



WORKING PAPER

HIGH-LEVEL CONFERENCE ON AVIATION SECURITY (HLCAS)

Montréal, 12 to 14 September 2012

Agenda Item 6: Ensuring the sustainability of aviation security measures – equivalence

THE IMPACT OF GNSS VULNERABILITY AND RESPONSE MEASURES

– focusing on Aviation Security –

(Presented by the Republic of Korea)

SUMMARY

As the GNSS navigation signals are vulnerable to signal interference, act of jamming, blocking and spoofing can pose a fatal threat to the safety and security of civil aviation, which calls for the attention and response from the international community.

Action: The High-level Conference on Aviation Security is invited to endorse the actions proposed in paragraph 5.

1. INTRODUCTION

1.1 All Member States, in accordance with the spirit and objective of the *Convention on International Civil Aviation (Chicago Convention)* and its Annex 17 — *Security*, should prevent and respond to all acts of unlawful interferences that threaten the safety and security of civil aviation. Also, the Declaration on Aviation Security, which has been adopted by the 37th ICAO Assembly in 2010, requires Member States to strengthen and promote the effective application of ICAO Standards and Recommended Practices with particular focus on Annex 17 — *Security*, and develop strategies to address current and emerging threats.

1.2 The recent developments in air navigation technologies and the transition to a future air navigation system based on GNSS imply that ICAO and Member States should focus not only on physical threats by weapons and explosives, but also on the establishment of a response system to the emerging security threats including attacks on a satellite-based navigation system.

1.3 The recent incidents of GPS interference in 2011 and 2012, which occurred in the Incheon FIR, show that the emerging security threats to the safety of civil aviation actually exist, and that it is necessary to acknowledge that damages caused by terrorist attacks based on technological advancement can be greater than those from traditional attacks with explosives.

2. RECENT INCIDENTS OF GNSS INTERFERENCE AND SUBSEQUENT SECURITY THREAT

2.1 GNSS nowadays plays an important role in air navigation systems and the reliance on GNSS is expected to increase further in the future. However, GNSS signals, innately, are vulnerable to interference and spoofing, and the recent interference occurred in the Incheon FIR is an empirical example of such case (see 2.2).

2.2 106 aircraft of 18 airlines from 6 States (from 4 March to 13 May 2011) and 1,016 aircraft including 88 aircraft of 33 airlines from 16 other States (from 28 April to 13 May 2012) were subject to GPS interference in the Incheon FIR. Among them, four aircraft made a missed approach due to the GPWS¹ warning. This issue was discussed at the meetings of the 196th Council and subsequent decisions were adopted which note the GPS interference incidents with grave concern, urge Member States to prevent recurrence of any similar incidents, and call upon collaboration between ICAO Secretariat and the International Telecommunications Union (ITU).

2.3 Currently, GPS interference is serious because most civil aircraft are equipped with a GPS navigation device and can cause a hazard to aviation safety. It may lead to aviation accidents by causing GPWS warning due to aircraft location information error, which in turn leads to a psychological burden of the pilot as well as his/her workload. As these incidents have repeated for the past several years and as damages keep increasing, global awareness and countermeasures are highly required.

3. DEVELOPMENT INTO FUTURE SECURITY THREAT

3.1 While the problem of GNSS interference has been discussed in ICAO and international aviation communities, safety has been the main focus with insufficient reviews on security aspects. Even from safety perspective, GNSS interference has been perceived in the context of efficiency rather than a safety threat. However, with recent new security threat technologies using GNSS vulnerabilities, it is necessary to reconsider whether GNSS interference is only a matter of efficiency or safety.

3.2 When GNSS jamming or blocking occurs, the pilot can recognize whether the GNSS receiver's signal is an error or not. However, in the case of GNSS spoofing, false signals are sent regarding the GNSS location and time, thus misleading the pilot to mistake them as accurate ones. Therefore, it may become a fatal threat to aviation safety and security since deviations from the normal flight routes can occur leading to a ground collision.

3.3 As such, the emerging security threats e.g. GNSS jamming, blocking and spoofing can not only directly impact air navigation systems but also cause serious damages to overall aviation safety and security due to their simultaneity and non-discriminatory nature. However, this matter has not been discussed sufficiently enough.

4. LACK OF RELEVANT SECURITY STANDARDS AND MEASURES

4.1 Likewise, the emerging security threats such as GNSS interference, etc. especially if they are intended to jeopardize the safety of civil aviation, are in contravention of the principles of *the Convention on International Civil Aviation* and pose an unacceptable hazard to civil aviation safety in a manner that undermines the objectives of Annex 17 to the Convention. The seriousness with which this

¹ The GPWS refers to Ground Proximity Warning System.

kind of activity is viewed by the international community is further reflected in *the Convention on the Suppression of Unlawful Acts relating to the international Civil Aviation* (Beijing Convention)².

4.2 Annex 17 — *Security* to the Chicago Convention categorizes acts of unlawful interference against civil aviation into seven categories. However, there is no clear and concrete reference to the emerging security threats, such as GNSS jamming, blocking and spoofing, arising from the recent developments in air navigation technologies.

4.3 As a result, compared with the physical terrorist attacks by explosives, etc. it is not easy for the international community to cooperate immediately in response to the emerging security threats which target satellite based navigation systems.

5. CONCLUSION AND RECOMMENDATIONS

5.1 The High-level Conference on Aviation Security is invited to:

- a) Recall the decision made by the 196th Council which notes GPS interference affecting air navigation safety with grave concern.
- b) Request ICAO and the Aviation Security Panel to conduct a threat assessment and develop proper guidelines if necessary, regarding the emerging security threats including GNSS jamming, blocking and spoofing.
- c) Request ICAO to review including the emerging security threats as one of “acts of unlawful interferences” under Annex 17 to the Convention and develop a standard procedure for Member States to respond to those threats.
- d) Urge Member States, upon recognizing any GNSS interference originated from their own or another State, to take immediate measures to remove the cause of interference, report to ICAO and related international organizations, and share the information with related States if needed.
- e) Request ICAO to develop a cooperation mechanism among related divisions within ICAO and relevant international organizations in response to the emerging threats including GNSS jamming, blocking and spoofing.

— END —

² This Convention obligates parties to criminalize conduct by any person that “unlawfully and intentionally...damages air navigation facilities or interferes with their operation, if any such act is likely to endanger the safety of aircraft in flight.” In addition, The Beijing Convention defines, in Article 2(C), air navigation facilities to include “signals ... necessary for the navigation of the aircraft.”