

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 2: Safety and security in air traffic management (ATM)

2.5 Safety and security of the ATM infrastructure

:

INCREASED SAFETY AND SECURITY BY KNOWLEDGE OF POSITION AND INTENT

(Presented by Sweden)

SUMMARY

This paper considers the potential safety and security benefits that can be derived from position and intent information. The paper presents the argument that such information supports the detection and resolution of deviations from the current flight plan including both unlawful interference (security benefit) and misinterpreted clearances (safety benefit). The paper goes on to argue that the position and intent information may also be used to enhance the security of digital data-links and in particular user authentication mechanisms. The ADS-B media used should provide for the independent verification of position information.

Proposed action by the Conference is in paragraph 5.

1. INTRODUCTION

1.1 Safety and security are fundamental to aviation, and are of growing concern in today's political climate. The introduction of new communications, navigation, surveillance/air traffic management (CNS/ATM) concepts and underlying technologies provides an opportunity of increased safety and security within ATM. In particular, knowledge of position and intent information, in concert with flight plan information, can support civil and military authorities in identifying and responding to security threats involving aeroplanes.

1.2 These new concepts are increasingly based on the exchange of the digital data via data link. The security of these data links is an equally important issue; use of position and intent information can be used to support user authentication to mitigate against security threats to data links such as spoofing.

2. USE OF POSITION AND INTENT

2.1 In today's air traffic control (ATC) system, the controllers are the focal points for detection of abnormal and unexpected behaviour. The increased use of automatic dependent surveillance (ADS-B) data (position, velocity and intent) and other data link applications such flight plan consistency (FLIPCY) will enable increased automation to support this role, allowing the system to detect unauthorised variations from the flight plan. This leads to a security benefit by supporting the detection of unlawful interference of the aircraft as well as a safety benefit by supporting the detection of misinterpreted clearances.

2.2 However, ADS-B has another important, safety role to play. The availability of surveillance and intent data from ADS-B will increase situational awareness in the cockpit and of others actors such as the airline operation centre (AOC). Hence, more people will be "informed" about the developing situation; more "pair of eyes" will observe the aviation process, increasing the possibility that hazardous situations will be detected and ultimately, accidents avoided.

2.3 An important issue is that the ADS-B position and intent data are generated and reported automatically without involvement of the aircrew. Hence, it is possible to detect deviations from the cleared flight route at an earlier stage and reduce nuisance alerts caused by incorrect data entry. This might provide longer lead-times for detection and resolving situations.

3. DATALINK SECURITY

3.1 Whilst the future ATC concepts provide for increased safety and security, they also open up a new threat to the underlying data links themselves. Therefore, applications such as controller pilot data link communications (CPDLC), digital voice, collaborative decision making, ADS-B and broadcast of weather information require data link security mechanisms to provide such services as:

- a) user authentication;
- b) integrity;
- c) confidentiality; and
- d) replay prevention.

3.2 Security mechanisms will be required in both the air-ground and ground-ground infrastructure. However, the key concern here is the air/ground media where the application of industry solutions will be harder:

- a) the real time nature of aviation applications coupled to the limited bandwidth available on air-ground data links severely restricts the security solutions possible, both in the amount of information sent and in the timeliness of the information; and

- b) the security guarantees, such as authentication, integrity or non-repudiation, in a broadcast environment have not been widely addressed by the computer industry.

3.3 The implication is that aviation needs to look at the properties of air-ground data links and available information when determining how best to achieve the required level of data link security. For example, the exchange of data between the traditional independent domains of communications, navigation and surveillance, suggests the possibility of using reported position data in authentication mechanisms.

3.4 As knowledge of position and intent is central to the future ATM concepts, these data should be used when ensuring that an aircraft is correctly identified prior to enabling access to ATC services such as datalink.

3.5 However, the use of ADS-B data raises the issue that the position information itself may be spoofed. The position data should therefore be compared with measurements of the time it took for the data to be transmitted from the sender to the receiver, thus providing independent verification of the position information used to determine identity.

3.6 Reporting position data and time measurements are inherent in an ADS-B system like VDL Mode 4, in which the receiver uses time measurements for independent verification of reported positions.

4. SUMMARY

4.1 This paper has considered how knowledge of position and intent can improve the safety and security of the future ATM system as well support the security of underlying digital datalinks required by the future system.

4.2 The paper particularly indicates that:

- a) the role of ADS-B in providing these data in an automated manner will support the timeliness of such functions;
- b) aviation will need to take advantage of available data and properties of data links when determining air-ground data link security mechanisms;
- c) the use of position information will enhance user authentication mechanisms; and
- d) the ability of ADS-B media to independently verify reported positions enhances the use of the data.

5. ACTION BY THE CONFERENCE

5.1 The Conference is invited to:

- a) note the information provided in this paper;

- b) note the need in aviation for secure systems resistant to interference from outside sources;
- c) recognize that ADS-B position and intent data is generated and reported automatically, thus increasing the chance for detecting deviations from cleared flight routes at an early stage;
- d) recognize that inherent functions in an ADS-B system can be used in authentication functions in traditional communication systems; and
- e) urge ICAO to develop provisions supporting safety and security functions based on available CNS data.

— END —