NAMIBIAN CIVIL AVIATION AUTHORITY

Advisory Pamphlet (AP)

ANSSO-FPD-AP173/05

GUIDANCE ON FLIGHT INSPECTION OF INSTRUMENT FLIGHT PROCEDURES

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GUIDANCE ON FLIGHT INSPECTION OF INSTRUMENT FLIGHT PROCEDURES

1. PURPOSE

This Advisory Pamphlet (AP) provides guidance and information on flight inspection of instrument flight procedures to ensure that the navigation system on which an instrument flight procedure is based adequately supports the procedure.

2. BACKGROUND

(a) Flight inspection of instrument flight procedures is carried out as part of a formal flight inspection programme and is performed by a qualified flight inspector using an appropriately equipped aircraft.

(b) NAMCAR Part 173 require that every instrument flight procedure made available for operational use be verified to ensure that the procedure meets the applicable requirements and standards.

(c) Below are the extracts of the Civil Aviation Regulations to which this Advisory Pamphlet apply.

3. EXTRACTS FROM NAM-CARS, PART 173 – FLIGHT PROCEDURE DESIGN SERVICES

173.04.3 Verification of instrument flight procedures

(1) An instrument flight procedure design organisation must establish a procedure for verifying every instrument flight procedures that it proposes to design, make available for operational use, and publish in the AIP.

(2) The procedure required by sub-regulation (1) must include:

a) details of the checks to be carried out by a senior person, who is authorised to verify and certify the particular type of flight procedure, to ensure that the instrument flight procedure meets the applicable requirements and standards prescribed by this Part.

GUIDANCE ON FLIGHT INSPECTION OF INSTRUMENT FLIGHT PROCEDURES

1. GENERAL

1.1. Introduction

1.1.1. This Advisory Pamphlet (AP) provides guidance and information on flight inspection of instrument flight procedures. The AP provides guidance to flight procedure design (FPD) organisations and all persons involved in the flight inspection of instrument flight procedures developed for operational use by aircraft.

1.1.2. Instrument flight procedures depict standard routings, manoeuvring areas, flight altitudes, and approach minima for instrument flight rules (IFR) flight activities. These procedures include airways, off-airway routes, jet routes, instrument approach procedures (IAPs), instrument departure procedures, terminal arrival routes, procedures predicated upon the use of Area Navigation (RNAV) systems.

1.1.3. Inspection of instrument flight procedures should be a part of the flight inspection processes for initial certification and a part of the quality assurance programme as established in accordance with the NCAA *Flight Procedure Design Quality Assurance Manual*.

1.2 Flight validation and flight inspection

1.2.1 The terms “flight validation” and “flight inspection” are often misinterpreted as the same concept. Flight validation and flight inspection are separate activities that, if required, may or may not be undertaken by the same entity. The purpose of flight validation is to obtain a qualitative assessment of procedure design including obstacle, terrain and navigation data, and provide an assessment of flyability of the procedure so as to ensure a proper standard for all publications. Flight validation is concerned with factors other than the performance of the navigation aid or system that may affect the suitability of the procedure for publication. The procedures for flight validation are described in NCAA *Advisory Pamphlet ANSSO-FPD-AP173/03*. The training and qualification requirements for flight validation pilots is contained in NCAA *Flight Validation Pilot Training and Evaluation Manual*.

1.2.2 Flight inspection is conducted with the purpose of confirming the ability of the navigation aids/system upon which the procedure is based to support the procedure. Flight inspection is defined as the operation of a suitably equipped aircraft for the purpose of calibrating ground-

based NAVAIDS or monitoring/evaluating the performance of the global navigation satellite system (GNSS). Flight inspection may be required to ensure that the appropriate navigation system (radio navigation aid/navigation sensor, GBAS data broadcast and/or FAS data) adequately supports the procedure.

1.2.3 Flight inspection of instrument flight procedures is carried out as part of a formal flight inspection programme and is performed by a qualified flight inspector using a suitably equipped aircraft. Personnel performing flight inspection duties should be qualified and certified as specified in Section 8 of this AP. In most cases flight inspection pilots also perform the flight validation of procedures. The training and qualification requirements of flight inspection pilots and flight validation pilots should therefore be similar. (See NCAA Flight Validation Pilot Training and Evaluation Manual). The characteristics and instrumentation requirements for flight inspection/validation aircraft are described in Section 9 of this AP.

2. PRE-FLIGHT REQUIREMENTS

2.1 Instrument Flight Procedure Specialist

2.1.1 The instrument flight procedure specialist is normally responsible for providing all data applicable to conducting a flight inspection to the flight inspections operations activity. This includes output from the navaid infrastructure coverage analysis together with any supporting data and design assumptions. The procedure owner should also identify any alternate routes published on the chart as ‘at ATC discretion’. Such routes should be reviewed to determine if it is necessary for them to be included in the flight inspection or the flight validation. When appropriate, the procedure specialists should be prepared to provide briefings to the flight inspection crews in those cases where flight procedures have unique application or special features.

2.1.2 The instrument flight procedures specialist should participate in the initial certification flight to assist in its evaluation and obtain direct knowledge of issues related to the procedures design from the flight inspection pilot and/or inspector.

2.2 Instrument approach procedure (IAP) data package

2.2.1 Each IAP flight inspection package should include the following data:

a) A plan view of the final approach obstacle evaluation template, drawn on air navigation charts of sufficient scale to safely accommodate use for navigation, elevated terrain analysis, obstacles, and obstructions evaluation.
b) Completed documents that identify associated terrain, obstacles and obstructions as applicable to the procedure. The controlling terrain/obstacle should be identified and highlighted on the appropriate chart.
c) Minimum altitudes determined to be applicable from map studies and database information 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.
f) Documented data as applicable for each fix, intersection, and/or holding pattern.
g) Air/ground communications, as applicable to each segment of the procedure.
h) Airport marking and any special local operating procedures such as noise abatement, non-standard traffic patterns, lighting activation, etc.

3. FLIGHT INSPECTION PROCEDURES

3.1 Objective

3.1.1 The objective of the flight inspection evaluation of instrument flight procedures is to assure that the navigation source supports the procedure, ensures obstacle clearance, and checks the flyability of the design. The following activities should be accomplished:

a) Verify the obstacle that serves as the basis for computing the minimum altitude in each segment of the IAP.
b) Evaluate aircraft manoeuvring areas for safe operations for each category of aircraft for which the procedure is intended.
c) Review the instrument procedure for complexity of design, and evaluate the intensity of the cockpit workload to determine if any unique requirements adversely impact safe operating practices. Check for correctness of information, propriety, and ease of interpretation.
d) If appropriate, verify that all required runway markings, lighting, and communications are in place and operative.

3.2 Instrument flight procedure verification

3.2.1 The flight inspection of an instrument flight procedure and verification of the obstacle data may be conducted during the associated navigation aid inspection if visual meteorological conditions (VMC) prevail throughout each segment.

3.3 Verification of obstacle clearance

3.3.1 *Original flight procedures*. A ground or in-flight obstacle verification should be conducted for each route segment during the development of original flight procedures.

3.3.2 *Identification of new obstacles*. When new obstacles are discovered during flight inspection activities, the fight inspector should identify the location and height of the new obstruction(s), and provide the information to the procedure specialist. Procedure commissioning should be denied until the procedure specialist's analysis has been completed and the flight procedure adjusted as appropriate.

3.3.3 *Determination of obstacle heights*. If in-flight height determination of obstacles or terrain is required, accurate altimeter settings and altitude references are necessary to obtain the most accurate results possible. The method of obstacle height determination should be documented on the flight inspection report.

3.4 Detailed procedures

3.4.1 ***En-route/terminal routes***

3.4.1.1 Evaluate each en-route or terminal segment during commissioning flight inspections to ensure that the proposed minimum obstacle clearance altitude (MOCA) is adequate. These segments should be flown at the proposed minimum en-route altitude (MEA) using the applicable NAVAID for guidance. For instrument departure procedures, the segment(s) should be evaluated according to an established NAVAID, fix or point where en-route obstacle clearance has been established. For a terminal arrival route, each segment should be evaluated from where the route departs established obstacle clearance to the point where the route

intercepts an established approach procedure. Periodic inspections of en-route and terminal route segments are not required.

3.4.2 ***Final approach segments***

3.4.2.1 The final approach course should deliver the aircraft to the desired point. The point varies with the type of system providing procedural guidance and should be determined by the procedure specialist. After flight inspection verifies the established point, it should not be changed without the concurrence of the procedure specialist. When the system does not deliver the aircraft to the established point, and if the system cannot be adjusted to regain the desired alignment, the procedure should be redesigned.

3.4.3 ***Missed approach***

3.4.3.1 The flight inspector should assure that the designed procedural altitudes provide the appropriate required or minimum obstacle clearance (ROC/MOC) and determine that the procedure is safe and operationally sound for the categories of aircraft for which use is intended.

3.4.4 ***Circling area***

3.4.4.1 The flight inspector should verify that the depicted circling manoeuvring areas are safe for each category of aircraft and that the controlling obstacle is correctly identified.

3.4.5 ***Terminal segments***

3.4.5.1 Controlling obstacles in terminal segments should be confirmed visually by in-flight or ground observation. If unable to confirm that the controlling obstacle, as identified by the procedure specialist, is the highest obstruction in the segment, the flight inspector should list the location, type, and approximate elevation of the obstacles to be provided to the procedure specialist for technical evaluation. Conduct obstacle evaluations in VMC only. The flight inspector should be responsible for ensuring that instrument flight procedures are operationally safe in all areas of design, criteria application and flyability.

3.4.6 ***Instrument approach procedure (IAP)***

An IAP intended for publication should be evaluated in flight. The final approach template should be evaluated to identify/verify the controlling obstruction. The final approach segment should be flown at an altitude 30 m (100 ft) below the proposed minimum descent altitude. Approaches with precision vertical guidance should be evaluated according to the proposed decision or missed approach altitude. Discrepancies or inaccurate data should be provided to the procedure specialist for action prior to commissioning the procedure.

3.4.7 ***Minimum en-route altitude (MEA) and change-over points (COPs)***

3.4.7.1 MEAs should be computed and published in the AIP. MEAs and COPs should be predicated on minimum obstruction clearance altitude (MOCA), minimum reception altitude (MRA), airspace, or communication requirements. If more than one of these altitudes are procedurally applicable, the highest altitude determined through a flight inspection should become the minimum operational altitude.

3.4.8 ***Fixes/holding patterns***

3.4.8.1 Controlling obstacles should be verified to ensure the adequacy of minimum holding altitude (MHA)

3.4.9 ***Air-ground communications***

3.4.9.1 Air-ground communications with the appropriate controlling facility should be evaluated for satisfactory performance at the minimum initial approach fix altitude and at the missed approach altitude. In those cases where air traffic control operations require continuous communications throughout the approach, flight inspection should evaluate availability of that coverage.

3.4.10 ***Area navigation (RNAV)***

Procedures based upon RNAV (GNSS or FMS) should be evaluated by flight inspection for conformance to safe and sound operational practices. In addition to the above applicable requirements, flight inspection of these procedures should evaluate the following:

a) *Waypoint accuracy*. The waypoints depicted on the procedure should be verified as properly labeled and correct. The fix displacement areas should be evaluated and determined to be accurate.

b) *Bearing accuracy*. Where applicable, the bearing, as depicted on the instrument approach procedure, should be evaluated for accuracy.

c) *Distance accuracy*. Distances should be verified for accuracy from the automated flight inspection system where applicable, or by using ground reference positions when conducting manual flight inspection operations. When utilizing an automated system, the software database information should be validated in the interest of distance accuracy.

3.5 Additional requirements

3.5.1 The inspection pilot should review and evaluate each segment of the procedure for conformance with safe operational practices as applicable to the following areas:

a) *Procedure safety*. The procedure should be evaluated to ensure compliance with safe operating practices, simplicity of the depiction, and a reasonable level of flight crew workload associated with programming and flying the required manoeuvres.

b) *Runway marking, lighting and communications*. The flight inspector should evaluate these airport facilities to assure their suitability in supporting the procedure. Lack of suitability in any of these areas supports denying the procedure.

3.6 Airport lighting evaluations

3.6.1 *New flight procedures*. For new instrument approach procedures at airports with no prior IFR service, a night flight inspection should be conducted to determine the adequacy of airport lighting systems prior to authorizing night minima.

3.6.2 *Approach/landing light system inspection*. Airport light systems should be evaluated during the hours of darkness. The evaluation should determine that the light system displays the correct lighting patterns, that they operate in accordance with operational design/capabilities and that local area lighting patterns do not distract, confuse or incorrectly identify the runway environment.

4. ANALYSIS

4.1. General

4.1.1 The flight inspection should determine that the procedure is flyable and safe. When a new procedure is found to be unsatisfactory, the flight inspector should coordinate with the instrument flight procedure specialist to resolve identified problem areas and determine the necessary changes. When a published procedure is found unsatisfactory, the flight inspector should initiate action to advertise the deficiency through a NOTAM publication and advise the procedure specialist.

4.2. Human Factors

4.2.1 The criteria used to develop instrument flight procedures include factors associated with minimizing cockpit workload and human limitations. The flight inspector should consider whether or not an instrument approach procedure is operationally safe and flyable for a minimally qualified solo pilot, flying an aircraft with basic IFR instrumentation in instrument meteorological conditions, using standard navigation charting. The flight inspector should apply the principles of Human Factors when certifying an original or amended procedure by considering the following characteristics.

a) *Complexity*. The procedure should be as simple as possible to avoid imposing an excessive workload.

b) *Presentation*. The flight inspector should confirm that the procedure presentation conforms to requirements.

5. TOLERANCES

5.1 Distance and bearing accuracies should be dependent on the type of navigation source upon which the instrument procedure has been developed (See Doc 8071, Vol 1). The navigation aid and the procedure should consistently deliver the aircraft to a point within the depicted fix displacement area, as applicable.

6. ADJUSTMENTS

6.1 The flight inspection crew should support the facility maintenance technicians' efforts by supplying all available data collected on the facility and provide flight inspection support where possible. Requests for ground based equipment adjustments should be specific.

7. REPORTS

7.1 Once all checks have been made, and input has been received from all flight crew members, the flight inspector should complete the flight inspection report to document that the procedure has been checked. An example report with associated checklists and worksheets is shown in the Appendix to this AP.

8. FLIGHT INSPECTION CREW

8.1 The flight inspection crew normally consists of two pilots and one or two technicians or engineers. The members of the flight inspection crew should be experts in their individual fields, have sound knowledge and experience in flight inspection procedures and requirements, and be capable of working as a team.

8.2 An approved flight inspection organisations should ensure that personnel carrying out flight inspections have been formally certified. The objectives of the certification are to:

a) grant authority to the flight crew member who ensures the satisfactory operation of air navigation facilities;
b) provide a uniform method for examining employee competence; and
c) issue credentials that authenticate inspection authority.

8.3 An approved flight inspection organisation should establish methods for determining that:

a) all personnel directly engaged in flight inspection have been adequately qualified and trained; and
b) there is in place, a management system that include a written procedure for ensuring the continued competence of flight inspection personnel through regular assessment; and
c) for aeronautical navigation aid specialists, there is in place, initial and recurrent training programmes which include a detailed explanation of maintenance procedures and their effect on the integrity of the radiated signal.

9. FLIGHT INSPECTION AIRCRAFT CHARACTERISTICS AND INSTRUMENTATION

9.1 Many factors should be considered when selecting an aircraft as a vehicle for flight inspection. The number of aircraft required will be determined by the qualities of the aircraft chosen and factors such as the number of facilities to be flight inspected, their relative geographical locations, periodicity of inspections, and other duties of the aircraft.

9.2 The following desirable characteristics should be found in a flight inspection aircraft:

a) reliable, efficient type equipped and certified for IFR operations;
b) sufficient carrying capacity for the flight crew, as well as all necessary electronic and recording equipment and spares. It may also be necessary to have additional capacity to transport ground personnel and equipment;
c) sufficient range and endurance to complete a normal mission without re-servicing;
d) aerodynamically stable throughout its speed range, but particularly at speeds encountered during flight inspection;
e) low noise and vibration levels;

f) low electrical noise characteristics to minimize interference with received signals; e.g. propeller modulation of the received signal must be as low as possible;
g) stable electrical system of adequate capacity to operate the required electronic equipment in addition to the aircraft equipment;
h) reasonably wide-speed and altitude range to enable flight inspection to be conducted, where possible, under the conditions encountered by users. Good low-speed characteristics are essential where theodolite tracking by ground observers is carried out;
i) suitable for future modifications or expansion of equipment to allow for inspection of additional aids or to increase accuracy or processing speed on existing facilities;
j) aircraft cabin environmental control equipment that minimizes the adverse effects of temperature and humidity on the sensitive test equipment used in flight inspection systems and maintains a comfortable environment for the crew; and
k) equipped with an autopilot to reduce crew workload.

9.3 The flight inspection aircraft contains a full range of navigation equipment as required for instrument flying. Additional equipment must be provided for the monitoring and recording of the received navigation signals. The navigation receivers may be used for both navigation and flight inspection. Special flight inspection receivers installed in addition to those used for navigation are preferable because of their special accuracy requirements.

9.4 The flight inspection equipment should comprises:
a) flight inspection receivers with associated antennas;
b) position-fixing system;
c) equipment for data display and processing; and
d) equipment for data recording.

APPENDIX

Example worksheets, checklists and report forms – RNAV procedures

RNAV IFP WAY-POINT VERIFICATION WORKSHEET (RUNWAY)

Date: _____ Aerodrome: _____

Procedure: _____ Checked by: _____

Runway survey:

WPT	POSITION	COMPUTED BRG, T	MAG VAR	COMPUTED BRG, M	PUBLISHED BRG, M	COMPUTED DISTANCE	RW LENGTH
Threshold	N W						
Departure end	N W						

Assessment: _____

North of 60N, set MAG VAR to 0 and perform all computations using true bearings.

RNAV IFP WAY-POINT VERIFICATION WORKSHEET

Date: _____ Aerodrome: _____

Procedure: _____ Checked by: _____

LEG	COMPUTED BRG, T	MAG VAR	COMPUTED BRG, M	DESIGN BRG, M	COMPUTED DISTANCE	DESIGN DISTANCE	PASS/FAIL

North of 60N, set MAG VAR to 0 and perform all computations using true bearings.

RNAV IFP FLIGHT INSPECTION/VALIDATION CHECKLIST – PLANNING AND PRE-FLIGHT

Aerodrome: _____ Procedure: _____

Date: _____ Inspector: _____

Type of inspection: _____

Documentation and tools			**Supporting information**		
Checklists	.....	☐	Anticipated date/time of inspection		
IAP form	.....	☐			
Inspection forms	.....	☐			
Approach plate	.....	☐	Wx		
Topographic maps	.....	☐			
Data collection system/DTU	.....	☐	Constellation predictions:		
Blank disks	.....	☐			
			RAIM (HIL)		
Flight plan			Number of Sats		
			HDOP		
Programme FMS/GPS	.....	☐	ATC coordination	.....	☐
Wpt entry verification	.....	☐	Contact Airport Authority	.....	☐
Leg lengths/tracks	.....	☐	Survey worksheet complete	.....	☐
Duplicate way-points	.....	☐	Way-point worksheet complete	.....	☐

WAY-POINT VERIFICATION

LEG	WPTS	DIST	DESIGN DIST	TK	DESIGN TK	PASS
Initial L						
Initial C						
Initial R						
Intermediate						
Final						
Missed						

RNAV IFP FLIGHT INSPECTION/VALIDATION CHECKLIST – INFLIGHT

Aerodrome: _____ Procedure: _____

Date: _____ Inspector: _____

Altimeter setting source ..... ☐ Wpt entry verification ..... ☐ Leg lengths/tracks ..... ☐	Duplicate way-points ..... ☐ Deselect non-GPS sensors..... ☐ Start data recording ..... ☐
Obstacle verification: Arrival ..... ☐ Initial L ..... ☐ Initial R ..... ☐ Initial C ..... ☐ Intermediate ..... ☐ Final ..... ☐ Missed ..... ☐ Circling ..... ☐ 25 NM MSA ..... ☐ Departure ..... ☐	**Confirm way-point positions:** Arrival ..... ☐ IAF ..... ☐ IF ..... ☐ SDF ..... ☐ FAF ..... ☐ SDF ..... ☐ MAPt ..... ☐ MATP ..... ☐ Hold ..... ☐
GNSS approach — Confirm MAtP position: N XTE W ATE Num SatsHDOP	
Comments:	

RNAV IFP FLIGHT INSPECTION/VALIDATION CHECKLIST — OPERATIONAL ACCEPTABILITY

Aerodrome: _____ Procedure: _____

Date: _____ Inspector: _____

A/C type: _____ Pilot flying: _____

Intended user A/C — (GA, Helo, Commuter, B/Jet, Heavy, Military)
(Circle significant types)

Intended use: Airspace ..... ☐ Noise ..... ☐ Environmental ..... ☐ Communications ..... ☐ Surveillance ..... ☐ Procedure plate ..... ☐ Aerodrome facilities ..... ☐	**Flyability:** Suitable for critical A/C ..... ☐ Climb/Descent gradient ..... ☐ Segment length ..... ☐ Alignment on final ..... ☐ Gradient/alignment combo..... ☐ Workload rating _____ *(1-7 acceptable, 8-10 excessive)*

Comments:

OVERALL ASSESSMENT — Pass Fail _____
(Inspector's signature)

RNAV IFP FLIGHT INSPECTION/VALIDATION WORKSHEET - INTERFERENCE

AND SIGNAL AVAILABILITY

Aerodrome: _____ Procedure: _____

Date: _____ Inspector: _____

LEG	HDOP	NUM SATS	RAIM STATUS

Comments:

RNAV IFP FLIGHT INSPECTION/VALIDATION — SUMMARY

Aerodrome: _____ Procedure: _____

Date: _____ Inspector: _____

Assessments:

Survey verification	.....	☐
Way-point verification	.....	☐
Topo map wpt verification	.....	☐
Signal coverage	.....	☐
Interference	.....	☐
Obstacle verification	.....	☐
MAPt verification	.....	☐
Human Factors	.....	☐
Communications	.....	☐
Lighting systems	.....	☐
Operational acceptability	.....	☐

Overall assessment: PASS FAIL

NOTAM issued: ☐

Inspector's signature: _____