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
1:2 Enabling concepts in support of the global ATM operational concept

COMMUNICATION NEEDS IN THE NEW ATM SYSTEM

(Presented by Sweden)

SUMMARY

New communications, navigation, surveillance/air traffic management (CNS/ATM) concepts are currently being defined and demonstrated based on a redistribution of the responsibility for maintenance of separation and decision making between the pilot and controller. To support these new concepts there will be a need to implement an efficient communication service providing an air-to-air broadcast service, primarily to provide position, track and intent information, and an air-to-air point-to-point service to provide trajectory negotiation and security assurance.

Action by the conference is in paragraph 5.

1. INTRODUCTION

1.1 New communications, navigation, surveillance/air traffic management (CNS/ATM) concepts are based on distributed responsibilities for decision making which will change the roles of both pilots and controllers. The availability of information essential to the decision-making process is a key issue; the CNS infrastructure has to support the efficient, safe and secure distribution of the necessary information. This paper discusses the need for surveillance data within the cockpit and direct air-to-air links to support these new concepts.

2. DISTRIBUTED RESPONSIBILITY FOR DECISION MAKING

2.1 Within Europe, there has been much recent work to define new ATM applications focussed on the delivery of enhanced safety and capacity (see Notes 1, 2 and 3). A key development within this new CNS/ATM concept is the increased reliance on distributed responsibility for decision making.

2.2 An important first stage is the introduction of "spacing" applications into the en route and terminal environment. Airborne spacing involves limited delegation to the pilot, who takes responsibility for carrying out certain manoeuvres – responsibility for maintaining separation remains with the controller.

2.3 Spacing applications include:

a) establishing in-trail spacing intervals, level spacing and in-descent spacing in core and transitional en route and terminal airspace;

b) level crossing and passing and vertical crossing in core and transitional airspace; and

c) final approach spacing in which aircraft establish and maintain separations in the approach path. This is also known as improved approach spacing or cockpit display of traffic information (CDTI) enhanced flight rules (Note 1). Benefits arise because aircraft have the potential to maintain a separation that is closer than the currently allowed minimum.

2.4 Spacing applications have the potential to deliver terminal and en route capacity benefits of typically 9 per cent (Note 3) but more crucially they prepare for the next stage of delegation through the implementation of ATM applications which involve the delegation of separation responsibility to the pilot. These include:

a) airborne separation in oceanic and remote airspace, including in-trail climb (ITC), in-trail descent (ITD), lateral passing manoeuvres and station keeping;

b) airborne separation in en route and terminal airspace, including following, crossing and climb/descent manoeuvres and sequencing applications;

c) final approach separation which enables reduced approach spacings; and

d) "cluster control" in managed airspace in which the pilot is provided with surrounding traffic information (state + trajectory intent) and maintains safe separation within a cluster of other aircraft.

2.5 Through the delegation of separation responsibility to the pilot these applications have the potential for a substantial reduction in controller workload and hence a large increase in capacity. Furthermore, in remote regions, the concepts have the potential to facilitate efficient operations without a ground infrastructure involving the direct negotiation of trajectories between aircraft.

2.6 The communication services required by these applications lead to an increase in safety levels by supporting positive identification of traffic, reducing mis-identification of aircraft and an earlier anticipation of collision risks. The benefits are most effective in high traffic density complex areas or where the quality of the air traffic services (ATS) is limited (for example due to the lack of ground surveillance) and include (Note 1):

a) better establishment of visual contact and positive identification of aircraft, even when more than one aircraft is visible;

b) reduced time required to establish visual contact with other aircraft;

c) improved crew capability of assessing the distance to a preceding aircraft and for keeping a certain distance from it, even at changing speed and/or heading;

d) reduced probability of a go-around for parallel approaches caused by loss of visual contact;

e) repeated positive identification of the target in high traffic density conditions.

2.7 Initial packages of spacing applications have been defined in Europe (Notes 2 and 3) and are supported by airline groups (Note 1). Delegation of responsibility leads to a reduction in the controller workload per flight and hence is seen as a key step to enhance capacity and safety.

3. COMMUNICATION NEEDS TO SUPPORT DELEGATED RESPONSIBILITY

3.1 As the pilot takes more responsibility for manoeuvres and separation, availability of information is important aid to the decision-making process; the CNS infrastructure has to support an efficient, safe and secure exchange of the necessary information.

3.2 Delegation of responsibility to pilots for maintaining separation requires surveillance data to be available in the cockpit. There is therefore a need to provide an aircraft to aircraft broadcast data link with sufficient integrity to support autonomous operations. Such links are now available to support automatic dependent surveillance — broadcast (ADS-B) operations and provide position, track and intent information.

3.3 A further prerequisite for pilots resolving conflicts by themselves is a direct, efficient and secure data link connectivity between aircraft. Such a point to point link could be used for many purposes including:

a) confirmation that an aircraft involved in a manoeuvre is being tracked by the other aircraft involved in the manoeuvre;

b) confirmation of the position, track and intent of other aircraft;

c) negotiation and confirmation of trajectories; and

d) issue of advisories in the event that an aircraft fails to implement a new negotiated trajectory.

3.4 Furthermore, the air-to-air data link could be used to enhance data link security by enabling the implementation of efficient authentication mechanisms augmented by position information from the broadcast media.

4. SUMMARY

4.1 New CNS/ATM concepts are currently being defined and demonstrated based on a redistribution of the responsibility for maintenance of separation and decision making between the pilot and controller. To support these new concepts an efficient communication service is required providing an air-to-air broadcast service, primarily to provide position, track and intent information, and an air-to-air point to point service to provide trajectory negotiation and security assurance.

5. ACTION BY THE CONFERENCE

5.1 The conference is invited to:

a) note that the implementation of the new CNS/ATM concept is based on a distributed responsibility for decision making and that the roles of pilots and controllers will change; and

b) recommend that ICAO develop provisions for direct air-to-air data link communications operating in a point-to-point mode including efficient authentication mechanisms.

Note 1.— AEA/IATA ATM-CNS Joint User Requirements Group (JURG) ADS Fast Track Initiative JAFTI, Version 1.2, May 2002.

Note 2.— Proposal for a first package GS/AS applications, Eurocontrol – CARE/ASAS Activity 5 – Version 1.2, 14 May 2002.

Note 3.— Executive summary of European Commission project: Data link roadmap, P167D017 Version 1.0a, March 2003.

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