
PAPUA NEW GUINEA

AIC

TELEPHONE	244672
TELEGRAPHIC	ADDRESS
AFTN	AYPYOYX
Fax	250749

AERONAUTICAL INFORMATION SERVICE
DEPARTMENT OF CIVIL AVIATION
P. O. BOX 684, BOROKO

1/1994 15 SEPTEMBER

File: 48.1.429

REQUIREMENTS FOR USE OF GLOBAL POSITIONING SYSTEM (GPS) AS AN APPROVED ENROUTE SUPPLEMENTAL NAVIGATION AID.

1 - GENERAL

1.1 - The purpose of this AIC is to provide updated information on GPS developments and to outline the Department of Civil Aviation's position in relation to the future use of GPS as an approved enroute supplemental navigation aid in Papua New Guinea airspace. The AIC does not constitute DCA's approval for the use of GPS for any type of operation as either a primary or supplemental navigation aid at this stage.

1.2 - Notwithstanding that, users are already taking advantage of GPS. DCA's primary goal is to ensure that users can obtain the significant benefits of GPS without sacrificing safety. This will require the introduction of GPS - based procedures to meet technological developments. DCA has set up a CNS/ATM Implementation committee including an industry representative, to evaluate PNG routes and co-ordinate approvals.

1.3 - Basic testing of the satellite system is completed. This was marked in December by the declaration of Initial Operational Capability (IOC) by the United States Department of Defence (US DoD). Leading up to the declaration of IOC, the GPS satellite constellation was continually being adjusted and tested by the US DoD. This testing can involve the deliberate shutdown of a satellite or a group of satellites without notice. The result of this random testing may result in loss of accuracy or even the total loss of the GPS capability.

1.4 - With the declaration of IOC and endorsement by FAA of aeronautical integrity, satellite system testing will continue. However, the US DoD has given an assurance that a minimum of 48 hours notice will be given prior to the commencement of any testing. This will be advised to the industry by Notam.

1.5 - Further, users should be aware that the basic GPS satellite constellation will not meet the stringent integrity and availability requirements of IFR operations. Integrity is the ability of a navigation aid to notify a pilot if it is radiating erroneous signals. For example, conventional radio navigation aid signals are monitored electronically; if out-of-tolerance conditions are detected, the aid shuts down automatically to prevent users from being led astray. The basic GPS system can take hours to identify "unhealthy" satellites.

1.6 - A number of solutions that will soon be available involves detection of problems by the receiver. The FAA Technical Standard Order (TSO) for IFR GPS receivers (TSO)-C129) "Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)" calls for Receiver Autonomous Integrity Monitoring (RAIM). The determination of GPS position requires four satellites to be in view. The basic principle behind RAIM is the comparison of GPPS positions using different combinations of four satellites. If the receiver detects disagreement, it determines which satellite is unhealthy, stops using this satellite and informs the pilot. RAIM requires at least six satellites in view to provide the receiver with enough combinations to detect an unhealthy satellite. Therefore, there will be times when RAID cannot work because of either insufficient satellites in view of their geometry is such that a solution to the required accuracy check is not possible. For this reason, GPS receivers built to the TSO-C129 standard will only be approved as "supplemental navigation aids," since a primary method must also exist.

1.7 - A supplemental navigation aid is defined as "an approved navigation system that must be monitored by the flight crew and can only be used in conjunction with an approved and operational alternative navigation system". This is to ensure that navigation can be safely continued when RAIM function becomes unavailable on aircraft operating under the IFR. The RAIM integrity problem will not be resolved in this region until the GPS is supplemented by another satellite system (such as GLONASS) or ground augmentation (ie, Wide Area Differential, Local Area Differential, Pseudolite, etc.).

1.8 - Another way of obtaining GPS integrity is through the monitoring of the GPS position by traditional NAVAIDS, such as NDB, VOR, DME, Omega or IRS. Whenever there is a predetermined difference between the GPS position and that calculated by the traditional navigation aids, the GPS position is discarded. This difference in position is one resulting from the flight evaluation begun in March 1994.

1.9 - These solutions, therefore, will allow a gradual phasing in of GPS and will provide users with the benefits of superior accuracy and RNAV routings without having to wait for the integrity issue to be completely resolved.

2 - REQUIREMENTS FOR APPROVAL OF GPS AS A ENROUTE SUPPLEMENTAL NAVIGATION AID.

2.1 - The minimum operational and Airworthiness standards required for GPS receivers/navigation systems to be approved for use as supplemental navigation aids are specified in TSO-C129. Only GPS equipment which meets this standard and which has TSO authorisation will be acceptable for use as a supplemental navigation and for operations under the IFR, and the VFR.

2.2 - Compliance with the requirements of the applicable TSO ensures that:-

- a. the equipment is certified to meet the minimum operational performance standards required for adequate performance in all aircraft environments claimed by the manufacturer, and assumed by the person involved in planning air route and approach and departure procedures;
- b. the equipment is manufactured in facilities having an appropriate quality control system in place and subject to surveillance by the PNG Regulatory Authority;
- c. changes (both hardware and software) to the equipment are subject to strict control to ensure that changes do not invalidate compliance with minimum standards;
- d. essential operating, installation and maintenance instructions, appropriate to the equipment, are adequate, and are provided with each item of equipment sold; and
- e. the manufacturer has a system in place, and is committed to provide the applicable aviation regulatory authority notice of any faults in the equipment which may invalidate compliance with the design standard specified, and to rectify any such defects that may be revealed in service.

2.3 - Specifically, GPS equipment which have TSO authorisation will have the following features which are essential elements for an approved navigation system;-

- a. Integrity. By use of RAIM and barometric smoothing techniques, system integrity is established to a consistent level.
- b. Continuity of Service. Through the incorporation of external sources of navigation information (eg. barometric altimeter) the continuity of service has been significantly improved.

- c. Accuracy Problems. The TSO standardises the geometric effects within the GPS receiver thus guaranteeing a consistent level of navigation accuracy.
- d. Display Characteristics. The TSO specifies the various display characteristics required for the phase of flight (i.e.; course Deviation Indicator (CDI) requirements, full scale deflection ranges, etc).
- e. Database Requirements. An accurate database is essential for confidence in the system navigation outputs. These database requirements are stated in the TSO>
- f. Installation and Continuing Airworthiness Requirements. The TSO requires specific information covering requirements for the initial and continued Airworthiness of the system, the detailed specification of the system installation requirements and limitations, and demonstration specifications when operated in aircraft environments.
- g. Equipment and Procedure Standardisation. The certified minimum performance standards inherent in TSO authorised equipment allows for the use of one common set of standards and procedures, thus simplifying pilot operation and ATC function by permitting the development of GPS navigation aid error budgets which can then be used to produce appropriate pilot and ATC standards and procedures.

2.4 - The first receivers designed to meet this standard have been approved. In the meantime, prospective purchasers who have a need for this type of GPS equipment are advised to wait until these receivers become available, or to ensure that the selected receiver can be upgraded to meet the TSO-C129 standard. Aviators with current technology GPS receivers in approved installations may continue to use these, but only as an "aid to navigate under the VFR"

2.5 - GPS equipment which does not meet the TSO requirements may provide dangerous misleading information. Accordingly, when GPS has been approved as a enroute supplemental navigation aid, Aircraft equipped with non-TSO-C129 GPS equipment will still be required to carry a placard to indicate that the fitted "GPS equipment is not approved for navigation.

3 - USE OF GPS FOR OCEANIC AND DOMESTIC ENROUTE OPERATIONS.

3.1 - The GPSIT is investigating the provisions and limitations for the use of GPS as a supplemental means of navigation for oceanic and domestic enroute operations. Current expectations are that the PNG provisions and limitations will closely follow those of other Pacific nations.

3.2 - The proposed provisions and limitations for the use of GPS for enroute operations are as follows:-

- a. The GPS navigation equipment used must have TSO-C129 authorisation; the design of the aircraft installation must be approved by a person having a delegation or 'Instrument of Appointment' under CAR 30 and the system must be operated in accordance with the approved Flight Manual, flight manual supplemental or approved operations manual.
- b. Navigation by the traditional navigation equipment is necessary when there are insufficient satellites in view for RAIM to operate.
- c. The position co-ordinates for nav aids, facility(s), reporting points and other aeronautical data require revision to match those of GPS. Maps such as ONC< WAC< JOG and TPC are included. The new datum included an unchanging datum from which GPS measures height although contours and heights on maps will not alter. The transformation will be complete by 1998.

4 - USE OF GPS FOR INSTRUMENT APPROACHES.

4.1 - Initially, GPS will not be approved as an instrument approach aid. Significant research in this area is being conducted overseas which the GPSIT will closely monitor. In addition, the 1971 approach design criteria used in PNG is being transformed to the 1993 criteria as a separate matter. The changes alone do not permit GPS usage at present, although the final outcome is not yet known. Operators will be kept informed of developments.

4.2 - In addition, to ensure navigation accuracy in the terminal area, the coordinate standard to which the navigation aids and runways were surveyed must be established. In PNG, various survey standards have been initiated to re-survey navigation aid sites to the internationally agreed World Geodetic Reference System- WGS 84. This work is expected to be completed by the end of 1995.

5 - USE OF GPS FOR VFR OPERATIONS.

5.1 - The present operational and Airworthiness guidelines, contained in AWI 10-12, continue to apply to aircraft equipped with GPS systems which do not have TSO authorisation. In essence, these systems are only permitted to be used as an aid to navigation and are limited to VFR operations and are not to be coupled to any other aircraft systems.

5.2 - GPS equipment which has TSO authorisation and is installed in accordance with the Airworthiness requirements will be approved for use as a enroute supplemental navigation aid on completion of the trials.

This should occur late 1994.

6 - CANCELLATION

6.1 - This AIC will remain current until further notice.

7 - Distribution:	Normal
Current AIC:	1985 5, 8
	1989 3, 4
	1990 2
	1991 3, 4, 5, 6
	1992 4, 5, 6
	1993 1, 2, 3, 4, 5, 6
	1994 1