early stage may generate additional benefits downstream (i.e. Blocks 2 and/or 3). Benefits from an integrated implementation of all modules are expected to be greater than the sum of all benefits attributable to each and every individual module.

2.14 Guidance material on the FF-ICE will be included in the *Manual on Flight and Flow – Information for a Collaborative Environment* (Doc 9965) and will be posted on the AN-Conf/12 website prior to the Conference.

3. CONCLUSION

3.1 The ASBUs describe ways to apply the concepts defined in the *Global Air Traffic Management Operational Concept* (Doc 9854) to achieve local and regional performance improvements.

The ultimate goal is global interoperability. Safety and efficiency demands this level of interoperability and harmonization which must be achieved at a reasonable cost with commensurate benefits. The Conference is invited to agree to the following recommendation:

Recommendation 3/x - ICAO aviation system block upgrades (ASBUs) relating to improved operational performance through flight and flow – information for a collaborative environment (FF-ICE)

That the Conference:

- a) urge States and industry to work through ICAO to mature the flight and flow – information for a collaborative environment concept;
- b) urge States, according to their operational needs, to implement the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment included in Block 0, as presented in Appendix A;
- c) endorse the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment included in Block 1, as presented in Appendix B, and recommend that ICAO use it as the basis of its work programme on the subject;
- d) endorse the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment included in Blocks 2 and 3, as presented in Appendices C and D, as the strategic direction for this subject; and
- e) request ICAO to include, following further development and editorial review, the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment in the draft Fourth Edition of the *Global Air Navigation Plan*.

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Figure 1. Block upgrade modules covered in this working paper

