# NAV data collection

## Fleet capabilities assessment according to FPL

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# Introduction

- 15 Nov 2012: standard ICAO format for airline flight plans changed.
- New fields have been added and/or modified to reflect current aircraft navigational and communications capabilities.
- The **fields 10a (Equipment and capabilities)** and **18 (Other Information - related PBN information)** within the new ICAO FPL form that have been revised enhance considerably the identification of aircraft capabilities.
- The objective of this assessment is to determine via the new flight plan information the current level of equipage and capabilities related to Navigation, as basis for deployment planning and monitoring.

# Field 10a: Equipment and capabilities

| Indicator | NAV system | Equipment |
|---|---|---|
| **A** | Ground-Based Augmentation System (GBAS) is a safety-critical system that augments the GPS Standard Positioning Service (SPS) and provides enhanced levels of service. | **GBAS** landing system |
| **B** | Localizer Performance with Vertical guidance (LPV). Approach with Vertical guidance (APV-SBAS). Space Based Augmentation System (SBAS). | **LPV** (APV with SBAS) |
| **C** | Long Range Navigation (LORAN) C is a terrestrial radio navigation system using low frequency radio transmitters to determine the location and speed of the receiver | **LORAN C** |
| **D** | Distance Measuring Equipment (DME) is a transponder-based radio navigation technology that measures distance between the equipment on ground and an aircraft by timing the propagation delay of VHF or UHF radio signals. | **DME** |
| **G** | Global Navigation Satellite System (GNSS).<br>The term GNSS encompasses all the satellite navigation systems such as GPS, GLONASS, GALILEO, etc | **GNSS** (If the letter G is used, the types of external GNSS augmentation, if any, are specified in field 18 following the indicator NAV/ and separated by a space) |
| **I** | An Inertial Navigation System (INS) or Inertial Reference System (IRS) or Inertial Reference Unit (IRU) is a navigation aid that uses a computer, motion sensors (accelerometers) and rotation sensors (gyroscopes) to continuously calculate the position, orientation, and velocity (direction and speed of movement) of a plane without the need for external references. | **INS** |
| **R** | R indicates the Perfomance Based Navigation (PBN) levels that can be met. It is used by ATC for clearance and routing purposes. The insertion of R in the field 10a requires PBN/ to be present in field 18. The PBN sub-field contains the RNAV and/or RNP certifications and operational approvals. | **PBN approved** (If the letter R is used, the performance based navigation levels that can be met are specified in field 18 following the indicator PBN/). |

# Field 18: Other Information – PBN information

Field 18 related PBN information (PBN/ Indication of RNAV and/or RNP capabilities): this field can include as many of the applicable descriptors, up to a maximum of 8 entries

| NAV Capability | Indicator | Equipment |
|---|---|---|
| **RNAV 10 (RNP 10)** | A1 | RNAV 10 (RNP 10) |
| **RNAV 5** | B1 | all permitted sensors |
| | B2 | GNSS |
| | B3 | DME/DME |
| | B4 | VOR/DME |
| | B5 | INS OR IRS |
| | B6 | LORAN |
| **RNAV 2** | C1 | all permitted sensors |
| | C2 | GNSS |
| | C3 | DME/DME |
| | C4 | DME/DME/IRU |
| **RNAV 1** | D1 | all permitted sensors |
| | D2 | GNSS |
| | D3 | DME/DME |
| | D4 | DME/DME/IRU |

| NAV Capability | Indicator | Equipment |
|---|---|---|
| **RNP 4** | L1 | RNP 4 |
| **Basic RNP 1** | O1 | all permitted sensors |
| | O2 | GNSS |
| | O3 | DME/DME |
| | O4 | DME/DME/IRU |
| **RNP APCH** | S1 | RNP APCH |
| | S2 | RNP APCH with barometric vertical navigation |
| **RNP AR APCH** | T1 | RNP AR APCH with RF (authorization required) |
| | T2 | RNP AR APCH without RF (authorization required) |

# Assessment

- **Analysis at aircraft equipment level:** Indication of equipment in field 10a (GNSS, DNE, INS...) in order to capture navigation capability information.

- **Analysis at aircraft navigation capabilities level:** If the letter R (PBN) is used in field 10a: indication of RNAV or RNP capabilities by relevant codes in field 18 per flight phase (Oceanic, En-Route, Terminal and Final).

- **Analysis at segment level:** Results by aircraft segment (mainline, regional, business and general aviation) to ensure a global view on NAV capabilities.

- **Analysis per geographical area:** Statistics on specific areas of air traffic in Europe in order to analyse the navigation capability evolution (for example: information collected from aircraft operating at top 50 European airports).

# Aircraft equipment level
## (according FPL Item 10a content)

- Results are valid for all flight plans for 6 months (Jan 2013 and June 2013)
- Numbers are based on the number of distinct aircraft (aircraft = piece of metal, this implies that changes of registrations has no impact on data).
- During this period *16.968* aircraft during *4.577.802* flights have been seen

| Equipment | Indicator | % aircraft | % flights |
|---|---|---|---|
| **GBAS landing system** | A | 2,63% *(2,5%*)* | 3,62% *(3,7%*)* |
| **LPV (APV with SBAS)** | B | 6,15% *(4,4%*)* | 2,06% *(2,2%*)* |
| **LORAN C** | C | 0,87% *(0,6%*)* | 0,12% *(0,1%*)* |
| **DME** | D | 96,97% *(96,9%*)* | 97,55% *(97,3%*)* |
| **GNSS** | G | 90,09% *(89,0%*)* | 87,31% *(87,5%*)* |
| **INS** | I | 74,32% *(76,3%*)* | 79,77% *(78,9%*)* |
| **PBN** | R | 95,99% *(96,9%*)* | 96,58% *(96,5%*)* |

*(*) according to first results presented in RAISG4 – April 2013*

# PBN approval status - % of total nb of flights (according FPL Item 18 content)

| Flight phase | NAV Capability | All permitted sensors | GNSS Only | DME/ DME Only | VOR/ DME Only | DME/ DME/IRU (or INS/IRS for B5) | LORAN |
|---|---|---|---|---|---|---|---|
| **Oceanic** | **RNAV 10 (RNP 10)** | 58,7% | | | | | |
| | **RNP 4** | 22,6% | | | | | |
| **En-Route** | **RNAV 5** | 58,0% | 24,6% | 26,1% | 26,3% | 13,1% | 0,0% |
| | **RNAV 2** | 34,2% | 12,3% | 6,0% | | 4,2% | |
| | **RNAV 1** | 60,8% | 13,1% | 14,8% | | 10,3% | |
| **Terminal** | **RNAV 1** | 60,8% | 13,1% | 14,8% | | 10,3% | |
| | **RNP 1** | 40,9% | 8,3% | 7,1% | | 3,1% | |
| **Final** | **RNP APCH (LNAV)** | 18,3% | | | | | |
| | **RNP APCH with Baro VNAV** | 33,4% | | | | | |
| | **RNP AR APCH with RF** | 3,8% | | | | | |
| | **RNP AR APCH without RF** | 0,9% | | | | | |

# PBN approval status - % of total nb of aircraft (according FPL Item 18 content)

| Flight phase | NAV Capability | All permitted sensors | GNSS Only | DME/ DME Only | VOR/ DME Only | DME/ DME/IRU (or INS/IRS for B5) | LORAN |
|---|---|---|---|---|---|---|---|
| Oceanic | RNAV 10 (RNP 10) | 28,77% | | | | | |
| | RNP 4 | 2,13% | | | | | |
| En-Route | RNAV 5 | 3,84% | 0,97% | 0,77% | 1,37% | 0,49% | 0,01% |
| | RNAV 2 | 1,92% | 0,11% | 0,62% | | 0,03% | |
| | RNAV 1 | 29,21% | 0,55% | 0,67% | | 0,23% | |
| Terminal | RNAV 1 | 29,21% | 0,55% | 0,67% | | 0,23% | |
| | RNP 1 | 2,7% | 0,5% | 0,44% | | 0,11% | |
| Final | RNP APCH (LNAV) | 1,7% | | | | | |
| | RNP APCH with Baro VNAV | 3,16% | | | | | |
| | RNP AR APCH with RF | 0,19% | | | | | |
| | RNP AR APCH without RF | 0,01% | | | | | |

- PBN approval status per aircraft segment is also available (Nb of aircraft)
- 736 most common aircraft/rotorcraft in PRISME (~95% of the flights)
- Segments: Mainline, Regional, Business, GA IFR, ROT IFR, Military

# Analysis per geographical area

- RNAV 1, RNP 1, RNP APCH (with and without Baro), RNP AR APCH (with and without RF) declared capability for the
  **25 (and Istanbul) largest airports**

*PARIS CH DE GAULLE; FRANKFURT MAIN, LONDON/HEATHROW, AMSTERDAM, MUENCHEN 2, MADRID BARAJAS, ISTANBUL-ATATURK, ROME FIUMICINO, BARCELONA, WIEN SCHWECHAT, ZURICH, LONDON/GATWICK, COPENHAGEN, OSLO/GARDERMOEN, PARIS ORLY, BRUSSELS NATIONAL, DUESSELDORF, STOCKHOLM, MILANO MALPENSA, PALMA DE MALLORCA, TEGEL-BERLIN, MANCHESTER, DUBLIN, NICE, LONDON/STANSTED*

- Warning: additional work is needed to consolidate the data provided in the report

# Conclusions

- FPL data is as good « as provided » by the operators

➔ Need to validate that operators are correctly stating NAV equipment and PBN capability

- Potential errors to be corrected:
  - No PBN capability declared
  - Incorrect list of PBN codes
  - PBN capability declared in Item 10, but no PBN code in Item 18

- **Warning:** some airports are planning to make use of this data (e.g. in certain weather conditions, only RNP APCH approved aircraft could access the airport)

# Questions ?