

ELEVENTH AIR NAVIGATION CONFERENCE**Montreal, 22 September to 3 October 2003****Agenda Item 1: Introduction and assessment of a global air traffic management (ATM) operational concept****DEVELOPMENT OF ATM REQUIREMENTS
FROM THE ATM OPERATIONAL CONCEPT**

(Presented by the Secretariat)

SUMMARY

In order to progress toward implementation of a global air traffic management (ATM) system as envisaged in the ATM operational concept, several follow-up activities must take place. These include specification, design and planning of the ATM system as well as development of Standards, procedures and guidance material necessary for implementation. The basis for progression of these activities is a clear set of ATM requirements. This paper describes briefly the evolution of activities associated with implementation of a global ATM system and highlights the need to develop ATM requirements.

Action by the Conference is in paragraph 6.

1. INTRODUCTION

1.1 The primary task on the work programme of the Air Traffic Management Operational Concept Panel (ATMCP) was to develop and describe, in sufficient clarity and detail, a gate-to-gate air traffic management (ATM) operational concept that will facilitate the evolutionary implementation of a seamless, global ATM system. The operational concept as developed by the ATMCP is presented in AN-Conf/11-WP/4.

1.2 To progress beyond the ATM operational concept to the development and implementation of a global ATM system, several activities, including specification, design and planning activities related to the future ATM system must take place. The entire future ATM system development process begins with identification of expectations of the ATM community and development of an operational concept and

progresses through development of ATM requirements, functional description of the ATM system and development of Standards and, eventually, includes planning and implementation activities.

1.3 It is useful to describe the total framework in which the interrelationship and dependencies of the various activities would take place. By understanding the dependencies and implementing a coordinated framework for the work that must be done, a managed and disciplined development process should take place. A structured framework would also provide the means to ensure that the development of ATM requirements, Standards and procedures, would proceed in a rigorous and easily documented manner. In particular, traceability of all work to originating ATM requirements would be ensured and the growth of new specifications or requirements would be contained within the context of a globally interoperable ATM system as envisaged in the ATM operational concept.

2. EVOLUTION OF THE GLOBAL ATM SYSTEM

2.1 The development activities guiding the evolution of the global ATM system can be seen in the context of six iterative steps:

- a) **Conceive.** In response to the needs and expectations of the ATM community a conceptual framework is first developed for the operation of the future ATM system.
- b) **Specify.** Functional and system operating requirements are specified.
- c) **Design.** A functional framework and system architecture is designed for the delivery of services and the functional integration and interoperability of system components.
- d) **Select.** Service and technology options are selected for development and implementation.
- e) **Deploy.** Plans for services, facilities, and capabilities are developed and the system is implemented.
- f) **Operate.** The modified and evolved ATM system commences operation.

3. DEVELOPMENT PROCESS OVERVIEW

3.1 A framework for the development and evolution of the global ATM system would stipulate the development dependencies as follows (Figure 1 at the Appendix refers):

- a) **ATM community expectations.** The needs and expectations of the ATM community guide operational concept development.

- b) **ATM operational concept.** The operational concept provides the vision to direct the development of the global ATM system.
- c) **ATM requirements.** The ATM requirements specify the scope, characteristics and attributes forming the ATM system environment. The ATM requirements collectively provide for the development of a functional architecture and system specifications.
- d) **Global ATM system design.** The Global ATM system design is driven by ATM requirements and takes into account external factors identified in the *Global Air Navigation Plan for CNS/ATM Systems* (Global Plan, Doc 9750). The design includes the functional architecture needed to achieve the required system performance (performance is addressed under Agenda item 3 of the Conference). The system design provides the basis for a scalable response to achieve explicit expectation outcomes (expectations are contained in the operational concept — AN-Conf/11-WP/4 refers). The review and development of necessary Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) completes the design process (AN-Conf/11-WP/26 refers). It is important that SARPs and PANS are traceable to the ATM requirements which originate from the operational concept.
- e) **Balancing requirements.** The operational concept envisages the balancing of the concept components (concept components are described in the ATM operational concept — AN-Conf/11-WP/4 refers) which are integrated to achieve different expectation outcomes. From the guidance and planning criteria, specific technological solutions can be selected for implementation.
- f) **Implementation.** The implementation of facilities and services would be based on guidance and transition strategies that identify all requirements. The regional air navigation plans would then provide the transition plan for implementation of system changes that must occur on a region-wide basis.
- g) **ATM community operations.** The implementation of facilities and services would allow for operations that meet the expectations of the ATM community.

4. **DEVELOPMENT OF THE ATM REQUIREMENTS FROM THE OPERATIONAL CONCEPT**

4.1 The process for developing the ATM requirements is accomplished through the derivation of the functions that the operational concept envisions that the ATM system would provide, followed by specification of the ATM requirements for those functions. A concept component function is a characteristic action or activity that must be performed in order to achieve a desired ATM community expectation or objective (ATM community expectations and concept components are described in the operational concept-AN-Conf/11-WP/4 refers).

4.2 The identification of the concept component functions is an iterative process and continues until all functions and sub-functions necessary to describe the expected performance of the concept component have been derived.

4.3 Scenarios also support the development of ATM requirements from the operational concept. The narrative scenarios describe various options and expand the community's understanding of the operational concept and thereby provide a basis for fully developing the concept component functional requirements. Through a comparison of the emerging ATM requirements with the scenarios, the derivation of ATM requirements is taken to a greater level of detail. By using the scenarios, the functions can be:

- a) arranged in their logical sequence;
- b) well-defined in their inputs, outputs, and functional interfaces (internal and external);
- c) traceable from beginning to end conditions;
- d) analysed, determined, and defined for time-critical requirements;
- e) successively established from the highest to lowest level for each function and interface;
- f) defined in terms of what needs to be accomplished without describing how it is to be accomplished; and
- g) traceable downward through successive functional decompositions.

4.4 The ATM concept component functional requirements do not describe the full set of ATM requirements. Operating requirements must also be derived to describe the ATM system operating environment and the performance it must meet to achieve the functional interactions described in the scenarios.

5. CONCLUSION

5.1 In order to progress toward implementation of a global ATM system as envisaged in the ATM operational concept, several follow-up activities must take place. These include specification, design and planning of the ATM system as well as development of Standards, procedures and guidance material necessary for implementation. The basis for progression of these activities is a clear set of ATM requirements.

6. ACTION BY THE CONFERENCE

6.1 The Conference is invited to agree on the following recommendation:

Recommendation 1/ — Development of ATM requirements

That ICAO develop a clear set of ATM functional and operating requirements for a global ATM system on the basis of the ATM operational concept.

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APPENDIX

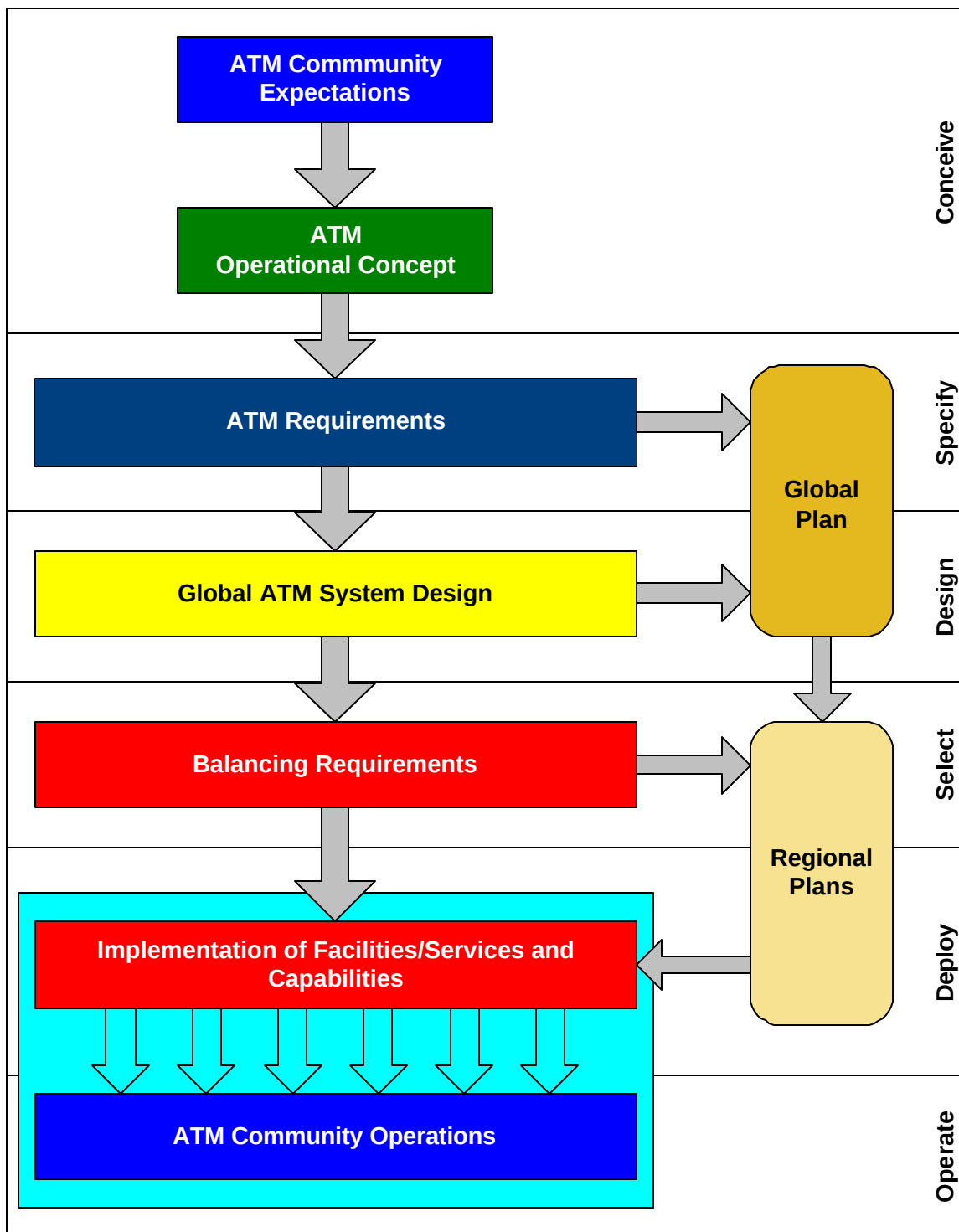


Figure 1. Development dependencies for the development and evolution of the global ATM system