

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

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*Volume 5 — Validation of Instrument Flight Procedures***

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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.

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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.

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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	Helipoint 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

AVIA

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.

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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