	<p style="text-align: center;"><b>TANZANIA CIVIL AVIATION AUTHORITY</b></p> <p style="text-align: center;">DIRECTORATE OF SAFETY REGULATIONS AIR NAVIGATION SERVICE INSPECTORATE</p>	<p>Revision: 2</p> <p style="text-align: center;"><b>Advisory Circular</b></p>
<p>Document No: TCAA/QSP/SR/AC/ANI-06</p>	<p style="text-align: center;"><b>Title: Construction of Visual and Instrument Flight Procedures</b></p>	<p>Page 1 of 14</p>

## CONSTRUCTION OF VISUAL AND INSTRUMENT FLIGHT PROCEDURES

### 1. PURPOSE

- 1.1. This Advisory Circular provides guidance to personnel engaged in the design and construction of Instrument and Visual Flight procedures intended for publication in the Aeronautical Information Publication (AIP).
- 1.2. The purpose of this Advisory Circular is to outline the fundamental guidelines for Air Navigation Service Providers (ANSPs), operators, and organizations involved in the development of instrument flight procedures. These guidelines aim to ensure that operators can conduct flights safely and efficiently, while promoting uniform practices across all aerodromes where visual and instrument flight procedures are implemented.

### 2. REFERENCES

- 2.1. The development of flight procedures shall be carried out in compliance with the provisions of the following documents:
  - 2.1.1. Civil Aviation (Construction of Visual and Instrument Flight Procedures) Regulations, 2017
  - 2.1.2. Civil Aviation (Aeronautical Charts) Regulations 2017
  - 2.1.3. Civil Aviation (Operation of Aircraft) Regulations: 2017
  - 2.1.4. Civil Aviation (Air Traffic Services) Regulations, 2017
  - 2.1.5. Civil Aviation (Aerodromes) Regulations, 2017
  - 2.1.6. Civil Aviation (Aeronautical Information Services) Regulations 2017
  - 2.1.7. Civil Aviation (Safety Management) Regulations 2017
  - 2.1.8. ICAO Doc 8168 – OPS/611 Procedure for Air Navigation Service - Aircraft Operations
  - 2.1.9. ICAO Doc 9613 - Performance based Navigation Manual - Volume I
  - 2.1.10. Concept and Implementation Guidance and Volume II Implementing RNAV and RNP
  - 2.1.11. ICAO Doc 9274 – AN/904 Manual on the Use of the Collision Risk Model (CRM) for ILS operations
  - 2.1.12. ICAO Doc 9368 – AN/911 Instrument Flight Procedure Construction Manual
  - 2.1.13. ICAO Doc 9674 – AN/946 World Geodetic System 1984 (WGS-84) Manual
  - 2.1.14. ICAO Doc 9906 – AN/472 Quality Assurance Manual for Flight Procedure Design.
  - 2.1.15. ICAO Doc 9365 - Manual of All-Weather Operations:
  - 2.1.16. ICAO Doc 9881 - Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information.

**Note:** Action must be taken to ensure that latest editions of the applicable reference documents are used in the construction and review of flight procedures.

### 3. GUIDANCE INFORMATION

#### 3.1. Scope

- 3.1.1. Flight procedures covered under this Advisory Circular include both conventional and Performance-

Based Navigation (PBN) procedures. These encompass RNAV departures, arrivals, and approaches, including both non-precision and precision approaches.

- 3.1.2. The criteria prescribed in ICAO Doc 8168 — *Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS)* shall be applied in the development of Instrument Approach Procedures (IAPs).
- 3.1.3. The design and format of IAP charts shall conform to the requirements of the Civil Aviation (Aeronautical Charts) Regulations, 2017, and ICAO Doc 8697 — *Aeronautical Chart Manual*.

### **3.2. Organizational Responsibilities for Flight Procedures.**

- 3.2.1. Air Navigation Service Providers (ANSPs) are responsible for the planning, design, construction, and publication of flight procedures. The Authority is responsible for establishing the applicable standards and granting approval of such flight procedures.
- 3.2.2. Upon receipt of a request for approval of a flight procedure for publication, the Authority shall evaluate the proposal, including all supporting documentation, and provide a formal response to the applicant.
- 3.2.3. The design of procedures in accordance with PANS-OPS criteria assumes normal operations. Operators remain responsible for developing and implementing contingency procedures for abnormal and emergency operations.

**Note:** *The Matrix of organizational responsibilities for Standard Flight Procedures design and approval is shown in Attachment 1 to this circular.*

### **3.3. Requirement for new procedures**

- 3.3.1. Where an operational requirement exists for a new flight procedure, the Air Navigation Services Provider shall ensure that such procedure is designed in accordance with the prescribed standards and submitted to the Authority for approval. The submission shall include the supporting documentation specified in Section 3.8.
- 3.3.2. The Instrument Flight Procedure Design Service provider shall seek and obtain the Authority's approval prior to the initiation of any new procedure to ensure compliance with regulatory requirements. The ANSP shall submit a project proposal for both new and revised procedures before commencement. The proposal shall include, at a minimum:
  - a) Project Scope
  - b) Project Objectives
  - c) Implementation Plan
  - d) Time frame
  - e) Budget

### **3.4. Requirement for revision of flight procedures**

- 3.4.1. Each flight procedure published in the AIP shall be revised under the following circumstances:
  - a) When a significant change to the obstacle environment occurs, requiring an amendment of procedural minimum altitudes;

- b) When a published bearing, track or radial would fall into error by 1/100 deg, consequent on a change to magnetic variation or station declination;
- c) To improve safety or operational efficiency, as identified by an interested party;
- d) To accommodate changes to aircraft category or characteristics;
- e) To accommodate route connectivity or airspace organization change;
- f) Necessitated by changes to the supporting navigation facility;
- g) To comply with amendments to applicable ICAO provisions and other international and national standards and recommended practices;
- h) Where a change in procedural attitude is required;
- i) When a significant change occurs to aerodrome physical characteristics such as runways (declared distances, location/elevation of the runway thresholds and/or runways ends); and
- j) When any other significant change occurs to aeronautical, cultural or topographical data

3.4.2. Each procedure shall be reassessed at intervals not exceeding five years, or earlier if changes occur in the data used during the initial design, as outlined in 3.4.1 above.

### **3.5. Proficiency of Procedure Designer**

- 3.5.1. In order to ensure that flight procedures, submitted to the Authority for approval and publication in AIP, meet the required standard of quality assurance the proficiency of the designers is specified as follows:
- a) A minimum of five years aviation experience as a pilot, air traffic controller, Engineer, Aeronautical Information Services Officer, or equivalent experience.
  - b) Successful completion of an ICAO PANS-OPS course for Conventional and/or PBN Flight Procedures; and
- 3.5.2. Completion of a minimum of two approved flight procedures designs under the supervision of a competent procedure designer;
- 3.5.3. Flight procedures submitted for approval should be accompanied by details of competence of the designer(s).
- 3.5.4. Further details on the on the training requirements of flight procedure design personnel are contained in TCAA-QSP-SR-AC-ANS 02.

### **3.6. Airspace Organization**

- 3.6.1. Instrument flight paths should be contained within controlled airspace, where established.
- 3.6.2. Where instrument flight paths are contained within controlled airspace which lies above uncontrolled airspace, the minimum procedural altitude should be at least 500ft above the base of the controlled airspace.
- 3.6.3. Any proposal to establish a terminal instrument flight path in uncontrolled airspace will require a safety assessment including consideration of types and density of air traffic, risk analysis and acceptable mitigation.

### **3.7. Flight Procedure Construction Principle**

In addition to the primary consideration of obstacle clearance, principles which should be applied to the design of flight procedures are that they should be safe, simple and economic in terms of time and airspace. Consistency among different procedures serving the same runway should be applied to the extent feasible e.g. through harmonization of segments altitudes (FAF altitude) segment lengths, speed restrictions, and other relevant parameters.

### **3.8. Supporting Documentation**

3.8.1. Documentation to be included with flight procedures submitted for approval with authenticity should include, as appropriate:

- a) Initiation approval from the Authority;
- b) Obstacle survey data including dates of last full and update surveys;
- c) Airfield and navigation facility data;
- d) Diagram of each segment and holding areas showing dominant obstacles;
- e) Procedural and minimum altitudes for each segment;
- f) Track guidance;
- g) Textual or abbreviated description and path terminators where applicable;
- h) Associated positional data e.g. Co-ordinates, bearings and distances;
- i) Description of methodology and options considered;
- j) Sufficient detail of significant calculation and design data to enable the proposal to be validated;
- k) Report/AIC of flight check for all NAVAIDS supporting the procedures
- l) IFP Ground validation report including the checklist used for that validation
- m) IFP flight simulation report including Checklist where applicable
- n) IFP flight validation report including Checklist where applicable
- o) Chart(s) depicting the procedure;
- p) Safety assessment including consideration of types and density of air traffic, risk analysis and acceptable mitigation;
- q) Draft of AIRAC Publication; and
- r) Other information considered relevant in support of the request for approval

### **3.9. Quality Assurance**

3.9.1. The Instrument Flight Procedure Design Services Provider shall ensure the quality management system is utilized at each stage of the instrument flight procedure design process including flight validations and conform with ICAO Doc 9906 –AN/472 Quality Assurance Manual for Flight Procedure Design

3.9.2. Working Practices

- a) **Use of software** Where practicable calculation and drawing of flight paths and protected areas should be done using accredited software.

- b) **Data Processing** Data processing and transfer techniques shall, where practicable, be based on electronic rather than manual methods. Techniques for deriving positional data shall ensure that accuracy, resolution, and integrity of such data complies with ICAO Doc 9674 AN/946 (WGS-84 Manual).

### 3.9.3. Survey and Charting Accuracies

Account must be taken of survey and charting accuracies by adding vertical and horizontal tolerances, as deemed appropriate.

### 3.10. Exceptions from PANS-OPS Criteria

Any exceptions from PANS-OPS criteria applied in the procedure construction should be identified. Such exceptions will require to be considered in conjunction with operators before approval for publication is issued. Only where an identifiable operational advantage can be gained, without compromising safety, taking account of the local environment will exceptions to the PANS-OPS criteria be accepted.

### 3.11. Implementation of the Instrument Flight Procedure Process.

The flight procedure design organization shall ensure that:

- a) The construction of visual and instrument procedures is coordinated with all relevant stakeholders and integrated into Tanzania airspace design process, taking into account air traffic flows, separation issues, airspace user requirements, etc.
- b) The procedure design process encompasses: the initiation and collection of requirements and constraints, the acquisition of data, the FPD, ground validation, flight validation and flight inspection (when required), approval and publication. It also includes review, verification and validation processes which are necessary to minimize the possibility of errors. It considers the safety analysis necessary prior to implementation. The process also incorporates the periodic review of data, criteria and feedback from operational implementation.
- c) The ANSP shall consult user representatives, where feasible, before submission of new procedures. The outcome of consultation shall be submitted to the Authority as part of supporting document for approval of IFP.
- d) The final IFPD report submitted for approval shall include a list of relevant obstacles, together with the identification and description of the controlling obstacles

### 3.12. Consultation with User Representatives

The Instrument Flight Procedure Design Services Provider shall consult with user representatives, before submission of new procedures, particularly where there are complexities in the design. Variations of the basic procedure to meet local conditions shall be authorized by the Authority after appropriate consultation with the operators, ATC and other parties concerned.

### 3.13. Terms of Reference for Procedure Designers

The ANSP shall develop terms of reference of personnel responsible for the construction of visual and instrument flight procedures.

### **3.14. Retention of records**

IFPDS providers shall ensure that all procedure design documentation, generated from the moment the need for a procedure design or amendment is identified until the formal request for approval, is retained to allow correction of any data anomalies or errors discovered during the production, maintenance, or operational use of the procedure.

### **3.15. Ground and Flight Validation of Instrument Flight Procedures**

Validation of instrument flight procedures is the essential final quality assurance step in the procedure design process, conducted prior to publication. The purpose of validation is to verify all obstacle and navigation data and to assess the flyability of the procedure. Validation shall include both ground validation and flight validation

#### **3.15.1. Ground Validation**

Ground validation shall involve a comprehensive review of the entire instrument flight procedure package using a ground validation checklist. This review must be conducted by personnel qualified in procedure design and with appropriate knowledge of flight validation considerations. The purpose is to identify errors in criteria and documentation, and to assess on the ground, as far as practicable, the elements that will later be evaluated during flight validation. Any issues identified during ground validation must be addressed before conducting flight validation. Additionally, ground validation will determine whether flight validation is necessary for modifications or amendments to previously published procedures.

#### **3.15.2. IFP Simulation**

IFP simulation shall use flight simulators and/or Flight management computer (FMC) simulation software tools approved by Authority where applicable using a checklist provided to check the predicted flight path for continuity and repeatability of the route. Such validation should include the effect of minimum and maximum indicated airspeed (IAS), winds, aircraft type and mass, and the type of FMC.

#### **3.15.3. NAVAIDS flight check requirements**

Prior to flight validation and approval for publication and use of any Instrument Approach Procedure (IAP), the ANSP shall ensure that any NAVAID relied upon for the IAP has been flight checked and approved by the Authority.

#### **3.15.4. Flight Validation**

The procedure designer shall be the originator of all data applicable to the conduct of a flight validation and shall provide this data to the flight validation or flight inspection operations activity. The procedure designer should also conduct a pre-flight validation meeting to brief the flight validation or flight inspection crews using the checklist indicated in Attachment 3.

Flight validation of instrument flight procedures shall be carried out using checklist as indicated in Attachment 4 so as to check the flyability of IFP. This shall be accomplished by a qualified and experienced flight validation pilot, certified or approved by the Authority.

### **3.16. Flight Inspection of Instrument Flight Procedures**

The Services Provider shall conduct flight inspection on all instrument flight procedures. Flight inspection of instrument flight procedures 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.

**3.17. Publication of the Obstacle Clearance Altitude/Height (OCA/H)**

In publishing the final product of a designed flight procedure, the service provider shall comply with the requirements of ICAO Doc 8168, Volume II, Part III, Section 5. The organization responsible for developing flight procedures shall also publish the obstacle clearance altitude/height (OCA/H).

**3.18. Establishment of Aerodrome Operating Minima**

When an aerodrome operating minima has been established, the organization responsible for developing flight procedures shall establish and publish operating minima (e.g. visibility, minimum descent altitude/height (MDA/H), decision altitude/height (DA/H)) for instrument approaches at aerodromes.

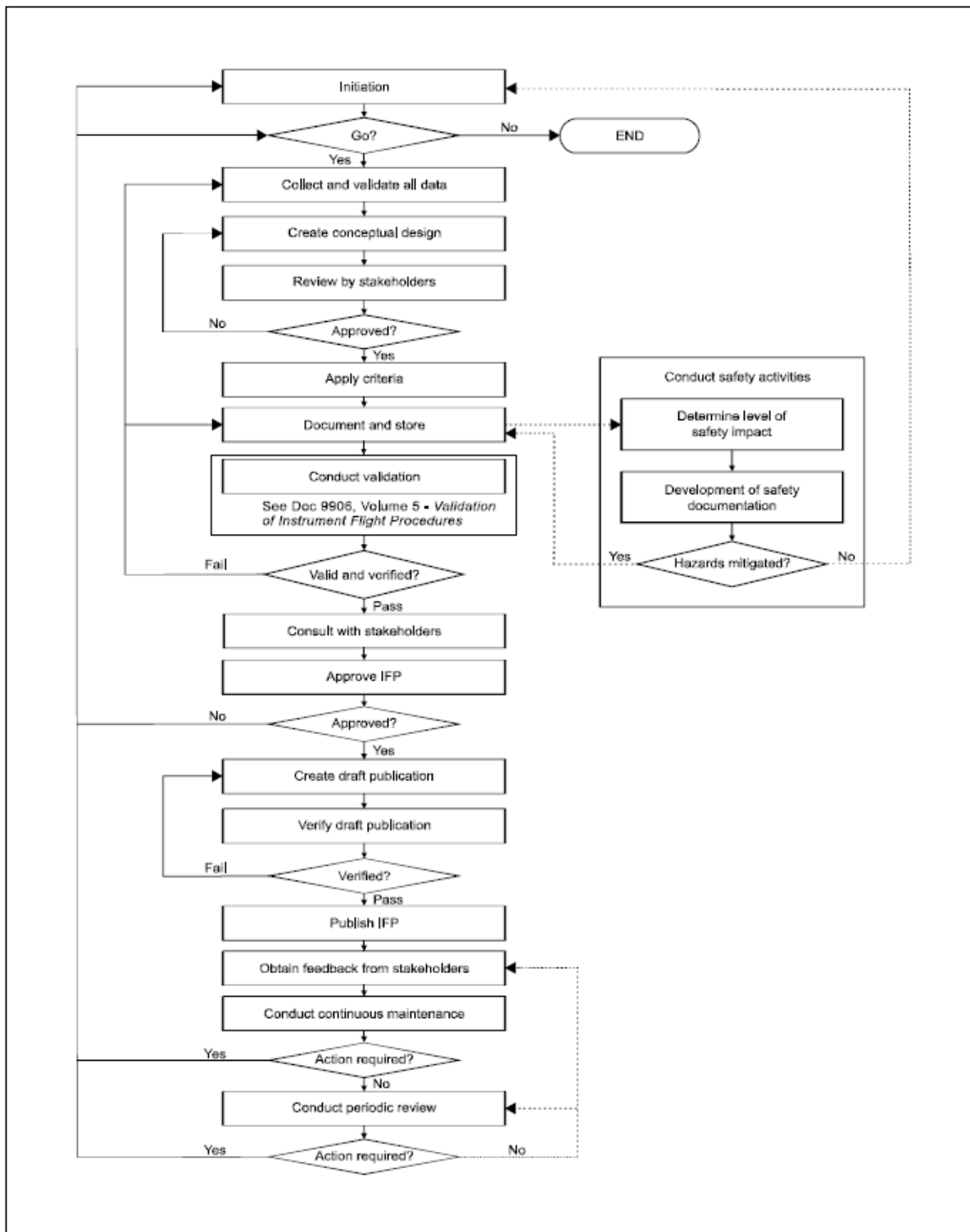


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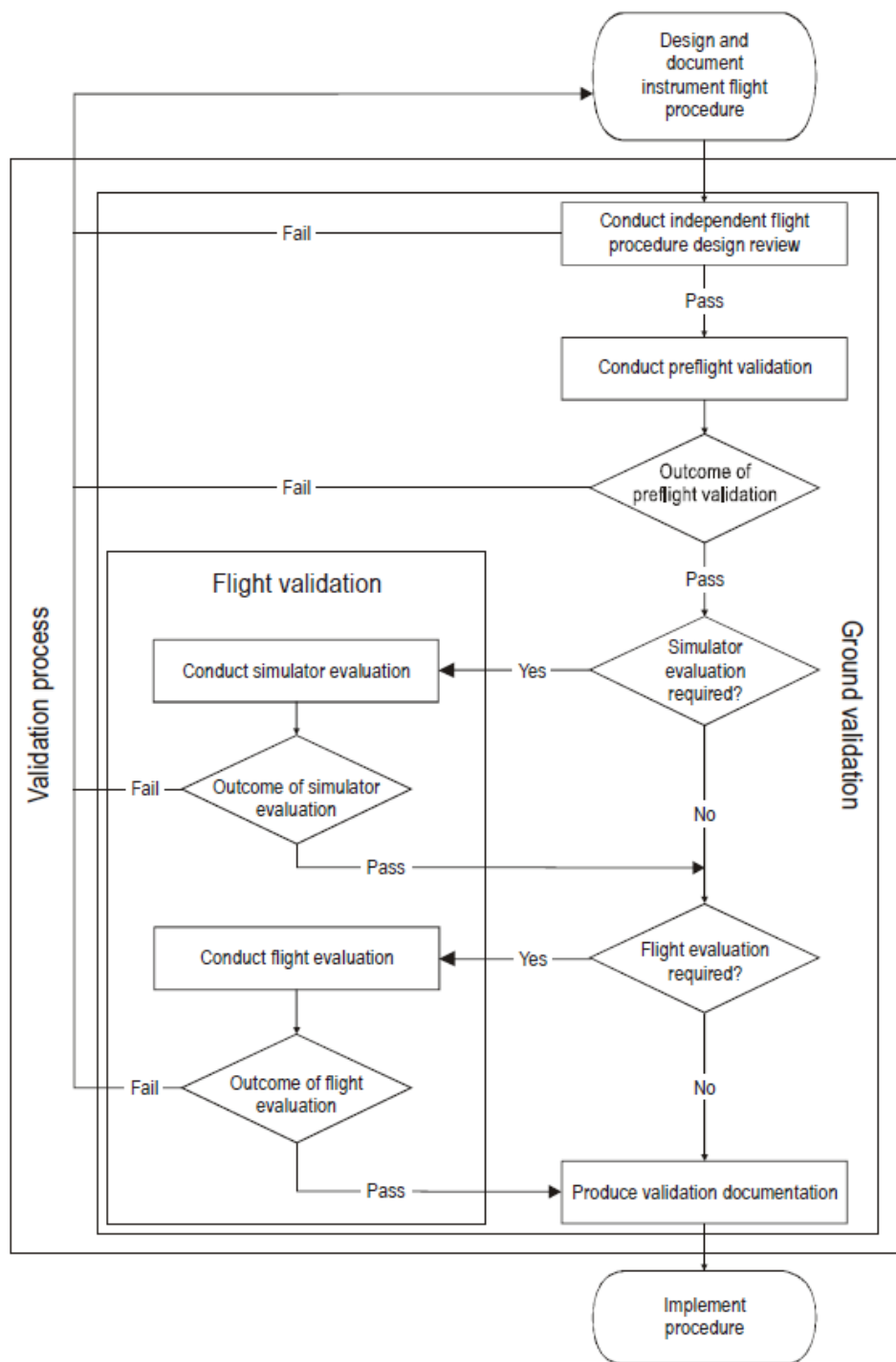
**Note:** See Attachment 1: - IFP process flow Diagram  
Attachment 2: - Validation process flow chart  
Attachment 3: - Pre-flight Validation Checklist  
Attachment 4: - Flight Validation Checklist

Attachment 1: IFP process flow Diagram





Attachment 2: Validation process flow chart



### Attachment 3: Pre-flight Validation Checklist

PRE-FLIGHT VALIDATION CHECKLIST			
<b>Airport Name:</b>			
<b>Date:</b>		<b>Validation type:</b>	New <input type="checkbox"/> /Amended Procedure <input type="checkbox"/>
<b>Validating Pilot:</b>	<b>Name</b>	<b>Title</b>	
<b>Instrument Procedure:</b>	<b>Procedure Name</b>	<b>Runway</b>	
<b>PBN NAVSPEC:</b>			
PRE-FLIGHT VALIDATION			
		SATISFACTORY	
		YES	NO
IFP package forms, charts and maps		<input type="checkbox"/>	<input type="checkbox"/>
Data verification (aerodrome, aeronautical, obstacle, ARINC coding)		<input type="checkbox"/>	<input type="checkbox"/>
Location of the controlling obstacles		<input type="checkbox"/>	<input type="checkbox"/>
Correctness and complexity of the graphical depiction (chart)		<input type="checkbox"/>	<input type="checkbox"/>
Intended use and special requirements		<input type="checkbox"/>	<input type="checkbox"/>
Overall design		<input type="checkbox"/>	<input type="checkbox"/>
Impact on the procedure of waivers to standard design criteria		<input type="checkbox"/>	<input type="checkbox"/>
Segment lengths and descent gradients allow deceleration /configuration		<input type="checkbox"/>	<input type="checkbox"/>
Comparison of the Flight Management System (FMS) Navigation Database with the IFP design, associated coding, and relevant charting information		<input type="checkbox"/>	<input type="checkbox"/>
Charting of notification of cold/warm temperature limits		<input type="checkbox"/>	<input type="checkbox"/>
Flight inspection reports available		<input type="checkbox"/>	<input type="checkbox"/>
REMARKS			
Simulator evaluation needed		YES <input type="checkbox"/>	NO <input type="checkbox"/>

Flight evaluation needed			YES <input type="checkbox"/>	NO <input type="checkbox"/>
PROCEDURE	PASS	<input type="checkbox"/>	FAIL	<input type="checkbox"/>
Evaluator's Signature				
Date:				

**Attachment 4: Flight Validation Checklist**

FLIGHT VALIDATION CHECKLIST				
Airport Name:				
Validating Pilot		Name	Title	Signature
Aircraft Type		Aircraft	Aircraft identification number	
Airport Authority		Name	Title	Signature
Instrument Procedure		Procedure Name		
Date				
Phase of Flight		Requirement	Circle	Remarks
Segment	Type			
Arrival		Is the rate of descent acceptable during this flight	Yes/No	
		When lead radials are used, does the aircraft round cut close to the intended track?	Yes/No	
		How does this phase blend with the next phase?	Acceptable/Not Acceptable/	
		Cockpit workload	Low/Medium/High	
Initial		Is the IAF easily identifiable?	Yes/No	
		Is the rate of descent acceptable during this flight	Yes/No	
		When the radials are used, does the aircraft round out close to the intended track?	Yes/No	
		How does this phase blend with the next phase?	Acceptable/Not Acceptable/	

		When turns are executed, does the aircraft roll-out close the next intended track?	Yes/No	
		Cockpit workload?	Low/Medium/High	
Intermediate		Is the IAF easy identifiable?	Yes/No	
		Is the intermediate segment length acceptable?	Acceptable/Not Acceptable/	
		Is the rate of descent acceptable during this flight	Yes/No	
		How does this phase blend with the next phase?	Acceptable/Not Acceptable/	
		When turns are executed, does the aircraft roll-out close the next intended track?	Yes/No	
		Cockpit workload?	Low/Medium/High	
Final	Non-precision	Is the FAF easy identifiable?	Yes/No	
		Is the Final segment length acceptable?	Acceptable/Not Acceptable/	
		Is the rate of descent acceptable during this flight?	Yes/No	
		Do published descent profiles provide a constant descent profile to the Mapt?	Yes/No	
		If step down fixes are published, does the published descent profile provide an altitude always higher at the SOF?	Yes/No	
		Do the visual indicators coincide with the constant descent profile?	Yes/No	
		Is the transition from this phase of flight to the next acceptable?	Acceptable/Not Acceptable/	
		Cockpit workload?	Low/Medium/High	
	Precision	Is there a smooth interception onto the Localiser	Yes/No	
		Is there a smooth transition from the intermediate segment at the FAP (Glide slope interception)?	Yes/No	
		Is the glide path angle and localizer stable?	Yes/No	

		Do the visual indicators coincide with the constant descent profile?	Yes/No	
		Cockpit workload?	Low/Medium/High	
Missed Approach Point		Is the Mapt easy identifiable?	Yes/No	
		If track adjustments are required at the Mapt, is it acceptable?	Yes/No	
		If minima is reached at the Mapt, will it be easy to land from this point?	Yes/No	
		Do the visual indicators coincide at this point?	Yes/No	
		Cockpit workload?	Low/Medium/High	
Missed Approach phase		Are published missed approach gradients acceptable?	Acceptable/Not Acceptable/	
		Are missed approach gradients acceptable?	Acceptable/Not Acceptable/	
		Are radial QDM interceptions acceptable after turns?	Acceptable/Not Acceptable/	
		Cockpit workload?	Low/Medium/High	
		At the missed approach termination point, will it be possible to attempt a new approach from this point?	Yes/No	
General		Are all radials/QDM's stable?	Yes/No	
		Did any unlocks occur?	Yes/No	
		Overall ease of use of procedure	Acceptable/Not Acceptable/	
		Overall workload?	Low/Medium/High	
		Were any uncomfortable situations experienced?	Yes/No	
		General impression of the procedure	Good/Acceptable/Not Acceptable/	
Visual Manoeuvring		Are the circling manoeuvring areas safe for each category of aircraft?	Yes/No	

<b><u>General Comments</u></b> (Obstacle reporting information if required shall also be stated here):     	
<b>Flight Validation Result</b>	<b>Flight Check Captain</b>
Acceptable <input type="checkbox"/>	Name
Not Acceptable <input type="checkbox"/>	Signature
Deferred <input type="checkbox"/>	Date