Air Traffic Controller Flyer - WHAT's NEW WITH TO PBN

NEED TO KNOW

1. TOWER CONTROLLERS

SID/DEP

a) RTF: Issues SIDs no change to RTF

b) RTF: *Unable RNP/RNAV* – meaning/possible reasons > action

ARR

a) RTF: no change > give landing clearance

b) RVR: can be required for some RNP approaches (chart)

c) MA: no change – could be due *unable RNP* (above) – meaning/possible reasons > action

2. APPROACH CONTROLLERS (SIDs/STARs/RV/Clear aircraft for APCH)

a) SEPARATION/spacing MINIMA – e.g. ADS-B only environment and NML:/CONT

b) ATC contingency

   a. RF capability when GNSS fails and RNP not possible.

   b. unable RNP meaning *(possible reasons)*

      i. That it might be single or multiple aircraft affected.

      ii. impact > action + awareness (depends on whether aircraft on SID/STAR/cleared for Approach)

Problem		***Potential contingency solution***	
Possible Cause	**Sample RTF report**	**IMPACT**	**ACTION**
Airborne receiver failure or	Single A/C CLEARED FOR APP says 'Unable RNP	RNP APCH procedure not usable by single aircraft	Clear this aircraft for alternative procedure e.g. ILS
Total GNSS signal loss (over an area) – duration unknown.	Several aircraft aligned for APP say 'Unable RNP'	RNP APCH procedure not usable by all aircraft	Clear all aircraft for alternative procedure e.g. ILS
Aircraft has FMS failure	One or more A/C ON PBN STAR says 'UNABLE RNAV' *(Radar Environment)*	Flight(s) continue(s) if conventional NAV available throughout	Controller to issue Radar Vectors (unless flight crew states that conventional procedures possible). Potentially, traffic flow management regulation
Total GNSS signal loss (over an area)		Flight(s) turn(s) back if above n/a	
Aircraft with single FMS has FMS failure	A/C ON PBN STAR says 'UNABLE RNP'	Aircraft cannot fly STAR	Controller Radar Vectors

Total GNSS signal loss (over an area)	*(Radar Environment)*	Some aircraft cannot fly STAR others can continue normally.	Controller Radar Vectors who cannot fly STAR; no action for those aircraft able to fly RNAV STAR
Aircraft has FMS failure	One or more A/C ON PBN STAR says 'UNABLE RNAV' *(Radar Environment)*	Flight(s) continue(s) if conventional NAV available throughout	Controller to issue Radar Vectors (unless flight crew states that conventional procedures possible). Potentially, traffic flow management regulation
Total GNSS signal loss (over an area)		Flight(s) turn(s) back if above n/a	
Aircraft with single FMS has FMS failure	A/C ON PBN STAR says 'UNABLE RNP' *(ADS-B only Environment)*	Aircraft cannot fly STAR	Vectoring provided using ADS-B
Total GNSS signal loss (over an area)		Some aircraft cannot fly STAR others can continue normally.	Procedural Control (local implementation) and potentially, traffic flow management regulation
Aircraft has FMS failure	One or more A/C ON PBN STAR says 'UNABLE RNAV' *(ADS-B only Environment)*	Flight(s) continue(s) if conventional NAV available throughout	Vectoring provided using ADS-B
Total GNSS signal loss (over an area)		Flight(s) turn(s) back if above n/a	Procedural Control (local implementation) and potentially, traffic flow management regulation
Aircraft has FMS failure	On or more aircraft on Free Route says 'Unable RNAV' or 'Unable RNP'	Single aircraft cannot continue cleared flight path.	Controller to issue Radar Vectors and continue to maintain separation assurance.
Total GNSS signal loss (over an area)		No aircraft can continue on cleared trajectory	Conventional navigation if available or Radar Vectoring and Traffic Flow Management regulation
<u>Note</u>: there may be several causes for UNABLE RNP above those included in this table. E.g. jamming or spoofing of the GNSS signal(s); signal interference (e.g. locally, unintentional), space weather.			

c. Credible RNP corruption meaning

i. that it might be single or multiple aircraft affected.

Problem	**Potential contingency solution**	
	IMPACT	**ACTION**
Credible RNP corruption (RNAV/RNP navigation avionics failure)	Single aircraft inadvertently deviates from planned trajectory (this case is not considered credible for multiple aircraft)	Deviation is detected by ATC and reported to the aircraft, after which an UNABLE RNP situation ensues.

Credible RNAV/RNP corruption (data integrity failures in either procedure designs, AIS data or nav databases)	Single or multiple aircraft inadvertently deviate from planned trajectory. Deviations not likely to be simultaneous.	Deviation is detected by ATC and reported to the aircraft, after which an UNABLE RNP situation ensues. Possible NOTAM and/or ATIS warnings issued for awareness of other aircraft.
Credible RNAV/RNP corruption (GNSS integrity failure/GNSS signals spoofed)	Multiple aircraft inadvertently deviate from planned trajectory. Several aircraft deviate simultaneously.	Deviation is detected by ATC and reported to the aircraft, after which an UNABLE RNP situation ensues. Possible NOTAM and/or ATIS messages issued for awareness of other aircraft.

c) Mixed equipage environment/mixed mode (RV+PBN).

Mixed mode of operation (SID/STAR RNAV/RNP and conventional) in both radar and non-radar environments should be considered.

d) Path management:

a. Understand the notion of strategic deconfliction in specific (local) airspace concept.
b. Turn Performance
    - Max intercept angle to final approach path (vertical/lateral) 30°
    - Direct To instructions to WPT on STAR or WPT off STAR > then RV.
    - Different between RF and Fly By.
    - Impact of GPS Outage on RF performance
c. Impact of alternative controller instructions (speed/alt/track & RF) on published procedure
d. Terrain clearance responsibility
e. ACAS in parallel runway operations

e) RTF: Unable RNP/RNAV – meaning/possible reasons > action; established on what?

f) Which PBN Approach options are available at my airports (associated RTF).

g) Management of Helicopters in a PBN environment (if locally applied) – difference PINS.

h) Be able to find PBN Information per flight provided by the ATC System.

i) Be able to correctly interpret the change to the aircraft label in the event of a GNSS outage, if functionality provided by ATC System.

3. <u>AREA CONTROLLERS (ATS and FRA) – additions to above list</u>

a) Turn anticipation on fly by turns.

b) Impact of GNSS Outage on free routes – function of aircraft ability to fly RNAV 1 without GPS.

c) Be able to find PBN Information per flight provided by the ATC System.

d) Be able to correctly interpret the change to the aircraft label in the event of a GNSS outage, if functionality provided by ATC System.
e) Causes of total GNSS signal loss over an area
f) ATCOs should be aware of the possible causes of GNSS signal losses (GNSS system failure and/or unfavourable satellite geometry, RFI, space weather) and of the differences in operative impact between them outages, they cause.

NICE TO KNOW ***(AC Handbook for PBN Implementation)***

a) Track confidence/level of accuracy of PBN? (link to positioning source used)
b) Chart titling change
c) ACAS in parallel runway operation;
d) Additional Approach Options introduced by PBN
e) AC capability, NAV Infrastructure, ATCO requirements
f) Time limits on GPS outage - impact per flight phase
g) PBN Codes used in the ATC FPL and ATM System Integration
h) mixed mode of operations
i) required elements for different RNAV/RNP specs
j) Operations capability (chicken and the Egg)
k) interaction between different nav specs (what you get including Path Terminators)
l) PBN Box of IAP Chart
m) Common terminology 'phraseology' definitions
n) PBN benefits: environmental mitigation – public consultation needed in support of environmental mitigation (ATCO awareness); CCO and CDO (impact - fuel/emissions) > global/common approach to PBN implementation; environmental mitigation; Noise respite routes;
o) FMS knowledge (see PBN Manual Vol I)