



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

**USE OF GLOBAL POSITIONING SYSTEM PRECISE
POSITIONING SERVICE IN DOMESTIC AND
INTERNATIONAL AIRSPACE**

(Presented by USA)

SUMMARY

The US Department of Defense (DoD) has a vision for DoD and allied aircraft to transparently navigate and operate in both domestic and international airspace in full compliance with international and local requirements using Global Positioning System (GPS) Precise Positioning Service (PPS) equipment in addition to current sensors. Since GPS-PPS is not generally available for civilian use, the DoD challenge is to develop and implement a comprehensive approach for meeting or exceeding all civilian requirements for operating in both domestic and international airspace. This paper provides a brief overview of the DoD approach and the progress that has been made to meet this real-world challenge.

1. BACKGROUND

1.1 The U.S. Department of Defense (DoD) is responsible for ensuring that military aircraft operating in consonance with civil aircraft have the necessary navigation capabilities. It is the DoD policy that military platforms conducting peacetime operations will conform to applicable rules to ensure interoperability and transparency within domestic and international controlled airspace.

1.2 DoD recognizes that their our aircraft must be equipped with instruments and navigation equipment appropriate to the routes being flown. The United States Federal Aviation Administration (FAA) issues Technical Standard Orders that prescribe minimum performance standards for navigation equipment used by the civil aviation community in the US National Airspace System (NAS). ICAO issues standards and recommended practices (SARPS) for international civil aviation. The implementation of minimum performance standards for military users is the responsibility of the Services (e.g. Air Force, Army, Navy). Standards must meet airspace navigation performance requirements, prevent violation of civil air traffic clearances, and ensure safe separation of military and civil aircraft.

1.3 The DoD has the authority and responsibility within the U.S. to certify and operate their aircraft in accordance with airspace requirements

1.4 The DoD also works with military establishments of its international allies as well as ICAO to seek approval for GPS-PPS equipment use in all global airspace.

1.5 GPS currently provides two levels of service, the Precise Positioning Service (PPS) and the Standard Positioning Service (SPS).

1.6 The Precise Positioning Service (PPS) is a highly accurate military positioning, velocity and timing service which is available on a continuous, worldwide basis to users authorized by the U.S.

1.7 The Standard Positioning Service (SPS) is available to all users on a continuous, worldwide basis, free of direct user fees. The course/acquisition (C/A) code on L1, which constitutes SPS, is used by military aircraft and also constitutes a part of PPS for acquisition.

2. DUAL TRACK APPROACH

2.1 The vision is for DoD and allied aircraft to transparently navigate and operate in both domestic and international airspace using GPS-PPS equipment. To achieve the vision, one challenge is to develop and implement a comprehensive approach for meeting or exceeding all civilian requirements for operating in both domestic and international airspace.

2.2 The approach developed and implemented must take into account the following considerations:

a) Certification and operation of U.S. military aircraft are the responsibility of DoD. Development of GPS-PPS standards (that is, military minimum performance standards like the DoD's Military Standard Orders, or MSOs) would likely simplify the military certification process for operating aircraft in both domestic and international airspace.

b) Many DoD aircraft are already equipped with GPS-PPS receivers. These receivers can support navigation functions, but minimum performance standards had not been developed prior to the procurement and installation of the GPS-PPS "current" equipment. A process is needed to be able to determine whether or not aircraft equipped with "current" GPS-PPS receivers possess the requisite navigation capabilities to operate in both domestic and international airspace.

2.3 The DoD approach requires two parallel actions—development of minimum performance standards for future GPS-PPS equipment, and development of a process to certify navigation operations for aircraft with current GPS-PPS equipment.

2.4 Since DoD aircraft operate globally, it was recognized that particular attention must be paid to navigation operations outside of the U.S. National Airspace System. Further, every consideration must be taken to assure individual State's airspace sovereignty was thoroughly respected.

2.5 On April 30, 2003 the GPS Joint Program Office (JPO) approved Military Standard Order (MSO) C145 as the certification document for GPS-PPS Primary Means Navigation. Specifically, titled AIRBORNE NAVIGATION SENSORS USING THE GLOBAL POSITIONING SYSTEM (GPS)/PRECISE POSITIONING SERVICE (PPS) FOR AREA NAVIGATION (RNAV) IN REQUIRED NAVIGATION PERFORMANCE (RNP) AIRSPACE; RNP-20 RNAV THROUGH RNP-0.3 RNAV. MSO-C145 was developed to approximate FAA Technical Order C-145: AIRBORNE NAVIGATION SENSORS USING THE GLOBAL POSITIONING SYSTEM (GPS) AUGMENTED BY THE WIDE AREA AUGMENTATION SYSTEM (WAAS) and insure seamless NAS operations and respect for other State's airspace sovereignty.

2.5.1 MSO-C145 prescribes the minimum performance standards that airborne area navigation sensors using the GPS-PPS must meet for primary means navigation in RNP-20 through RNP-0.3 airspace.

2.6 DoD directives also address international compatibility with respect to airspace sovereignty. The following specific information is provided:

The DoD's operational concept for the GPS-PPS is a truly seamless worldwide source of radionavigation. As such, the flight crew should not normally have to select any other radionavigation service for RNP-20 through RNP-0.3 RNAV operations anywhere in the world. The U.S. recognizes that authorities in certain nations may choose to not allow GPS-PPS based navigation or any GPS based navigation in airspace under their control. In airspace regions where no GPS based navigation is allowed, GPS-PPS equipment will necessarily be superfluous. In those airspace regions where GPS based navigation is allowed but not GPS-PPS based navigation (i.e. GPS-SPS based navigation only), GPS-PPS equipment can still be used, provided that certified equipment is able to access and operate using only the SPS. To accommodate such national peculiarities, GPS-PPS equipment will be required to incorporate an operator-commanded lock out capability, which limits the equipment to employing only the SPS signals for positioning functions. The lock out capability will provide a SPS based receiver which meets or exceeds civil standards (e.g. TSO-C129a, FAA Notice 8110.60, EUROCONTROL 003-93)"

2.7 The other parallel action--development of a process to certify navigation operations for aircraft with current GPS-PPS equipment--required a thorough examination of current DoD certification policies, practices and procedures as well as researching civil certification guidelines and documents. It was recognized that since individual GPS-PPS current equipment, such as the Miniaturized Airborne Global Positioning System Receiver (MAGR 2000) was manufactured prior to the development of minimum performance standards (e.g. MSO-C145), the likelihood of successfully developing a "box level" approval process for current receivers would be small. Consequently, the decision was made to investigate the option for a "platform level" certification process.

2.8 The concept of platform level certification is not new and will be applied to future GPS receiver integrations regardless of what type of receiver is integrated (MSO or non-MSO). In fact, it is similar to traditional certification methods used by the military services. The basic idea is to be able to provide formal verification that an aircraft complies with airspace and operational requirements; including that the aircraft performance either meets/exceeds civil standards or provides an equivalent level of performance.

2.9 Responsibility for each platform to be certified resides with the military service designated as the overall manager for the platform. For instance, the US Air Force is responsible for C-5 and F-15 aircraft; the Navy is responsible for P-3 and F-18 aircraft, etc.

2.10 Each military service has its own set of procedures, rules and regulations governing platform certification. The approach taken by each military service is similar but not exactly the same. Variations in approaches and procedures are mainly driven by service unique mission requirements (for instance, the Navy operates aircraft on/off ships). However, the detail and thoroughness of each service approach are on the same level--intense.

2.11 From a high level perspective, the military services' approaches rely on civil specifications and relevant documents, functional analyses, system safety assessments, certification methodologies, ground and airborne testing, and complete and thorough performance documentation. The length of time to actually complete platform level certification is variable. Obviously, the more complex the platform, the more time it will take to complete the detailed process.

2.12 The point is that a “way forward” has been developed and adopted by DoD. There is a path to follow to be able to determine whether or not aircraft equipped with “current” GPS-PPS receivers possess the requisite navigation capabilities to operate in both domestic and international airspace.

2.13 The long platform level certification process has started--several military aircraft with current GPS-PPS receivers are in various stages of assessment and evaluation to determine their level of navigation performance.

2.14 One of these platforms completed the process and has been approved for operations. Specifically, a January 12, 2004 Department of the Navy, Office of the Chief of Naval Operations memorandum approved “...integration of the MAGR 2000 into 40 MH-53E aircraft and use as the primary means of navigation during enroute, terminal and GPS non-precision approach phases of flight”.

3. CONCLUSION

3.1 The meeting is requested to note the information in this paper.

3.2 The U.S. DoD and other U.S. Government representatives are prepared to provide further information or respond to questions by member states at future venues.
