ICAO EUR PBN Task Force 6

Status of PBN in Germany

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STATUS of airspace concepts in Germany

- ENR
  - Conventional (only 13 ATS routes = 2% of all published ATS Routes)
  - RNAV-5 [B-RNAV]
- SID/STAR/Transitions
  - Conventional
  - Conventional combined with RNAV-5 [B-RNAV] (MRVA)
    both available as RNAV overlay procedures
  - RNAV(GPS) (since 1998) „stand-alone“
  - GPS/FMS Transition to final approach as overlay to radar vectoring pattern (since 1998)
    - Partly designed and used as CDO ("Transition and Profile")
- APCH
  - Conventional Precision Approaches
  - Conventional Non-Precision Approaches
  - RNP APCH [RNAV(GPS)] (since 1998)
    as NPA and as APV baro-VNAV since 2009, vertical guidance on APV baro VNAV also available with EGNOS since December 15th 2011
  - GLS CAT I at Bremen airport

RNAV- and RNP-concepts in Germany - 2011

Phase of flight	Title according ICAO PBN-Manual	OPS-Requirement	Charting (ICAO-conformal)	Concept conformal to ICAO PBN-Manual?	
Approach	RNP APCH	JAA TGL 3 (EASA AMC 20-5) EASA AMC 20-27	RNAV(GPS)	**YES**	
Approach	RNP APCH with APV Baro-VNAV	EASA AMC 20-27	RNAV(GPS)	**YES**	
Approach	RNP APCH with APV-SBAS	EASA AMC 20-28 (planned)	RNAV(GPS)	**YES**	
Departure SID	RNAV-5	JAA TGL 2 (EASA AMC 20-4)	conventional, after MRVA B-RNAV-Approval Mandatory	**YES**	
Departure SID	RNAV-1 (TBD)	JAA TGL 3 (EASA AMC 20-5)	RNAV(GPS)	**NO**	YES (TBD)
Arrival STAR	RNAV-5	JAA TGL 2 (EASA AMC 20-4)	Until MRVA B-RNAV-Approval Mandatory, conventional	**YES**	
Arrival STAR	RNAV-1 (TBD)	JAA TGL 3 (EASA AMC 20-5)	RNAV(GPS)	**NO**	YES (TBD)
Arrival	-	NfL I 274/10 (AIP ENR 1.5-16)	"Transition to final Approach" (RNAV-**Overlay** to Radar Vectoring Pattern)	**NO**	
En-Route	RNAV-5	JAA TGL 2 (EASA AMC 20-4)	RNAV	**YES**	

Problems: RNAV-1 vs. RNAV Arrival Concepts in Germany

- Problem based on „RNAV-history“ in Germany (implementation begun 1998):
  - No „PBN“ concept
  - No sophisticated Material for approvals available
- No RNAV routes with requirement of RNAV-1-equivalent approval
  - "DME/DME only“ RNAV-1 capability of several a/c operating in Germany
  - RNAV-1 approvals do not distinguish between sensor-types used
  - DME infrastructure not established in regard to RNAV applications
  - ➢ Insufficient RNAV DME/DME coverage below certain FLs in most TMAs
- German solution (1998): „GPS/FMS RNAV Transition to Final Approach“ as RNAV-**Overlay Procedure to support Radar Vectoring Patterns**
  - No OPS approvals according FAA/EASA/JAA criteria
  - FMS or GPS [at least TSO C-129 (a)] in conjunction with an actual NAV-DB as minimum requirement
  - In fact RNAV-1 but without a requirement to fulfil this NAV-accuracy
- Major arrival concept at international and some regional airports

Problems: RNAV(GPS) „Stand Alone“ as sensor restricted „RNAV-1“?

- RNAV(GPS) „Stand-alone“ SIDs/STARs established since 1998 (long before PBN-concept, before „P-RNAV“)
- Concept based on criteria „RNAV with GNSS“ in Doc 8168 and the „JAA TGL3“ (now EASA AMC 20-5) as requirement for operators
- AMC 20-5 (ex-TGL 3) is not reflected in Doc 9613 (PBN Manual)
- AMC 20-5 will be suspended by EASA
- RNAV(GPS) Stand-Alone Procedures conformal to RNAV-1 but restricted on the sensor GPS only
  - New charting („DME/DME not authorized“)
  - Additional Statement of Conformity (RNAV-1 according Doc 9613) in AIP

Problems – NAV-Infrastructure Rationalization

Problems, Lessons Learned

NSP Dec 11 WGW /IP___

NAVIGATION SYSTEMS PANEL (NSP)
Working Group of the Whole Meeting
Montreal, December 6 - 14, 2011

Agenda Item 2: ANC/12 Preparation

INFORMATION PAPER

Status of the Navigation Infrastructure Rationalization in Germany

Presented by Stefan Naerlich
Prepared by Roland Kaluza and Stefan Naerlich

SUMMARY

With the availability of GPS-based RNAV approach procedures, the German Air Navigation Service Provider DFS intended to reduce the amount of non-precision navigation aids (NDB, VOR) installed for the approach phase of flight.
The rationalization process was modified due to limitations appearing with regard to the limitations from the currently available capability of aircraft avionics.

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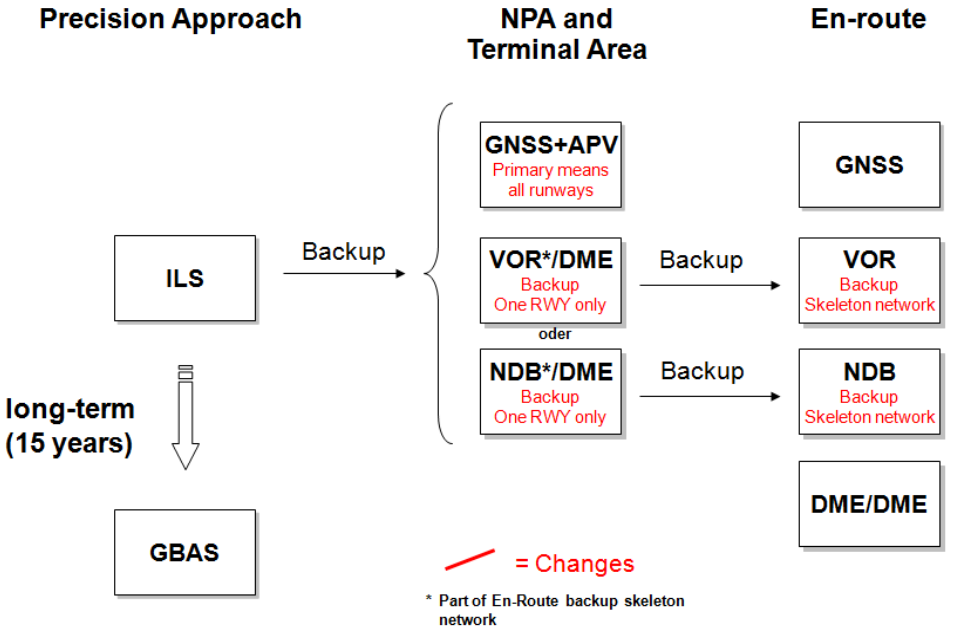
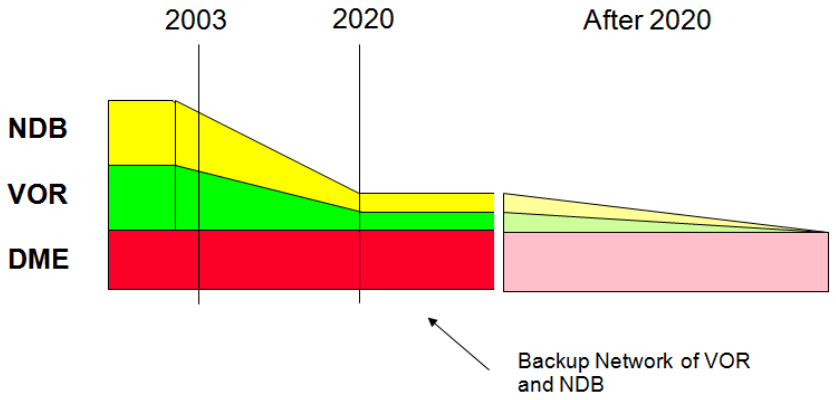
Problems – NAV-Infrastructure Rationalization

DFS Rationalization Concept in 2003:

- Based on the assumption of available NAV-Specifications
- Based on the assumption that GPS as primary sensor available
- Based on the assumption of a mandate to use GNSS as primary sensor





Intended evolution of NDB and VOR

Future Plans („PBN implementation Plan“)

- NAV-Infrastructure
  - In May 2011 the “generic” German infrastructure rationalization plan has been withdrawn until further notice.
  - GNSS is still optional for any kind of RNAV-operation
  - If any further reduction of conventional navigation infrastructure can take place, it is only after very precise analyses of the respective, individual TMA and ENR-effects, taking into account current route structures, Nav-performance in regard to sensors used of aircrafts operating in TMAs and an assessment/estimate which **public impact** a total redesign of the TMA will have
  - There will be no further “generic” infrastructure rationalization plans until the German minimum equipment requirements for IFR Operations is not updated in regard to GNSS

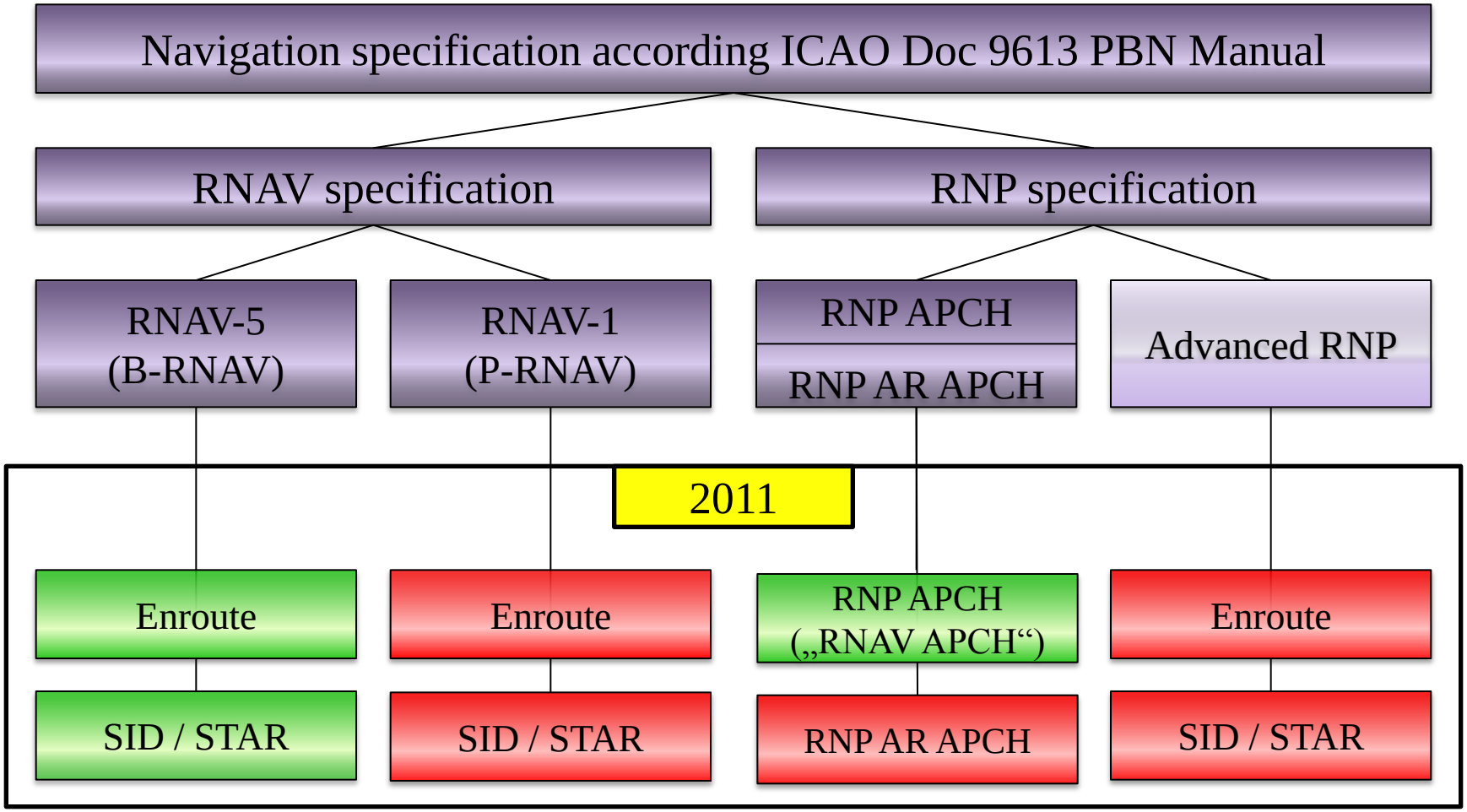
Future Plans („PBN implementation Plan“)

- ENR
  - All ATS routes to become RNAV-5
  - Further developments only in European context
- Arrivals / Departures
  - RNAV-1 SIDs/STARs partly combined with CDO and CCO (Point Merge)
    Motivation: Gain experience with new procedure design processes (DME-Assessment, Flight Validation and Flight Inspection)
  - Use of RNP functionalities (RF-leg) on SIDs/STARs without „AR“ implementing process to react to environmental and political requirements: Implementation today only feasible as „RNP overlay procedure“, eventually as RNP-1?
  - Looking forward to „Advanced RNP“
  - **Use current / mid-future concepts as future (long term) backup**

Future Plan („PBN implementation Plan“)

- APCH
  - At least 5 regional airports with APV SBAS-Procedures (down to LPV Minimum) in 2012 (step 1)
  - Several further implementations of APV SBAS planned (step 2)
  - Depends on requests from airport operators as DFS is not service provider of regional airports (Costs of Flight Inspection)
  - Helicopter PinS:
    - Off-shore
    - HEMS
  - GLS CAT I procedures for Public Use beginning 09 FEB 2012 at Bremen
  - Further GLS CAT I procedures on request
  - RNP AR actually not planned by DFS, development is dependent on user requests [DFS (procedure design) is not the only key player in that subject – approval process is the main hurdle]
  - "xLS" ?

Conclusions - Today



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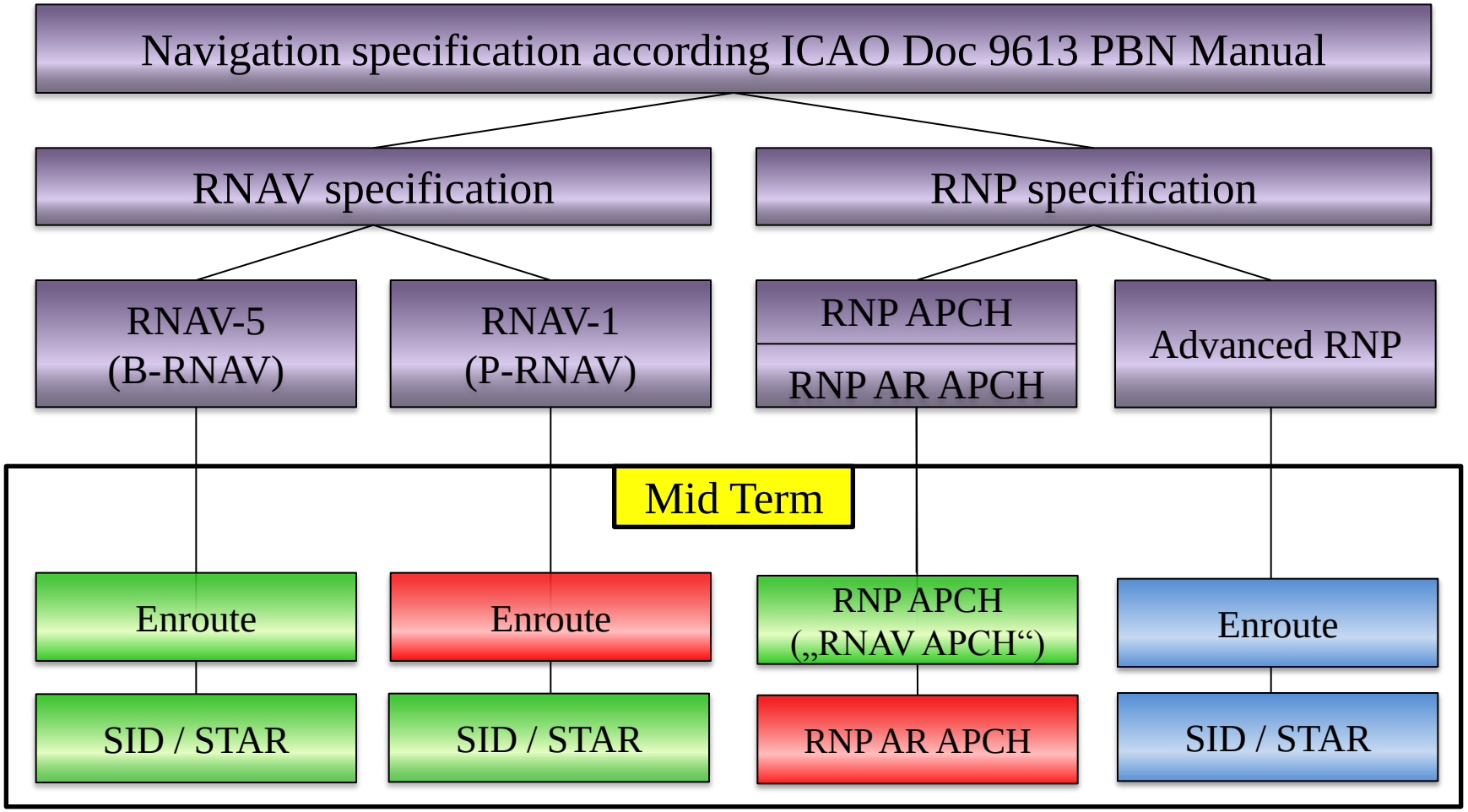
Conclusions – Mid Term



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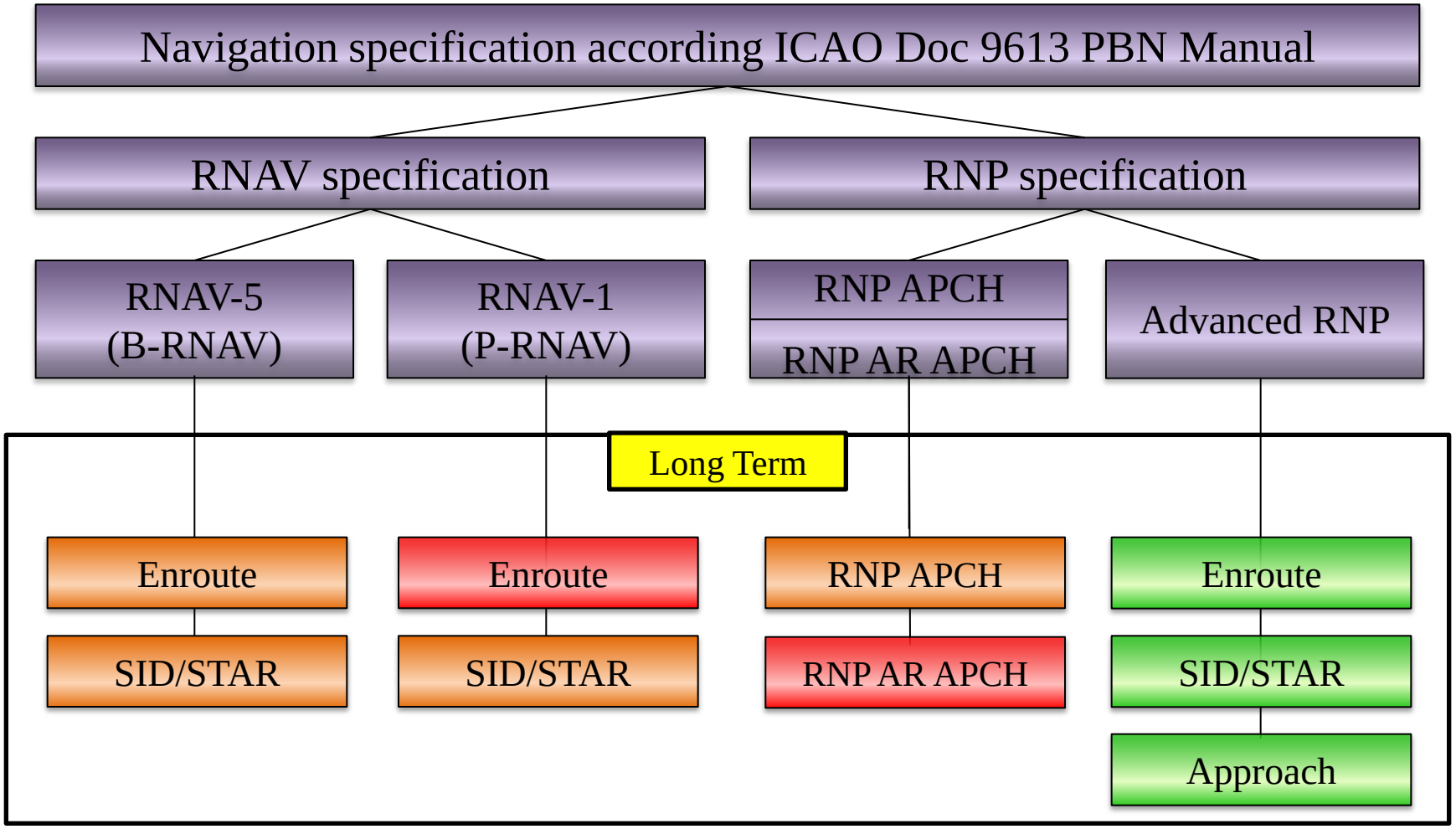
Conclusions – Long Term



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PBN Go-Team Visit Germany 6 - 9 Dec 2011

- **Purpose of Visit:**
  - Support Germany's PBN implementation efforts, and
  - Support Germany as a PBN champion in the European Region.
- **Challenge: Alignment of ICAO PBN provisions with**
  - Germany's PBN implementation history, and
  - today's airspace/regulatory structure of the European Region.
- **Progress of Work: Technical discussions on**
  - Airspace Concept,
  - Approach Design,
  - OPS Approval, and
  - Regulatory Oversight
- **Support by National/European Experts such as:**
  - Regulators (BMVBS, BAF, LBA, EU COM, EASA, EUROCONTROL),
  - ANSP (DFS),
  - Airports (ADV, IDRF, ERAC),
  - Airlines (Lufthansa, Air Berlin, GBAA, AOPA),
  - Military (BMVg), and
  - Others (Lufthansa Systems, DLR).

Federal Ministry of Transport, Building and Urban Development

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PBN Go-Team Visit Germany 6 - 9 Dec 2011

OUTCOME:

- Recommendations of ICAO to Germany (extract)
  - Establishment of German PBN implementation Support Team
  - Establishment of new process (DME/DME flight validation – flight inspection) to overcome the RNAV-1 issues
  - Develop further CDO and CCO procedures
  - Further Develop SBAS procedures, in addition to Baro-VNAV
  - Review of the existing OPS Approval process

  ➢ **Benefits ??**

- **<u>General Problem in Germany</u>:**

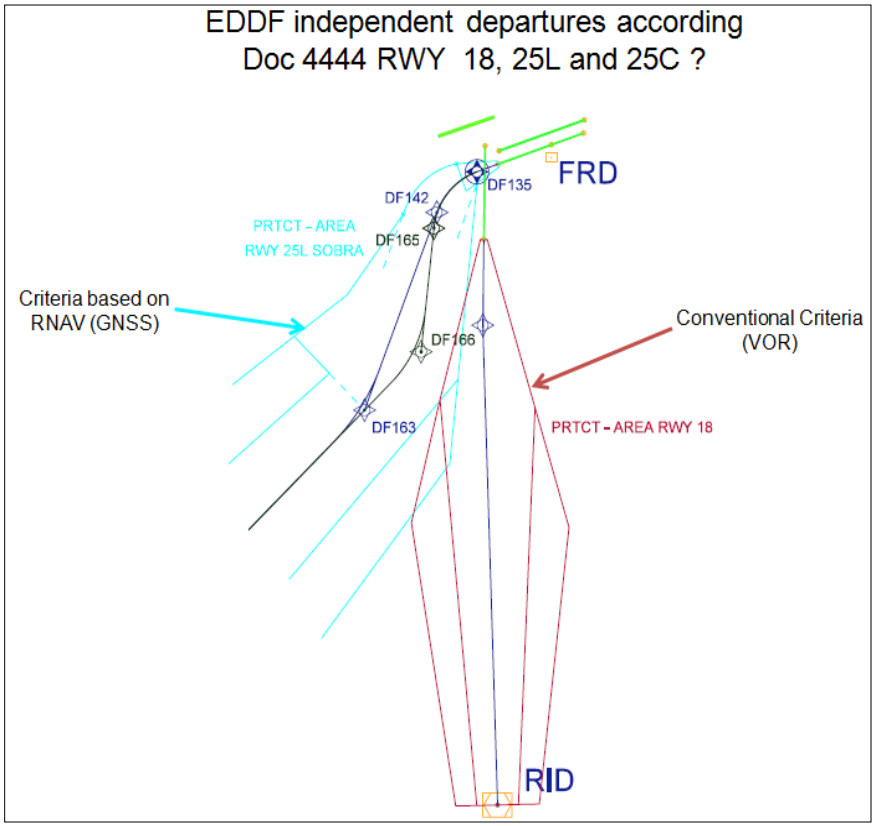
  - RNAV concepts have been established long before PBN concept.

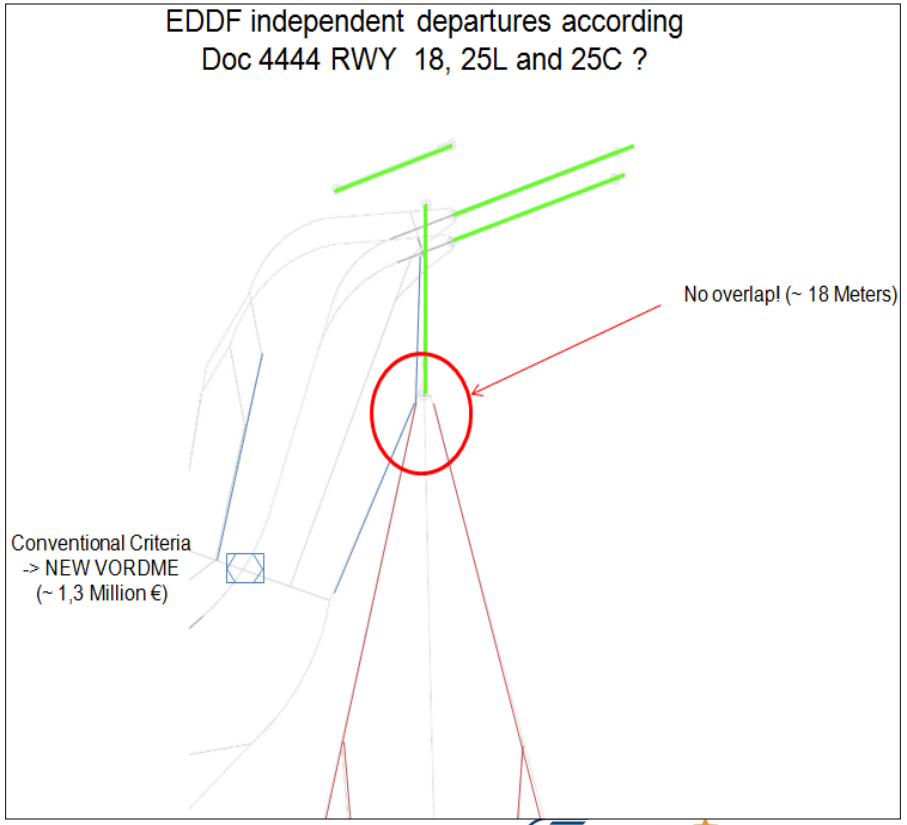
  - Main operational requirements of the concepts are not regarded in PBN-Manual and will not be covered by upcoming regulation material.

PBN Go-Team Visit Germany 6 - 9 Dec 2011

OUTCOME:

- Recommendations of Germany to ICAO (extract)
  - Develop more pragmatic PBN separation standards
    - **Example:** Independent Departures at Frankfurt EDDF RWY18, 25C and 25L





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PBN Implementation in Germany

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