Chapter 2 RNAV 10

1. General

RNAV 10 operations have been, prior to the development of the PBN concept authorized as RNP 10 operations. An RNAV 10 operational approval does not change any requirement nor does it affect operators that have already obtained an RNP 10 approval.

RNP 10 was developed and implemented at a time when the delineation between RNAV and RNP had not been clearly defined. As the requirements for RNP 10 did not include a requirement for on-board performance monitoring and alerting, it is more correctly described as an RNAV operation and hence the inclusion in the PBN Manual as RNAV 10.

Recognising that airspace, routes, airworthiness and operational approvals have been designated as RNP 10, further declaration of airspace, routes, and aircraft and operator approvals may continue to use the term RNP 10, while the PBN Manual application will be known as RNAV 10.

RNAV 10 is applicable to operations in oceanic and remote areas and does not require any ground-based navigation infrastructure or assessment.

2. ATS communications and surveillance

The PBN Manual does not address communication or air traffic services (ATS) surveillance requirements that may be specified for operation on a particular route or area. These requirements are specified in other documents, such as the aeronautical information publications (AIP) and ICAO Regional Supplementary Procedures (Doc 7030). An operational approval conducted in accordance with the requirements of the PBN Manual assumes that operators and flight crews take into account all the communication and surveillance requirements related to RNP 10 routes.

3. Summary

As RNAV 10 is intended for use in oceanic and remote areas the navigation specification is based on the use of Long Range Navigation Systems. A minimum of two LRNs is required for redundancy.

Commonly available LRNs are:

- INS
- IRS
- GNSS

The most common combinations of dual LRNs are:

- Dual INS
- Dual IRS
- Dual GNSS
- GNSS/IRS (IRS updated by GNSS)

Inertial systems (unless updated by GNSS) are subject to a gradual loss of position accuracy with time (drift rate) and therefore are subject to a maximum time limit in order to meet the

RNAV 10 accuracy requirement. The basic time limit is 6.2 hrs, but this may be extended by updating or by demonstration of reduced drift rate (<3.7km/2NM per hr.)

GNSS position is continuously updated and not subject to any time limit. However GNSS is subject to some operational limitations that impact on oceanic and remote navigation.
The minimum level of GNSS receiver (TSO C129) is capable of fault detection (FD) but will not provide a navigation solution if a fault is detected. Consequently, no matter how many serviceable satellites are available, the continued availability of GNSS cannot be assured and is therefore this standard of GNSS is unsuitable for oceanic and remote navigation. In order to be approved for oceanic and remote applications a GNSS receiver must be capable of excluding a faulty satellite from the solution (Fault detection and Exclusion/FDE) so that continuity of navigation can be provided. FDE is standard for GNSS receivers based on later TSO C145A/146A standards and is available as an option or modification for TSO C129( ) receivers. Consequently, where a TSO C129 ( ) GNSS is used to satisfy the requirement for one or both of the LRNs it needs to be determined that the receiver is capable of FDE and approved for oceanic/remote operations.

Despite the GNSS receiver capability for FDE, the satellite constellation may not always be adequate to provide sufficient satellite for the redundant navigation solutions to be computed in order to identify and eliminate a faulty satellite from the position solution, and in such situations FDE is not available. In order to limit the exposure to the potential loss of a navigation solution due to unavailability of FDE, a prediction of satellite availability is required, and the maximum period during which FDE is predicted to be unavailable is 34 minutes. This time limit is based on the assumption that should a fault occur during a period when FDE is unavailable, then navigation accuracy is reduced (DR).

For an IRS/GNSS system the same 34 minute time limit is also applied to a loss of FDE.
Due to the time limitations applicable to INS or IRS the operator needs to evaluate the route(s) to be flown to determine that RNAV 10 capability can be satisfied. Accordingly an RNAV 10 operational approval is not universal for aircraft without GNSS and needs to apply to specific routes or be subject to the operator's procedures for route evaluation.

As inertial position accuracy slowly deteriorates over time since update, for aircraft with INS or IRS only, some attention needs to be placed on radio updating. Aircraft equipped with a Flight Management System normally provide automatic radio updating of inertial position. Automatic updating is normally considered adequate in such circumstances, provided the aircraft is within a reasonable distance of the radio aids at the point at which the last update is expected. If any doubt exists then the operator should be required to provide any an analysis of the accuracy of the update.

Manual updating is less common, and the operational approval needs to be based on a more detailed examination of the circumstances. Guidance is provided in the PBN Manual.

4. Operating Procedures

The standard operating procedures adopted by operators flying on oceanic and remote routes should normally be generally consistent with RNAV 10 operations, except that some additional provisions may need to be included to specifically address RNAV 10 operations.
A review of the operator's procedure documentation against the requirements of the PBN Manual and the regulatory requirements should be sufficient to ensure compliance.

The essential elements to be evaluated are that the operator's procedures ensure that:

- The aircraft is serviceable for RNAV 10 ops
- RNAV 10 capability is indicated on the flight plan
- Route limitations are defined and observed (e.g. time limits)
- En-route loss of capability is identified and reported
- Procedures for alternative navigation are described

GNSS based operations also require the prediction of FDE availability. Most GNSS service prediction programs are based on a prediction at a destination and do not generally provide predictions over a route or large area. However for RNAV 10 operations the probability that the constellation cannot support FDE is remote and this requirement can be met by either a general route analysis or a dispatch prediction of satellite availability. For example a specified minimum satellite constellation may be sufficient to support all RNAV 10 operations with out specific real-time route prediction being required.

5. Pilot Knowledge and Training

Unless the operator is inexperienced in the use of RNAV, flight crews should possess the necessary skills to conduct RNAV 10 operations with minimal additional training.

Where GNSS is used, flight crews must be familiar with GNSS principles related to en-route navigation.

Where additional training is required, this can normally be achieved by bulletin, computer based training or classroom briefing. Flight training is not normally required.