

## What is PBN?

Performance-based Navigation, or PBN, is area navigation that uses on-board systems and will be based on global navigation satellite systems (GNSS) in Namibia. This is in contrast with traditional sensor-specific navigation based on fixed ground-based beacons guiding aircraft along published routes via waypoints defined by these beacons.

PBN defines aircraft navigation requirements in terms of the accuracy, availability, integrity, continuity and functionality required for the proposed operations.

PBN encompasses two types of navigation specifications:

- » RNAV (aRea NAVigation), and
- » RNP (Required Navigation Performance).

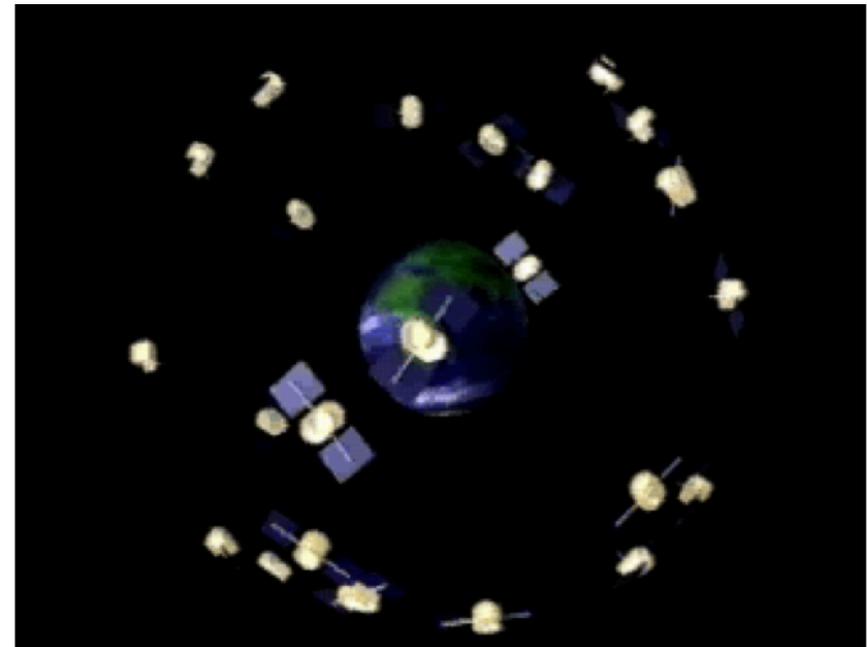
The difference between the RNAV and RNP navigation specifications is that on-board performance monitoring and alerting is required for RNP but not for RNAV operations.

In an aircraft utilising a stand-alone GNSS, RNP is achieved through the use of Receiver Autonomous Integrity Monitoring (RAIM). Area navigation systems often integrate several sources of navigation information e.g. inertial and GNSS, to provide highly accurate navigation solutions.

These systems may use alternate means of aircraft autonomous integrity monitoring systems that are the equivalent of RAIM.

The on-board performance monitoring and alerting function ensures the integrity of the navigation solution i.e. the system is meeting the required accuracy.

Information from the GNSS calculates its position from the satellites in view.



This has the major advantage of flexibility: providing the aircraft has a means of determining its current position, it can operate anywhere that positioning system will operate.

Under PBN, airspace and route design take into account the aircraft operations in the region, and the capability of aircraft flying there.



Both aircraft and flight crew must meet performance standards for that route, which may change according to the flight phase (en route, approach etc.) and the class of airspace in which the aircraft is flying.

Common Namibian operational navigation specifications will be:

- » RNAV 5 or RNP 2—en route
- » RNP 1—for Standard Instrument Departures (SIDs), and Standard Terminal Arrival Routes (STARs)
- » RNP APCH— LNAV/VNAV or LNAV approach

## Benefits of PBN

The introduction of PBN allows pilots, operators and air traffic control to make the best use of advances in navigation technology, and brings increased safety, efficiency and environmental benefits, including:

- ▣ » Reduced separation standards for all phases of flight. As the skies become busier, PBN allows the most efficient use of available airspace, through appropriately managed reductions in separation standards and track miles flown during the en-route, approach and

landing phases. Namibia's airways system will be able to handle more aircraft and do this more safely within time and airspace constraints.

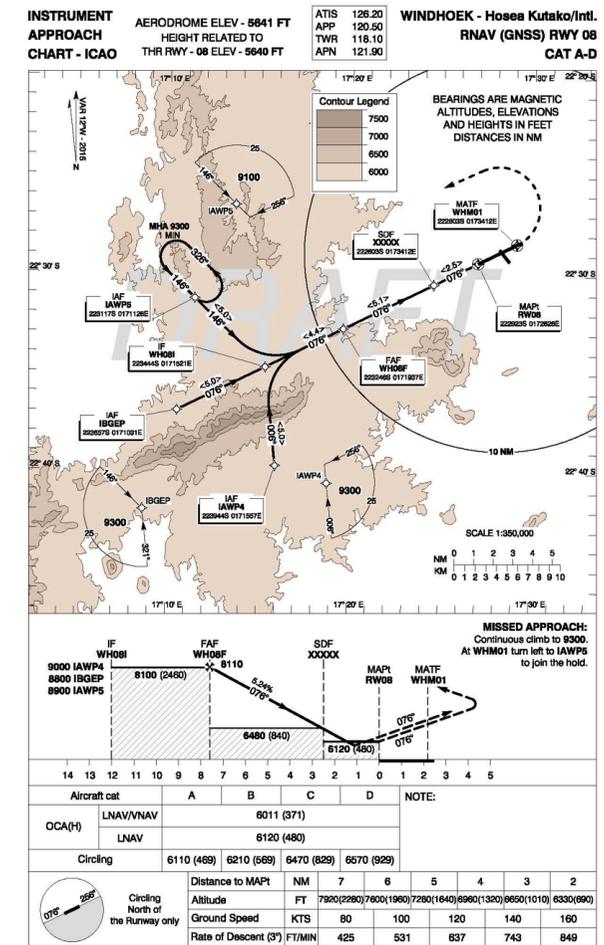
- ▣ » Reduced track miles/fuel burn/carbon dioxide emissions during landing approaches. PBN technology has the real potential to reduce unproductive flight time, unnecessary delays and fuel burn, providing obvious economic benefits to operators, and the environment. Air traffic management will bring even more efficiency, with aircraft operating on direct routes at optimum altitudes, thus avoiding the dreaded arrival holding pattern.
- ▣ » PBN and GNSS allow straight-in approaches to be designed for most runways. International Civil Aviation Organization (ICAO) data shows that straight-in approaches are 25 times safer than circling approaches. Adding vertical guidance to the approach brings a further safety gain.

• Approaches with vertical guidance (APV), where the aircraft has both lateral and vertical navigation capability, are a further eight times safer than approaches without vertical guidance, so are a significant safety enhancement. Currently the only approaches with vertical guidance available in Namibia is the ILS.

APV (RNP APCH LNAV/VNAV) will be available in Namibia using Baro-VNAV, where aircraft barometric altitude is used to control the aircraft to a defined vertical path.

• Lack of vertical guidance during instrument approach to land operations is a major contributing factor to accidents involving controlled flight into terrain (CFIT). Such accidents almost always result in 100 per cent fatalities.

» Reduced reliance on terrestrial radio- navigation aid infrastructure through widespread use of GNSS-enabled PBN will permit a reduction of ground navigation aids. Approaches at some aerodromes in Namibia that have radio- navigation aids are flown with lateral guidance only, using the VHF omni-range (VOR) radio- navigation aids. These navigation aids are 70-year- old technology,



which is becoming increasingly expensive to install and maintain.

» Global harmonisation—ICAO's PBN navigation standards are being applied worldwide for use by any authorised operator from any ICAO state. This means that certifying both operators and aircraft will be much easier, and aircraft will be built to common global standards.

### Why is it happening?

- » Global aviation calls for global standards. As PBN becomes more common worldwide, the need for standardisation becomes more urgent. The advantages brought by PBN can be undone by confusion in terminology and standards.
- » This process began in the 1990s in the continental airspace of Europe and North America, but lack of worldwide harmonisation has hindered the global implementation that would allow the many benefits of PBN to be realised.

» Many States have been moving away from traditional and ground-based nav aids such as VOR and NDB for the en-route, terminal and approach phases of flight, and adopting GNSS-based area navigation. Traditional air routes as we know them will soon be superseded, not just for the major airlines, but for general aviation as well. Advances in technology are rapidly making old navigation standards (as defined by traditional, ground-based nav aids) constrained and obsolete.

» PBN allows for more straight-in approaches, which are safer. It also allows for vertical guidance, which further improves approach safety.

» By facilitating optimal flight routes PBN can save fuel. It also allows higher traffic densities to be managed safely.

Further updates and information will be made available as the roll out of PBN based procedures begins and continues through Namibia. Check back often for information changes.

For queries and further information relating to PBN email [pbn@dca.com.na](mailto:pbn@dca.com.na)