DESIGN CRITERIA
INSTRUMENT FLIGHT PROCEDURES
AIR NAVIGATION ORDER

VERSION : 2.0
DATE OF IMPLEMENTATION : 30-06-2019
OFFICE OF PRIME INTEREST : Directorate of Air Navigation and Aerodrome Regulations

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TYPE OF DOCUMENT	AIR NAVIGATION ORDER(ANO)		
STATUS OF DOCUMENT	CONTROLLED		

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A. AUTHORITY:

A1. This Air Navigation Order (ANO) has been issued in pursuance of Rules 4(3), 57, 66, 161 and other enabling provisions of Civil Aviation Rules, 1994 (CARs, 94).

B. PURPOSE:

B1. The purpose of this ANO is:

i) to provide specifications and guidance for all personnel involved in the design, review, validation and publication process of constructions of Visual and Instrument Flight Procedures in Pakistan.

ii) to defines responsibilities, criteria and provides minimum standards to ensure an effective constructions of Visual and Instrument Flight Procedure (IFP) Process.

C. SCOPE:

C1. The provisions contained in this ANO shall be applicable to all aspects of constructions of Visual and Instrument Flight Procedures, which includes personnel qualification, design, review, validation, promulgation, maintenance and oversight of all Instrument Flight Procedures within Pakistan airspace.

D. DESCRIPTION:

D1. DEFINITIONS:

D1.1 The following terms shall have the meanings assigned to them hereunder. Any other not defined here but used in this ANO shall have the same meaning as given in Civil Aviation Ordinance, 1960 and CARs, 94.

D1.1.1 **ACCURACY:**
A degree of conformance between the estimated or measured value and the true value.

D1.1.2 **AERODROME OPERATING MINIMA:**
The limits of usability of an aerodrome either for take-off or landing usually expressed in terms of visibility or Runway visual range, decision altitude/height or Minimum Descent altitude/height and cloud conditions.

D1.1.3 **APPROACH PROCEDURE WITH VERTICAL GUIDANCE (APV):**
An instrument procedure which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.

D1.1.4 **AREA NAVIGATION (RNAV):**
A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

D1.1.5 **CERTIFICATION**
An authoritative confirmation of meeting specific standards.

D1.1.6 **COMPETENCY**
A dimension of human performance that is used to reliably predict successful performance on the job.

D1.1.7 **DATA QUALITY:**
A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity.

D1.1.8 **DESIGNER:**
A person adequately trained who performs the design of an instrument flight procedure.

D1.1.9 **FLIGHT PROCEDURE DESIGN:**
The complete package that includes all the considerations that went into the development of an instrument flight procedure.

D1.1.10 **FLIGHT PROCEDURE DESIGNER:**
A person responsible for flight procedure design who meets the competency requirements as laid down by the State.

D1.1.11 **FLIGHT PROCEDURES INSPECTORATE (FPI)**
A State entity designated to carry out the safety oversight activities in the area of development and maintenance of visual and instrument flight procedures.

D1.1.12 **FLIGHT PROCEDURE INSPECTORATE STAFF**
A person responsible for the oversight of the process of development and maintenance of visual and instrument flight procedures.

D1.1.13 **FLIGHT PROCEDURE DESIGN PROCESS**:
The process which is specific to the design of instrument flight procedures leading to the creation or modification of an instrument flight procedure.

D1.1.14 **GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS):**
A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.

D1.1.15 **HOLDING PROCEDURE:**
A predetermined manoeuvre which keeps an aircraft within a specified airspace while awaiting further clearance.

D1.1.16 **INSTRUMENT FLIGHT PROCEDURE:**
A description of a series of predetermined flight manoeuvres by reference to flight instruments, published by electronic and/or printed means.

D1.1.17 **INSTRUMENT FLIGHT PROCEDURE DESIGN SERVICE (IFPDS)**
A service established for the design, documentation, validation, maintenance and periodic review of instrument flight procedures necessary for the safety, regularity and efficiency of air navigation.

D1.1.18 **INSTRUMENT FLIGHT PROCEDURE SERVICE Provider (IFPDSP)**
A body that provides an IFPDS.

D1.1.19 **INSTRUMENT FLIGHT PROCEDURE PROCESS:**
The overarching process from the data origination to the publication of an instrument flight procedure.

D1.1.20 **NON-PRECISION APPROACH (NPA) PROCEDURE:**
An instrument approach procedure which utilizes lateral guidance but does not utilize vertical guidance.

D1.1.21 **OBSTACLE ASSESSMENT SURFACE (OAS):**
A defined surface intended for the purpose of determining those obstacles to be considered in the calculation of obstacle clearance altitude/height for a specific APV or precision approach procedure.

D1.1.22 **OBSTACLE CLEARANCE ALTITUDE (OCA) OR OBSTACLE CLEARANCE HEIGHT (OCH):**

The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

D1.1.23 **OPERATOR:**

A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

D1.1.24 **PERFORMANCE-BASED NAVIGATION (PBN):**

Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

D1.1.25 **PRECISION APPROACH (PA) PROCEDURE:**

An instrument approach procedure using precision lateral and vertical guidance with minima as determined by the category of operation.

D1.1.26 **PRIMARY AREA:**

A defined area symmetrically disposed about the nominal flight track in which full obstacle clearance is provided.

D1.1.27 **RADIO NAVIGATION SERVICE:**

A service providing guidance information or position data for the efficient and safe operation of aircraft supported by one or more radio navigation aids.

D1.1.28 **REVIEW:**

An activity undertaken to determine the suitability, adequacy and effectiveness of an Instrument Flight Procedure.

D1.1.29 **SAFETY ASSESSMENTS:**

A proactive mechanism for identifying potential hazards and finding ways to control the risks associated with them.

D1.1.30 **SAFETY MANAGEMENT SYSTEM:**

A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

D1.1.31 **SAFETY PROGRAMME:**

An integrated set of regulations and activities aimed at improving safety.

D1.1.32 **SECONDARY AREA:**

A defined area on each side of the primary area located along the nominal flight track in which decreasing obstacle clearance is provided.

D1.1.33 **STANDARD INSTRUMENT ARRIVAL (STAR):**

A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

D1.1.34 **STANDARD INSTRUMENT DEPARTURE (SID):**

A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.

D1.1.35 **VALIDATION:**

Confirmation through the provision of objective evidence that the requirements for a specific intended use or application have been fulfilled. The activity whereby a data element is checked as having a value that is fully applicable to the identity given to the data element, or a set of data elements that is checked as being acceptable for their purpose.

D1.1.36 **VEGETATION:**

A collective term for plants- the plants of a particular area which may be very diverse or belong to just one or a few species, depending on climatic conditions, the nature of the soil and human activity.

D1.1.37 **VERIFICATION:**

Confirmation through the provision of objective evidence that specified requirements have been fulfilled. The activity whereby the current value of a data element is checked against the value originally supplied.

D1.1.38 **V_{S0}:**

The stalling speed or the minimum steady flight speed in landing configuration (full flaps, landing gear down, spoiler retracted).

D1.1.39 **V_{S1G}:**

The one-G stall speed at which the airplane can develop a lift force (normal to the flight path) equal to its weight (aviation).

D2. DESIGN STANDARDS:

D2.1 GENERAL CRITERIA:

D2.1.1 Aircraft performance differences have a direct effect on the airspace and visibility required for maneuvers such as circling approach, turning missed approach, final approach descent and maneuvering to land (including base and procedure turns). The most significant factor in performance is speed

D2.1.2 The landing configuration, which is to be taken into consideration, shall be defined by the operator or by the airplane manufacturer.

D2.1.3 Where airspace requirements are critical for a specific category of aircraft, procedures may be developed based on lower speed category aircraft, provided use of the procedure is restricted to those categories only. Alternatively, the procedure may be designated as limited to a specific maximum IAS for a particular segment without reference to category.

D2.1.4 An operator may impose a permanent, lower landing mass, and use of this mass for determining V_{at} if approved by the Director General. The category defined for a given aeroplane shall be a permanent value and thus independent of changing day-to-day operations.

D2.2 PROCEDURE DESIGN:

D2.2.1 AIRCRAFT PERFORMANCE CATEGORIES:

D2.2.1.1 The criteria taken into consideration for the classification of aeroplanes by categories is the indicated airspeed (IAS) at threshold (V_{at}) which is equal to the stall speed V_{so} multiplied by 1.3 or stall speed V_{s1g} multiplied by 1.23 in the landing configuration at the maximum certificated landing mass, whichever is higher.

D2.2.1.2 Letter designations assigned to each category of aircraft, based on the above stated classification criteria, in the design of instrument flight procedures shall be as under;

D2.2.1.2.1 Category A — less than 91 Kt indicated airspeed (IAS)
D2.2.1.2.2 Category B — 91 kt or more but less than 121 Kt IAS
D2.2.1.2.3 Category C —121 kt or more but less than 141 Kt IAS
D2.2.1.2.4 Category D —141 kt or more but less than 166 Kt IAS
D2.2.1.2.5 Category E —166 kt or more but less than 211 Kt IAS
D2.2.1.2.6 Category H — Helicopters (stall criteria does not apply)

D2.2.1.3 Procedures should normally be designed for aircraft category A-D. Category E& H procedures should be designed whenever a specific requirement arises. Helicopters while flying IFR will utilize the OCA/H of Category A.

D2.2.2 DESIGN CRITERIA:

D2.2.2.1 Design criteria contained in ICAO Doc 8168 Volume-II (PANS-OPS) “Construction of Visual and Instrument Flight Procedures” should apply as a minimum in all aspects e.g. segment lengths, fix tolerances, area widths, turn protection areas, merging of segments, obstacle clearances etc, except for intermediate segment in which the optimum length of 3NM may be considered while the minimum requirement is 5NM. In all such cases, stabilization distance required for turn at IF needs to be considered unless otherwise prescribed by the Director General.

D2.2.2.1.1 Differences with the design criteria prescribed in the Construction of Visual and Instrument Flight Procedures – PANS-OPS DOC 8168 Vol. II shall be published in AIP Pakistan.

D2.2.2.2 Temperature less thanISA+15shall not be used for indicated airspeed conversion (IAS). However, if climatologically conditions of a place requires, higher values should be used based on the available data.

D2.2.2.3 Wind criteria of PANS-OPS DOC 8168 shall be used for computation of wind in different segments. If the wind data of a place indicates that a lower value is desirable, the permission shall be obtained from the Director General prior to using any such value.

D2.2.2.4 Obstacle Assessment Surfaces or Collision Risk Model should be used for computation of OCA/H in ILS approaches.

D2.2.2.5 All straight-in Instrument Approach Procedure(s) (IAP) shall be protected for obstacles in the visual segment, for this purpose, no obstacles shall penetrate a Visual Segment Surface (VSS). In case of obstacle penetration is found in VSS, an aeronautical study should be conducted to verify significance of Hazard and recommend mitigation measures for the implementation of IAP or unless otherwise approved by the Director General. In no case, penetration of OCS should be accepted.

D2.2.2.6 Area Navigation Procedures shall be designed in accordance with PBN criteria according to required navigation specifications and sensors.

D2.2.2.7 Deviations from design criteria shall only be made for specific cases wherein compliance to the PANS-OPS DOC 8168provisions is impracticable. In all such cases, a safety assessment shall be made and proper mitigation process including consultation with relevant operators shall be followed prior to submitting case for the approval of Director General. However, for area navigation procedures, in no case segment length less than the Minimum stabilization distance is allowed.

D2.2.2.8 Wherever possible, non-precision approach procedures should be designed as straight-in approaches in accordance with the alignment criteria contained in PANS-OPS DOC 8168.

D2.2.3 AIRSPACE BUFFERS:

D2.2.3.1 OVERLAPPING PROCEDURES:

D2.2.3.1.1 The secondary areas for instrument approach procedures of one aerodrome shall not overlap the secondary area of another procedure of a second aerodrome, unless all procedures involved are wholly contained in controlled airspace. Wherever this is not practicable, vertical separation shall be used to ensure that a minimum of 1000ft is maintained between aircraft on the two procedures during all segments of Instrument approach procedures.

D2.2.3.2 CONTROLLED AIRSPACE:

D2.2.3.2.1 When it is desired to confine procedures within controlled airspace, it must be designed so that horizontally a buffer of 01NM is provided between primary areas of holding and each segment of Instrument approach procedure; and a vertical buffer of 1000ft is provided between aircraft nominal position and airspace limit.

D2.2.3.3 PROHIBITED, DANGER AND RESTRICTED (P, D AND R) AREAS:

D2.2.3.3.1 Instrument Flight Procedures, which cross or abut P, D and R areas, when such areas contain flying activities, shall be designed to ensure that:

D.2.2.3.3.1.1 horizontally, the boundary of such area does not infringe the primary protection areas of the relevant procedures plus a 2.5NM buffer.

D.2.2.3.3.1.2 vertically, the altitude limit over the area must be the vertical limit of the area plus 1000 ft, or the altitude dictated by obstacle clearance criteria, if higher

D2.2.3.3.2 Instrument Flight Procedures, which cross or abut P, D and R areas,when such areas

are not used for flying activities, shall be designed to ensure that:

D.2.2.3.3.2.1 horizontally, the boundary of such area does not infringe the primary protection areas of the relevant procedures plus a 1NM buffer.

D.2.2.3.3.2.2 vertically, the altitude limit over the area must be the vertical limit of the area plus 500 ft, or the altitude dictated by obstacle clearance criteria, if higher.

D2.3 PROCEDURE NAMING AND IDENTIFICATION:

D2.3.1 Instrument Approach Procedure shall be named in accordance with the naming convention contained in ICAO PANS-OPS DOC 8168.

D2.3.2 Arrival and Departure procedures shall be designated in accordance with the criteria prescribed in ANO-002-DRAN-1.0.

D2.3.3 All instrument flight procedure charts shall be identified in accordance with the criteria prescribed in ANO-010-DRAN-1.0.

D2.4 OBSTACLE CLEARANCE ALTITUDE/HEIGHT:

D2.4.1 Procedure designers shall only compute OCA/H of the Instrument Approach Procedure for promulgation.

D2.4.2 Aerodrome operating minima (MDA/DA and visibility requirement) shall be established by the Aircraft operators in accordance with the ANO 91.0019 “All weather operations and limitations”.

D2.4.3 Publication of straight-in OCA/H(Instrument Flight Procedure) is limited to aerodromes where the descent gradient/rate of descent is within permissible limit prescribed in ICAO PANS-OPS DOC 8168.

D2.4.4 Common grouping for promulgating OCA/H for category A/B and C/D aircraft may be used for penalties of less than 100 ft.

D2.4.5 The vertical and horizontal accuracy of the maps and charts used during instrument flight procedure design shall be accounted for.

D2.4.6 An allowance, for vegetation depending upon the nature of terrain while computing OCA/H and MOCA for each segment, shall be made. The same shall be recorded in the documentation along with justification.

D2.5 SCALE OF MAPS:

D2.5.1 The following scale of maps should be used for plotting instrument flight procedure segments when manual designing is carried out:

D2.5.1.1 1:1000,000 and 1:500,000 for initial calculation of minimum sector altitudes.

D2.5.1.2 1:250,000 for confirmation of minimum sector altitude, standard arrival routes, racetrack and reversal areas, initial, intermediate and missed approach segments.

D2.5.1.3 1:100,000 and 1:50,000 for detail checks within racetrack/reversal areas, intermediate areas, final approach area and missed approach area.

D2.5.1.4 1:25,000 and 1:10,000 for check of the ILS precision segment and preparation of obstacle data for CRM.

D2.5.2 Suitable geo-referenced maps with appropriate contour values may be utilized in designing using automation tools.

D2.6 PROMULGATION:

D2.6.1 Aeronautical Information service provider (ANS Division of CAA) in accordance with relevant applicable provisions shall undertake the promulgation of the instrument flight procedures in AIP Pakistan.

D2.6.2 Procedure Designers shall ensure that all important and necessary information pertaining to safety of air navigation has been depicted on the charts.

D2.7 REFERENCE MATERIAL:

D2.7.1 The procedure designers shall be provided the documents as appropriate to the type of Instrument Flight Procedure design. The provision of following documents is recommended:

D2.7.1.1 Air Navigation Order No. ANO-006-DRAN-2.0

D2.7.1.2 Air Navigation Order No. ANO-002-DRAN-2.0

D2.7.1.3 Air Navigation Order No. ANO 91.0019 “All weather operations and limitations”

D2.7.1.4 Aeronautical Information Publication (AIP) Pakistan

D2.7.1.5 ICAO PANS-OPS Doc 8168-OPS/611 Volume I & II

D2.7.1.6 Aeronautical Chart Manual Doc 8697

D2.7.1.7 ICAO Template Manual for Holding, Reversal and Racetrack Procedures, DOC 9371-AN/912/2;

D2.7.1.8 ICAO Manual on the use of Collision Risk Model (CRM) for ILS operations Doc 9274;

D2.7.1.9 ICAO Instrument Flight Procedures Construction Manual, Doc 9368.

D2.7.1.10 ICAO Performance Based Navigation Manual Doc 9613

D2.7.1.11 ICAO Quality Assurance Manual for Flight Procedure Design Doc 9906

D2.7.1.12 Annex 2, 4, 6, 11 and 15 to ICAO Convention.

D2.7.2 Document and data control processes shall ensure that;

D2.7.2.1 documents are authorized for use by the Procedure Designer;

D2.7.2.2 the currency of documentation can be readily determined;

D2.7.2.3 documents are available at locations where needed by the procedure designer; and

D2.7.2.4 only current versions of documents are available.

D3. DESIGN ORGANIZATION/PERSONNEL

D3.1 INTRODUCTION

D3.1.1 The provision of erroneous, incomplete or badly designed flight procedures and associated minima has direct consequences to the safety and efficiency of aircraft operations. Quality in the design process depends mainly on the accuracy of source data and competency of the design organization /personnel.

D3.1.2 The Authorities responsible for the design organization shallensure the accuracy of source data being used in the design process.

D3.1.3 The Authorities responsible for the design organization shall ensure the compliance of following provisions regarding design organization and personnel.

D3.2 DESIGN ORGANIZATION:

D3.2.1 Design organization(s),involved in the design of instrument flight procedures for aerodromes in Pakistan shall obtain approval from the Director General before undertaking instrument flight procedure design.

D3.2.2 In order to ensure Quality Assurance of Instrument flight procedures design process the design organization shall comply with requirements (as appropriate) described in Appendix A.

D3.2.3 Design organization(s) shall ensure that adequate and competent personnel are assigned the task of construction of visual and instrument flight procedure design.

D3.2.4 Design organization shall ensure suitable workplace equipped with required tools / maps including design automation tools (where applicable) necessary to be utilized in the development of IFP.

D3.2.5 Design organization(s) shall develop training program for acquiring required competency and skills for its designers. Based upon training program the organization shall develop training plan for each official deployed for the task through training need analysis..

D3.3 DESIGNERS TO BE AUTHORIZED:

D3.3.1 A person shall not act as a procedure designer in a Design Organization unless specifically authorized by the Director General. The Director General shall determine the terms and conditions for the grant of such authorization. The minimum qualification required for procedure designers are prescribed in ParaD3.3.3 to D3.3.7, or any other terms and conditions as specified by DGCAA.

D3.3.2 Personnel who are not authorised and not qualified as prescribed under paragraph D3.3.3 to D3.3.7(as applicable) must not:

D3.3.2.1 design a procedure except under the direct supervision of an authorised procedure designer supervisor who is engaged on a full-time basis in the same premises; or

D3.3.2.2 validate (check) a procedure designed by an authorised procedure designer.

D3.3.3 The minimum qualification required for a Designer to be authorized to design conventional procedures is:

D3.3.3.1 satisfactory completion of an approved PANS-OPS DOC 8168 procedures design course; and

D3.3.3.2 satisfactory completion of On the Job Training (OJT) in procedure design under the supervision of an authorised designer.

D3.3.4 The minimum experience required for a Designer to be authorised for design of conventional procedures is at least one satisfactory design under the supervision of authorised designer, completed within last six consecutive months.

D3.3.5 The minimum qualification required for a Designer to be authorised to design Area Navigation procedures(PBN) is:

D3.3.5.1 satisfactory completion of an approved PANS-OPS DOC 8168 procedures design course;

D3.3.5.2 satisfactory completion of an approved RNAV PBN procedures design course; and

D3.3.5.3 satisfactory completion of On the Job Training (OJT) in procedure design under the

supervision of an authorized designer.

D3.3.6 The minimum experience required for a Designer to be authorized for Area Navigation procedures is at least one satisfactory design under the supervision of an authorized designer, completed within last six consecutive months.

D3.3.7 The designer to be authorized, must have designed, checked or been directly involved in the detailed review of a procedure within last one year to meet recency requirement.

D3.3.8 In order to act as a supervisor, the authorized designer must has at least two years experience in the relevant field, whether conventional or area navigation.

D3.3.9 Upon approval / Authorization from DGCAA for Instrument Flight Procedure Design Organization(s) (IFPDOs) and /or personnel(s) DAAR shall issue certification.

D3.4 APPROVED COURSES:

D3.4.1 In determining whether a course will be considered as an approved course, the following criteria shall apply;

D3.4.1.1 an appropriate syllabus;

D3.4.1.2 adequate duration;

D3.4.1.3 the approved training organization.

D3.4.2 Where assessment required is not possible due to any reason, the Director General may consider a course to be approved if:

D3.4.2.1 sufficient evidence exists that the course was completed satisfactorily; and

D3.4.2.2 the course could reasonably have been expected to meet the minimum requirements of an approved course applicable at the time that it was completed

D3.4.3 The design organization/applicant can provide evidence of additional training or practical experience, which enable the design organization/applicant to satisfy the syllabus requirements of an approved course.

D3.5 APPROVALS AND RECORD OF PROCEDURE DESIGNERS:

D3.5.1 Design organization(s) providing procedure design service shall obtain approval for each person engaged as a Designer or supervisor from the Director General prior to any such deployment.

D3.5.2 The Director General, may issue such authorization(s) to person(s) engaged in instrument flight procedure design specifying:

D3.5.2.1 that the person is an authorized Designer; and

D3.5.2.2 the types of procedure that the person is authorized to design; and

D3.5.2.3 any limitations or supervision requirements that apply; and

D3.5.2.4 any authorization to supervise other procedure designers

D3.5.3 A register shall be maintained by the design organization for each procedure designer to record the following details:

D3.5.3.1 basic and technical qualifications;

D3.5.3.2 courses attended;

D3.5.3.3 OJT record;

D3.5.3.4 the authorization issued by the Director General;

D3.5.3.5 proficiency checks conducted; and

D3.5.3.6 designing recency record.

D3.5.4 Records as mentioned in D3.5.3shall be retained during the time that person is employed by the design organization.

D4. PROCEDURE DESIGN ADMINISTRATION:

D4.1 CLASSIFICATION OF PROCEDURES:

D4.1.1 Instrument flight procedures may be designed either in accordance with the conventional or area navigation criteria.

D4.1.2 Terminal instrument flight procedures are classified as either arrival or departure routes.

D4.1.3 Instrument approach procedures are classified as:

D4.1.3.1 Non-precision approach (Conventional/Area Navigation);

D4.1.3.2 Precision approach (Conventional/Area Navigation);

D4.1.3.3 Approach procedure with vertical guidance (APV);

D4.1.3.4 Approach procedure with vertical guidance (APV) SBAS / BARO-VNAV / GLS

D4.1.4 Enroute (Conventional / PBN) ATS route design.

D4.2 GROUND VALIDATION:

D4.2.1 **GENERAL:**

D4.2.1.1 Ground Validation is a review of the entire instrument flight procedure package by a person(s) by an authorized designer. It is a necessary quality assurance step in the procedure design process. Its purpose is the verification of all obstacles and navigation data; and to catch errors in criteria and documentation on the ground, to the extent possible, prior to any flight validation. The ground validation will also determine if flight validation is needed for modifications and amendments to previously published procedures.

D4.2.1.2 Instrument Flight Procedure Design Organization(s) shall develop procedure and mechanism for Ground validation of each procedure.

D4.2.2 designer, validating the procedure must verify the data used for designing from the source before validating the procedure.

D4.2.3 designer, validating the procedure must validate all calculations, worksheets, drawing used in the design of procedure.

D4.2.4 Any discrepancy/improvement needed, shall be documented & forwarded to the designer for required action prior to undertaking flight validation.

D4.3 FLIGHT VALIDATION:

D4.3.1 The purpose of flight validation is to verify database information, to check all obstacles that affect the procedure safety of air navigation, and to assess the 'flyability' of the procedure.

D4.3.2 Flight validation of an instrument flight procedure comprises a review of the draft procedures from an operational perspective conducted by the validation pilot through a flight check.

D4.3.3 If the IFPDS can verify, through ground validation, the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with. However, flight validation is essential in following conditions:

D4.3.3.1 the flyability of a procedure cannot be determined by other means;
D4.3.3.2 the procedure requires mitigation for deviations from design criteria;
D4.3.3.3 the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means;
D4.3.3.4 Reviewed procedures differ significantly from existing procedures. which includes.

i) Different reversal approach methodology is applied.
ii) OCA/H is significantly changed and / or reduced
iii) the final course has been re-aligned by 3° or more
iv) Significant Obstacle(s) have been erected in the Intermediate / Final approach and or Missed approach initial phase area which result in the change Descent / Climb Gradient (%)
v) MHA is reduced by 1000'feet or more.

D4.3.4 The minimum qualification for a flight validation pilot is at least a commercial pilot license with instrument rating in the appropriate aircraft category

D4.3.5 Flight validation pilot should be experts in the field, have sound knowledge and experience in flight-testing/inspection procedures and requirements. The minimum experience for a flight validation pilot is the supervised on-the-job training adequate to achieve the required level of competency in flight validation knowledge and skills.

D4.3.6 Validation flights shall be undertaken in daylight hours and in VMC. The ceiling should preferably be above the initial approach altitude. The flight validation pilot shall occupy a seat in the cockpit with a field of view adequate to conduct the flight validation

D4.3.7 The complete design, as proposed for publication, shall be checked for operational acceptability. The segments requiring validation should be flown at the possible maximum speed relevant to the segment.

D4.3.8 Procedure designer shall provide all relevant data depicted on the map of appropriate scale to flight validation pilot in order to facilitate the conduct of flight validation.

D4.3.9 Whenever possible, Procedure designer undertaking the design or validating should accompany the flight validation pilot during flight validation of the designed procedures.

D4.4 DESIGN RECORDS:

D4.4.1 A designer shall document all records including data with source, calculations, worksheets, drawings, charts and other information pertaining to the design/review of a procedure for validation, publication and traceability.

D4.4.2 All correspondence, safety assessment and mitigation measures, consultation with operators, ground and flight validation reports shall be made part of the record for the relevant procedure. In continuation process the SQMS Directorate shall verify that all mitigation measures have been addressed by ANSP.

D4.4.3 Records relating to procedure designs shall be retained for the period that procedure is available for use and for a period of two years after a procedure ceases to be available or is withdrawn.

D4.5 PUBLICATION:

D4.5.1 The procedure designed/reviewed shall be forwarded to Directorate of Air Navigation and Aerodrome Regulations for the approval of the Authority along with relevant details, ground and flight validation reports and any corrective action taken based on these reports.

D4.5.2 Upon the receipt of the approval of the Authority, procedure along with draft chart shall be forwarded to the Directorate of air Navigation Services for its promulgation in the AIP Pakistan.

D4.5.3 Upon the receipt of the approval of the Authority, procedure not to be published in the AIP shall be forwarded to the relevant operator, for use at a particular aerodrome.

D4.6 MAINTENANCE/PERIODIC REVIEW

D4.6.1 Design organization and/or an aerodrome operator (as appropriate) shall ensure the maintenance of all Instrument Flight Procedures. It shall include assessment of significant changes to obstacles, aerodrome, aeronautical and navigation aids/data for their impact on the IFP on a continuous basis. Maintenance of an Instrument Flight Procedure includes:

D4.6.1.1 general text and data amendments;

D4.6.1.2 redesign to conform with changes to design standards;

D4.6.1.3 redesign or amendment required as a result of changes to critical obstacles, relocation of navigation aids or other changes necessitating such review; and

D4.6.1.4 changes as directed by the Authority.

D4.6.2 On a periodic basis, organization responsible for design/review of instrument flight procedure for an aerodrome shall ensure that all changes to criteria, user requirements and depiction standards, obstacles, aerodrome, aeronautical and navigation aids/data have been assessed in relation to the procedures implemented. Such period shall not exceed five years.

D4.6.3 IFPDS shall ensure review of each published IFPs has been undertaken within specified time frame.

D4.7 PROCEDURE DESIGN AUTOMATION

D4.7.1 **GENERAL:**

D4.7.1.1 Procedure design automation tools have the potential to reduce errors in the procedure design process. There are numerous software packages available that automate, to varying degrees, the application of PANS-OPS DOC 8168 criteria to the procedure design. The advantages include maintaining the integrity of the source data throughout the design phase, reducing human errors, gaining the capability to develop “what-if” scenarios, and standardized application of the criteria.

D4.7.2 In order to ensure safety of instrument flight procedures, design organization should ensure that the software package used in the design of procedures has been validated in accordance with ICAO Quality Assurance Manual for Flight Procedure Design Doc 9906 Vol III Software Validation.

D5. PROCEDURE DESIGN OVERSIGHT:

D5.1 GENERAL:

D5.1.1 The authority, shall make arrangements to ensure implementation and compliance of the Procedure Design requirements by the design organization(s).

D5.2 PROCEDURE DESIGN INSPECTORS:

D5.2.1 Procedure design inspector should be an authorized designer meeting requirements contained in Para D3.3.3 to D3.3.7 and having at least 02 years of experience in the field of procedure design

D5.2.2 In order to ensure the safety and quality of procedures, Procedure design inspector shall evaluate all procedures submitted for the approval of Director General in accordance with the prescribed criteria.

D5.2.3 Procedure design inspector shall inspect each design organization at least once a year to ensure that the organization/personnel deployed in the process of instrument flight procedure design are complying with the applicable provisions.

E. EVIDENCES (ACRONYMS / RECORDS / REFERENCES):

E1. ACRONYMS:

AIP Pakistan	Aeronautical Information Publication, Pakistan
ANO	AIR NAVIGATION ORDER
APV	APPROACH PROCEDURE WITH VERTICAL GUIDANCE
CRM	COLLISION RISK MODEL
DA/H	DECISION ALTITUDE/HEIGHT
ft	FEET
GNSS	GLOBAL NAVIGATION SATELLITE SYSTEM
IAS	INDICATED AIRSPEED
IFP	INSTRUMENT FLIGHT PROCEDURE
ILS	INSTRUMENT LANDING SYSTEM
ISA	INTERNATIONAL STANDARD ATMOSPHERE
kt	KNOT
MDA/H	MINIMUM DESCEND ALTITUDE/HEIGHT
MOCA	MINIMUM OBSTACLE CLEARANCE ALTITUDE
NPA	NON-PRECISION APPROACH
OAS	OBSTACLE ASSESSMENT SURFACE
OCA/H	OBSTACLE CLEARANCE ALTITUDE/HEIGHT
OJT	ON THE JOB TRAINING
PANS–OPS	PROCEDURES FOR AIR NAVIGATION SERVICES–AIRCRAFT OPERATIONS
PA	PRECISION APPROACH
PBN	PERFORMANCE BASED NAVIGATION
RNAV	AREA NAVIGATION
RNP	REQUIRED NAVIGATION PERFORMANCE
SID	STANDARD INSTRUMENT DEPARTURE
STAR	STANDARD TERMINAL ARRIVAL ROUTE
V	SPEED
V_{at}	SPEED AT THRESH HOLD
V_{SIG}	STALL SPEED IN LANDING CONFIGURATION AT MAXIMUM LANDING MASS
V_{so}	STALL SPEED

E2. RECORDS

E2.1 Nil

E3. REFERENCES

E3.1 Air Navigation Order No. ANO-002-DRAN-2.0

E3.2 Air Navigation Order No. ANO 91.0019 "All weather operations and limitations"

E3.3 ICAO PANS-OPS Doc 8168-OPS/611 Volume I & II

E3.4 Aeronautical Chart Manual Doc 8697

E3.5 ICAO Manual on the use of Collision Risk Model (CRM) for ILS operation Doc 9274;

E3.6 ICAO Instrument Flight Procedures Construction Manual, Doc 9368.

E3.7 ICAO Performance Based Navigation Manual Doc 9613

E3.8 Annex 2, 4, 6, 11 and 15 to ICAO Convention

E3.9 ICAO Doc-9906 Quality Assurance Manual for Flight Procedure Design Vol-I, II, III,V and VI

E3.10 ICAO Doc-10068 Manual on the development of Regulatory frame work for Instrument Flight Procedure Design Service

E3.11 Document & Record Control Procedure (CAAO-001-MSXX-2.0)

E3.12 Security Grading / Classification of maintenance of files / Documents (CAAO-001-HRBS)

IMPLEMENTATION

This ANO shall be implemented with effect from July, 2019.

Sqn.Ldr (R)
(SHAHRUKH NUSRAT)
Director General
Pakistan Civil Aviation Authority

Dated: _____July, 2019

_____
(JAVED AZIZ FAROOQI)
A / Director Airspace & Aerodrome Regulations

Dated: July, 2019
File No. HQCAA/1111/411/ARAN/I

Appendix-A

	CHECKLIST FOR FLIGHT PROCEDURE DESIGN WORK Quality Assurance				CAAF-015-ARAN-1.0
Step No. : Procedure Identification		**YES**	**NO**	**N/A**	**REMARKS**
Step 1: INITIATION					
1	**Has the office approved to undertake the subject flight procedure design work?**				
2	**Is this a new flight procedure design work?**				
3	**Is this a periodic review of existing flight procedure?**				
4	**Is this maintenance of existing flight procedure?**				
Step-2: COLLECTION AND VALIDATION OF DATA					
1	**Is the required data available for the task?**				
2	**Is the source of data has been verified?**				
	Step-3 and 4: CREATION OF CONCEPTUAL DESIGN AND REVIEW BY STAKEHOLDER				
1	**Is conceptual design is created?**				
2	**Is input from stakeholder on conceptual design has been obtained and evaluated?**				
3	**Is input considerable and incorporated in conceptual design?**				
4	**If not than is it discussed with stakeholder and agreed?**				

Step 5: APPLY CRITERIA					
1	**Is PANS (OPS) DOC -8168 criteria are applied on agreed conceptual design for final draft?**				
Step-6: DOCUMENT AND STORE					
1	**Is the IFP design work documented and stored?**				
Step-7: SAFETY ASSESSMENT					
1	**Is safety assessment required for the IFP?**				
2	**If safety assessment required than is it done and documented?**				

Step 8a: GROUND VALIDATION AND CRITERIA VERIFICATION					
1	**Is ground validation and criteria verification is done?**				
2	**Is the record of the ground validation and criteria verification is kept?**				
Step 8b: FLIGHT VALIDATIONAND DATA VERIFICATION					
1	**Is flight validation can be dispensed based on ground validation?**				
2	**If done, is flight validation report is received and recommend unrestricted use?**				
3	**If not, is the input is evaluated and incorporated in IFP design?**				
Step 9: CONSULT WITH STAKEHOLDERS					
1	**Is final draft charts forwarded to stakeholder for consultation?**				
2	**Is any input received?**				
3	**If any input received, is it considerable and draft charts are amended accordingly?**				
4	**If not, is stakeholder informed and agreed?**				

Step 10: APPROVAL OF IFP					
1	Is flight validation report and draft charts are forwarded to DAAR for approval?				
2	Is any observation from DAAR?				
3	If any, is it incorporated in draft charts?				

Step-11 and 12: CREATION AND VERIFICATIN OF DRAFT CHART FOR AIS PUBLICATION		YES	NO	N/A	REMARKS
1	Is draft chart forwarded to AIS?				
2	Is final charts prepared for publication by AIS is verified for completeness and consistency?				
Step-13: IFP PUBLICATION BY AIS					
1	Is draft publication checked?				
2	IFP published by AIS.				
Step-14: FEEDBACK FROM STAKEHOLDER					
1	Is any feedback from stakeholders received?				
2	If any, is it analyzed on the accepting ability of the work performed?				
Step 15: CONTINUOUS MAINTENACE OF THE IFP					
1	Is any significant changes to obstacles, aerodrome, aeronautical or Nav. aids data received?				
2	Are any significant changes to criteria and design specification received?				
3	If any, is the IFP reviewed accordingly?				

Step-16: CONDUCT PERIODIC REVIEW					
1	Is 5 years period completed after the implementation of IFP?				
2	If yes, did the periodic review is done?				