

PERFORMANCE BASED NAVIGATION (PBN)

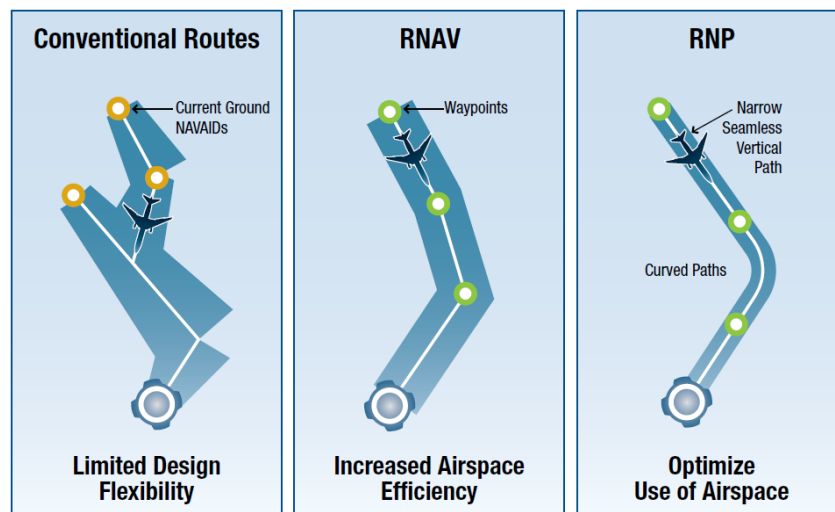
BACKGROUND

As aviation moves towards navigation systems based on GPS satellite technology, Performance Based Navigation (PBN) is becoming the new way to navigate. Whereas the conventional navigation infrastructure is based primarily on ground based systems and equipment, PBN uses GPS and sophisticated avionics to enable aircraft to fly accurate paths, both laterally and vertically.

PBN brings a number of operational and environmental benefits including:

- Route structures which allow for more efficient flight paths to be designed that result in reduced fuel burn and emissions;
- Access to airspace and runways that are limited or not achievable by conventional navigation technology;
- Improved safety through more straight-in instrument approaches with vertical guidance;
- Increased airspace capacity;
- Reduced infrastructure cost; and
- Reduced environmental impact.

There are two types of specifications for PBN: Area Navigation (RNAV); and Required Navigation Performance (RNP). RNAV and RNP are fundamentally similar. The key difference is that RNP includes a requirement for onboard performance monitoring and alerting capability, whereas RNAV does not demand the onboard requirement. As a result, RNP is more precise and is recognized worldwide as the navigation standard that should be adopted in order to support improvements in safety, efficiency and reduced impact on the environment. RNP requires special equipment on board the aircraft, trained crew, and certified designs.



Source: NAV CANADA

RNP IN CANADA

There are currently 80 RNP approach procedures at over 20 airports in Canada. However, the use of these approaches is restricted to only a few operators.

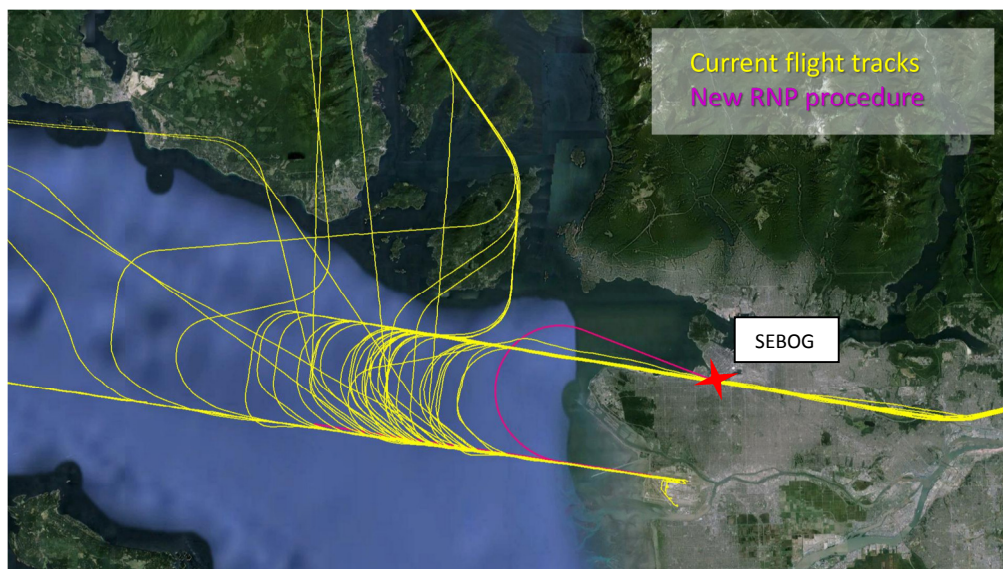
Transport Canada recently published new criteria that enables RNP procedures to be designed for use by more airlines and more types of aircraft. In developing these procedures, priority has been given to major airports and airports located in challenging terrain where the technology may improve access or enhance safety.

RNP AT VANCOUVER INTERNATIONAL AIRPORT

Vancouver International Airport (YVR) will be the first airport in Canada to have a public RNP procedure. The new RNP approach procedure will be an arrival procedure for Runway 08L and will be available for use in the fall of 2015.

Arriving aircraft follow a procedure known as Standard Terminal Arrival Route (STAR) when operating under Instrument Flight Rules (IFR). A STAR is a preplanned arrival procedure with set instructions, and there are a number of STARs published for YVR to provide guidance for aircraft approaching from various directions.

The new RNP 08L approach procedure will follow the same path as one of these existing STARs, known as the CANUCK THREE ARR for most of the approach. The CANUCK THREE ARR is used mainly by aircraft approaching YVR from the North East. Aircraft flying the RNP procedure will turn out over the water at the waypoint SEBOG during the final segment of the approach. The figure below illustrates sample flight tracks of aircraft using the current CANUCK THREE ARR (in yellow) and flight path for the RNP leg (in magenta).



[A video clip illustrating and describing the new procedure and its benefits can be found here.](#)

NOTES:

- The new portion of the flight track associated with the RNP procedure occurs over the English Bay and is away from populated areas.
- Aircraft using the RNP procedure will need to be at lower altitude SEBOG (5,800 feet compared to 8,000 feet if following the conventional CANUCK THREE ARR). This difference in altitude should not materially change the sound levels experienced by an observer on the ground under the flight path¹.
- It is expected that less than 10% of current traffic using the CANUCK THREE ARR will use the RNP procedure. This is due to the fact that there are only a limited number of aircraft appropriately equipped and certified to fly RNP procedures currently and air traffic controllers' ability to fit aircraft using the new procedure into the sequence of other traffic. Usage of the procedure is expected to grow in the future as more airlines equip their aircraft with the required technology and train their aircrews, and air traffic control becomes accustomed to accommodating RNP aircraft into the traffic patterns.
- The new RNP approach procedure is expected to have several environmental benefits , including:
 - Producing lower levels of noise as the aircraft will be in a "clean" configuration and in continuous descent,;
 - Saving approximately 2-3 minutes of flying time and an average of 18km per flight;
 - Saving approximately 100-300 litres of fuel per flight, depending on the aircraft type; and,
 - Reducing Greenhouse Gas impact on the environment by eliminating 2,500 tonnes of CO₂-e emission per year and potential annual fuel savings exceeding 1 million litres.

Additional RNP procedures for other runways at YVR will be developed and made available in the future as more aircraft become capable to use these procedures. The aviation industry is committed to ensuring the community is advised of flight path changes over populated areas associated with the new procedures, and will engage with the community on flight path design as appropriate, depending on the type of change involved.

If you would like more information, please contact the YVR Noise Management at noise@yvr.ca.

¹ In general, in order to have a perceptible change in the sound level to an observer on the ground, the aircraft would need to be at an altitude of 4,000 feet or lower.