GOVERNMENT OF INDIA

OFFICE OF DIRECTOR GENERAL OF CIVIL AVIATION

OPP. SAFDARJUNG AIRPORT, NEW DELHI-110003

F. No. AV.27031/06/2015- ANS

GUIDELINES ON THE DESIGN, VALIDATION, APPROVAL AND PROMULGATION OF INSTRUMENT FLIGHT PROCEDURES (IFP)

(M. Sathiyavathy)

Director General of Civil Aviation

Preface

Instrument flight procedures based on conventional ground-based navigational aids have always demanded a high level of quality control. As a regulatory authority DGCA had issued Guidelines for preparation and implementation of Instrument Approach and Landing Procedures in India vide Office Memorandum No. AV.15026/006/92- AS dated 3rd February, 1992. With the implementation of Performance Based Navigation (PBN) and associated airborne database navigation systems the Instrument Flight Procedure (IFP) process and its products have become the key enablers of Air traffic Management system. Therefore in order to keep pace with the updated technology of aircraft navigation and operation, it has been decided to review the existing guidelines and develop a new document to ensure that the quality of flight procedures published in India is fully established and maintained.

In order to achieve this objective, this document has been prepared by a Task Force duly constituted vide DGCA order no. AV27031/06/2015-ANS dated 26-8-2015 comprising the following members:

1. Shri A. K. Bhardwaj, Director of Operations (ANS)
2. Capt A. Kathpalia, Director (OPS), Air India
3. Capt. Atul Chandra, Dy. CFOI
4. Shri N. V. Atale, Jt. General Manager (ATM), AAI
5. Shri. J. M. S. Negi, (Retd. ED (ATM), Consultant)

Guidelines of this document should be used by all stake holders (DGCA, AAI, Airport Operators and Aircraft Operators) for the expeditious and safe implementations of instrument flight procedures in India.

DGCA O.M. No. AV.15026/006/92- AS dated 3rd February, 1992 stands cancelled.

(M. Sathiyavathy)
Director General Civil Aviation
(Approved vide F. No. F. No. AV.27031/06/2015- ANS dated 21st October 2015)

GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT, NEW DELHI – 110003

F. No. AV27031/06/2015-ANS
Dated 26-08-2015

ORDER

In order to amend the guidelines for construction, design, validation and promulgation of instrument approach procedures within India at civil airports and military airports where scheduled flights are operating, a Task Force of following members is constituted:

1. Shri A.K. Bhardwaj, Director of Operations (ANS), DGCA
2. Capt. Atul Chandra, Dy. CFOI, DGCA
3. Shri N.V. Atale, Jt. GM, AAI
4. Shri J.M.S. Negi, Ex. ED (ATM), AAI and Consultant DGCA

The Task Force may co-opt any other member from the airline industry.

The Terms of Reference of the Task Force are as follows:

a) To prepare guidance for conducting validation of instrument flight procedures, including safety, flyability and design accuracy.
b) To prepare guidance for stakeholders so that they are fully aware of the task and responsibilities regarding validation process of the instrument flight procedures and ensure the quality of the procedures published in India is in accordance with the criteria laid down by ICAO.

The Task Force shall submit its report within 15 days of issuance of this Order.

This issues with the approval of Director General (Civil Aviation).

(Lalit Gupta)
Joint Director General

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DESIGN, VALIDATION, APPROVAL AND PROMULGATION OF INSTRUMENT FLIGHT PROCEDURE (IFP)

1 BACKGROUND

1.1. As a State authority it is the responsibility of DGCA to ensure that all published instrument flight procedures (IFP) can be flown safely by the appropriate category of aircraft. Safety is not only accomplished by application of the technical criteria specified in ICAO Doc 8168-Vol II (PANS-OPS) and associated ICAO provisions, but also by identifying authorised Flight Procedure Design Service Provider (FPDSP), accuracy and integrity of the aeronautical data and obstacle data used in IFP design, measures that control the quality of the process used to apply that criteria such as review & verification, stakeholder coordination, ground validationand flight validation of the IFP.

2. PURPOSE

2.1 This circular provides a detailed description and guidance for design, validation, approval and promulgation of Conventional and PBN Instrument Flight IFP (IFP) for both fixed-wing and helicopter aircraft.

2.2 In order to achieve the objectives of para 2.1, guidance on following topics is provided in this document:

- Flight Procedure Design Service Provider (FPDSP)
- Criteria for IFP Design
- Use of Automation in IFP Design
- Aeronautical and Obstacle Data used in IFP
- Instrument Flight Procedure (IFP) Design Process
- Ground, Simulator and Flight Validation of IFPs
- Approval of IFP
- Preparation of Draft IFP Publication
- Publication of IFP
- Post-Implementation Feedback
- Continuous Maintenance and Periodic Review of IFP
- Oversight of Flight Procedure Design Service Provider (FPDSP)
- Flight Validation Pilot Training and Evaluation
- Instrument Flight Procedure Designer Training
- IFP validation forms (IFPV-01, IFPV-02 & IFPV-03)
- Procedure Design Checklist (Precision IFP & Non-Precision IFP)

3 FLIGHT PROCEDURE DESIGN SERVICE PROVIDER (FPDSP)

3.1 AAI is responsible for designing the all conventional and PBN IFP including SIDs and STARs for all civil airports in India.

3.2 For all privately owned airports; IFP shall be developed by AAI as it has the trained manpower and requisite infrastructure in place.

4 CRITERIA FOR INSTRUMENT FLIGHT PROCEDURE (IFP) DESIGN

4.1 The IFP shall be developed based on the criteria as specified in ICAO Doc 8168-Vol II (PANS-OPS) and other associated documents and the approved Flight Procedure Development Manual of AAI.

4.2 AAI shall develop Flight Procedure Development (FPD) Manual which will be based on ICAO Doc 8168-Vol II criteria for uniform application and standardisation of procedure designing. The manual shall comply with the criteria in ICAO Doc 8168-Vol II (PANS-OPS).

5 USE OF AUTOMATION IN IFP DESIGN

5.1 Procedure design automation tools have the potential to greatly reduce errors in the procedure design process, as well as to standardize the application of the PANS-OPS criteria. AAI may use the available software packages to design the instrument flight procedure. Such software should be robust and meet the criteria for integrity and traceability.

5.2 While using the software package tool to design the instrument flight procedure, it should be ensured that automation functions have been validated to ensure compliance of the final results with applicable criteria as per the guidance contained in ICAO Doc 9906-Vol 3(Flight Procedure Design Software Validation).

6 AERONAUTICAL AND OBSTACLE DATA USED IN IFP

6.1 All IFPs require accurate data based on the WGS-84 geodetic datum. This requires high integrity of survey data used in the procedure design.

6.2 AAI as the air navigation service provider shall maintain an appropriately documented Quality Assurance (QA) system covering all domains of survey data collection accuracy, integrity, validation, processing and publication as per applicable provisions of ICAO Annexes 4, 11, 14, and 15.

7 REQUIREMENT FOR INSTRUMENT FLIGHT PROCEDURE (IFP) DESIGN

7.1 A new IFP or amendment to existing IFP may result due to the following:

- request or feedback from stakeholder/s, or
- installation/upgradation of navigation aid/final approach aid, or
- change in airport infrastructure, e.g. revision of declared distances, or
- change in the airspace structure, or
- as a part of continuous maintenance or periodic review

7.2 Justification for the new IFP or modification to existing IFP must be clearly stated and must be in accordance with the airspace concept and the State navigation strategy.

8. THE INSTRUMENT FLIGHT PROCEDURE (IFP) DESIGN PROCESS

8.1 Once a decision has been taken to design/modify the IFP based on the para 7.1, development of Instrument Flight Procedure (IFP) process will encompass following steps:

- Acquisition, compilation and verification of data
- IFP Design
- IFP Design Documentation (IFP Package)
- Ground validation, Simulator and/orFlight Validation of the IFP
- Approval and Publication of IFP
- Promulgation of IFP
- Post-implementation feedback

8.2 Acquisition, compilation and verification of data

8.2.1 AAI shall ensure use of validated and certified survey data for flight procedure design analysis. The source of terrain, obstacle, and aeronautical data used in IFP design must be documented.

8.3 Instrument Flight Procedure (IFP) Design

8.3.1 IFP shall be designed in accordance with current ICAO Doc 8168-Vol II and/or approved AAI Flight Procedure Design Manual criteria and design inputs based on the amendments issued by ICAO.

8.3.2 However, due to environmental, operational, terrain or obstacle considerations, deviations from ICAO Doc 8168-Vol II criteria such as non-standard approach angles/gradients, non-standard segment lengths, speeds, bank angles etc may be required to be applied during procedure design. Any variations from ICAO Doc 8168-Vol II criteria shall be documented as deviations.

8.3.3 The procedure design information shall be coordinated with all relevant stakeholders.

8.4 IFP Design Documentation (IFP Package)

8.4.1 The documentation provided by the procedure designer is divided into following three categories:

8.4.2 Documentation required for publication in the States' AIP in accordance with ICAO Annexes 4 and 15;

8.4.3 Information/data used in the design;

8.4.4 Documentation required to maintain transparency concerning the details and assumptions used by the procedure designer, which should include supporting additional documentation required to facilitate ground and flight validation of the procedure by airlines/DGCA.

8.4.5 The IFP Design Documentation (IFP Package) must contain following minimum information:

a) IFP Summary
b) List of relevant obstacles, identification and description of controlling obstacles for each segment and obstacles otherwise influencing the design of the procedure,
c) Waypoint ID/Fixname, waypointlatitude/longitude (where applicable), procedural tracks/course, distances and altitudes
d) Any specific environmental requirements related to IFP(e.g. noise abatement, non-standard traffic patterns, etc)
e) Detailed listing of deviation/s from design criteria, if any, reasons for such deviationand proposed mitigation to ensure continued safe operations, ifapplicable.
f) Identification any specific training, operational or equipment requirements due to deviation/s.
g) Airport infrastructure information, such as navaid, approach light system (ALS), visual aids (PAPI/VASIS) etc.
h) Airspace requirements
i) Proposed IFP chart/depiction of appropriate and adequate detail to safely navigate and identify significant terrain and obstacles as per Annex 4 provisions.
j) Proposed ARINC 424 coding* (for PBN IFP only)
k) Appropriate validation checklist and report forms
l) Any other information considered necessary
*Provisions regarding ARINC coding are provided in ICAO Doc 8168-Vol II and may be referred for compliance.
m) Documentations forwarded to DGCA shall also include all mathematical calculations associated with the development of procedure to facilitate the ground validation. Refer Appendix 6, 7 & 8 for IFP Design checklist.

8.4.6 Copies of the draft procedure shall also forwarded to the operators providing only the salient features of the procedure. However there is no need to forward all the documents as required in the case of DGCA.

8.4.7 All documentation related to development and validation of IFP should be retained to assist in recreating the procedure in the future for periodic review, maintenance & investigation. The period of retention shall be up to **1year** after the operational lifetime of the procedure.

8.5 Validation of Instrument Flight Procedure (IFP)

8.5.1 Validation is the necessary final quality assurance step in the procedure design process, prior to publication. The purpose of validation is the verification of all obstacle and navigation data, and assessment of flyability of the procedure. Validation normally consists of ground validation and simulator/flight validation.

8.5.2 **Ground Validation**

8.5.2.1 Ground validation shall always be undertaken. Ground Validation will be accomplished by completing the form **(Appendix 3/Form IFPV-01)**

8.5.2.2 Ground validation is a review of the entire instrument flight procedure package by a person(s) trained in procedure design and with appropriate knowledge of flight validation issues. This may be a joint activity by flight procedure designer, pilot(s) duly authorized by DGCA and a representative of DGCA. If required, DGCA may nominate one or more representatives of the aircraft operators.

8.5.2.3 Operators who receive the draft IFP from AAI will forward their comments to AAI and the DGCA on the flyability of the procedure and any other observation as appropriate.

8.5.2.4 Ground validation will aid in evaluating, to the extent possible, those elements of the IFP that will be evaluated in a flight validation. Issues identified during Ground validation should be addressed prior to undertaking Flight validation.

8.5.2.5 In case of new IFP, while conducting Ground validation, if, the accuracy and completeness of obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, can be verified, then the flight validation requirement for the new IFP based on ground-based navigation aids may be dispensed with.

8.5.2.6 The ground validation in case of modifications/amendments to existing IFP will determine if flight validation is required. It will also determine if suchmodifications/amendments can be promulgated without any requirement of either simulator or flight validation.

8.5.2.7 If required, for clarificatios and better understanding of the procedure, DGCA may convene IFP Review committee Meeting.The meeting will comprise the designated officials from DGCA, representatives from airlines, airport operator & AAI-FPDS. AAI procedure designer may be required to make presentation on the proposed procedure packages under discussion.

8.5.2.8 During the ground validation it will be decided whether there is any necessity of conducting the missed approach in case the flight validation is recommended. Normally, whenever a turning missed approach has been specified prior to reaching either the MHA or the MSA, in a IFP due to the terrain or the obatacles, flight validation of the missed approach will be recommended. If the missed approach specifies the climb straight ahead to either

MHA or the MSA it may not be recommended to be conducted during the flight validation.

8.5.2.9 Ground validation of IFP/s by the DGCA shall be completed within **30 days** of receiving the IFP.

8.5.2.10 Unsatisfactory reportsof ground validation in respect of IFPs shall be forwarded to AAI Flight Procedure Design (FPD) section by DGCA for comments/ amendments in the procedure.

8.5.3 **Flight Simulator Evaluation**

8.5.3.1 To provide an initial evaluation of database coding, flyability and feedback to the procedure designers, a Simulator Evaluation might be necessary based on the recommendation of Ground validation.

8.5.3.2 Simulator Evaluation must be accomplished by a qualified and experienced Flight Validation Pilot (FVP) certified or approved by the DGCA.

8.5.3.3 Simulator evaluation must not be used for obstacle assessment. Preparation for the simulator evaluation should include a comprehensive plan with description of the conditions to be evaluated, profiles to be flown and objectives to be achieved. Flight simulator evaluation will be accomplished by completing the Simulator evaluation form **(Appendix 4/Form IFPV-02).**

8.5.3.4 IFPs with complex turning missed approach procedure, RNP-APCH (LNAV, LNAV/VNAV, LPV) IFP and Required Navigation Performance Authorization Required (RNP AR) IFP should undergo simulator evaluation.

8.5.4 **Flight Validation (FV)**

8.5.4.1 The objective of the Flight Validation of IFP are to:

a) provide assurance that adequate obstacle clearance has been provided;
b) verify that the navigation data to be published, as well as that used in the design of the IFP, is correct;
c) verify that all required infrastructure, such as runway markings, lighting, visual aids and communications and navigation sources, are in place and operative;
d) conduct an assessment of flyability to determine that the IFP can be safely flown; and
e) evaluate the charting, required infrastructure, visibility and other operational factors.

8.5.4.2 Flight Validation should be performed in the following cases:

i. New IFP is being implemented for the first time for a runway

ii. If the flyability of a proposed IFP cannot be determined by other means.

iii. If the proposed IFP contains deviations from PANS-OPS (ICAO Doc 8168-Vol II) criteria

iv. If the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means

v. If modified/amended IFP differ significantly from existing IFP

vi. For Helicopter Pins IFP

8.5.4.3 Flight Validation may not be required in the following cases:

i. In the case of modification/amendment to non-precision approach (NPA) IFP:

a) final approach track (FAT) does not differ from the existing FAT by more than 5^0; and

b) there is no change in the OCA/H; and

c) other segments of the IFP remain unchanged. However, in case of change in initial/intermediate/missed approach segment but the final approach segment remains unchanged and flyability of the IFP can be ensured either by ground validation or flight simulator validation.

ii. In the case of precision approach, initial/intermediate/missed approach segmentis/are amended but the final approach segment and the OCA/H remain unchanged and the flyability of the IFP can be ensured either by ground validation or flight simulator validation.

8.5.4.4 Flight Validation Pilot/Evaluator must either be:

i. a check pilot or examiner pilot or a pilot with minimum 1000 hours of flying experience as PIC in the aircraft type; or

ii. A DGCA Flight Standard Directorate Inspector (Operations) duly authorised; or

iii. An individual with similar pilot qualifications as in 1) who has been authorised by DGCA.

8.5.4.5 The minimum crew complement is two pilots comprising pilot-in-command (PIC) and co-pilot. Both the pilots need to be current and qualified in the appropriate aircraft and proficient with the specific FMS and associated software part number, software version, and revision. Flight Validation Evaluator, although not required to be a crew member, may act as the PIC or Co-pilot in accordance with the requirements above.

(Note: Refer Appendix 1 for qualification and experience requirement of Flight Validation Pilot)

8.5.4.6 DGCA may authorise AAI aircraft for the purpose of flight validation along with an authorised pilot from Flight Safety Directorate (FSD) and procedure designer on-board.

8.5.4.7 AAI may obtain services of other agencies having suitable aircraft with qualified and experienced FV pilot and/or FV evaluator.

8.5.5 **Visibility requirement for Flight Validation**

8.5.1.1 Flight Validation shall be conducted in visibility to permit assessment of obstacles and determine that the IFP flight track reflects the IFP design. In no case; the minimum visibility for the conduct of FV shall be less than the landing minima for the IFP calculated with No ALS (NALS) as determined in accordance with AWO CAR.

8.5.6 **Night Flight evaluation**

8.5.6.1 Night Flight evaluation is required when an IFP is developed to an IFR or visual flight rules (VFR) airport/heliport with no prior night IFR operation.The purpose of night evaluation is to ascertain satisfactory usability of airport lighting systems/visual aidsfor night operations by means of the proposed IFP prior to authorizing night operations. Visibility requirements for night evaluations are same as in Para 8.5.5.1.

8.5.7 **Conducting Flight Validation**

8.5.7.1 A review of the results of the simulator evaluations should be completed before the flight evaluation.

8.5.7.2 The procedure designer may participate in the flight validation to assist in its evaluation and obtain direct knowledge of issues related to the IFP design from the flight validation pilot/evaluator.

8.5.7.3 The procedure designer may be required to provide briefings to the flight validation crew in those cases where IFP have unique application or special features.

8.5.7.4 AAI shall ensure that navigational aid associated with the procedure has been successfully calibrated prior to the flight validation or the submission of final publication documentation of the procedure to DGCA, as the case may be.

8.5.7.5 Aircraft operators, who are assigned responsibility by DGCA for flight validation, shall plan the operation so that the concerned station may be intimated to facilitate the conduct of flight validation. Operator must inform General Manager (ATM-

FPD), AAI at least 48 hrs in advance about the flight validation operation. Flight validation aircraft may be provided priority over other arriving flights which may be delayed by holding over a facility, if necessary.

8.5.7.6 General Manager (ATM-FPD), AAI will ensure that the Airport Director/ATS-in-charge of the concerned airport are informed about the planned validation flight so that the ATC unit may extend all assistance.

8.5.7.7 The pilot-in-command of the flight validation aircraft will be properly briefed by the operator prior to undertaking such flight. Flight validation shall be conducted as per the recommendations of the Ground validation report and may include the missed approach.

8.5.7.8 In case of execution of missed approach procedure during the flight validation, the pilot may conduct normal instrument approach or a visual approach for landing. ATC must be informed clearly about the intention so that other traffic may regulate accordingly.

8.5.7.9 Flight Validation will be accomplished by completing the form **(Appendix 5/Form IFPV-03)**

8.5.8 **Flight Evaluation of SBAS& GBAS IFP–**

8.5.8.1 IFPs based on SBAS and GBAS require analysis of additional parameters contained in the Final Approach Segment (FAS) Data Block and datalink (GBAS). These parameters include:

i. Glide Path Angle
ii. Threshold Crossing Height (LTP or FTP)
iii. Landing Threshold Point (LTP) Coordinates or Fictional Threshold Point (FTP)
iv. Final Path Alignment Point (FPAP) Coordinates
v. Verification of the spatial data contained in the final approach segment definition.
vi. The FAS data evaluation system must be capable of performing the necessary analysis in a documented, quantitative process

8.5.9 **Recording of Flight Validation activity –**

8.5.9.1 A recording device should be used that is capable of IFP storage, time and 3-dimensional position in space with an acceptable sampling rate (not less than 1 Hz), and ability to post-process recorded data.Record and save the minimum of following flight data:

i. Date and time

ii. Number of satellites in view
iii. Minimum number of satellites
iv. Average Position Dilution of Precision (PDOP)
v. Maximum Observed Horizontal Dilution of Precision (HDOP) [LPV IFP only]
vi. Vertical Protection Level (VPL) [LPV and GLS IFP only]
vii. Horizontal Protection Level (HPL) [LPV, GLS IFP only]
viii. Maximum Observed Vertical Dilution of Precision (VDOP)[LPVIFP only]
ix. For each segment, the maximum and minimum altitude, ground speed, climb rate and climb gradient
x. A printed graphic or an electronic file of sufficient detail that depicts the horizontal (and the vertical for VNAV IFP) flight track flown referenced to the desired track of the instrument approach procedure (IAP), including procedure fixes

Note1 -the recording of HDOP, PDOP, VDOP, HPL and VPL are a collection of data in a limited timeframe and their purpose is to document the actual situation at the time of the validation flight.

Note 2–LPV & GLS IFP require analysis of additional parameters contained in the Final Approach Segment (FAS) Data Block.

9 APPROVAL OF IFP

9.1 Based on the reports of ground validation, simulator validation and/or the flight validation DGCA shall consult stakeholders and take decision whether the IFP could be approved for promulgation. 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.

9.2 Considering safety impact, prior approval from DGCA for promulgation of OCA/H may not be required in the following cases:

i. Change in OCH of IFP as a result of amendment to aerodrome elevation or threshold elevation.
ii. Publication of upward revision in IFP procedure altitude/s or OCA/H through NOTAM due to identification of new obstacle/s impacting safety.

9.3 Subsequently necessary documents regarding the change in OCA/H shall be forwarded to DGCA as early as possible.

10 PREPARATION OF DRAFT IFP FOR PUBLICATION

10.1 DGCA would convey the approval of the IFP to the AAI, who, in turn, will prepare a Draft Publication Document (Draft AIP Supplement), based on the Annex 4 and the AIS Manual. All relevant requirements for the safe operation of

the procedure, as brought out in ground validation/simulator evaluation/flight validation shall be included in the text and chart.

10.2 AAI would forward the new draft IFP (text and the chart) to all stakeholder.

10.3 The final draft of the IFP must be verified as to completeness and correctness by all stakeholders within a period of **15 days** from the date of receipt of the final draft and forward their comments to AAI.

11 PUBLICATION OF IFP

11.1 After receiving feedback from the stakeholders on correctness and consistency of final draft of the procedure, AAI should forward it to DGCA for final approval.

11.2 DGCA would then authorise AAI to promulgate the procedure through AIRAC publication.

11.3 The publication of the IFP, supporting data and its accuracy is AAI's responsibility.

12 POST-IMPLEMENTATION FEEDBACK

12.1 After the promulgation of the IFP, stakeholders may provide feedback to DGCA or AAI about the operational implementation of the IFP along with the relevant comments.

12.2 The advice of data provider, ATC and pilots actually using the IFP is particularly relevant. Necessary steps may be taken by AAI, if any positive suggestions for improvement of the IFP are received.

13 CONTINUOUS MAINTENANCE AND PERIODIC REVIEW OF IFP

13.1 Published IFP shall be subjected to a continuous maintenance and periodic review to ensure that they continue to comply with changing criteria, and meetuser requirements. The IFP shall be reviewed, when; either:

i. A new survey/updated survey of the airport or the associated runway takes place; or
ii. The procedure design criteria is/are amended; or
iii. Change in location of navigation aid or runway threshold; or
iv. A new obstacle is identified within the limits of approach segments; or
v. At a periodic review interval of not greater than 5 years whichever of the above occurs first.

14 REGULATORY OVERSIGHT OF FLIGHT PROCEDURE DESIGN SERVICE PROVIDER(FPDSP)

14.1 DGCA may carry out regulatory oversight of the FPDSP. Necessary access to safety, IFP design and training documents may be provided to DGCA inspectors for the purpose.

15 EXPLANATION OF TERMS

AAI	Airports Authority of India
AWO	All Weather Operations
CAR	Civil Aviation Requirements
DGCA	Director General of Civil Aviation
FAS	Final Approach Segment
FPAP	Final Path Alignment Point
FPD	Flight Procedure Design
FPDSP	Flight Procedure Design Service Provider
FV	Flight Validation
FVP	Flight Validation Pilot
GBAS	Ground Based Augmentation System
GLS	GBAS Landing System
HDOP	Horizontal Dilution of Precision
HPL	Horizontal Protection Level
IAP	Instrument Approach Procedure
IFP	Instrument Flight Procedure
LNAV	Lateral Navigation
LP	Localiser Performance
LPV	Localiser Performance with Vertical Guidance (SBAS)
LTP	Landing Threshold Point
MHA	Minimum holding Altitude
MSA	Minimum Sector Altitude
NDB	Navigation Data Base
OCA/H	Obstacle Clearance Altitude/Height
PBN	Performance Based Navigation
PANS-OPS	Procedures For Air Navigation Services- Aircraft Operations
PDOP	Position Dilution of Precision
SBAS	Satellite Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival
VDOP	Vertical Dilution of Precision
VNAV	Vertical Navigation
VPL	Vertical Protection Level

Appendix 1

FLIGHT VALIDATION PILOT TRAINING AND EVALUATION REQUIREMENTS

1. PRE-REQUISITE

1.1. In order to achieve the safety and quality assurance objectives of the flight validation and to ensure that the quality assurance in the procedure design process and its output, including the quality of aeronautical information/data, meets the requirements of Annex 15, flight validation pilots must acquire and maintain minimum established competency level through initial training and supervised on-the-job training (OJT).

1.2. Initial training must ensure that the flight validation pilot is able to demonstrate a basic level of competency that includes at least the following elements:

i. knowledge of the information contained in ICAO Doc 8168-Vol.II(PANSOPS), Volumes I, and other related ICAO provisions relevant to the State; and

ii. Knowledge of and skills in ground and flight validation of IFP.

1.3. Recurrent training must ensure that the flight validation pilot is able to demonstrate a basic level of competency that includes at least the following elements:

i. Knowledge about updates in ICAO provisions and other provisions pertaining to procedure design and flight validation of IFP; and

ii. Maintenance and enhancement of knowledge and skills on ground and flight validation of IFP

1.4. It must ensure that flight validation pilots have undergone an adequate supervised OJT.

1.5. Competency of the flight validation pilot must be evaluated at regular intervals.

2. INITIAL TRAINING

2.1. **Knowledge and skills in ground and flight validation of IFP**

2.1.1. **Ground training in-flight and ground validation duties:**

i. Procedure package contents;

ii. Procedure package review;

iii. Requirements, techniques and considerations for verifying that the navigation data to be published, as well as that used in the design of the procedure, are correct;
iv. Techniques and considerations for ground validation of obstacle data;
v. Requirements, techniques and considerations for obstacle assessment in flight;
vi. Techniques and considerations in the application of ICAO Doc 8168-Vol II (PANS-OPS)IFP design criteria in the ground and flight validation of IFP;
vii. Airport infrastructure assessment
viii. Flyability/Human Factors assessment
ix. Charting considerations
x. Operational factors
xi. Criteria to be met for waiving the requirement for a flight validation

2.1.2. **Flight training in-flight validation duties**:

i. Obstacle assessment requirements, techniques and considerations;
ii. Techniques and considerations in the applications of ICAO Doc 8168-Vol II (PANS-OPS) procedure design criteria in the flight validation of IFP.
iii. Requirements, techniques and considerations for verifying that the navigation data to be published, as well as that used in the design of the procedure, are correct
iv. Airport infrastructure assessment
v. Flyability/Human Factors
vi. Charting considerations and
vii. Operational factors

2.1.3. Supervised OJT adequate to achieve the required level of competency in flight and ground validation, knowledge and skills.

3. RECURRENT TRAINING

3.1. The following are the minimum competencies to be addressed in a recurrent training programme for flight validation pilots, which should be accomplished at least every two years, or when major changes occur:

i) Update on changes in ICAO Doc 8168-Vol II (PANS-OPS) criteria;

ii) Review portions of ICAO Doc 8168-Vol II (PANS-OPS) criteria most relevant to current or projected duties;

iii) Review changes in airport infrastructure requirements; and

iv) Knowledge and skills related to new developments in flight validation.

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Appendix 2

INSTRUMENT FLIGHT PROCEDURE DESIGNER TRAINING REQUIREMENTS

1. TRAINING (BASIC)

1.1. Procedure designers shall be trained in Basic PANS-OPS course at a recognised training institute.

1.2. The basic training shall ensure that the flight procedure designer is able to demonstrate a basic level of competency that includes at least the following elements:

i. Knowledge of information contained in the PANS-OPS, Volumes II and other related ICAO provisions; and

ii. Skills in the design of IFP.

1.3. After successful completion of Basic PANS-OPS Course, those procedure designers posted in Flight Procedure Development Section (FPDS) undergo OJT for a period of six months as Procedure Designer (Trainee).

1.4. Upon successful completion of OJT, Procedure Designer (Trainee) shall be authorised to work as Approved Procedure Designers (APD).

2. ON-THE-JOB TRAINING (OJT)

2.1. The following are the minimum requirements for the completion of OJT by a Procedure Designer (Trainee)

2.1.1. Working under supervision of an active approved procedure designer (APD) for a minimum period of six months. Active APD is a procedure designer who is currently posted in an FPDS and is tasked with development of Instrument Flight Procedures (IFPs).

2.1.2. Develop at least two full-fledged non-precision IFPs during OJT. In case, no new non-precision IFP are planned, then a full-fledged review of at least three non-precision IFP during OJT.

2.1.3. Develop at least one full-fledged precision IFP during OJT. In case, no new precision IFP are planned, then full-fledged review of at least two precision IFPs during OJT.

2.1.4. The procedure designer (Trainee) will be assessed by in-charge of the flight procedure development section for eligibility as APD based on procedure design work undertaken by him/her during OJT.

3. TRAINING (PBN)

3.1. Procedure designers may be further trained in development of IFP based on the performance based navigation (PBN) and satellite based navigation (SBAS) course at a recognised training institute.

3.2. The PBN training course shall ensure that the flight procedure designer is able to demonstrate a basic level of competency that includes at least the following elements:

i. Knowledge of information contained in the PBN Manual (DOC 9613), PANS- OPS, Volumes I and II and other related ICAO provisions; and

ii. Skills in the design of PBN and SBAS (LP/LPV), GBAS (GLS) IFP.

4. ON THE JOB TRAINING (OJT)

4.1. In order to qualify as the APD(PBN) the procedure designer shall undergo the OJT as specified at para 2.2.

4.2. As an On-the-Job Trainee (OJT) for PBN the procedure designer shall design/review at least one SID/STAR, LNAV/LNAV-VNAV&LPV procedure.

5. RECURRENT TRAINING

5.1. Recurrent training to the procedure designers may be provided as and when deemed necessary. This will ensure that the flight procedure designer is able to demonstrate a level of competency that includes at least the following elements:

i. Knowledge about updates in ICAO provisions and other provisions pertaining to procedure design; and

ii. Maintenance and enhancement of knowledge and skills in the design of IFP.

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PRE-FLIGHT/GROUND VALIDATION CHECKLIST			IFPV-01
	1	Procedure Title	
	2	Procedure applicable to Categories of aircraft	
	3	New or Amended Procedure	
	4	Name of the Airport	
	5	Runway Designation	
	6	Evaluator name/phone/email	
	7	Procedure Designer name/phone/email	
	8	Navigation sensor/Navaid	
	9	PBN navigation specification	

B		PRE-FLIGHT VALIDATION	Satisfactory
	1	IFP package forms & procedure chart/s	
	2	Data verification (e.g. aerodrome/heliport, aeronautical, obstacle, ARINC coding)	
	3	Location of the controlling obstacle in respect of all IAP segments indicated in IFP package	
	4	Graphical depiction (chart) correctness	
	5	Intended use and special requirements	
	6	Overall design is meeting PANS-OPS Criteria	
	7	Consider impact on the procedure of waivers to standard design criteria, if applicable	
	9	Segment lengths and descent gradients allow for deceleration/configuration	
	10	Comparison of FMS navigation database with the IFP design, coding and relevant charting information (if applicable)	
	11	Charting of notification of cold/warm temperature limits (if applicable)	
	12	Flight Inspection reports available	
	13	Remarks	

C		CONCLUSION	
	1	Simulator evaluation needed	
	2	Flight evaluation needed	
	3	PROCEDURE	

D		
	Evaluators' Signature	
	Date	

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FLIGHT SIMULATOR EVALUATION CHECKLIST			IFPV-02
	1	Procedure Title	
	2	Procedure applicable to Categories of aircraft	
	3	New or Amended Procedure	
	4	Name of the Airport	
	5	Runway Designation	
	6	Evaluator name/phone/email	
	7	Navigation sensor/Navaid	
	8	PBN navigation specification	

B		SIMULATOR EVALUATION	Satisfactory
	1	Comparison of FMS navigation database and source documents, including proper ARINC 424 coding	
	2	Document simulator aircraft information including FMS software	
	3	Assessed faster and/or slower than charted	
	4	Assessed at allowed temperature limits-Minimum	
	5	Assessed at allowed temperature limit-Maximum	
	6	Assessed with adverse wind components	
	7	Flight track matches tracks depicted on the IAP chart	
	8	Flyability	
	9	Human Factors assessment in respect of flightdeck workload	

C		IAP SEGMENT-WISE SIMULATOR EVALUATION	
C1		Initial Approach Segment	Completed
	1	Heading/Track	
	2	Distance	
	3	Wind Component	
	4	Temperature Conditions	
	5	Maximum Bank Angle Achieved during RF leg (if applicable)	
C2		Intermediate Approach Segment	Completed
	1	Heading/Track	
	2	Distance	
	3	Wind Component	
	4	Temperature Conditions	
	5	Maximum Bank Angle Achieved during RF leg (if applicable)	

C3		Final Approach Segment	Completed
	1	Heading/Track	
	2	Distance	
	3	Vertical Path Angle/Descent Gradient	
	4	Wind Component	
	5	Temperature Conditions	
	6	Maximum Bank Angle Achieved during RF leg (if applicable)	
C4		Missed Approach Segment	Completed
	1	Heading/Track	
	2	Distance	
	3	Wind Component	
	4	Temperature Conditions	
	5	Maximum Bank Angle Achieved during RF leg (if applicable)	
C5		SID	Completed
	1	Heading/Track	
	2	Distance	
	3	Wind Component	
	4	Temperature Conditions	
	5	Maximum Bank Angle Achieved during turn	
C6		STAR	Completed
	1	Heading/Track	
	2	Distance	
	3	Wind Component	
	4	Temperature Conditions	
	5	Maximum Bank Angle Achieved during turn	
D		Recorded Simulator data, to be provided as an attachment to this form	
E		REMARKS	
F		CONCLUSION	
		PROCEDURE	
G		Evaluators' Signature	
		Date	

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FLIGHT VALIDATION (FV) REPORT					IFPV-03
	1	Procedure Title			
	2	Procedure applicable to Categories of aircraft			
	3	New or Amended Procedure			
	4	Name of the Airport			
	5	Runway Designation			
	6	FV Pilot or Evaluators' name/phone/email			
	7	Navigation sensor/Navaid			
	8	PBN navigation specification			
B		**FLIGHT VALIDATION (FV) PARAMETERS**		**Satisfactory**	**Unsatisfactory**
B1		**Holding Procedure**			
	1	Inbound Course/Track			
	2	Minmum Holding Altitude			
B2		**Procedure Outbound (Initial and Intermediate Approach Segment)**			
	1	Outbound Course/Track			
	2	Rate of Descent			
	3	Turn Altitude			
	4	Outbound Distance			
	5	Maximum Distance in Turn			
	6	TAWS Alert			
	7	Segment length, turns and bank angles, speed restrictions			
	8	Use of Autopilot			
B3		**Procedure Inbound (Final Approach Segment)**			
	1	Interception of Inbound Course/Final Approach Track/Localiser			
	2	Rate of Descent			
	3	Straight-In Approach			
	4	OCA/H to Touchdown (Visual Segment)			
	5	Threshold Crossing Height (LTP or FTP, if applicable)			
	6	FAS Datablock (if applicable)			
	7	TAWS Alert			
B4		**Missed Appraoch Segment**			
	1	Missed appproach, if done			
	2	Climb Gradient			
	3	TAWS Alert			

B5		Visual Aids		
	1	Prerformance of Visual Aids (PAPI/VASIS)		
	2	Approach Light System		
D		Night Evalutation		
	1	Aerodrome Ground Light		
	2	Instrument Approach Procedure usability		
E		Recommendation/Comment		
F		FV Pilot/Evaluators'		

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Procedure check list - Non- Precision

Runway: **Threshold elevation:**

INITIAL 1	A	B	C	D
Type: straight (S) racetrack (RT) reversal (R)				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal altitude				
Speed restriction: no (N) yes (Y) value				
Comments				

INITIAL 2	A	B	C	D
Type: straight (S) racetrack (RT) reversal (R)				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal altitude				
Speed restriction: no (N) yes (Y) value				
Comments				

INTERMEDIATE: yes (Y) no (N)	**A**	**B**	**C**	**D**
Length (L) or time (T) value				
Alignment with final: straight (S) angle				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal altitude				
Gradient (G) rate of descent (R) value				
Comments				

FINAL	**A**	**B**	**C**	**D**
On- or off-aerodrome facility				
Rwy QDM, final approach track				
Intercept angle and distance with extended Rwy C/L from THR				
Length (L) time (T) value				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
Stepdown fix: yes (Y) or no (N)				
MOC applied				
OCA (final)				
Gradient (G) rate of descent (R) value				
Comments				

MISSED APPROACH MAPt: facility (F) fix (FIX) distance/FAF (D) value	**A**	**B**	**C**	**D**
Straight missed approach				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied (full MOC = 30 m)				
Required altitude				
OCA missed approach				
Gradient (G) rate of climb (R) value				
Comments				

TURNING MISSED APPROACH Fix (F) altitude (A) distance (D)	**A**	**B**	**C**	**D**
Obstacle elevation in turn initiation area (if turn at an altitude)				
Obstacle elevation in turn area				
Minimum turn altitude (MOC = 50 m)				
MOC applied (full MOC = 30 m)				
Resulting turn altitude				
OCA missed approach				
Restricted speed: no (N) yes (Y) value				
Comments				

RESULTS	**A**	**B**	**C**	**D**
Resulting OCA for the procedure				
Gradient (G) rate of descent (R) value on final				
Level acceleration segment height				
Comments				

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Procedure check list—Precision

Runway: **Threshold elevation:**

INITIAL 1	A	B	C	D
Type: straight (S) racetrack (RT) reversal (R)				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal/Procedure altitude				
Speed restriction: no (N) yes (Y) value				

INITIAL 2	A	B	C	D
Type: straight (S) racetrack (RT) reversal (R)				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal/Procedure altitude				
Speed restriction: no (N) yes (Y) value				

INTERMEDIATE: yes (Y) no (N)	A	B	C	D
Length (L) or time (T) value				
Alignment with final: straight (S) angle				
Obstacle elevation				
Location of obstacle primary (P) secondary (S)				
MOC applied				
Required altitude				
Nominal/Procedure altitude				
Gradient (G) rate of descent (R) value				

PRECISION SEGMENT	A	B	C	D
Distance FAP/threshold				
OAS penetrated no (N) yes (Y) surface				
Obstacle height				
HL applied				
OCHps (precision segment) applied				
OCHps CRM(if application)				
Comments				

STRAIGHT MISSED APPROACH AFTER PS	A	B	C	D
Obstacle height				
SOC height				
HL applied				
OCHm (missed approach)				
Comments				

TURNING MISSED APPROACH	A	B	C	D
Fix (F) or height (H)				
Obstacle height in turn initiation area (if turn at ht.)				
Obstacle height in turn area				
Minimum turn height (MOC = 50 m)				
MOC applied (full MOC = 30 m)				
Resulting turn height				
SOC height				
HL applied				
OCHm (missed approach)				
Comments				

RESULTS	A	B	C	D
Resulting OCH for the procedure				
Level acceleration segment height				
Comments				

GP INOPERATIVE	A	B	C	D
Fix (F) or height (H)				
Obstacle height				
MOC applied				
OCHf (final)				
MAPt: facility (F) fix (FIX) distance/FAF (D) value				
Missed approach: straight (S) turn (T)				
If obstacle height in turn initiation (T) area Minimum T height (MOC = 50 m)				
Required height				
OCHm (missed approach)				
Resulting OCH				
Comments				

Appendix 8

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Procedure checklist—Circling

CIRCLING	**A**	**B**	**C**	**D**
Obstacle elevation				
MOC applied				
OCA (check minimum values)				
Comments				

Procedure check list—Minimum Sector altitude (MSA)

Minimum Sector Altitude(MSA)	**A**	**B**	**C**	**D**
Sector orientations (as applicable)				
Obstacle location and elevation Sectors :				
MOC applied				
MSA values				
Comments				

Procedure check list—Minimum Holding Altitude (MHA)

Minimum Holding Altitude(MHA)	**A**	**B**	**C**	**D**
Holding fixes				
Controlling Obstacle location and elevation for each holding fix:				
MOC applied				
MHA values for each fix				
Comments				