PBN
IMPLEMENTATION AND TRAINING

Victor Hernandez
RO ATM/SAR
Mexico City, 4-8 May 2015

CONTENT

- Implementation
- Training

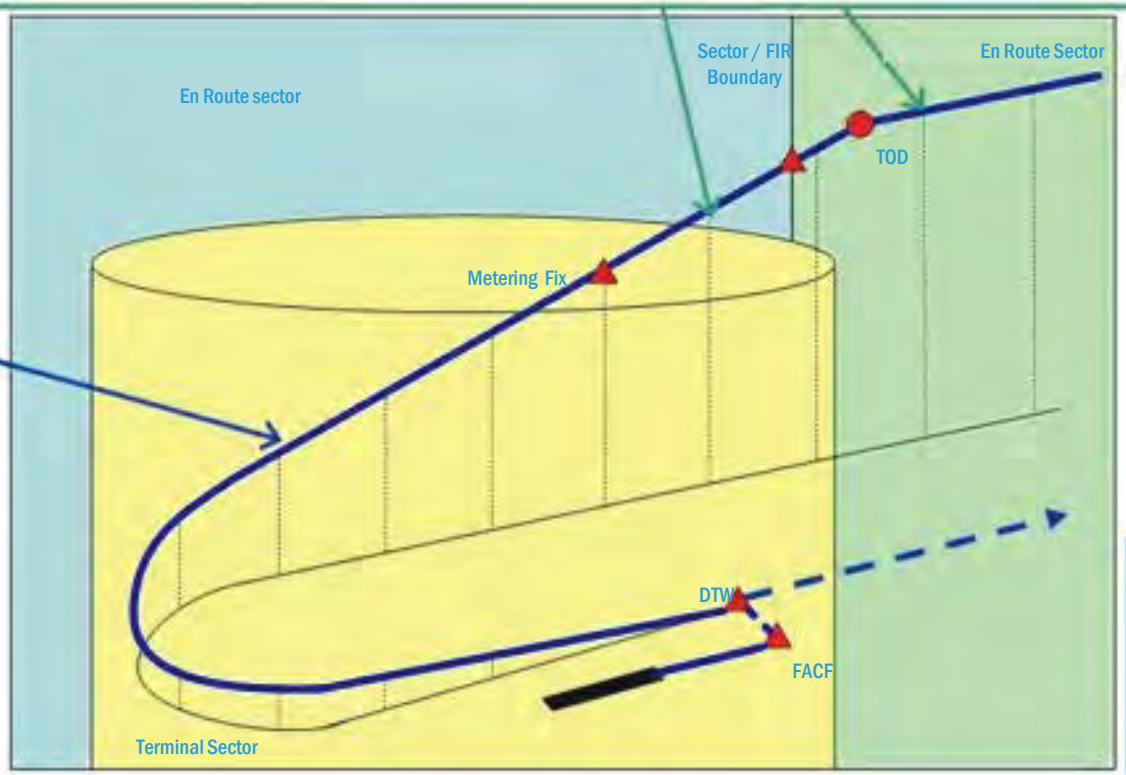
Procedure validation

- Verification of terrain, obstacle and aeronautical data used to support design
- Validate intended use of procedure (match to conceptual design)
- Validate correct application of criteria
- Validate flyability and human factors (charting)
- Flight Inspection (if required)

ICAO SARPS

-Speed and route tailoring here better merges streams and enables extension of the arrival from downwind to the runway even during congested periods.

-Maximum use of aircraft avionics provides maximum flight efficiency for airlines and environment, and maximum predictability for ATS.



Standard operations:

Vectoring and level-off below metering fix

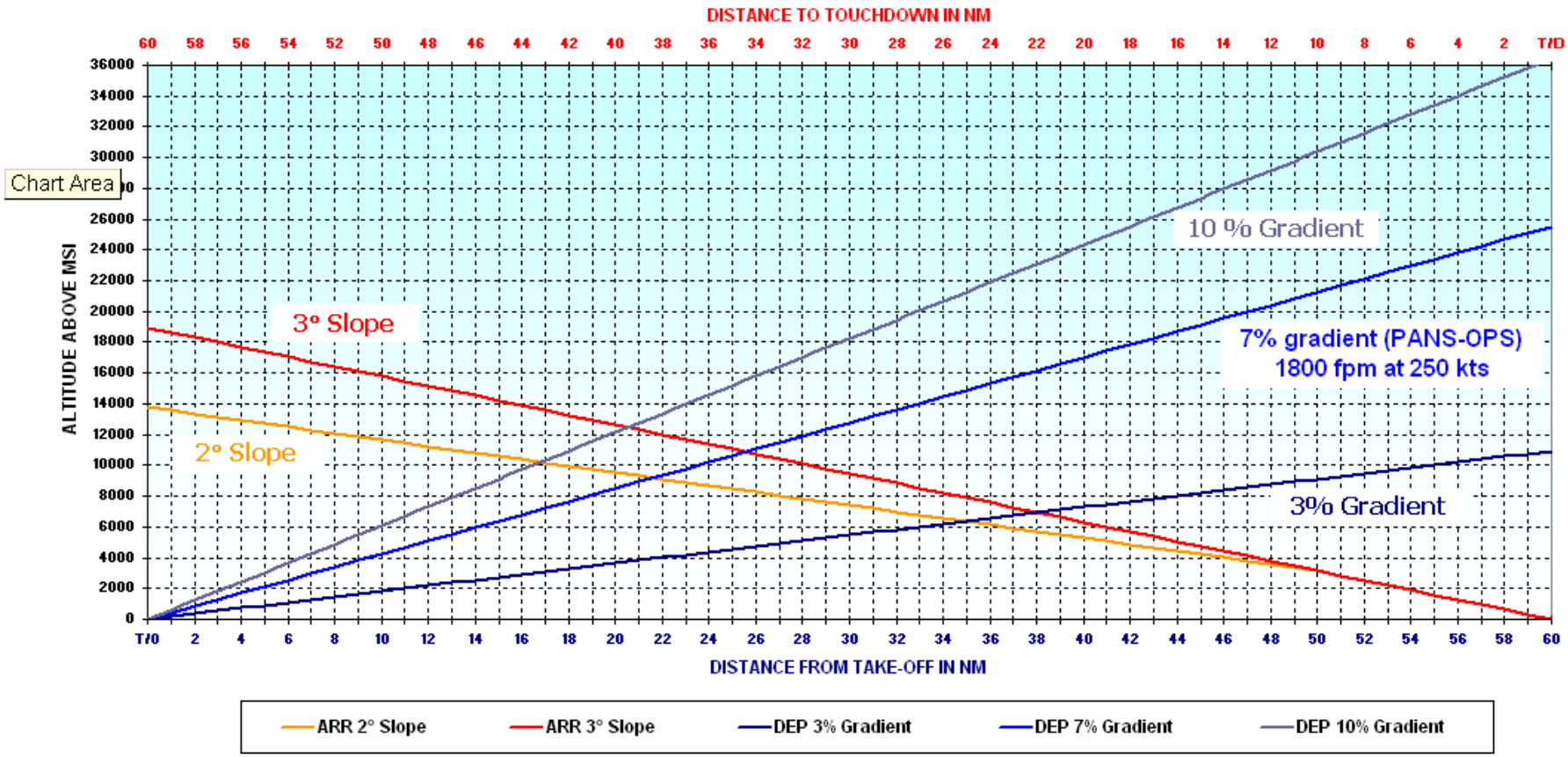
Standard operations:

Variable length downwind leg, with level-offs

Standard operations:

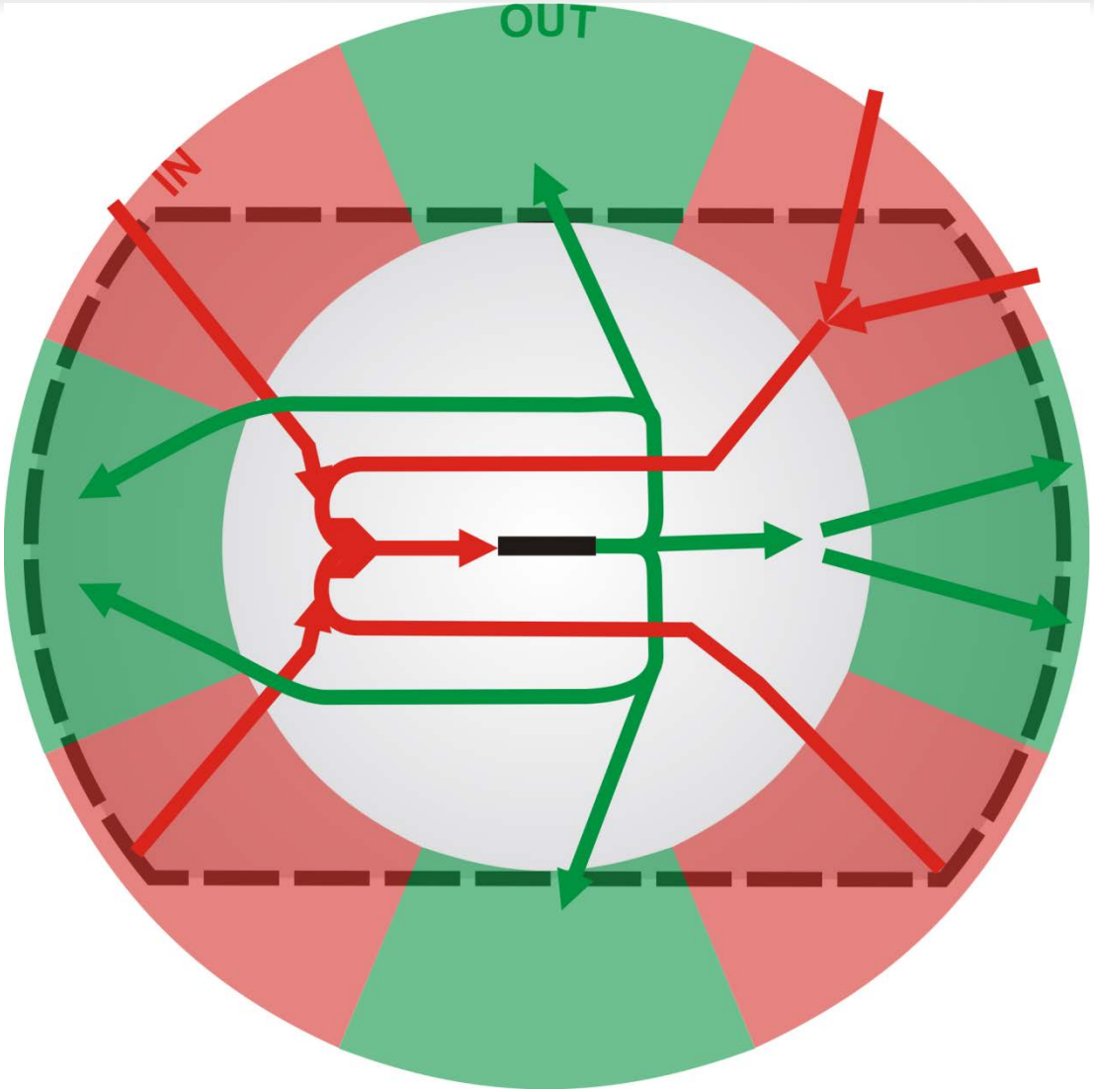
Variable length downwind leg, with level-offs

VERTICAL INTERACTION BETWEEN UNCONSTRAINED DEP & ARRIVAL [ELEV. @ MSL]



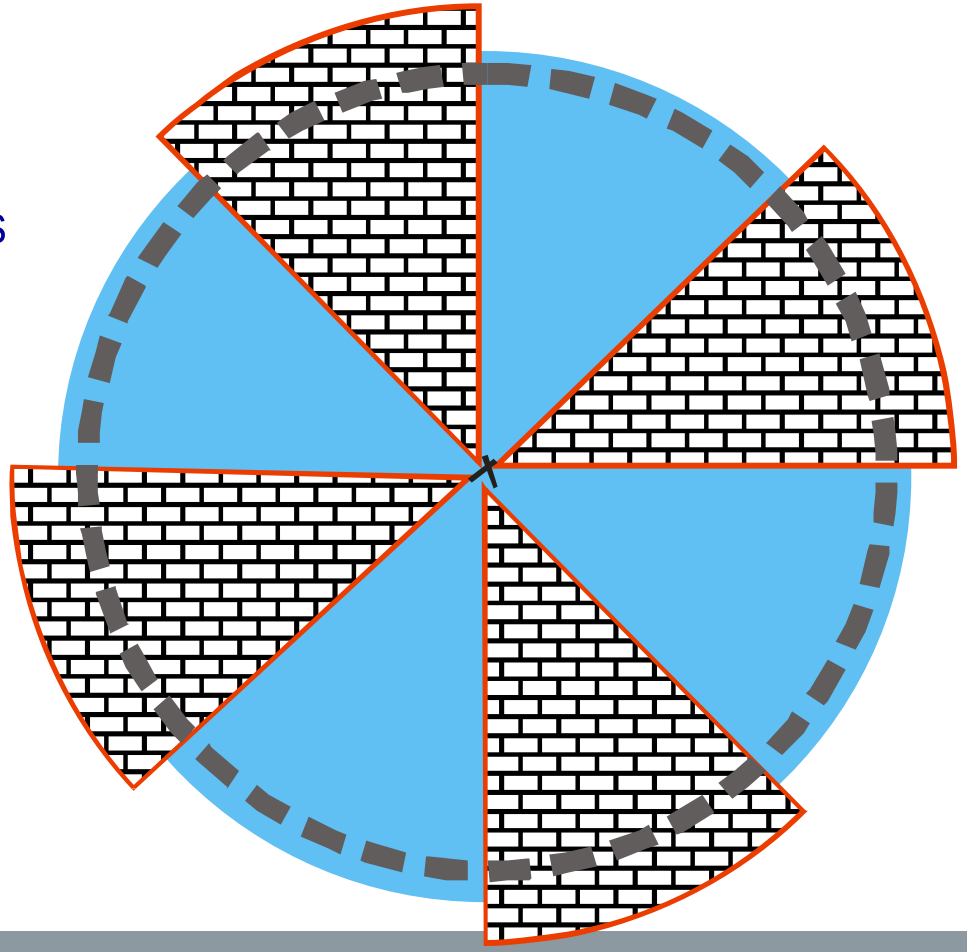
Arrivals

Departures



Good design practice

Arrivals Departures



ATC System Integration

- Changes to ATC system interfaces and displays to ensure controllers have the necessary information on aircraft capabilities and the appropriate displays to support the new routings. Such system changes could include modifications to:
  - Air Traffic Flight Data Processor (FDP)
  - Air Traffic Radar Data Processor (RDP)
  - ATC situation display
  - ATC support tools

Awareness and Training Material

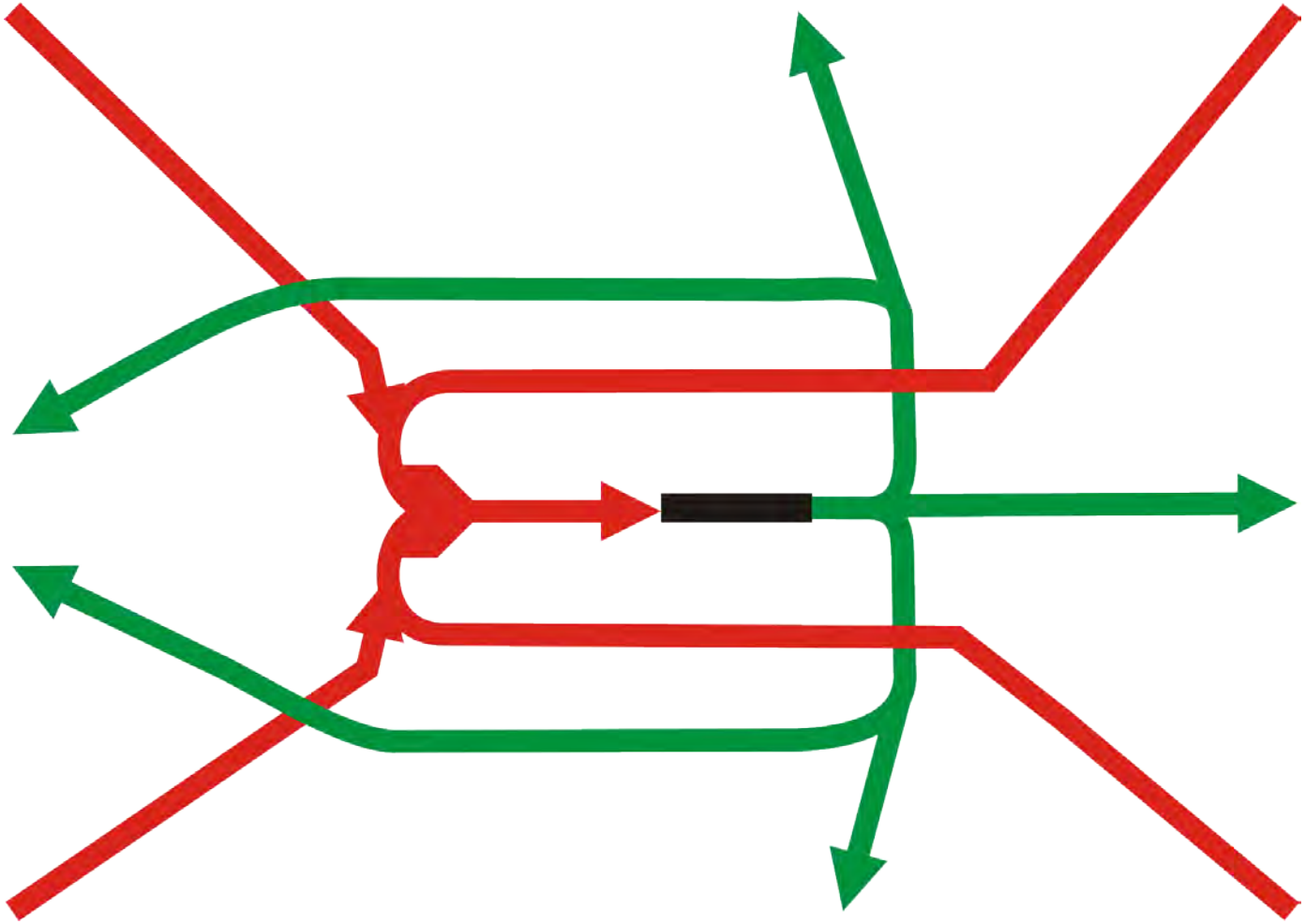
- The introduction of PBN can involve considerable investment in terms of training, education and awareness material for both flight crew and controllers.
  - Printed training packages
  - Computer based training
  - NOTAMS
  - ICAO provides additional training material and seminars.

Implementation

- Have the Safety and Performance Criteria been satisfied;
- Have the required changes been made to the ATM system;
- Have the required changes been made to the ground navigation systems;
- Do the assumptions and conditions upon which the Airspace Concept has been developed still pertain. (are traffic flows as forecast, is the fleet suitably equipped and approved etc);
- Are the critical enablers all in place.;
- Have the pilots and controllers received appropriate training.

Post Implementation Review

- **Keep LOG**
  - **Assess if objectives are met**
  - **Measure!**
  - **System safety assessment – collect evidence**



Implementation Phase Considerations

- Implementation Date decision
- PRE IMPLEMENTATION REVIEW
  - ATS LOAs and other considerations
  - TRAINING
  - AIP / AIRAC

PBN Training

Programme

- BASIC
- RECURRENT
- ADVANCED

Topics

- ENROUTE
  - OCEANIC
  - CONTINENTAL
- TERMINAL
- APPROACH

PBN - ATC Training

ATS procedures for airspace utilizing RNAV and RNP applications.

Include procedures to enable the use of the parallel offset on-board functionality or to enable the transition between airspaces having different performance and functionality requirements, as follows:

a) determining the specific points where the traffic will be directed as it transits from airspace requiring a navigation specification with less stringent performance and functional requirements to an airspace requiring a navigation specification having more stringent performance and functional requirements; and

b) coordinating efforts with relevant parties in order to obtain a regional agreement detailing the required responsibilities.

ATCOs should take appropriate action to provide increased separation and to coordinate with other ATC units as appropriate, when informed that the flight is unable to maintain the prescribed level of navigation performance.

CDO Training

- a) speed restrictions
- b) level constraints or crossing restrictions
- c) the level of automation to be used
- d) the possible effect of wind, atmospheric pressure, altimeter setting and expected icing conditions
- e) the effect of the transition level
- f) ATC phraseology.

CDO Training and Awareness Material

a) CDO benefits and their local importance;

b) training requirements for the selected (open or closed) CDO facilitation method;

c) a simple pamphlet describing the aims and requirements for CDO;

d) the individual roles and responsibilities relevant to the conduct of individual CDO flights; and

e) method for providing ongoing feedback on progress to all participants.

PBN En-route - ATC Training

RNAV 5:

a) How area navigation systems work :

i) include functional capabilities and limitations of this navigation specification;
ii) accuracy, integrity, availability and continuity; and
iii) GPS receiver, RAIM, FDE, and integrity alerts;

b) Flight plan requirements;

c) ATC procedures:

i) ATC contingency procedures;
ii) separation minima;
iii) mixed equipage environment (impact of manual VOR tuning);
iv) transition between different operating environments; and
v) phraseology.

PBN - ATC Training

RNAV 1 and RNAV 2

a) How area navigation systems work (in the context of this navigation specification):
- i) include functional capabilities and limitations of this navigation specification;
- ii) accuracy, integrity, availability and continuity;
- iii) GPS receiver, RAIM, FDE, and integrity alerts; and
- iv) waypoint fly-by versus fly-over concept (and differences in turn performance);

b) Flight plan requirements; and

c) ATC procedures:
- i) ATC contingency procedures;
- ii) separation minima;
- iii) mixed equipage environment (impact of manual VOR tuning);
- iv) transition between different operating environments; and
- v) phraseology.

RNP 4- ATC Training

a) How area navigation systems work:
- i) functional capabilities and limitations of this navigation specification;
- ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
- iii) GNSS receiver, RAIM, FDE, fault detection and integrity alerts; and
- iv) waypoint fly-by versus fly-over concept (and different turn performance);

b) Flight plan requirements;

c) ATC procedures:

- i) ATC contingency procedures;
- ii) separation minima;
- iii) mixed equipage environment (impact of manual VOR tuning);
- iv) transition between different operating environments; and
- v) phraseology.

Training specific: for application of 30/30 separation minima:

a) CPDLC communications;

b) ADS-C system and simulation training; and

c) effect of periodic reporting delay/failure on longitudinal separation.

RNP 2 - ATC Training

a) How area navigation systems work:
i) functional capabilities and limitations of this navigation specification;
ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
iii) GNSS receiver, RAIM, FDE, fault detection and integrity alerts; and
iv) waypoint fly-by versus fly-over concept (and different turn performance);

b) Flight plan requirements;

c) ATC procedures:

i) ATC contingency procedures;
ii) separation minima;
iii) mixed equipage environment (impact of manual VOR tuning);
iv) transition between different operating environments; and
v) phraseology.

***Training specific* :**

a) RNP 2 ATS route control requirements (in either ATS surveillance or procedural control environments)
i) descend/climb clearances; and
ii) route reporting points;

b) RNP 2 related phraseology; and

c) impact of requesting an in-flight change to route.

RNP 1 - ATC Training

a) How area navigation systems work:

i) functional capabilities and limitations of this navigation specification;
ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
iii) GNSS receiver, RAIM, FDE, fault detection and integrity alerts; and
iv) waypoint fly-by versus fly-over concept (and different turn performance);

b) Flight plan requirements;

c) ATC procedures:

i) ATC contingency procedures;
ii) separation minima;
iii) mixed equipage environment (impact of manual VOR tuning);
iv) transition between different operating environments; and
v) phraseology.

***Training specific* :**

a) RNP 1 STARs, SIDs, related control procedures:

i) radar vectoring techniques (where appropriate);
ii) open and closed STARs;
iii) altitude constraints; and
iv) descend/climb clearances;

b) RNP approach and related procedures;

c) RNP 1 related phraseology; and

d) impact of requesting a change to routing during a procedure

ADVANCED RNP (A-RNP) - ATC Training

a) How area navigation systems work:
- i) functional capabilities and limitations of this navigation specification;
- ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
- iii) Availability of ATS and infrastructure;
- iv) GNSS receiver, RAIM, FDE, and integrity alerts; and
- v) Leg transitions, relative turn performance of waypoint fly-by versus fly-over concept;

b) Flight plan requirements including the applicability of A-RNP to RNAV 1, RNAV 2, RNAV 5, RNP APCH, RNP 1, and RNP 2 navigation applications;

c) ATC procedures:

- i) ATC contingency procedures;
- ii) separation minima;
- iii) mixed equipage environment (impact of manual VOR tuning);
- iv) transition between different operating environments; and
- v) phraseology
- vi) ATC intervention considerations.

Training specific :

a) Related control procedures:
- i) Vectoring techniques (where appropriate);
  - 1) RF leg limitations including ground speed constraints;

b) RNP approach and related procedures;
- i) Approach minima;
- ii) Potential negative impact of issuing an amended clearance for a procedure when the aircraft is already established on the procedure due to possible difficulty in complying with revised procedure requirements. Sufficient time needs to be allowed for the crew to accomplish navigation systems reprogramming requirements, e.g. a change to the en-route or runway transition;

c) RNP en route:
- i) FRT as a computed turn by the aircraft versus a unique en-route path segment;

d) Parallel offsets. RNP systems termination of offsets and return to original flight plan; and

e) Lateral performance associated with route or procedure.

RNP APCH - ATC Training

RNP APCH - Controller training:

a) How area navigation systems work:

i) functional capabilities and limitations of this navigation specification;
ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
iii) GNSS receiver, RAIM, FDE, and integrity alerts; and
iv) waypoint fly-by versus fly-over concept (and different turn performances);

b) Flight plan requirements;

c) ATC procedures:

i) ATC contingency procedures;
ii) separation minima;
iii) mixed equipage environment (impact of manual VOR tuning);
iv) transition between different operating environments; and
v) phraseology.

***Training specific* :**

a) Related control procedures:

i) Radar vectoring techniques (where appropriate);

b) RNP approach and related procedures;

i) including T and Y approaches; and
ii) approach minima;

c) impact of requesting a change to routing during a procedure.

RNP APCH - ATC Training

a) How area navigation systems work:
- i) functional capabilities and limitations of this navigation specification;
- ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
- iii) GNSS receiver, RAIM, FDE, and integrity alerts; and
- iv) waypoint fly-by versus fly-over concept (and different turn performances);

b) Flight plan requirements;

c) ATC procedures:

- i) ATC contingency procedures;
- ii) separation minima;
- iii) mixed equipage environment (impact of manual VOR tuning);
- iv) transition between different operating environments; and
- v) phraseology.

Training specific :

a) Related control procedures:
- i) Radar vectoring techniques (where appropriate);

b) RNP approach and related procedures;
- i) including T and Y approaches; and
- ii) approach minima;

c) impact of requesting a change to routing during a procedure.

RNP AR APCH - ATC Training

a) How area navigation systems work:
- i) functional capabilities and limitations of this navigation specification;
- ii) accuracy, integrity, availability and continuity including on-board performance monitoring and alerting;
- iii) GNSS receiver, RAIM, FDE, and integrity alerts;
- iv) waypoint fly-by versus fly-over concept (and different turn performances); and
- v) RF leg applications in RNP AR APCH procedure design;

b) Flight plan requirements;

c) ATC procedures:

- i) ATC contingency procedures;
- ii) separation minima;
- iii) mixed equipage environment (impact of manual VOR tuning);
- iv) transition between different operating environments; and
- v) phraseology.

Training specific :

a) Related control procedures:
- i) Radar vectoring techniques (where appropriate);
  - — RF leg limitations;
  - — airspeed constraints;

b) RNP AR APCH procedures;
- i) approach minima; and
- ii) additional requests for altimeter settings;

c) impact of requesting a change to routing during a procedure.