**Airbus Prosky**
Thomas Bernstein

# ICAO Doc 9906 Step 8 to 10 Validation Approval

ICAO AFPP Workshop

3rd – 6th November 2015

# Validation, Consult and Approval

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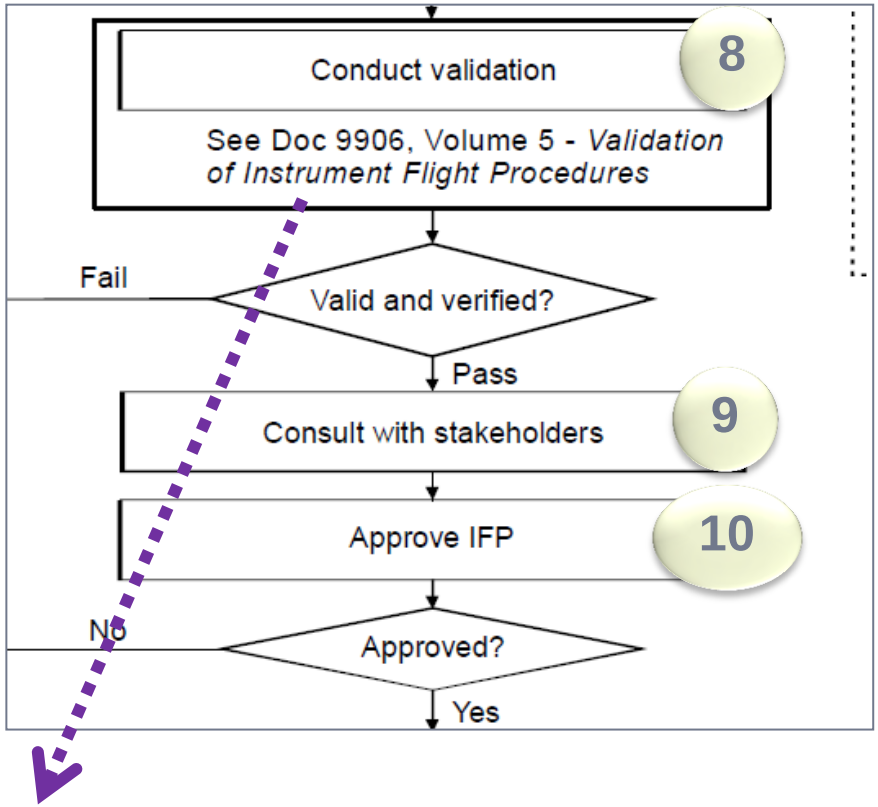


**Extract of ICAO 9906 Vol. 1**
**IFP Process flow diagram**

**Step 8: See Doc 9906 Vol. 5 – Validation of IFP**





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# Validation

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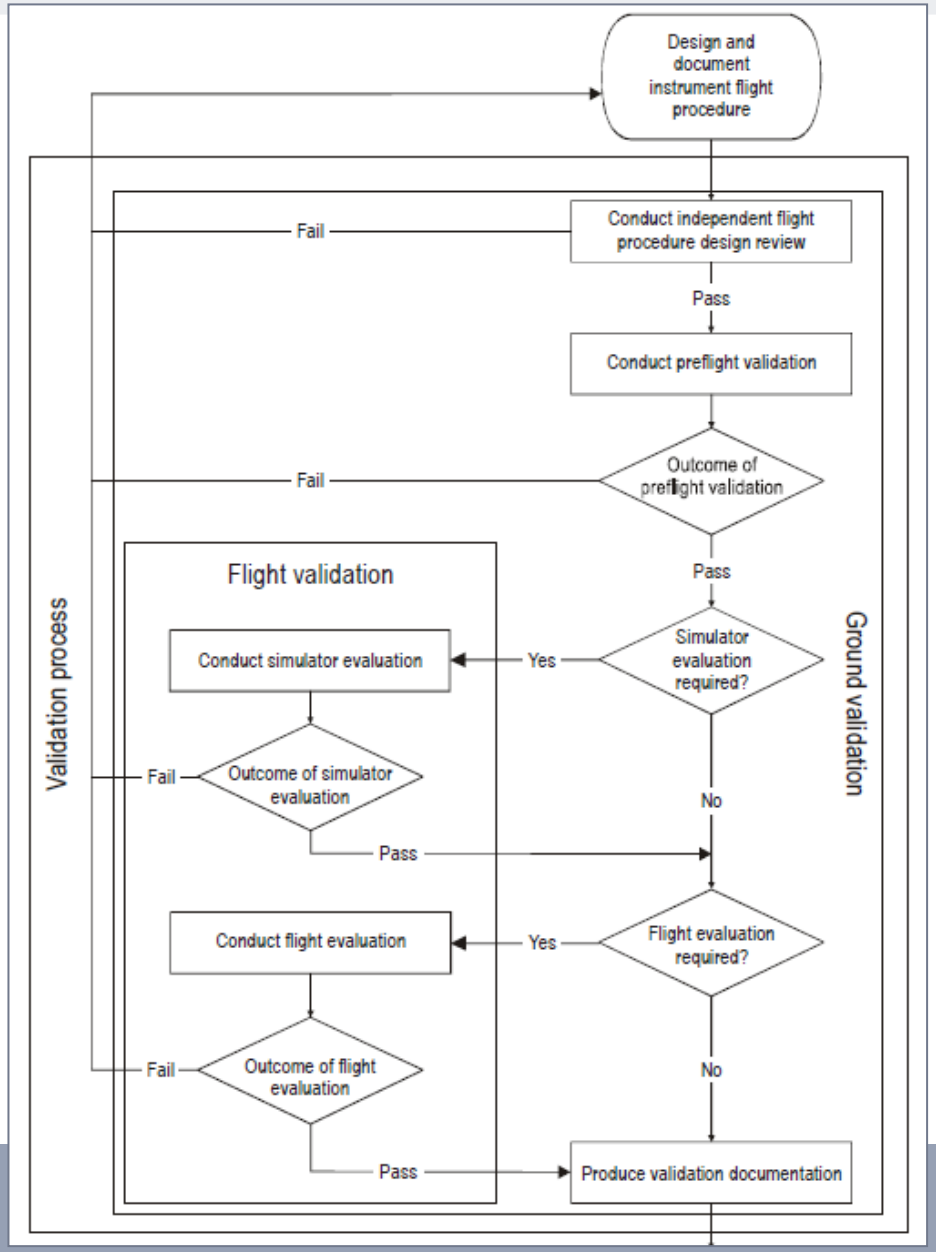


**See Doc 9906 Vol. 5**

Validation Process Flow Chart

**Final Objective: To give the green light for procedure implementation**

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# Validation

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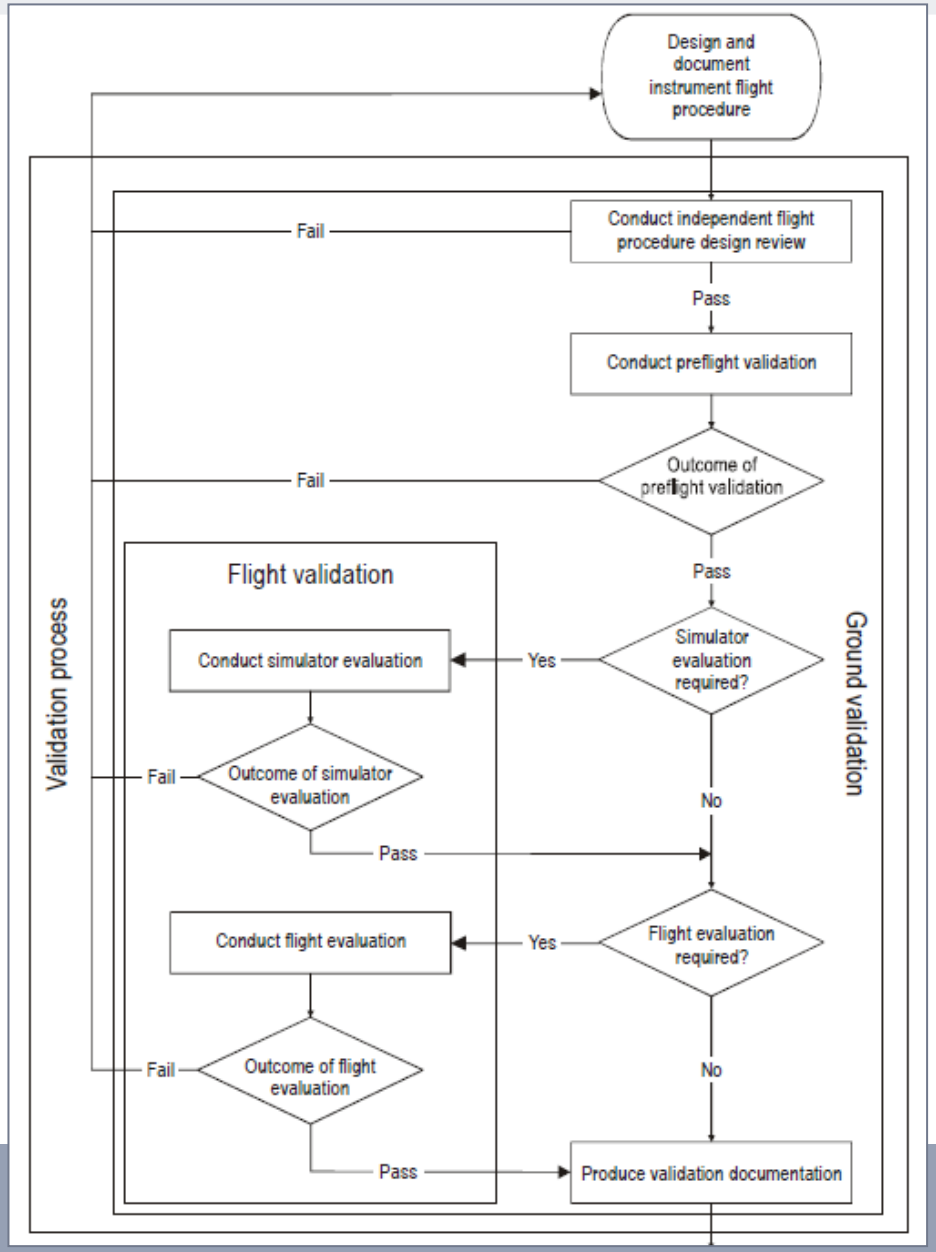


**See Doc 9906 Vol. 5**

## Ground Validation

- Independent FPD review
- Pre Flight validation

## Flight Validation

- Simulator evaluation
- Flight evaluation

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# Validation

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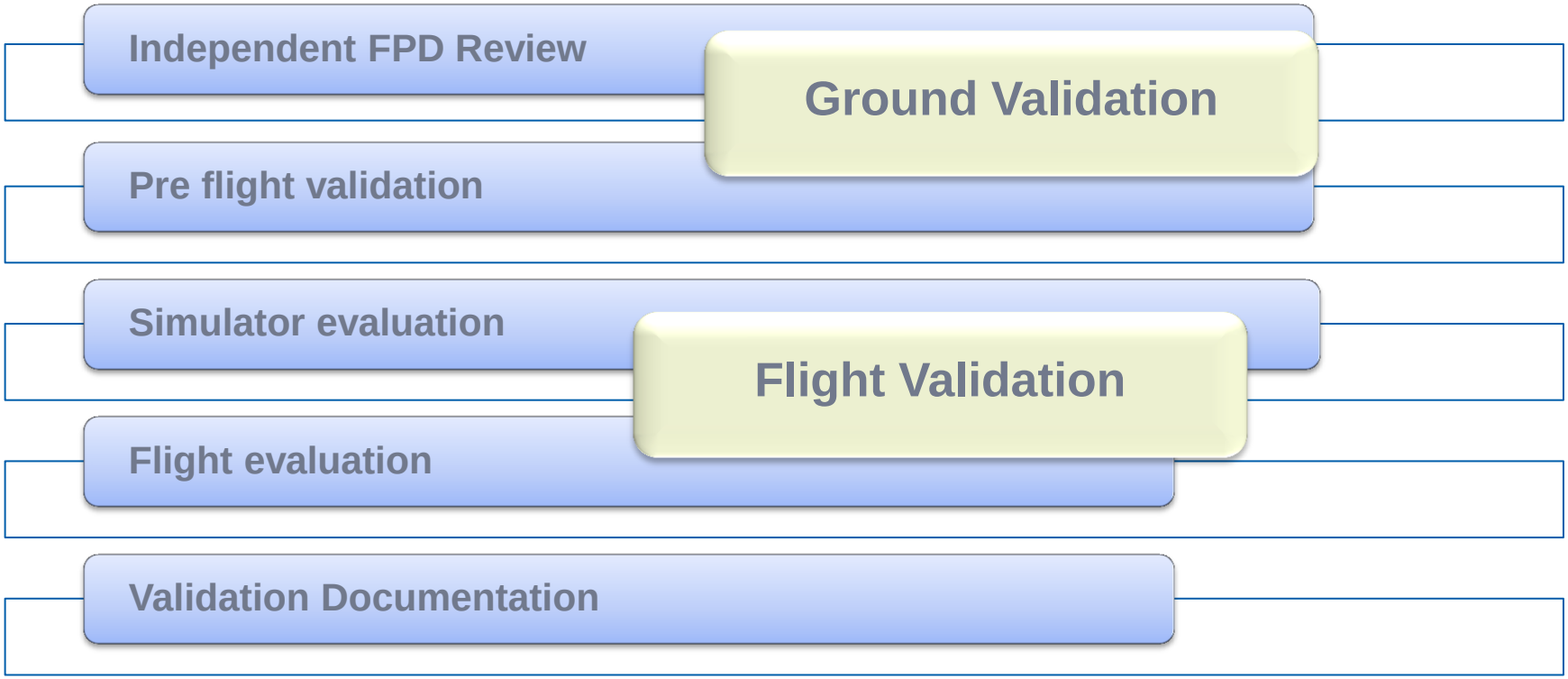






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# Ground Validation

## Independent FPD Review

# Ground Validation

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## Independent FPD review

- A flight procedure designer other than the one who designed the procedure must perform this step. The designer can be assisted by specialists in other fields of expertise as necessary (Pilot, ATC…)

- Tasks:
  - Confirm correct application of Criteria
  - Confirm data accuracy and integrity
  - Verify mitigations for deviations from design criteria
  - Verify draft chart is provided and correct
  - *Confirm correct FMS behaviour – No mean for Proc Designer to test this*
  - Perform obstacle assessment



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# Independent procedure review

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- Catch errors in criteria and documentation
  - Skilled procedure designer
  - Good knowledge of design criteria

- ***If the procedure documentation is not compliant with requirements : no validation step is possible***

- Doc 9906 contains a description of what an IFP package should contain (Vol. 5, paragraph 1.5.1). States should either endorse that list or publish their own.

- Independent reviewer should sign off IFP package or an equivalent document





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# Independent procedure review

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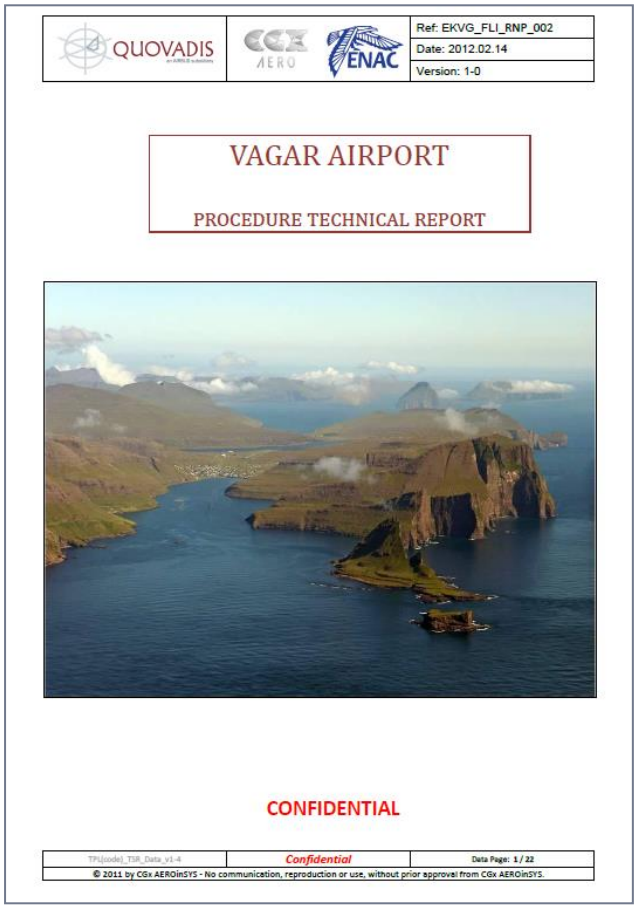
- Technical Report : the document describing the procedure design



QUOVADIS | CGX AERO | ENAC

Ref: EKVG_FLI_RNP_002
Date: 2012.02.14
Version: 1-0

VAGAR AIRPORT

PROCEDURE TECHNICAL REPORT

CONFIDENTIAL

TPL(code)_TSR_Data_v1-4 | *Confidential* | Data Page: 1 / 22



***The Technical Report contains***:

- References of Obstacle Data
- Minimum Safety Altitude (MSA) construction details
- Holding construction details
- Approach contruction details, including Vertical Error Budget (VEB) and minima calculation .
- Departure construction details





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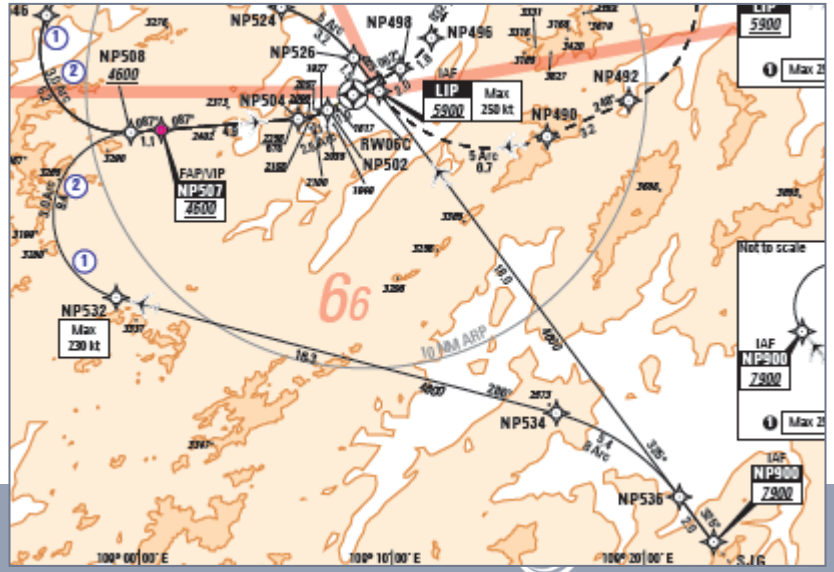
# Technical Report: Procedure details

| | NP900 TF NP536 | NP536 TF LIP | LIP TF NP526 | NP526 RF (L) NP524 |
|---|---|---|---|---|
| RNP required (NM) | 0.3 | 0.3 | 0.3 | 0.3 |
| Initial Orientation (°) | 323.5969 | 323.5875 | 323.5057 | 323.5935 |
| Length (NM) | 2 | 18 | 1.4777 | 3.2348 |
| Radius (NM) | | | | 5 |
| Angular amplitude (°) | | | | 37.0676 |
| Max IAS (Kt) | | | | 250 |
| Wind Speed (Kt) | | | | 95 |
| Max TAS (Kt)/ (Altitude (ft)) | | | | 293 /8700 |
| Max bank angle (°) | | | | 23.7 [2] |
| Significant obstacle | NP1072 | NP1079 | NP1080 | NP1130 |
| Obstacle elevation (m) | 991 + 40 | 992 + 40 | 520 + 40 | 650 + 40 |
| MOC (m) | 300 | 300 | 300 | 300 |
| MOCA (m/ft) | 1331 / 4367 | 1332 / 4371 | 860 / 2822 | 990 / 3249 |
| Safety altitude (ft) | 4600 [1] | 4600 [1] | 4600 [1] | 4600 [1] |
| Procedure altitude (ft) | 4600 [1] | 4600 [1] | 4600 [1] | 4600 [1] |



# Technical Report: Minima assessment details

### 3.2 Finals and Missed Approach parameters

The minimum reference OAT at ZUNP is -10°C.
By using the new ICAO formula, at maximum VPA tested (4.3°) the maximum temperature is 33°C.
The values provided in the table below were computed with a FAF at 4600ft. The HL has been raised to take into account the VPA at 4°. RDH: 50ft.
The VEB has been computed for wingspan ≤ 262ft (80m) and 25° Bank Angle for RF.

| | CAT A | | CAT B | | CAT C | | CAT D | |
|---|---|---|---|---|---|---|---|---|
| IAS (KT) | 100 | | 130 | | 160 | | 185 | |
| HL raised for VPA 4°(ft) | 147 | | 166 | | 179 | | 195 | |
| VPA (°) | 4 | | 4 | | 4 | | 4 | |
| OAS gradient (%) | 6.3862 | | 6.3862 | | 6.3862 | | 6.3862 | |
| Distance origin VEB to threshold (m) TF/RF | 1073.82 | 1220.75 | 1073.82 | 1220.75 | 1073.82 | 1220.75 | 1073.82 | 1220.75 |
| TAS (KT) | 105 | | 136.5 | | 168 | | 194.27 | |
| TrD (m) | 1894.84 | | 2137.94 | | 2381.03 | | 2583.61 | |
| Missed Approach Surface (Z) origin (m) | -1472.04 | | -1632.31 | | -1818.74 | | -1951.58 | |
| MA Climb Gradient (%) | 2.5 | | 2.5 | | 2.5 | | 2.5 | |

Table 3-3: Final RNP 0.3 Parameters

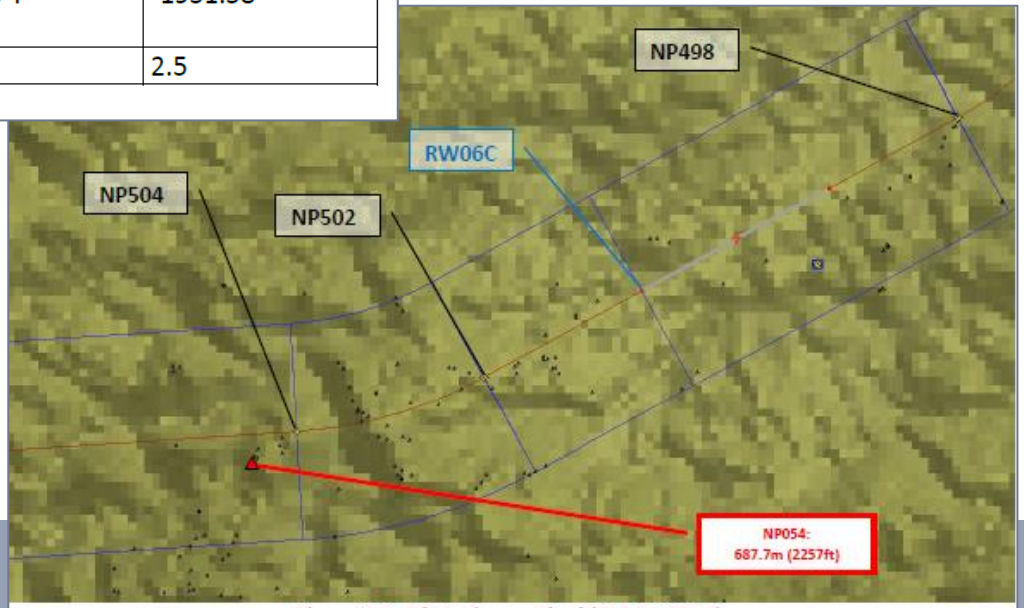



Figure 3-2: Obstacles on Final (MA RNP 0.3)

# Ground Validation

## Pre flight validation

# Pre flight Validation

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- This may be a joint activity by flight procedure designer and pilots

- Persons performing pre flight validation must ensure that the IFP documentation is complete and that all necessary charts, data, coding are available. As a minimum, the following tasks must be performed:

- Ensure the completeness of the IFP package as described in Chapter 1, §1.5.1
- Ensure that charts are available in sufficient detail for assessment of the IFP during the FV *(very useful for pilot!)*
- Familiarize with the target population of the procedure (e.g. aircraft categories, type of operation).
- Discuss the IFP package with the procedure designer, as necessary



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# Pre flight Validation

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- Compare the IFP design, coding and relevant charting information against the navigation database (NDB) used for flight validation
- Verify that controlling obstacles and obstacles otherwise influencing the design of the procedure are properly identified
- Review the airport infrastructure and special airport regulations
- Review the navigation infrastructure used by the procedure



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# Pre flight Validation

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## Outcomes:

- Determine the need for flight simulator evaluation, especially where there are special or unique design considerations
- Determine the need for flight evaluation in the aircraft
- Record specific additional actions required in a flight validation (if required)
- Provide a detailed written report of the results of pre-flight validation.

"Simulator evaluation" and/or 'flight evaluation" are not mandatory !



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# Testing and Validation : NavDB Coding Check

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Coding check is carried out prior to any testing to, proactively preparing for expected behaviour or coding problems, and take full advantage of the testing slots.

```
TQVSP MSLPMSFR07-X ARELTA 010RELTAMSEA0E  A 101IF                          + 09200                          U
TQVSP MSLPMSFR07-X ARELTA 020LP664MSPC0E    101TF                 17490020                                   U
TQVSP MSLPMSFR07-X ARELTA 030LP578MSPC0E   L101RF      0065001749 14310036                          LPC63 MSPCU
TQVSP MSLPMSFR07-X ARELTA 040LP574MSPC0E    302TF                 14310026                                   U
TQVSP MSLPMSFR07-X ARELTA 050LP570MSPC0E   R302RF      0085001431 19500077    + 03900               LPC62 MSPCU
TQVSP MSLPMSFR07-X ARELTA 060LP568MSPC0E    302TF                 19500014                                   U
TQVSP MSLPMSFR07-X ARELTA 070LP564MSPC0E    302TF                 19500066    + 03700                        U
TQVSP MSLPMSFR07-X ARELTA 080LP562MSPC0E    302TF                 19500024                                   U
TQVSP MSLPMSFR07-X ARELTA 090LP560MSPC0E  B 302TF                 19500020                                   U
TQVSP MSLPMSFR07-X ARELTA 100LP526MSPC0EE   302TF                 19500100      03500                        U
TQVSP MSLPMSFR07-X R      010LP526MSPC0E  F 302IF                               03500                        U
TQVSP MSLPMSFR07-X R      020LP504MSPC0E    302TF                 19500010                      -300         U
TQVSP MSLPMSFR07-X R      030LP502MSPC0E   L302RF      0030001950 06890066                      -300LPC58 MSPCU
TQVSP MSLPMSFR07-X R      040RW07 MSPG0GE M 302TF                 06890030      00119          -300         U
TQVSP MSLPMSFR07-X Z      050LP602MSPC0E M  101TF                 06890047                                   U
TQVSP MSLPMSFR07-X Z      060LP590MSPC0E   R101RF      0050000690 18070097                          LPC05 MSPCU
TQVSP MSLPMSFR07-X Z      070LP533MSPC0E    101TF                 18070228    + 03000                        U
TQVSP MSLPMSFR07-X Z      080LP533MSPC0EE HL   HM                 3600T010      03000          230           U
```



**ICAO DOC 9906 vol 5**
**2.2.2 Evaluate data and coding**





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# Determine the need for Flight Validation

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A **Flight Validation** (simulator and/or aircraft as required) is required in the following cases:

- ❑ If the flyability of a procedure cannot be determined by other means
- ❑ If the procedure contains non-standard design elements (deviations from criteria, e.g. non-standard approach angles/gradients, non-standard segment lengths, speeds, bank angles)
- ❑ If the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means
- ❑ If new procedures differ significantly from existing procedures



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# Determine the need for Flight Evaluation in the aircraft

Flight Evaluation *(i.e. actual flight)* is required in the following cases:

- For procedures where runway or landing location infrastructure has not been previously assessed in flight for instrument operations; and
- As determined by the State Authority.

# Flight Validation

## Simulator Evaluation

# Procedure Testing and Validation: Objectives

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### 1.1 The need for validation

The purpose of validation is to obtain a qualitative assessment of procedure design including obstacle, terrain and navigation data, and provides an assessment of flyability of the procedure.

The validation is one of the final quality assurance steps in the procedure design process for instrument flight procedures (IFP) and is essential before the procedure design documentation is issued as part of the integrated aeronautical information package.

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## PROCEDURE VALIDATION OBJECTIVES:

1) TAWS system: No Alert triggered

2) Fly-ability check





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# Procedure Validation Process (ICAO)

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## 1.2 Validation process

The full validation process includes ground validation and flight validation.

Ground validation consists of an independent IFP design review and a pre-flight validation. Flight validation consists of a flight simulator evaluation and an evaluation flown in an aircraft. An overview of the necessary steps in the validation process can be found in Figure 1-1. The validation process of IFP(s) must be carried out as part of the initial IFP design as well as an amendment to an existing IFP.

If the State can verify through ground validation the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with.

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- ✓ Ground testing is required.
- ✓ Flight testing and validation may be dispensed if validation activities can be fully conducted during the Ground Validation phase





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# Validation Process (ICAO)

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## Benefits of simulator evaluation compared to actual flight evaluation:

4.3.4.3 Many of these factors can be evaluated, entirely or in part, during ground validation. Initial flyability checks should be conducted with software tools allowing the flyability of the procedure to be confirmed for a range of aircraft and in a full range of conditions (wind/temperature, etc.) for which the procedure is designed. The verification of the flyability of an RNAV or RNP procedure can also include independent assessments by procedure designers and other experts using specialized software or full-flight simulators. Flyability tests using flight inspection aircraft can be considered, but it must be borne in mind that this only proves that the particular aircraft used for the test can execute the procedure correctly. This is probably acceptable for the majority of less complex procedures. The size and speed of flight test aircraft can seldom fully represent the performance of a fully loaded B747 or A340 and therefore simulation is considered the most appropriate way to carry out the flyability test. Flight simulator tests should be conducted for those more complex procedures, such as RNP AR APCH, when there is any indication that flyability may be an issue. Software tools that use digital terrain data (typically digital terrain elevation data (DTED) level 1 being required) are available to confirm appropriate theoretical navaid coverage.

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**Unique testing capabilities provided by simulator are fully recognized for RNP APCH and RNP AR operations**





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# Flight Validation – Simulator evaluation

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**6.2.4.4 *State ground and flight validation***

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6.2.4.4.1 As RNP AR APCH procedures do not have a specific underlying navigation facility, there is no requirement for flight inspection of navigation signals. Due to the importance of publishing correct data, validation (ground and flight) of the procedure must be conducted in accordance with PANS-OPS (Volume II, Part I, Section 2, Chapter 4, 4.6). The validation process prior to publication should confirm obstacle data, basic flyability, track lengths, bank angles, descent gradients and compatibility with aircraft predictive terrain hazard warning functions (e.g. TAWS) as well as the other factors listed in PANS-OPS. When the State can verify, by ground validation, the accuracy and completeness of all obstacle data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with regarding those particular factors.

6.2.4.4.2 Because of the unique nature of RNP AR APCH procedures, simulator assessment of each procedure should be accomplished during ground validation to evaluate the factors, including basic flyability, to be considered in the flight validation, to the extent possible, prior to flight validation. To the maximum extent possible, this simulator assessment should evaluate the factors considered in the flight validation, including basic flyability.

*Note.— The evaluation of procedure flyability, and the performance of navigation and flight control systems, including speeds, aircraft weights and other operational variables, is the responsibility of the operator.*

- ✓ Ground testing is required
- ✓ Flight testing and validation may be dispensed if validation activities can be fully conducted during the Ground Validation phase

# Flight Validation – Simulator evaluation

- The simulator used should be suitable for the validation tasks to be performed. For complex or special procedures where simulator evaluation is desired, the evaluation should be flown in a simulator which matches the procedure requirements.
- When the procedure is designed for a specific aircraft model or series and specific FMS and software, simulator evaluation should be flown in a simulator with the same configuration used by the operator in daily operations.

Consideration should be given to what should / will be part of an Operational Approval

**From the initiation of the project, simulation means availability and necessity to include an air operator should be considered**

# Procedure testing and validation

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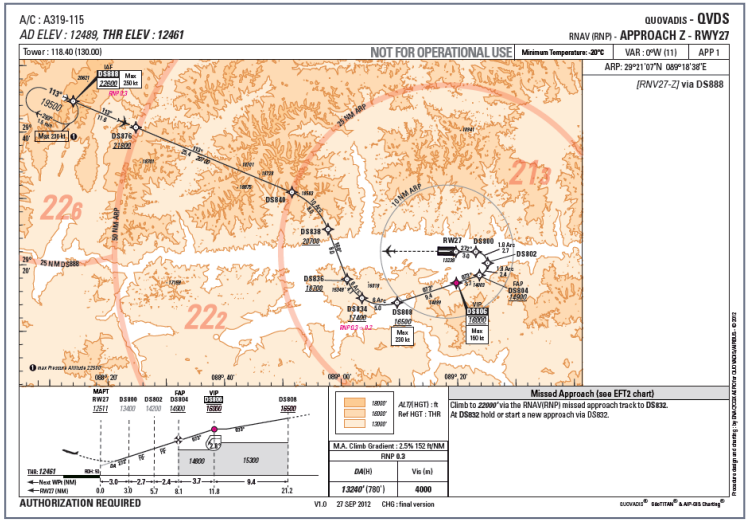
| Airport | EKVG |
|---|---|
| Type | IAP |
| Nav. Type | R |
| Catégorie | UKN |
| Designat. | RNV12Z |

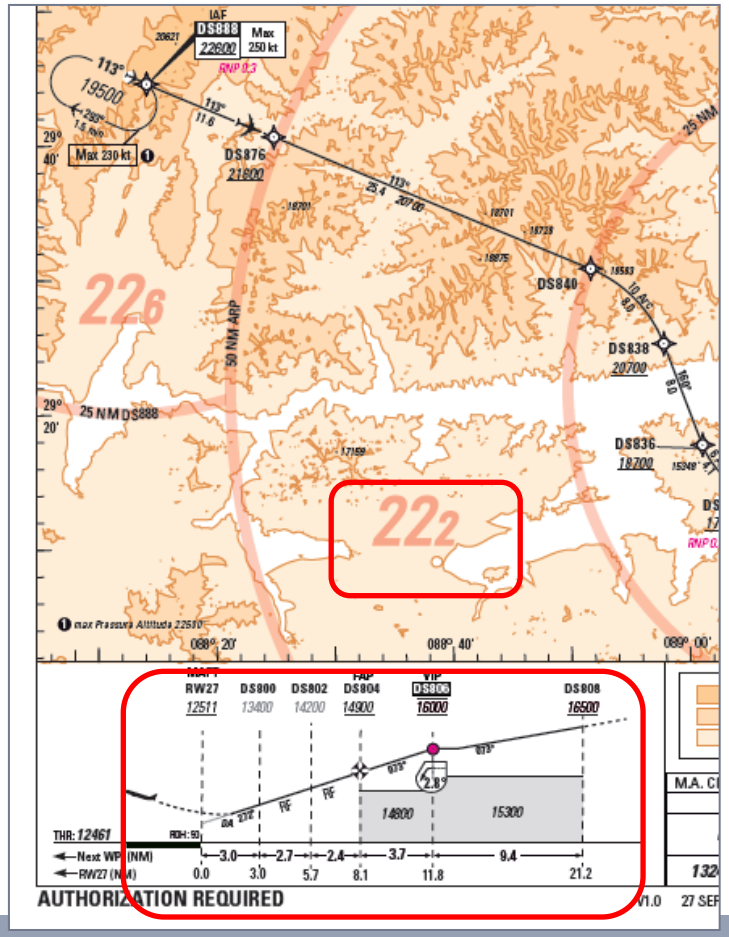
| Seq N° | PT | WP ID | OverFly | Fix role | TD | RMD VHF | THETA (°) (magnetic) | RHO Val | RHO uom | OBD CRS Val (°) | OBD CRS Type | TIME val | TIME uom |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | IF | BUREM | | IAF | | | | | | | | | |
| 20 | TF | VG476 | N | | | | | | | | | | |
| 30 | TF | VG474 | N | | | | | | | | | | |
| 40 | RF | VG473 | N | | R | | 285,881 | | | 332,841 | TT | | |
| 50 | RF | VG472 | N | IF | R | | 332,841 | | | 006,490 | TT | | |
| 60 | RF | VG468 | N | | R | | 006,490 | | | 104,873 | TT | | |
| 10 | IF | VG466 | | | | | | | | | | | |
| 20 | TF | VG464 | N | FAF | | | | | | | | | |
| 30 | TF | VG465 | N | | | | | | | | | | |
| 40 | RF | VG462 | N | | R | | 102,536 | | | 117,671 | TT | | |
| 50 | TF | RW12 | N | MAPT | | | | | | | | | |
| 60 | TF | VG446 | N | | | | | | | | | | |
| 70 | RF | VG447 | N | | R | | 118,011 | | | 306,674 | TT | | |
| 80 | TF | VG480 | N | | | | | | | | | | |
| 90 | HM | VG480 | N | | R | | 296,000 | 2,638 | NM | 116,000 | TT | 60,000 | S |
| 10 | IF | VG800 | | IAF | | | | | | | | | |
| 20 | TF | VG475 | N | | | | | | | | | | |
| 30 | TF | VG473 | N | | | | | | | | | | |
| 40 | RF | VG472 | N | IF | R | | 332,841 | | | 006,490 | TT | | |
| 50 | RF | VG468 | N | | R | | 006,490 | | | 104,873 | TT | | |
| 10 | IF | VG480 | | IAF | | | | | | | | | |
| 20 | TF | VG470 | N | | | | | | | | | | |
| 30 | TF | VG468 | N | IF | | | | | | | | | |
| 40 | TF | VG467 | N | | | | | | | | | | |
| 50 | TF | VG466 | N | | | | | | | | | | |

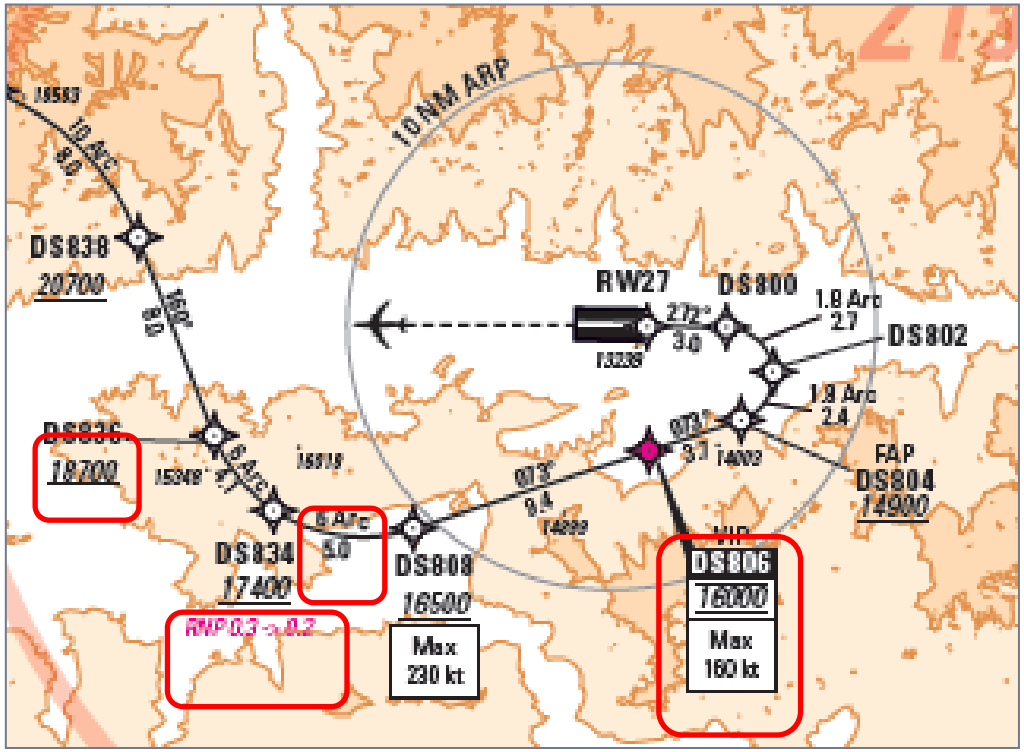
Coding Table

***Charting tool***
***+***
***Manual customization***



# Customized charts to accurately reflect RNP specificities



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# Simulator testing and validation

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- Normal and non normal operations testing
  - Fly-ability checks
  - Any Lateral Deviation (XTK) observed
  - Energy management (eg : final slope -3.7°), maximum bank angles
  - Terrain alerts
  - FMS predictions (speed/altitudes, level offs, deceleration points)
  - Failures (EO, navigation failure, loss of RNP capability…)
  - Wide range of temperature, wind and QNH environmental conditions

Example for RNP AR






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# Procedures Testing and Validation – Fly-ability check

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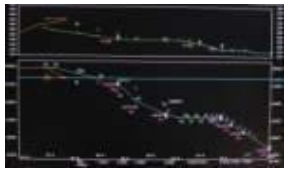
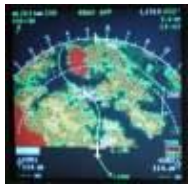
Wind and temperature effects



Example for RNP AR

Free of TAWS

Contingency procedure check



Recording → Design → Performance → Coding → Charting → Testing → Recording

**Design optimization**
**Performance optimization**
**Coding check**
**FOSA**
**Training Items**

**Fly-ability Check**
- Bank record
- Leg transitions
- Energy Management
- Failures cases

Coding check





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# Testing and Validation : Fly-ability of procedures

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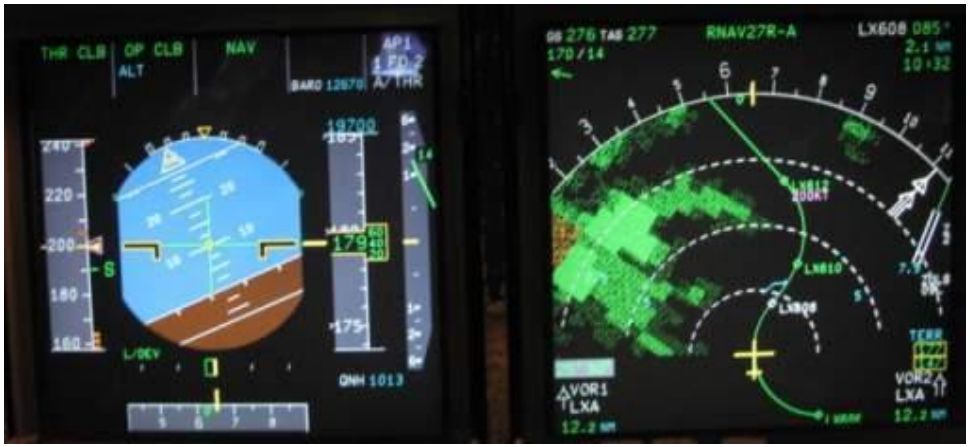
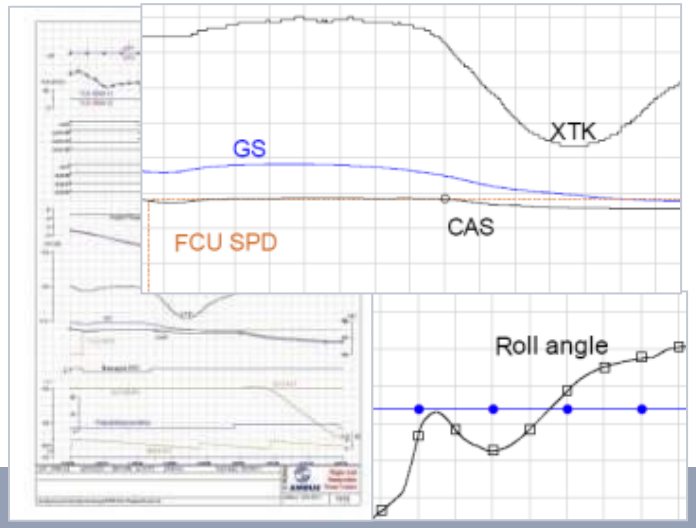
Fly-ability check (normal & failures) with Aircraft / Engines model + equipments (EIS, FMS,…)




SIMULATOR Test Report #3

Example for RNP AR





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# Testing: Conclusion

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**Simulator testing** is the only mean allowing evaluation of:

- ✓ Failure cases *(if required, i.e. RNP-AR)*
- ✓ Wide range of temperature, wind, pressure, weight conditions to assess fly-ability, TAWS warnings, track keeping and bank angle limitations.

**Flight inspection aircraft** may not be representative of operator's aircraft systems behavior, fly ability, and performance.

**Demonstration flight** could be conducted to check the integration with ATC, and is recommended as part of the operator ops approval process.

- ✓ *E.g.: May be performed during a revenue flight, in VMC conditions*

**Conclusion:**

**Simulator testing may be organized with the participant operator to the project**

**Ask your operators whether simulator may be available for such validation**

# Flight Validation

## Flight Evaluation

# Flight Validation / Flight Evaluation

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- If it has been declared necessary!
- Mandatory in some cases:
  - For procedures where runway or landing location infrastructure has not been previously assessed in flight for instrument operations; and
  - As determined by the State Authority.

**Conclusion:**

- **A demonstration flight may be organized with participant operator to the project**
- **Flight Inspector/Procedure Designer may be on-board**
- **Demonstration of satisfactory integration of the procedure in the ATM environment**
- **ATC/Pilot use of (new) phraseology**
- **Check of satisfactory radio communication**
- **Useful for Flight Inspector to observe Crew in the frame of Operator Operational Approval of the operator**

# Flight Inspection

# Flight inspection for RNP procedure?

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The terms "flight validation" and "flight inspection" are often misinterpreted as the same concept. Flight validation and flight inspection are separate activities that, if required, may or may not be undertaken by the same entity.

a) Flight validation is concerned with factors other than the performance of the navigation aid or system that may affect the suitability of the procedure for publication, as detailed in PANS-OPS, Volume II, Part I, Section 2, Chapter 4, Quality Assurance.

b) Flight inspection is conducted with the purpose of confirming the ability of the navigation aid(s)/system upon which the procedure is based, to support the procedure, in accordance with the Standards in Annex 10 — *Aeronautical Telecommunications* and guidance in the *Manual on the Testing of Radio Navigation Aids* (Doc 8071). Personnel performing flight inspection duties should be qualified and certified in accordance with Doc 8071, Volume I, *Testing of Ground-Based Radio Navigation Systems*.

ICAO 9906 Volume 5





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# Flight inspection for RNP procedure?

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**6.2.4.4** ***State ground and flight validation***

6.2.4.4.1 As RNP AR APCH procedures do not have a specific underlying navigation facility, there is no requirement for flight inspection of navigation signals. Due to the importance of publishing correct data, validation (ground and flight) of the procedure must be conducted in accordance with PANS-OPS (Volume II, Part I, Section 2, Chapter 4, 4.6). The validation process prior to publication should confirm obstacle data, basic flyability, track lengths, bank angles, descent gradients and compatibility with aircraft predictive terrain hazard warning functions (e.g. TAWS) as well as the other factors listed in PANS-OPS. When the State can verify, by ground validation, the accuracy and completeness of all obstacle data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with regarding those particular factors.

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# Flight inspection for RNP procedure?

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- The EASA AMC 20-26 document *(Airworthiness Approval and Operational Criteria for RNP-AR operations)* does not make the Flight Inspection as mandatory. Extract of the AMC 20-26: “As RNP-AR does not have a specific underlying navigation facility, there is no requirement for flight inspection of navigation signals”

- The EUROCONTROL document “Guidance material for the flight inspection of RNAV procedures” mentions that “In the case of GNSS, the orbiting constellation provides a continually changing set of point sources and, for this reason, flight inspection cannot generate any meaningful assessment of positioning accuracy or coverage”

**Conclusion:**

**Flight Inspection is not required for RNP procedure validation**





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# Flight inspection for RNP procedures

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- Regarding the previous recommendations, a recommended method should be to put in place a **RNP monitoring program** to analyze a large set of flights data collected from flights done in conditions defined by the authority (VMC conditions, increased Decision Altitude for a given period, etc)

**Conclusion:**

- **Flight Inspection is not required for RNP procedure validation**
- **Process of Procedure Approval should not be stopped if "Flight Inspection" not achieved**
- **Participant operator to the project may be authorized to start operations (in given conditions) to gather Flight Data/Pilot reporting/ATC reporting**
- **Procedure may be published, but restricted to trials flight phase (NOTAM)**
- **Flight Data/pilot reporting/ATC reporting may be analysed to demonstrate satisfactory integration of the procedure**

# Validation Documentation

# Validation Documentation

Document the results of the validation process as follows:

- Complete a detailed written report of the results of the validation process including justification for any steps in the validation process deemed not required. This involves a compilation of reports provided by the individual steps in the validation process
- Ensure that any findings and operational mitigations are documented
- Forward uncharted controlling obstacle position and elevation data to the procedure designer
- Ensure that recorded data are processed and archived together with the IFP and validation documentation

# Validation conclusion

- Assess the results of the validation process as follows:
  - Review all aspects of the validation process to complete the assessment.
  - Make a determination of satisfactory or unsatisfactory results, based on criteria established by the State.

- For satisfactory validation, complete the IFP processing as follows:
  - Ensure the completeness and correctness of the IFP package to be forwarded.
  - Propose suggestions for improved operation of the procedure when such factors are outside the scope of the procedure design (e.g. ATC issues).

- For unsatisfactory validation, return the IFP to the procedure designer for corrections:
  - Provide detailed feedback to the procedure designer and other stakeholders.
  - Suggest mitigation and/or corrections for unsatisfactory results.

# Step 9: Review with Stakeholders

# Step 10: Procedure Approval

# Review with Stakeholders

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Once Validation accomplished:

- ❑ All stakeholders should be consulted to get their opinion on the proposed final procedure

- ❑ Gathering their input at this stage allows the creation of a statement on the fulfilment of the initially agreed requirements *(at the "Kick Off Meeting")*

A "Detailed Design Review" meeting should be organized



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# Procedure Approval

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- Once Validation accomplished
- Once reviewed by stakeholders
- Clear organisation = Clear responsible and efficient process

*Extract of ICAO 9906 Vol. 1:*

"The IFP must be approved by the State or by an authority designated by the State, prior to publication. This approval process must ensure that all the appropriate steps within the IFP process have been completed, documented and signed off by the competent authority"



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# Example of organisation – in France

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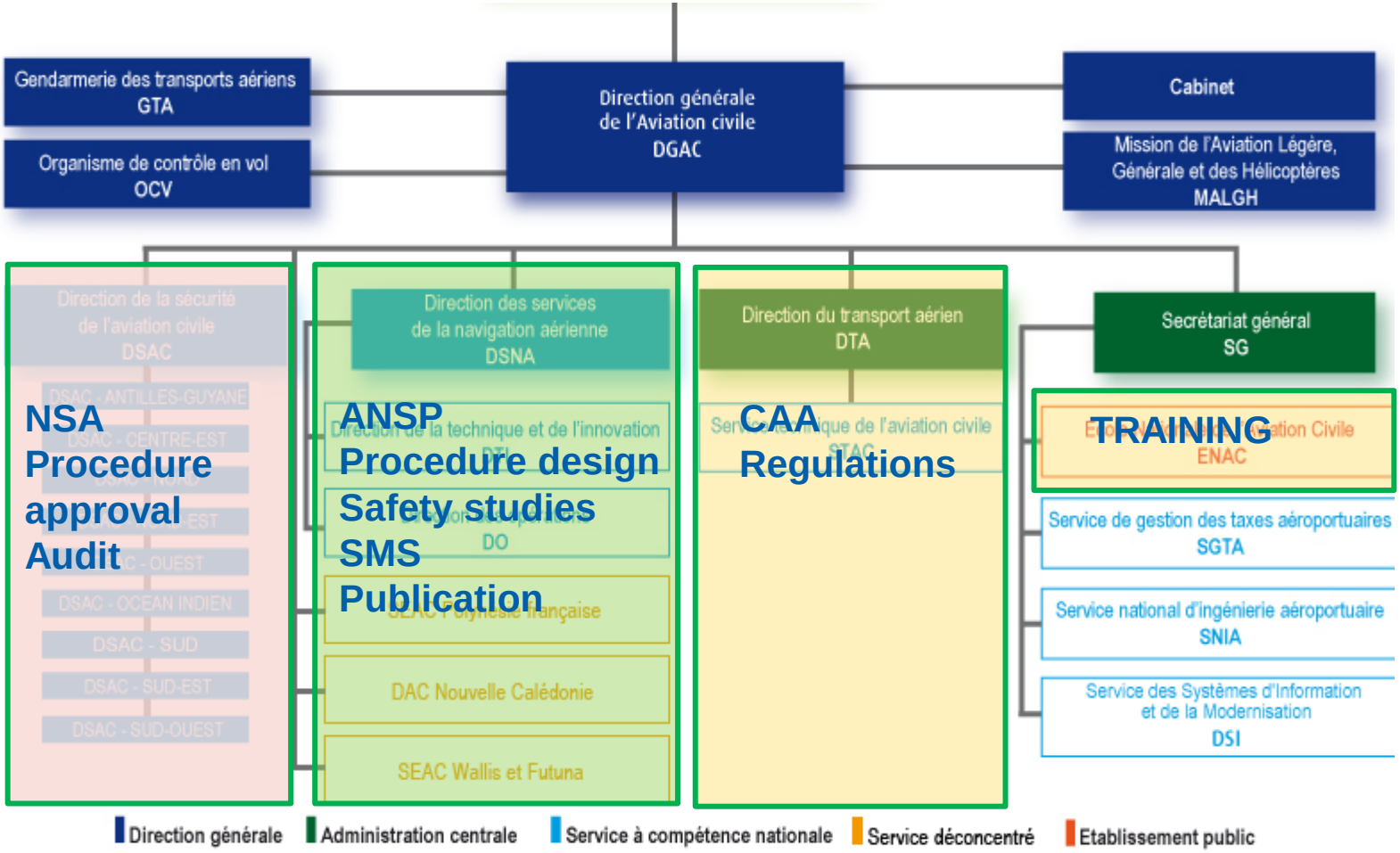




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# Procedure Approval is different from Operational approval

# Recommendations & Regulations

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Applicable recommendations & regulations used for design are the base for the validation requirements:

| PROCEDURE APPROVAL | | |
|---|---|---|
| Procedure Design | ICAO | DOC 9905 & 8168 |
| Procedure Validation | ICAO | DOC 9906 volume 5<br>*Validation of Instrument Flight Procedures* |

**OPERATIONAL APPROVAL**

Local Regulations – (where applicable)

| | | |
|---|---|---|
| Operational Approval | FAA | AC90-101A<br>*Approval Guidance for RNP Procedures with AR* |
| | EASA | AMC 20-26 *for RNP AR Operations*<br>*AMC 20-27 for RNP APCH* |





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# Performance Based Navigation (**PBN)** solutions

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## Any Questions?



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