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| **SADC AVIATION SAFETY ORGANIZATION (SASO)****REGULATIONS** |



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| **ANNEX IV – PART-FPD** **REGULATIONS FOR FLIGHT PROCEDURES DESIGN SERVICES PROVIDERS****First Edition****FEBRUARY 2023** |

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# RECORD OF REVISIONS

| **Rev. No** | **Date****(DD-MM-YYYY)** | **Subject** | **Inserted By****(Department-Division)** |
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# PART I

# PRELIMINARY PROVISIONS

## Citation and commencement

1. These Regulations may be cited as the SASO Model Civil Aviation (Flight Procedures Design Services Providers) Regulations, 202X
2. These regulations come into operation on the date on which it is published in the [State] Gazette.

## Application

1. These Regulations shall apply to a person providing [Flight Procedures Design Services] services within designated air spaces and at aerodromes.

# PART II

# INSTRUMENTS FLIGHT PROCEDURE DESIGN

## General Requirements

1. These Regulations should be read in conjunction with;
2. ICAO Doc 8168 Volumes I and II - Procedures for Air Navigation Services – Aircraft Operations
3. ICAO Doc 8697 – Aeronautical Chart Manual
4. ICAO Doc 9365 – All Weather Operations Manual
5. ICAO Doc 9368 – IFP Construction Manual
6. ICAO Doc 9371 – Template Manual
7. ICAO Doc 9573 – RNAV Operations
8. ICAO Doc 9613 – Manual of Required Navigation Performance (RNP)
9. ICAO Doc 9674 – World Geodetic System 1984 (WGS 84) Manual
10. ICAO Doc 9724 – CRM Manual
11. ICAO Doc 9906 – Quality Assurance Manual for Flight Procedure Design
12. ICAO Annex 4 – Aeronautical Charts
13. ICAO Annex 5 –Units of Measurement
14. ICAO Annex 6 – Aircraft Operations
15. ICAO Annex 14 Vol I – Aerodromes
16. ICAO Annex 14 Vol II – Heliports
17. ICAO Annex 15 – Aeronautical Information Services
18. ICAO Annex 19 – Safety Management
19. Where there is a difference between a standard in these Regulations and that of the above-mentioned ICAO documents, the standard in these Regulations shall prevail.
20. When the instrument flight procedure design service Provider is not able to comply with any standards specified or referenced in these Regulations, the instrument flight procedure design service Provider shall apply to Authority for exemption or deviation from the relevant standards.
21. 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.
22. When the instrument flight procedure design service provider is not able to comply with any standards specified, the instrument flight procedure design service provider shall notify the Authority 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 standards can be expected.
23. Any exemption or deviation granted to the instrument flight procedure design service provider shall also be recorded in the operations manual. The operations 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.
24. A person or Organisation shall not provide an instrument flight procedure design service within the states unless-
	1. certified by the Authority as an Instrument Flight Procedure Design Service Provider (IFPDSP); and
	2. the services are provided in accordance with- (i) these Regulations prescribed or any other publications issued by the Authority.
25. A person or organization shall not design, maintain, review, amend, adapt or publish flight procedures for use in the region without the Authority’s approval and in accordance with these requirements.
26. The Authority (CAA) may:
	1. Provide an instrument flight procedure design service (IFPDS); and/or
	2. Agree with one or more Contracting State(s) to provide a joint instrument flight procedure design service; and/or
	3. Delegate the provision of the instrument flight procedure design service to external agency (ies).
27. The instrument flight procedure design service provider intending to design a flight procedure for aerodromes or airspace within the region shall meet these requirements.
28. The instrument flight procedure design service provider shall utilize a quality management system at each stage of the instrument flight procedure design process.
29. In all cases in above, the Authority shall approve all visual and instrument flight procedures for aerodromes and airspace within the region.
30. The Regulations for the design, continuous maintenance and periodic review of instrument flight procedures shall be as follows
31. An Organisation shall not design, maintain, review, amend, adapt or publish flight procedures for use in the region without the Authority’s approval and in accordance with these regulations.
32. An air navigation service provider shall be designated by the Authority to provide such services.
33. The designated air navigation service provider shall follow an instrument flight procedure process that encompasses acquisition of data, design and promulgation of procedures.
34. The designated air navigation service provider shall ensure that the quality and safety of the procedure design product are assured through review, verification, coordination and validation of the procedure at appropriate points in the process; and
35. The designated air navigation service provider shall ensure that the units of measurement, as specified in these regulations are used in the design of instrument flight procedure.
36. In addition to the Requirements, the following may also be issued as and when required to supplement the Requirements:
37. Safety Directive – this is a mandatory requirement to be complied by the instrument flight procedure design service provider. 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 of the Requirements.
38. Safety Publication – this is published for purposes of promulgating supplementary guidance materials to the standards and recommended practices in the Requirements. The publications are intended to provide recommendations and guidance to illustrate an Instrument Flight Procedure Design Service, but not necessarily the only Instrument Flight Procedure Design Service, of complying with the Requirements. Safety Publications may explain certain regulatory Regulations by providing interpretive and explanatory materials.
39. Information Circular – this is published for purposes of bringing to the attention of the instrument flight procedure design service provider 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 Authority. The instrument flight procedure design service provider 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 Requirements.

## Instrument Flight Procedure Design Organization

1. The instrument flight procedure design service provider shall maintain an appropriate instrument design office to enable the IFP designer to carry on design work in instrument flight procedures in accordance with the Regulations set out in these Requirements.
2. The instrument flight procedure design service provider shall ensure that the designs of instrument flight procedure are in accordance with:
	1. applicable standards set out or referred to in ICAO Doc 8168; and
	2. applicable standards as set out in these Requirements.
3. The instrument flight procedure design service provider shall make provisions for a person(s) trained in IFP design to check and verify independently the Instrument Flight Procedure Design Service of each instrument flight procedure designed.

## Instrument Flight Procedure Design Manual

1. The instrument flight procedure design service provider shall develop and maintain operations manual. The operations manual shall serve to demonstrate how the service provider will comply with these Regulations
2. The contents of the operations manual shall include but not limited to the following:
3. the information required of the instrument flight procedure design service provider as mentioned in these requirements; and
4. a description of the IFP design office that shows the role, responsibilities and job functions of the IFP design office personnel who are responsible for ensuring the compliance of the instrument flight procedure design service provider with the Regulations in sub-paragraph (a).
5. The instrument flight procedure design service provider shall:
6. keep the operations manual in a readily accessible form;
7. ensure that the IFP designer has ready access to the operations manual; and
8. amend the operations manual whenever necessary to keep its content up to date.
9. The instrument flight procedure design service provider shall submit a copy of the its current operations manual to the Authority.

## Resource Regulations

1. The instrument flight procedure design service provider shall provide and maintain facilities for the design work on instrument flight procedures. This would include:
	1. having available equipment appropriate for the design, design verification, flight validation, and maintenance of the types of instrument flight procedures;
	2. 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
	3. 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. If an aeronautical database and aeronautical data is required for designing an instrument flight procedure, the instrument flight procedure design service provider 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.

## Instrument Flight Procedure Development Process

1. The instrument flight procedure design service provider shall establish an IFP development process. The IFP development process shall cover the entire lifespan of a flight procedure, from the initial development, including the approval and publication, and up to the withdrawal of the flight procedure.
2. The IFP design process shall establish a quality system for the entire IFP development process. Refer to ICAO Doc 9906 for guidance on such a quality system.

## Documents and Records Control System

1. The instrument flight procedure design service provider shall establish and put into effect, a system for controlling documents and records relating to the instrument flight procedures on which the designer carries on design work, including the policies and procedures for making, amending, preserving and disposing of those documents and records.
2. The instrument flight procedure design service provider shall, at Authority’s request, make the documents and records, or copies of them or extracts from them, available for inspection by Authority.

## Instrument Flight Procedure Design Qualifications and Training

1. The instrument flight procedure design service provider shall ensure that a person designing or amending a flight instrument procedure demonstrates required competency level for flight procedure design. IFP designers 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 Regulations of ICAO Annex 4 – Aeronautical Charts and Annex 15 – Aeronautical Information Services.
2. The training for IFP designers shall include an initial training and recurrent training at periodic intervals.
3. The instrument flight procedure design service provider shall ensure that the IFP designer is able to demonstrate a basic level of competency through initial training that includes at least the following elements:
4. overview of ICAO Standards and Recommended Practices (SARPs) relating to IFP design and promulgation;
5. knowledge of information contained in ICAO Doc 8168 – PANS -OPS, and other related ICAO provisions relevant to procedure designs;
6. general criteria in IFP designing;
7. non-precision approach design;
8. precision approach design;
9. instrument departure designs;
10. criteria for RNAV, GNSS and RNP; and
11. exercises in the design of procedures.
12. practical The instrument flight procedure design service provider shall ensure that the IFP designer is able to demonstrate a basic level of competency through recurrent training that includes at least the following elements:
13. knowledge about updates in ICAO provisions and other provisions pertaining to procedure design; and
14. maintenance and enhancement of knowledge and skills in the design of procedures.
15. OJT is aimed at permitting the new IFP designer to integrate his basic knowledge with actual practice. The instrument flight procedure design service provider shall ensure that new IFP designers undergo an adequate, supervised OJT.
16. The competency of the IFP designer shall be subject to periodic verification by Authority to ensure continued compliance with the Regulations in this manual.
17. The instrument flight procedure design service provider shall maintain training records for their IFP designers.

##  Information Acquisition

1. Current and complete survey data and information is crucial to the design of safe IFP. The instrument flight procedure design service provider shall ensure that the survey and subsequent IFP design activities are controlled and monitored by a person(s) trained in procedure design.
2. In the obstacle survey for procedure design, the IFP designer shall consider that:
3. 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
4. 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.
5. 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:
6. airport, navigation aid, obstacle, terrain coordinate and elevation data, based on verified surveys and complying with ICAO Annex 11, 14 and 15 requirements;
7. airspace requirements;
8. user Regulations– the needs of Air Traffic Service provider and operators who will use this procedure;
9. airport infrastructure such as runway classification, lighting, communications, runway markings, and availability of local altimeter setting;
10. environmental considerations; and
11. any other potential issue associated with the procedure

## Instrument Flight Procedure Design Process

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.
2. IFP shall be accompanied by a narrative, which describes the procedure in textual format.
3. 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.
4. Each new or revised procedure shall be verified by a person(s) trained in procedure design other than the one who designed the procedure, to ensure compliance with applicable criteria.
5. 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.

## Procedure Design Documentation

1. The documentation provided by the IFP designer is divided into three categories and includes:
2. documentation required for publication in the AIP in accordance with ICAO Annexes 4 and 15;
3. documentation required to maintain transparency concerning the details and assumptions used by the IFP designer, which should include supporting information/data used in the design, such as:
	1. controlling obstacle for each segment of the procedure;
	2. effect of environmental considerations on the design of the procedure;
	3. infrastructure assessment;
	4. airspace constraints;
	5. for modifications or amendments to existing procedures, the reasons for any changes; and
	6. for any deviation from existing standards, the reasons for such a deviation and details of the mitigations applied to assure continued safe operations.
4. Additional documentation required to facilitate ground and flight validation of the procedure.
5. 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.
6. 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.
7. 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.
8. All documentation shall undergo a final verification for accuracy and completeness prior to validation and publication.
9. 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 lifetime of the procedure.

## Ground and Flight Validation

1. The purpose of validation is to obtain a qualitative assessment of the procedure design including obstacle, terrain and navigation data, and provide an assessment of the flyability of the procedure.
2. Validation is the final quality assurance step in the procedure design process for instrument flight procedures (IFP) and is essential before the procedure design documentation is issued as part of the integrated aeronautical information package.
3. The full validation process includes ground validation and flight validation. Ground validation shall always be undertaken.

## Ground Validation

1. Ground validation encompasses a systematic review of the steps and calculations involved in the procedure design as well as the impact of the procedure on flight operations. It must be performed by a person(s) trained in flight 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.
2. The ground validation would also determine if flight validation is needed for modifications and amendments to previously published procedures.
3. If the State 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.

## Flight Validation

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 flight inspector.
2. Flight validation is required under the following conditions:
3. the flyability of a procedure cannot be determined by other means;
4. the procedure requires mitigation for deviations from design criteria;
5. the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means;
6. new procedures differ significantly from existing procedures; and
7. for helicopter PinS procedures.
8. The objectives of the flight validation of instrument flight procedures are to:
9. provide assurance that adequate obstacle clearance has been provided;
10. verify that the navigation data to be published, as well as that used in the design of the procedure, is correct;
11. verify that all required infrastructure, such as runway markings, lighting, and communications and navigation sources, are in place and operative;
12. conduct an assessment of fly ability to determine that the procedure can be safely flown;
13. evaluate the charting, required infrastructure, visibility and other operational factors.
14. Flight validation should be apart from flight inspection. Flight inspection of IFP is required to assure that the appropriate radio navigation aids adequately support 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.
15. The IFP designer shall be the originator of all data applicable to conduct a flight validation provided to the flight inspection operations activity. The IFP designer should be prepared to provide briefings to the flight inspection crews in those cases where flight procedures have unique application or special features.
16. The IFP designer 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 flight inspection pilot and/or inspector.

## Validation Report and Documentation

1. As part of the flight procedure design documentation, a validation report should be completed at the end of the process including reports of individual steps performed. The validation report should contain:
2. the name and signature of the validation experts (flight procedure designer and/or flight validation pilot)
3. Date
4. activities performed
5. type of simulator or aircraft
6. any findings and flight validation pilot comments and
7. operational recommendations.
8. If a flight validation is performed, a printed graphic and/or electronic file of sufficient detail that depicts the flight track flown must be included in the report. Such a file should show procedure fixes, the maximum and minimum altitude, ground speed, climb rate and climb gradient and a comparison of the actual track flown with the desired track of the instrument flight procedure.
9. The validation process flow chart in the context of the flight procedure design process is shown in the figure below.



## Safety Assessment

1. The instrument flight procedure design service provider 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.
2. The safety assessment shall consider relevant factors determined to be safety-significant, including but not limited to:
3. types of aircraft and their performance characteristics, including navigation capabilities and navigation performance;
4. traffic density and distribution;
5. airspace complexity; ATS route structure and classification of the airspace;
6. aerodrome layout
7. type and capabilities of ground navigation systems
8. any significant local or regional data (e.g., obstacles, infrastructures, operational factors, etc.
9. 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.
10. 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.
11. The instrument flight procedure design service provider 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 instrument flight procedure.

## Publication of Instrument Flight Procedures

1. The instrument flight procedure design service provider shall ensure that instrument flight procedures designs/charts, are provided to the Aeronautical Information Service (AIS) provider for publication in the AIP.
2. The intended effective date for operational use of the IFP shall be included in the document narrative.
3. The designs/charts published in the AIP shall be produced in accordance with the provisions contained in the documents listed below:
4. ICAO Annex 4 – Aeronautical Charts
5. ICAO Doc 8168 Volumes I and II - Procedures for Air Navigation Services – Aircraft Operations (PANS -OPS)
6. ICAO Doc 8697 – Aeronautical Chart Manual
7. ICAO Doc 10066 – Procedures for Air Navigation Services – Aeronautical Information Management (PANS-AIM)
8. The aeronautical charts included in the AIP shall be kept up-to-date by Instrument Flight Procedure Design Service of replacement sheets where necessary. Significant amendments or revisions in the IFP shall be clearly indicated in the revised charts.

## Procedures Design Automation

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.
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, providing an Instrument Flight Procedure Design Service to evaluate the total risk of impact with an obstacle or the ground on precision approaches.
3. The Instrument Flight Procedure Design Service provider 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 operated in accordance with the manufacturer’s operating instructions and manuals, shall be made readily available to the IFP designer.

**APPENDIX 1 – Instrument Flight Procedure Design**

**Process**

