



<b>CAMEROON CIVIL AVIATION AUTHORITY – DIRECTION OF AVIATION SAFETY</b>		
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## **Chapter 7 AIRCRAFT QUALIFICATION**

### **7.1 Eligibility**

In the process of issuing an operational approval for PBN, it is necessary to establish that the aircraft and its navigation and other systems are suitable for the specific operation. For conventional navigation, rules and processes exist for the design, manufacture, certification and operation of navigation systems in accordance with well established standards and practices. For PBN operations it is less likely, especially given the recent development of the PBN Manual and State regulatory documentation, that an aircraft is approved in the state of manufacture in accordance with the requirements of a particular navigation specification.

Consequently it is often necessary to authorise PBN operations without the benefit of complete airworthiness approval documentation, and this is an important step in the operational approval process. It is important to understand that the lack of specific airworthiness certification does not imply any lack of capability. All operational aircraft will as a matter of course be “airworthy” in the general sense, however the specific airworthiness with regard to a particular PBN operation may not have been completed. In such cases it is necessary to demonstrate that the aircraft is suitably equipped and capable of the PBN operation. The terms “certification” and “approval” should be used appropriately, and care needs to be taken not to confuse the two.

Operational approval needs to consider the capability, functionality, performance and other characteristics of the navigation and other relevant flight systems against the requirements of the particular PBN operation and determine that the operation is sound. In some cases operational mitigations and alternative means of meeting the PBN Manual requirements may need to be examined and approved.

The term eligibility is used to describe the fundamental aircraft capability, however considerable additional evaluation may be needed before an eligible aircraft is determined to be adequate for the issue of an operational approval.

Following the development of the PBN Manual and relevant State regulatory material, a number of manufacturers have or are in the process of obtaining airworthiness approval for PBN operations. In such cases the operational approval process can be greatly simplified. It is expected that in due course manufacturers will pursue PBN Manual compliant airworthiness approvals both for new and previously certified aircraft.

A considerable number of aircraft may never, for engineering, economical or practical reasons, be able to obtain airworthiness approval consistent with all PBN Manual navigation specifications. Despite this, operational approval is frequently





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able to be achieved, by the implementation of operational limitations, specific operating procedures, data collection, systems evaluation or trialling.

## **7.2 Aircraft Evaluation**

The AFM will commonly include a statement of RNAV or RNP capability, which often leads to the assumption that the aircraft is approved for a particular PBN operation. Unfortunately the basis upon which a statement is included in an AFM is often not consistent with the PBN Manual, as many of the terms, requirements, operating practices and other characteristics either differed or did not exist at the time the AFM was issued.

Consequently, unless the aircraft AFM specifically references relevant State airworthiness documents consistent with the PBN Manual, additional information will need to be obtained to evaluate the relevance of the AFM statement.

In order to support PBN operational approval a number of manufacturers provide additional information to support claims of PBN Manual compliance and capability. Such supporting documentation may or may not be approved or endorsed by the State of manufacture, and it may be necessary to contact the relevant authority to validate the manufacturer's claims.

It should also be noted that operational philosophies differ particularly in the management of non-normal events, and that an airworthiness or operational approval granted on one State may not be consistent with the practice in another region. For example in the US greater emphasis is placed on crew procedures in the management of non-normal events, whereas in Europe emphasis tends to be placed on engineering solutions.

## **7.3 Functionality**

An area of aircraft capability that generally involves some attention during the operational approval process is the evaluation of navigation functionality, and cockpit control, display, and alerting functions. Many area navigation systems were designed and installed at a time when some of the PBN applications were not envisioned, and the need for certain functionality was not considered necessary. These circumstances do not mean that the installed equipment is not capable of PBN operations but in some cases the design is such that the minimum requirements of the PBN Manual may not be available as installed.

For example, a cross-track indication in the form of a Course Deviation Indicator (CDI) or Horizontal Situation Indicator (HSI) enabling accurate monitoring of cross-track deviation may not have been considered necessary at the time of certification. An avionics upgrade may be available to meet the later requirements of the PBN Manual, but in some aircraft for a variety of technical or economic reasons this may not be possible.





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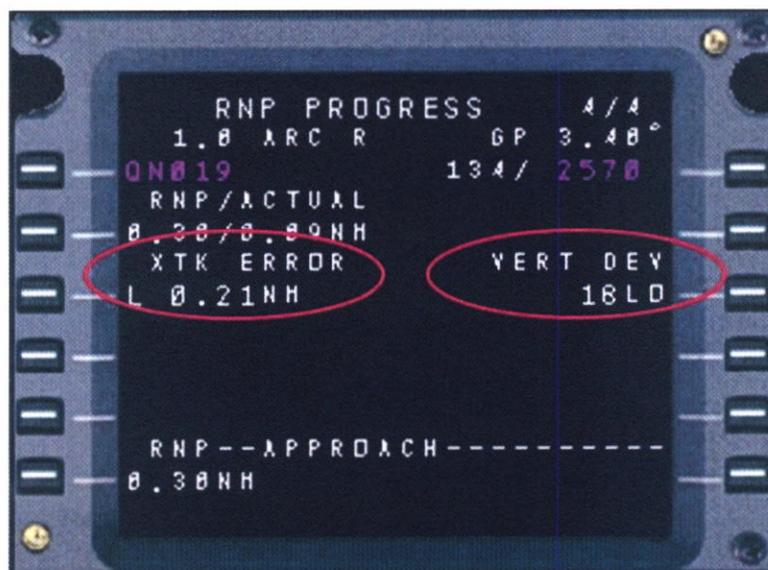


Figure 7.1: Cross-track and Vertical Deviations shown on Control and Display Unit

The aircraft evaluation therefore needs to consider the options available to meet the intent of the PBN Manual navigation specification, in circumstances where the specified functionality may simply be unavailable. In the example above (CDI), the objective is to ensure that a particular level of cross-track accuracy can be monitored and if alternative means are available, such as a crew procedures to monitor another source of cross-track deviation, then operational approval should not be unreasonably withheld.



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Fig 7.2: Example of cross-track deviation display in 1/10<sup>th</sup> NM

In determining that the alternative means is acceptable, the applicant may be required to demonstrate (e.g. in a simulator), that the procedure is satisfactory, taking into account all other relevant factors. Alternatively some operational limitation (e.g. limiting RNP) may be applied in order to demonstrate an equivalent level of safety.

For more detail refer to Part 2 for functionality associated with individual Navspecs.



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## **Chapter 8 FLIGHT CREW TRAINING**

### **8.1 General**

The amount and type of training required for flight crews varies significantly depending upon a number of factors including;

- Previous training and experience
- Complexity of operations
- Aircraft equipment

Consequently it is not possible to specify for each of the PBN Manual navigation specifications the particular training that will be required, and some judgement is required in determining the content and structure of flight crew training. The navigation specifications in the PBN Manual cover a wide range of operations, from basic to complex and that training needs to be appropriate to the particular circumstances.

Each navigation specification includes guidance on flight crew training although it should be noted that the training specified for each operation is generally considered independently. It should be recognised that the PBN Manual is a compilation of guidance material, some of which has been in existence in other forms for some number of years, and the training requirements may not be entirely consistent across the range of navigation specifications.

For en-route operations, ground training is commonly sufficient to provide crews with the necessary knowledge. Delivery methods will vary, but classroom training, computer based training or in some cases desk-top simulator training is normally sufficient.

Arrival and departure operations and particularly approach operations normally will also require some flight simulator training, in addition to ground training and briefings.

Consideration should also be placed upon the need for flight crews to demonstrate that competency standards are achieved and the means of documentation of qualification.

### **8.2 Knowledge requirements**

For all PBN operations the following areas of knowledge will need to be included, with varying content and complexity depending upon the particular operations.

*Area navigation principles.* Area navigation is the basis for all PBN operations, and the same general knowledge of is applicable to all navigation specifications. Note that pilots with previous experience may not be familiar with some more





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advanced features such as Radius to Fix legs (RF) and the application of vertical navigation.

*Navigation system principles.* Flight crews should have a sound knowledge of the navigation system to be used. The relevance of the navigation system to particular PBN Manual navigation specifications should be clearly established. For example knowledge of inertial navigation and updating is relevant to requirements for some oceanic and remote navigation specifications, as is knowledge of GNSS is necessary for RNP AR APCH operations.

*Equipment operation and functionality.* Considerable variation exists in the operation of navigation equipment, cockpit controls, displays and functionality. Crews with experience on one type of installation or aircraft may require additional training on another type of equipment. Special attention should be placed on the differences between stand-alone GNSS equipment and Flight Management Systems with GNSS updating.

*Flight planning* Knowledge of the relevant aspects of each of the navigation specifications that relate to flight planning is required.

*Operating procedures.* The complexity of operating procedures varies considerably between PBN operations. RNP APCH and RNP AR APCH require a detailed knowledge of standard operating procedures for both normal and non-normal operations.

*Monitoring and alerting.* Flight crew responsibilities for performance monitoring and alerting provided by the navigation system or other means (crew procedures) must be understood.

*Limitations.* Operating limitations (e.g. time limits, minimum equipment) vary both between and within the PBN Manual navigation specifications and flight crews need to be able to recognise and plan accordingly.

*Contingencies* Alternative means of navigation or other contingency procedures must be included.

*Air Traffic Control procedures.* Flight crews need to be aware of ATC procedures that may be applicable to PBN operations.

### **8.3 Flight Training requirements**

Approach and departure operations, and in some cases arrivals require flight training and the demonstration of flight crew competency.

The amount of flight training required varies with the PBN operation, previous flight crew training and experience and other factors. In the course of operational approval all relevant circumstances need to be considered and the training



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evaluated for completeness and effectiveness. Ongoing and recurrent training should also be considered.

Despite the variation in training requirements, some general guidelines may be helpful in evaluating the extent of training that might be required. Some examples of “average” cases are included below. These examples assume that flight crews have previous relevant experience, and have completed knowledge training curriculum.

*En-Route:* In general flight training is not required.

*Arrival & Departure:* As departure and arrival operations require strict adherence to track during periods of higher workload, and are associated with reduced clearance from terrain and increased traffic, crews need to be fully conversant with the operation of the navigation system. Consequently, unless crews have significant appropriate operational experience simulator or flight training must be provided. Particular care should be taken in the evaluation of this type of operation conducted with stand-alone GNSS equipment where functional limitations require crew intervention.

*RNP APCH:* Training for RNP APCH conducted using stand-alone GNSS equipment, particularly in a single-pilot aircraft normally requires multiple in-flight exercises each with pre-flight and post-flight briefing. Considerable attention needs to be given to programming and management of the navigation system, including in-flight re-programming, holding, multiple approaches, mode selection and recognitions, human factors and the navigation system functionality.

Approaches conducted in FMS equipped aircraft, are generally much easier to manage and aircraft are generally fitted with good map displays assisting situational awareness. Normal operations are generally quite simple and competency can be achieved with one or two approaches. Additional training should be provided to achieve familiarity and competency in operations which involve changes to the planned approach, system alerting and missed approach requirement. Attention also needs to be placed on the method of vertical navigation, using standard non-precision approach procedures (LNAV) or barometric VNAV (LNAV/VNAV). As a guide initial training for crews with previous relevant GNSS & RNAV experience typically can achieve competency during one full flight simulator training session with associated pre-flight and post flight briefing.

*RNP AR APCH:* RNP AR APCH operations are able to deliver improvements in safety and efficiency which are enabled by the Authorisation Required process which ensures that all areas of the operating are carefully examined and appropriate attention placed on all aspects of the operation including training. Accordingly





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training for RNP AR APCH operations should be thorough and ensure that crews are able to manage operations safely within the additional demands placed on procedure design, aircraft and crew procedures.

As a guide, crews without previous relevant experience (e.g. RNP APCH with Baro VNAV), may require a course of ground training (1 – 2 days) plus simulator flight training (4hrs or more) in order to achieve competency.

Additional information regarding flight crew knowledge and training is included in PART 2.