



International Civil Aviation Organization

**NINTH MEETING OF THE
COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND
METEOROLOGY SUB-GROUP OF APANPIRG
(CNS/MET SG/9)**

Bangkok, Thailand, 11–15 July 2005

Agenda Item 5: Navigation:

**1) review strategies for Precision Approach and Landing
Guidance Systems and GNSS Implementation**

**REVIEW OF STRATEGIES FOR IMPLEMENTATION OF
GNSS AIR NAVIGATION CAPABILITY AND
THE PROVISION OF PRECISION APPROACH AND LANDING
GUIDANCE SYSTEMS**

(Presented by the Secretariat)

SUMMARY

This paper presents the Regional Strategies for the implementation of GNSS navigation capability and for the provision of precision approach and landing guidance systems for review.

1. INTRODUCTION

1.1 The regional strategies for implementation of GNSS air navigation capability and the provision of precision approach and landing guidance systems were reviewed and updated by the Eighth Meeting of CNS/MET Sub-Group of APANPIRG in July 2004.

1.2 The updated strategies were adopted by APANPIRG/15 in its Conclusions 15/23. The Regional Strategy for the Provision of Precision Approach and Landing Guidance Systems is provided in Attachment 1 and the Strategy for Implementation of GNSS Navigation Capability in the ASIA/PAC Region is provided in Attachment 2 to this paper.

2. DISCUSSION

2.1 It was noted that the AN Conf/11 emphasized the need for ICAO, States, airspace users and other parties concerned to continue work towards the safe and efficient global navigation system for all phases of flight.

2.2 The APANPIRG/15 noted recommendations of AN-Conf/11 and also additional information provided by States. The meeting noted that the strategies were generally consistent with the AN Conf/11 recommendations and minor changes were required. The revisions to the strategies included the provision of approach with vertical guidance (APV).

2.3 The APANPIRG/15 reviewed both strategies in light of available information presented to the meeting. The strategies with the amendments proposed by the Sub-Group were adopted without any change.

3. ACTION BY THE MEETING

3.1 The meeting is expected to:

- a) review the Regional Strategy for Precision Approach and Landing Guidance Systems and the Strategy for the Implementation of GNSS Navigation Capability in the ASIA/PAC region, in light of developments of aeronautical navigation systems; and
- b) propose necessary updates, as required.

**UPDATED STRATEGY FOR THE PROVISION OF PRECISION APPROACH
AND LANDING GUIDANCE SYSTEMS**

Considering:

- a) in the Asia/Pacific region, ILS is capable of meeting the majority of requirements for precision approach and landing;
- b) requirements for provision of terrestrial-based navigation facilities, non-precision and precision approach and landing have been implemented in most cases;
- c) the availability of ICAO SARPs and guidance material for GNSS with augmentation to support Cat I precision approach and approach and landing with vertical guidance (APV);
- d) the knowledge that APV operations may be conducted using GNSS with augmentation as required or barometric vertical guidance and GNSS or DME/DME RNAV lateral guidance;
- e) APV operations provide enhanced safety and generally lower operational minima as compared to non-precision approaches;
- f) the knowledge that GNSS without augmentation can support non-precision approaches and that augmented GNSS- based systems is expected to be available to support Category I operations by year 2009. This date may be brought forward with the launch of another navigation satellite constellation;
- g) GNSS with augmentation to support category II and III operations is expected to be available in 2010-2015 time frame;
- h) MLS Cat I is operational and ground and airborne CAT III B certification is in progress;
- i) a multi-modal airborne approach and landing capability is necessary and expected to be available;
- j) the definition of Required Navigation Performance for approach, landing and departure operations; and
- k) the need to maintain aircraft interoperability both within the region and between the Asia/Pacific region and other ICAO regions and to provide flexibility for future aircraft equipage.

The strategy for Asia/Pacific region in the provision of precision approach and landing guidance is:

- a) Retain ILS as an ICAO standard system for as long as it is operationally acceptable and economically beneficial;
- b) Implement GNSS with augmentation as required for APV and Category I operations where operationally required and economically beneficial;
- c) Conduct studies for the implementation of GNSS ground- based augmentation systems and GNSS avionics equipment for Category II and III operations;
- d) Introduce applicable Required Navigation Performance (RNP) for approach, landing and departure operations in accordance with ICAO provisions;
- e) Conduct necessary on-going GNSS and RNP education and training for operational personnel to ensure safe operations;
- f) Implement MLS where operational requirements cannot be satisfied by implementation of ILS or GNSS;
- g) Protect radio frequency spectrum of ILS, MLS and GNSS since the transition from ILS to GNSS and /or MLS will be evolutionary and will take some time; and
- h) Promote the use of APV operations, particularly those using GNSS vertical guidance, to enhance safety and accessibility.

**UPDATED STRATEGY FOR THE IMPLEMENTATION OF
GNSS NAVIGATION CAPABILITY IN THE ASIA/PACIFIC REGION**

Considering that:

- 1) Safety is the highest priority;
- 2) Elements of Global Air Navigation Plan for CNS/ATM system on GNSS and requirements for the GNSS implementation have been incorporated into the CNS part of FASID;
- 3) GNSS SARPs, PANS and guidance material for GNSS implementation are available;
- 4) The availability of avionics including limitations of some receiver designs; the ability of aircraft to achieve RNP requirements and the level of user equipage;
- 5) Development of GNSS systems including satellite constellations and improvement in system performance;
- 6) Airworthiness and operational approvals allowing the current GNSS to be used for en-route and non precision approach phases of flight without the need for augmentation services external to the aircraft;
- 7) Development status of aircraft-based augmentation systems;
- 8) Regional augmentation systems include both satellite-based (SBAS) and ground-based systems (GBAS);
- 9) Human, environmental and economic factors will affect the implementation of GNSS;
- 10) The vulnerability of GNSS to radio interference and adverse effect of ionosphere; and
- 11) The regional navigation requirements are:
 - (a) RNP10/RNP4 for en-route;
 - (b) RNP4 for *transition to* terminal phase of flight;
 - (c) RNP1 for terminal phase of flight;
 - (d) NPA/APV for approaches and departures; and
 - (e) Precision approaches at selected airports.

The general strategy for the implementation of GNSS in the Asia/Pacific region is detailed below:

- 1) There should be an examination of the extent to which the GNSS system accessible in the Region can meet the navigational requirements of ATM service providers and aircraft operators in the Region;
- 2) Evolutionary introduction of GNSS Navigation Capability should be consistent with the Global Air Navigation Plan for CNS/ATM Systems;

- 3) During transition to GNSS, sufficient ground infrastructure for current navigation systems must remain available. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip with GNSS to attain equivalent navigation service;
- 4) Implementation shall be in full compliance with ICAO SARPs and PANS;
- 5) Introduce the use of GNSS for en-route, terminal and approach navigation;
- 6) States are encouraged to implement future GNSS approvals based on SBAS receiver standards or equivalents;
- 7) To the extent possible, States should work co-operatively on a multinational basis to implement GNSS augmentation systems in order to facilitate seamless and inter-operable systems;
- 8) States consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance, taking due consideration of the need of State aircraft;
- 9) As GNSS is introduced for en-route navigation, States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition to GNSS-based navigation;
- 10) The introduction of GNSS offers the possibility to remove conventional ground-based navigation aids. However States should approach this with caution to ensure that safety is not compromised, such as by performance of safety assessment and consultation with users through regional air navigation planning process;
- 11) States undertake a co-coordinated R & D programme on GNSS implementation and operation;
- 12) ICAO and States should undertake education and training to provide necessary knowledge in GNSS theory and operational application, including RNP, and
- 13) States establish multidisciplinary GNSS implementation teams, using section 6.10.2 of ICAO Circular 267, Guidelines for the Introduction and Operational Approval of the GNSS , as a guide.

Note 1: Identified SBAS systems are EGNOS, MSAS and WAAS. The MSAS is expected to be available for providing augmentation for the Asia/Pacific region.