



**ICAO APAC
PBN Seminar
ATCO Training: a milestone in PBN
implementation**

Bangkok, THAILAND, 8 - 10 June 2015

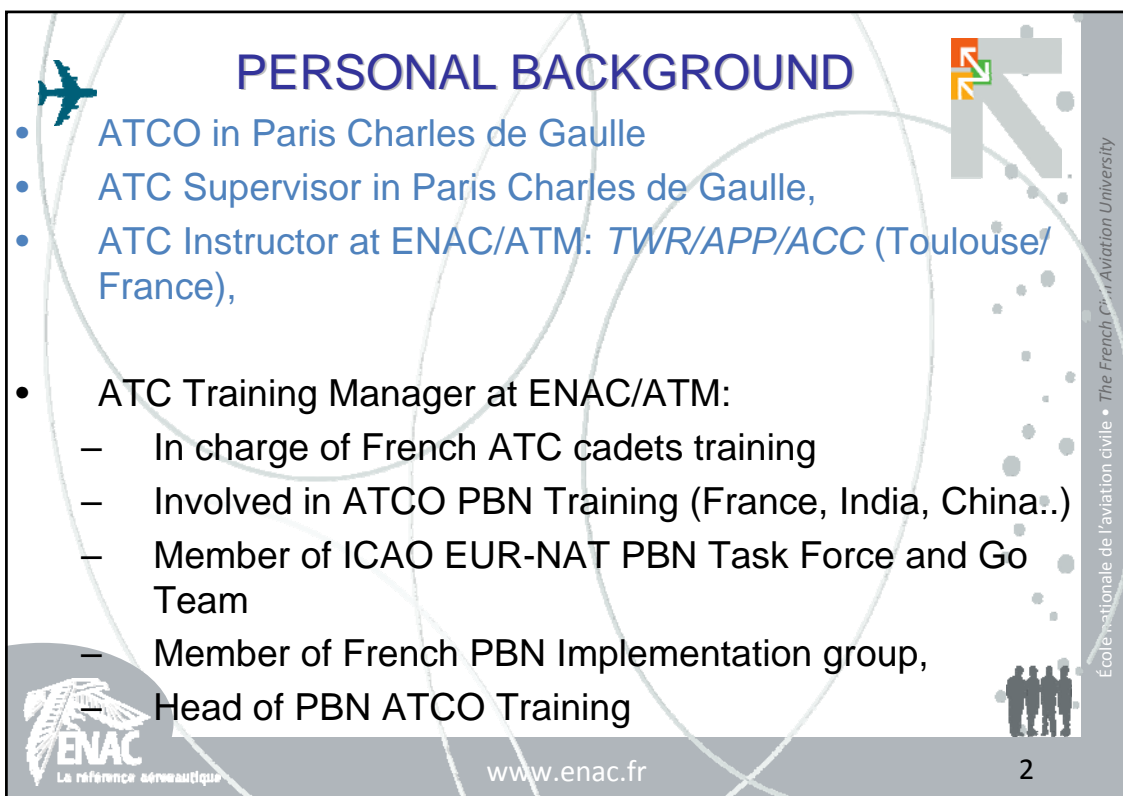
**Bertrand FOUCHER
ENAC ATM**

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PERSONAL BACKGROUND

- ATCO in Paris Charles de Gaulle
- ATC Supervisor in Paris Charles de Gaulle,
- ATC Instructor at ENAC/ATM: *TWR/APP/ACC* (Toulouse/France),
- ATC Training Manager at ENAC/ATM:
 - In charge of French ATC cadets training
 - Involved in ATCO PBN Training (France, India, China..)
 - Member of ICAO EUR-NAT PBN Task Force and Go Team
 - Member of French PBN Implementation group,
 - Head of PBN ATCO Training

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AGENDA

1. PBN Introduction: WHY TRAINING ?
2. PBN in a few words...
3. What we have learned: French example
4. An adapted Training,
5. Questions ?



AGENDA

1. **PBN Introduction: WHY TRAINING ?**
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QUESTION: Taking into consideration that ATCos are reluctant to changes.....



Could we succeed in adapting a PBN Training for ATCos?

If Yes, what milestones would we have to implement ?

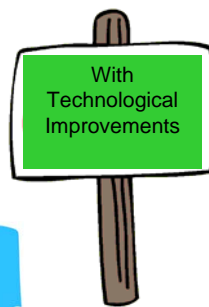
New Challenge!!!



Two different futures for aviation



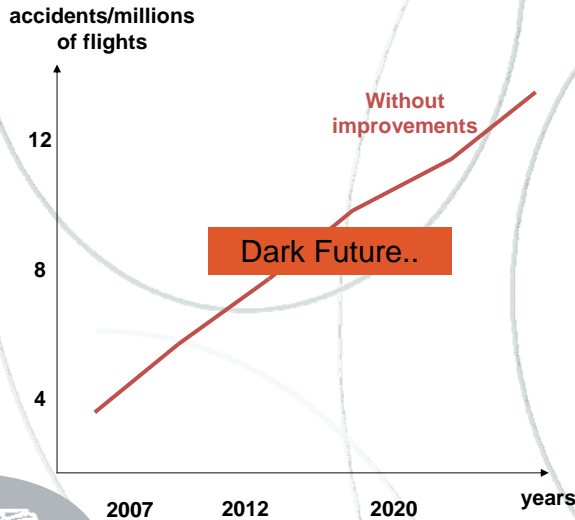
Make your choice: Red or Green???





Two different futures for aviation

Graphical Timeline



How did we succeed in enhancing the System?



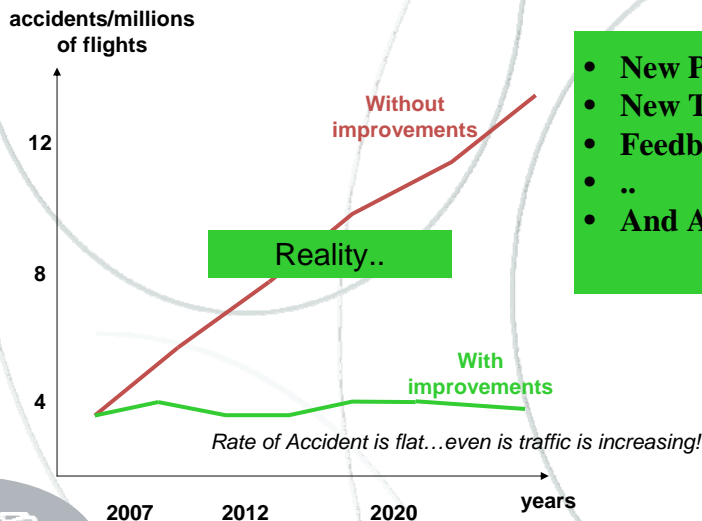
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Two different futures for aviation

Graphical Timeline



- New Procedures,
- New Technologies,
- Feedback,
- ..
- And ATC/Pilots Training,



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A Reference Document...

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Appendix 5: Technology Roadmaps

- a) Communication:
 - 1) Air-ground data link communication.
 - 2) Ground-ground communication.
 - 3) Air-ground voice communication.
- b) Surveillance:
 - 1) Surface surveillance.
 - 2) Ground-based surveillance.
 - 3) Air-to-air surveillance.
- c) Navigation:
 - 1) Dedicated technology.
 - 2) Performance-based navigation.
- d) Information Management.
 - 1) SWIM
 - 2) Other
- e) Avionics:
 - 1) Communications.
 - 2) Surveillance.
 - 3) Navigation.
 - 4) Aircraft safety nets.
 - 5) Onboard systems.

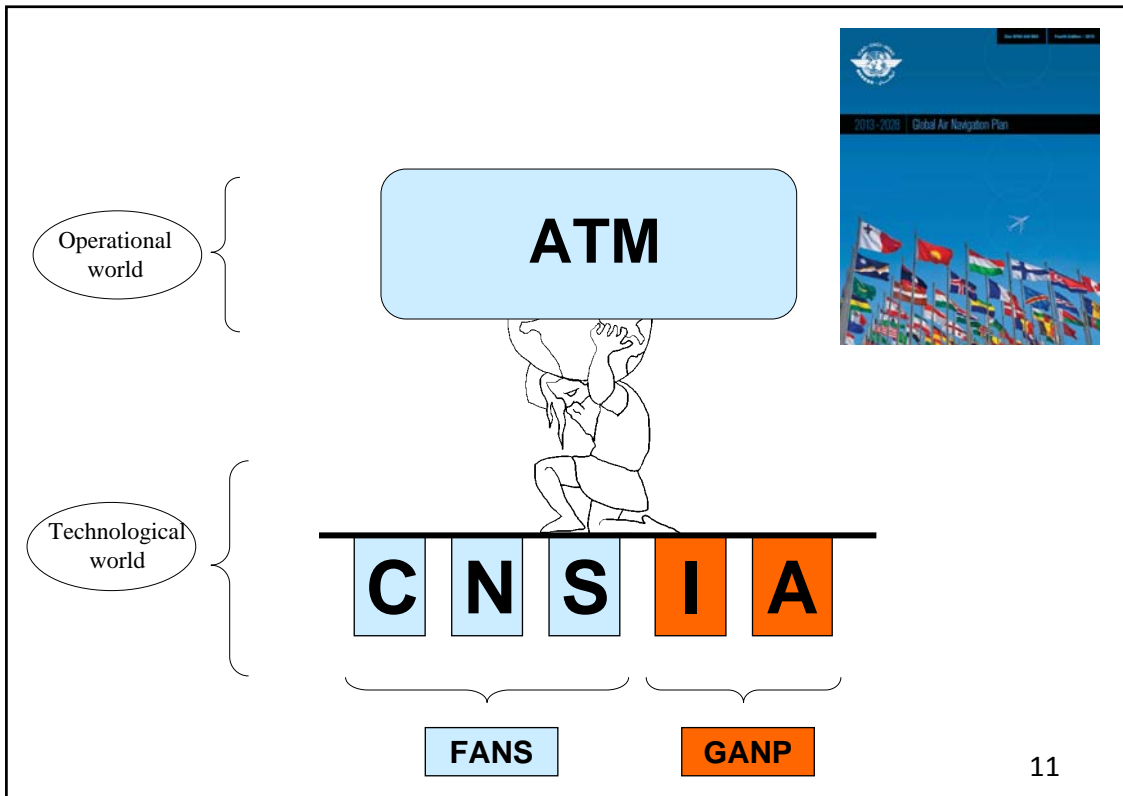
When the technology is to be implemented

Which module(s) supports the technology..

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Our Priorities

PBN: Our Highest Priority

Prior to the development of the ASBU Modules, ICAO focused its efforts on the implementation of Performance-based Navigation (PBN), Continuous Descent (C)



Next Steps

PBN is a complex and fundamental change affecting multiple disciplines and specializations within the aviation workforce. It is also a Standards-intensive area requiring both the development of new Standards and the fine-tuning of existing provisions.

Future implementation of PBN in terminal airspace is seen as a key enabler for the advanced terminal operations envisaged by a mature ATM modernization programme.

In light of these ongoing areas of priority, the following have been highlighted as the key outstanding areas of concern for States and industry to help ensure effective ongoing implementation of PBN:

- The need for guidance material, workshops and symposia.
- Computer-based learning packages.
- Formal training courses to ensure that PBN requirements and Standards are fully understood and properly implemented.
- Active, coordinated support for continuing Standards development and amendment
- Support in order to ensure harmonized and integrated implementation of related technologies and support tools to optimize performance capability objectives.

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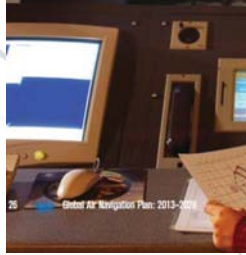
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PBN Training as a key to PBN Implementation



AGENDA



1. PBN Introduction: WHY TRAINING ?
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5. Questions ?





By the way, How to explain PBN?



- Guidance material,
- Formal Training,
- PBN Tools,
- CBT,
- Continuous Training,

How to calculate the aircraft position?



Knowing my position I can navigate



What is GNSS?



PBN Concept

Operational Aspects



By the way, How to explain PBN?

How to calculate the aircraft position?



- NDB,
- INS/IRS/IRU
- VOR,
- DME,
- GNSS,

- Introduce the notion of SENSORS
 - DME/DME,
 - VOR/DME,
 - GNSS
 - Inertial System,





By the way, How to explain PBN?

Knowing my position I can navigate



Conventional Way

RNAV Way

- Waypoint:
 - Fly by vs Fly over
- Path Terminator:
 - CF,
 - CA,
 - ...



By the way, How to explain PBN?

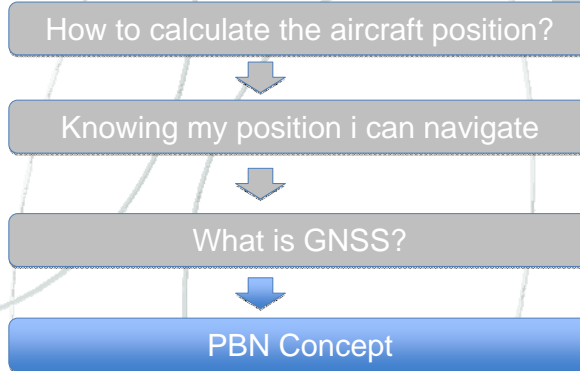
What is GNSS?



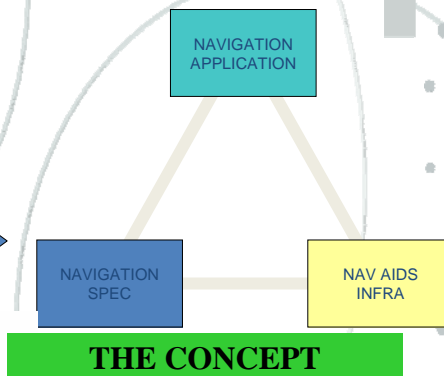
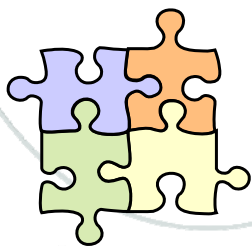
- On board receiver,
- Positioning System,
- Augmentation System:
 - ABAS,
 - SBAS,
 - GBAS,



By the way, How to explain PBN?



How to explain PBN Concept?





Components of PBN Concept

To be explained

NAVIGATION APPLICATION

NAVIGATION SPECIFICATION

NAVAID INFRASTRUCTURE



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Example of RNAV1 implementation

By examples

NAVIGATION APPLICATION

RNAV 1 Terminal Area

NAVIGATION SPECIFICATION

NAVAID INFRASTRUCTURE

RADAR COVERAGE ?

RNAV 1. SENSORS:

STATE A:

• DME/DME/IRU

• DME/DME

STATE B: GNSS

STATE A:

• DME (CAA decision not to allow GNSS)

STATE B:

• GNSS

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By the way, How to explain PBN?

How to calculate the aircraft position?



Knowing my position I can navigate



What is GNSS?



PBN Concept

Operational Aspects



OK for the Theory but in Operational environment?



ATC

PILOT





By the way, How to explain PBN?

- RNAV Phraseology?
- Speed constraints?
- Altitude constraints?
- Radar vectoring in Mixed environment?
- Emergency procedures?
- ...

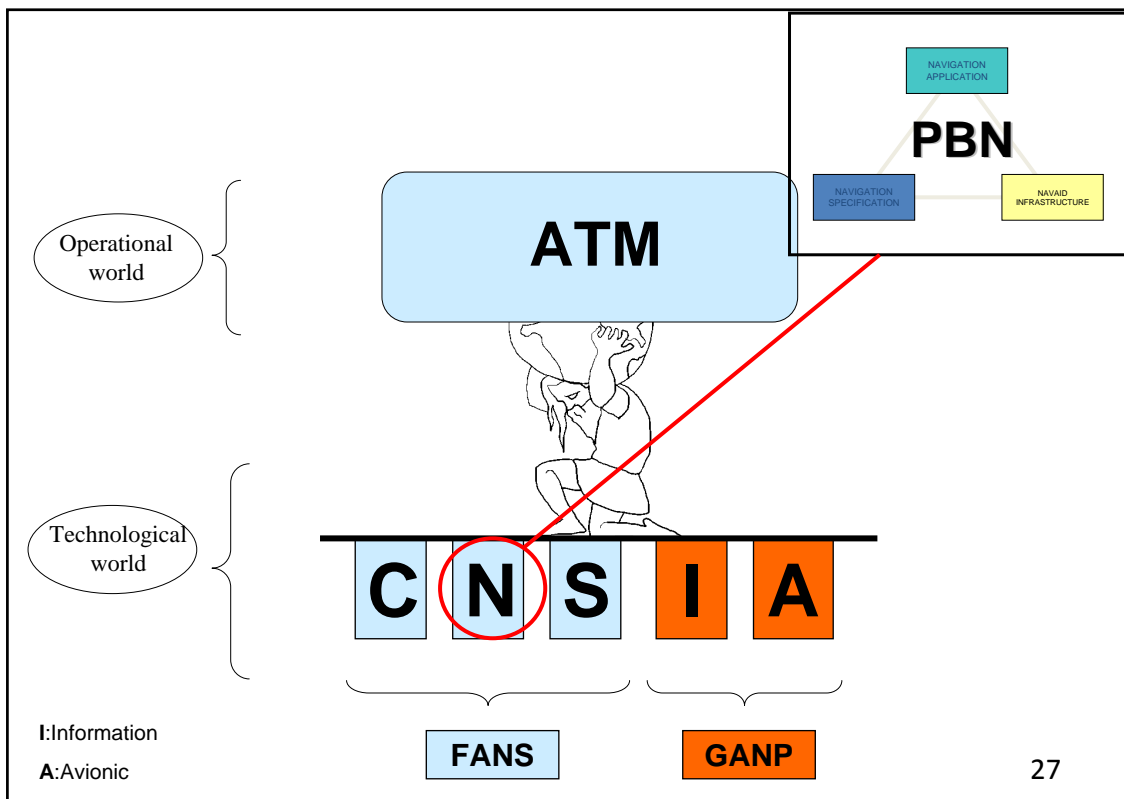
Operational Aspects



How to explain PBN Concept?

1. As an ATM component,
2. In which ATCOs are involved,

In Order for ATCOs to address



How to explain PBN Concept?

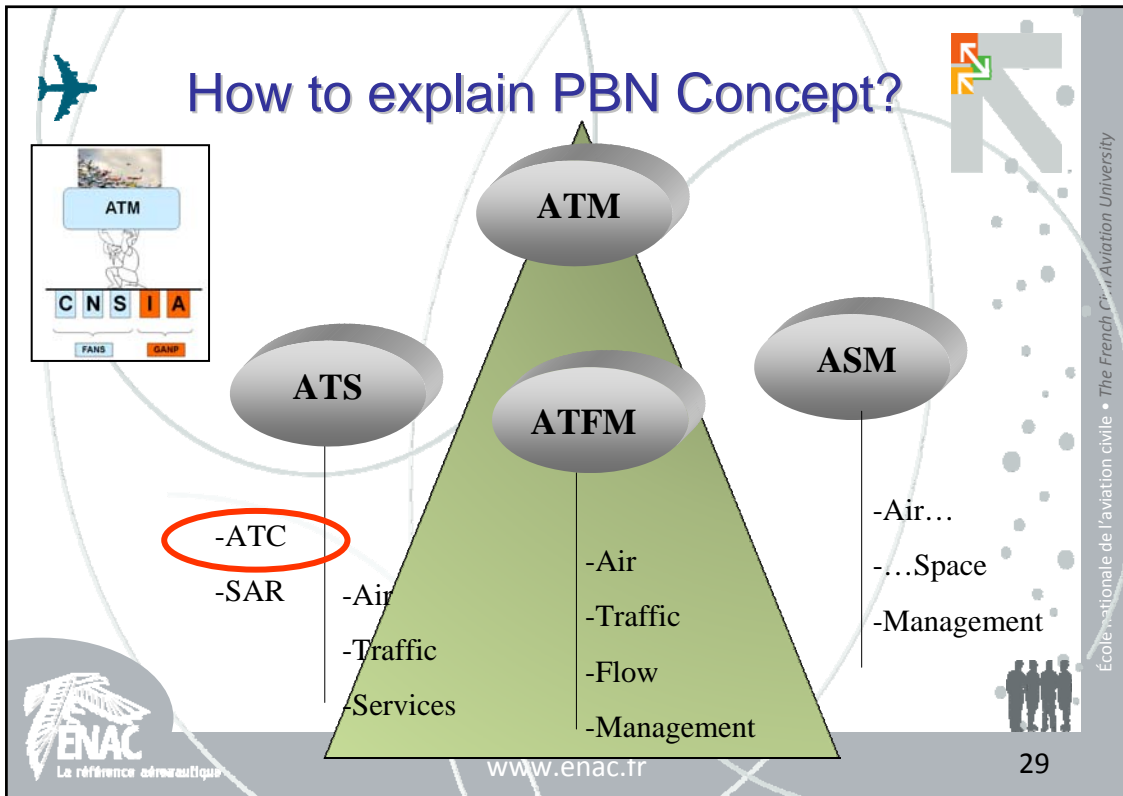
1. As an ATM component,
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PART III

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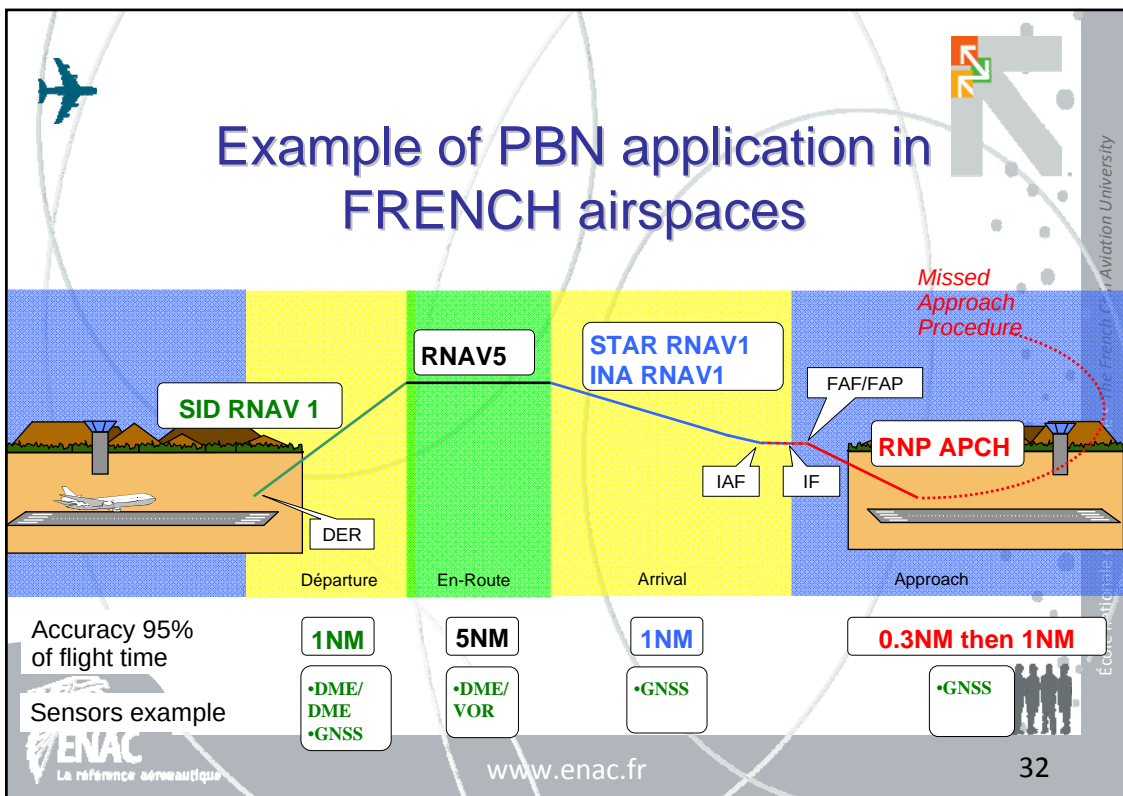
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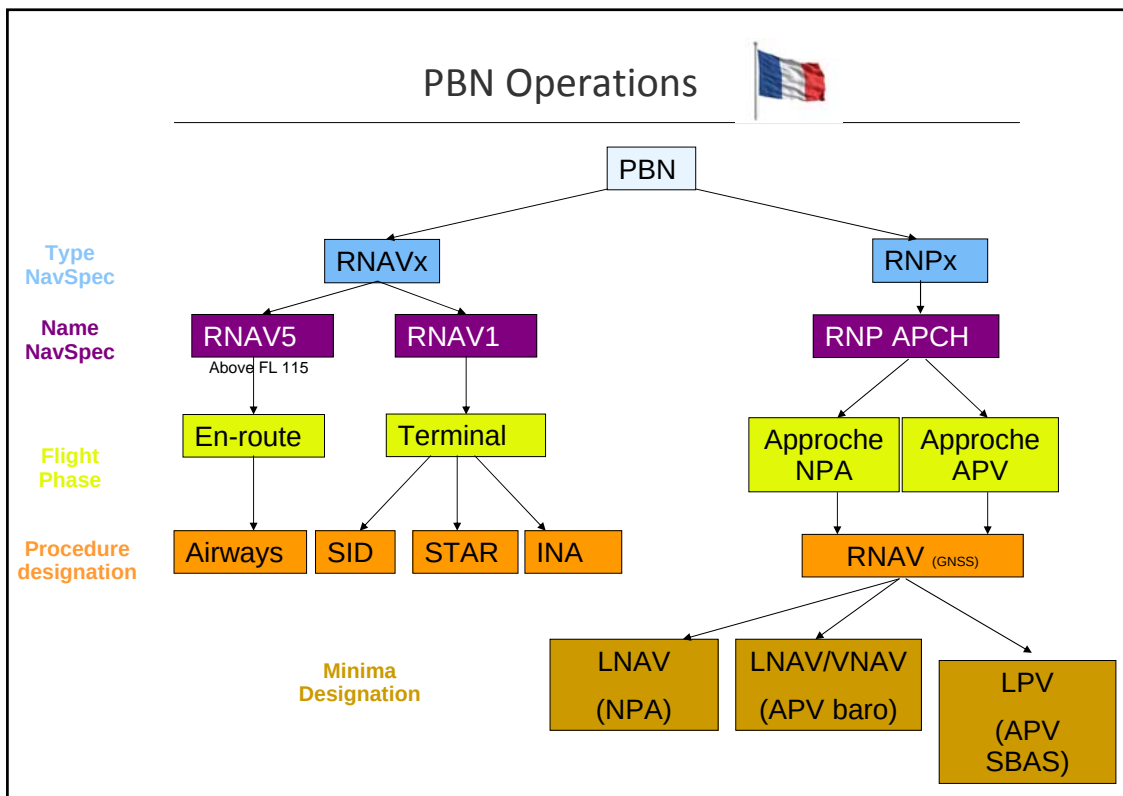
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Let's have a Look...



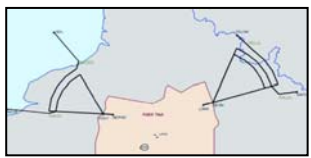
Example of PBN application in FRENCH airspaces





RNAV 1 In Terminal Area

- **SID/STARs**
 - Implementation since 2008 in about fifteen TMA...
 - **Better Flight flexibility**
- **Continuous Descent Operations**
 - CDO on 12 major airports
 - **Benefit/ cost reduction**
- **New Single European Sky Concepts**
 - Point Merge System in extended TMA (Paris ACC): Operational since december 2013
 - PMS in TMA under experimentations
 - **Improvements on capacity, safety...**





Get feedback from surveys



Feedback from French newly trained ATCO

Young ATCOs..



Too much

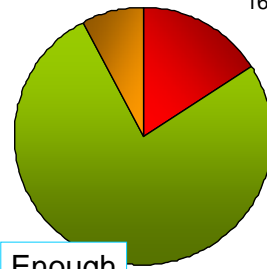
8%

Not enough

16%

Enough

76%



Get feedback



Feedback from French Training Departments/ Managers



Women and men with experience in Civil Aviation whose training finished before PBN concept...

Too much

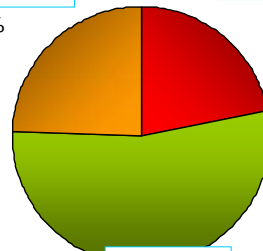
24%

Not enough

22%

Enough

54%





Get feedback



Example of questions from French newly trained ATCO

- Why do we develop RNAV trajectories ?
- How many RNP APCH approaches are developed in our country each year ?
- Why don't we develop GBAS instead of SBAS ?
- Why don't we encourage GNSS use only ?
- **What is the ultimate point for vectoring towards RNP APCH final ?**
- **Can we perform Low Visibility Procedure with RNAV ?**
- **Do we say « RNAV approach » or « GNSS approach » ?**
- **Why do we keep conventional procedures in case of RNAV overlay ?.....**



OPERATIONAL QUESTIONS...

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THE SOLUTION:





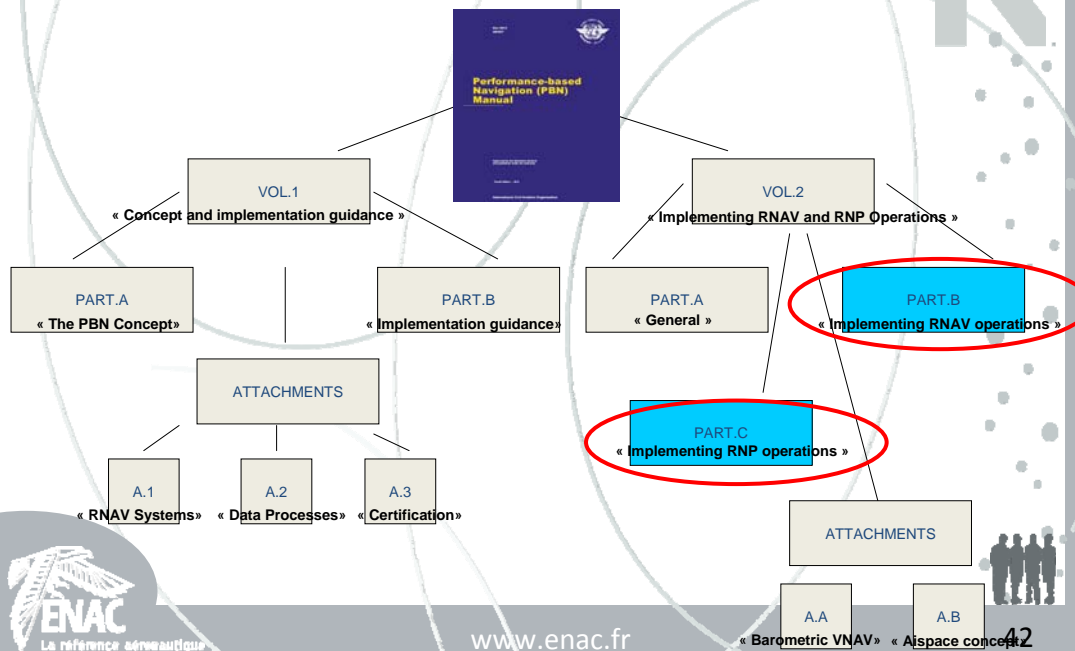
AGENDA



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The reference Documentation:





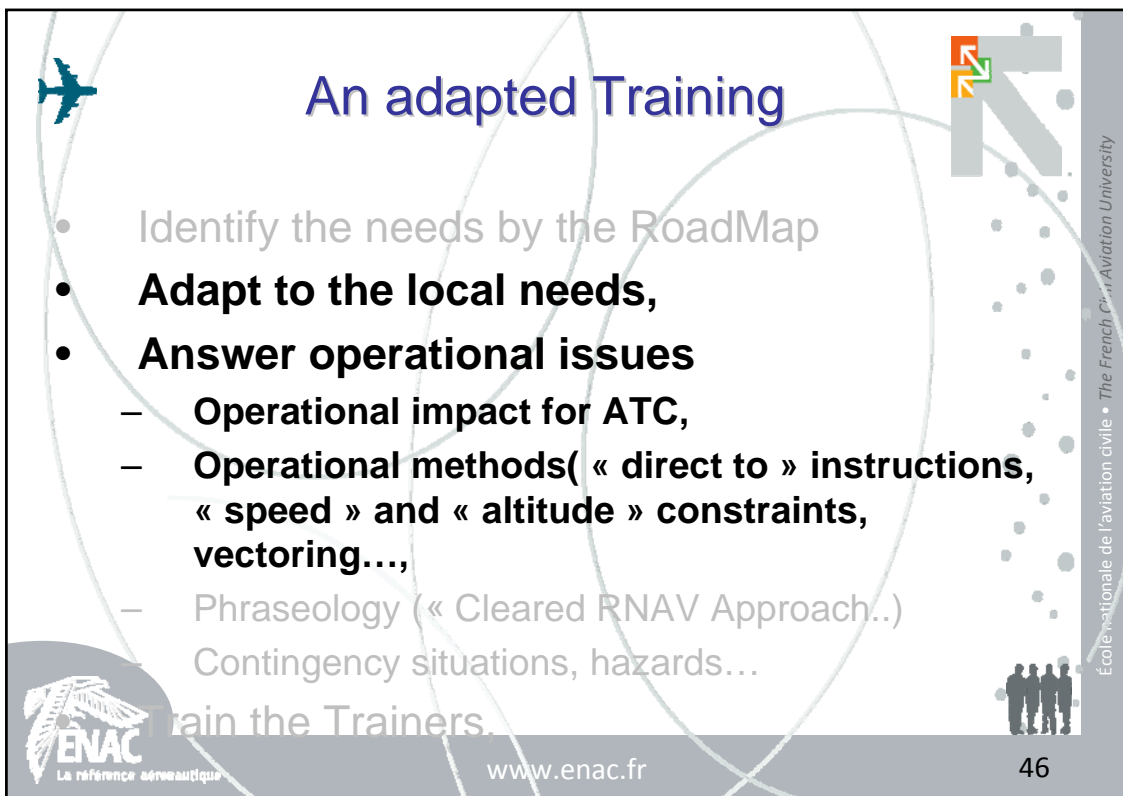
CHINA CIVIL AVIATION
Performance Based Navigation
Implementation Roadmap

中国民用航空局
Civil Aviation Administration of China

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An adapted Training

- Identify the needs by the RoadMap
- **Adapt to the local needs,**
- **Answer operational issues**
 - **Operational impact for ATC,**
 - **Operational methods(« direct to » instructions, « speed » and « altitude » constraints, vectoring...,**
 - **Phraseology (« Cleared RNAV Approach..) Contingency situations, hazards...**

Train the Trainers.

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An adapted Training

- Identify the needs,
- Adapt to the local needs,
- Answer operational issues
 - Operational impact for ATC,
 - Operational methods(« direct to » instructions, « speed » and « altitude » constraints, vectoring...)
 - **Phraseology**
 - Contingency situations, hazards...

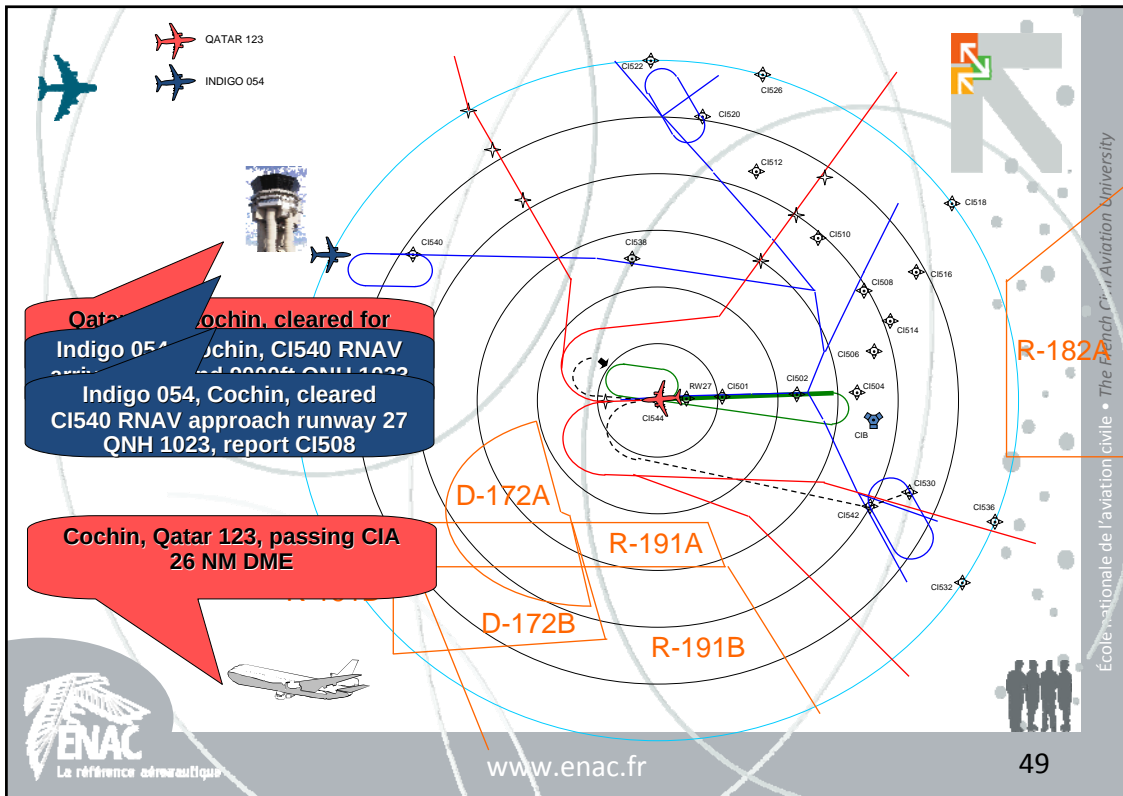
Train the Trainers,



Example of phraseology training Non Radar environment

RNP1 SID + RNP APCH APPROACH





Present Phraseology

And in France?

ASIE DU NORD
ASIE DU SUD
OCEAN PACIFIQUE
AMERIQUE DU NORD
AFRIQUE DU NORD
AFRIQUE DU SUD
EUROPE
OCEAN INDIEN
OCEAN ATLANTIQUE
AMERIQUE DU SUD
AUSTRALIE
NOUVELLE ZELANDE
PAYS-BAS
ALLEMAGNE
ITALIE
ESPAGNE
PORTUGAL
FRANCE
ROYAUME-UNI
IRLANDE
ISRAEL
JAPON
CORÉE DU SUD
CHINE
TAÏWAN
PHILIPPINES
VIETNAM
THAÏLANDE
MALAISIE
SINGAPOUR
INDONÉSIE



Present Phraseology

**Systematically use « RNAV ».
Related to area navigation as a whole
and not to any Navigation specification**

Navigation specification : technical consideration
Phraseology: communication only

✈ Citron Air 3 2 4 5, requesting R_NAV approach runway 0 8.
🎧 Citron Air 3 2 4 5, cleared R_NAV approach runway 0 8.



Official AIP phraseology since 2013



Present Phraseology

**Radar
Vectoring**

✈ Citron Air 3 2 4 5, requesting R_NAV final approach runway 0 8 right.
🎧 Citron Air 3 2 4 5, depart BALOD heading 0 3 0, vectoring R_NAV final approach runway 0 8 right.
Then
🎧 Citron Air 3 2 4 5, turn right heading 0 6 0, descend 4000 feet Q_N_H 1 0 2 6, intercept R_NAV final runway 0 8 right. report established.
Then
🎧 Citron Air 3 2 4 5, cleared R_NAV final approach runway 0 8 right.

**RNAV
Approach
Impossible**

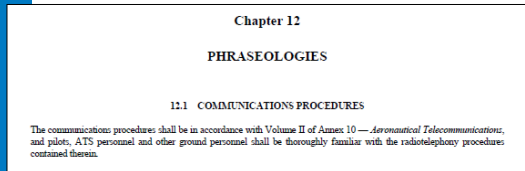
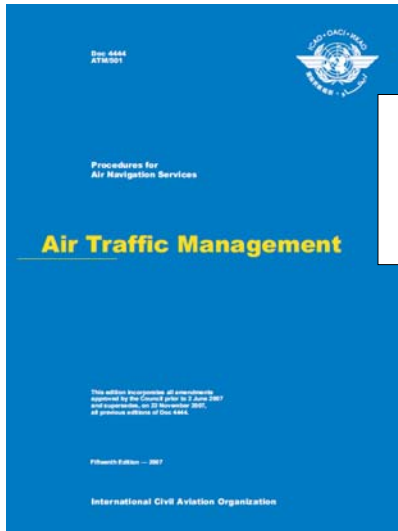
✈ Citron Air 3 2 4 5, unable R_NAV approach runway 0 8 due equipment.



Analysis



PANS ATM DOC.4444: Are there any specific Term for a RNAV (GNSS) Approach???



Participation to ICAO Groups

... In order to harmonize PBN PHRASEOLOGY



ICAO ATM OPS PANEL in progress to amend Doc 4444

**« Cleared for RNAV Approach » ??
« Cleared for RNP Approach » ??**



An adapted Training

- Identify the needs,
- Adapt to the local needs,
- Answer operational issues
 - Operational impact for ATC,
 - Operational methods(« direct to » instructions, « speed » and « altitude » constraints, vectoring...,
 - Phraseology (« Cleared RNAV Approach..)
 - Contingency situations, hazards...
- **Train the Trainers,**



Example of WEB PBN for ATCO

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Train-the-trainers in 8 milestones

→ **ATC Impact**

PBN Ops. Flight Prep. ATC Interface Phraseology Speed use Direct Route Proc.Interruption Feedback

This Training can be adapted for:

- Pilots,
- Engineers,
- Operational staff..

WEB PBN for ATCO
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5. **Questions,**
hesitations, propositions.. ?

Contact: bertrand.foucher@enac.fr

We want more...

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