PART 1 PBN TECHNOLOGY

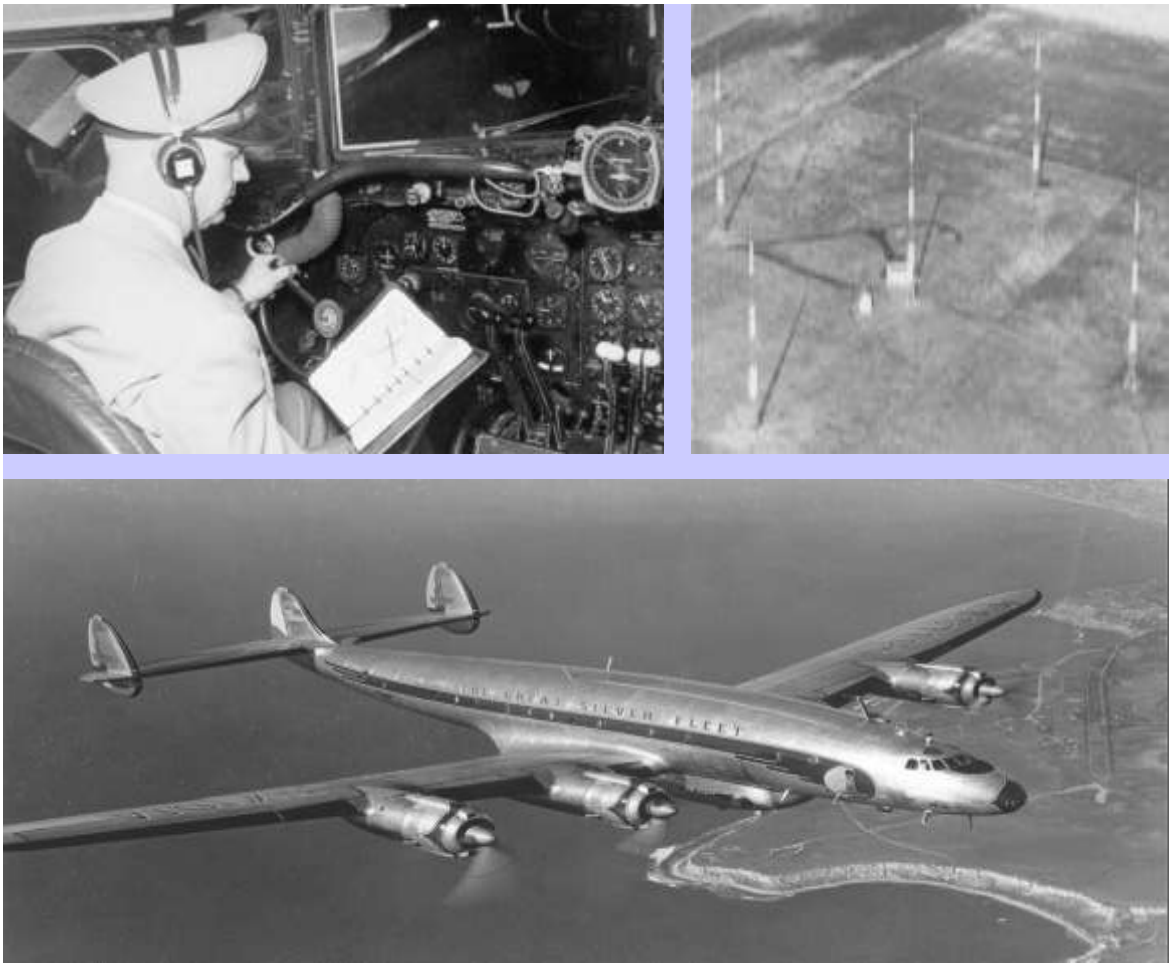
Chapter 1 OVERVIEW

1. Introduction.

The information in this Part is intended to provide inspectors with the necessary technical knowledge necessary to manage an application for operational approval in accordance with a navigation specification contained in the PBN Manual. This Part contains information relative to the full complement of PBN Manual navigation specifications and in general individual PBN operations are not discussed in detail.

2. Transition from Conventional Navigation to PBN

Conventional navigation, that is navigation dependent upon ground-based radio navigation aids, has long been the mainstay of aviation. Pilots, operators, manufacturers and ANSPs are all familiar with the technology, and the avionics, instrumentation, operations, training and performance are very much standard throughout the world. Consequently, apart from some more demanding operations such as Cat II/III ILS, specific operational approval is not necessary.



Performance Based Navigation is dependent on area navigation, and while various methods of RNAV have been in existence for many years, the use of RNAV has not yet reached the same level of common use as conventional navigation. The Performance Based Navigation concept is intended to better define the use of RNAV systems and provide a means to eventually reach a similar level of common use. However, until there is general standardisation in aircraft, operating procedures, training and ATS application, there is a need for an operational approval process.

While there is a need for an approval process, the fundamentals of PBN operations are relatively straightforward, and operational approval need not be a complicated process for either applicant or regulator. Even the highest performing type of operation (RNP AR APCH), once implemented, due the capability of modern avionics and auto-flight systems, is a simple and safe operation when conducted in an appropriately equipped aircraft operated by a properly trained crew.

However the transition to new technology, new navigation and operational concepts and the dependence on data driven operations requires careful management. It is the purpose of the operational approval process to ensure that for all PBN operations the appropriate level of oversight is provided to ensure that in the current environment where there are many variables in terms of equipment and experience that the benefits of PBN can be achieved consistently and safely.

The key to successful PBN implementation is knowledge and experience. For many States, both operators and regulators lack both, and this handbook is intended to assist in improving that level of knowledge. Experience can only be gained by doing, and an operational approval will commonly be required before relevant experience is gained. In this handbook guidance is also provided on strategies for implementation which allow experience to be gained (by all parties) in a controlled environment, allowing progression to full capability in stages as experience is gained.

3. Performance Based Navigation

Performance Based Navigation encompasses a range of operations which are all based upon Area Navigation. Area navigation, commonly abbreviated as RNAV, has been available for around 30 years using a variety of technologies, however some difficulties arise in the dual application of the term RNAV as a fundamental method of navigation (area navigation) and also as a particular type of operation (e.g. RNAV 5). Further complications arise with the implementation of Required Navigation Performance (RNP) operations which by definition are also area navigation operations.

There has been some difficulty in identifying the differences between RNAV operations and RNP operations, and some lack of definition in the requirements for both RNAV and RNP operations. A number of regions established local RNAV and RNP standards which led to complexity in international operations and operational approvals.

ICAO established the Required Navigation and Special Operational Requirements Study Group (RNPSORSG) to resolve these issues. The RNPSORSG (now called the PBN Study Group) developed the concept of Performance Based Navigation to encompass both RNAV and RNP operations.

4. RNAV vs. RNP

One of the issues that the RNPSORSG had to deal with was to differentiate between area navigation operations which are described as either RNAV or RNP. It was recognised that while both RNAV and RNP operations could be described in terms of navigation performance (e.g. accuracy), RNP operations can be identified by the capability of the on-board navigation system to monitor in real

time the achieved navigation performance and to alert the operating crew when the specified minimum performance appropriate to a particular operation could not be met. This additional functionality provided by RNP allows the flight crew to intervene and to take appropriate mitigating action (e.g. a go-round), thereby allowing RNP operations to provide an additional level of safety and capability over RNAV operations.

As GNSS systems incorporate performance monitoring and alerting, the distinction between RNAV and RNP operations in practice is the requirement for GNSS. While there are exceptions to this rule, in simple terms RNP operations are GNSS based, and for RNAV operations are based on older technology.
RNAV navigation specifications have been developed to support existing capability in aircraft equipped with systems which in the general case were not designed to provide on-board performance monitoring and alerting.

RNP navigation specifications have been developed from a need to support operations that depend upon GNSS to provide the required performance.