Kingdom of Saudi Arabia
General Authority of Civil Aviation

GACA REGULATION

Section 23
Instrument Flight Procedures

Edition 2.0

FOREWORD

The following Regulations governing Construction of Visual and Instrument Flight Procedures are intended for the guidance of procedures specialists and describes the regular instrument flight operations. It provides the basic requirements to GACA-ANS, and those operators and organizations producing instrument flight charts that will result in uniform practices at all KSA aerodromes where instrument flight procedures are carried out.

The design of procedures in accordance with the criteria of this section assumes normal operations. It is the responsibility of aircraft operator to provide contingency procedures for abnormal and emergency operations, in accordance with ICAO Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) - Volume II - Construction of Visual and Instrument Flight Procedures.

The promulgation of this regulation is based on the authority granted in Article 179 of the Civil Aviation Act, and is issued under the authority of the President, General Authority of Civil Aviation, as a duly delegated representative of the GACA Board of Directors, in accordance with Order No.T-41, dated 30/12/1429H (28/12/2008G).

The General Authority of Civil Aviation is responsible for the preparation and distribution of all regulations in sufficient quantities so that all service providers and aircraft operators based in the Kingdom of Saudi Arabia are able to obtain an authentic copy prior to the effective date of the Regulation.

APPROVED:

Original Signed by

Fahad Bin Abdullah Al-Saud

President, General Authority of Civil Aviation
Kingdom of Saudi Arabia

Effective Date: 15 November 2012

CONTENT RULES

1) Organization Structure

GACA has established an Air Navigation System Safety Division (ANS Safety) within the Safety Department (SD) of the Safety and Economic Regulation Sector (S&ER) to carry out the function of safety regulation of air navigation services, to ensure and enforce compliance with the applicable regulations and procedures of GACAR Section 23; and to provide safety oversight to include audits, inspections, investigations and data analysis; and to perform an on-site facilities inspection on an annual basis as a minimum; however, more frequent inspections may be directed by higher authority.

2) Safety Management

a) The GACA SD shall establish a safety program in order to achieve an acceptable level of safety in air navigation operations.

b) The GACA SD shall establish the acceptable level(s) of safety to be achieved by utilizing the Guidance on safety program and on defining acceptable levels of safety that is contained in the ICAO Safety Management Manual (SMM) (Doc 9859).

c) GACA SD shall require, as part of its safety program, that Air Navigation Services implements a safety management system acceptable to the GACA that, as a minimum:
   1) identifies safety hazards;
   2) ensures that remedial action necessary to maintain an acceptable level of safety is implemented;
   3) provides for continuous monitoring and regular assessment of the safety level achieved; and
   4) aims to make continuous improvement to the overall level of safety.

d) A safety management system shall clearly define lines of safety accountability throughout the staff of Air Navigation Services, including direct accountability for safety on the part of senior management.

e) The intent of a safety management system is to have in place an organized and orderly approach in the management of Air Navigation Services safety. Guidance on an air navigation services safety management system is given in the ICAO Safety Management Manual (SMM) (Doc 9859).

3) Rules of Construction

a) To avoid any misunderstanding within this regulation, certain words are to be interpreted as having specific meanings when they are used, unless the context requires otherwise:

   (1) words importing the singular include the plural;

   (2) words importing the plural include the singular; and

   (3) words importing the masculine gender include the feminine.

b) In this regulation, the following protocol is used:

(1) the words **"shall"** and **"must"** indicate that compliance is compulsory;

(2) The word **"should"** indicates a recommendation. It does not means that compliance is optional but rather that, where insurmountable difficulties exist, the GACA- S&ER may accept an alternative means of compliance, provided that an acceptable safety assurance from the Air Navigation Services shows that the safety requirements will not be reduced below that intended by the requirement.

(3) The word **"Can" or "May"** is used in a permissive sense to state authority or permission to do the act prescribed, and the words "no person may * * *" or "a person may not * * *" mean that no person is required, authorized, or permitted to do the act prescribed;

(4) The word **"will"** is used to express the future; and

(5) The word **"includes"** means **"includes but is not limited to".**

AMENDMENT PROCEDURE

The existing General Authority of Civil Aviation Regulations (GACAR) will be periodically reviewed to reflect the latest updates of International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) and PANS; it will be also amended to reflect the latest aviation safety provisions issued by GACA and other regional and international Civil Aviation organizations. A complete revised edition incorporating all amendments will be published every three years from the original effective date of this regulation. The amendment procedure shall be as follows;

1. When the General Authority of Civil Aviation (GACA) receives an amendment to any of the current ICAO Annexes that can affect the provisions of this regulation, it will be forwarded by the Vice President of International Organization Affairs to the Vice President, Safety and Economic Regulation (S&ER) who in turn will provide a copy of this amendment to the concerned department for study and comments taking into account the ICAO deadline for the reply.

2. When any GACA department or stakeholder proposes an amendment to this regulation, it will send a letter with the proposed amendment including a clear justification and argument for such amendment. Following the receipt of an amendment proposal, the S&ER will analyze this proposal and forward its comments and any proposed decision action to the S&ER Vice President.

3. An accepted amendment proposal will be prepared as draft amendment to the GACAR-Section 23 and forwarded to the originator of the amendment proposal and concerned GACA department (s) for further review and comment within a specified timeline.

4. All accepted amendments will be drafted in the form of Notices of Proposed Amendments (NPA) and forwarded to all concerned parties including stakeholders for comment within a two-month reply period. The NPA shall indicate the proposed Amendment's effective date.

5. Following the receipt of NPA replies, the S&ER will analyze the comments received and produce a new draft in consultation with the concerned GACA department. The final draft will be submitted to President of the General Authority of Civil Aviation for formal approval prior to publication.

6. The Amendment's effective date will take into account the comments of all the concerned parties and stakeholders.

7. Any differences between the GACAR Section 23 new amendment and ICAO PANS-OPS will be forwarded to ICAO as a Difference and published as it is in the Aeronautical Information Publication (AIP).

8. All concerned parties and stakeholders will be provided a copy of the new amendment and will be requested to update their copy of the GACAR Section 23 accordingly.

9. It is the responsibility of all concerned parties to keep their copy of GACAR Section 23 and other GACA regulation publication up to date.

SUPPLEMENTARY REGULATIONS

From time to time it will be necessary to issue regulations which supplement or augment the GACA Regulations. The following procedures will apply:

1. Supplementary regulations will be issued in the form of a GACA Regulation Circular (RC).

2. The GACA Regulation Circular will be approved by the President.

3. The process for preparation and publishing of the GACA Regulation Circular will be addressed in the GACA Quality System Manual.

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AMENDMENT RECORD

This edition incorporates all ICAO amendments to PANS-OPS (Doc 8168 – Volume II) (5th Edition) up to and including amendment 4 (Effective 15 November 2011) and corrigenda.

Amendment number	Amendment date	Affected pages	Effective date	Incorporated by	Incorporated on
1.0	May 2009	**All**	**May 2009**	**S&ER**	**May 2009**
2.0	**15 November 2012**	**All pages reviewed**	**15 Nov 2012**	**S&ER ANS Safety**	**15 Oct 2012**

LIST OF CURRENT DIFFERENCES TO ICAO PANS

GACA Regulation Section 23 is based on ICAO Procedures for Air Navigation Services – Flight Operations – Volume II (PANS-OPS Volume II). The following is a list of differences between the GACA Regulation and the ICAO Procedures for Air Navigation Services (PANS). Differences have been notified to ICAO and are also published in the KSA Aeronautical Information Publication (AIP-GEN 1.7).

ICAO PANS OPS VOLUME II: CONSTRUCTION OF VISUAL AND INSTRUMENT FLIGHT PROCEDURES 5th Edition – Amendment 4		
PANS Identifier	**Regulation Reference**	**Difference**
		No differences listed in AIP

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CHAPTER 1 - DEFINITIONS

1.1. Definitions

When the following terms are used in this regulation, they shall have the following meanings:

APV/Baro-VNAV – An instrument approach procedure, which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.

Area navigation (RNAV). A method of navigation which permits aircraft operation on any desired flight path within the coverage of the station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Circling approach. An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Decision altitude (DA) or decision height (DH). A specified altitude or height in the precision approach or approach with vertical guidance at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

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.

Flight procedure designer. A person responsible for flight procedure design who meets the competency requirements as laid down by GACA.

'Flyability' of an Instrument Flight procedure (IFP) - An assessment that the IFP is flyable by the anticipated range of aircraft types in various weight, speed and centre of gravity configurations, and in various weather conditions (temperature, wind effects and visibility). It is also designed to assess that the required aircraft manoeuvring is consistent with safe operating practices, and that flight crew workload is acceptable.

Instrument Approach Procedure (IAP) - A series of pre-determined manoeuvres by reference to flight instruments with specific 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 landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply.

Instrument Flight Procedure (IFP): A description of a series of predetermined flight manoeuvres by reference to flight instruments, published by electronic and/or printed means.

Minimum descent altitude (MDA) or minimum descent height (MDH). A specified altitude or height in a non-precision approach or circling approach below which descent must not be made without the required visual reference.

Minimum obstacle clearance altitude (MOCA). The minimum altitude for a defined segment that provides the required obstacle clearance.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

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.

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.

Obstacle data. Any man-made fixed or temporary object which has vertical significance in relation to adjacent and surrounding features and which is considered as a potential hazard to the safe passage of aircraft, or man-made fixed or temporary objects that extend above a defined surface intended to protect aircraft in flight.

RNAV T- or Y- Bar Procedure – An RNAV non-precision approach or APV incorporating a T- or Y- bar arrangement. It is based on a runway aligned final segment preceded by an intermediate segment and up to three initial segments arranged either side of, and along, the final approach track to form a T or a Y. The lateral initial segments are based on course differences of 70° to 90° from the intermediate segment track.

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.

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.

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.

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.

CHAPTER 2 - CRITERIA FOR THE APPROVAL OF PROCEDURE DESIGNERS

2.1 General guidelines

2.1.1 GACA-S&ER shall accept designs only from a GACA-ANS approved entity or an approved contracted specialist IFP design organization**.** GACA-S&ER will retain a list of Approved Designers. Such list will not absolve GACA-S&ER from carrying out checks as might be considered necessary to satisfy GACA requirements.

2.1.2 GACA-S&ER shall grant individual IFP designer approval to GACA-ANS Staff, provided they comply with GACA requirements for training and experience. Such approvals shall be specific to an individual and non-transferable.

2.1.3 GACA-S&ER shall not be obliged to accept an application for the approval of an instrument approach procedure where that application is not supported by detailed reports issued by the GACA-ANS approved entity (or approved contracted specialist IFP design organization).

2.1.4 GACA-S&ER shall approve a GACA-ANS Staff as IFP designer if it is satisfied that the applicant is competent [having regard to his knowledge, experience, competence, skill and other arrangements] to design an instrument flight procedure which is safe for use by aircraft.

2.1.5 All applications will be judged solely on merit and compliance to declared requirements, where approval is withheld GACA-S&ER will notify GACA-ANS with a full explanation of reasons for the decision.

2.1.5 GACA-ANS will be notified with the list of successful applicants.

2.2 Criteria for approval of individual IFP designers

2.2.1 A three-staged approach for qualification for GACA-S&ER approval is used and set out in the paragraph below. This approach covers the essential elements for an effective, efficient and safe IFP designer.

2.2.2 Any request for approval of GACA-ANS Staff, should contain proof of the following items:

a) **PANS-OPS Qualification**:- Proof of attendance and successful completion of an ICAO PANS-OPS course based upon ICAO PANS-OPS Doc 8168 (including ICAO Doc 9906 Volume 2 training). The courses shall be provided by an approved training institution or organization. A copy of the approval of the training institution or organization shall be provided.

b) **Practical Application of theoretical knowledge**: The ability of an applicant to demonstrate practical application of theoretical knowledge is required. GACA-ANS Staff are expected to provide:

1) **Proof of recent IFP design**: this should include details of specific designs that have been completed and over what period of time. A Statement detailing what work has been done with at least three examples of IFP designs for each type of procedures Conventional NPA approach, RNAV PBN NPA approach, precision approach (ILS CAT I and CAT II), conventional STAR, RNAV STAR, conventional SID, RNAV SID and RADAR approach.

2) **References** Applicants should provide details of previous or current employers; (e.g. Names and addresses of previous or current managers that will be used as a check by GACA-S&ER)

c) **Aviation Experience:**- It is generally accepted that a high level of aviation experience is an important attribute for successful IFP design, ideally as aircrew or air traffic controller. It is not considered essential to hold a current license nor to distinguish between a civil or military background. However, it is considered necessary to consolidate knowledge with experience in order to provide a good platform for IFP design. Therefore, a minimum of 5 years recent operational aviation experience is considered a reasonable qualification period. Procedure Designers who have not the aviation experience, should provide evidence that supports a minimum of five years PANS-OPS, on-the-job design training;

d) **Quality Management System:** GACA-ANS applicants shall demonstrate that they have established and are able to maintain a documented quality system. This quality system shall be such that it enables the design entity to ensure that each design or any advice given with respect to any IFP issue conforms to ICAO or GACA requirements and thus exercise the privileges as granted by their Approval. The quality system shall be described in a quality manual that includes control procedures for:

1) Management responsibility;
2) A Quality System including:
   - (i) Controlled documentation of the design process;
   - (ii) Record control system of design drawings and worksheets;
   - (iii) Record control system of input data including items such as: survey data and charting;
   - (iv) Record control system of regulatory documents and reference material;
   - (v) Control procedures for validation of software tools;
   - (vi) Control of non-conforming design;
   - (vii) Records of personnel competence and qualifications;
   - (viii) Training of personnel;
   - (ix) Internal quality audits and corrective actions;
   - (x) Subcontractor assessment audit and control; and,
   - (xi) Co-ordination throughout the process from design to the publication of the IFP..

2.3. Process for the approval of individual IFP designers

2.3.1. Applying For Approval

2.3.1.1. GACA-ANS shall submit the required material to demonstrate the suitability of applicants against the criteria contained in the Paragraphs above.

2.3.1.2. Submissions for GACA-S&ER approval to design IFPs should be presented in a bound form to ensure material is not lost in transit. Applications should be sent to GACA-S&ER Vice President.

2.3.1.3. Applications shall be acknowledged within 5 workings days of receipt and include a call for Interview or meeting. In considering an application, GACA-S&ER may call upon the concerned applicant to provide clarification or expansion of the information provided.

2.3.1.4. Following an examination of the applicant's submission against the criteria and a successful interview, the Applicant will be notified, in writing, of GACA-S&ER's decision within 2 weeks from the date of interview. A copy of this notification will be sent to the approved GACA-ANS entity. Any objection on GACA-S&ER decision shall be explained in writing. This rationale shall be sent to GACA-S&ER Vice President for action within 2 months of the decision being made.

2.3.2 Design Privileges

2.3.2.1. An approved IFP designer shall be entitled to design IFPs within the scope of the Approval. The list of IFP approved designer will include all the privileges of each designer.

2.3.3 Issue of Approval

2.3.3.1. GACA-ANS shall be entitled to have a design approval issued by GACA-S&ER when it has demonstrated compliance with the applicable requirements.

2.3.4 Duration and continued validity

2.3.4.1. GACA-ANS design approval shall be issued for an unlimited duration. It shall remain valid unless:

a) GACA-ANS designer entity fails to demonstrate compliance with the applicable requirements; or
b) GACA-ANS designer entity no longer meets the eligibility requirements for the design approval

2.3.5. Maintenance of Approval

2.3.5.1. Design approval shall be granted for a period of 3 calendar years.

2.3.5.2. GACA-ANS approved designers should note that their approval will automatically lapse without an application for renewal. Applications for renewal shall be submitted to GACA-S&ER within 3 months from the expiry date of the applicant's Approval. Should an applicant feel it appropriate, GACA-S&ER will accept a catalogue of IFP design activity that has taken place during the previous 3 calendar years.

2.3.5.3. GACA-ANS shall develop job description for IFP designers and all Staff involved in the production and dissemination of instrument flight procedures.

2.3.5.4. GACA-ANS shall develop a training programme based on ICAO Doc 9906 (Quality Assurance Manual for Flight Procedures Design) for all Staff involved in the design and verification of instrument flight procedures. This program shall cover initial, recurrent, specialized and advanced training.

2.3.5.5. GACA-ANS shall maintain training records for all Staff involved in the design and verification of instrument flight procedures.

2.3.6. Withdrawal of Approval

2.3.6.1. The list of approved designers shall be withdrawn or reviewed under the following conditions:

a) the designer(s) fail(s) to satisfy GACA-S&ER of his/their continuing competency. In this event, the designer will be advised in writing of GACA-S&ER's decision and the reasons for it.

b) GACA-ANS requests, in writing, that a designer is withdrawn. Should GACA-ANS wish to reapply for IFP designer approval, the applicant shall be subject to the "Applying for Approval" process detailed in Paragraph 2.3.1 above.

2.4 Audits of GACA-ANS approved design entity

2.4.1 GACA-S&ER shall carry out regular audits of GACA-ANS approved design entity.

2.4.2 When objective evidence is found showing non-compliance of the approved designers with the requirements, the finding shall be set out as follows:

a) **Critical finding** is any non-compliance with applicable requirements and could affect the safety of aircraft operations.

b) **Significant finding** is any non-compliance with these Requirements, which is not classified as critical.

2.4.3 After a receipt of notification of findings:

a) Critical finding must be rectified immediately or within the short timescale specified by GACA-S&ER;

b) In case of significant findings, the corrective action period granted by GACA-S&ER shall be appropriate to the nature of the finding but in any case shall not be more than three months. In certain circumstances GACA-S&ER may extend the three-month period subject to a satisfactory corrective action plan.

2.4.4 In the case of critical or significant findings, the Approval of GACA-ANS design entity may be subject to a partial or full suspension or revocation.

CHAPTER 3 - DESIGN CRITERIA AND PROCESS FOR THE ANALYSIS OF IFP DESIGNS

3.1 Design Criteria

3.1.1 The criteria for IFP design in the Kingdom of Saudi Arabia (KSA) shall be based on and comply with the requirements of ICAO Doc 8168 Volume II PANS-OPS with consideration of any and all differences notified/published in KSA AIP. Where there is a difference between a standard prescribed in ICAO documents and the GACA Regulation 23, the Regulation 23 standard shall prevail. Interpretation of the criteria plays an important role and it is intended that such issues be addressed by a policy statement. Where there are doubts as to the interpretation of the criteria as declared, GACA-S&ER shall be approached for clarification. All such requests shall be made in writing to the Director General of Safety Department.

3.1.2 IFP should also be developed in compliance with the provisions of the latest edition of the following reference documents:

- ICAO Doc 9274 – AN/904 Manual on the Use of the Collision Risk Model (CRM) for ILS Operations
- ICAO Doc 9368 – AN/911 Instrument Flight Procedure Construction Manual
- ICAO Doc 9674 – AN/946 World Geodetic System 1984 (WGS-84) Manual
- ICAO Doc 9365 - Manual of All Weather Operations
- ICAO Doc 9613 – Performance-Based Navigation (PBN) manual
- ICAO Doc 9905 - Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual
- ICAO Doc 9931 - Continuous Descent Operations (CDO) Manual
- ICAO DOC 9906 - The Quality Assurance Manual for Flight Procedure Design VOLUME 1 to 6

3.1.3 Detailed procedures for the calculation of visibility required to be published with a Minimum Descent Altitude or Height (or a Decision Altitude or Height, as appropriate) for ILS and other approaches are shown in Appendix A.

3.2 Design Submission Format and Content

3.2.1 General

3.2.1.1 The content and format of the submission is intended to:

a) Provide a complete record of the design process;
b) Provide all the source data and information used in the design process;
c) Provide a complete record of all calculations and drawings used;
d) Provide a record of Quality Assurance and Quality Control (Internal processes for validation);
e) Supply a full description of the IFPs (Narrative);
f) Supply draft (AIP formatted) charts of the IFPs;
g) Assist and facilitate effective and efficient evaluation of IFPs by GACA-S&ER;
h) Provide all data and information required to re-design IFPs if deemed appropriate by GACA-S&ER; and
i) A report demonstrating how the applicable requirements have been satisfied.

3.2.1.2 GACA-S&ER accepts that all procedures are different and therefore a fully standardized submission is not practical. The requirements in the section are intended as a minimum applicable to the specific IFP and aerodrome in question. Should any doubts arise as to the content and format of a specific submission, guidance will be given by GACA-S&ER.

3.2.1.3 The submission shall include a written description of the final procedure and a draft chart for narrative description which unambiguously describes the procedure in textual format and table showing all tracks in degrees Magnetic (and True bearing when necessary).

3.2.2 Layout

3.2.2.1 The following layout is intended as guidance exemplifying the expected content of a submission.

3.2.2.2 General Section - Common to all IFPs

(a) Runway Parameters including magnetic and true direction, magnetic variation used, threshold coordinates (WGS84), and elevation;
(b) Navigation aids used including frequency, DOC, declination, and coordinates (WGS84);
(c) Aerodrome elevation;
(d) Any redundancy alternatives considered in the design; and
(e) Aeronautical data tabulation including path terminator.

3.2.2.3 General Section - Relating to specific IFPs:

(a) A comprehensive design rationale including references to PANS-OPS Volume II and GACA differences where appropriate;
(b) Reference points for the start and finish of each segment;
(c) Details of obstacle field including controlling/dominant obstacles for each segment;
(d) MOC used (primary and secondary areas) and the resultant calculations including allowance for excessive length for each segment as applicable;
(e) Allowances used for
  a. vegetation, if any;
  b. additional MOC; and
  c. buildings;
(f) Segment length;
(g) Details of significant terrain;
(h) Descent gradient;
(i) Speeds used;
(j) Bank Angle used;
(k) Wind Velocity used;
(l) Altitudes (maximum and minimum) per segment;
(m) Timings;
(n) Reference navigation aid;
(o) Fixes (including Step Down Fixes) and the relevant tolerances; and
(p) Tracks, Radials, QDRs and QDMs applicable.

3.2.2.4 In addition to the common requirements the individual requirements for each segment and specific type of flight procedures are listed in the following paragraphs.

3.2.2.5 Holding/Racetrack/Reversal

(a) Details of the holding facility or fix including tolerances
(b) Inbound track, Outbound Track
(c) Maximum speed
(d) Maximum altitude
(e) Minimum Altitude
(f) Outbound limit
(g) Entry procedures
(h) Entry sector limitations if restricted joins applicable
(i) Obstacle field
(j) Dominant obstacle
(k) Published parameters

3.2.2.6 Standard Arrival Routes

(a) Segment type and track guidance
(b) STAR identification
(c) Reference facilities
(d) Track distances
(e) Lead radials, and
(f) Change over points
(g) Step Down fixes and minimum altitudes for each section

3.2.2.7 Initial Segment(s) (a separate sheet of data for each Initial Segment)

(a) How many and why
(b) Type (if a reversal is used confirm type)
(c) All the design parameters including the speed, timings, minimum altitude, maximum altitude, inbound timings and/or distances, outbound timing, distances and/or limits, all tolerances used, all offset angles used
(d) Entry sectors for reversals and racetracks
(e) IAF and IF or start of initial segment as applicable
(f) Obstacle field applicable
(g) Descent gradients and/or rates required
(h) Dominant obstacle
(i) Published parameters

3.2.2.7 Intermediate Segment(s) (a separate sheet of data for each Intermediate Segment)

(a) IF or start of Intermediate segment
(b) Alignment
(c) Descent required
(d) Proof of provision of a level portion of flight in this segment.
(e) Segment length
(f) Obstacle field
(g) Dominant obstacle
(h) Maximum altitude
(i) Minimum Altitude
(j) Published parameters

3.2.2.8 Final Segment

(a) NPA with FAF:
  (i) FAF and tolerances
  (ii) Alignment and crossing point,
  (iii) Reference facilities
  (iv) Segment length
  (v) Missed Approach Point – how determined (timing, distance)
  (vi) Missed Approach Point tolerances
  (vii) Missed Approach Point distance from threshold
  (viii) SOC parameters
  (ix) Obstacle field
  (x) Dominant Obstacle
  (xi) Step Down Fixes and minimum altitudes
  (xii) Minimum Altitude - OCA(H)
  (xiii) Descent Gradient
  (xiv) Profile – distance vs. height
  (xv) Rate of descent required
  (xvi) MOC applied
  (xvii) Published parameters
  (xviii) Recommended profile
  (xix) WPT coordinates for RNAV or RNP approaches
  (xx) Timing*
  (xxi) Rate of descent*
  (xxii) Distance from DME to threshold*
  *(*if DME available)*

(b) NPA no FAF:
  (i) Rate of descent
  (ii) Timings

Precision Segment:

(a) Final Approach Point
(b) Basic ILS Surfaces infringements list if used in OCA/Hps calculation
(c) Localiser to threshold distances
(d) Glide path angle
(e) Missed Approach Point
(f) Reference datum height (RDH)
(g) Threshold elevation
(h) OAS infringement list and OCA/Hps calculation details
(i) CRM including input criteria if used in OCA/Hps calculation
(j) OAS coefficients as used unchanged including any adjustments to the relevant constants
(k) Obstacle field
(l) Dominant Obstacle
(m) Precision OCA(H) for different categories of aircraft
(n) DA(H)
(o) SOC
(p) Height Loss margins applied

3.2.2.9 Missed Approach Segment

(a) Start of Climb
(b) Climb Gradient
(c) OCA(H) due to missed approach obstacles (if appropriate)
(d) Proof of Obstacle Clearance to the Missed Approach obstacle i.e. Nominal Altitude Greater than required Altitude
(e) Turning Point including tolerances i.e. earliest Turning Point, Latest Turning Point, Minimum Turn Altitude etc.
(f) Turn initiation area and turn area if turn altitude defined
(g) Termination Point & Altitude of the procedure
(h) All Turn Parameters i.e. speed, altitude, temperature, ISA and TAS
(i) Textual missed approach instructions
(j) Obstacle field
(k) Dominant obstacle

3.2.2.10 Minimum Sector Altitudes ((MSA) or terminal arrival altitude (TAA)

(a) Reference(s) upon which centre(s) based
(b) Sector definitions
(c) Distance between compound centres
(d) DME subdivisions (if any)
(e) Obstacle field
(f) Dominant obstacle for each sector
(g) Published parameters

3.2.2.11 Visual Manoeuvring

(a) Divisions between circling Sectors (where appropriate)
(b) Obstacle field
(c) Dominant obstacle for each circling sector
(d) OCA(H) for each category of aircraft

3.2.2.12 standard instrument departure

a) SID identification
b) Climb gradient
c) ATS climb gradient if appropriate
d) Obstacle field
e) WPT coordinates
f) Aeronautical tabulation data for RNAV or RNP procedures

3.2.2.13 En-route criteria

a) Minimum altitude: MOCA and MEA
b) COP
c) True and Magnetic Bearing

3.3 Data and Information

3.3.1 All data used in the design process must be submitted in source format as well as any modified formats created during the design process. The data handling process used by the designer must be documented including all Quality Assurance and Quality Control processes, procedures and documentation. A full reference to any maps or charts is required. Copies of paper maps used will be required unless electronic versions are available.

3.3.2 Where any maps or charts have been scanned or digitized such scans or digitized drawings shall be included in the submission. It is the responsibility of GACA-ANS to ensure that all relevant data and information is submitted and data handling techniques and routines are subject to appropriate Quality Assurance and Quality Control measures or alternative processes.

3.3.3 Data and information can be subdivided into the following main groups:

(a) Aerodrome data and information
  (i) Aerodrome Licensing Inspection Report
  (ii) Survey data (Thresholds, RWY centreline, elevations etc)
  (iii) Aerodrome layout plan
  (iv) GACAR Section 14 surfaces applicable
  (v) Aerodrome operating license including any restrictions and/or conditions
(b) Obstacle data
(c) Surveyed obstacles
(d) Additional obstacles identified
(e) Terrain models if used
(f) Any other overlay data used
(g) Navaids data and information
  (i) Survey data of all Navaids
  (ii) Calibration and/or commissioning reports
  (iii) Navaids information (DOC, Frequency, Power output etc)
(h) Geodetic data and information
  (i) Survey data on airfield geodetic reference points/monuments
  (ii) Local transformation parameters
(i) Airspace data and information
(j) Reference to any/all topographical maps used in design (Actual paper map not required)

3.3.4 Current and complete survey data and information is crucial to the design of safe IFPs. GACA-ANS is responsible to ensure that the survey and subsequent IFP activities are controlled and monitored by an appropriate and adequate Quality Assurance and Quality Control Process such as those set out in ISO 9001- 2008 aimed at service provision.

3.4 Drawings

3.4.1 All procedure design drawings shall be included in the submission. The drawings can be electronic drawing files generated using an appropriate CAD tool or paper drawings.

3.4.2 Requirements for CAD drawings:

(a) Any appropriate IFP software can be used as required by GACA-ANS
(b) Drawing files submitted should be in the native digital format used, as well as in a generic format *.dgn file
(c) The drawing must be structured in such a way that each segment of the procedure can easily be identified and isolated on the drawing

(d) Each element of the drawing should be easily identifiable and have the capability to isolate each individual group of drawing elements
  (i) Thresholds and Runway
  (ii) Navaids
  (iii) Obstacles
  (iv) Maps
  (v) Segment drawings
(e) Obstacles and Navaids must maintain same numbering and naming convention as used in the survey
(f) The dominant obstacle for each segment must be clearly marked, identified and referenced to the survey or other data source
(g) Drawing shall be set-up in WGS 84 as a Lambert Conformal Conic projection and all set-up parameters must be declared

3.4.3 Requirements for Paper Based Drawings:

(a) All drawings should be made to the declared scale
(b) All drawing elements should clearly identifiable
(c) The drawing must be structured in such a way that each segment of the procedure can easily be identified on the drawing
(d) Obstacles and Navaids must maintain same numbering and naming convention as used in the survey
(e) All drawings must be number and an index to the drawings supplied
(f) The dominant obstacle for each segment must be clearly marked, identified and referenced to the survey or other data source

3.5 New reporting point/waypoint

All new name of reporting point or waypoint must be approved from ICAO – ICARD software. Copy of result to be attached to the report and submitted to S&ER for approval.

3.6 Calculations

3.6.1 All calculations and results of calculations shall be presented in a manner that enables GACA-S&ER to follow and trace the logic and resultant output including a record of all relevant calculations that must be kept in order to prove compliance to or variation from the standard criteria.

3.6.2 The calculation record shall be completed enough to prove and substantiate all the elements as required in the content section above. Formulae used during calculation shall be the standard formulae as declared in Document 8168 Volume II and related ICAO publications.

3.6.3 Units of measurement and conversion factors between such units must be in accordance to GACAR Section 4, 5 and 6 or Annex 4, Annex 5 and Annex 6 with consideration of any applicable GACA differences.

3.6.4 Rounding of results shall follow the standard guidelines in Document 8168 Volume II 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. Obstacle heights rounded up, speeds rounded up, turn altitudes rounded down etc.

3.6.5 Calculations records can be submitted as computer based spreadsheet, word processor or text files, or as handwritten records. Calculation records shall be accompanied by an index and be cross-referenced to the procedures they apply.

3.7 Narratives

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

3.8 Charts

3.8.1 A draft chart shall accompany the IFP and shall reflect in graphic form the content of the narrative provided.

3.9 Reports

3.9.1 Each procedure shall be accompanied by a design rationale giving details of how the requirement has been satisfied and why the eventual procedure has evolved in its proposed form.

CHAPTER 4 - PROCESS FOR THE APPROVAL OF IFP DESIGNS

4.1 Approval of the Design

4.1.1 The regulatory cycle for evaluation of IFP designs is envisaged to originate from one of the following conditions:

- (a) New procedure required (e.g. new runway built or new Navaids installed or existing runway re-classified or new type of procedure).
- (b) Changes required to existing procedures due to e.g. magnetic variation changes, Aircraft category Changes, Navaids changes or airspace changes or changes of existing PANS-OPS criteria.
- (c) Changes required by obstacle additions or exclusions following environmental development changes.

4.1.2 A notification will be required and GACA-S&ER approval obtained before a navigation aid is withdrawn from service. Similarly, GACA-S&ER shall be advised prior to the withdrawal of an existing IFP. All such information shall be forwarded to the Aviation Safety Standards department who will ensure that it is routed to the relevant sections and notified throughout GACA-S&ER.

4.1.3 When any of these conditions occur the GACA-ANS is required to notify GACA-S&ER of intentions to change IFPs at the airport concerned. This notification will initiate the regulatory process and, at the request of GACA-ANS, a meeting can be arranged between GACA-ANS and GACA-S&ER to discuss requirements, implications and any other pertinent issues.

4.1.4 Upon receipt of a notification form, GACA-S&ER will acknowledge the receipt in writing to GACA-ANS within 5 days. As soon as the notification is processed, GACA-S&ER will advise GACA-ANS of a reference number and contact person within GACA-S&ER. All further correspondence and liaison regarding the notification shall be directed to the contact person. GACA-S&ER contact, in coordination with GACA-ANS, will provide timescales for the regulatory events and a target date for completion.

4.1.5 When completed designs are submitted to GACA-S&ER for evaluation and quality control purposes, the receipt of such submissions will be acknowledged in writing to GACA-ANS. GACA-S&ER contact will at this stage confirm timescales for the evaluation of the submission and provide feedback to GACA-ANS on the result of the evaluation and quality control process by means of a written report. This process will aim to ensure that completed designs meet all applicable criteria for obstacle clearance and operational implementation as well as those required for publication in the KSA AIP.

4.1.6 GACA-ANS remains responsible for the submission and shall ensure compliance and completeness. The evaluation process shall commence once the submission has been received.

4.1.7 As part of the safety management process required by GACA-S&ER, and except as provided in 4.2 below, all new procedures will require a flight validation. This is required in order to validate the prevailing obstacle environment and the flyability and human factors of the approach procedure. GACA-S&ER will provide guidance on the requirements of the flight validation. If GACA-S&ER concerned staff are available it may be possible for them to attend this flight validation on request from GACA-ANS. A flight validation will be required due to one or more of the following changes:

- (a) Navaids
- (b) Radial
- (c) Aircraft category(s)
- (d) OCA(H)
- (e) Aeronautical data tabulation
- (f) Turn direction in missed approach segment.
- (g) Turn direction or climb gradient in departure procedure

4.1.8 If GACA-S&ER contact person has any concerns about the procedure design, it shall be referred back to GACA-ANS with a full and written explanation. This action may lead to a further meeting only at the request of GACA-ANS

4.1.9 Once all and any outstanding issues have been addressed, GACA-S&ER will approve promulgation of the procedure in the AIP with an effective date.

4.1.10 The nominal timescale for the Regulatory Process from the start of the process to inclusion in the AIP is 6 months. In all cases GACA-S&ER will endeavour to meet the agreed deadlines and, where possible, improve on them. However adjustments might be needed to take into account published AIRAC cycle dates.

4.2 Special Approval

4.2.1 Under certain circumstances, a request may be received to develop instrument flight procedures for a particular private airport which will be used for private or other non-commercial purposes and which will not be published in the AIP. Where possible, the design and approval of these procedures should proceed in accordance with the requirements of Chapters 3 and 4 in this GACAR, including a flight validation.

4.2.2 Where it is not possible, or desirable, for any reason, to conduct a flight validation of the procedure, S&ER shall request that the applicant provide a certified independent survey of all terrain and obstacles within a 30NM radius of the affected airport in order to conduct a ground validation of the designed procedures.

> ***Note:*** *the requirement for a 30NM survey is related for the need to determine obstacles within the 25NM MSA area, plus the required design buffer area.*

4.2.3 Where the applicant chooses not to provide such a survey, S&ER may approve the designed procedures subject to the following conditions:

(a) the procedures will not be published in the AIP;
(b) the procedures may only be flown by private or military aircraft approved by the applicant;
(c) the procedures may not be flown by commercial air transport aircraft;
(d) the procedures should be flown by aircraft approved by the applicant in VMC by day prior to being used in IMC, the purpose of these flights being to determine if there are obstacles within the flight envelop; and
(e) the applicant should report any identified obstacles to S&ER as soon as they are detected to enable the procedure to be reviewed and amended.

4.2.4 Where a procedure has not been subject to a flight validation, or has not been ground validated against an independent obstacle and terrain survey, it will not published in the AIP.

4.2.5 If an applicant subsequently desires to allow commercial air transport aircraft to operate at the airport using the IFPs, the applicant must comply with the requirements of this regulation and allow a regulatory flight validation as specified in 4.1.7, and the IFP chart will be re-issued for general use.

4.3 Responsibility

4.3.1 GACA-ANS is responsible for:

(a) ensuring that verified aerodrome survey data is provided by an appropriate organization;
(b) ensuring that verified obstacle survey data is provided by an appropriate organization;
(c) IFP design
(d) Submission of IFP package to GACA-S&ER
(e) Adherence to Criteria
(f) Adherence to GACA-S&ER policy
(g) Adherence to Safety standards
(h) Adherence to Quality standards
(i) Chart Production (Draft to final copy)
(j) Pre-promulgation check (Designs vs. Charts)
(k) follow-up of Maintenance of surveys
(l) Maintenance of IFPs

4.3.2 GACA-S&ER is responsible for:

(a) Regulation of IFP design
(b) Assess compliance to criteria
(c) Assess compliance to GACA policy
(d) Enforce of Safety standards
(e) Enforce of Quality standards
(f) Granting approval to IFP designs;
(g) Approval of Promulgation of IFPs;
(h) Providing guidance to GACA-ANS as appropriate in developing IFPs.
(i) Approval of IFP
(j) Providing manmade and terrain obstacles data and survey
(k) Providing GACA-ANS with OLS detailed report; and
(l) Approval of IFP software

CHAPTER 5 VALIDATION OF INSTRUMENT FLIGHT PROCEDURES

5.1 General

5.1.1 The purpose of this chapter is to describe GACA policy on the validation of Conventional, Precision and RNAV instrument flight procedures (IFP). It is considered as part of the criteria that will be applied for the introduction of Performance Based Navigation.

5.1.2 The following ICAO documentation form the requirements and basis for the design, validation and publication of GACA IFP:

- ICAO PANS-OPS Doc 8168;
- ICAO Doc 8071 Volume 1 Chapter 8 and Volume II Chapter 5;
- Doc 9274 – AN/904 Manual on the Use of the Collision Risk Model (CRM) for ILS Operations
- Doc 9368 – AN/911 Instrument Flight Procedure Construction Manual
- Doc 9674 – AN/946 World Geodetic System 1984 (WGS-84) Manual
- Doc 9365 - Manual of All-Weather Operations
- Doc 9613 – Performance - based navigation (PBN) manual
- Doc 9905 - Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual
- Doc 9931 - Continuous Descent Operations (CDO) Manual
- DOC 9906 - The Quality Assurance Manual for Flight Procedure Design VOLUME 1 to 6

5.1.3 GACA has delegated to GACA-ANS the responsibility for ensuring the safe design of instrument flight procedures within the Kingdom and GACA-S&ER is therefore required to establish an IFP design process with the required means to ensure compliance with its responsibility.

5.1.4 The process for producing instrument flight procedures encompasses the acquisition of data, and the design and promulgation of procedures. It starts with the compilation and verification of the many inputs and ends with ground and/or flight validation of the finished product and documentation for publication.

5.1.5 Consequently, ground and/or flight validation and, in the case of RNAV IFP, an additional navigation database validation become part of the package of IFP design activities that GACA-S&ER will require GACA-ANS to complete.

5.1.6 This chapter addresses:

(a) The ground validation of instrument flight procedures;
(b) The flight validation of instrument flight procedures;
(c) The navigation database validation of RNAV instrument flight procedures;
(d) The flight validation crew and aircraft requirements; and
(e) The meteorological conditions required for conducting flight validations.

5.2 Validation

5.2.1 Validation is the final step in the procedure design process, prior to publication in KSA AIP. The purpose of validation is to confirm the accuracy and completeness of all relevant obstacle and navigation data, and to assess the flyability and human factors of the IFP.

5.2.2 Validation comprises a ground validation element and may also comprise a flight validation element. In the case of RNAV procedures, a navigation database validation is also required.

5.2.3 GACA-ANS will compile an instrument flight procedure validation package for use in the ground / flight validation process. Each validation package shall include the following:

(a) A plan view of the final approach protection area, drawn on an appropriate topographical map of a suitable scale;

(b) The controlling terrain/obstacle should be identified and highlighted on the appropriate chart;

(c) Minimum altitudes determined for each segment of the procedure;

(d) A narrative description of the instrument approach procedure;

(e) Plan and profile pictorial views of the instrument approach procedure SID or STAR;

(f) Documented data as applicable for each fix, intersection, and/or holding pattern; and

(g) The output from the navaid coverage analysis (if available) that was conducted by/for GACA-ANS together with any supporting data and design assumptions.

5.2.4 GACA-ANS is responsible for all elements of the validation and shall document their proposed validation activities in a plan and submit as early as possible for agreement with GACA-S&ER.

5.2.5 GACA-ANS shall retain all procedure design documentation so as to allow any data anomalies or errors found during the production, maintenance or operational use of the procedure to be corrected

5.3 Ground Validation

5.3.1 The aim of ground validation is to reveal any errors in criteria application and documentation, and assess the flyability and human factors of the IFP.

5.3.2 Ground validation comprises the following elements:

(a) Aerodrome assessment - Verify that the infrastructure required for the provision of an instrument runway as required by GACAR Section 14 – Aerodrome Design and Operations is in place;

(b) Navigational aid coverage – Verify that the navigational aid coverage infrastructure required for the instrument flight procedure as required by GACAR Section 10 – Part B requirements and ICAO DOC 8071 is in place;

(c) Obstacle clearance review – A review conducted by an approved designer not involved in the design of the considered IFP for each segment;

(d) Charting review – A review of the chart conducted by an approved designer not involved in the design;

(e) Coding review – A review of the coding of RNAV IFP conducted by an approved designer not involved in the design; and

(f) Flyability and human factors assessment - with the use of software tools, e.g. computer-based to full flight simulator, which can be used to evaluate a range of aircraft types in various weight, speed and centre of gravity configurations, and in various weather conditions (temperature, wind effects and visibility), it shall be possible to evaluate the flyability and human factors of most procedures as follows:

a. Fly each segment of the IFP on course and on-path.
b. Validate the intended use of IFP as defined by stakeholders and described in conceptual design
c. Evaluate other operational factors, such as charting, required infrastructure, visibility intended aircraft categories, etc.
d. Evaluate the aircraft manoeuvring area for safe operations for each category of aircraft to use the IFP.
e. Evaluate turn anticipation and the relationship to standard rate turns and bank angle limits
f. Evaluate the IFP complexity , required cockpit workload, and any unique requirements.
g. Check distance to runway at decision altitude/height or minimum descent altitude/height that are likely to be applied by operators and evaluate the ability to execute a landing with normal manoeuvring.
h. Evaluate required climb or descent gradients, if any.
i. Evaluate the proposed charting for correctness, clarity, and ease of interpretation.
j. Evaluate TAWS warnings

5.3.3 Where a flyability and human factors assessment is conducted using a flight simulator the following elements shall be evaluated:

(a) All segments of the instrument flight procedure shall be assessed;
(b) In the case of STAR, all segments of the procedure from the en-route structure to IAF shall be flown;
(c) In the case of SIDs, all segments of the procedure from the departure end of the runway (DER) to joining the en-route structure or termination point shall be assessed; and
(d) In the case of IAPs all segments of the procedure from the Arrival/ Initial Approach Fix (IAF) through to the Missed Approach shall be assessed.

5.3.4 Where procedures share the same segment of flight (e.g. initial), the shared segment needs only to be validated once.

5.3.5 In the case of RNAV IFP a test database for the full flight simulator produced by an appropriate navigation data provider for use in the flight management system (FMS) shall be used.

5.3.6 Where a ground validation cannot fully verify the accuracy and completeness of all obstacle and navigation data considered in the procedure design or the flyability and human factors of the IFP, GACA-S&ER may decide that the flight validation is required. GACA-S&ER in determining whether a flight validation is required shall consider a number of factors. These include, but are not limited to the following:

(a) Deviation from PANS-OPS criteria;

(b) Speed restrictions applied in the design;

(c) Any segment length less than PANS-OPS optimum length;

(d) A descent gradient used in the design greater than 6.1% for a non- precision approach and 3.5° for a precision approach;

(e) Procedures designed for use in a challenging terrain area and/or dense obstacle environment;

(f) Use of a Step Down Fix (SDF) in the final approach segment;

(g) A track change of greater than 90° at a waypoint has been used within an RNAV procedure;

(h) The introduction of new procedures at an aerodrome;

(i) A procedure type that is new; and

(j) Special crew procedures and/or operational techniques likely to be necessary to fly the procedures.

5.4 Flight Validation

5.4.1 Flight validation shall be carried out, in cases when ground validation determines that flight validation is necessary.

5.4.2 The objectives of the flight validation of IFP are:

a) Obstacle verification.

(1) Flight validation should aim to verify the obstacle that is identified as the controlling obstacle for each segment, and to check that no new obstacles have been erected at an elevation at or higher than the controlling obstacle since the design was undertaken, or that no existing obstacles have been charted with grossly incorrect heights or locations within the relevant procedure design segment; and

(2) Such validations must be carried out in daylight hours in VMC and are flown at the minimum published altitude. The final approach segment should be flown at an altitude 30m (100ft) below the proposed minimum descent altitude on a non-precision approach and should be flown ½ scale deflection low, evaluated according to the decision altitude on a precision approach. Procedures design is based on true altitudes. Flight evaluation should be conducted at true altitudes with consideration for temperature variations from standard day .Lateral and vertical transitions from departure, en route, descent, and

approach must produce a seamless path that ensures flyability in a consistent, smooth, predictable, and repeatable manner.

b) Flyability and Human Factors Assessment

(1) Flight validation can provide a detailed assessment of crew workload and charting issues. However, due to the limitation of data received from one aircraft under flight validation conditions, relying on ground validation for a flyability and human factors assessment may provide a more comprehensive analysis.

(2) It shall be possible to evaluate the flyability of most procedures. as follows as follows:

a. Fly each segment of the IFP on course and on-path.
b. Validate the intended use of IFP as defined by stakeholders and described in conceptual design
c. Evaluate other operational factors , such as charting , required infrastructure, visibility intended aircraft categories., etc.
d. Evaluate the aircraft manoeuvring area for safe operations for each category of aircraft to use the IFP.
e. Evaluate turn anticipation and the relationship to standard rate turns and bank angle limits
f. Evaluate the IFP complexity , required cockpit workload, and any unique requirements.
g. Check distance to runway at decision altitude/height or minimum descent altitude/height that are likely to be applied by operators and evaluate the ability to execute a landing with normal manoeuvring.
h. Evaluate required climb or descent gradients, if any.
i. Evaluate the proposed charting for correctness, clarity, and ease of interpretation.
j. Evaluate TAWS warnings

c) Infrastructure evaluation

Verify that all required infrastructure , such as runway marking, lighting, and communications and navigations sources are in place and operative.

d) Verify data for PBN procedures

PBN procedures should be packed and loaded electronically into the FMS or suitable navigation system without manually coding the ARINC 424 path /terminator data. If the procedure waypoint data is manually entered into FMS, it must be independently compared to the procedure data to ensure they match.

Flight validation pilot must ensure that data from the flight validation database matches that used in the procedure design ,and ensure the data produces the desired flight track.

5.4.3 Where a flight validation is conducted the following elements shall be evaluated:

(a) All segments of the instrument flight procedure shall be flown;
(b) In the case of STAR, all segments of the procedure from the en-route structure to IAF shall be flown
(c) In the case of SIDs and PDRs, all segments of the procedure from the departure end of the runway (DER) to joining the en-route structure or termination point shall be flown; and
(d) In the case of IAPs all segments of the procedure from the Arrival/ Initial Approach Fix (IAF) through to the end of the Missed Approach shall be flown.
(e) Flight validation of the Visual Manoeuvring area shall also be carried out.

5.4.4 Where procedures share the same segment of flight (e.g. initial), the shared segment needs only to be validated once.

5.4.5 In the case of RNAV IFP a test database produced by an appropriate navigation data-coding provider or procedures designer for use in the RNAV system shall be used.

5.4.6 However, in the case of RNAV (GNSS) IAPs of a T- or Y- bar design, manual entry of the procedure into the RNAV system in use is acceptable. In this case the validating pilot will need to manually activate the Course Deviation Indicator (CDI) scaling changes during the different phases of the flight.

5.4.7 The use of trials can provide comprehensive flight validation in a number of aircraft types under controlled conditions. The data should be assessed to determine how best it applies to the instrument flight procedure under consideration.

5.5 Crew Requirements

5.5.1 The minimum crew of the validation aircraft shall be one pilot to validate the IFP and an observer to assist the pilot in the validation process while observing the "out of cockpit" environment. In the case of an aircraft requiring two pilots, one of the pilots may carry out the observer role. It is required that the observer has ICAO PANS-OPS Volume II knowledge (the procedure designer who designed the approach can be this observer).

5.5.2 Where the procedure to be flight validated is an RNAV (GNSS) IFP of a T- or Y- bar design and is to be manually loaded into the RNAV system, the flight validation pilot shall ensure that the observer is fully competent in the use of the RNAV system to be used for the flight.

5.5.3 Flight validation shall be accomplished by a pilot with all of the following current qualifications:

(a) Commercial Pilot's Licence or Airline Transport Pilot's Licence (A) or (H) as applicable;

(b) Instrument Rating; and

(c) Flight Instructor Rating with applied instrument instruction privileges or Instrument Rating Instructor Rating.

5.6 Aircraft Requirements

5.6.1 The aircraft to be used for flight validation of an IFP shall have the performance capabilities appropriate to the categories for which the IFP has been designed and to provide an adequate and safe climb and maneuverability performance due to the nature of the operation in close proximity to variable terrain.

5.7 Meteorological Conditions

5.7.1 All IFP validation flights shall be conducted during daylight hours in visual meteorological conditions (VMC), which allow the flight to be carried out with a flight visibility of not less than 8KM, and in sight of the surface throughout the flight validation of the procedure.

5.8 Navigation Database Validation

5.8.1 Navigation database validation is only applicable to RNAV instrument flight procedures. Such procedures are coded using ARINC 424 path terminators to define specific nominal tracks, which are defined by waypoint location, waypoint type, and path terminator and, where appropriate, speed constraint, altitude constraint and course.

5.8.2 The key element of a navigation database validation is to ensure that the coding of the procedure in the RNAV/FMS system does not compromise the flyability and human factors of the procedure.

5.8.3 For small projects and/or individual flight procedure designs the following is an acceptable method of conducting a navigation database validation.

(a) On the successful outcome of the ground and/or flight validation, the IFP would then be published in the AIP. Once a database is available with the IFP included (normally available 7-10 days before the effective date of the procedure), it will require validation in the RNAV system on the ground.

5.8.4 For large projects affecting multiple procedures in an airspace change, where it may not be practicable to use the previous method, the Navigation Data Integrity Assurance Methodology may be considered as an acceptable means of navigation database validation. It is also recommended that GACA-ANS liaise with AOC holders to take account of findings from their own navigation database checks prior to the IFP effective date. The suitability of any method employed for navigation database validation shall be discussed with the GACA-S&ER at an early opportunity, in the context of the overall validation plan.

5.8.5 If the database validation is unable to take place until after the effective date of the IFP, then NOTAM action shall be required to delay the effective date.

5.9 Reports

5.9.1 Where a ground and/or flight and navigation database validation has been conducted, a report shall be completed by each of the following where applicable:

(a) Instrument flight procedure approved designer;

(b) Validating pilot;

(c) Relevant ATS unit.

5.9.2 Validation reports shall be forwarded to GACA-S&ER after the final validation of the IFP has been completed. Completed reports shall be forwarded to GACA-S&ER Vice President.

5.9.3 For unsatisfactory validation, return the IFP to the procedure design entity of GACA-ANS for corrections by providing a detailed feedback to the procedure designers and other stakeholders, and suggest mitigation and corrections for unsatisfactory results.

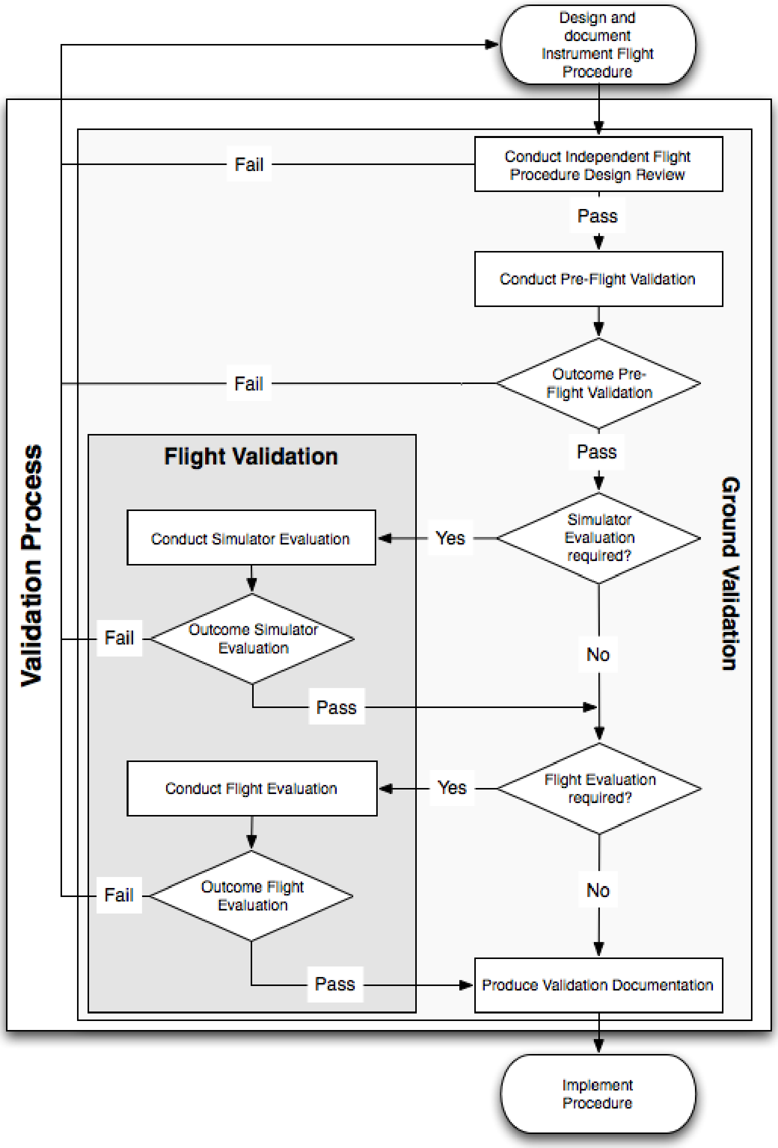

Fig 1: Validation Process

CHAPTER 6 MAINTENANCE, REVIEW AND SAFEGUARDING

6.1 Maintenance

1.1 Maintenance of the procedures includes updates due to:

- (a) magnetic variation changes;
- (b) new survey information; and
- (c) changes to airspace structure
- (d) regulation change.

1.2 A full review of the procedures is required on a 5 yearly basis.

1.3 Changes to IFPs at aerodromes with military activities shall be agreed with Air defense prior to promulgation, and Air defense should be informed of updates due to changes in magnetic variation.

1.4 Records supporting the design of the IFP(s) shall be kept throughout the lifetime of the IFP and for five years after any change or withdrawal.

6.2 Safeguarding of IFPs

2.1 The assessment of the impact of a proposed development or construction, or planned temporary obstacle, might have on an aerodrome's operation is known as safeguarding. The assessment should include the impact on an aerodrome's IFPs. The aerodrome directorate/operator (license holder) is responsible for having the safeguarding assessment carried out. GACA-ANS shall establish a letter of agreement covering the assessment.

2.2 The aerodrome directorate/operator (license holder) is responsible following a safeguarding assessment for any NOTAM action required for temporary obstructions.

APPENDIX A DETERMINATION OF VISIBILITY REQUIRED TO BE PUBLISHED WITH THE MDA/H OR DA/H

A1.1 The following material is provided to assist instrument procedures designers to calculate the visibility required to be published with a Minimum Descent Altitude or Height, or a Decision Altitude or Height, as appropriate.

A1.2 Approach and landing minima for Non-Precision Approach (NPA) procedure

A1.2.1 A non-precision approach (NPA) operation is an instrument approach and landing with a MDH not lower than 250 feet and an RVR/Visibility of not less than 800 metres.

A1.2.2 Pilots may not continue approaches below the MDA/MDH unless they have visual references for the intended runway. This includes visual aids comprising **standard runway day markings** and **approach and runway lighting** (runway edge lights, threshold lights, runway end lights, and in some cases also touch-down zone and or runway centreline lights). The approach light configurations acceptable are classified and listed in Table A1-1.

OPS Class of Facility	Length, Configuration and intensity of approach lights
FALS (Full Approach Lighting System)	ICAO: Precision Approach CAT I Lighting System (HIALS 720m ≥), distance coded centreline.
IALS (Intermediate Approach Lighting System)	ICAO: Simple Approach Lighting System (HIALS 420 – 717 m), single source, Barrette.
BALS (Basic Approach Lighting System)	Any other approach lighting system (HIALS, MIALS, or ALS 210 – 419 m)
NALS (No Approach Lighting System)	Any other approach lighting system (HIALS, MIALS, or ALS < 210 m) or no approach lights

Table A1-1 Approach Lighting Systems

A1.2.3 The visual aids are classified into three categories as shown in Table A1-2.

Full Facilities	Cat I lighting system (precision approach), runway edge lights, threshold lights, end lights and runway markings.
Intermediate Facilities	High intensity simple approach lighting system, runway edge lights, threshold lights, end lights and runway markings.
Basic Facilities	Low intensity simple approach lighting system, runway edge lights, threshold lights, end lights and runway markings.

Table A1-2 - Facility Categories

A1.2.4 The minimum visibility to be associated with the MDH shall be determined using Table A1-3 when the MDH is 320 feet or higher, and Table A1-4 for MDH between 250 feet and 320 feet.

A1.2.5 The visibility values in table A1-3 are based on the availability of full facilities. If only intermediate facilities are available, the visibility extracted from the table shall be increased by 400m and if only basic facilities are available, it shall be increased by 800 m.

MDH	Aircraft Category			
	A	B	C	D
Feet	Metres			
320 - 390	1600	1600	1600	2000
391 - 460	1600	1600	2000	2400
461 – 530	1600	1600	2000	2800
531 – 600	1600	1600	2400	2800
601 - 670	1600	1600	2800	3200
671 – 740	1600	1600	3200	3600
741 – 810	1600	2000	3600	4000
811 - 880	1600	2000	4000	4400

Table A1-3 – Approach and Landing Minima – NPA – RVR vs MDH 320 ft or higher

Category of Facility	Aircraft Category			
	A	B	C	D
	Metres			
Full Facilities	800	800	800	1600
Intermediate Facilities	1200	1200	1200	1600
Basic Facilities	1600	1600	1600	1600

Table A1-4 – Approach and Landing Minima – NPA – RVR vs MDH 250 ft - 320 ft

A1.3 Circling Approach

A1.3.1 The Minimum Descent height (MDH) for a circling approach shall be the higher of:

1. the published circling OCH for the aircraft category; or
2. the minimum circling height given in table A1-5 below; or
3. the DH/MDH of the preceding instrument approach procedure, whichever is the highest.

A1.3.2 The Minimum Descent Altitude (MDA) for a circling approach shall be calculated by adding the published aerodrome elevation to the MDH.

A1.3.3 The minimum visibility (not RVR) for a circling approach shall be the higher of:

1. the circling visibility for the aircraft category; or
2. the minimum visibility given in Table A1-5 below.

	Aircraft Category			
	A	B	C	D
MDH (ft)	400	500	600	700
Visibility (m)	1600	1600	2400	3600

Table A1-5: Minimum visibility and MDH for circling vs aircraft category

A1.4 Precision Approach – Category 1

A1.4.1 A category I approach is a precision instrument approach and landing with a decision height not lower than 200 feet and with either a visibility not less than 800 m, or a runway visual range not less than 550 m.

A1.4.2 The minimum RVR (or visibility if RVR is not reported) to be associated with the decision height between 200 feet and 250 feet is given in Table A1-6. If the decision height is more than 250 feet, but less than 300 feet, the minimum RVR/visibility given in Table A1-6 should be increased by 100m. The full, intermediate and basic facilities referred to in the Table A1-6 are those described in Table A1-2.

A1.4.3 If the DH is more than 300 feet, the required RVR/visibility can be determined using the following formula:

Required RVR or Visibility (m) = ((DH in feet – 50) x 60) / (GS angle x 3.2808) rounded up to the nearest 100 m

A1.4.4 The values obtained using this formula will be the RVR/visibility minima for basic facilities. If only full facilities are available, the RVR/visibility calculated shall be reduced by 800 m, and if only intermediate facilities are available, the RVR/visibility calculated shall be reduced by 400 m.

Category of Facility	Commercial transport Aircraft (multi-engine)	
	DH (Feet)	RVR / VIS (m)
Full Facilities	200	550/800
Intermediate Facilities	200	800
Basic Facilities	200	1200

Table A1-6 – Approach and landing Minima
Precision Approach cat I – RVR/VIS vs DH of 200 feet

A1.5 Precision Approach Category II

A1.5.1 A category II approach is a precision instrument approach and landing with a decision height lower than 200 feet but not lower than 100 feet., and a runway visual range not less than 350 m.

A1.5.2 The minimum RVR values that can be used for Cat II operations are given in Table A1-7. However, in certain specific circumstances such as temporary visual aid outages, it is necessary to increase the RVR for a specific DH. Each case must be evaluated on an individual basis.

DH (ft)	Auto-Coupled / Approved HUDLS to below DH	
	RVR Aircraft category A, B, C	RVR Aircraft category D
100 – 120	350	350 / 400
121 – 140	450	450
141 and above	500	500

Table A1-7 – Approach and Landing Minima
Precision Approach Cat II – RVR for Cat II Operations vs DH of 200 feet

A1.6 Precision Approach Category III

A1.6.1 A Category III approach is divided as follows:

a. Category IIIA operations. A precision instrument approach and landing using ILS with:
1. A decision height lower than 100 feet; and
2. A runway visual range not less than 200m.

b. Category IIIB operations. A precision instrument approach and landing using ILS with:
1. A decision height lower than 100 feet; and
2. A runway visual range lower than 200m but not less than 75 m.

A1.6.2 The minimum RVR values that can be used for Cat III operations are given in Table A1-8. However, in case of temporary visual aid outages, the aircraft operator must contact GACA SER to get specific approval. Each case must be evaluated on an individual basis.

Category	Decision Height (ft)	Roll out Control/Guidance System	RVR (m)
IIIA	Less than 100	Not required	Not less than 200
IIIB	Less than 100	Fail Passive	Not less than 200
IIIB	Less than 50	Fail Passive	150
IIIB	Less than 50 or no DH	Fail operational	Not less than 75

Table A1-8 – Approach and Landing Minima – Precision Approach Cat III
RVR for Cat III Operations vs DH and Roll-out Control/Guidance System

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