Doc 9906
AN/472
Volume 5

Quality Assurance Manual for Flight Procedure Design

Volume 5
Validation of Instrument Flight Procedures

Approved by the Secretary General and published under his authority

First Edition — 2012

International Civil Aviation Organization

Doc 9906
AN/472
Volume 5

Quality Assurance Manual for Flight Procedure Design

Volume 5
Validation of Instrument Flight Procedures

Approved by the Secretary General and published under his authority

First Edition — 2012

International Civil Aviation Organization

Published in separate English, French, Spanish, Russian,
Arabic and Chinese editions by the
INTERNATIONAL CIVIL AVIATION ORGANIZATION
999 University Street, Montréal, Quebec, Canada H3C 5H7

For ordering information and for a complete listing of sales agents
and booksellers, please go to the ICAO website at www.icao.int

First edition 2012

ICAO Doc 9906, *Quality Assurance Manual for Flight Procedure Design*
Volume 5 — Validation of Instrument Flight Procedures
Order Number: 9906-5
ISBN 978-92-9231-996-0

© ICAO 2012

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, without prior permission in writing from the International Civil Aviation Organization.

AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by

PREFACE

Instrument flight procedures based on conventional ground-based navigation aids have always necessitated a high level of quality control. However, with the implementation of area navigation and associated airborne database navigation systems, even small errors in data could lead to catastrophic results. This significant change in data quality requirements (accuracy, resolution and integrity) has led to the requirement for a systemic quality assurance process (often part of a State Safety Management System). The *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part 1, Section 2, Chapter 4, *Quality Assurance,* refers to this manual and requires that the State take measures to “control” the quality of the processes associated with the construction of instrument flight procedures. This manual aims to provide guidance in attaining these stringent requirements. As detailed below all six volumes of this manual address crucial areas related to the attainment, maintenance and continual improvement of procedure design quality and flight validation (FV). Data quality management, procedure designer training, and validation of software are all integral elements of a quality assurance system.

Volume 1 — *Flight Procedure Design Quality Assurance System* provides guidance for quality assurance in the procedure design processes, such as procedure design documentation, verification and validation methods and guidelines about the acquisition/processing of source information/data. It also provides a generic process flow diagram for the design and implementation of flight procedures.

Volume 2 — *Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme)* provides guidance for the establishment of flight procedure designer training. Training is the starting point for any quality assurance programme. This volume provides guidance for the establishment of a training programme.

Volume 3 — *Flight Procedure Design Software Validation* provides guidance for the validation (not certification) of procedure design tools, notably with regard to criteria.

Volume 4 — *Flight Procedure Design Construction* (to be developed).

Volume 5 — *Validation of Instrument Flight Procedures* provides guidance for conducting validation of instrument flight procedures, including safety, flyability and design accuracy.

Volume 6 — *Flight Validation Pilot Training and Evaluation (Development of Flight Validation Pilot Training Programme)* provides guidance for the establishment of flight procedure validation pilot training. Training is the starting point for any quality assurance system. This volume provides guidance for the establishment of a training programme.

Note.— In the independent volumes, when a reference is made to the term "manual", without further specification, it is presumed to refer to the present volume of the Quality Assurance Manual for Flight Procedure Design.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS ..... *(vii)*

ABBREVIATIONS ..... *(ix)*

DEFINITIONS ..... *(xi)*

PUBLICATIONS ..... *(xiii)*

FOREWORD ..... *(xv)*

Chapter 1. The validation process 1-1

1.1 The need for validation 1-1
1.2 The validation process 1-1
1.3 Validation report and documentation 1-3
1.4 Description of the validation process 1-4
1.5 Preparation for validation 1-6

Chapter 2. Step-by-step description of activities within the validation process 2-1

2.1 Step 1: Conduct independent IPP design review 2-1
2.2 Step 2: Conduct preflight validation 2-2
2.3 Step 3: Conduct simulator evaluation 2-5
2.4 Step 4: Conduct flight evaluation 2-7
2.5 Step 5: Produce validation report 2-11

Appendix A. Obstacle assessment ..... App A-1

Appendix B. Human Factors ..... App B-1

Appendix C. Validation templates for fixed-wing aircraft ..... App C-1

Appendix D. Validation templates for helicopters ..... App D-1

ABBREVIATIONS

AIP	Aeronautical Information Publication
AIS	Aeronautical information service
ALS	Approach lighting system
ATS	Air traffic services
CF	Course to a fix
CRC	Cyclic redundancy check
DME	Distance measuring equipment
FAS	Final approach segment
FMS	Flight management system
FPA	Flight path angle
FPAP	Flight path alignment point
FPD	Flight procedure design
FTP	Fictitious threshold point
FV	Flight validation
FVP	Flight validation pilot
GNSS	Global navigation satellite system
GV	Ground validation
HA	Holding/racetrack to an altitude
HDOP	Horizontal dilution of precision
HF	Holding/racetrack to a fix
HM	Holding/racetrack to a manual termination
HPL	Horizontal protection level
HRP	Heliport reference point
ICA	Initial climb area
ICAO	International Civil Aviation Organization
IFP	Instrument flight procedure
IFR	Instrument flight rules
LNAV	Lateral navigation
LTP	Landing threshold point
MOC	Minimum obstacle clearance
NAVAID	Navigation aid
PBN	Performance-based navigation
PDOP	Position dilution of precision
PinS	Point-in-space
PV	Preflight validation
RAIM	Receiver autonomous integrity monitoring
RFI	Radio frequency interference
RNAV	Area navigation
RNP	Required navigation performance
SBAS	Satellite-based augmentation system
SKA	Skills, knowledge and attitudes
SOP	Standard operating procedure
TAWS	Terrain awareness warning system
VASIS	Visual approach slope indicator system

VDOP	Vertical dilution of precision
VMC	Visual meteorological conditions
VNAV	Vertical navigation
VPL	Vertical protection level

DEFINITIONS

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

Flight validation pilot. A person performing flight validation who meets the competency requirements as laid down by the State.

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

Instrument flight procedure. A description of a series of predetermined flight manoeuvres by reference to flight instruments, published by electronic and/or printed means.

Instrument flight procedure process. The overarching process from data origination to the publication of an instrument flight procedure.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

a) are located on an area intended for the surface movement of aircraft; or

b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

Validation. Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled. This activity consists of ground and flight validation.

Verification. Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled.

PUBLICATIONS

(referred to in this manual)

Annexes to the Convention on International Civil Aviation

Annex 4 — *Aeronautical Charts*

Annex 6 — *Operation of Aircraft*

Part I — *International Commercial Air Transport — Aeroplanes*
Part II — *International General Aviation — Aeroplanes*
Part III — *International Operations — Helicopters*

Annex 10 — *Aeronautical Telecommunications*

Volume I — *Radio Navigation Aids*
Volume II — *Communication Procedures including those with PANS status*
Volume III — *Communication Systems*
Volume IV — *Surveillance and Collision Avoidance Systems*
Volume V — *Aeronautical Radio Frequency Spectrum Utilization*

Annex 14 — *Aerodromes*

Volume I — *Aerodrome Design and Operations*
Volume II — *Heliports*

Annex 15 — *Aeronautical Information Services*

Procedures for Air Navigation Services

*OPS — Aircraft Operations (*Doc 8168)

Volume I — *Flight Procedures*
Volume II — *Construction of Visual and Instrument Flight Procedures*

Manuals

Manual on Testing of Radio Navigation Aids (Doc 8071)

Volume I — *Testing of Ground-based Radio Navigation Systems*
Volume II — *Testing of Satellite-based Radio Navigation Systems*

Quality Assurance Manual for Flight Procedure Design (Doc 9906)

Volume 1 — *Flight Procedure Design Quality Assurance System*
Volume 2 — *Flight Procedure Designer Training (Development of a Flight Procedure Designer Training Programme)*
Volume 3 — *Flight Procedure Design Software Validation*
Volume 4 — *Flight Procedure Design Construction* (to be developed)

Volume 5 — *Validation of Instrument Flight Procedures*
Volume 6 — *Flight Validation Pilot Training and Evaluation*
(Development of Flight Validation Pilot Training Programme)

Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual (Doc 9905)

———————

FOREWORD

Instrument flight procedures are an integral component of the airspace structure. Thousands of aircraft fly instrument departure, arrival or approach procedures to airports around the world. As such the safety and efficiency of these procedures are important, and the development of these procedures should be subject to a quality assurance system.

The objective of conducting validation is to ensure safety, data accuracy and integrity and flyability of the instrument flight procedure through a qualitative assessment of the procedure design including obstacle, terrain and navigation data, and provide an assessment of the flyability of the procedure so as to ensure a proper standard for all publications. The validation process applies to fixed-wing and helicopter instrument flight procedures.

This volume provides a detailed description of the validation process for instrument flight procedures. The validation process is subdivided into ground validation and flight validation. Volume 6 of Doc 9906 contains recommended qualifications and training, as well as guidance concerning the skills, knowledge and attitudes (SKA) to be addressed in the training and evaluation of flight validation pilots and should be considered complementary to this volume.

The terms “flight validation” and “flight inspection” are often misinterpreted as the same concept. In fact, flight validation and flight inspection are separate activities that, if required, may or may not be undertaken by the same entity:

a) 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, as detailed in PANS-OPS, Volume II, Part I, Section 2, Chapter 4, *Quality Assurance*.

b) 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, in accordance with the Standards in Annex 10 and the guidance in Doc 8071. Personnel performing flight inspection duties should be qualified and certified in accordance with Doc 8071, Volume I.

A procedure design organization may not have the expertise necessary to determine under which conditions flight validation and/or flight inspection may be necessary. For this reason it is recommended that a review by the flight validation and/or flight inspection organizations be included in the State’s procedure design process. The State is responsible for the overall performance of the procedure as well as its quality and suitability for publication.

PANS-OPS, Volume II, Part I, Section 2, Chapter 4, *Quality Assurance,* requires the State to have a written policy requiring minimum qualifications and training for flight validation pilots, including the flight inspection pilots who perform flight validation of instrument flight procedures. This policy also includes standards for the required competency level for flight validation pilots.

The pilot-in-command is responsible for the safe operation of the flight in accordance with applicable State regulations; however, due to the nature of flight validation requirements, it is understood that some of the regulations related to altitude and aircraft positioning must be waived by the State in order to properly validate published procedures.

The implementation of procedures is the responsibility of Contracting States, which implies that the State authorities have the final responsibility for procedures published within their territory. The validation process may be carried out by the States themselves or delegated by States to third parties (ATS providers, private companies, other States, etc.). Doc 8168 requires that States take measures to perform validation of instrument flight procedures to ensure the quality and safety of the procedure design for its intended use before publication. In all cases, including when third parties are involved in any step of the validation process, States assume ultimate responsibility for the procedures published in their national aeronautical information publication (AIP). This manual has been developed to provide guidance to Contracting

States in developing a validation process to ensure the quality of the flight procedures published by them. The manual provides a means, but it is not the only one, for the implementation of the validation process. Latitude is permitted in order to comply with local requirements. The manual may be of interest to any person or organization involved in the validation domain.

Chapter 1

THE VALIDATION PROCESS

1.1 THE NEED FOR VALIDATION

1.1.1 The purpose of validation is to obtain a qualitative assessment of the procedure design including obstacle, terrain and navigation data, and provide an assessment of the flyability of the procedure.

1.1.2 Validation is the final quality assurance step in the procedure design process for instrument flight procedures (IFP) and is essential before the procedure design documentation is issued as part of the integrated aeronautical information package.

1.2 THE VALIDATION PROCESS

1.2.1 The full validation process includes ground validation and flight validation.

1.2.2 Ground validation must always be undertaken. It encompasses a systematic review of the steps and calculations involved in the procedure design as well as the impact of the procedure on flight operations. It must be performed by persons trained in flight procedure design and with appropriate knowledge of flight validation issues.

1.2.3 Ground validation consists of an independent IFP design review and preflight validation. Flight validation consists of flight simulator evaluation and evaluation flown in an aircraft. An overview of the necessary steps in the validation process can be found in Figure 1-1. The IFP validation process must be carried out as part of the initial IFP design as well as for any amendment to an existing IFP.

1.2.4 If the State can verify, through ground validation, the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with.

1.2.5 Flight validation is required under the following conditions:

a) the flyability of a procedure cannot be determined by other means;

b) the procedure requires mitigation for deviations from design criteria;

c) the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means;

d) new procedures differ significantly from existing procedures; and

e) for helicopter PinS procedures.

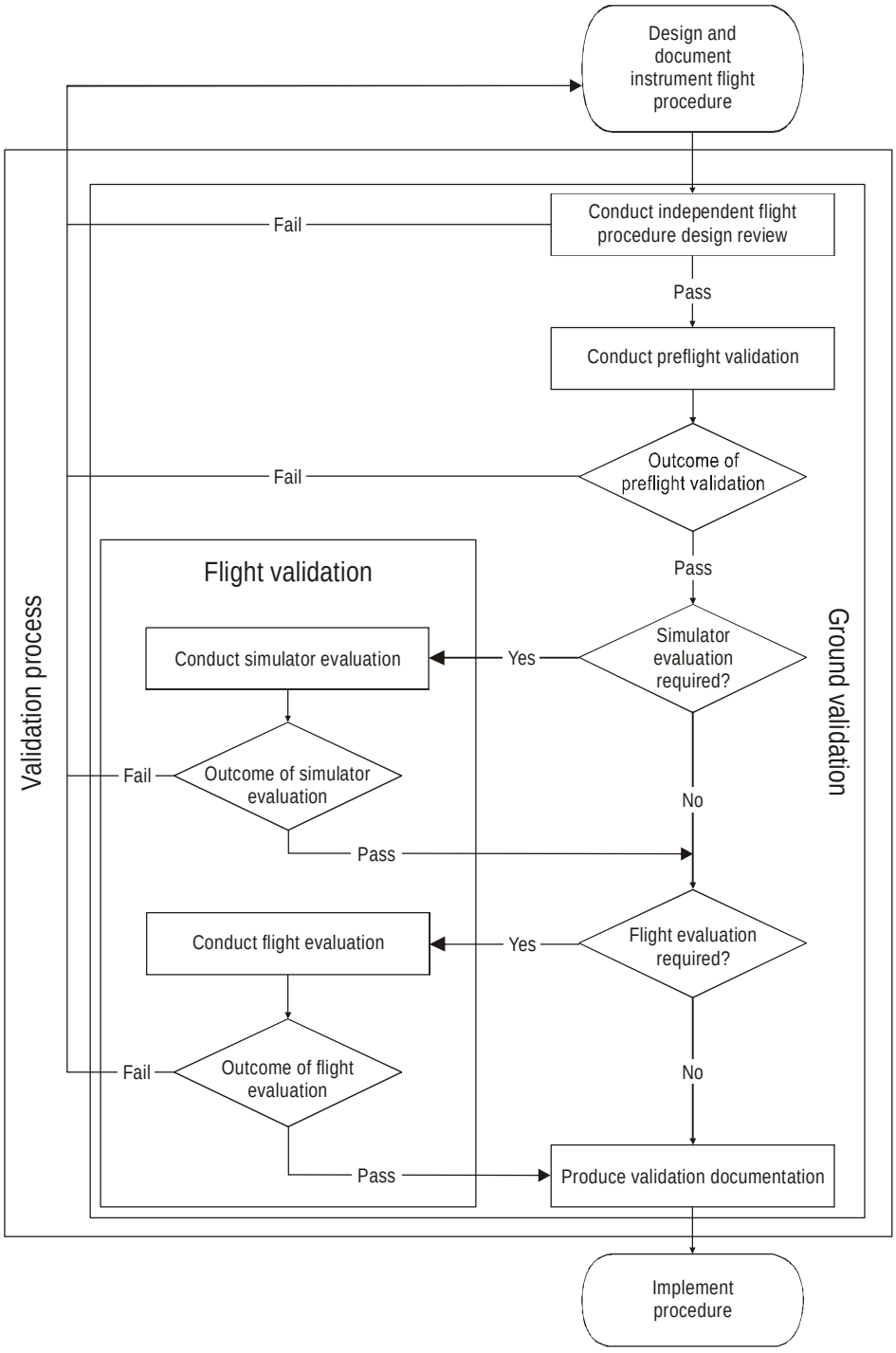

Figure 1-1. Validation process flow chart

1.3 VALIDATION REPORT AND DOCUMENTATION

1.3.1 It is the responsibility of the State to determine the minimum content and retention policy of documentation. As part of the flight procedure design documentation, a validation report should be completed at the end of the process including reports of individual steps performed. The minimum suggested requirements are the name and signature of the validation experts (flight procedure designer and/or flight validation pilot), date, activities performed, type of simulator or aircraft, any findings and flight validation pilot comments and operational recommendations. If a flight validation is performed, a printed graphic and/or electronic file of sufficient detail that depicts the flight track flown must be included in the report. Such a file should show procedure fixes, the maximum and minimum altitude, ground speed, climb rate and climb gradient and a comparison of the actual track flown with the desired track of the instrument flight procedure.

1.3.2 The validation process flow chart in the context of the flight procedure design process is shown in Figure 1-1.

1.4 DESCRIPTION OF THE VALIDATION PROCESS

PHASE	STEP	DESCRIPTION	INPUT	OUTPUT	PARTIES INVOLVED	QUALITY RECORDS	REFERENCES
GROUND VALIDATION	1	CONDUCT INDEPENDENT IFP DESIGN REVIEW Review of the IFP design package by a flight procedure designer other than the one who designed the procedure. • Confirm correct application of criteria • Confirm data accuracy and integrity • Verify mitigations for deviations from procedure design criteria • Verify that a draft chart (if required) is provided and is correct • Confirm correct FMS behaviour using desktop simulation tools (if required) • Perform obstacle assessment with State-approved ground-based methods for cases where obstacle/terrain data accuracy and integrity cannot be guaranteed (if required)	• Detailed report of IFP design	• Approval to proceed forward in the validation process	• Flight procedure designer • Any other appropriate stakeholder, such as: – FVP – ARINC 424 database coder – airport authorities – airspace designers	• GV report	• Doc 8168, Volumes I and II • Annexes 4, 6, 10, 11, 14, 15 • Doc 9368 • Doc 9906, Volumes 1 and 2 • ARINC 424 • State AIP • State regulations
	2	CONDUCT PREFLIGHT VALIDATION Determination, by persons with appropriate knowledge of flight validation issues (best practice: flight validation pilot), of the impact of IFP on flight operations. The goal of PV is to familiarize and identify potential issues in the procedure design from a flight operational perspective. The necessary further steps in the validation process are then determined. • Conduct inventory and review of the IFP package • Evaluate ARINC 424 data and coding • Review special operational and training requirements • Coordinate operational issues • Determine the required further steps in the validation process	• IFP package including: – IFP graphical depiction – submission forms – charts/maps • Flight inspection records for NAVAIDS/ sensors used in the development of IFP • Safety assessment report as applicable	• Approval to proceed with the validation process. If a correction is required, return the IFP to the designer to reinitiate the validation process after correction. • Determination of further steps in the validation process • Crew and required aircraft scheduling • Determination of required weather minima and NAVAIDS to proceed to FV • Determination of FI requirements in conjunction with FV • Determination of simulator evaluation requirements • Input to final safety assessment report as applicable	• FVP • Flight procedure designer • Any other appropriate stakeholder, such as: – ATC – airport authorities – flight inspection/ validation service provider	• PV report	• Annexes 4, 6, 10, 11, 14, 15 • Doc 8071 • Doc 8168, Volumes I and II • Doc 9906 • ARINC 424 • State regulations • State forms

PHASE	STEP	DESCRIPTION	INPUT	OUTPUT	PARTIES INVOLVED	QUALITY RECORDS	REFERENCES
FLIGHT VALIDATION	3	CONDUCT SIMULATOR EVALUATION Recommended step for complex procedures or procedures requiring waiver/mitigation for deviations from design criteria. • Verify chart depictions and details • Assess flyability and Human Factors • Conduct associated validation tasks • Record flight validation • Document the results	• IFP graphical depiction • ARINC 424 IFP database	• Flyability validation • Input to final safety assessment report as applicable • Recorded data • Findings and operational mitigations	• FVP • Flight procedure designer as appropriate	• Flight simulator evaluation report • Findings and operational mitigations	• Doc 9906
	4	CONDUCT FLIGHT EVALUATION Perform flight evaluation in order to: • Verify data • Verify chart depictions and details • Assess obstacle infrastructure • Assess airport infrastructure • Assess flyability and Human Factors • Conduct associated validation tasks • Record flight validation	• FV package • SIM evaluation report (if available)	• Validated IFP • Findings and operational mitigations • Input to final safety assessment report as applicable • Recorded data	• FVP • Flight procedure designer as appropriate	• Findings and operational mitigations • Recorded data	• Doc 8071 • Doc 9906 • State depiction standard • Doc 8168, Volume II
GROUND VALIDATION	5	PRODUCE VALIDATION REPORT This final step is to ensure proper completeness of all forms and reports to validate the entire FPD package. The validation report should consist of individual reports of all steps performed in the validation process.	• Findings and operational mitigations • Recorded data	• Validation report • Flight inspection report (when performed)	• FVP and/or • Flight procedure designer	• GV report • FV report • Flight inspection report (when performed)	• Doc 9906 • State forms

1.5 PREPARATION FOR VALIDATION

This section describes various activities that should be performed prior to the validation process.

1.5.1 The instrument flight procedure package

1.5.1.1 The IFP package provided by the procedure design service provider must contain the following minimum data in an acceptable format to conduct a validation.

1.5.1.2 The IFP package includes:

a) an IFP summary;

b) proposed instrument procedure chart/depiction of sufficient detail to safely navigate and identify significant terrain, obstacles and obstructions;

c) proposed ARINC 424 path terminators (for PBN procedures only);

d) list of relevant obstacles, identification and description of controlling obstacles and obstacles otherwise influencing the design of the procedure, waypoint fix latitude/longitude, procedural tracks/course, distances and altitudes;

e) airport infrastructure information, such as visual aids (ALS, VASI);

f) information on aerodrome obstacle limitation/safeguarding processes applied;

g) any special local operational procedure (e.g. noise abatement, non-standard traffic patterns, lighting activation);

h) detailed listing of deviations from design criteria and proposed mitigation;

i) for a non-standard IFP: training, operational or specific equipment requirements; and

j) appropriate validation checklist and report forms.

1.5.2 Flight inspection

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. Flight inspection is carried out as part of the programme detailed in Doc 8071 or equivalent State document. Flight inspection must be performed by a qualified flight inspector using a suitably equipped aircraft.

1.5.3 Data integrity and ARINC encoding requirements

1.5.3.1 Flight procedures to be validated should be contained in the suitable navigation system (i.e. FMS). The procedure may be on a pre-production custom navigation database. It could be downloaded from an electronic media with adequate data integrity protection such as CRC wrapping. If no other means exist, manual entry is permissible if sufficient mitigation means have been considered and implemented. All procedure coding data must originate from the official data source.

Custom navigation database (preferred method)

1.5.3.2 A navigation database can be customized by an official database supplier to include procedures for flight validation. A customized navigation database is the most desirable source because it will contain a normal operational navigation database and new, official, source-coded flight procedures for validation/inspection. The custom navigation database should be updated on a periodic schedule.

Electronic media

1.5.3.3 Some procedure design tools output an electronic ARINC 424 code of the final procedure that can be input to commercial aircraft flight management systems. This process, when used with cyclic redundancy checks, ensures that the procedure design remains unchanged through the final production chain, thus ensuring a high degree of data integrity.

Manual entry

1.5.3.4 This method of entry should be limited to LNAV procedures only. It should be used sparingly and requires additional verification steps to confirm proper data entry. If the navigation system used allows manual input of ARINC path/terminators they should be used. It is recommended that the coded procedure provided by an official database supplier be used as soon as available, to confirm appropriate coding prior to public use.

———————

Chapter 2

STEP-BY-STEP DESCRIPTION OF ACTIVITIES WITHIN THE VALIDATION PROCESS

The validation process consists of ground validation and flight validation. Ground validation must always be performed. Each phase consists of several important steps as illustrated in Chapter 1, Figure 1-1. The following sections reflect all the steps of the process flow shown in Figure 1-1 and provide additional comments and explanations.

2.1 STEP 1: CONDUCT INDEPENDENT IFP DESIGN REVIEW

A flight procedure designer other than the one who designed the procedure must perform this step. The designer can be assisted by specialists in other fields of expertise as necessary.

2.1.1 Confirm correct application of criteria

The use of the correct design criteria in PANS-OPS, Volume II, or Doc 9905 and their correct application should be ensured. This can be achieved by assessing and recalculating every single element of the procedure design in accordance with Doc 9906, Volume 1, or by performing selected checks and calculations as appropriate.

2.1.2 Confirm data accuracy and integrity

The origin of any data (airport, navigation aids, waypoints, obstacles, terrain) should be known. Using data from a known source usually allows the accuracy and the integrity of the data to be determined. If data from unknown sources are used or if data accuracy and/or integrity cannot be adequately determined, the data should be validated. This can be done through flight validation or through State-approved ground-based methods.

2.1.3 Verify mitigations for deviations from procedure design criteria

If deviations from procedure design criteria are used, mitigations must provide an acceptable level of safety. Flight evaluation should be performed to verify the acceptability of previously performed safety studies.

2.1.4 Verify that a draft chart (if required) is provided and is correct

A draft chart is required to conduct a flight validation. It should be verified that a draft chart is provided and contains the required elements to perform the flight validation efficiently.

2.1.5 Confirm correct FMS behaviour using desktop simulation tools (if required)

The correct translation of a procedure into ARINC 424 code can initially be assessed with a desktop simulation tool. Such tools provide feedback on the correct selection of ARINC 424 path terminators as well as any issues with the choice of waypoint positions and segment lengths (e.g. route discontinuity).

2.1.6 Perform obstacle assessment with State-approved ground-based methods (if required)

For cases where obstacle and/or terrain data accuracy and/or integrity cannot be guaranteed, ground-based obstacle assessment methods can provide an alternative to an assessment with an aircraft. Such ground-based methods should be approved by the State and should provide a defined minimum level of accuracy as determined by the State.

2.2 STEP 2: CONDUCT PREFLIGHT VALIDATION

Preflight validation must be conducted by persons trained in flight procedure design and with appropriate knowledge of flight validation issues. This may be a joint activity by flight procedure designers and pilots. The required qualification for pilots involved in the preflight validation step must be determined by State policy. Preflight validation should identify the impact of a flight procedure on flight operations, and any issues identified should be addressed prior to flight validation. Preflight validation determines the subsequent steps in the validation process.

Note.— Several States define the qualification for pilots involved in the preflight validation step according to PANS-OPS, Volume II, Part I, Section 2, Chapter 4, 4.6.6, and Doc 9906, Volume 6.

2.2.1 Conduct inventory and review of the IFP package

Persons performing preflight validation must ensure that the IFP documentation is complete and that all necessary charts, data and forms are available. As a minimum, the following tasks must be performed:

a) Ensure the completeness of the IFP package (i.e. that all forms, files and data are included) as described in Chapter 1, 1.5.1, of this manual.

b) Ensure that charts and maps are available in sufficient detail for assessment of the IFP during the FV.

c) Familiarize with the target population of the procedure (e.g. aircraft categories, type of operation).

d) Discuss the IFP package with the procedure designer, as necessary.

e) Verify that the IFP procedure graphics and data match.

f) Compare the IFP design, coding and relevant charting information against the navigation database used for flight validation.

g) Verify that controlling obstacles and obstacles otherwise influencing the design of the procedure are properly identified.

h) Review the airport infrastructure and special airport regulations.

i) Review the navigation infrastructure used by the procedure.

j) Review pertinent flight inspection documentation, if required.

2.2.2 Evaluate data and coding

2.2.2.1 For an IFP based on area navigation, the true course to the next waypoint, distances and altitudes that reflect the flight procedure design must be verified. Leg segment data accuracy must be evaluated by comparison of the procedural waypoint data to the flight plan waypoint data.

2.2.2.2 When evaluating CF legs or holding legs (HM, HF, HA), aircraft navigation performance with the instrument procedure design must be compared. Any tolerance to course-to-fix values cannot be applied. Confirmation of proper ARINC coding must be accomplished with either an appropriately equipped aircraft or by a desktop evaluation of the current navigation database.

2.2.2.3 Out-of-tolerance values or questionable ARINC 424 coding must be resolved.

2.2.2.4 For an IFP based on ground-based navigation aids, the course, distances and the FPA indicated on the IFP depiction and submission form of the procedure design should be verified. Where positive course guidance is required by the IFP design, it must be confirmed that the performance of navigation aids meets all required flight inspection tolerances in conjunction with the flight validation.

2.2.2.5 The following are the steps to evaluate data and coding:

a) Prepare loadable data and coding.

b) Compare true courses and distances for segments between the data file and the procedural data.

c) Compare ARINC 424 coding for legs and path terminators between the data file and the procedural data.

2.2.2.6 When the flight procedure design involves a complex new procedure or a significant change to existing procedures/routes in a complex airspace, the State must liaise with the major commercial navigation data houses prior to promulgation. This liaison should provide the data houses with additional advance notice of the proposed changes and should allow them to review the proposed procedures, clarify any outstanding questions and advise the State of any technical issues that may be identified. Advance notification of procedures should contain the following elements:

a) graphical layout of the procedure;

b) a textual description of the procedure;

c) coding advice, when applicable; and

d) coordinates of fixes used in the procedure.

2.2.3 Review special operational and training requirements

a) Review deviations from criteria and ensure that an equivalent level of safety is provided by waivers/ mitigations.

b) Review the safety case supporting the waiver/mitigation.

c) Assess restricted procedures for special training and equipment requirements.

2.2.4 Document the results of preflight validation

2.2.4.1 a) Determine if a flight inspection is necessary.

b) Determine the need for flight simulator evaluation, especially where there are special or unique design considerations.

c) Determine the need for flight evaluation in the aircraft, especially where there are special or unique design considerations or when the accuracy/integrity of the data used in the IFP design and/or the aerodrome environment is not assured.

d) Record specific additional actions required in a flight validation (if required).

e) Provide a detailed written report of the results of preflight validation. (See Appendix C for fixed-wing sample report forms. See Appendix D for helicopter sample report forms.)

2.2.4.2 A flight validation (simulator and/or aircraft as required) is required in the following cases:

a) if the flyability of a procedure cannot be determined by other means;

b) if the procedure contains non-standard design elements (deviations from criteria, e.g. non-standard approach angles/gradients, non-standard segment lengths, speeds, bank angles);

c) if the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means;

d) if new procedures differ significantly from existing procedures; and

e) for helicopter PinS procedures.

2.2.4.3 Flight evaluation is required in the following cases:

a) for procedures where runway or landing location infrastructure has not been previously assessed in flight for instrument operations; and

b) as determined by the State Authority.

2.2.5 Coordinate operational issues (if flight evaluation is required)

a) Consider temperature and wind limitations, air speeds, bank, angles, climb/descent gradients, etc.

b) Determine the aircraft and equipment required to complete flight validation of the IFP.

c) Determine airport infrastructure and navigation aid/sensor availability.

d) Check weather minima and visibility required for flight validation. Conduct the initial assessment in daylight conditions in VMC in each segment with visibility requirements sufficient to perform obstacle assessment.

e) Assess the need for a night evaluation in the case of at least one of the following circumstances:

1) an IFP developed for an airport with no prior IFR procedures;

2) an IFP to newly constructed runways or to runways lengthened or shortened;

3) addition of lights to, or reconfiguration of lights in, an existing system already approved for IFR operations; and

4) circling procedures intended for night use.

f) Coordinate with ATS and other stakeholders in accordance with the instrument flight procedure process documented in Volume 1 of Doc 9906.

2.3 STEP 3: CONDUCT SIMULATOR EVALUATION

2.3.1 General

2.3.1.1 Simulator evaluation must be accomplished by a qualified and experienced FVP, certified or approved by the State.

2.3.1.2 To provide an initial evaluation of database coding, flyability and to provide feedback to the procedure designers, simulator assessment might be necessary. Simulator evaluation must not be used for obstacle assessment. Preparation for simulator evaluation should include a comprehensive plan with a description of the conditions to be evaluated, profiles to be flown and objectives to be achieved. A review of the results of simulator evaluation should be completed before flight evaluation.

2.3.1.3 The simulator used should be suitable for the validation tasks to be performed. For complex or special procedures where simulator evaluation is desired, the evaluation should be flown in a simulator which matches the procedure requirements. When the procedure is designed for a specific aircraft model or series and specific FMS and software, simulator evaluation should be flown in a simulator with the same configuration used by the operator in daily operations.

2.3.1.4 Required navigation performance authorization required (RNP AR) IFP(s) must always undergo simulator evaluation.

2.3.1.5 The following steps should be taken when conducting simulator evaluation:

a) Evaluate the suitability of the simulator equipment in terms of:

1) FMS and avionics;

2) simulator type and/or category.

b) Conduct simulator evaluation:

1) Evaluate flyability.

2) Evaluate database coding and accuracy.

3) Verify that waivers/mitigations for deviations from design criteria do not compromise safety.

4) Where permitted by the simulator, evaluate any other factors (such as wind, temperature and barometric pressure) that may be pertinent to the safety of the procedure.

c) Document the results of simulator evaluation:

1) Assess whether the IFP is ready for further processing in the validation process.

2) Provide a detailed written report of the results of simulator evaluation.

2.3.2 Assess flyability and Human Factors issues

2.3.2.1 To assess flyability and Human Factors issues, at least one on-course/on-path assessment of the proposed procedure should be flown in an appropriate aircraft capable of conducting the procedure. If different minima are provided for the same final segment (e.g. LNAV, LNAV/VNAV, LPV), the evaluation of the final segment must be accomplished on separate runs. See Appendix B for more detailed Human Factors information.

2.3.2.2 The objectives of a flyability assessment of instrument flight procedures are to:

a) evaluate aircraft manoeuvring areas for safe operations for each category of aircraft for which the procedure is intended; and

b) review the flyability of the instrument procedure as follows:

1) fly each segment of the IFP on-course and on-path;

2) validate the intended use of the IFP as defined by stakeholders and described in the conceptual design;

3) evaluate other operational factors, such as charting, required infrastructure, visibility and intended aircraft categories;

4) evaluate the aircraft manoeuvring area for safe operations for each category of aircraft to use the IFP;

5) evaluate turn anticipation and the relationship to standard rate turns and bank angle limits;

6) evaluate the IFP complexity, required cockpit workload and any unique requirements;

7) check that waypoint spacing and segment length are suitable for aircraft performance;

8) check the distance to runway at decision altitude/height or minimum descent altitude/height that is likely to be applied by operators and evaluate the ability to execute a landing with normal manoeuvring;

9) evaluate required climb or descent gradients, if any;

10) evaluate the proposed charting for correctness, clarity and ease of interpretation;

11) evaluate TAWS warnings.

2.3.2.3 The flyability assessment must be flown at speeds and aircraft configurations consistent with normal IFR operations and meet the design intent (aircraft category). The final approach fix to threshold of an instrument approach procedure must be flown in the landing configuration, on profile, on speed and with the TAWS active. Flyability should be evaluated with the simulator/aircraft coupled to the autopilot (to the extent allowed by the aircraft flight manual or SOPs) and may require additional evaluation by hand flying.

2.3.2.4 Aircraft category restrictions might be published and must be confirmed acceptable. In every case, the pilot is required to pay particular attention to the general safe conduct of the procedure and efficiency of the flight for the intended aircraft category.

Note.— It is recommended that if different minima are provided for the same final segment (e.g. LNAV, LNAV/VNAV, LPV), that evaluation of the final segment be accomplished on separate runs.

2.3.3 Document the results of flight simulator evaluation

A detailed written report of the results of flight simulator evaluation needs to be provided. (See Appendix C for fixed-wing sample report forms. See Appendix D for helicopter sample report forms.)

2.4 STEP 4: CONDUCT FLIGHT EVALUATION

2.4.1 General

2.4.1.1 Flight evaluation must be accomplished by a qualified and experienced FVP, certified or approved by the State.

2.4.1.2 The objectives of flight evaluation are to validate the intended use of the IFP as defined by stakeholders and described in the conceptual design and to evaluate other operational factors, such as charting, required infrastructure, visibility and intended aircraft category.

2.4.1.3 The FVP must occupy a seat in the cockpit with visibility adequate to conduct the flight validation, and additional crew members must be briefed on FV requirements. Only task-related persons should normally be allowed on such flights.

2.4.1.4 Ground track path error performance varies with mode of flight guidance system coupling. New procedures should be evaluated coupled to the flight director and autopilot (when not prohibited). Lateral and vertical disconnects from the autopilot/flight director should be evaluated.

2.4.1.5 Procedure 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.

2.4.1.6 The procedure must be flown in the navigation mode using the correct sensor, or with navigation equipment that permits the flight to be conducted at an equivalent level of performance, as required by the design. For example, for IFP based on GNSS, it needs to be ensured that only the GNSS sensor is utilized during the FV. All the following required steps should be adapted to the specifics of each design and IFP:

a) Conduct an assessment of flyability to determine that the procedure can be safely flown.

b) Provide the final assurance that adequate terrain and obstacle clearance have been provided.

c) Verify that the navigation data to be published are correct.

d) Verify that all required infrastructure, such as runway markings, lighting, and communications and navigation sources are in place and operative.

e) Ensure the navigation system's documentation confirms that the applicable navigation systems (navigation aid/sensor, GNSS, radar, etc.) support the procedure.

f) Evaluate other operational factors, such as charting, required infrastructure, visibility and intended aircraft category.

g) Verify that waivers/mitigations for deviations from design criteria do not compromise safety.

Note.— Where applicable, credit for the results of simulator evaluation can be given.

2.4.1.7 For complex procedures including helicopter PinS and RNP AR, additional flyability checks are required in the proponent's aircraft or simulator.

2.4.1.8 IFPs based on SBAS or GBAS require analysis of additional parameters contained in the FAS data block and data link (GBAS). These parameters include:

a) glide path angle;

b) threshold crossing height (LTP or FTP);

c) LTP coordinates or FTP; and

d) FPAP coordinates.

2.4.1.9 Verification of the spatial data contained in the final approach segment definition is required. Any error in the coded data with respect to the proper reference datum may result in improper final approach guidance to the pilot. The FAS data evaluation system must be capable of performing the necessary analysis in a documented, quantitative process as described in 2.4.2.3.

Note.— For GBAS, additional inspection requirements are specified in Doc 8071, Volume II, Chapter 4.

2.4.2 Verify data

2.4.2.1 It is essential that the data used in the procedure design are consistent in the charts, FMS data or suitable navigation system data. The validation flights (simulator or aircraft) should be recorded with a collection/recording device that archives the procedure and aircraft positioning data (see 2.4.7). The procedure development package, charts and airport data must match. It is recommended that PBN procedures are packed and loaded electronically into the FMS or suitable navigation system without manually coding the ARINC 424 path/terminator data. Integrity measures such as a cyclic redundancy check (CRC) should be used to ensure that data are not corrupted. This allows evaluation of the data as designed, without manipulation. If the procedure waypoint data are manually entered into the FMS, they must be independently compared to the procedure data to ensure they match.

2.4.2.2 The following steps should be taken to verify data:

a) Ensure that the data from the flight validation database match the data used in the procedure design.

b) Ensure that the data produce the desired flight track.

c) Ensure that the final approach course glide path delivers the aircraft to the desired point-in-space.

SBAS/GBAS FAS data requirements

2.4.2.3 For SBAS and GBAS FAS data, the LTP/FTP latitude and longitude, the LTP/FTP ellipsoid height and the FPAP latitude and longitude contribute directly to the final approach alignment and angle. Corrupted data may skew lateral, vertical and along-track alignment from the intended design. A direct assessment should be made of the LTP latitude/longitude, LTP ellipsoid height, and FPAP latitude/longitude coordinates used in the procedure design. This may be accomplished using a survey grade GNSS receiver on the runway threshold while making a comparison with the actual final approach segment data to be published. Another indirect method is to evaluate the following IFP characteristics as a means of validating the FAS data:

a) horizontal course characteristics:

   1) misalignment type, linear or angular; and

   2) measured angular alignment error in degrees (when applicable) and linear course error/offset at the physical runway threshold or decision altitude point.

b) vertical path characteristics:

   1) achieved/measured TCH/RDH; and

   2) glide path angle.

2.4.3 Assess obstacles

Detailed guidance regarding obstacle assessment is contained in Appendix A. In general, obstacles should be visually assessed to the lateral limits of the procedure design segment. The aircraft should be positioned in a manner that provides a good view of the obstacle environment that is under consideration. This may require flying the lateral limits of the procedure protection areas in order to detect if unaccounted obstacles exist. The controlling obstacle should be verified for each segment of the IFP. Should unaccounted obstacles be observed, further investigation by the FVP is required.

2.4.4 Assess flyability and Human Factors issues

The same provisions as in 2.3.2 apply.

2.4.5 Conduct associated validation tasks

2.4.5.1 The following associated validation tasks should be performed in conjunction with the obstacle or flyability assessment as appropriate:

a) Verify that all required runway markings, lighting and communications are in place and operative.

b) Verify that any required navigation aids/sensors have been satisfactorily flight inspected to determine that they support the procedure design.

c) Ensure that the components of the VASIS angles appear as intended or charted when evaluating vertically guided procedures.

d) Ensure that adequate ATS communications, according to State regulations, are available.

e) Where required, ensure that radar coverage is available for all portions of the procedure.

f) Indicate any TAWS warnings or alerts. Record details of the alert to include latitude/longitude, aircraft configuration, speed and altitude.

g) If night evaluation is required, determine the adequacy of airport lighting systems prior to authorizing night operations. Conduct night evaluations during VMC following appropriate daytime evaluation.

2.4.5.2 The lighting system needs to be evaluated for:

a) correct lighting facilities (particularly if pilot activated) and lighting patterns as charted; and

b) local lighting patterns in the area surrounding the airport to ensure they do not distract, confuse or incorrectly identify the runway environment.

2.4.5.3 It needs to be verified that waivers/mitigations for deviations from design criteria do not compromise safety.

2.4.6 Verify chart depiction and details

a) Ensure that the chart has sufficient detail for significant terrain or obstacles to be safely navigated and identified.

b) Ensure all required notes are included (e.g. DME required, do not confuse RWY 14 with RWY 16, non-standard approach angle).

c) Ensure that the chart accurately portrays the procedure in both plan and profile view and is easily interpreted. Ensure that the flight track matches the chart and takes aircraft to the designed point.

d) Verify that the true and magnetic course to the next waypoint indicated on the FMS or GNSS receiver accurately reflects the procedure design. (Magnetic courses displayed by the FMS/GNSS navigator may be dependent upon the manufacturer's software processing of magnetic variation.)

e) Verify that segment distances indicated by the aircraft navigation system accurately reflect the procedure design.

f) Verify that the FPA indicated on the FMS or GNSS receiver accurately reflects the procedure design.

g) Check that waypoint spacing and segment length are sufficient to allow the aircraft to decelerate or change altitude on each leg without bypassing.

2.4.7 Record flight validation

2.4.7.1 A recording device should be used that is capable of the following: IFP storage, time and three-dimensional position in space with an acceptable sampling rate (not less than 1 Hz) and the ability to post-process recorded data.

2.4.7.2 Record and save the following flight data as a minimum;

a) processing date and time;

b) number of satellites in view;

c) minimum number of satellites;

d) average PDOP;

e) maximum observed HDOP (SBAS procedures only);

f) VPL (SBAS/GBAS procedures only);

g) HPL (SBAS/GBAS procedures only);

h) maximum observed VDOP (SBAS procedures only);

i) for each segment, the maximum and minimum altitude, ground speed, climb rate and climb gradient; and

j) a printed graphic or an electronic file of sufficient detail that depicts the horizontal (and the vertical for VNAV procedures) flight track flown, referenced to the desired track of the approach procedure, including procedure fixes.

Note.— The recording of HDOP, PDOP, VDOP, HPL and VPL is a collection of data in a limited time frame and its purpose is to document the actual situation at the time of the validation flight.

2.4.7.3 SBAS and GBAS IFPs require analysis of additional parameters contained in the FAS data block. FAS data block validation requires verification of the coordinates and heights used in the FAS or by indirect flight inspection system analysis of the IFP characteristics described in 2.4.2.3.

2.5 STEP 5: PRODUCE VALIDATION REPORT

2.5.1 Assess the results of the validation process as follows:

a) Review all aspects of the validation process to complete the assessment.

b) Make a determination of satisfactory or unsatisfactory results, based on criteria established by the State.

2.5.2 For satisfactory validation, complete the IFP processing as follows:

a) Ensure the completeness and correctness of the IFP package to be forwarded.

b) Propose suggestions for improved operation of the procedure when such factors are outside the scope of the procedure design (e.g. ATC issues).

2.5.3 For unsatisfactory validation, return the IFP to the procedure designer for corrections:

a) Provide detailed feedback to the procedure designer and other stakeholders.

b) Suggest mitigation and/or corrections for unsatisfactory results.

2.5.4 Document the results of the validation process as follows:

a) Complete a detailed written report of the results of the validation process including justification for any steps in the validation process deemed not required. This involves a compilation of reports provided by the individual steps in the validation process.

b) Ensure that any findings and operational mitigations are documented.

c) Forward uncharted controlling obstacle position and elevation data to the procedure designer.

d) Ensure that recorded data are processed and archived together with the IFP and validation documentation.

Note.— Templates of checklists and reports are contained in Appendix C (fixed wing) and Appendix D (helicopters).

———————

Appendix A

OBSTACLE ASSESSMENT

1. VERIFICATION OF MINIMUM OBSTACLE CLEARANCE (MOC)

Controlling obstacles in each segment must be confirmed during the initial certification and cyclic review of flight procedures. If unable to confirm that the declared controlling obstacle of the respective segment is correctly identified, then list the location, type and approximate elevation of the obstacles the FVP desires the designer to consider. The FVP will place special emphasis on newly discovered obstacles. If the controlling obstacle is listed as terrain/trees or adverse assumption obstacles (e.g. vegetation tolerance, ships, tolerance for potential unreported structures as defined by the State), it is not necessary to verify the actual height of the controlling obstacle, only that no higher obstacle is present in the protected airspace. If the FVP observes that the documented controlling obstacle is not present, the FVP must indicate this information in the report.

2. IDENTIFICATION OF NEW OBSTACLES

2.1 In most instances, accurate information concerning the location, description and heights of tall towers and other obstacles is available from the database and/or other government sources. When new, potentially controlling obstacles not identified in the procedure package are discovered, the procedure's initial certification will be assessed as failed until the designer can analyse the impact of the obstacle on the overall procedure. Particular emphasis is given to power lines, man-made structures, wind farms and chimneys with high velocity exhaust gases, which may not be populated in the database.

2.2 Obstacle locations must be noted with latitude/longitude or radial/bearing and distance from a known navigation aid or waypoint. If these methods are not available, an accurate description on the flight validation map may be used and a digital picture taken if possible.

2.3 Obstacle heights measured in flight are not considered accurate and should not be used unless the actual height of the obstacle cannot be determined by other means. GNSS is the preferred measurement tool; however, if barometric height determination is required, accurate altimeter settings and altitude references must be used to obtain reasonable results. The flight validation report will reflect the documentation for the method of height determination including altimeter corrections applied for low temperature, mountain wave, etc. The GNSS altitude must also be noted.

2.4 Obstacle assessment for multiple approaches to the same runway may be completed during a single evaluation to meet periodic requirements.

2.5 While the challenging nature of this task is acknowledged, its basic purpose is to confirm that at no time during the approach was the aircraft ever brought into close proximity — laterally or vertically — to any obstacles. It is not intended to imply an exhaustive survey of every obstacle in the area.

3. TERRAIN AWARENESS WARNING SYSTEM (TAWS) ALERTS

TAWS alerts may be generated while flying over irregular or rapidly rising terrain at altitudes providing standard obstacle clearance. If TAWS alerts are received while validating a procedure, repeat the manoeuvre, ensuring flight at the

designed true altitude using temperature compensation at the maximum design speed for the procedure. If the alert is repeatable, notify the information in the report, including sufficient details for resolution by the designer. The FVP should not hesitate to provide potential operational solutions such as speed restrictions, altitude restrictions or waypoint relocation. A TAWS alert may be generated when approaching an airport runway that is not in the TAWS database. The TAWS check should be performed with proper aircraft configuration in the respective phase of flight.

_____

Appendix B

HUMAN FACTORS

The purpose of flight validation is to determine whether a flight procedure is operationally safe, practical and flyable for the target end-user. The criteria used to develop instrument flight procedures represent many factors such as positioning requirements, protected airspace, approach system and avionics capabilities. Sensory, perceptual and cognitive restrictions historically have been incorporated in the criteria only to a limited extent (e.g. length of approach segments, descent gradients and turn angles). These are products of subjective judgements in procedure development and cartographic standards. It is incumbent upon the flight crew to apply the principles of Human Factors and professional judgement when certifying an original or amended procedure. ICAO Annex 4, Chapter 2, provides directions in that regard. The following factors must be evaluated:

a) ***Practicality.*** The procedure should be practical. For example, segment lengths for approach and missed approach segments should be appropriate for the category of aircraft using the procedure. Procedures must not require excessive aircraft manoeuvring to remain on the lateral and vertical path.

b) ***Complexity.*** The procedure should be as simple as possible. It should not impose an excessive workload on the target user. Complex procedures may be developed for specific aircraft equipment or aerodrome environment and/or for specialized training and authorizations.

c) ***Interpretability.***

1) The final approach course should be clearly identifiable, with the primary guidance system or NAVAID unmistakable.

2) The procedure should clearly indicate which runway the approach serves and indicate which runways circling manoeuvres apply to.

3) Fix naming must be readable and clearly understood. Fixes/waypoints with similar sounding identifiers should not be used in the same procedure.

4) Areas not to be used for manoeuvring must be clearly defined. Significant terrain features must be displayed on approach charts.

5) Approaches to runways with significant visual illusions should be noted and corrective action suggested, i.e.:

— caution note;

— additional equipment required:

- PAPI/VASI;
- electronic glide path; and
- wind shear warnings.

d) ***Human memory considerations.*** Pilots must be able to extract information quickly and accurately during an instrument procedure. Multiple tasks complicate the memory process and tend to produce prioritization during high workload phases of flight. Workload reduction can be accomplished through methodical chart layout that encourages the pilot to periodically refer to the depicted procedure rather than trying to memorize complex manoeuvres detailed in the text.

Appendix C

VALIDATION TEMPLATES FOR FIXED-WING AIRCRAFT

The following sample checklist and report templates contain suggested minimum data and information required to be recorded during the validation process. If certain items are not applicable to the intended IAP, identify those items by striking them out or using the term “N/A”. These forms must be signed.

States may develop their own version for other types of IFPs as required.

C.1 Preflight validation checklist — fixed wing

PREFLIGHT VALIDATION CHECKLIST — FIXED WING				
REPORT HEADER				
Date:		Validation type (new/amended procedure):		
Organization:				
Procedure title:				
Location:				
Airport:		Runway:		
Evaluator's name/telephone no.:				
PBN navigation specification:				
PREFLIGHT VALIDATION				
			SATISFACTORY	
			YES	**NO**
IFP package forms, charts and maps				
Data verification (e.g. aerodrome/heliport, aeronautical, obstacle, ARINC coding)				
Location of the controlling obstacles				
Correctness and complexity of the graphical depiction (chart)				
Intended use and special requirements				
Overall design (i.e. practical, complete, clear and safe)				
Impact on the procedure of waivers to standard design criteria				
Segment lengths and descent gradients allow for deceleration/configuration				
Comparison of FMS navigation database with the IFP design, coding and relevant charting information				
Charting of notification of cold/warm temperature limits				
Flight inspection reports available				
REMARKS				
Simulator evaluation needed			**YES**	**NO**
Flight evaluation needed			**YES**	**NO**
PROCEDURE	**PASS**		**FAIL**	
EVALUATOR'S SIGNATURE: Date:				

C.2 Simulator evaluation checklist — fixed wing

SIMULATOR EVALUATION CHECKLIST — FIXED WING				
REPORT HEADER				
Date:	Validation type (new/amended procedure):			
Organization:				
Procedure title:				
Location:				
Airport:	Runway:			
Evaluator's name/telephone no.:				
PBN navigation specification:				
			SATISFACTORY	
			YES	**NO**
Comparison of FMS navigation database and source documents, including proper ARINC 424 coding				
Provide simulator documentation, including FMS software				
Assessed faster and/or slower than charted				
Assessed at allowed temperature limits				
Assessed with adverse wind components				
Flight track matches procedure design				
Flyability				
Human Factors assessment				
ADDITIONAL REQUIREMENTS FOR SIMULATOR ACTIVITIES				
			COMPLETED	
Document the following information as satisfactory or not for each procedure segment as appropriate: heading/track, distance, TAWS alerts, flight path angle (for final segment only) and note the wind component and temperature conditions				
Note the maximum bank angle achieved during any RF segments				
Record simulation data (if applicable)				
REMARKS				
PROCEDURE	**PASS**		**FAIL**	
EVALUATOR'S SIGNATURE: Date:				

C.3 Flight evaluation checklist — fixed wing

FLIGHT EVALUATION CHECKLIST — FIXED WING			
REPORT HEADER			
Date:	Validation type (new/amended procedure):		
Organization:			
Procedure title:			
Location:			
Airport:	Runway:		
Evaluator's name/telephone no.:			
PBN navigation specification:			
PLANNING			
		COMPLETED	
Check that all the necessary items from the IFP package are available, including: graphics, text, maps, submission form			
Check that the necessary flight validation forms are available			
Check that the aircraft and avionics are appropriate for the IFP being evaluated			
Does the procedure require use of autopilot or flight director?			
PREFLIGHT			
		COMPLETED	
Review preflight validation assessment			
Review simulator evaluation assessment (if applicable)			
Obstacle assessment planning: areas of concern; ability to identify and fly lateral limits of obstacle assessment area (if required)			
Verify source of IFP data for aircraft FMS (electronic or manual creation)			
Evaluate navigation system status at time of flight (NOTAM, RAIM, outages)			
Weather requirements			
Night evaluation requirement (if applicable)			
Required navigation (NAVAID) support (if applicable)			
Combination of multiple IFP evaluations			
Estimated flight time			
Coordination (as required) with ATS, procedure designer, airport authority			
Necessary equipment and media for electronic record of validation flight			
GENERAL			
		SATISFACTORY	
		YES	**NO**
IFP graphic (chart) is complete and correct			
Check for interference: document all details related to detected RFI			
Satisfactory radio communication			
Required radar coverage is satisfactory			
Verify proper runway markings, lighting and VASIS			
Altimeter sources			
Extra consideration given to non-surveyed areas			
For approach procedures with circling minima, verify controlling obstacle for each circling category			

FLYABILITY		
	SATISFACTORY	
	YES	**NO**
Comparison of FMS navigation database and source documents, including proper ARINC 424 coding. *Note.— If manual entry is used, this field is marked "N/A", and a note must be inserted in the remarks section to alert the approving authority of the procedure that a table top review of the coded procedure, or an operational assessment by a company pilot, should be completed prior to operational approval being granted.*		
Human Factors and general workload are satisfactory		
Was there any loss of RAIM?		
Was there any loss of required RNP (where applicable)?		
Missed approach procedure		
Descent/climb gradients		
Procedure flown auto-coupled		
Segment length, turns and bank angles, speed restrictions and deceleration allowance		
TAWS		
INSTRUMENT APPROACH PROCEDURE		
	SATISFACTORY	
	YES	**NO**
Segment lengths, headings/tracks and waypoint locations match procedure design		
Final segment vertical glide path angle (if applicable)		
Threshold crossing height (LTP or FTP), if applicable.		
Course alignment		
Along-track alignment		
FAS data block		
REMARKS		

PROCEDURE	**PASS**		**FAIL**	

EVALUATOR'S SIGNATURE:

Date:

C.4 Validation report checklist — fixed wing

VALIDATION REPORT CHECKLIST — FIXED WING				
REPORT HEADER				
Date:	Validation type (new/amended procedure):			
Organization:				
Procedure title:				
Location:				
Airport:	Runway:			
Evaluator's name/telephone no.:				
PBN navigation specification:				
POST FLIGHT				
				COMPLETED
Evaluate collected data				
Submit flight validation report with recorded electronic flight data for archives				
Request NOTAM action (if appropriate)				
Sign and submit the IFP submission documentation				
REMARKS				
PROCEDURE	**PASS**		**FAIL**	
EVALUATOR'S SIGNATURE: Date:				

Appendix D

VALIDATION TEMPLATES FOR HELICOPTERS

The following sample checklist and report templates contain suggested minimum data and information required to be recorded during the flight validation process of an RNAV IAP including SBAS. If certain items are not applicable to the intended IAP, identify those items by striking them out or using the term “N/A”. These forms must be signed.

States may develop their own version for other types of IFP as required.

D.1 Preflight validation checklist — helicopters

PREFLIGHT VALIDATION CHECKLIST — HELICOPTER	
REPORT HEADER	
Date:	Validation type (new/amended procedure):
Organization:	
Procedure title:	
Location:	
Heliport:	Heliport:
Evaluator's name/telephone no.:	
PBN navigation specification:	

PREFLIGHT VALIDATION	SATISFACTORY	
	YES	**NO**
IFP package forms, charts and maps		
Data verification (e.g. aerodrome/heliport, aeronautical, obstacle, ARINC coding)		
Location of the controlling obstacles		
Correctness and complexity of the graphical depiction (chart)		
Intended use and special requirements		
Overall design (i.e. practical, complete, clear and safe)		
Impact on the procedure of deviations from design criteria		
Segment lengths and descent gradients allow for deceleration/configuration		
Flight inspection reports available		

REMARKS

Simulator evaluation needed			**YES**	**NO**
Flight evaluation needed			**YES**	**NO**
PROCEDURE	**PASS**		**FAIL**	

EVALUATOR'S SIGNATURE:

Date:

D.2 Simulator evaluation checklist — helicopters

SIMULATOR EVALUATION CHECKLIST — HELICOPTER				
REPORT HEADER				
Date:	Validation type (new/amended procedure):			
Organization:				
Procedure title:				
Location:				
Heliport:	Heliport:			
Evaluator's name/telephone no.:				
PBN navigation specification:				
			SATISFACTORY	
			YES	**NO**
Comparison of FMS navigation database and source documents, including proper ARINC 424 coding				
Provide simulator documents, including FMS software				
Assessed faster and/or slower than charted				
Assessed with adverse wind components				
Flight track matches procedure design				
Flyability				
Human Factors assessment				
ADDITIONAL REQUIREMENTS FOR SIMULATOR ACTIVITIES				
			COMPLETED	
Document the following information as satisfactory or not for each procedure segment as appropriate: heading/track, distance, TAWS alerts, flight path angle (for final segment only) and note the wind component and temperature conditions				
Note the maximum bank angle achieved during any RF segments				
Record simulation data (if applicable)				
REMARKS				
PROCEDURE	**PASS**		**FAIL**	
EVALUATOR'S SIGNATURE: Date:				

D.3 Flight evaluation checklist — helicopters

FLIGHT EVALUATION CHECKLIST — HELICOPTER		
REPORT HEADER		
Date:	Validation type (new/amended procedure):	
Organization:		
Procedure title:		
Location:		
Heliport:	Heliport:	
Evaluator's name/telephone no.:		
PBN navigation specification:		
PLANNING		
	COMPLETED	
Check that all the necessary items from the IFP package are available, including: graphics, text, maps, submission form		
Check that the necessary flight validation forms are available		
Check that the aircraft and avionics are appropriate for the IFP being evaluated		
Does the procedure require use of autopilot or flight director?		
PREFLIGHT		
	COMPLETED	
Review preflight validation assessment		
Review simulator evaluation assessment (if applicable)		
Obstacle assessment planning: areas of concern; ability to identify and fly lateral limits of obstacle assessment area (if required)		
Verify source of IFP data for aircraft GPS/GNSS/FMS (electronic or manual creation)		
Evaluate navigation system status at time of flight (NOTAM, RAIM, outages)		
Weather requirements		
Night evaluation requirement (if applicable)		
Required navigation (NAVAID) support (if applicable)		
Combination of multiple IFP evaluations		
Estimated flight time		
Coordination (as required) with ATS, designer, relevant authority		
Necessary equipment and media for electronic record of validation flight		
GENERAL		
	SATISFACTORY	
	YES	**NO**
IFP graphic (chart) is complete and correct		
Check for interference: document all details related to detected RFI		
Satisfactory radio communication		
Required radar coverage is satisfactory (if radar is required)		
Verify proper heliport markings, lighting and VASIS (if installed)		
Altimeter sources		

OBSTACLE ASSESSMENT		
	SATISFACTORY	
	YES	**NO**
Verify the controlling obstacle in each segment (including, as appropriate, VFR, direct visual segment, or manoeuvring visual segment areas, missed approach); if any obstacles are missing or any new obstacles are observed, record the latitude/longitude and elevation of the obstacles observed		
Where necessary, fly the lateral limits of the obstacle assessment area; most appropriate for procedures designed in challenging terrain or when there are questionable obstacles *Note.— Extra consideration should be given to non-surveyed areas.*		
FLYABILITY		
	SATISFACTORY	
	YES	**NO**
Comparison of GPS/GNSS/FMS navigation databases and source documents, including proper ARINC 424 coding *Note.— If manual entry is used, this field is marked "N/A", and a note must be inserted in the remarks section to alert the approving authority of the procedure that a table top review of the coded procedure, or an operational assessment by a company pilot, should be completed prior to operational approval being granted.*		
Human Factors and general workload satisfactory		
Was there any loss of RAIM?		
Was there any loss of RNP (where applicable)?		
Missed approach procedure		
Descent/climb gradients		
Procedure flown auto-coupled		
Segment length, turns and bank angles, speed restrictions and deceleration allowance		
TAWS		
INSTRUMENT APPROACH PROCEDURE		
	SATISFACTORY	
	YES	**NO**
Segment lengths, headings/tracks and waypoint locations match procedure design		
Final segment vertical glide path angle (if applicable)		
Heliport crossing height (HRP), if applicable		
Course alignment		
Along-track alignment		
FAS data block (for SBAS APV procedures)		
REMARKS		

PROCEDURE	**PASS**		**FAIL**	

EVALUATOR'S SIGNATURE:

Date:

D.4 Validation report checklist — helicopters

VALIDATION REPORT CHECKLIST — HELICOPTER				
REPORT HEADER				
Date:	Validation type (new/amended procedure):			
Organization:				
Procedure title:				
Location:				
Heliport:	Heliport:			
Evaluator name/phone:				
PBN navigation specification:				
POST-FLIGHT				
			SATISFACTORY	
			YES	**NO**
Evaluate collected data				
Submit flight validation report with recorded electronic flight data for archive				
Request NOTAM action (if appropriate)				
Sign and submit the IFP submission documentation				
REMARKS				
PROCEDURE	**PASS**		**FAIL**	
EVALUATOR'S SIGNATURE: Date:				

— END —

ISBN 978-92-9231-996-0