ENAC

La référence aéronautique

PBN GO TEAM
Tunis, 24-28 February 2014

PBN procedures
design training, Quality Assurance and Oversight

D. Szymanski, ENAC PANS-OPS Office

Who am I ?

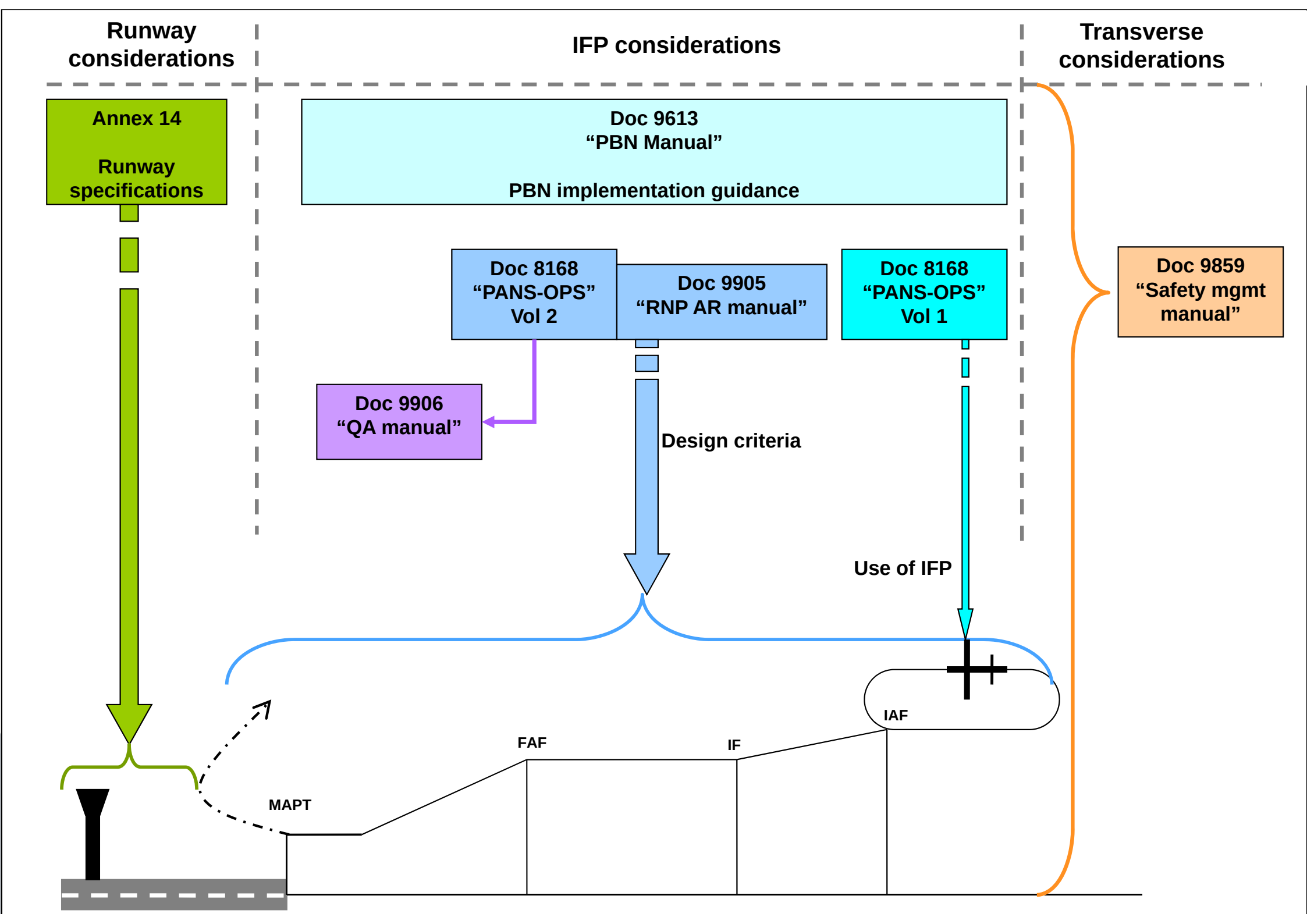
- 1990 : graduated Civil Aviation Technician (ENAC)
- 1990-1993 : Air Traffic Controller (Merville, north of France)
- 1993-1996 : Computer maintenance, software development and user training (Bordeaux)
- 1996-1999 : ENAC Engineer course and graduation (Toulouse)
- 1999-2002 : Quality engineer (Paris CDG Airport)
- 2002-2007 : ATCO training inspector (Air law teacher, ENAC)
- 2007-2011 : Human factors and SESAR Project (DTI, Toulouse)
- 2011- ? : Head of PANS-OPS Office (ENAC)

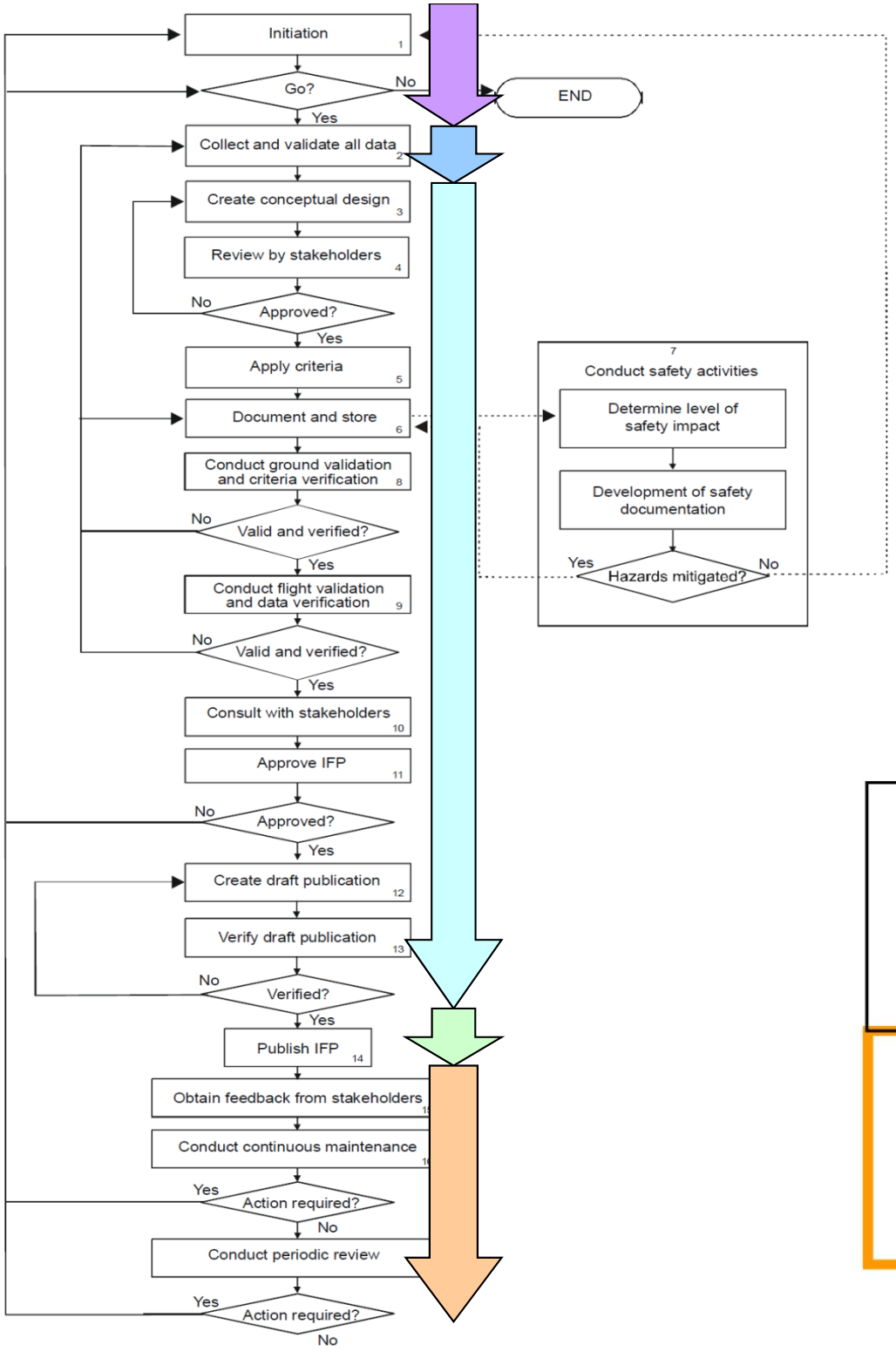
Schedule

- Procedure design process
- Designer training
  - Example : ENAC training programme
- Quality Assurance for procedure design
  - The notion of quality
  - Quality assurance provisions
  - QA in the IFP implementation process
  - QA as a pre requisite
- Oversight activities

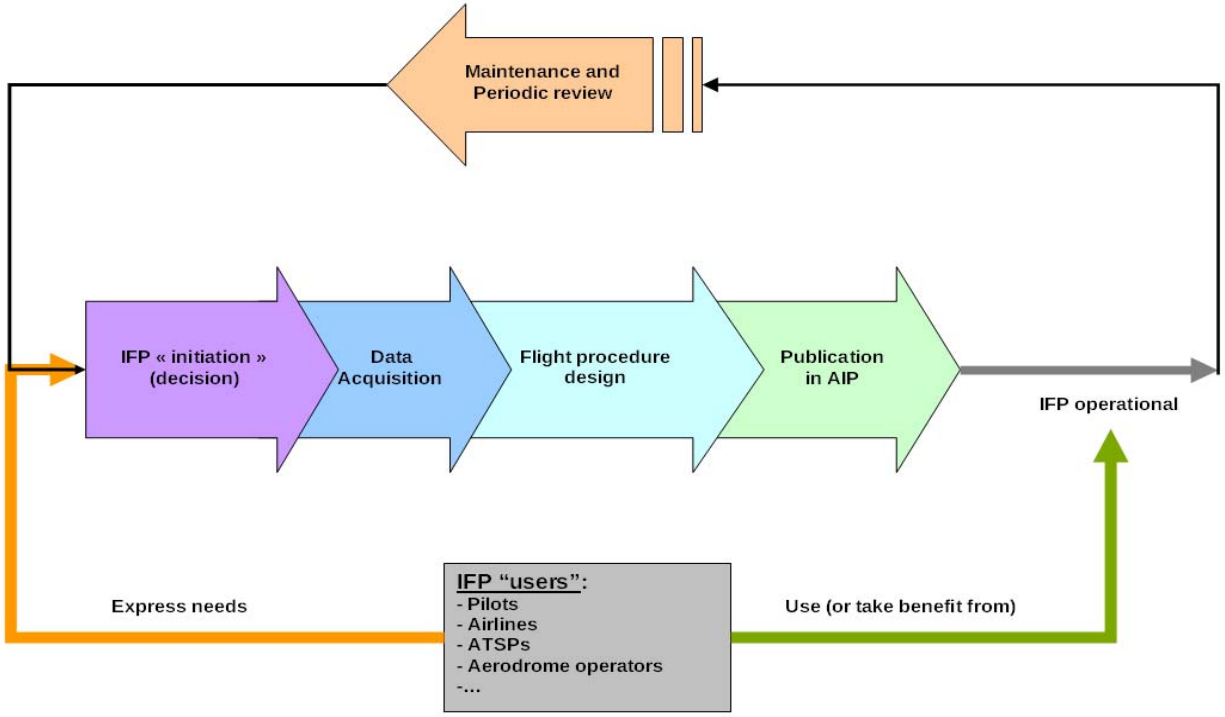
Reference documentation

- Doc 8168 “PANS-OPS”
- Doc 9613 “PBN Manual”
- Doc 9905 “RNP AR design manual”
- Doc 9906 “Quality assurance manual”
- Doc 9859 “Safety management manual”

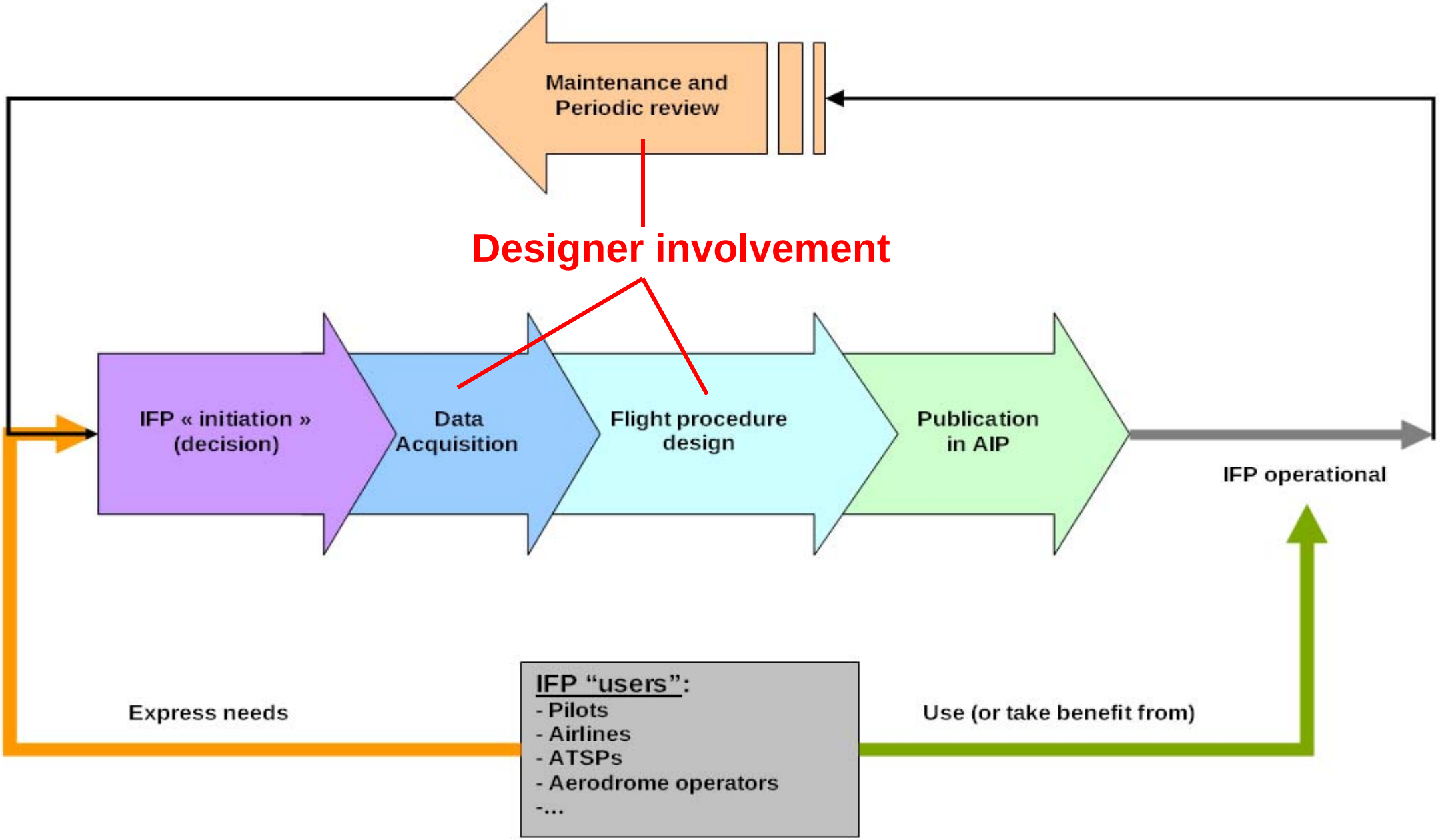

Runway considerations
IFP considerations
Transverse considerations
Annex 14
Runway specifications
Doc 9613
“PBN Manual”
PBN implementation guidance
Doc 8168
“PANS-OPS”
Vol 2
Doc 9905
“RNP AR manual”
Doc 8168
“PANS-OPS”
Vol 1
Doc 9859
“Safety mgmt manual”
Doc 9906
“QA manual”
Design criteria
Use of IFP
IAF
FAF
IF
MAPT



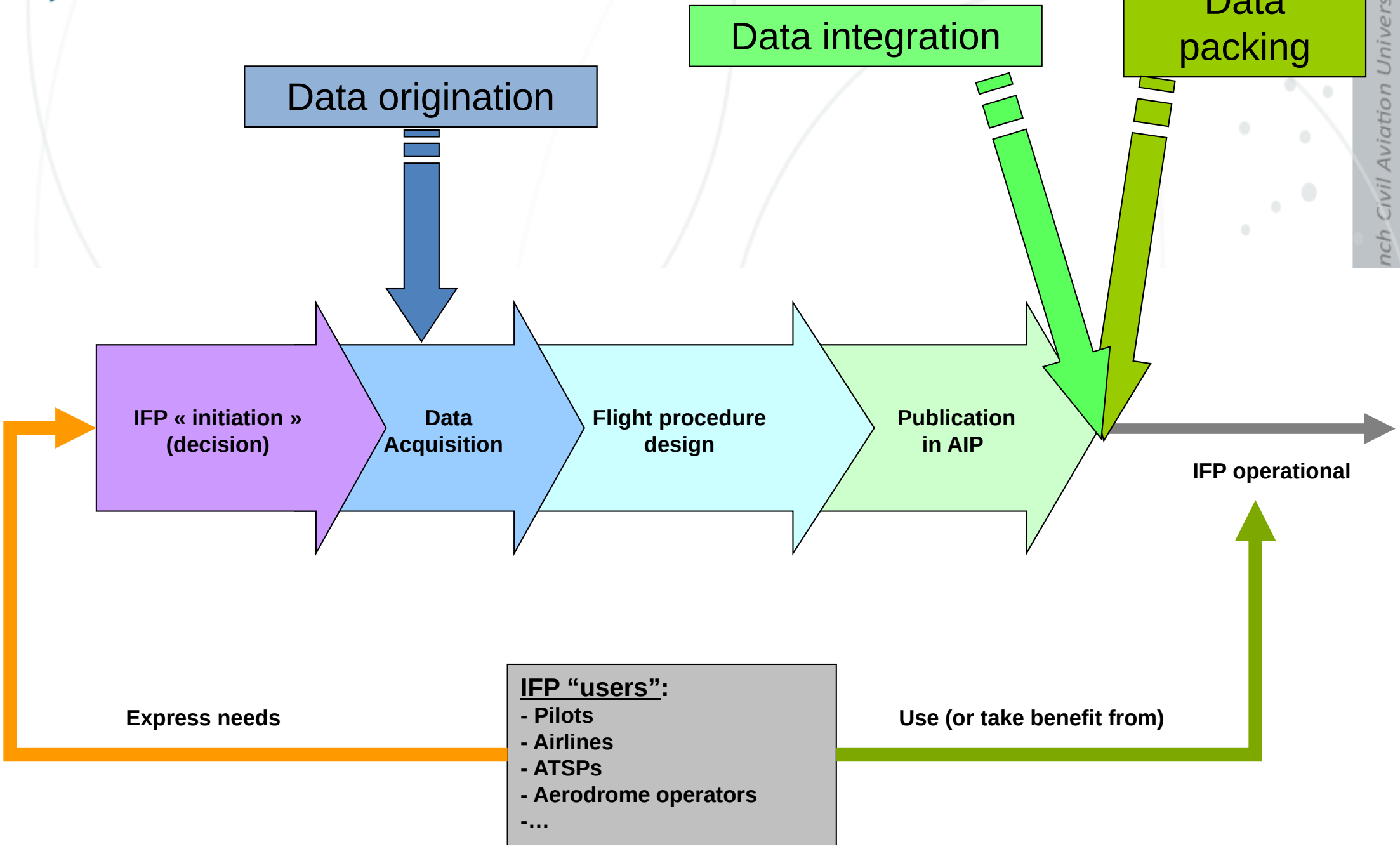
- Doc 9906 details 17 steps
- Correspond to different “sub processes” of an “overall process”



Overall IFP implementation process



III- Other related processes



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Competency ≠ Training

- Competency-based approach of the training
- Job and task analysis to produce a competency framework
- i.e.

4.9	Design RNP approach (RNP APCH) procedure			
	4.9.1	Collect and validate electronic/paper data for RNP approach (RNP APCH) procedure	III-1-2	AN 15, Ch. 2, App. 7, App. 8 AN 14, Ch. 2, Ch. 4
	4.9.2	Apply criteria for RNP approach (RNP APCH) procedure	III-1-2 III-3-2 and 3	
	4.9.3	Establish Minimum Sector Altitudes (MSA, if applicable)	I-4-8	
	4.9.4	Apply the T/Y-Bar concept (if applicable)	III-2-3	
	4.9.5	Establish Terminal Arrival Altitudes (TAA, if applicable)	III-2-4	
	4.9.6	Document and store RNP approach (RNP APCH) procedure	III-1-2 III-3-2 and 3	AN 15, Ch. 3

Skills, Knowledge and Attitudes

- Demonstrate 3D vizualisation (skill)
  - What are the different types of terrain data (knowledge)
  - Interpreting cartographic map (skill)
  - …
- Demonstrate ability to work as part of a team (ability)
  - Communication (skill)
  - Negotiation (skill)
  - Groupwork facilitation (skill)
  - …
- Criticism (attitude)
- …

Different levels of training

- Ab initio
  - Give the trainee entry skills and knowledge to start initial training
- Initial training
  - First phase of training, providing basic skills and knowledge to move onto OJT
- On the job training
  - Reinforce formal training and support the consolidation of acquired skills and knowledge
- Advanced training
  - Augment the skills and knowledge of procedure designer to deal with more complex design problems
- Recurrent training
  - Knowledge and skills update to address changes in regulations.
- Refresher training
  - Strengthen skills and knowledge that have weakened through disuse or passage of time.

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Designer training

- 3 linked modules
  - 1 : General criteria and Non Precision Approach
  - 2 : RNAV/PBN Non Precision Approach and departure
  - 3 : Approach with Vertical Guidance (PA and APV)
- Spread on one year
- Allows on the job training between two modules
- Optional 4th module : Helicopter Approaches (for confirmed designers)

Airspace Design for Terminal Airspace Optimization

- 2 weeks session (June 2014)
- Provide theoretical background in PBN, design of airspace, particularly in lower airspace and terminal areas.
- Two practical workshop allows participants to take part in the different steps of the design of a new TMA and new procedures on real cases.

PBN Oversight

- 5 days session (June 2014)
- PBN and the way it has been introduced in the french oversight process
- Focuses on
  - Quality Assurance Process associated to procedure design activities,
  - Enforcement of PBN operations by aircraft operators and the associated oversight.

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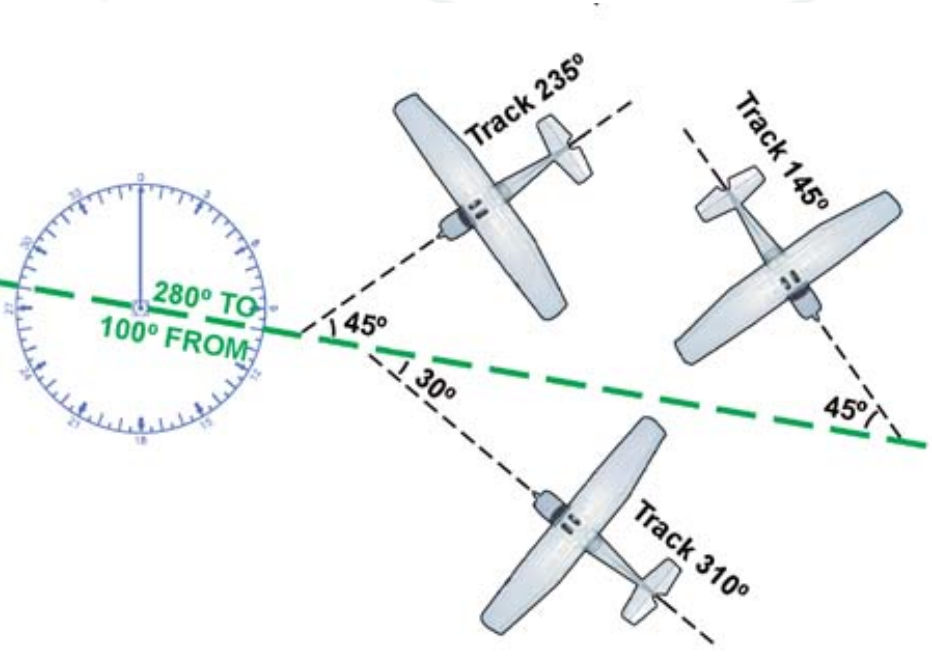
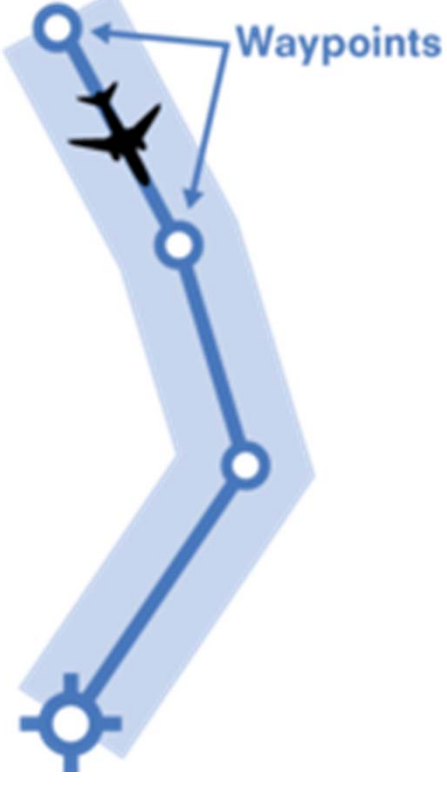
The notion of quality

As stated in ICAO annex 15:

- PBN implementation increases the criticality of aeronautical information and data:
  - Use of coded waypoints instead of direct guidance by Navaids (SiS)
  - Airborne computer-based navigation with data basis





The notion of quality

- The safety of air navigation can potentially be affected by:
  - Erroneous aeronautical information/data
  - Corrupt aeronautical information/data
- IFPs are one of the most critical type of aeronautical information/data
- RNP IFPs are even more critical because they strongly rely on data that is:
  - Published
  - Coded

The notion of quality

- Quality assurance :
  - Contains necessary and sufficient actions undertaken to ensure the quality of a final product
  - Should be:
    - Systematic (same causes => same consequences)
    - Documented
- Quality = what the final user expects of a product, either:
  - Explicitly (marketing)
  - Implicitly !
- Quality includes:
  - Safety
  - Performance
  - Environment

The notion of quality

- QA goals in terms of safety:
  - Minimize the possibility of errors during the design and implementation process
  - Identify errors that do occur before they impact safety
  - Provide continuous improvement of the process to avoid future errors

- For IFPs, the “final users” (from which quality requirements come from) are:
  - Pilots
  - Aircraft operators
  - ATSPs
  - Aerodrome operators
  - States

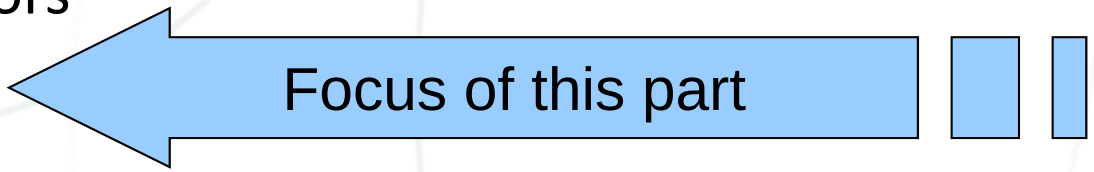
The notion of quality

- The product users will not have quality at all cost
  - One user requirement is to have a good quality/cost ratio
  - Nobody will buy 100% reliable product at an infinite price
  - Most will buy a 99% reliable product at a moderate price

- Quality implies a compromise between:
  - Performance
  - Cost
- The resources needed to ensure the quality of IFPs (or any product) must be controlled

The notion of quality

- Quality assurance system: a coherent set of documented processes that ensure the quality of IFPs
- Many stakeholders => Not a single QAS
- “distributed QAS”:
  - Data originators
  - IFP designers
  - AISPs
  - Data integrators
  - Data packers



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QA provisions

- ICAO level:
  - Description of the ≠ QA activities to be undertaken
  - Guidance on the processes to be implemented:
    - ICAO doc 8168 (vol II) => high level provisions
    - ICAO doc 9906 (QAM) => detailed provisions
- State level:
  - National regulation
    - Acceptable Means of Compliance
    - Guidance Material
- Individual stakeholder level:
  - Enforce QA activities
  - Document a QAS

QA provisions

- ICAO doc 8168 (vol II)
  - High level provisions
  - Defines the framework for the QA process
  - Details are in ICAO doc 9906 - QAM
- Part I - Section 2 – Chapter 4

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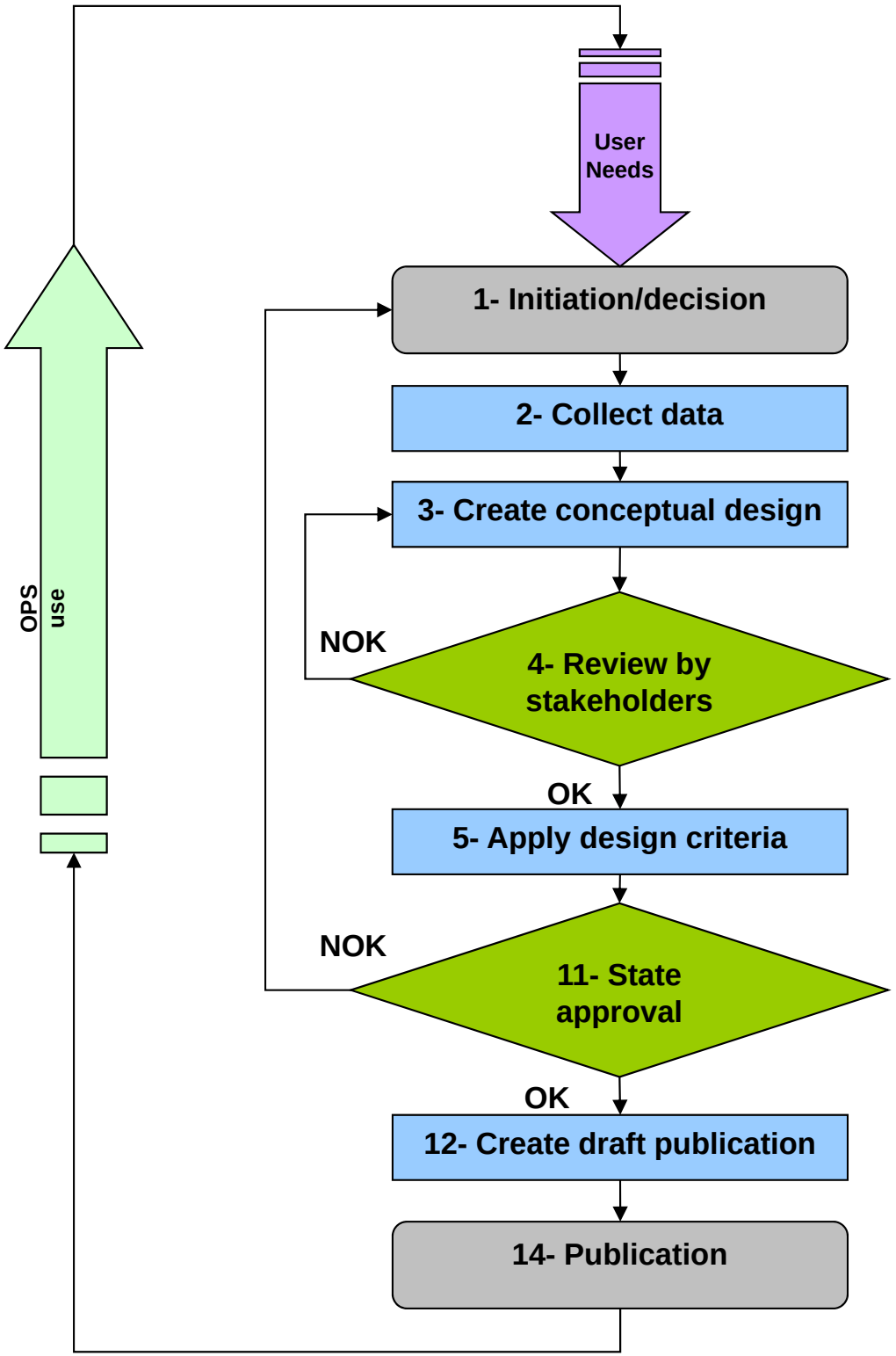
QA in IFP implementation

- Some QA activities are de-correlated from:
  - IFP design processes
  - IFP implementation process

=> constitute pre-requisites before these processes can begin

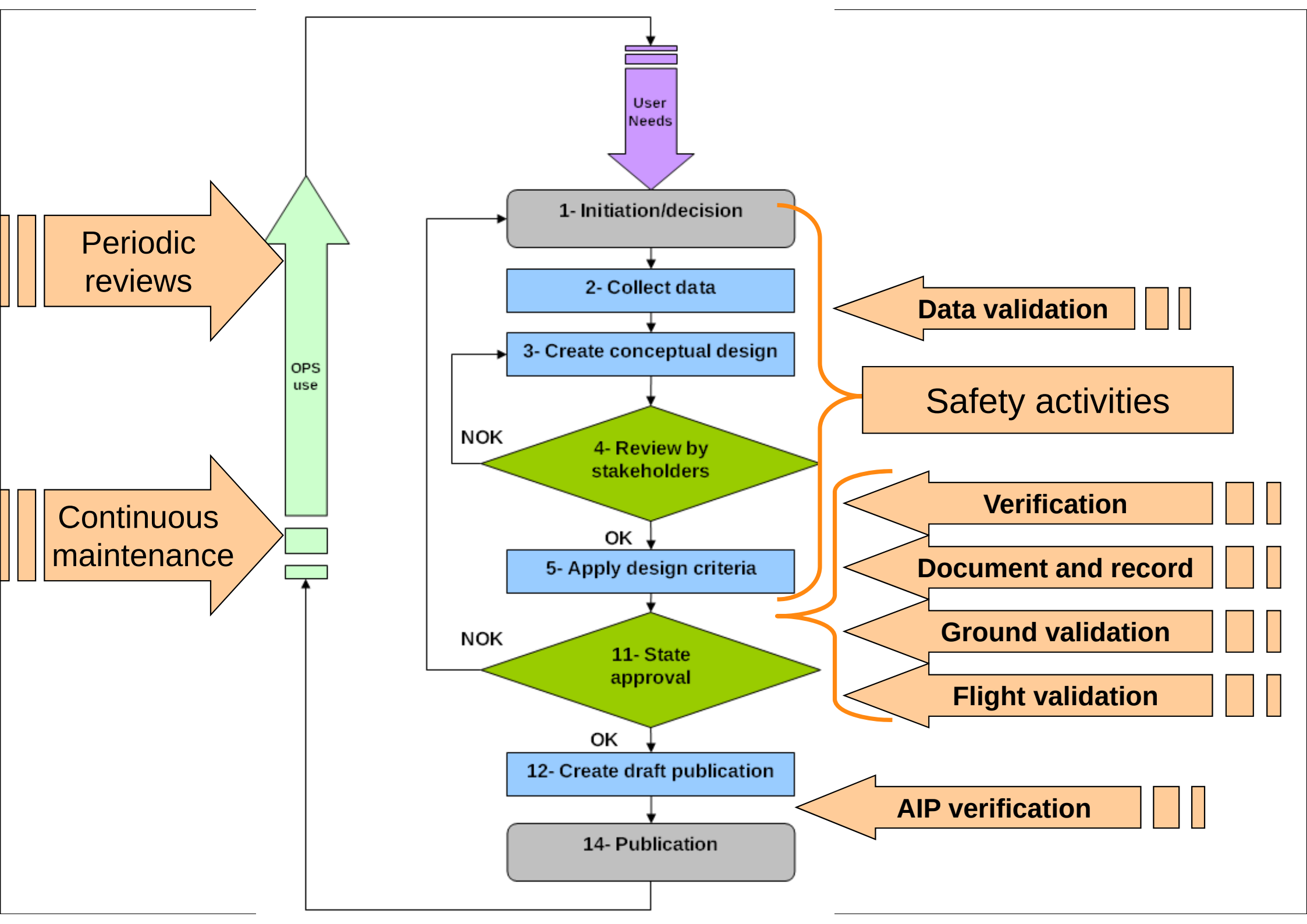
- Several QA activities take place during the IFP implementation process

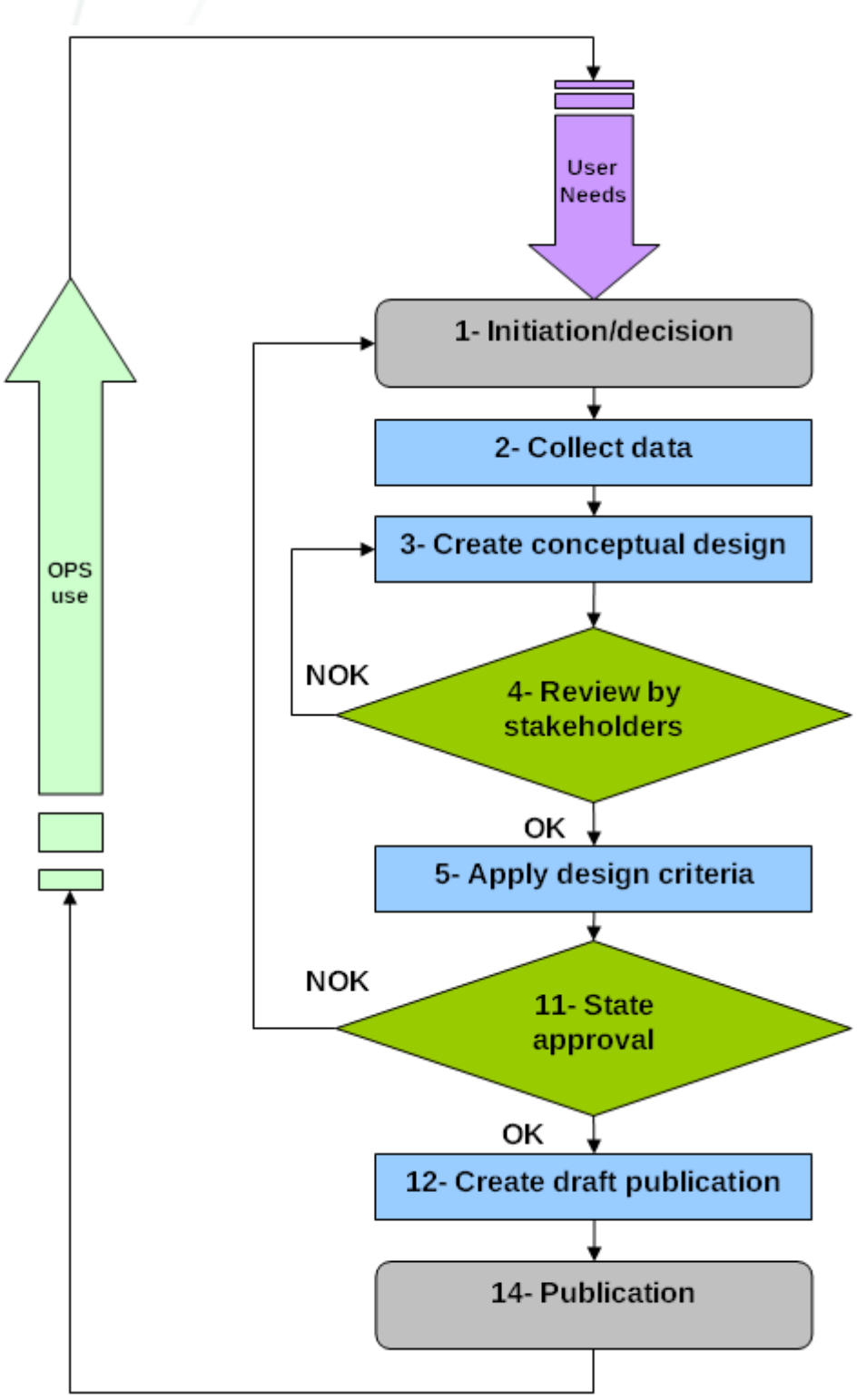


- The IFP implementation process is quite simple without the “quality control” steps
- Two types of quality assurance :
  - Control steps embedded in the IFP implementation process:
    - Reviews
    - Studies
    - Verifications
    - Validations
    - …
  - Prerequisites to the IFP design process:
    - Software validation
    - IFP designers training
    - …

⇒ Minimizes the risk of errors

⇒ Rises the complexity of the process


User Needs
1- Initiation/decision
2- Collect data
3- Create conceptual design
4- Review by stakeholders
NOK
OK
5- Apply design criteria
11- State approval
NOK
OK
12- Create draft publication
14- Publication
OPS use
Periodic reviews
Continuous maintenance
Safety activities
Data validation
Verification
Document and record
Ground validation
Flight validation
AIP verification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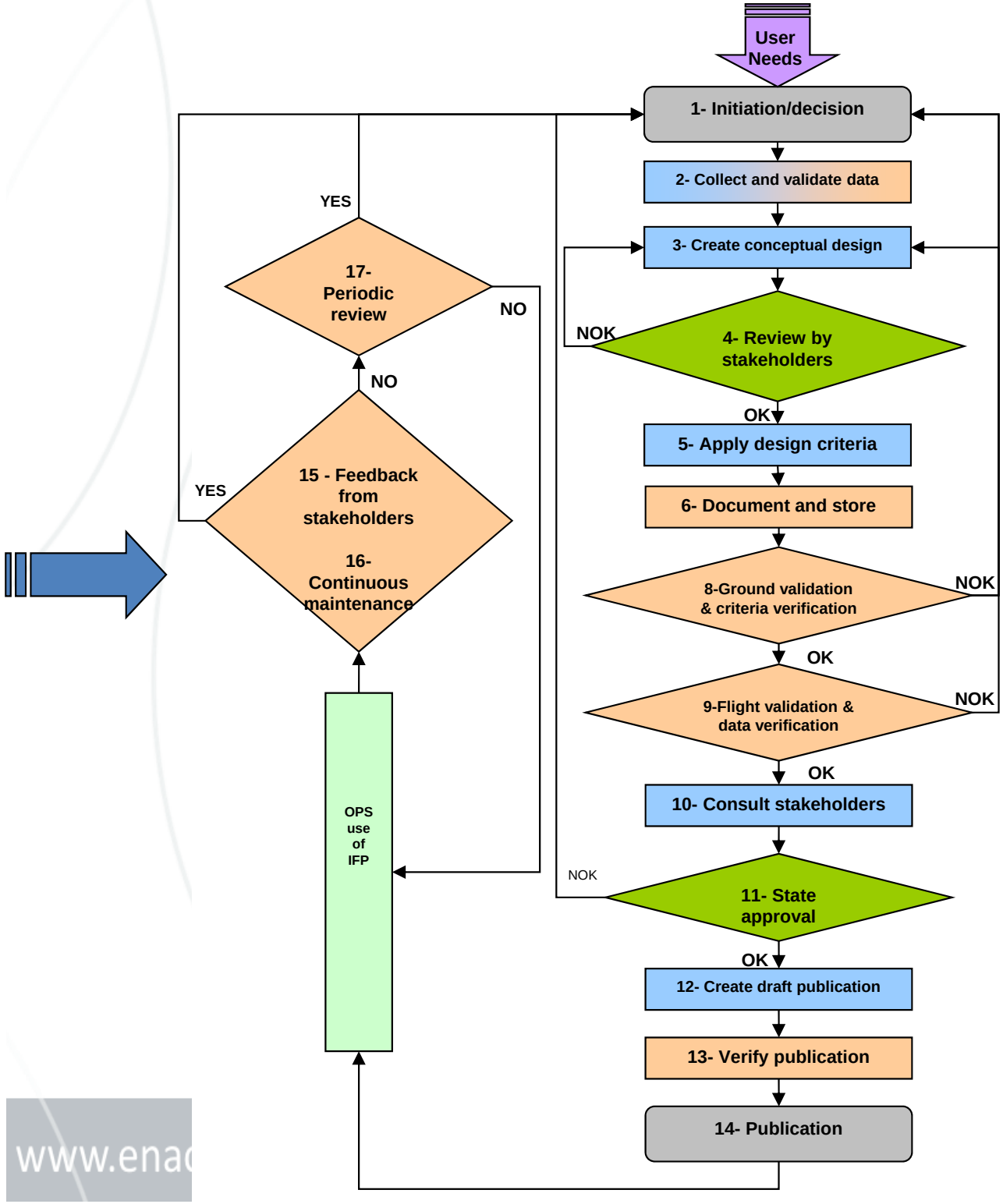
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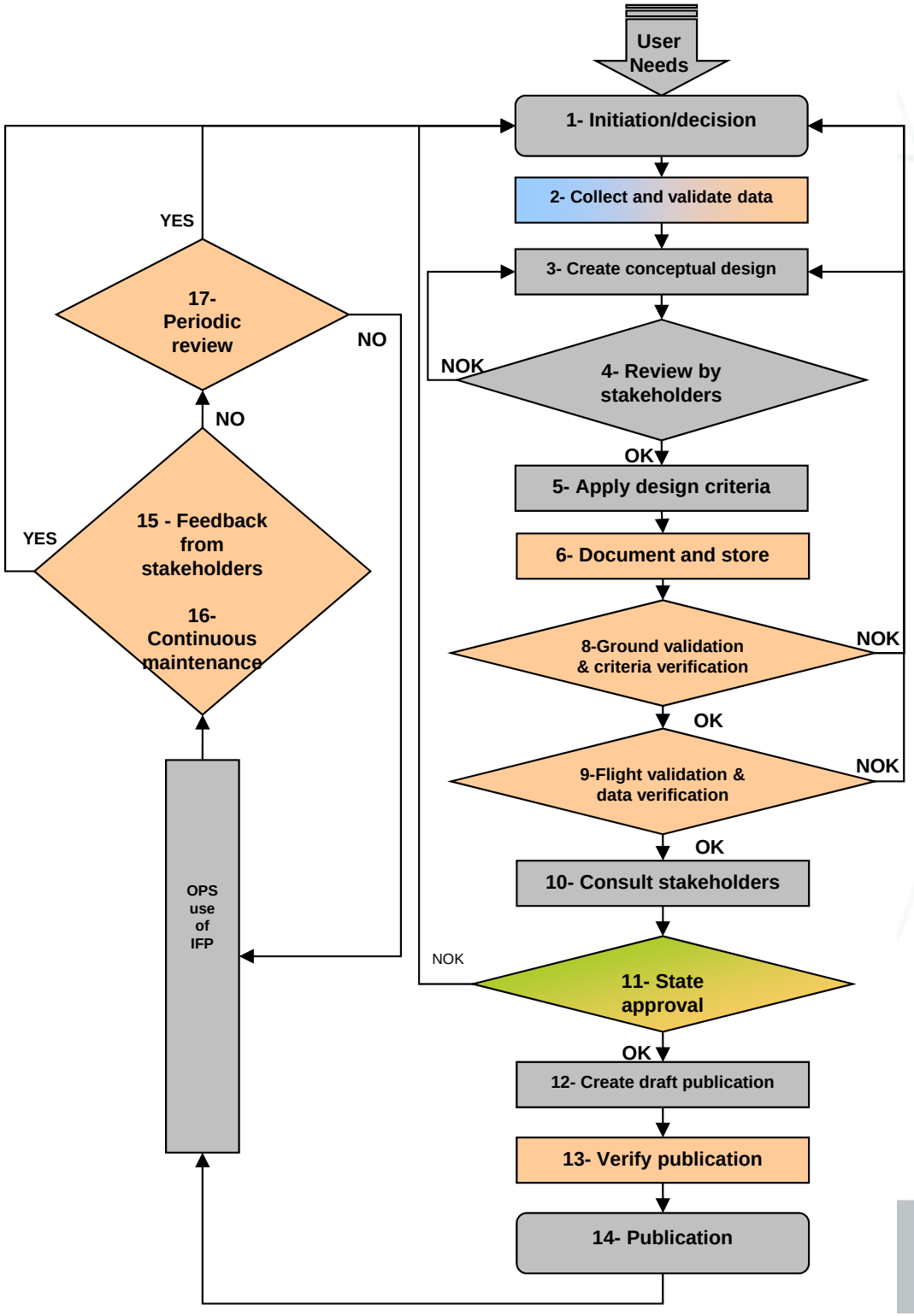
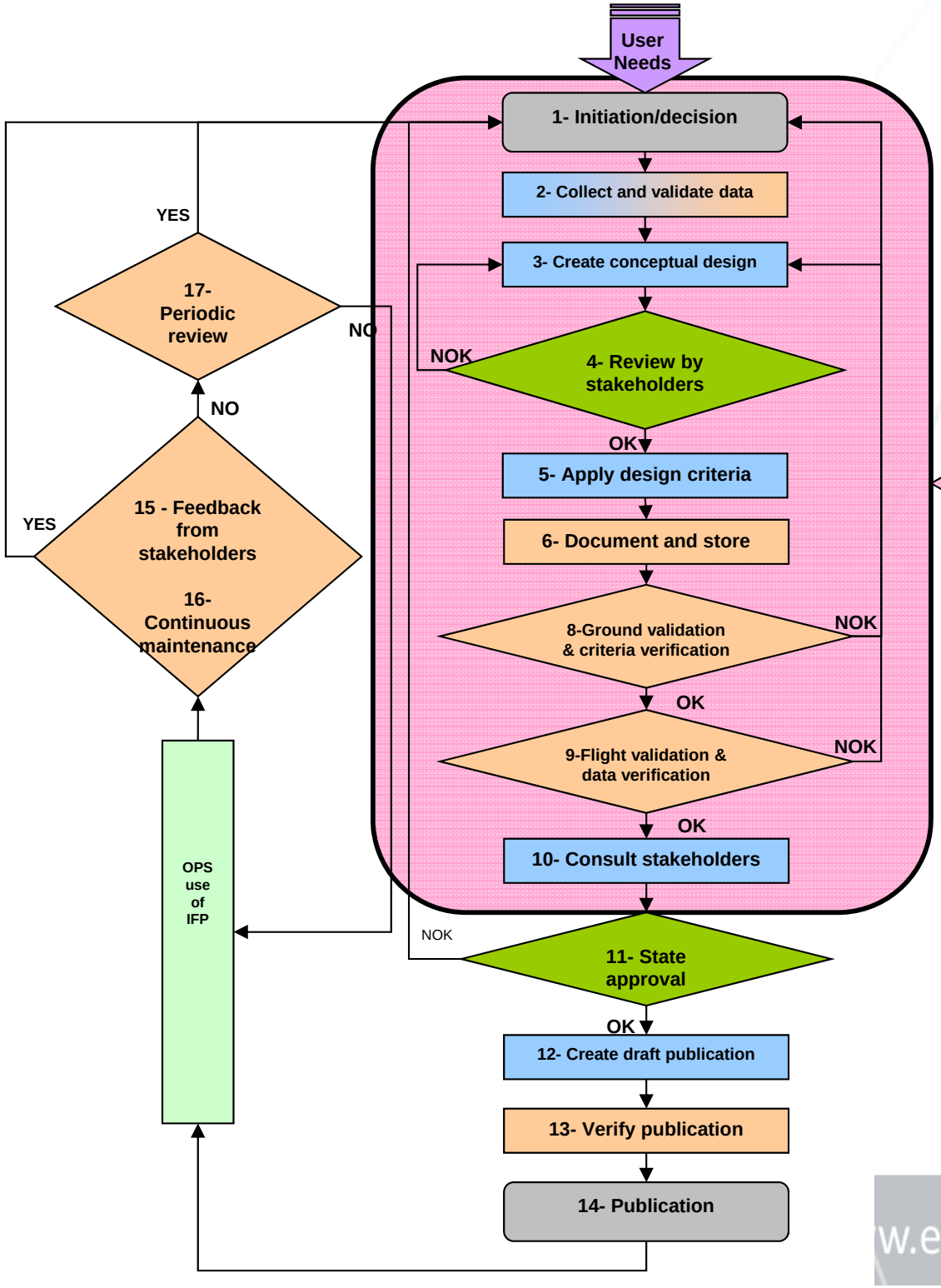
NOK
OK
9-Flight validation & data verification
NOK
OK
10- Consult stakeholders
11- State approval
NOK
OK
12- Create draft publication
13- Verify publication
14- Publication
YES
17- Periodic review
NO
NO
15 - Feedback from stakeholders
YES
16- Continuous maintenance
OPS use of IFP

QA in IFP implementation

- Data validation
- Documentation and recording
- Design criteria verification
- Ground validation
- Flight validation (and data verification)
- Safety assessment activities
- Approval
- Publication verification
- Continuous maintenance
- Periodic reviews

Quality control steps/activities





7- Safety assessment activities

QA in IFP implementation

Safety assessment

WHAT ?

- Safety assessment (SA) = a set of activities undertaken to give sufficient confidence to an organisation that a concept is acceptably safe
- Important “quality control” step to validate:
  - A new IFP
  - A new PBN concept
- Proactive management of safety associated to “changes”
- Assumption:
  - the “baseline” operations is safe
  - Risks arise from “changes” made to the operational system

QA in IFP implementation

Safety assessment

WHEN ?

- SA activities start at the beginning of the project (as soon as possible)
- Conclusions of SA to be taken into account into IFP design and implementation
- SA must have reached its conclusions before submitting the IFP to state approval

QA in IFP implementation

Safety assessment

WHO ?

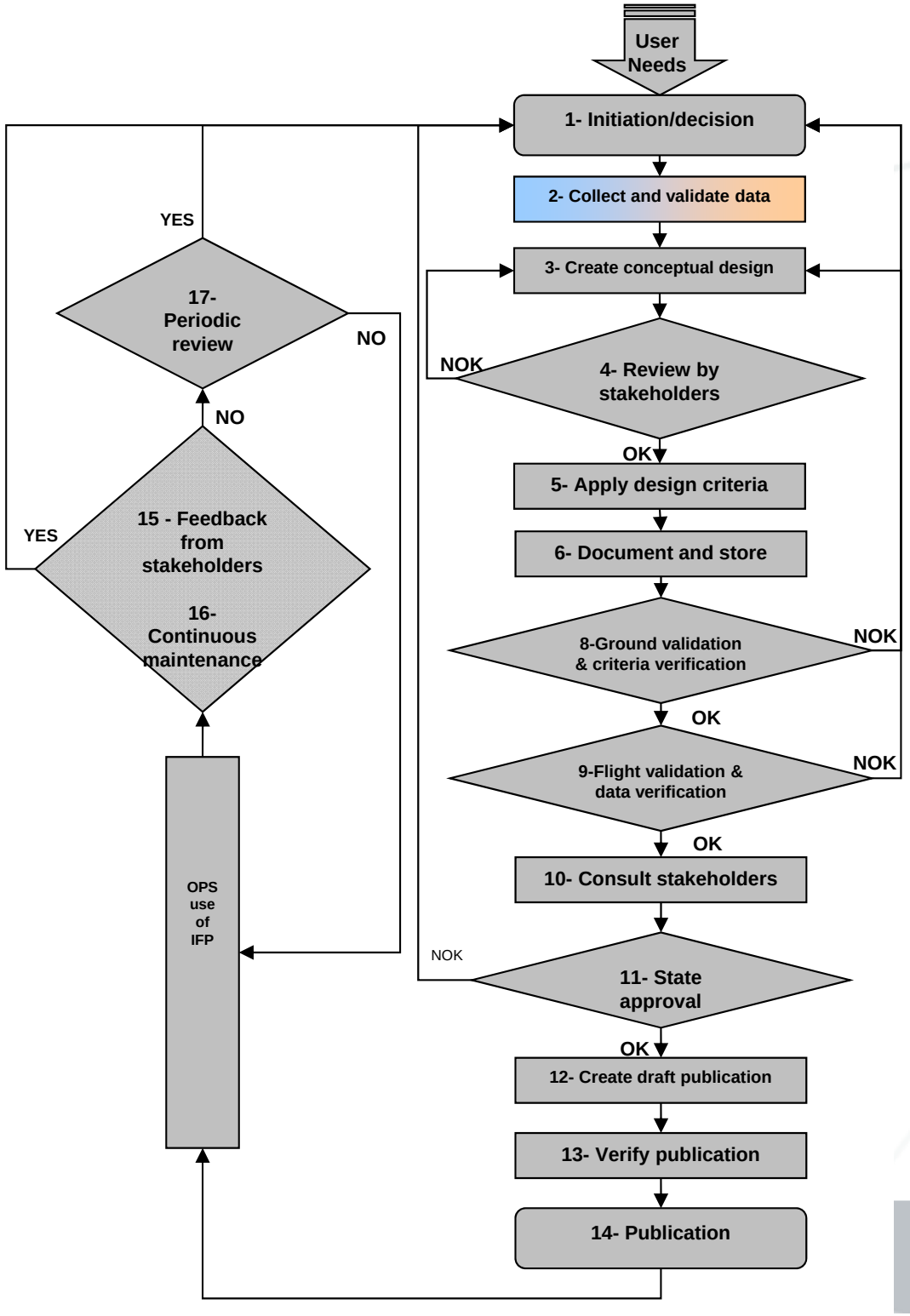
- SA activities can involve many stakeholders but:
  - One entity should have the lead
  - One entity should be responsible in fine that a SA is done
- Depending on national regulation:
  - ATSP
  - Procedure designer
  - Initiating entity (can subcontract the task)

QA in IFP implementation

Safety assessment

HOW ?

- SA activities should be done according to specific methodologies
- ICAO provides guidance in doc 9859 (SMM)
- Eurocontrol® has defined the risk assessment and mitigation methodology in use in Europe : Safety assessment Methodology (SAM)


User Needs
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4- Review by stakeholders
NOK
OK
5- Apply design criteria
6- Document and store
8-Ground validation & criteria verification
NOK
OK
9-Flight validation & data verification
NOK
OK
10- Consult stakeholders
NOK
11- State approval
OK
12- Create draft publication
13- Verify publication
14- Publication
YES
17- Periodic review
NO
NO
YES
15 - Feedback from stakeholders
16- Continuous maintenance
OPS use of IFP

Data validation

Reference documentation for data quality:

- ICAO annex 15:
  - References for measuring system
  - Quality requirements for aeronautical data
- ICAO annex 11 for ATS related data
- ICAO annex 14 for Aerodrome related data
- ICAO Doc 9674 (WGS84 manual)
- ICAO Doc 9881 (DTM, Mapping information)
- Regulation 73/2010 on aeronautical information and data quality (ADQ, concerns data used in IFP design and publication)

QA in IFP implementation

Data validation

- IFP designer has to “validate” the collected data
- Identification and use of “recognized” suppliers:
  - Land surveyors
  - Charting agencies
  - Official AIP
  - MET providers
  - ATSPs
- Get sufficient assurance (from data supplier) of conformity to quality requirements:
  - Integrity
  - Accuracy
  - Resolution

QA in IFP implementation

- IFP designer shall get sufficient confidence the collected data is “up to date”
- Especially true for “obstacle” data:
  - Use of a “recent” obstacle surveys (less than “X” years old)
  - Enquire of potential new obstacles:
    - Growing trees (use of vegetation growth margins)
    - Man made structures (AIO)
- If Data quality is unknown or supposed invalid (e.g.: data supplier does not have a QAS):

  ⇒ Proceed to further verification:
    - cross checks,
    - use of safety buffers,
    - flight validation,
    - formal assessment of the consequences on the IFP.
    - …

QA in IFP implementation

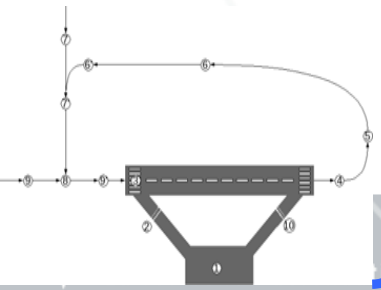
- Ensuring the quality of aeronautical data is the responsibility of the "owner" of the data:
  - AISP
  - Land surveyors
  - Aerodrome operator
  - …

- The "validation" is the responsibility of the IFP designer (validation) = Getting sufficient confidence of the quality of the data necessary for IFP design

QA in IFP implementation

- Data acquisition and validation step to be done whenever an IFP is:
  - Created
  - Modified
  - Maintained
  - Reviewed
- The vector used to transmit the data is critical for integrity

QA in IFP implementation



Data Validation

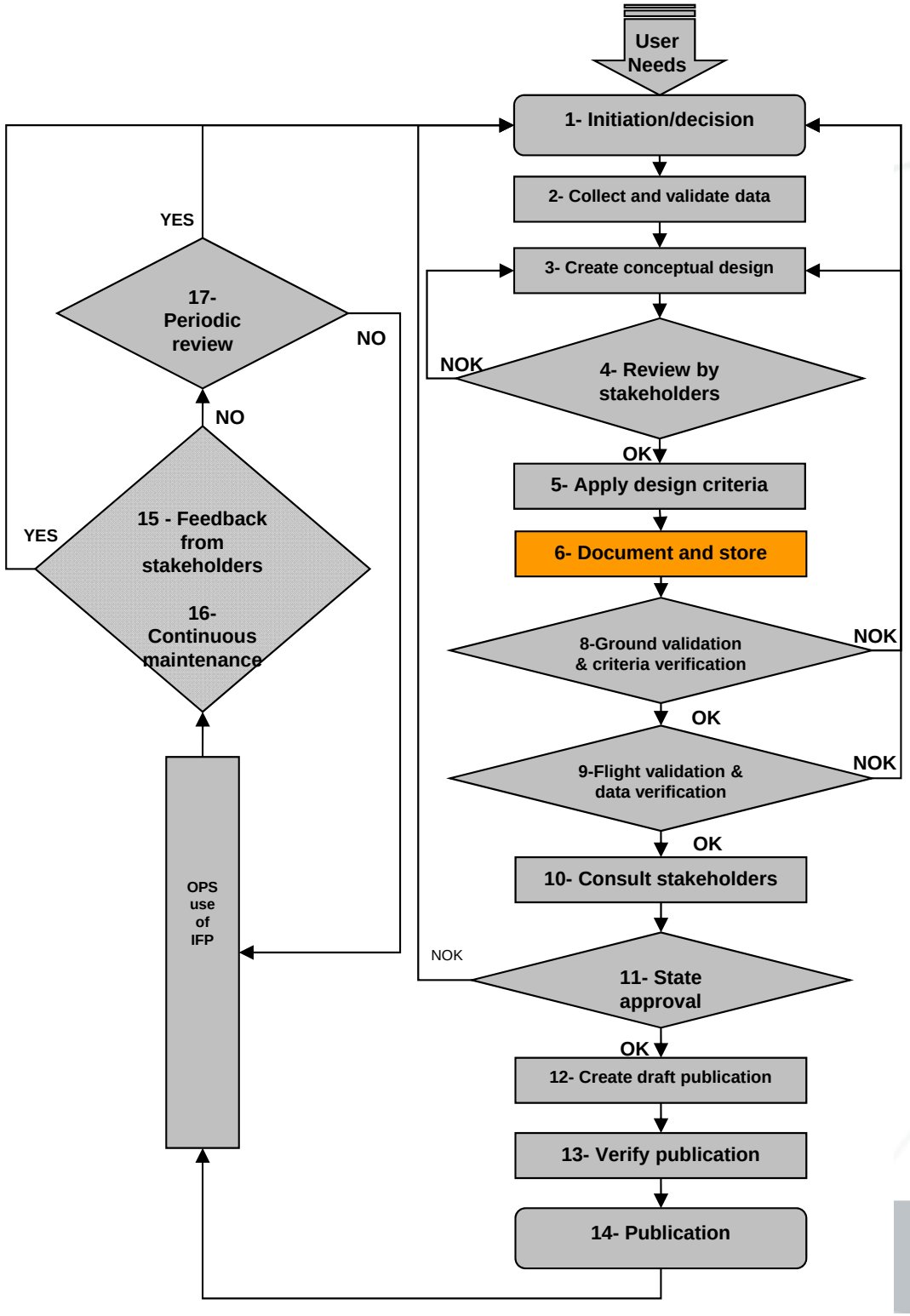
Data collector

Transmission vector

IFP designer

Ensuring initial data quality:
- Integrity
- Accuracy
- Resolution

Maintaining data integrity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YES
17- Periodic review
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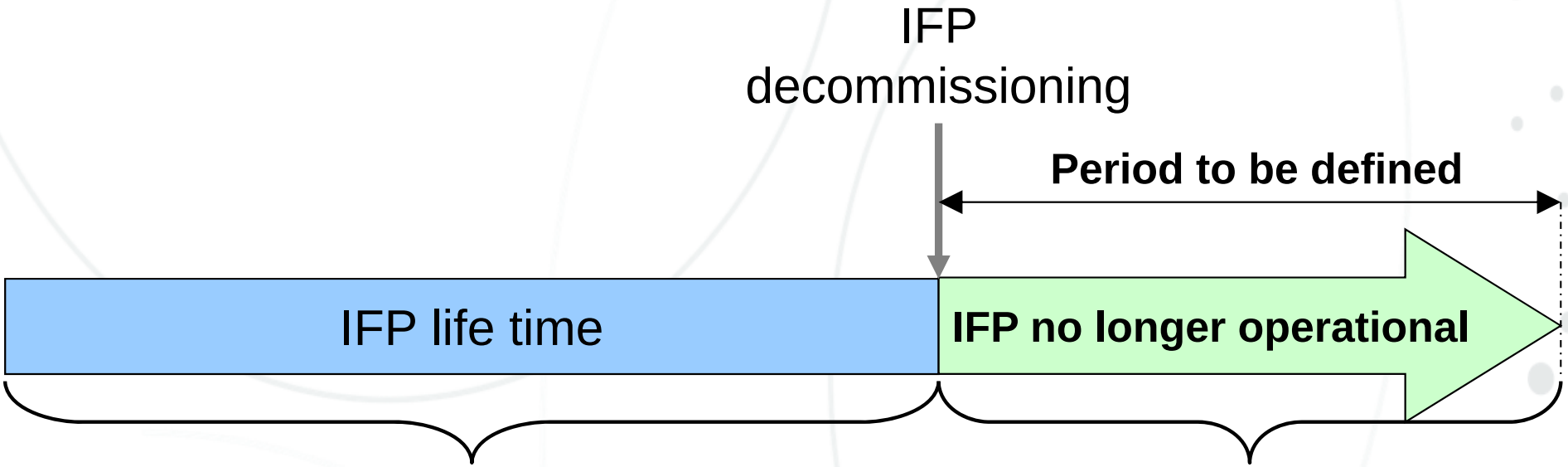
QA in IFP implementation

Documentation and records

- The IFP design process has to be documented and recorded in order to ensure:
  - Traceability
  - Re-usability:
    - Maintenance
    - Review
  - Transparency
  - Liability in case of accident
- Records should at least be kept for the lifetime of the IFP
- States should define minimum archive keeping periods

QA in IFP implementation

Documentation and records



Records for:

- Maintenance
- Reviews
- ...

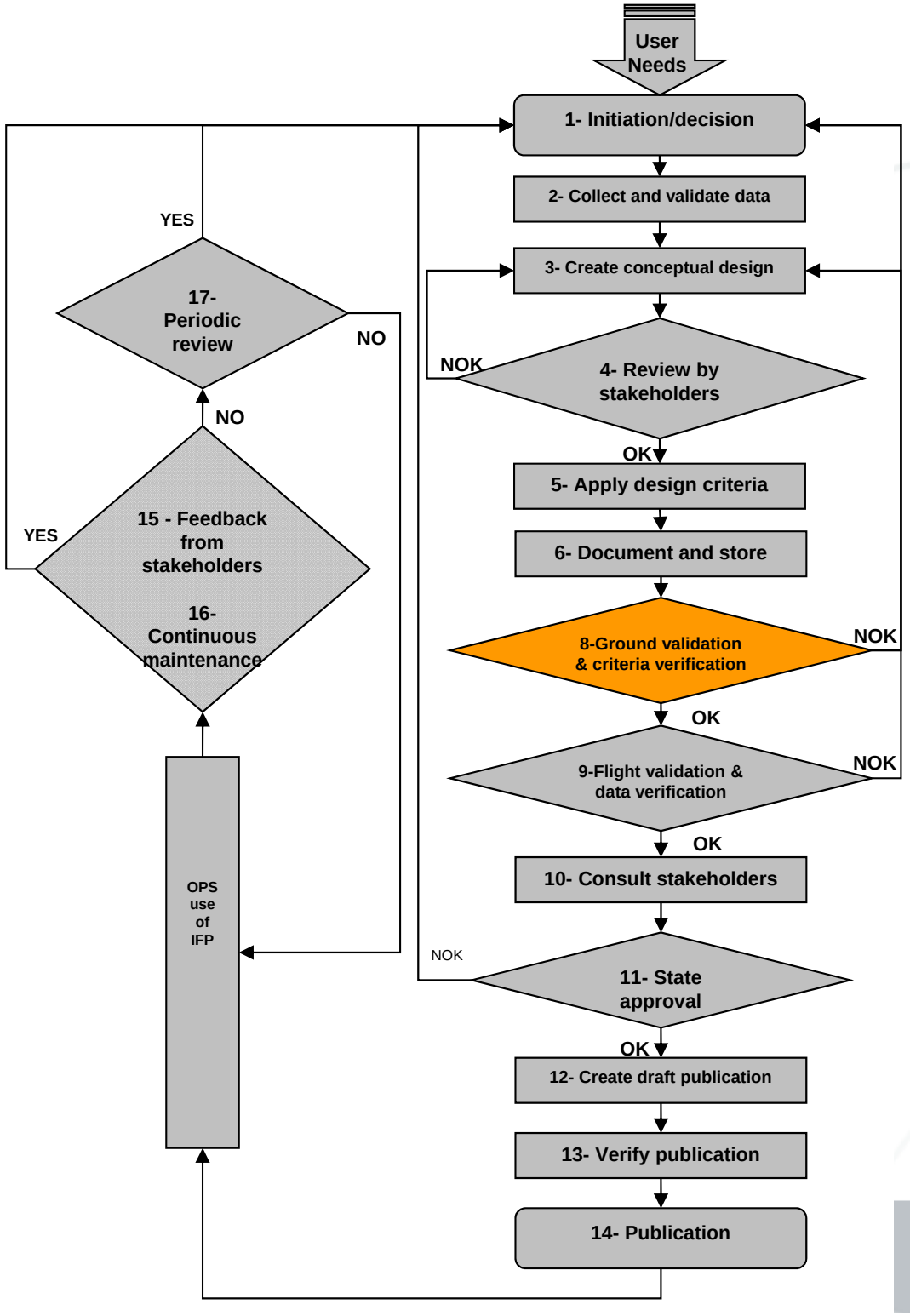
Legal archive:

- Liability (in case of incident/accident)

QA in IFP implementation

Documentation and records

- IFP designer has to document:
  - Necessary data used as input
  - IFP design file:
    - Design criteria and rationale
    - Calculations
    - Parameters
    - Publication drafts (or the data to be put in AIP)
    - Tools and SW
  - Stakeholder feedback
  - Ground and flight validation reports
  - IFP related studies (such as the safety assessment)
- Records should be endorsed, versioned and dated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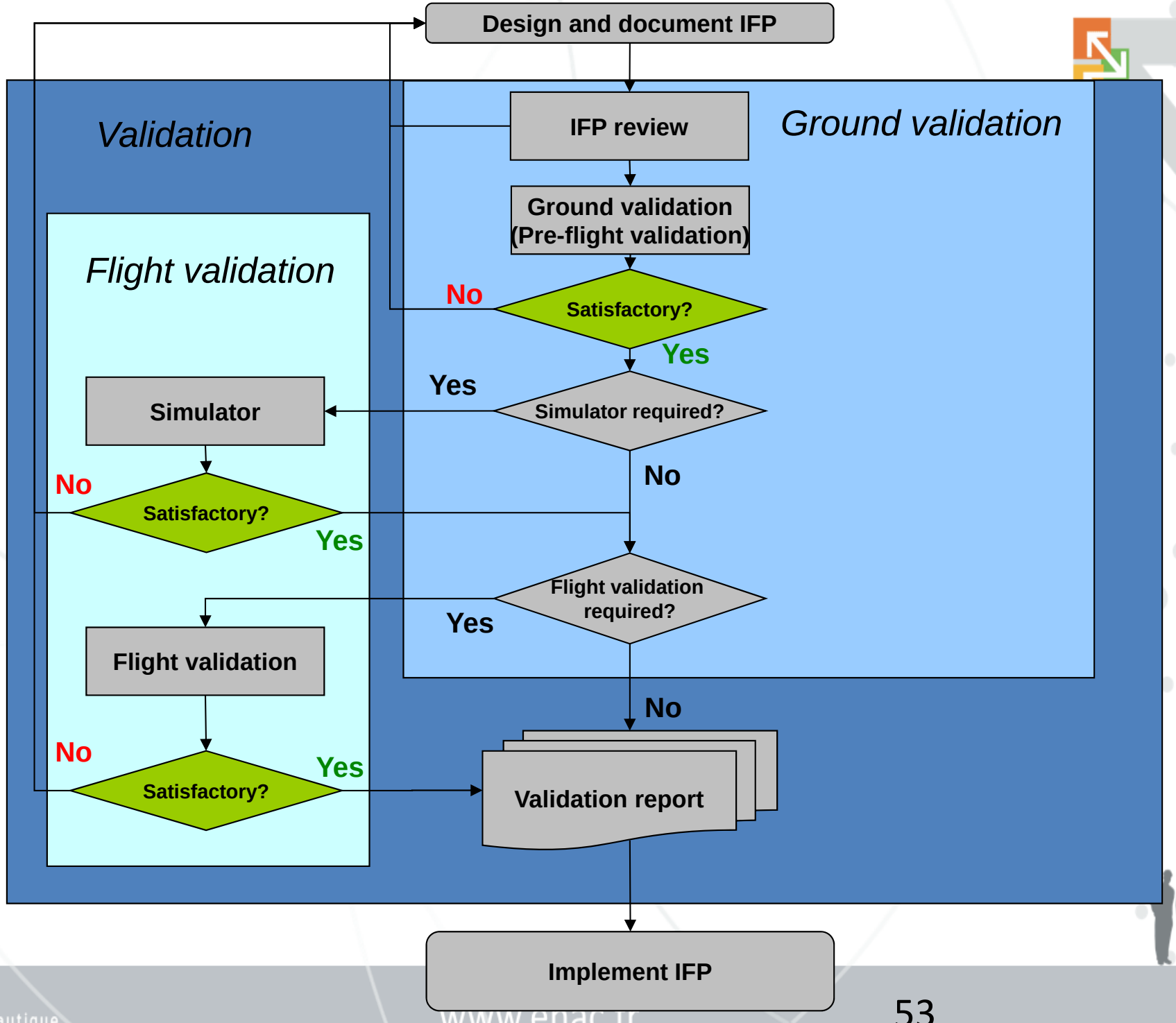
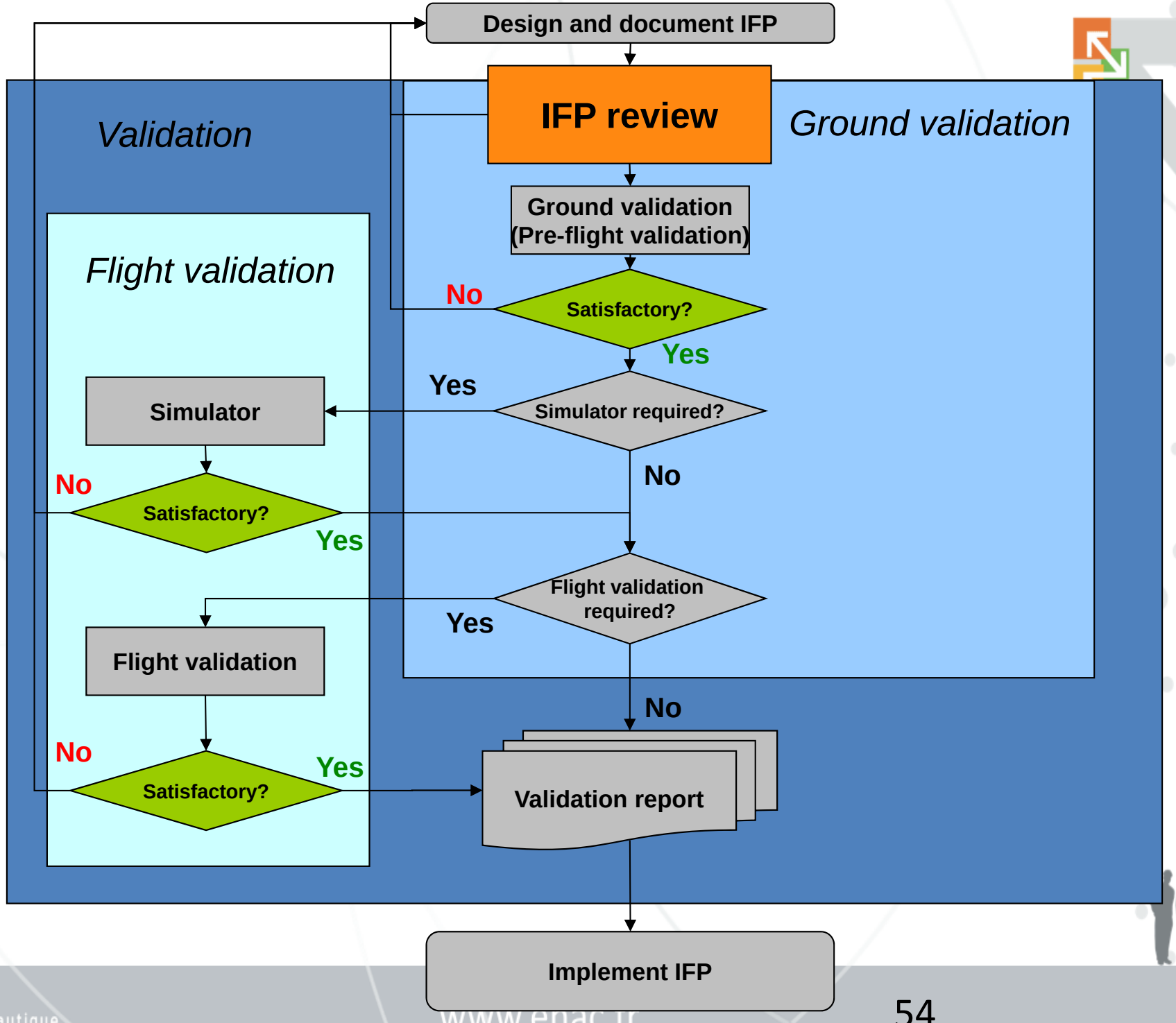

Design and document IFP
Validation
Ground validation
IFP review
Ground validation
(Pre-flight validation)
Flight validation
No
Satisfactory?
Yes
Yes
Simulator
Simulator required?
No
No
Satisfactory?
Yes
Flight validation
required?
Yes
Flight validation
No
No
Satisfactory?
Yes
Validation report
Implement IFP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Flight validation
required?
Yes
Flight validation
No
No
Satisfactory?
Yes
Validation report
Implement IFP

QA in IFP implementation

Criteria verification

- Purpose: ensure the IFP design is complete and correct
- Undertaken by an independent designer (which has not been "involved" in the initial design)
- Can be a designer from another organization
- Consists of a review of the IFP design case:
  - Complete review,
  - or sampling (depending on incoming further validation activities)

QA in IFP implementation

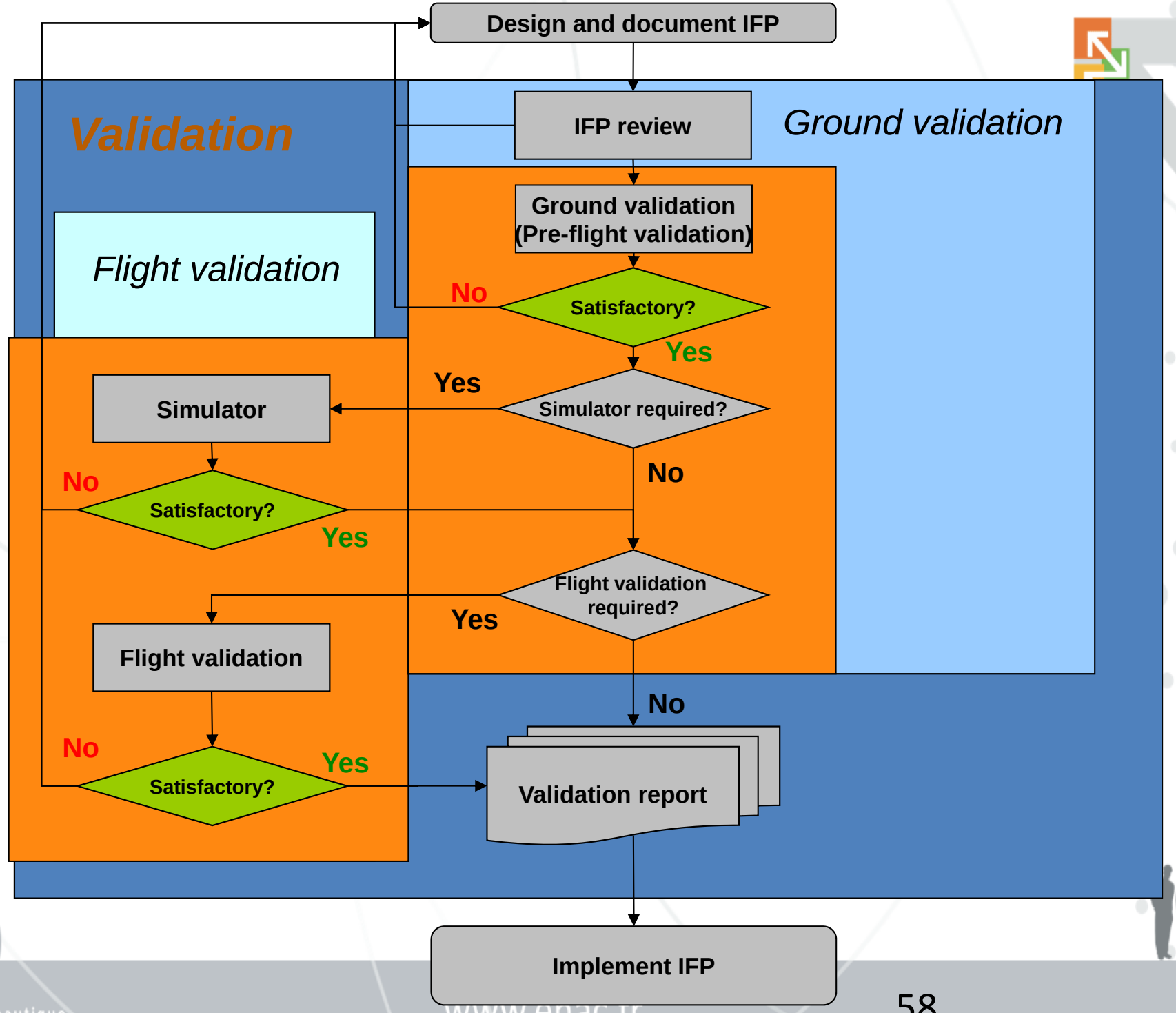
Criteria verification

- The verification should contain both:
  - A review of the design criteria that were used
  - An assessment of the subjective logic of the designed IFP (the IFP designer “choices”)
- The use of independent methods and tools improves the verification effectiveness
- It is not necessary to re-design the IFP from scratch
- The “verificator” designer should endorse the IFP design report

QA in IFP implementation

Criteria verification

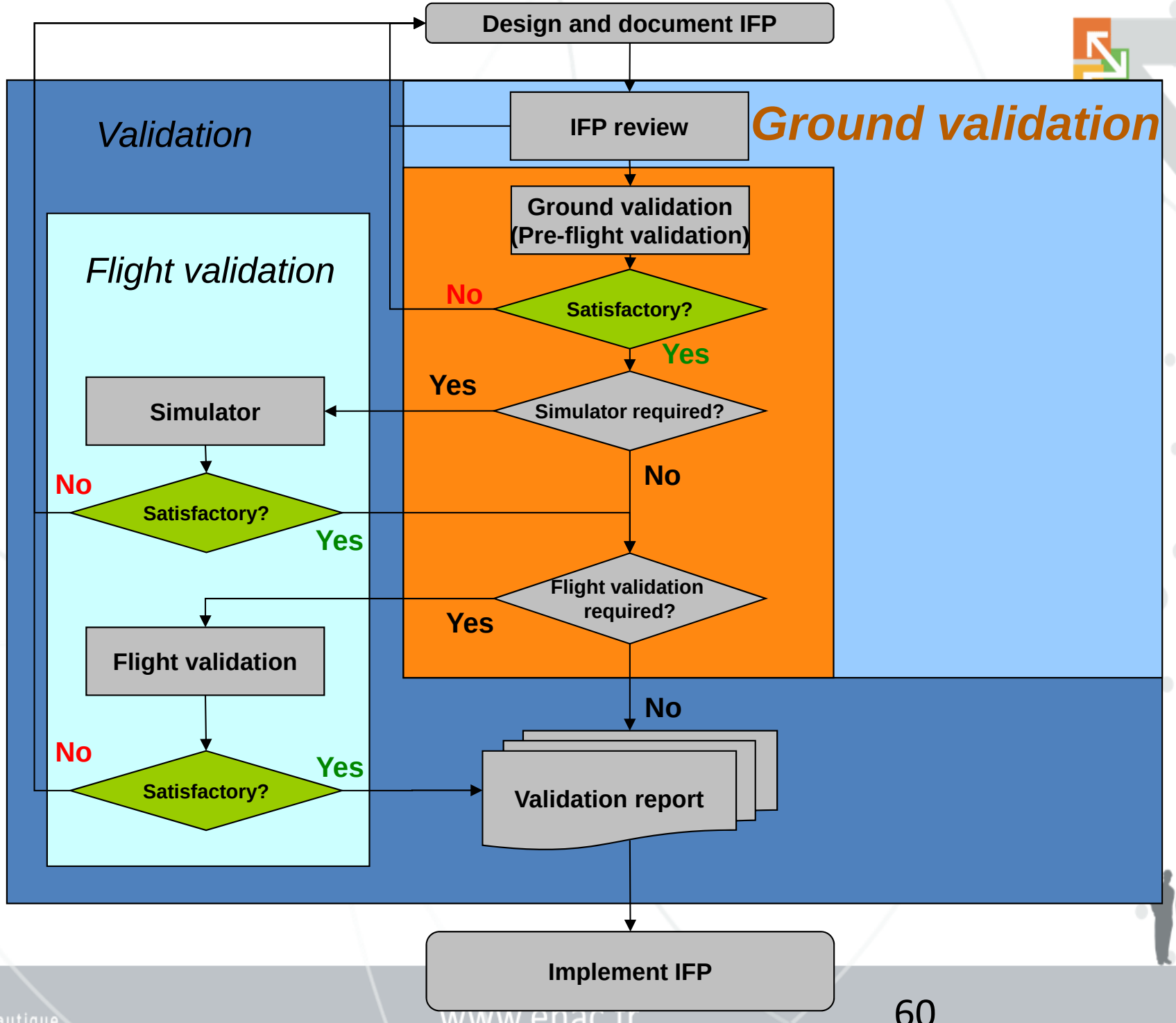
- ICAO QAM - Verification should:
  - Confirm correct application of criteria
  - Confirm data accuracy and integrity
  - Verify mitigations for deviations from design criteria
  - Verify the draft chart(s)
  - Confirm correct FMS behavior using desktop SW simulation tools (if required) (translation of IFP into ARINC 242 code)
  - Perform obstacle assessment with State-approved ground-based methods (if required)


Design and document IFP
Validation
IFP review
Ground validation
Flight validation
Ground validation
(Pre-flight validation)
No
Satisfactory?
Yes
Yes
Simulator
Simulator required?
No
No
Satisfactory?
Yes
Flight validation
required?
Yes
Flight validation
No
No
Satisfactory?
Yes
Validation report
Implement IFP

QA in IFP implementation

Validation

- The validation of an IFP contains:
  - Ground validation (step 8)
  - Flight validation (step 9)
- The purpose of validation consists in a verification, by a qualitative assessment (expert judgment), of:
  - Obstacle/terrain data
  - Navigation data
  - Flyability of the IFP
  - Operational issues associated to the IFP
- Validation:
  - Focuses on the operational aspects of an IFP
  - is not concerned about the performance of the navaids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Flight validation
No
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Satisfactory?
Yes
Validation report
Implement IFP

QA in IFP implementation

Ground validation

- Should be done for every IFP (organized by IFP designer)
- Review of IFP design outputs :
  - Obstacle data
  - Navigation data to be published / airport infrastructure
  - ARINC 424 data and coding proposal
  - Flyability of the trajectories
  - Charting information
  - Operational characteristics and minima (wind, speed, bank angles, gradients…)
  - Crew training or A/C equipment requirements
- Purpose:
  - Identify issues prior to flight validation
  - Decide on the necessity of a flight validation (simulator, or real flight)
  - Compare the produced IFP to the initial stakeholders needs

QA in IFP implementation

Ground validation

- Needed expertise:
  - IFP designer
  - Appropriate knowledge in IFP validation
- Pilot expertise should be used for ground validation:
  - Pilots are the final users of the IFP
  - IFP designers do not necessarily have pilot background
- It is even better to have:
  - Pilots with IFP design background,
  - Flight validation pilots !!

PRE-FLIGHT VALIDATION CHECKLIST FIXED WING	
REPORT HEADER	
Date:	Validation type (new/amended procedure):
Organization:	
Procedure title:	
Location:	
Airport:	Runway:
Evaluator name/phone:	
PBN navigation specification:	

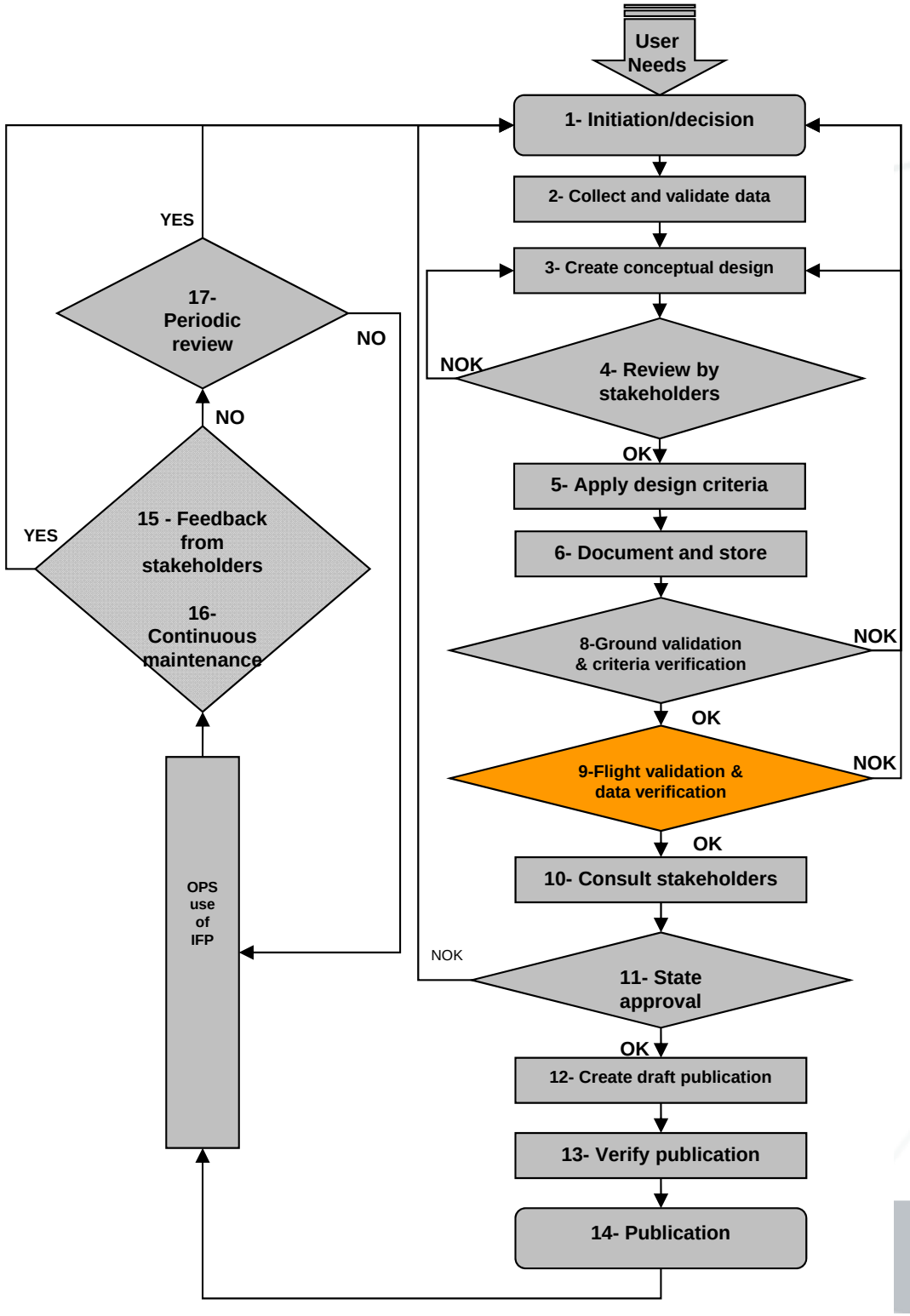
PRE-FLIGHT VALIDATION		
	SATISFACTORY	
	YES	**NO**
IFP package forms, charts, and maps.		
Data verification (e.g. aerodrome/heliport, aeronautical, obstacle, ARINC coding).		
Location of the controlling obstacles.		
Graphical depiction (chart) correctness and complexity.		
Intended use and special requirements.		
Overall design is practical, complete, clear and safe.		
Consider impact on the procedure of waivers to standard design criteria.		
Segment lengths and descent gradients allow for deceleration/ configuration.		
Comparison of FMS navigation database with the IFP design, coding, and relevant charting information.		
Charting of notification of cold/warm temperature limits.		
Flight Inspection reports available.		

REMARKS:

Simulator evaluation needed.			**YES**	**NO**
Flight evaluation needed.			**YES**	**NO**
PROCEDURE	**PASS**		**FAIL**	

EVALUATOR SIGNATURE:

Date: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4- Review by stakeholders
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OK
5- Apply design criteria
6- Document and store
8-Ground validation & criteria verification
NOK
OK
9-Flight validation & data verification
NOK
OK
10- Consult stakeholders
NOK
11- State approval
OK
12- Create draft publication
13- Verify publication
14- Publication
OPS use of IFP
YES
17- Periodic review
NO
NO
YES
15 - Feedback from stakeholders
16- Continuous maintenance

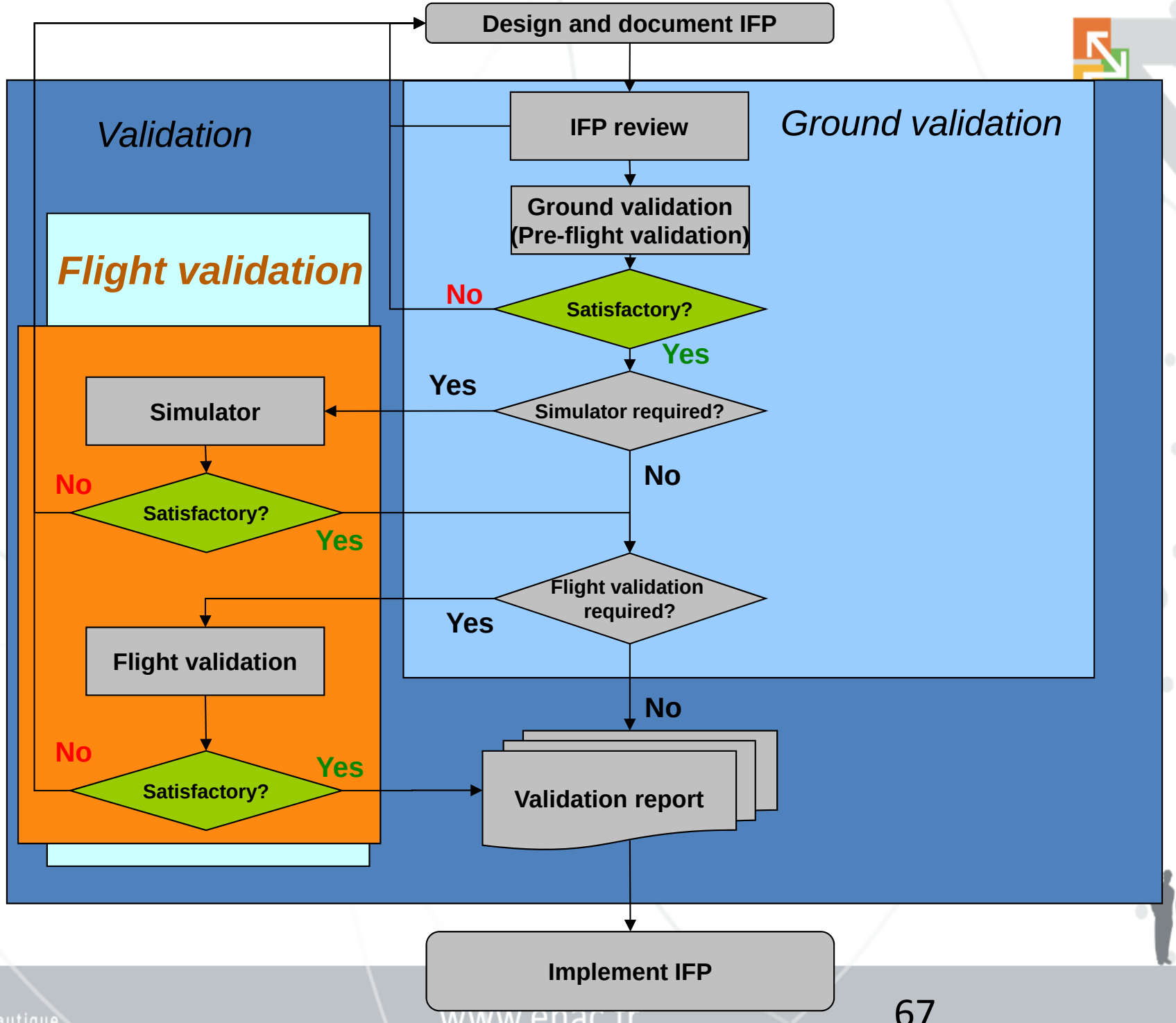
QA in IFP implementation

- This step covers two different activities:
  - Flight inspection
  - Flight validation
- Both steps are based on the inputs provided by the IFP designer
- IFP designer should provide adequate briefing to pilots responsible for these validations:
  - IFP characteristics
  - Specific points to be verified
- IFP designer can participate to the flight validation/inspection activities

QA in IFP implementation

Flight inspections

- Flight inspection => performance of the NAVAIDs
  - DME/DME coverage for RNAV
  - GPS jamming
  - VoR radials
  - ILS
  - FAS DB integrity (SBAS IFPs)
  - GBAS
- Navaids conformity to ICAO Annex 10 SARPs
- Guidance: ICAO doc 8071 “Manual on the Testing of Radio Navigation Aids”
- Qualified flight inspector + Specially equipped aircraft
- Can be used to assess flyability of IFP but conclusions have to be taken into account with caution….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Satisfactory?
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Validation report
Implement IFP

QA in IFP implementation

Flight validation

- The need for flight validation is determined during ground validation
- If ground validation can confirm:
  - the accuracy and completeness of all obstacle and navigation data considered in the procedure design,
  - any other factors normally considered in the flight validation,
  - ⇒ Flight validation can be dispensed with
- Flight validation should be required if:
  - Doubts about the flyability of the IFP
  - IFP deviates from standards
  - Doubts about accuracy/integrity of obstacle and terrain data
  - New IFP differs significantly from existing IFPs
  - Helicopter PinS IFPs

QA in IFP implementation

Flight validation

- Requires to use an aircraft with similar performance than the ones the IFP is intended for
- IFP under flight validation to be contained in navigation system (FMS):
  - Nav DB customized by official DB supplier to contain (most preferred):
    - Normal operations IFPs
    - IFPs under validation
  - Electronic media:
    - Some IFP design tools produce electronic ARINC 424 code
    - Introduced in commercial DB (Use CRC to guarantee integrity)
  - Manual entry (less preferred):
    - Should be limited to LNAV IFPs
    - Additional verification to guarantee proper data entry

QA in IFP implementation

Flight validation

- Flight validation:
  - Adequate obstacle clearance (controlling obstacles)
  - Correctness of navigation data
  - Adapted infrastructure in place and operative:
    - Runway markings and lightings
    - Communication sources (frequencies)
    - Navigation sources
  - Flyability, :
    - Aircraft performance
    - Human factors (complexity and interpretability of the IFP)
  - Operational factors:
    - Charting
    - Visibility
    - …

QA in IFP implementation

Flight validation

- Need qualified and experienced flight validation pilot
- Depending on the outcome of ground validation, flight validation can consist of:
  - Simulator sessions
  - Real flights
- Not the same topics can be assessed
- For real flight validation:
  - Start flying in VMC to get minimum confidence in the IFP
  - Then IMC to carry on validation

SIMULATOR EVALUATION REPORT HEADER	
Date:	Validation type (new/amended procedure):
Organization:	
Procedure title:	
Location:	
Airport:	Runway:
Evaluator name/phone:	
PBN navigation specification:	

	SATISFACTORY	
	YES	NO
Comparison of FMS navigation database and source documents, including proper ARINC 424 coding.		
Document simulator aircraft information including FMS software.		
Assessed faster and/or slower than charted.		
Assessed at allowed temperature limits.		
Assessed with adverse wind components.		
Flight track matches procedure design.		
Flyability.		
Human Factors assessment.		

ADDITIONAL REQUIREMENTS FOR SIMULATOR ACTIVITIES	
	COMPLETED
Document the following information as satisfactory or not for each procedure segment as appropriate: heading/track, distance, TAWS alerts, flight path angle (for final segment only); and note the wind component and temperature conditions.	
Note the maximum bank angle achieved during any RF segments.	
Record simulation data (if applicable).	

REMARKS:

PROCEDURE	PASS		FAIL	

EVALUATOR SIGNATURE:

Date:

FLIGHT EVALUATION CHECKLIST - FIXED WING	
REPORT HEADER	
Date:	Validation type (new/amended procedure):
Organization:	
Procedure title:	
Location:	
Airport:	Runway:
Evaluator name/phone:	
PBN navigation specification:	

PLANNING	
	COMPLETED
Check all necessary items from IFP package are available, to include: graphic, text, maps, submission form.	
Check that the necessary flight validation forms are available.	
Appropriate aircraft and avionics for IFP being evaluated.	
Does the procedure require use of autopilot or flight director?	

PREFLIGHT	
	COMPLETED
Review pre-flight validation assessment.	
Review simulator evaluation assessment (if applicable).	
Obstacle assessment planning: areas of concern; ability to identify and fly lateral limits of obstacle assessment area (if required).	
Verify source of IFP data for aircraft FMS (electronic or manual creation).	
Evaluate navigation system status at time of flight (NOTAM, RAIM, outages).	
Weather requirements.	
Night evaluation requirement (if applicable).	
Required navigation (NAVAID) support (if applicable).	
Combination of multiple IFP evaluations.	
Estimated flight time.	
Coordination (as required) with: ATS, designer, airport authority.	
Necessary equipment and media for electronic record of validation flight.	

GENERAL		
	SATISFACTORY	
	YES	**NO**
IFP graphic (chart) is complete and correct.		
Check for Interference: document all details related to detected RFI.		
Satisfactory radio communication.		
Required RADAR coverage is satisfactory.		
Verify proper runway markings, lighting and VASIS.		
Altimeter source(s).		
Extra consideration should be given to non-surveyed areas.		
For approach procedures with circling minima, verify controlling obstacle for each circling category.		

FLYABILITY		
	SATISFACTORY	
	YES	**NO**
Comparison of FMS navigation database and source documents, including proper ARINC 424 coding. *Note.— If manual entry used N/A, but a note in the remarks section is*		

required to alert the approving authority of the procedure that a table top review of the coded procedure, or an operational assessment by a company pilot, should be completed prior to operational approval granted.		
Human Factors and general workload satisfactory.		
Was there any loss of RAIM.		
Was there any loss of required RNP navigation performance (when RNP pertains).		
Missed approach procedure.		
Descent/climb gradients.		
Use of autopilot satisfactory.		
Segment length, turns and bank angles, speed restrictions and deceleration allowance.		
TAWS.		
INSTRUMENT APPROACH PROCEDURE		
	SATISFACTORY	
	YES	**NO**
Segment lengths, headings/tracks, and waypoint locations match procedure design.		
Final segment vertical glide path angle (if applicable).		
Threshold crossing height (LTP or FTP), if applicable.		
Course alignment.		
Along track alignment.		
FAS datablock.		

REMARKS:

PROCEDURE	**PASS**		**FAIL**	

EVALUATOR SIGNATURE:

Date:

QA in IFP implementation

Flight validation/inspection

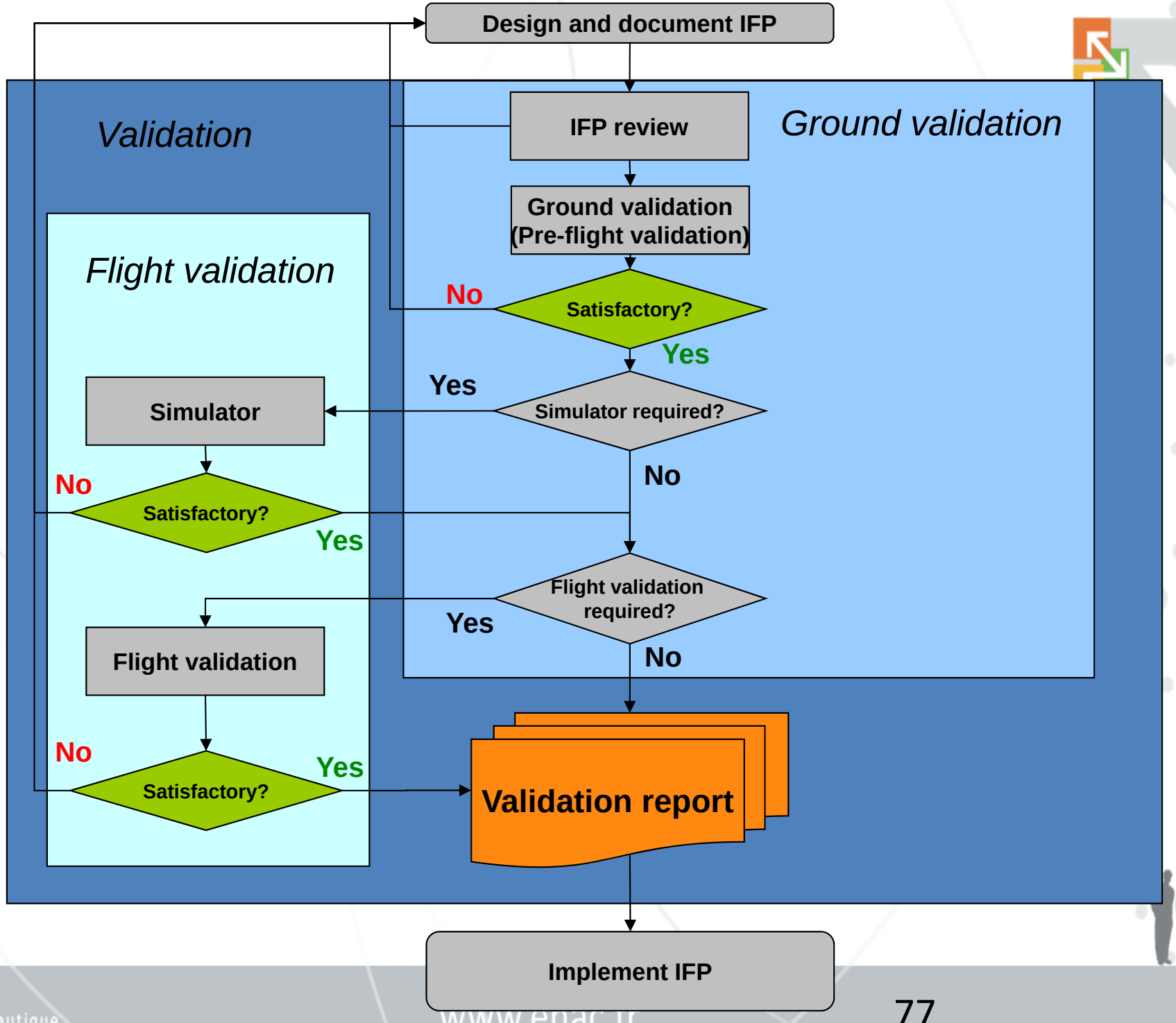
States must define:

- If flight validation is systematic or not (and what the conditions are)
- What kind of flight inspections must by undertaken
- What organizations are allowed to undertake flight validations/inspections:
  - The state
  - ATSPs
  - Private organizations
  - Other states
- What is required for pilots performing flight validation/inspections in terms of:
  - Qualification
  - Experience
  - Training

QA in IFP implementation

Flight validation/inspection

- ICAO Doc 8168:
  - Commercial pilot license with instrument rating in the aircraft category
  - Other equivalent authorization from the State
- Doc 9906 – vol. 1 – Appendix B : recommended qualification and training for flight validation pilots
- Doc 9906 – vol.6: more detailed guidance for qualification of flight validation pilots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Simulator required?
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Satisfactory?
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Flight validation
required?
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Flight validation
No
Satisfactory?
Yes
Validation report
Implement IFP

QA in IFP implementation

Validation report

- Ground and flight validation should be subject to a documented report:
  - Date, name and signature of the validation experts:
    - IFP designer
    - Flight validation pilot
  - Activities performed
  - Findings and flight validation pilots comments
  - Ops recommendations

  For flight validation:
  - Type of aircraft/simulator
  - Flight track flown
  - Procedure fixes, max and min altitudes
  - Ground speed, climb rate, climb gradient
  - Comparison between the flown track and the IFP

VALIDATION REPORT CHECKLIST - FIXED WING	
REPORT HEADER	
Date:	Validation type (new/amended procedure):
Organization:	
Procedure title:	
Location:	
Airport:	Runway:
Evaluator name/phone:	
PBN navigation specification:	

POST FLIGHT		
	COMPLETED	
Evaluate collected data.		
Submit flight validation report with recorded electronic flight data for archive.		
Request NOTAM action (if appropriate).		
Sign and submit the instrument flight procedure submission documentation.		

REMARKS:

PROCEDURE	**PASS**		**FAIL**	

EVALUATOR SIGNATURE:

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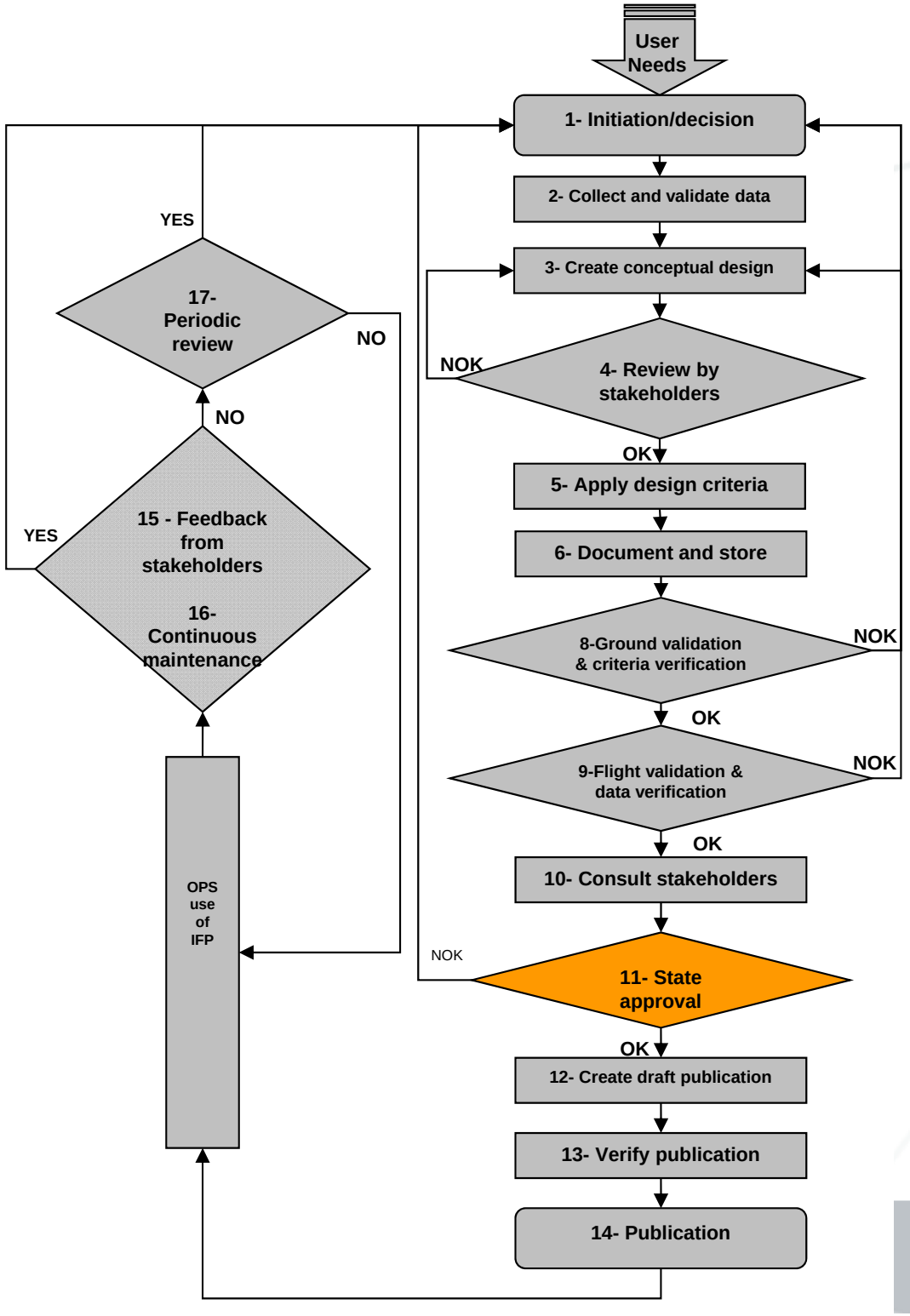
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8-Ground validation & criteria verification
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10- Consult stakeholders
NOK
11- State approval
OK
12- Create draft publication
13- Verify publication
14- Publication
OPS use of IFP
YES
17- Periodic review
NO
NO
YES
15 - Feedback from stakeholders
16- Continuous maintenance

QA in IFP implementation

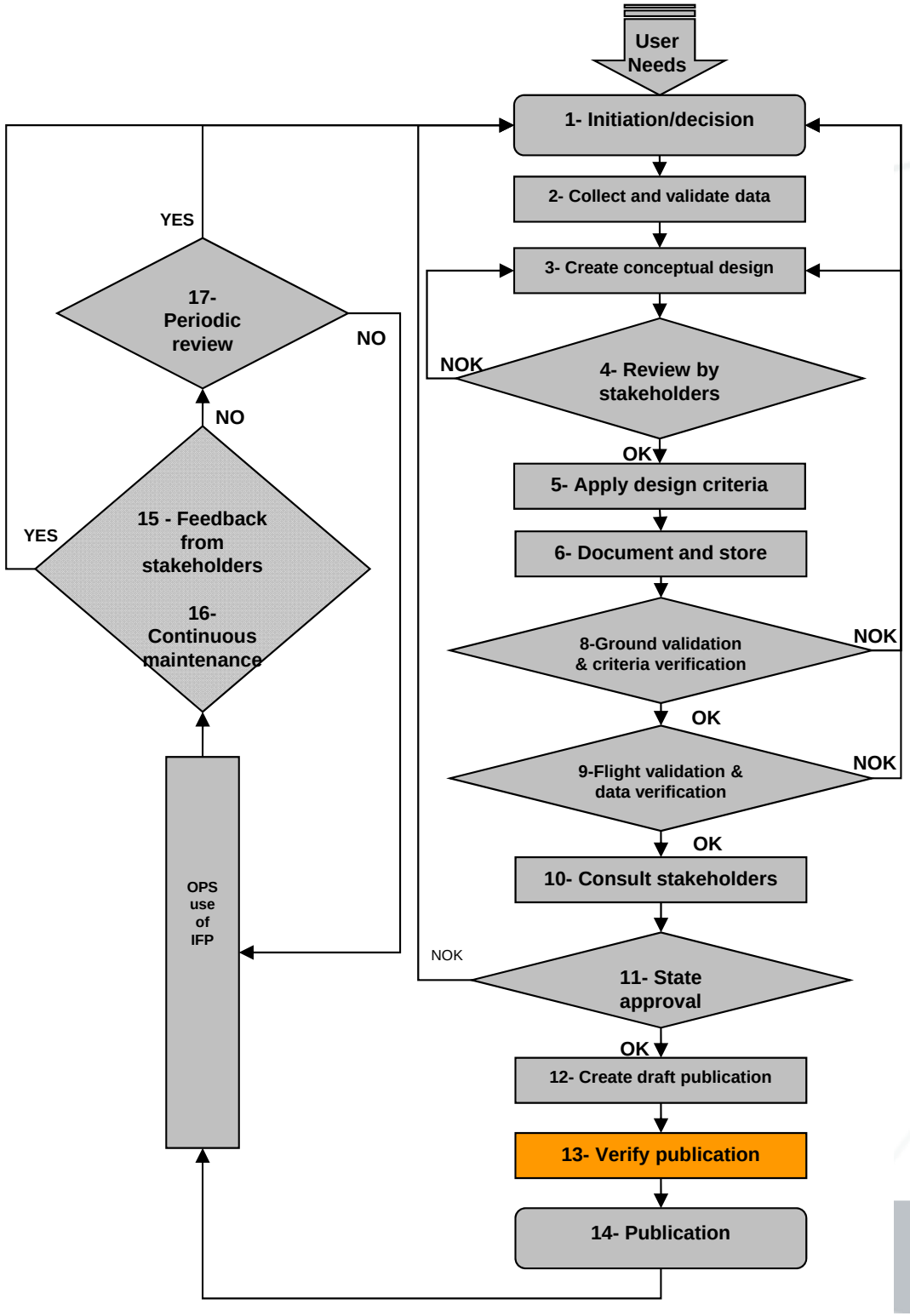
State approval

- State has the overall responsibility for the quality of the IFPs published in the national AIP => State approval of all IFP is necessary
- Formal decision of the state representative authority
- Endorsement by the state of the overall implementation process
- But also consists in a “control step”
- Validates the “completeness” of the IFP implementation process

QA in IFP implementation

State approval

- Does the submitted case contain all the necessary evidence ?
  - IFP design report
  - Ground validation reports
  - Flight validation reports
  - Safety assessment
  - Draft publication and coding proposal
- Verification that the documents are signed
- High level verification that the documents correspond to what they are meant to be
- Does not focus on the “substance” of the document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QA in IFP implementation

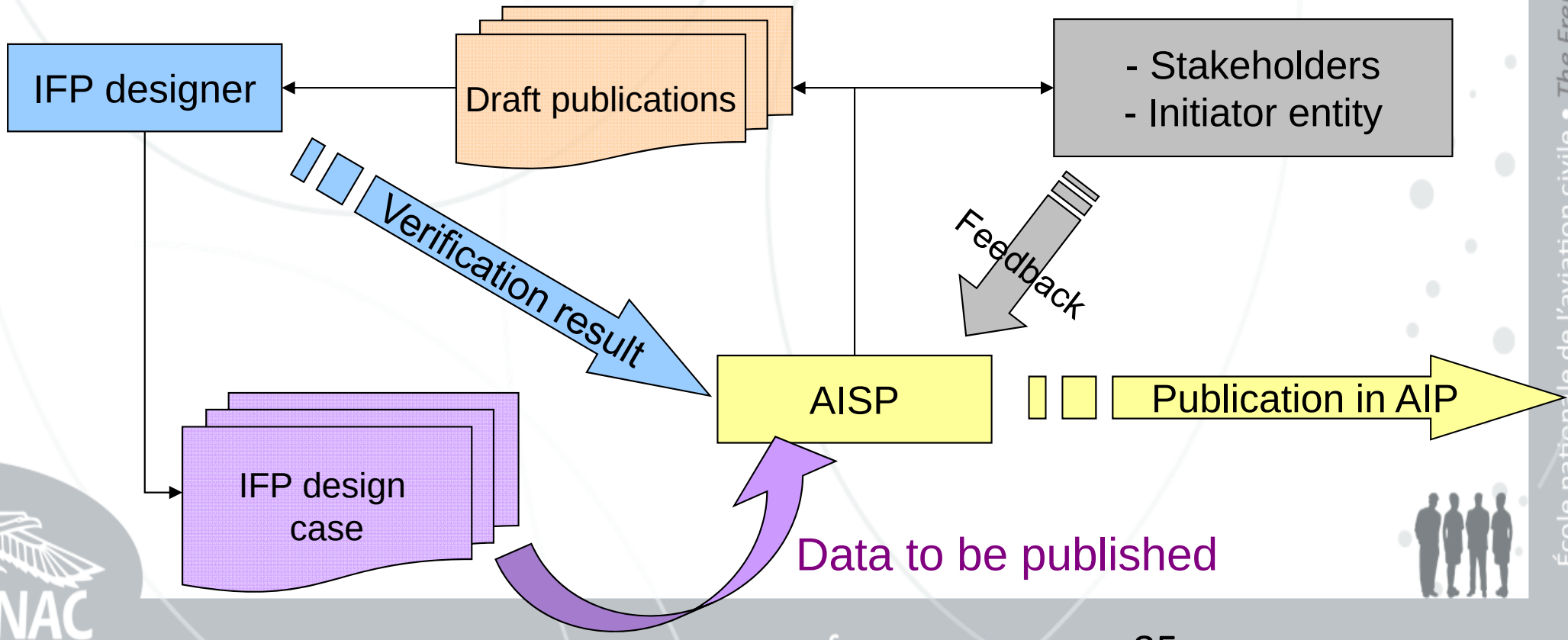
Publication verification

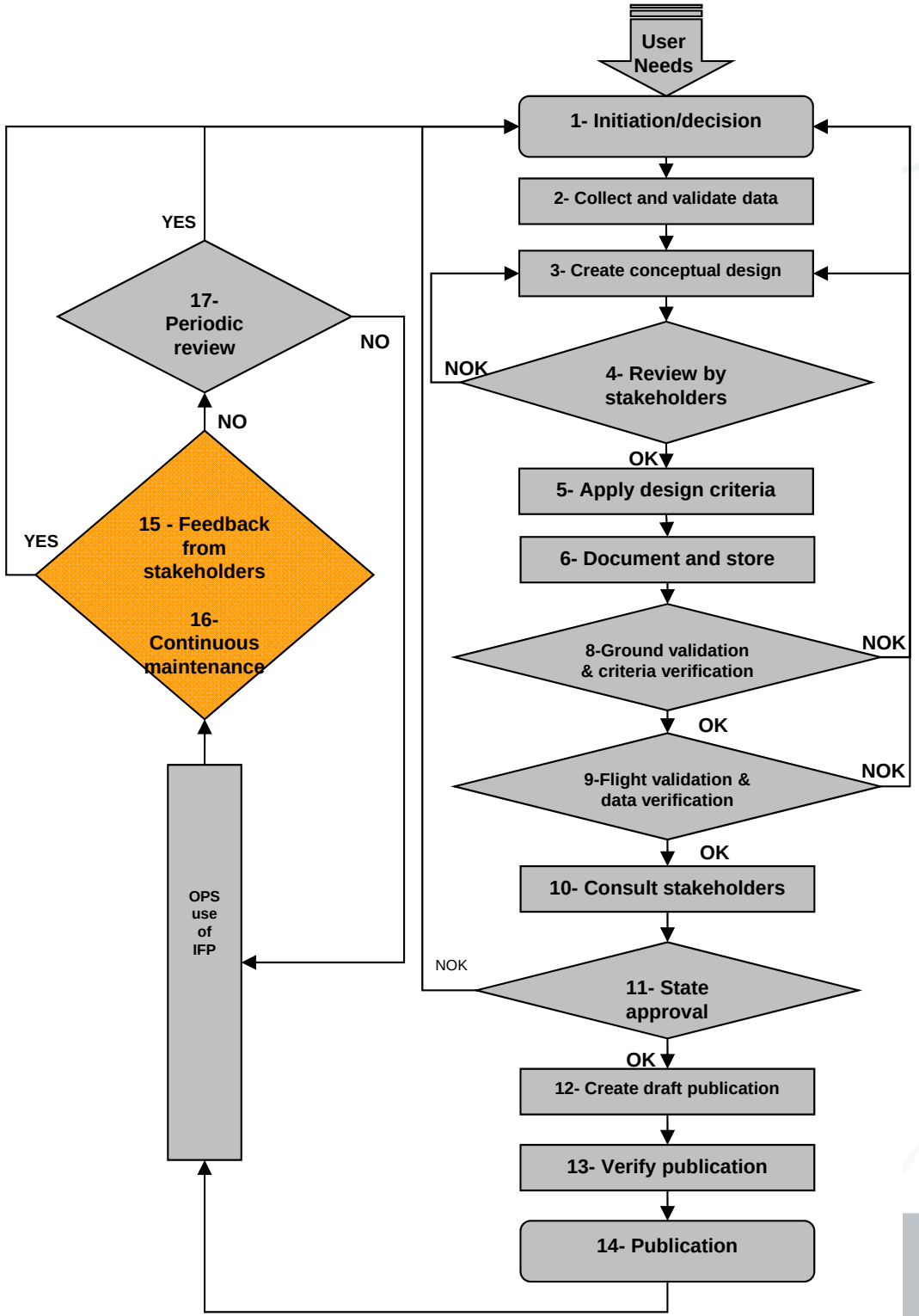
- IFP designer produces during the design:
  - Publication draft
  - Or at least the data to be published
    - Drawing of the IFP
    - Obstacle/terrain
    - Navaids/Comms
    - Textual information
    - Etc…
- AISP will produce the publication draft to be included in the AIP
- Before the implementation of the IFP, the designer has to check the publication draft for:
  - Completeness
  - Correctness

QA in IFP implementation

Publication verification

- Should also have a look at the Publication:
  - Stakeholders/users
  - The “initiator”

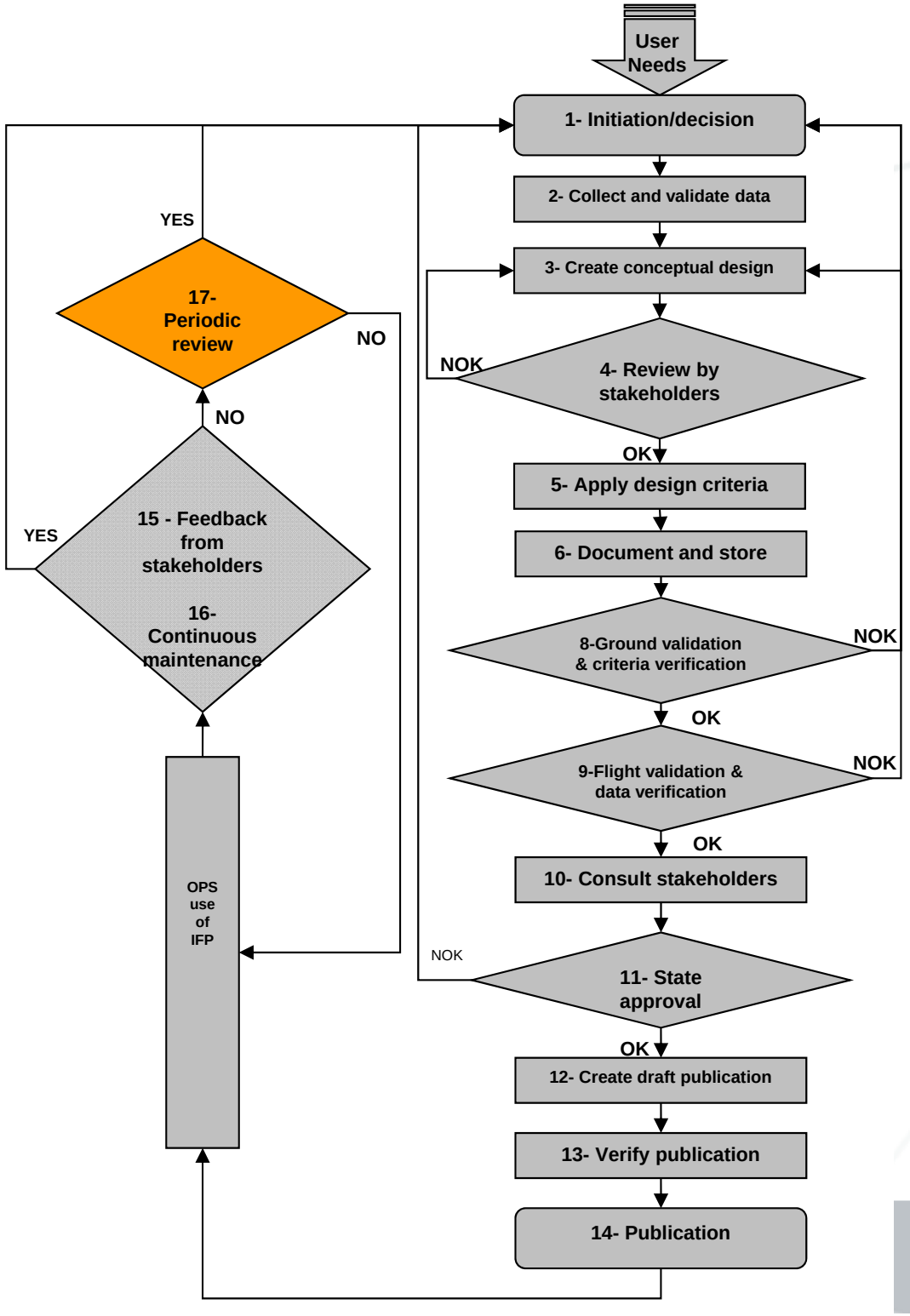




QA in IFP implementation

Continuous maintenance

- Maintenance triggered for specific reason
- Focus on a particular part of the IFP
- Identification of triggers for continuous maintenance:
  - Feedback from users/stakeholders
    - ATS wants modified trajectories for flow segregation
    - Pilots not happy with final approach gradient
    - NSA conservatory measure enforcement
  - Design criteria update/modification
  - Change in input data
    - Length of runway
    - PAPI slope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QA in IFP implementation

Periodic review

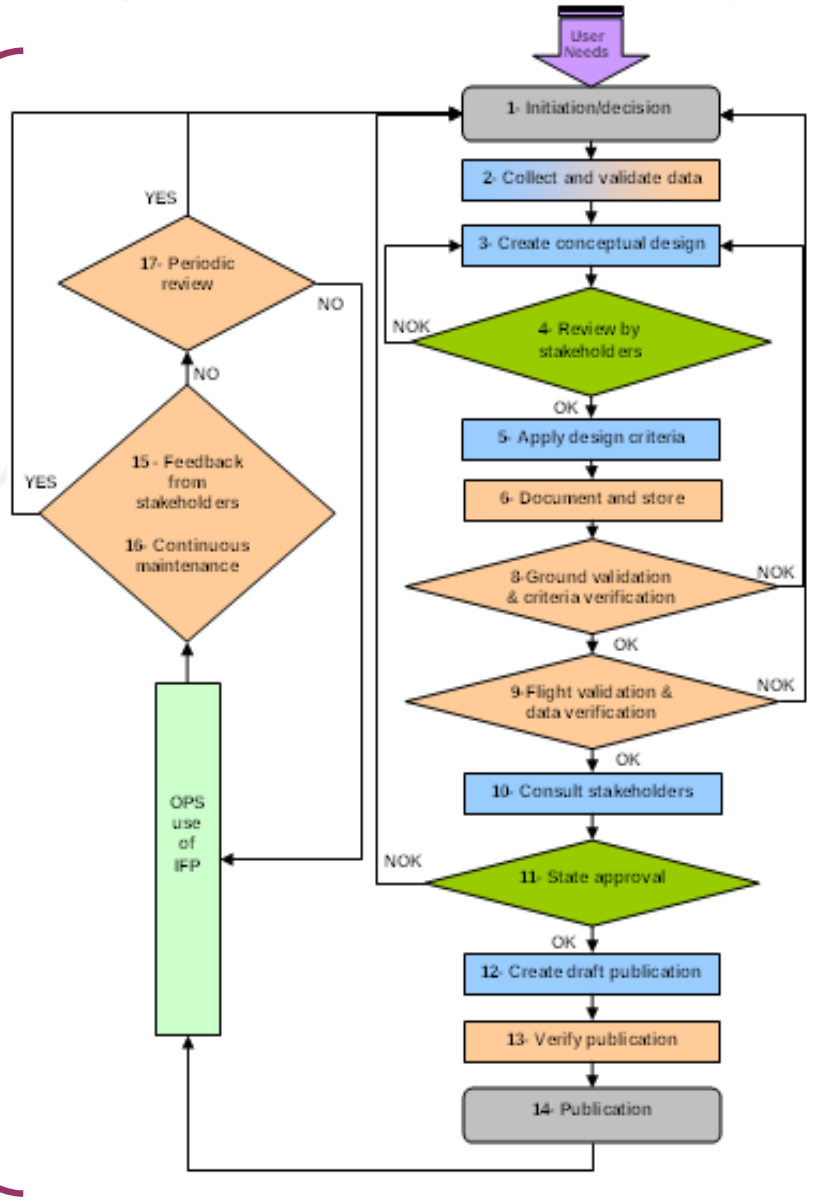
- Review of the whole IFP on regular basis
- States should specify the period for reviews
- ICAO mentions a maximum period of 5 years
- IFP review shall permit to ensure that changes in following inputs are taken into account:
  - Obstacles,
  - Aerodrome data,
  - Aeronautical data
  - Navaid data
  - Design criteria
  - User requirements
  - Depiction standards

Schedule

- Procedure design process
- Designer training
  - Example : ENAC training programme
- Quality Assurance for procedure design
  - The notion of quality
  - Quality assurance provisions
  - QA in the IFP implementation process
  - QA as a pre requisite
- Oversight activities

QA as a pre requisite

- IFP designer training
- Flight validation/inspection pilots training
- Software validation



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ICAO level

- ICAO Doc 9859 « Safety Management Manual » (ed. 2013)
- ICAO Annex 19 « Safety Management » (ed. 2013, ap. 14/10/2013)

- Guidance to States to develop State Safety Programmes.
- Guidance to establish Safety Management Systems for stakeholders

European level

- European regulation applies in UE states and supersedes national regulations.
- Two regulations on ATM/ANS
  - Regulation 1035/2011 on ATM/ANS providers
  - Regulation 1034/2011 on safety oversight

- No European regulation for IFP design and implementation
  - A PBN Implementing Rule is in progress.

- Regulation 73/2010 on aeronautical information and data quality (ADQ, concerns data used in IFP design and publication)

National level

- National regulations implemented to apply ICAO principles in the national context.
  - Designers qualification
  - Oversight activities
  - Consultations
  - Studies to be made
  - Implementation processes
  - Quality assurance.

Example : French DSAC

- Two levels of regulation
  - Regulatory requirements
    - The Law
    - Mandatory requirements
    - High level
  - Acceptable Means of Compliance
    - Possible means by which one can comply to the law
    - Allows the DSAC to clarify the « high level » regulation
    - Allows to define more precise requirements

Example : French DSAC

- For each new or modified procedure :
  - Before the publication:
    - Studies
    - Consultations
    - Ground validation
    - Flight inspections & validation
    - Approval by regional DSAC
  - Between publication and entry into service:
    - Verification of the published data
  - After the entry into service:
    - Continuous maintenance

Conclusion

Conclusion

- Quality assurance for IFP relies upon many different actors but States have the ultimate responsibility for the IFPs they publish

- States have to set the legal framework for IFP implementation and QA process:
  - Regulation(s)
  - AMCs
  - Guidance material

- States have to:
  - Define the mandatory and/or recommended tasks
  - Specify which entities can (or have to) do what tasks
  - Mandate NSAs to undertake oversight activities

Conclusion

- IFP design organizations have to document and enforce a Quality Assurance system:
  - According to applicable national regulation
  - Using ICAO QAM as a guidance
- NSAs have to verify that QA is implemented:
  - PANS-OPS oversight policy
  - Oversight activities
  - AMCs and GM to regulation

Conclusion

- This presentation talks about the complete picture (the whole set of QA activities)
- For each QA activity, detailed documentation exists to provide guidance
- Might be difficult to implement:
  - every SA activity…
  - at the same time…
  - at the most thorough level of detail.
- Priorities have to be set by states:
  - What QA is mandatory to implement ?
  - Which level of detail/thoroughness ?
  - What activities will be subject to oversight ?
- Adapted to each country specific situation

ENAC
La référence aéronautique

Thank you for your attention.