

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

THE ROLE OF COLLISION AVOIDANCE IN FUTURE ATM SYSTEMS

(Presented by the Secretariat)

SUMMARY

The global air traffic management (ATM) operational concept defines three layers of conflict management, the last of which is collision avoidance. The role of collision avoidance is an important part of the operational concept. This working paper provides additional information to the references to collision avoidance as contained in the operational concept, including the use of the phrase “level of safety” and the term “independent” in the context of collision avoidance.

Action by the Conference is in paragraph 4.

1. INTRODUCTION

1.1 The ATM operational concept (AN-Conf/11-WP/4 refers) defines three layers of conflict management. These are: strategic conflict management, separation provision and collision avoidance. There is only one paragraph in the operational concept which addresses collision avoidance. This can be found under the description of the concept component: Conflict Management. As the contents of this particular paragraph are considered to be extremely important and relate directly to Agenda Item 1.4 of the Conference, this working paper was prepared as additional supporting material to assist in the discussions.

2. DISCUSSION

2.1 When discussing collision avoidance in the context of the operational concept, the following points should be noted:

- a) although the concept describes an environment approximately twenty-five years from now, it should not be considered solely as a future target, as the concept is expected to

assist in progress and guide the development of ATM systems, beginning in the immediate future up to the target time period;

- b) what the concept refers to as “conflict management” is the subject of much ongoing work. It is important, therefore, to have a clear understanding of the roles of each of the layers of conflict management as used in the concept and how they interrelate; and
- c) the operational concept is the definitive reference; therefore no part of this working paper should be seen as amending the operational concept.

2.2 Section 2.7.6 of the operational concept: Collision Avoidance, contains the following paragraph:

“Collision avoidance is the third layer of conflict management, and must activate when the separation mode has been compromised. Collision avoidance is not part of separation provision, and collision avoidance systems are not included in determining the calculated level of safety required for separation provision. Collision avoidance systems will, however, be considered part of the ATM safety management. The collision avoidance functions and the applicable separation mode, although independent, must be compatible.”

2.3 This part of the paper addresses and expands upon each part of the above paragraph, and is repeated in bold text at the beginning of each paragraph below.

2.3.1 **Collision avoidance is the third layer of conflict management.** . . . The operational concept ensures an integrated and holistic approach to conflict management against all hazards. Each layer has a defined role and place in conflict management. Collision avoidance is the last layer, and is meant to avoid disaster through the circumvention of collisions with hazards.

2.3.2 **. . . and must activate. . . . when the separation mode has been compromised.** In the future, when an ATM system based on the operational concept is implemented, collision avoidance will not be an optional extra but “must activate when the separation mode has been compromised”. For this to occur in all environments is a challenge; however, collision avoidance equipment is already compulsory for some hazards in some environments today. Separation mode comes under the heading of Separation Provision and is a wide subject for discussion on its own. The operational concept uses a layered approach which recognizes that any system of separation provision can fail and that a layer is required to avoid collision when the separation provision layer has failed.

2.3.3 **Collision avoidance is not part of separation provision . . .** This is an emphatic statement that separation provision and collision avoidance are not the same, that there is a functional difference, and that the operational concept definition of a third layer is deliberate.

2.3.4 **. . . and collision avoidance systems are not included in determining the calculated level of safety required for separation provision.** The operational concept deliberately avoids use of target level of safety (TLS) due to the fact that TLS has particular meanings today. The “calculated level of safety required”, used in the operational concept, is not defined as either being “determining” or “demonstrating” a level of safety. In fact, the “level of safety” may be something that is dynamically determined and proved in routine ATM operations in the future based on the operational concept. The current understanding of meaning and use of TLS is expected to evolve, and the operational concept makes provision

for this. In addition, there may be levels of safety for each layer of ATM system design, including conflict management. This sentence is provided to make clear that, at least in relation to separation provision, there will be a different level of safety in separation provision to the overall ATM system level of safety, as the latter will include collision avoidance.

2.3.5 Collision avoidance systems will, however, be considered part of the ATM safety management. This is a continuation of the previous concept statement. While current arguments sometimes suggest that we justify the cost of collision avoidance equipment by reducing separation standards, the operational concept clearly proposes an alternative to this approach. The concept's previous sentence (and definition of layers) indicates that collision avoidance systems are not to be mixed with separation provision. However, the concept does recognize the importance of collision avoidance systems and their value to overall ATM safety management, which can justify their expense.

2.3.6 The collision avoidance functions and the applicable separation mode, although independent, must be compatible. The operational concept, having established that the particulars of separation provision (the separation mode) and collision avoidance are separate layers of conflict management, also states that these layers must be compatible. Compatible, in this context, means that the activities of one layer do not compromise the activities of the other layer. A correctly implemented separation mode should not invoke the collision avoidance layer. Independent, in this context, means not dependent on the other layer for operation. This, however, does not prevent one layer being aware of the activities of the other layer. The subject of how the ATM system is designed to meet these requirements is expected to generate some discussion. However, as an example, consider the following. As collision avoidance systems are designed to activate when a separation mode has been compromised, the ATM system design should take into account the effects of the failure of an ATM system component that changes the separation mode to a larger separation minima. This would require collision avoidance systems to ensure, despite that ATM component failure, that collisions are avoided between aircraft operating at less than the new separation minima.

3. CONCLUSION

3.1 In the context of the ATM operational concept:

- a) collision avoidance is an important, but separate, layer of conflict management;
- b) the level of safety required for separation provision is both “determining” and “demonstrating”, and does not include allowances for collision avoidance systems;
- c) collision avoidance systems are of value to the ATM system and are an important part of the ATM system design and ATM safety management;
- d) as collision avoidance systems must activate to overcome failure of separation provision, the collision avoidance system must not be dependent on ATM system components used for separation provision.

4. **ACTION BY THE CONFERENCE**

4.1 The Conference is invited to note the expanded explanation of the paragraph in the ATM operational concept on collision avoidance and use the information in the discussions under this agenda item.

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