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DEFINITIONS

Instrument flight procedure (IFP)
A published procedure used by aircraft flying in accordance with the instrument flight rules which is designed to achieve and maintain an acceptable level of safety in operations and includes an instrument approach procedure, a standard instrument departure, a planned departure route and a standard instrument arrival. (ICAO)

Instrument flight procedure designer (IFPD)
A person who has acquired and maintained the required competency level to design instrument flight procedures in accordance with the applicable criteria. (DCA)

Approved Procedure Designer (APD)
An APD is an instrument flight procedures designer who has met the competency requirements laid down by the DGCA Malaysia and holds an approval for the design of instrument flight procedures for aerodromes or heliports, which are under the jurisdiction of the DGCA Malaysia. (DCA)

Instrument flight procedure design organization (IFPDO)
Referring to an organization responsible for the design and maintenance of instrument flight procedure. (DCA)

Approved Procedure Design Organization (APDO)
An APDO is an organization employing two or more suitably qualified APDs. (DCA)

Flight Validation Pilot (FVP)
A person performing flight validation who meets the competency requirements as laid down by the States. (ICAO)

Flyability
The ability to keep an aircraft within predefined tolerances of designed lateral and vertical flight track. (ICAO)

Instrument approach procedure (IAP) - A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply. Instrument approach procedures are classified as follows; (ICAO)

Non-precision approach (NPA) procedure - An instrument approach procedure design for 2D instrument approach operation Type A. (ICAO)
**Approach procedure with vertical guidance (APV).** A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach Type A. (ICAO)

**Precision approach (PA) procedure.** An instrument approach procedure based on navigation systems. (ILS, MLS, GLS, SBAS Cat I) designed for 3D instrument approach operations Type A and B.

**Standard Instrument Departure (SID)**
A designated instrument flight rule (IFR) departure route linking the aerodrome or a specific runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the enroute phase of a flight commences. (ICAO)

**Planned departure route**
A notified instrument flight rule departure (IFR) route linking the aerodrome or a specific runway of the aerodrome with a specified significant point, normally on the boundary of controlled airspace associated with the aerodrome. (ICAO)

**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. (ICAO)
<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>ATM</td>
<td>Air Traffic Management</td>
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<td>AIP</td>
<td>Aeronautical Information Publication</td>
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<td>Aeronautical Information Services</td>
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<td>ATC</td>
<td>Air Traffic Control</td>
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<td>ATS</td>
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<td>CRM</td>
<td>Collision Risk Model</td>
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<td>DCA</td>
<td>Department of Civil Aviation</td>
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<td>FIR</td>
<td>Flight Information Region</td>
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<td>FVP</td>
<td>Flight Validation Pilots</td>
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<td>ICAO</td>
<td>International Civil Aviation Organization</td>
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<td>IFP</td>
<td>Instrument Flight Procedure</td>
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<td>IAP</td>
<td>Instrument Approach Procedures</td>
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<td>Instrument Flight Rules</td>
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<td>OJT</td>
<td>On-the-Job Training</td>
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<tr>
<td>PANS-OPS</td>
<td>Procedure for Air Navigation Services – Aircraft Operations</td>
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<td>PBN</td>
<td>Performance Based Navigation</td>
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<td>RNAV</td>
<td>Area Navigation</td>
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<td>SID</td>
<td>Standard Instrument Departure</td>
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<td>SARP</td>
<td>Standards and Recommended Practices</td>
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<td>MIFPD</td>
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AMENDMENT RECORDS

The amendments listed below have been incorporated into this copy of the Manual of Instrument Flight Procedure Design:

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<th>Amendment No.</th>
<th>Subject</th>
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FOREWORD

The Manual of Instrument Flight Procedure Design (MIFPD) is published and issued under the authority of the Director General of Civil Aviation (DGCA) pursuant to Civil Aviation Act 1969 Section 24(o) to specifying the national standards and requirements to be met by the instrument flight procedure designers or Instrument flight procedure design or organization for the design and maintenance of instrument flight procedures within the Malaysia airspace.

The standards and recommended practices in this MIFPD are based mainly on ICAO Document 8168 Vol. II (Procedures for Air Navigation Services – Aircraft Operations [PANS-OPS]) and other relevant ICAO documents, and with such modifications as may be determined by DCA Malaysia.


Readers should forward advice of errors, inconsistencies or suggestions for improvement to this Manual to the address below.

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EFFECTIVE DATE

This issue of the MIFPD becomes effective as of 31 Dec 2013
CHAPTER 1 - INTRODUCTION

1.1 General

1.1.1 The Manual of Instrument Flight Procedure Design provides standards and requirements for the design and maintenance of instrument flight procedures (IFP). This is to ensure that all published IFP intended for use by aircraft operating under instrument flight rules (IFR) in Malaysian airspace meets ICAO requirements for instrument flight procedures. APDO shall ensure that the quality and safety of the procedure design product are assured through the review, verification, coordination and validation at appropriate points in the process, so that corrections could be made at the earliest opportunity in the process.

1.1.2 In the interest of safety, APDO shall implement the provisions in the MIFPD and PANS-OPS in a consistent manner, using processes that will minimise the possibility of errors, identify errors that do occur before they impact safety, and provide for continuous improvement of the procedure design process in order to eliminate or reduce future errors.

1.2 Manual of Instrument Flight Procedure Design

1.2.1 This Manual should be read in conjunction with:

(a) ICAO Doc 8168 Volumes I and II - Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS)
(b) ICAO Doc 9368 – IFP Construction Manual
(c) ICAO Doc 9371 – Template Manual
(d) ICAO Doc 9724 – AN/904-Manual on the Use of the Collision Risk Model (CRM) for ILS Operations
(e) ICAO Doc 9365 – All Weather Operation manual
(f) ICAO Doc 9613 – Performance Based Manual
(i) ICAO Doc 8697 – Aeronautical Chart Manual
Where there is a difference between a standard in this document and that of the above-mentioned ICAO documents, the standard in this Manual shall prevail.

In this document, standards are preceded by the word “shall”, whereas recommended practices are preceded by the word “should”. The APD and APDO shall comply with all standards at all times and should endeavour to comply with all recommended practices.

When the APDO is not able to comply with any standards specified or referenced in this Manual, the APDO shall apply to the DGCA for exemption or deviation from the relevant standards. Applications shall be supported in writing with the reasons for such exemption or deviation including any safety assessment or other studies undertaken and where appropriate, an indication of when compliance with the current standards can be expected.

When the APDO is not able to comply with any recommended practices specified or referenced in this Manual, the APDO shall notify the DGCA of the non-compliance or deviation with the supporting reason including any safety assessment or other studies undertaken, and where appropriate, an indication of when compliance with the current recommended practices can be expected.

Any exemption or deviation granted to the APDO shall also be recorded in the operation manual. The operation manual shall also contain the details of the exemption or deviation, such as the reason that the exemption or deviation was requested and any resultant limitations or conditions imposed.

The APDO shall ensure that the units of measurement as specified in the Manual – Units of Measurement to be used in Air and Ground
Operations are used in the design of instrument flight procedures where applicable.

1.2.8 In addition to this document, APDO shall also comply with the following publication as appropriate;

(a) Safety Directive – It is published for purposes of immediate promulgation of local standards and recommended practices in response to, but not limited to, amendments to the ICAO documents. The Safety Directives will be incorporated into subsequent amendments to the Manual.

(b) Safety Publication – this is published for purposes of promulgating supplementary guidance materials to the standards and recommended practices in the Manual of Standards. The publications are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the Manual. Safety Publications may explain certain regulatory requirements by providing interpretive and explanatory materials.

(c) Information Circular – this is published for purposes of bringing to the attention of the APDO educational materials related to aviation safety. The publications could be initiated as a result of ICAO State letters which do not require immediate changes to local regulations, new safety initiatives or international best practices as identified by the DGCA. The APDO is encouraged to review and adopt the material if practicable. Where appropriate, the material in the publications may be incorporated into subsequent amendments of the MIFPD.
CHAPTER 2 - APPROVED PROCEDURE DESIGN ORGANISATION

2.1 Organization

2.1.1 The APDO shall maintain an appropriate instrument design office to enable the APD to carry on design work in instrument flight procedures in accordance with the requirements set out in this document.

2.1.2 The APDO shall ensure that the designs of instrument flight procedure are in accordance with:

(a) applicable standards set out or referred to in ICAO Doc 8168 and associated guidance materials; and
(b) applicable standards as set out in this document.

2.1.3 The APDO shall make provisions for each IFP design to be checked and verified by another APD who is not involved in the designing process.


2.2.1 The APDO shall develop and maintain an operation manual which serves to demonstrate how the service provider complies with the requirements set out in this Manual.

2.2.2 The contents of the operation manual shall include but not limited to the following:

(a) the administrative information required of the APDO; and
(b) a description of the IFP design office that shows the role and responsibilities and job functions of the IFP design office personnel who are responsible for ensuring the compliance of the organization with the requirements in this Manual.

2.2.3 The APDO shall:

(a) keep the operation manual in a readily accessible form;
(b) ensure that the operation manual is readily available to all designing personnel; and
(c) amend the operation manual whenever necessary to keep its contents up to date.

2.2.4 The APDO shall submit a copy of the most current operation manual to the DGCA.
2.3 **Resource Requirements**

2.3.1 The APDO shall provide and maintain facilities for the design work on instrument flight procedures. This would include:

(a) having available equipment appropriate for the design, design verification, flight validation, and maintenance of the types of instrument flight procedures;

(b) access to relevant and current data including, but not limited to, aeronautical data, land contour data, and obstacle data for the design, design verification, flight verification, and maintenance of the instrument flight procedures; and

(c) ready access to copies of relevant documentation comprising technical standards, practices, and instructions, and any other documentation that may be necessary for the design, design verification, flight validation, and maintenance of the types of instrument flight procedure.

2.3.2 If an aeronautical database and aeronautical data is required for designing an instrument flight procedure, the APDO shall ensure the integrity of the database and the data. The data used shall be current, traceable, and meets the required level of verifiable accuracy for the design.

2.4 **Documents and Records Control System**

2.4.1 The APDO shall establish and put into effect, a system for controlling documents and records relating to the instrument flight procedures on which the APD carries on design work, including the policies and procedures for making, amending, preserving and disposing of those documents and records.

2.4.2 The APDO shall make the documents and records, or copies of them or extracts from them, available for inspection by the DGCA.
CHAPTER 3  -  APPROVED PROCEDURE DESIGNER QUALIFICATIONS AND TRAININGS

3.1 Qualifications

3.1.1 The APDO shall ensure that a person designing or amending a flight instrument procedure demonstrates required competency level for flight procedure design.

3.1.2 APDs shall acquire and maintain this competency level through training and supervised on-the-job training (OJT). This is 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 ICAO Annex 4 – Aeronautical Charts and Annex 15 – Aeronautical Information Services.

3.2 Training

3.2.1 The training for APD shall include an initial training and recurrent training at periodic intervals.

3.2.2 A basic level of competency through initial training shall include at least the following elements,

(a) overview of ICAO SARP relating to IFP design and promulgation;
(b) knowledge of information contained in ICAO Doc 8168 –PANS-OPS, and other related ICAO provisions relevant to procedure designs;
(c) general criteria in IFP designing;
(d) non-precision approach design;
(e) precision approach design;
(f) instrument departure designs;
(g) criteria for PBN; and
(h) practical exercises in the design of procedures.

3.2.3 Periodic recurrent training for APDs shall include at least the following elements:

(a) knowledge about updates in ICAO provisions and other provisions pertaining to procedure design; and
(b) maintenance and enhancement of knowledge and skills in the design of procedures.
3.2.4 New IFP designer shall undergo OJT to integrate his basic knowledge with actual practice.

3.2.5 The competency of new IFP designer applying for APD certification shall be subjected to verification by DGCA to ensure compliance with the requirements stipulated in this Manual.

3.2.6 The APDO shall maintain training records for APDs in its employment.
CHAPTER 4 - PROCEDURE DESIGN INFORMATION ACQUISITION

4.1 Information Acquisition

4.1.1 Current and complete survey data and information is crucial to the design of a safe IFP. The APDO shall ensure that the survey and subsequent IFP design activities are controlled and monitored by a person(s) trained in procedure design.

4.1.2 In the obstacle survey for procedure design, the APD shall consider that:

(a) all obstacles be accounted for. Items, such as trees and heights of tall buildings shall be accounted for either by physical examination of the site or by addition of a suitable margin above terrain contours; and

(b) the accuracy of the vertical and horizontal data obtained may be adjusted by adding an amount equal to the specified survey error to the height of all measured obstructions and by making a corresponding adjustment for specified horizontal error.

4.1.3 The procedure design information shall be coordinated with all relevant stakeholders. As input for the procedure design process the following aspects need to be assessed:

(a) airport, navigation aid, obstacle, terrain coordinate and elevation data, based on verified surveys and complying with ICAO Annex 11, 14 and 15 requirements;

(b) airspace requirements;

(c) user requirements – the needs of Air Traffic Service provider and operators who will use this procedure;

(d) airport infrastructure such as runway classification, lighting, communications, runway markings, and availability of local altimeter setting;

(e) environmental considerations; and

(f) any other potential issue associated with the procedure.
CHAPTER 5 - INSTRUMENT FLIGHT PROCEDURE DESIGN PROCESS

5.1 Introduction

5.1.1 The Instrument Flight Procedure Design process (see Appendix 1) encompasses the acquisition of data, design and promulgation of procedures. It starts with compilation and verification of the many inputs and ends with ground and/or flight validation of the finished product, and documentation for publication.

5.1.2 IFP shall be accompanied by a narrative, which describes the procedure in textual format.

5.2 Procedure Design

5.2.1 Procedures shall be designed according to ICAO Doc 8168 – PANS-OPS criteria. Coordination with all concerned parties shall continue throughout the procedure design and validation process to ensure that the procedure meets the needs of the user and the community.

5.2.2 Each new or revised procedure shall be verified by an APD other than the one who designed the procedure, to ensure compliance with applicable criteria.

5.2.3 Published procedures shall be subject to periodic review to ensure that they continue to comply with changing criteria, and meets user requirements. The maximum interval for this review is five years.

5.3 Procedure Design Documentation

5.3.1 The documentation provided by the APD is divided into three categories and includes:

(a) documentation required for publication in the AIP in accordance with ICAO Annexes 4 and 15;

(b) documentation required to maintain transparency concerning the details and assumptions used by the APD, which should include supporting information/data used in the design, such as:

i. controlling obstacle for each segment of the procedure;
ii. effect of environmental considerations on the design of the procedure;
iii. infrastructure assessment;
iv. airspace constraints;
v. ATM operations requirement.
vi. for modifications or amendments to existing procedures, the reasons for any changes; and
vii. for any deviation from existing standards, the reasons for such a deviation and details of the mitigations applied to assure continued safe operations.

(c) additional documentation required to facilitate ground and flight validation of the procedure.

5.3.2 All calculations and results of calculations shall be presented in a manner that enables the reader to follow and trace the logic and resultant output. A record of all calculations shall be kept in order to prove compliance to or variation from the standard criteria.

5.3.3 Formulae used during calculation shall be the standard formulae as stated in ICAO Doc 8168 and related ICAO publications. Units of measurement and conversion factors between such units shall be in accordance to ICAO Annexes 4, 5 and 6.

5.3.4 Rounding of results shall follow the standard guidelines in ICAO Doc 8168 and related ICAO publications. Rounding shall only be made at the publication stage to facilitate usable figures on maps and charts. Where rounding is required at earlier stages rounding shall be made to the pessimistic consideration, i.e. obstacles heights rounded up, speeds rounded up, turn altitudes rounded down etc.

5.3.5 All documentation shall undergo a final verification for accuracy and completeness prior to validation and publication.

5.3.6 All documentation shall be retained to assist in recreating the procedure in the future in the case of incidents and for periodic review and maintenance. The periodic retention shall not be less than the operational life time of the procedure.

5.4 Ground and Flight Validation

5.4.1 Validation

5.4.1.1 Validation is the necessary final quality assurance step in the procedure design process, prior to publication. The purposes of validation are the verification of all obstacle, terrain and navigation data, and provide an assessment of flyability of the procedure. Validation includes ground validation and flight validation as stipulated in ICAO Doc 9906 Volume 5.

5.4.1.2 Ground validation consists of an independent IFP design review and a pre-flight validation. Flight validation consists of a flight simulator evaluation and an evaluation flown in an aircraft.
5.4.1.3 When ground validation can verify 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.

5.4.2 Ground Validation

5.4.2.1 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. It is meant to arrest errors in criteria and documentation, and evaluate on the ground, to the extent possible, those elements that will be evaluated in a flight validation. Issues identified in the ground validation should be addressed prior to any flight validation.

5.4.2.2 The ground validation would also determine if flight validation is needed for modifications and amendments to previously published procedures.

5.4.3 Flight Validation

5.4.3.1 Flight validation of instrument flight procedures should be carried out as part of the initial record and should also be included as part of the periodic quality assurance programme. It shall be accomplished by a qualified and experienced FVP.

5.4.3.2 The objectives of the flight validation of instrument flight procedures 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 procedure, is correct;

(c) verify that all required infrastructure, such as runway markings, lighting, and communications and navigation sources, are in place and operative;

(d) conduct an assessment of flyability to determine that the procedure can be safely flown; and

(e) evaluate the charting, required infrastructure, visibility and other operational factors.
5.4.3.3 Flight validation should be a separate activity from flight inspection. Flight inspection may be required to assure that radio navigation aids are adequately supporting the procedure. This is carried out as part of a formal flight inspection programme and is performed by a qualified Flight Inspector using an appropriately equipped aircraft.

5.4.3.4 The APD shall be the originator of all data applicable to conduct a flight validation. The APD should be prepared to provide briefings to the FVP in those cases where flight procedures have unique application or special features.

5.4.3.5 The APD may participate in the initial validation flight to assist in its evaluation and obtain direct knowledge of issues related to the procedure’s design from the FVP.

5.4.3.6 All completed flight validation report must be submitted to DGCA using validation templates as in the Appendix C or D Doc 9906 Vol. 5 as appropriate.

5.4.4 Qualification for Flight Validation Pilot

5.4.4.1 FVP who wishes to perform a flight validation of IFPs must be qualified in term of minimum qualifications and trainings and competent for flight validations and flight inspection’s work.

5.4.4.2 The qualifications for FVPs shall include:

(a) At least a commercial pilot licence with instrument rating.

(b) The licence held by the FVP should be for the aircraft category (e.g. aeroplane or helicopter) appropriate for the procedure to be validated.

(c) FVPs shall meet all the experience requirements for the airline transport pilot licence in the relevant category of aircraft (e.g. aeroplane or helicopter).

(d) The FVP does not have to be the pilot-in-command of the validation flight nor is he required to have the type rating on the aircraft used for the validation flight.

(e) A thorough knowledge of ICAO PANS-OPS and PBN procedures design principles and methods;

(f) Satisfactory completion of a flight validation course designed according to ICAO Doc 9906 Volume 6.
5.4.4.3 Helicopter procedures are to be validated by pilots who, in addition to the above qualifications, are familiar with helicopter procedure design and operations.

5.4.4.4 Should the FVP not be qualified as pilot-in-command of an aeroplane or a helicopter to be used for a validation flight, another pilot may be assigned to be the Pilot-in-Command provided the FVP occupies a control seat and directs the conduct of the validation.

5.4.4.5 The FVP shall ensure that the Pilot-in-Command or an observer is fully competent in the use of the RNAV system to be used for the flight.
CHAPTER 6 - SAFETY ASSESSMENT

6.1 Safety Assessment

6.1.1 The APDO shall carry out a safety assessment in respect of proposals for new flight procedure designs or any significant changes in a revised procedure. Proposals shall be implemented only when the assessment has shown that an acceptable level of safety will be met.

6.1.2 The safety assessment shall consider relevant factors determined to be safety-significant, including but not limited to:

(a) types of aircraft and their performance characteristics, including navigation capabilities and navigation performance;

(b) traffic density and distribution;

(c) airspace complexity, ATS route structure and classification of the airspace;

(d) aerodrome layout;

(e) type and capabilities of ground navigation systems; and

(f) any significant local or regional data (e.g. obstacles, infrastructures, operational factors, etc).

6.1.3 Safety risk control/mitigation process shall include hazard/consequence identification and safety risk assessment. Once hazards and consequences have been identified and safety risks assessed, the effectiveness and efficiency of existing aviation system defences relative to the hazards and consequences should be evaluated. As a consequence of this evaluation, existing defences shall be reinforced, new ones introduced, or both.

6.1.4 As part of the safety assurance, the risk control/mitigation process shall include a system of feedback. This is to ensure integrity, efficiency and effectiveness of the defences under the new operational conditions.

6.1.5 The APDO shall ensure that the results and conclusions of the safety assessment and mitigation process of a new or changed procedure are specifically documented, and that this documentation is maintained throughout the life of the IFP.
CHAPTER 7 - DESIGN PUBLICATION

7.1 Publication of Instrument Flight Procedures

7.1.1 The APDO shall ensure that IFPs designs/charts are provided to the Aeronautical Information Service (AIS) provider for publication in the AIP.

7.1.2 The intended effective date for operational use of the IFP shall be included in the document narrative.

7.1.3 The designs/charts published in the AIP shall be produced in accordance with the provisions contained in the documents listed below:

(a) ICAO Annex 4 – Aeronautical Charts

(b) ICAO Doc 8168 Volumes I and II - Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS)

(c) ICAO Doc 8697 – Aeronautical Chart Manual

(d) ICAO Doc 8126 AN/872 Aeronautical Information Services Manual

7.1.4 The aeronautical charts included in the AIP shall be kept up-to-date by means of replacement sheets where necessary. Significant amendments or revisions in the IFP shall be clearly indicated in the revised charts.
CHAPTER 8 - PROCEDURE DESIGN AUTOMATION

8.1 General

8.1.1 Procedure design automation tools have the potential to reduce errors in the procedure design process, as well as to standardize the application of the PANS-OPS criteria.

8.1.2 ICAO produces several tools automating elementary portions of the procedure design criteria, where the consequences of error are particularly significant to safety. Included in these tools are the PANS-OPS Obstacle Assessment Surface (OAS) Software and the PANS-OPS Software (CD-101), providing a means to evaluate the total risk of impact with an obstacle or the ground on precision approach.

8.2 Procedural Design Automation

8.2.1 The APDO shall ensure that the software packages used in the design of procedures have been validated. A description of the procedures to be used to ensure that all equipment, including software is operated in accordance with the manufacturer’s operating instructions and manuals, shall be made readily available to the APD.

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INSTRUMENT FLIGHT PROCEDURE DESIGN PROCESS