QUALITY ASSURANCE FOR AIRSPACE & PROCEDURE DESIGN

Presentation by dans

Presentation to ICAO IFP provision and Safety Oversight Workshop

07.12.2025

dans

دبي لخدمات الملاحة الجوية

DUBAI AIR NAVIGATION SERVICES

PANS-OPS, DOC 8168 VOLUME II, PART 1, SECTION 2, CHAPTER 4

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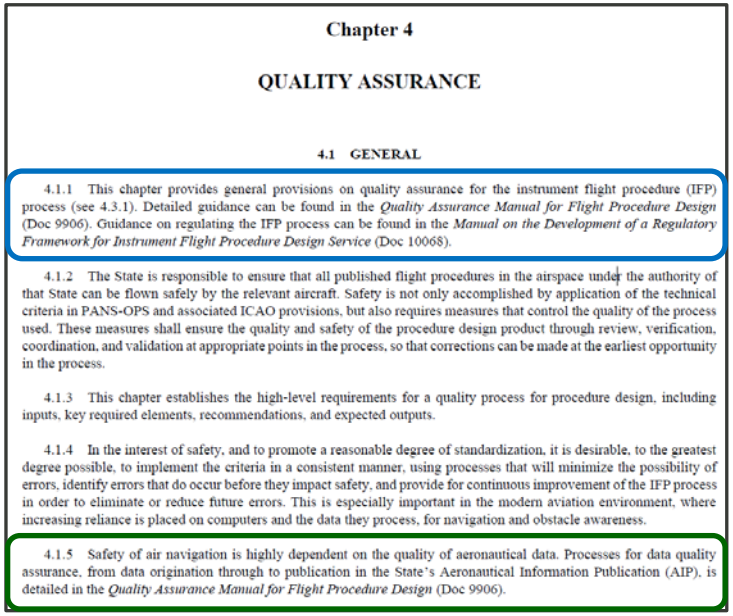

Chapter 4

QUALITY ASSURANCE

4.1 GENERAL

4.1.1 This chapter provides general provisions on quality assurance for the instrument flight procedure (IFP) process (see 4.3.1). Detailed guidance can be found in the *Quality Assurance Manual for Flight Procedure Design* (Doc 9906). Guidance on regulating the IFP process can be found in the *Manual on the Development of a Regulatory Framework for Instrument Flight Procedure Design Service* (Doc 10068).

4.1.2 The State is responsible to ensure that all published flight procedures in the airspace under the authority of that State can be flown safely by the relevant aircraft. Safety is not only accomplished by application of the technical criteria in PANS-OPS and associated ICAO provisions, but also requires measures that control the quality of the process used. These measures shall ensure the quality and safety of the procedure design product through review, verification, coordination, and validation at appropriate points in the process, so that corrections can be made at the earliest opportunity in the process.

4.1.3 This chapter establishes the high-level requirements for a quality process for procedure design, including inputs, key required elements, recommendations, and expected outputs.

4.1.4 In the interest of safety, and to promote a reasonable degree of standardization, it is desirable, to the greatest degree possible, to implement the criteria in a consistent manner, using processes that will minimize the possibility of errors, identify errors that do occur before they impact safety, and provide for continuous improvement of the IFP process in order to eliminate or reduce future errors. This is especially important in the modern aviation environment, where increasing reliance is placed on computers and the data they process, for navigation and obstacle awareness.

4.1.5 Safety of air navigation is highly dependent on the quality of aeronautical data. Processes for data quality assurance, from data origination through to publication in the State's Aeronautical Information Publication (AIP), is detailed in the *Quality Assurance Manual for Flight Procedure Design* (Doc 9906).

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DOC 9906 PREFACE

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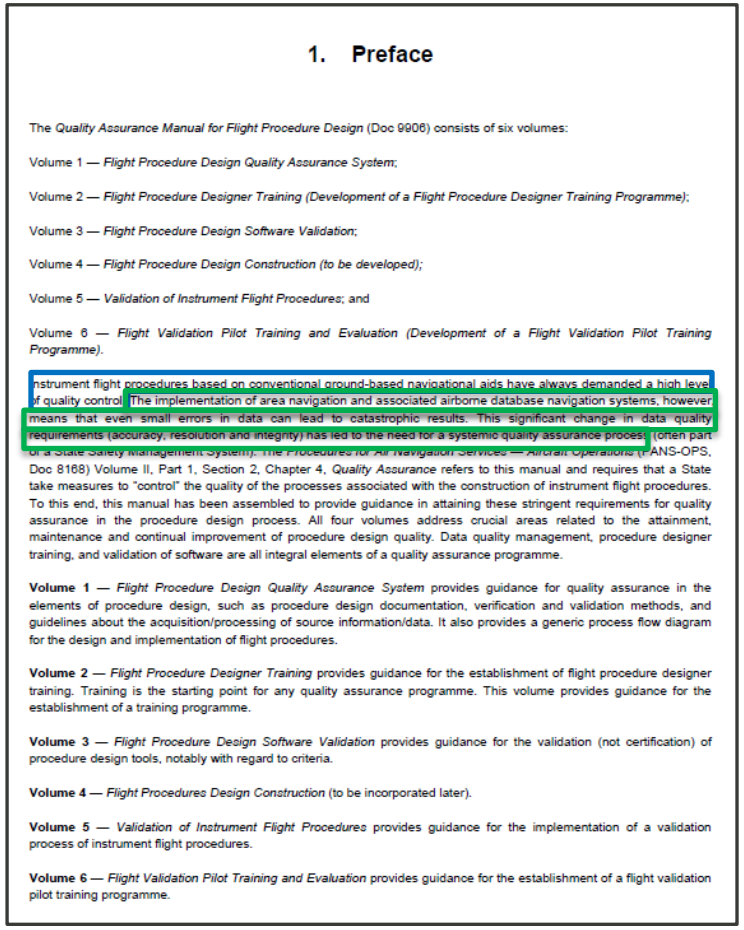


1. Preface

The *Quality Assurance Manual for Flight Procedure Design* (Doc 9906) consists of six volumes:

Volume 1 — *Flight Procedure Design Quality Assurance System*;

Volume 2 — *Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme)*;

Volume 3 — *Flight Procedure Design Software Validation*;

Volume 4 — *Flight Procedure Design Construction (to be developed)*;

Volume 5 — *Validation of Instrument Flight Procedures*; and

Volume 6 — *Flight Validation Pilot Training and Evaluation (Development of a Flight Validation Pilot Training Programme)*.

Instrument flight procedures based on conventional ground-based navigational aids have always demanded a high level of quality control. The implementation of area navigation and associated airborne database navigation systems, however, means that even small errors in data can lead to catastrophic results. This significant change in data quality requirements (accuracy, resolution and integrity) has led to the need for a systemic quality assurance process (often part of a State Safety Management System). The *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168) Volume II, Part 1, Section 2, Chapter 4, *Quality Assurance* refers to this manual and requires that a State take measures to "control" the quality of the processes associated with the construction of instrument flight procedures. To this end, this manual has been assembled to provide guidance in attaining these stringent requirements for quality assurance in the procedure design process. All four volumes address crucial areas related to the attainment, maintenance and continual improvement of procedure design quality. Data quality management, procedure designer training, and validation of software are all integral elements of a quality assurance programme.

Volume 1 — *Flight Procedure Design Quality Assurance System* provides guidance for quality assurance in the elements of procedure design, such as procedure design documentation, verification and validation methods, and guidelines about the acquisition/processing of source information/data. It also provides a generic process flow diagram for the design and implementation of flight procedures.

Volume 2 — *Flight Procedure Designer Training* provides guidance for the establishment of flight procedure designer training. Training is the starting point for any quality assurance programme. This volume provides guidance for the establishment of a training programme.

Volume 3 — *Flight Procedure Design Software Validation* provides guidance for the validation (not certification) of procedure design tools, notably with regard to criteria.

Volume 4 — *Flight Procedures Design Construction* (to be incorporated later).

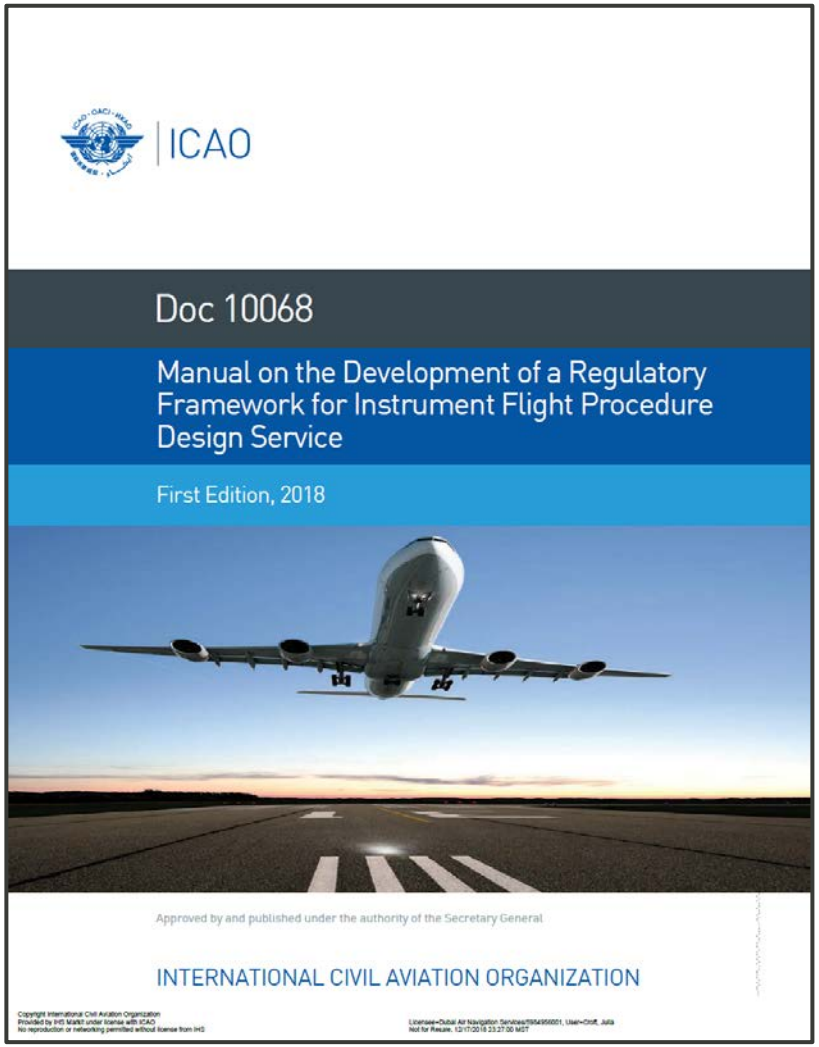
Volume 5 — *Validation of Instrument Flight Procedures* provides guidance for the implementation of a validation process of instrument flight procedures.

Volume 6 — *Flight Validation Pilot Training and Evaluation* provides guidance for the establishment of a flight validation pilot training programme.

"Instrument flight procedures based on conventional ground-based navigational aids have always demanded a high level of quality control."

"The implementation of area navigation and associated airborne database navigation systems, however, means that even small errors in data can lead to catastrophic results. This significant change in data quality requirements (accuracy, resolution and integrity) has led to the need for a systemic quality assurance process"

MANUAL ON THE DEVELOPMENT OF A REGULATORY FRAMEWORK FOR INSTRUMENT FLIGHT PROCEDURE DESIGN SERVICE (DOC 10068)



Chapter 1. Introduction

Introductory information on the manual: target audiences, goals, structure, and how to use the manual

Chapter 2. State Safety Oversight Function

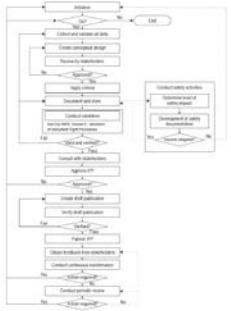
Guidance to State safety oversight authorities in the development of a regulatory framework for the provision of IFPDS and its safety oversight

Chapter 3. Service Provider Function

A secondary goal is to provide guidance to IFPDS providers in the development of their organization and working procedures

QUALITY ASSURANCE MANUAL FOR FLIGHT PROCEDURE DESIGN (DOC 9906)

Volume 1 — *Flight Procedure Design Quality Assurance System*



Volume 2 — Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme)

Volume 3 — *Flight Procedure Design Software Validation*

Volume 4 — *Flight Procedure Design Construction (to be developed)*

TO BE DEVELOPED

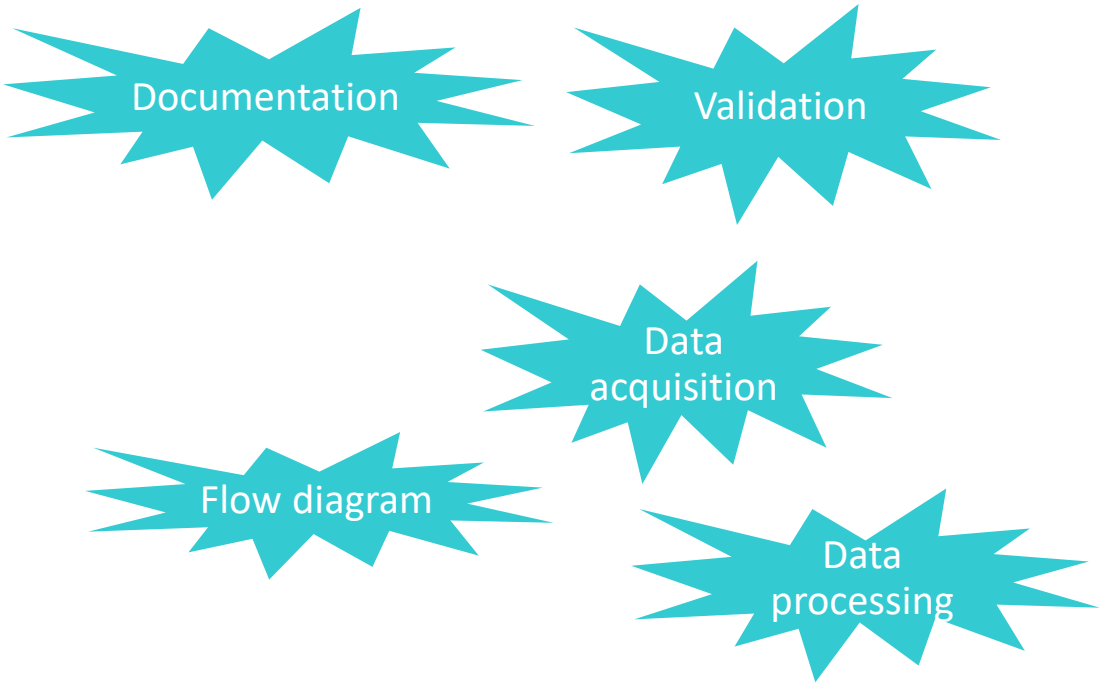
Volume 5 — *Validation of Instrument Flight Procedures*

Volume 6 — *Flight Validation Pilot Training and Evaluation (Development of a Flight Validation Pilot Training Programme)*.

DOC 9906 VOLUME 1

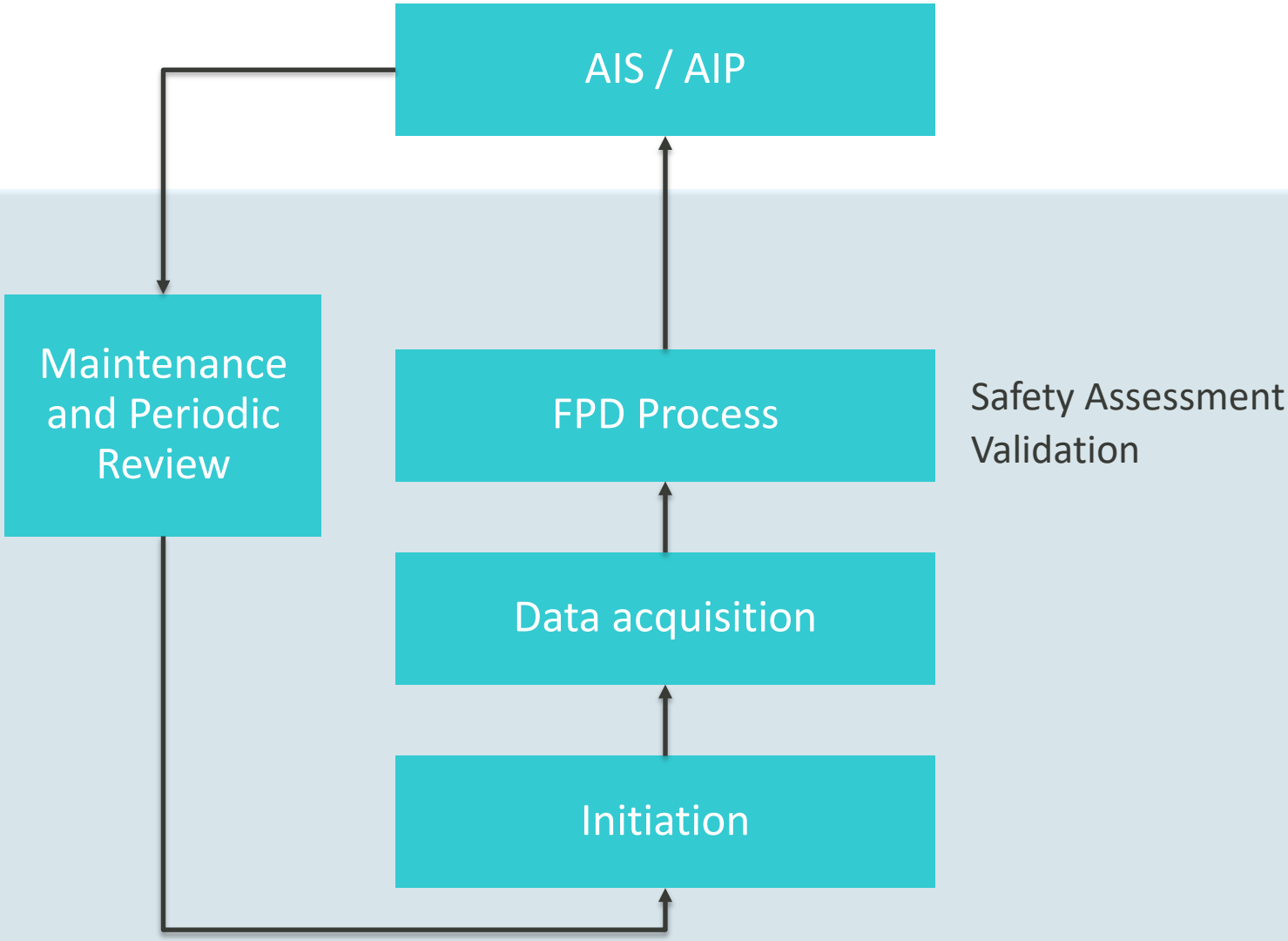
Volume 1 — *Flight Procedure Design Quality Assurance System*

Guidance for quality assurance in the elements of procedure design

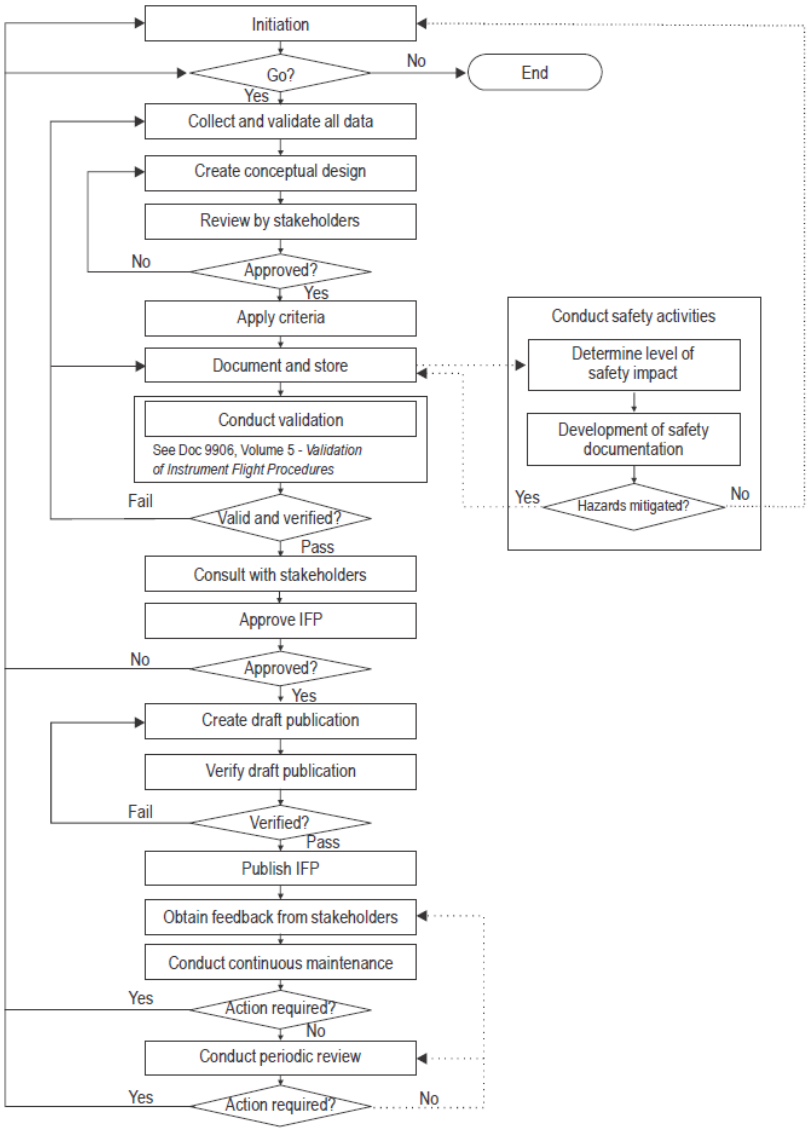


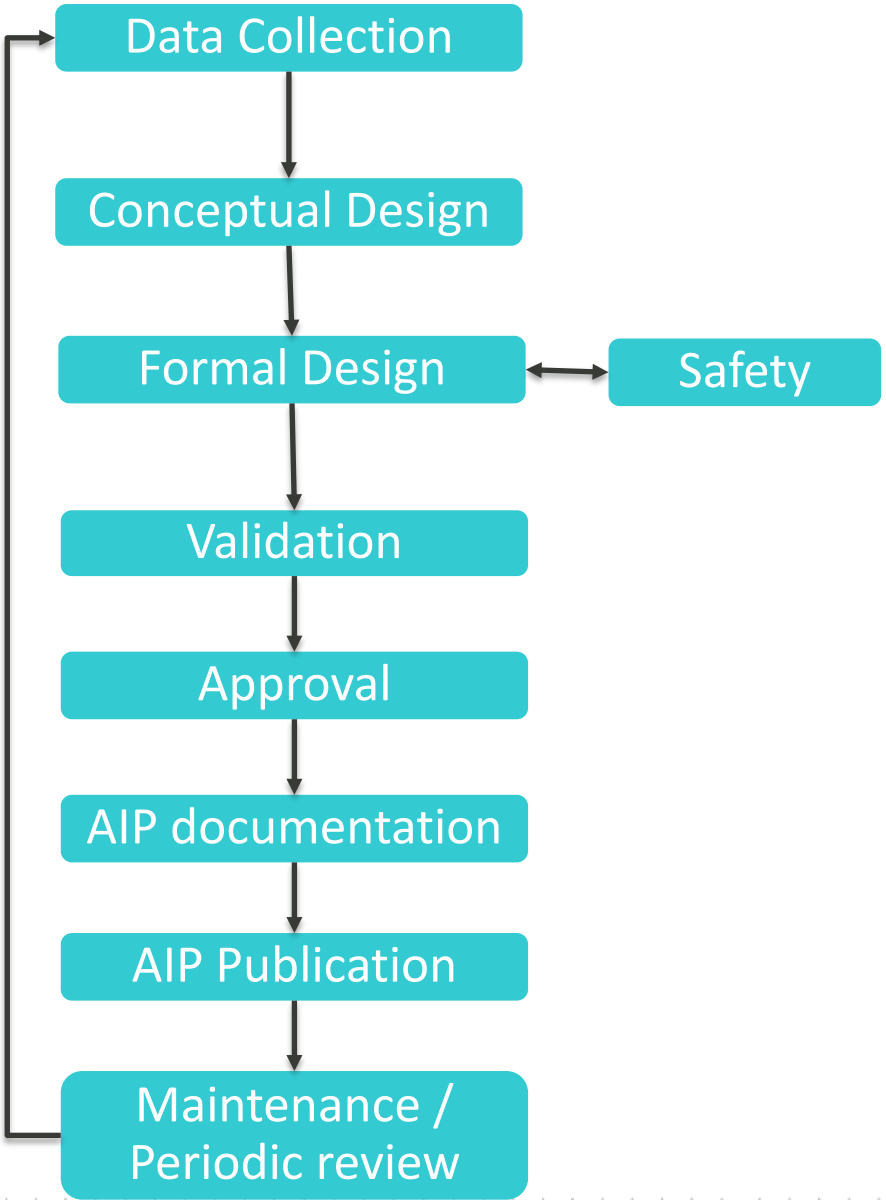
IFP PROCESS

The IFP process encompasses the full process from initiation to publication/promulgation of procedures and includes the continuous maintenance of the procedure as well as periodic review.



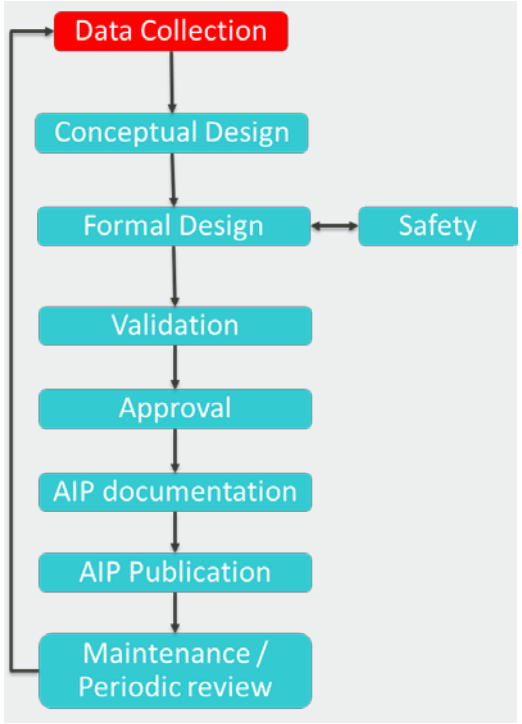
FPD PROCESS

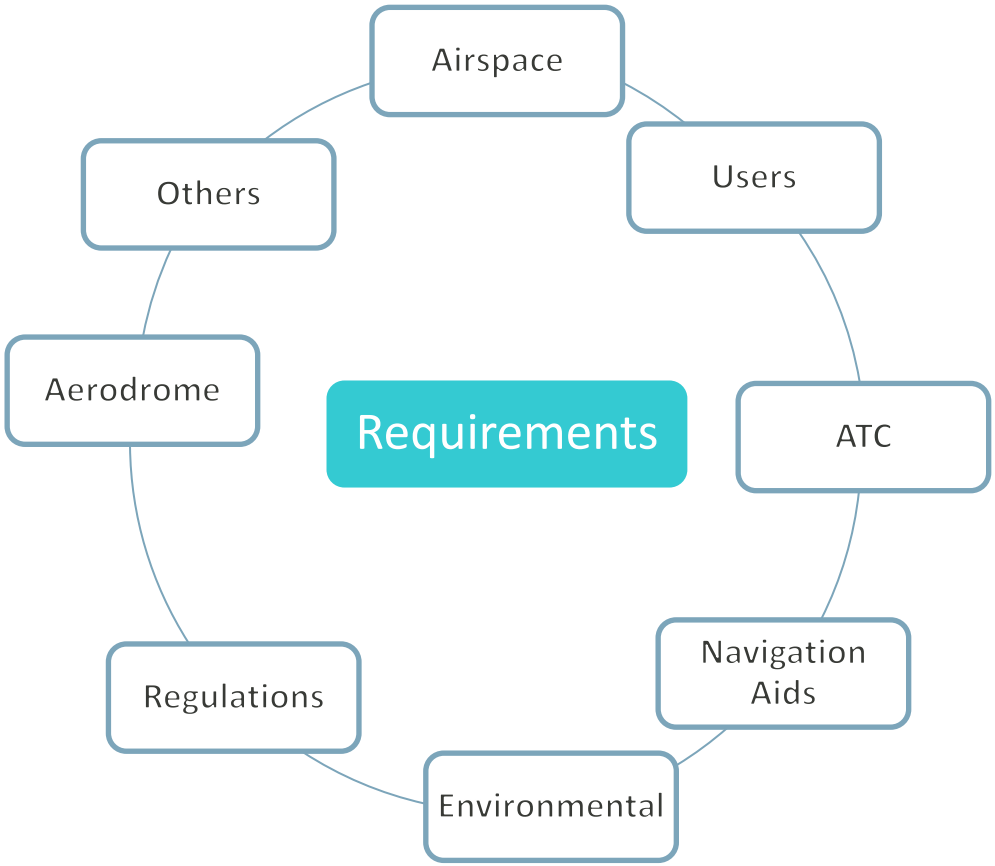

Initiation
Go?
No
End
Yes
Collect and validate all data
Create conceptual design
Review by stakeholders
No
Approved?
Yes
Apply criteria
Document and store
Conduct validation
See Doc 9906, Volume 5 - Validation of Instrument Flight Procedures
Fail
Valid and verified?
Pass
Consult with stakeholders
Approve IFP
No
Approved?
Yes
Create draft publication
Verify draft publication
Fail
Verified?
Pass
Publish IFP
Obtain feedback from stakeholders
Conduct continuous maintenance
Yes
Action required?
No
Conduct periodic review
Yes
Action required?
No
Conduct safety activities
Determine level of safety impact
Development of safety documentation
Yes
Hazards mitigated?
No


Data Collection
Conceptual Design
Formal Design
Safety
Validation
Approval
AIP documentation
AIP Publication
Maintenance / Periodic review

DATA COLLECTION / INFORMATION ACQUISITION

Aeronautical Data | **Obstacle Data** | **Terrain Data**



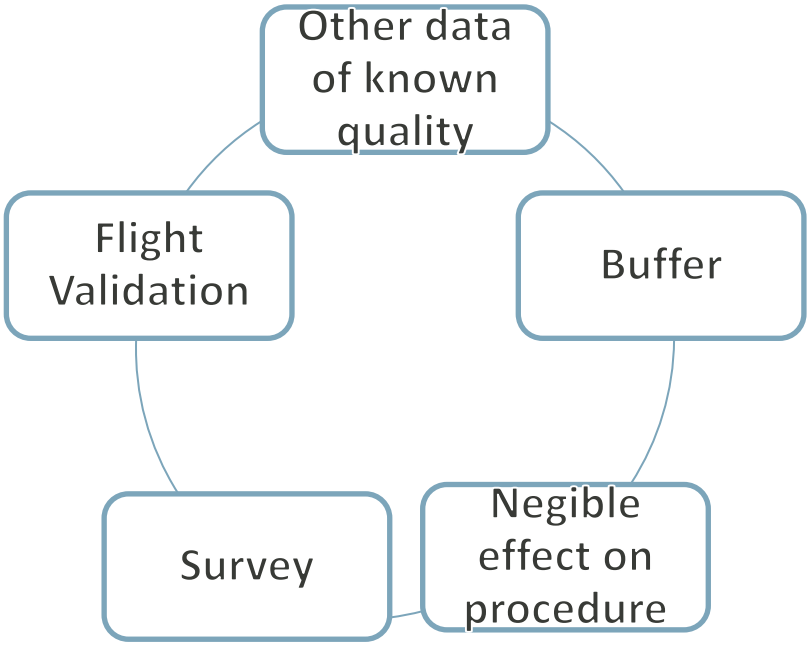


DATA VALIDATION / VERIFICATION

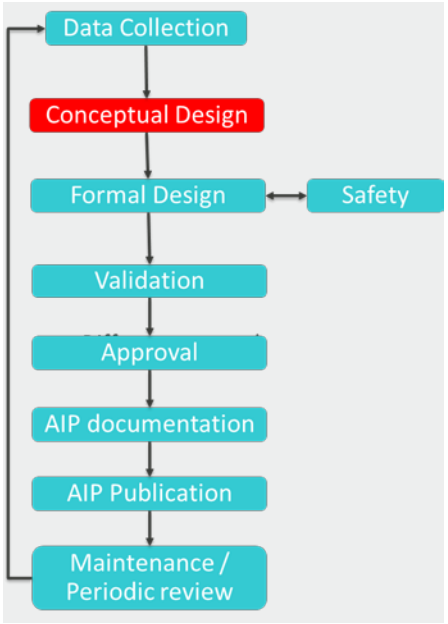
All data to be used in the FPD process must be validated against the data quality requirements

If the validated data met the data quality requirements, then the data may be used without additional verification

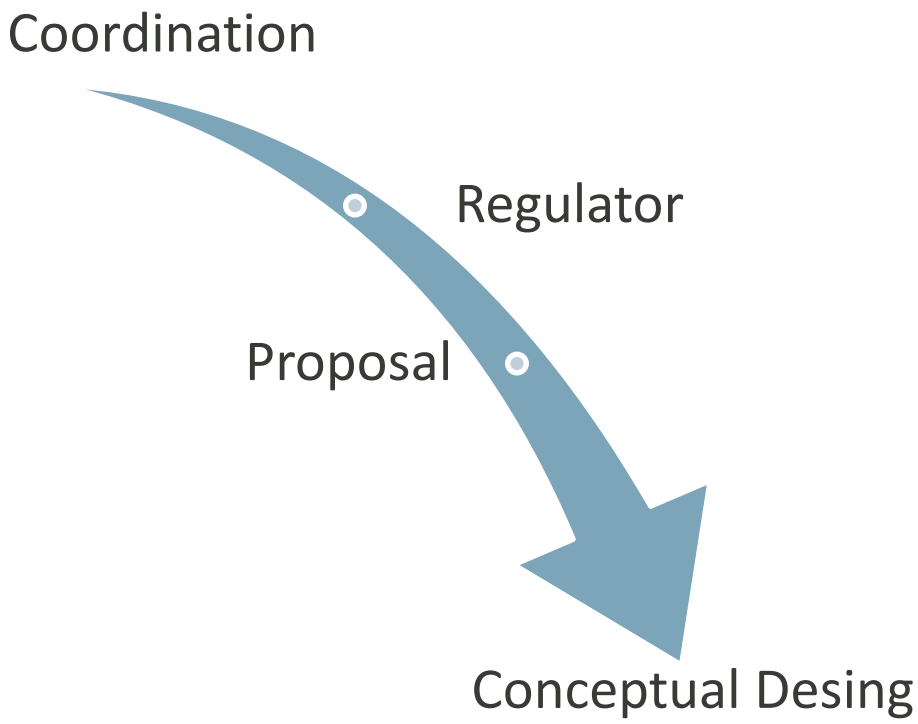
If the validated data does not met the data quality requirements, then the data may be used with additional verification or mitigation



CONCEPTUAL DESIGN

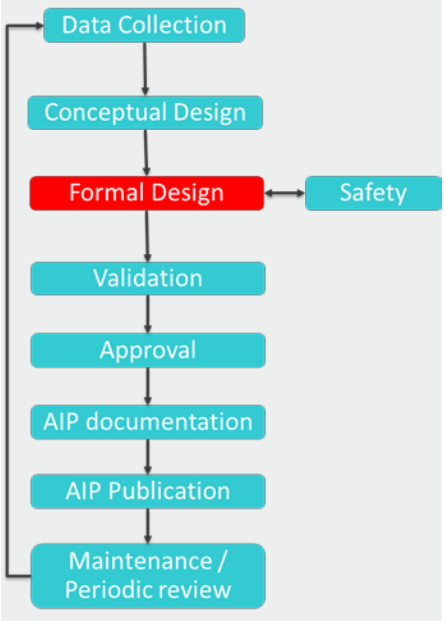


Conceptual design. High-level graphical and/or textual description of the designer's interpretation of the stakeholders' requirements



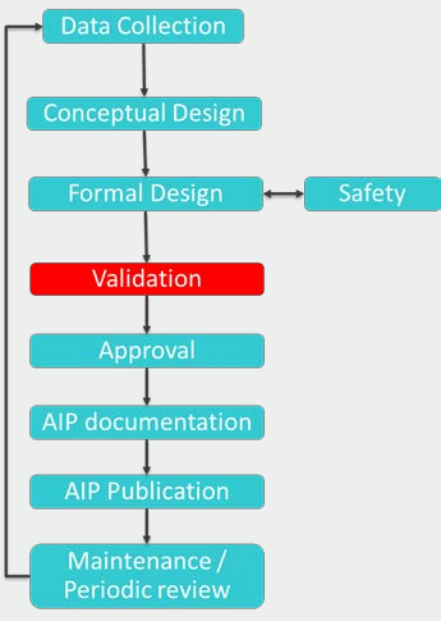
FORMAL DESIGN

Once the relevant data have been collected and the draft IFP has been approved, the design activity begin



- Desing Activities
- Draft procedure Layout
- Calculations
- Coordinates
- Textual Description

VALIDATION



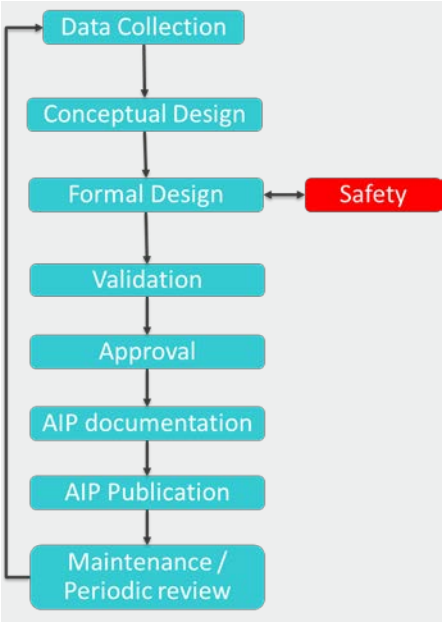
Validation shall be incorporated into the procedure design processes and occurs first at the collection/acquisition and onward submission of relevant data, followed through the design, then ground and if necessary, flight validation before publication of a designed procedure. Validation of designed RNAV procedure in addition to the above shall include validation of ARINC 424 coding instructions to be used by onboard navigation system.

Independent procedure design review
qualified flightprocedure designer who was not involved in the design of the procedure

VALIDATION. DANS

Check list	Definition	Document Name	Document Code
SCENARIO	Verification of the files setting parameters used in the design including the validation of the aeronautical, obstacles and the terrain data.	APD Formal Design Review (Scenario)	AMD-CHL-1
STAR	Review of instrument standard instrument arrivals	APD Formal Design Review (STAR)	AMD-CHL-2
SID	Review of standard instrument departures	APD Formal Design Review (SID)	AMD-CHL-3
IAP	Review of instrument approach procedures	APD Formal Design Review (IAP)	AMD-CHL-4
ATCSMAC	Review of ATC surveillance minimum altitude chart	APD Formal Design Review (ATCSMAC)	AMD-CHL-5
CODING TABLES	Review of coding tables required for STAR, SID and IAP. Includes the following: - Procedure Design - ARINC Database - ARINC 424 Coding	APD Formal Design Review (Coding Tables)	AMD-CHL-6
AIRSPACE	Review of new or amendment to: - Airspace structure (CTA/CTR) - Prohibited, Restricted and Danger areas, - Aerial sporting and recreational activities - Other activities of dangerous nature	APD Formal Design Review (Airspace)	AMD-CHL-7
VFR	Review of new or amendment to VFR procedures that includes Visual Reporting Points (VRPs) and VFR Transit Routes;	APD Formal Design Review (VFR)	AMD-CHL-8

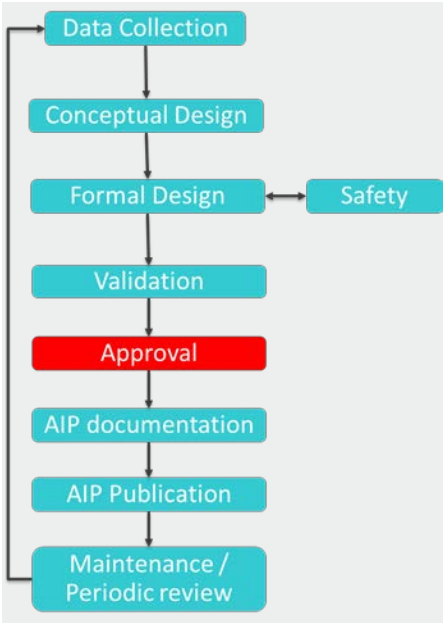
SAFETY



Safety is generally defined as “freedom from unacceptable risk “.

From a formal point of view, a system can only be considered to be safe for operational use if its inherent risks have been identified, assessed and agreed to be below predefined limits. If such a commitment is reached, the system can be considered as acceptably safe.

APPROVAL



Phase 1 – Exploratory Meeting

Phase 2 – Concept Submission meeting

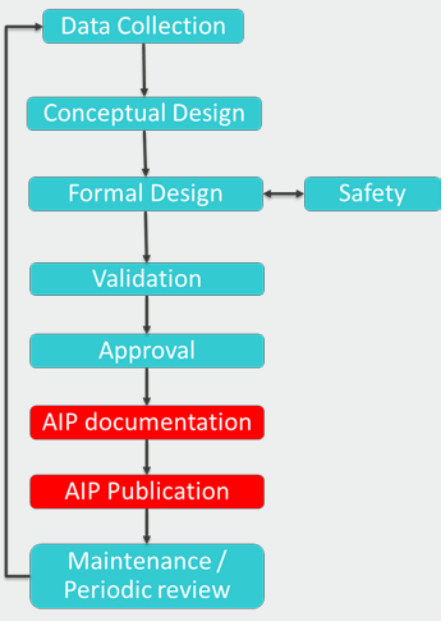
Phase 3 – PANS-OPS criteria / Safety Assessment

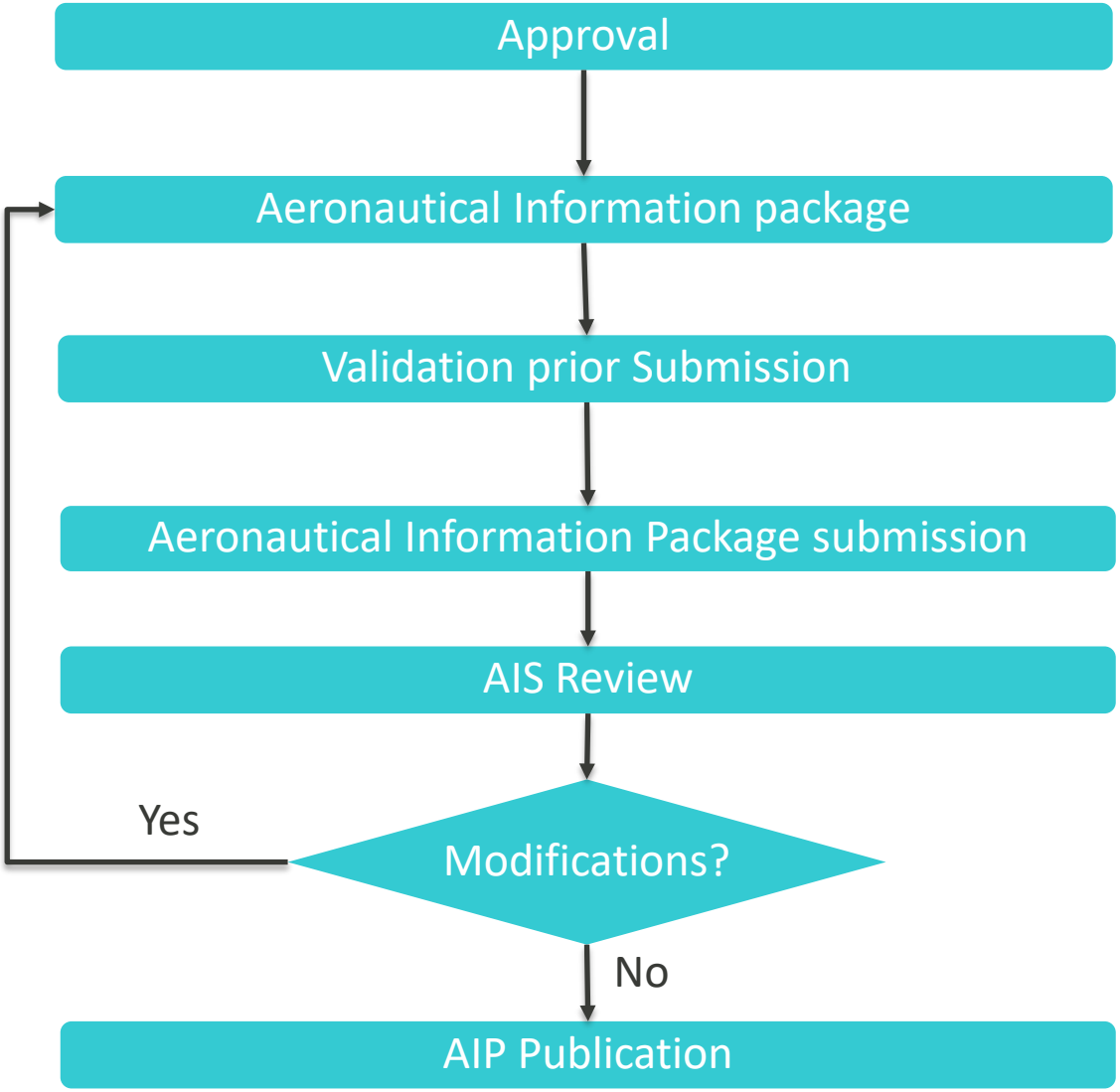
Phase 4 - Final Submission

Phase 5 Evaluation of submission

Phase 6 Acceptance or rejection

AIP


Data Collection
Conceptual Design
Formal Design
Safety
Validation
Approval
AIP documentation
AIP Publication
Maintenance / Periodic review


Approval
Aeronautical Information package
Validation prior Submission
Aeronautical Information Package submission
AIS Review
Modifications?
Yes
No
AIP Publication

DOC 9906. VOLUME 2

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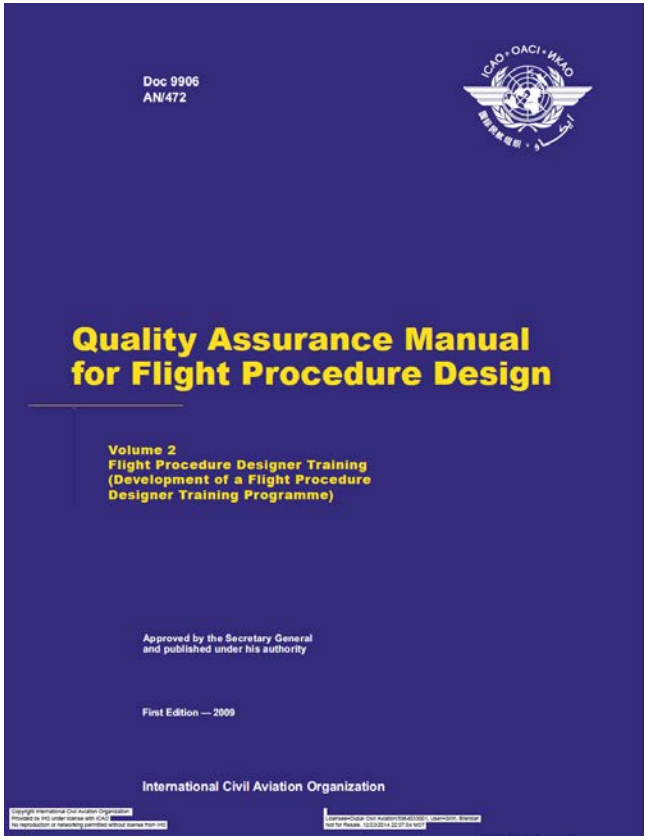
Volume 2 — *Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme)*;



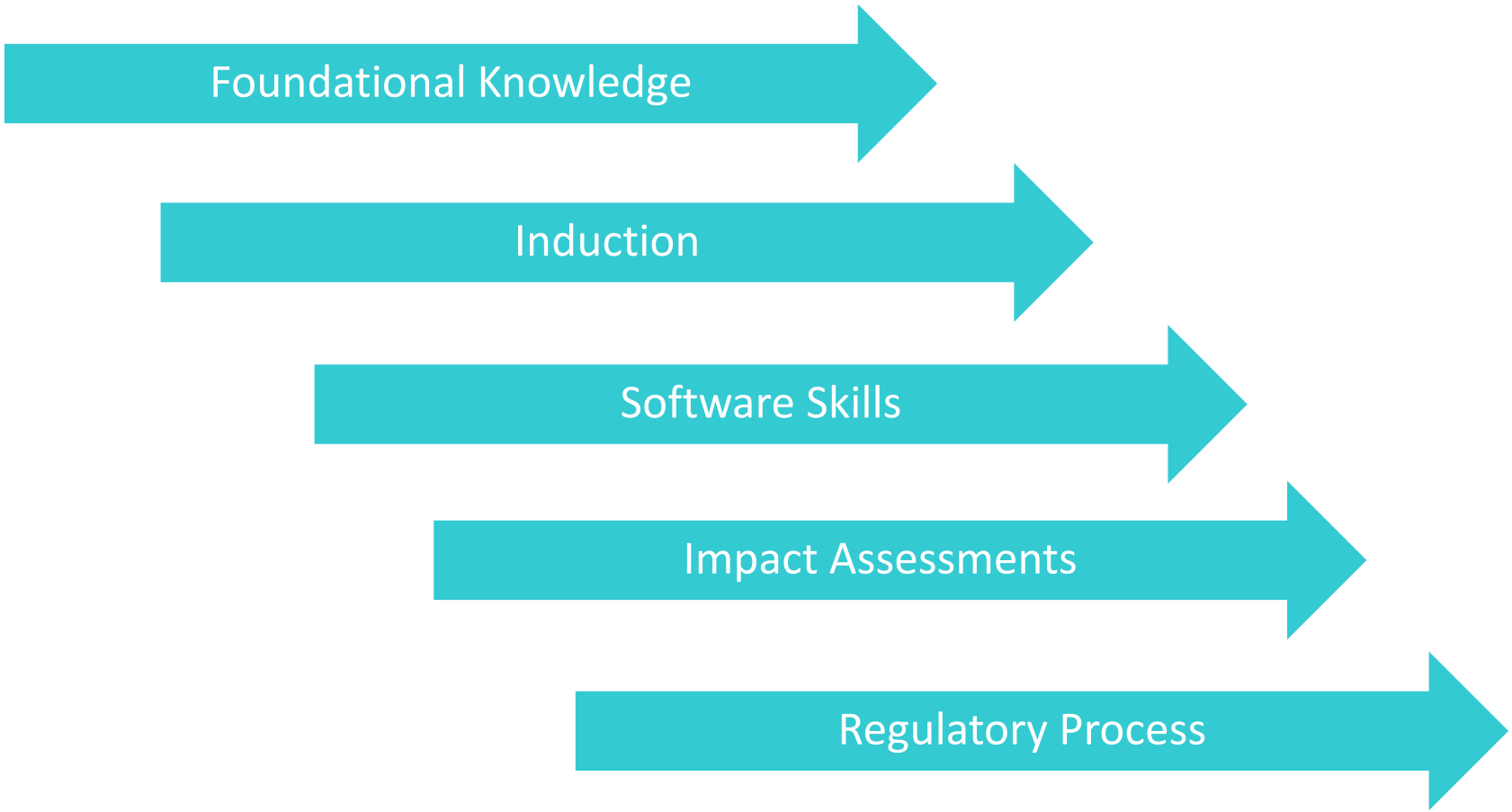
Flight Procedure Designer Training provides guidance for the establishment of flight procedure designer training.

Training is one of the most important elements of quality assurance. Each State must establish standards for the required competency level for flight procedure design. Each State must ensure that flight procedure designers have acquired and maintain this competency level through training, supervised on-the-job training (OJT), recurrent and refresher training.

PROCEDURE DESIGNER TRAINING

Ab Initio Training	Basic skills and knowledge (will not cover any procedure design technique or criteria)
Initial Training	Basic procedure design skills and knowledge
On-the-job training (OJT)	Reinforce formal training and support the achievement
Advanced training	Augment the skills and knowledge dealing with more complex procedure design problems.
Recurrent Training	Address changes in the available criteria and regulations
Refresher Training	Strengthen skills and knowledge that have weakened through disuse and the passage of time.

DANS NEW JOINERS



DANS TRAINING / COMPETENCY

PANS-OPS Recurrent / Refresher

At least once every 3 years or earlier, if there are changes to the design criteria that impacts on flight procedures

Other training

Skills and knowledge related with the flight procedure designers

Competency

The competency of Procedure Design Specialists is assessed annually to ensure compliance with UAE, ICAO, and dans regulations and processes

DOC 9906. VOLUME 3

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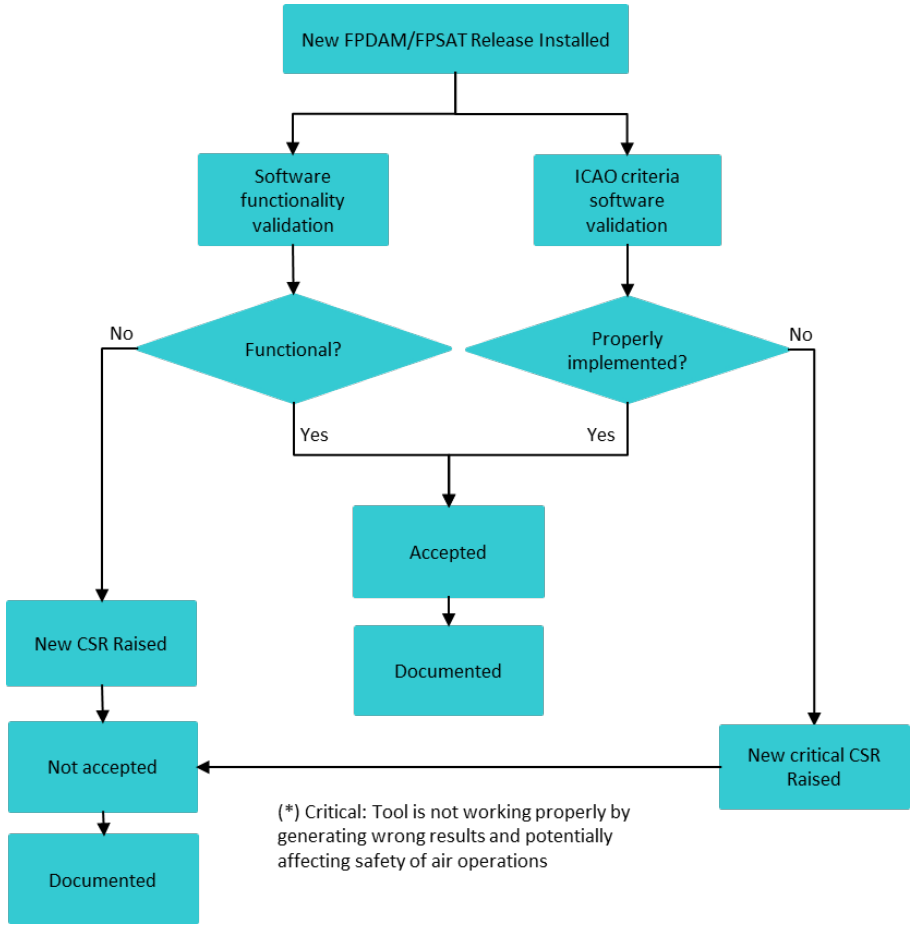
Volume 3 — *Flight Procedure Design Software Validation*;

Flight Procedure Design Software Validation provides guidance for the validation (not certification) of procedure design tools, notably with regard to criteria

DANS APD SOFTWARE VALIDATION AND ACCEPTANCE



Functional validations should confirm that the tool automation functions have been implemented correctly (confirmation of the proper general automation functions).

Validation regarding the ICAO criteria looks at the compliance by verifying of the results obtained in certain tests of the tool

IDS dedicated Customer Support Request (CSR) program. The CSR allows ‘dans’ and other IDS customers to seek resolution of identified problems and omissions with the software, receive responses to queries and submit request for software change, when required.

DOC 9906. VOLUME 4

Volume 4 — *Flight Procedure Design Construction (to be developed);*

DOC 9906. VOLUME 5

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Volume 5 — *Validation of Instrument Flight Procedures*;

Validation of Instrument Flight Procedures provides guidance for the implementation of a validation process of instrument flight procedures

The validation process is subdivided into ground validation and flight validation

DOC 9906. VOLUME 6

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Volume 6 — *Flight Validation Pilot Training and Evaluation (Development of a Flight Validation Pilot Training Programme)*.

Flight Validation Pilot Training and Evaluation provides guidance for the establishment of a flight validation pilot training programme.

QUESTIONS

END

dans

دبـي لـخـدمـات الـمـلاحـة الـجـويـة

DUBAI AIR NAVIGATION SERVICES