

MANUAL OF STANDARDS (173 – INSTRUMENT FLIGHT PROCEDURE DESIGN) 2024

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FIRST SCHEDULE — DEFINITIONS

In exercise of the powers conferred by paragraph 5(2) of the Civil Aviation Authority of Singapore (Air Navigation Services) Directions 2010 (Ministerial Direction No. 1/2010), the Civil Aviation Authority of Singapore (“the Authority”) issues the following Manual of Standards.

PART 1

PRELIMINARY

Citation and commencement

1. This Manual is the Manual of Standards (173 – Instrument Flight Procedure Design) 2024 and comes into operation on 15 April 2024.

Definitions

2. In this Manual, unless the context otherwise requires, any term defined in the First Schedule has the meaning given to that term in that Schedule.

Application of this Manual

3.— (1) This Manual applies to the provider of air navigation services within the Singapore Flight Information Region and such other area as the Minister for Transport may authorise (called in this Manual the “Air Navigation Services Provider” or “ANSP”) who is engaged in the design, maintenance and promulgation of instrument flight procedures.

(2) To avoid doubt, this Manual does not apply to the design of aircraft performance operating limitations, or flight paths for critical engine inoperative emergency procedures.

PART 2

Division 1 — General

Instrument Flight Procedure Operations Manual

4.— (1) The ANSP must establish and maintain an instrument flight procedure operations manual which must include the following:

- (a) the organisational structure of the instrument flight procedure design office;
- (b) a job description of each of the personnel involved with the instrument flight procedure design process which must contain the job function and responsibilities;
- (c) the qualifications and training requirements of personnel responsible for instrument flight procedure designs;
- (d) the criteria used for the design of instrument flight procedure;
- (e) the documentation required for the design of instrument flight procedure;
- (f) the instrument flight procedure design process;

- (g) a system maintained by the ANSP's instrument flight procedure design office for keeping documents and records relating to the instrument flight procedure design process;
- (h) the quality assurance programme established under paragraph 6(2);
- (i) the details of the procedures necessary to ensure compliance with this Manual; and
- (j) the procedures to control, amend and distribute the operations manual, including the distribution of the initial copy and all subsequent amendments made to the operations manual.

(2) The ANSP must notify the ANS Regulator of any changes to the instrument flight procedure operations manual in a timely manner.

(3) The ANSP must take all reasonably practicable measures and develop and apply appropriate procedures to ensure that the instrument flight procedure operations manual being used by all its personnel contains current information.

(4) The ANSP must update, amend or add to the instrument flight procedure operations manual as the ANS Regulator may require for ensuring:

- (a) the accuracy of the instrument flight procedure operations manual; and
- (b) the safety, efficiency or regularity of air navigation.

Use of the Instrument Flight Procedure Operations Manual

5.— (1) The ANSP must design every instrument flight procedure in accordance with the instrument flight procedure operations manual established under paragraph 4.

(2) The ANSP must ensure that the instrument flight procedure operations manual is readily available to all personnel concerned with the instrument flight procedure design process.

Division 2 — Development and Management of Instrument Flight Procedure Design

Management of Instrument Flight Procedure life cycle

6.— (1) The ANSP must establish, implement and maintain a process for the management of the life cycle of an instrument flight procedure, including:

- (a) the design stage;
- (b) the updating of and maintaining the instrument flight procedure; and
- (c) the withdrawal of an instrument flight procedure when that procedure has become irrelevant or obsolete.

(2) The ANSP must establish and maintain a quality assurance programme for the management of the life cycle of an instrument flight procedure mentioned in sub-paragraph (1) which consists of all the components and elements stipulated in Chapter 6 of Volume 1 of ICAO Doc 9906.

Design process

7.— (1) Every instrument flight procedure must be designed in accordance with a process established by the ANSP.

(2) The process of designing an instrument flight procedure must:

- (a) meet the applicable requirements in this Manual; and
- (b) specify the means or methods for the following:
 - (i) the acquisition, compilation and verification of data and any other information that is relevant to the design of the instrument flight procedure;
 - (ii) the design of the instrument flight procedure;
 - (iii) the validation of the instrument flight procedure;
 - (iv) the conduct of a safety risk assessment of the instrument flight procedure; and
 - (v) the publication and promulgation of the instrument flight procedure.

(3) Each instrument flight procedure design must be accompanied by an explanatory statement, in such form (for example, text, graph or chart) as would sufficiently describe the content and purpose of that instrument flight procedure.

(4) The ANSP must ensure that instrument flight procedure design activities are carried out by a person who is qualified in instrument flight procedure design in accordance with paragraph 16.

Information acquisition

8.— (1) The ANSP must establish, implement and maintain a process for the acquisition of relevant survey data and information for the purpose of designing each instrument flight procedure.

(2) The process mentioned in sub-paragraph (1) must ensure that the survey data and information used in the design of every instrument flight procedure are up-to-date and verified by the designer of the instrument flight procedure for accuracy:

- (a) prior to commencing the design or a review of the instrument flight procedure; or
- (b) throughout the life cycle of that instrument flight procedure.

(3) The acquisition of survey data and information must:

- (a) take into consideration all obstacles (for example, buildings, terrain and trees) that define the airspace around the aerodrome;
- (b) take into consideration the requirements in relation to charting accuracy stipulated in Chapter 1 of Volume II of PANS-OPS (Doc 8168); and
- (c) in relation to aeronautical data in such survey data and information, satisfy the aeronautical data quality requirements specified in paragraph 26 of the Manual of Standards (175 – Aeronautical Information Services) 2024.

(4) The ANSP must ensure that the following information acquired through the process established under sub-paragraph (1) is assessed for its relevance to the design of an instrument flight procedure by the person who is responsible for the design of that instrument flight procedure:

- (a) airport, navigation aid, obstacle, terrain coordinates and elevation data, based on verified surveys and in accordance with Annex 11, Annex 14 and Annex 15 to the Chicago Convention;

- (b) airspace requirements;
- (c) user requirements;
- (d) airport infrastructure such as runway classification, lighting, communications, runway markings, and availability of local altimeter setting;
- (e) environmental considerations; and
- (f) any other information that endanger or may endanger the safety of air navigation.

Design criteria

9.— (1) The ANSP must ensure that every instrument flight procedure is designed in accordance with the appropriate design criteria specified in:

- (a) Volume I and II of PANS-OPS (Doc 8168);
- (b) such other document that is issued by ICAO as is relevant to flight instrument procedure design.

(2) The ANSP must design every Required Navigation Performance Authorization Required Approach procedure in accordance with the appropriate design criteria specified in ICAO Doc 9905 and the relevant provisions in PANS-OPS (Doc 8168).

(3) The ANSP must ensure that the design of the instrument flight procedure is compatible with any air traffic service and associated procedure that is provided within the area or areas of airspace where the instrument flight procedure is intended to be established.

(4) The ANSP must ensure that every new or revised instrument flight procedure design is verified to meet the design criteria mentioned in sub-paragraph (1).

(5) The verification conducted under sub-paragraph (4) must be made by a person who is:

- (a) qualified in instrument flight procedure design in accordance with paragraph 16; and
- (b) independent from the the person directly responsible for the design of the new or revised instrument flight procedure that is being verified.

(6) The ANSP must ensure that every instrument flight procedure that is published is reviewed within a period of not more than 5 years from the date of its publication to ensure that the instrument flight procedure continues to meet user requirements and updates to the design criteria specified in Chapter 7 of Volume 1 of ICAO Doc 9906.

Ground and flight validation

10.— (1) The ANSP must conduct a ground validation in accordance with Volume 5 of ICAO Doc 9906 to verify the accuracy and completeness of all obstacle and navigation data considered in the flight instrument procedure design and any other factors normally considered in the flight, prior to promulgating an instrument flight procedure.

(2) If the ANSP is not able to verify the accuracy and completeness of the data mentioned in sub-paragraph (1) by a ground validation, the ANSP must conduct a flight validation in accordance with Volume 5 of ICAO Doc 9906 to validate the relevant data and assess if the instrument flight procedure is safe for flight.

(3) A ground or flight validation must be conducted by a person who has received the requisite training and knowledge in instrument flight procedure design and ground or flight validation, as the case may be.

Safety risk assessment

11.— (1) The ANSP must conduct a safety risk assessment in respect of every proposal for a new instrument flight procedure or a significant change to an instrument flight procedure in accordance with its safety management system established under the Manual of Standards (170 – Air Navigation Services Provider) 2024.

(2) The ANSP must not promulgate a new instrument flight procedure or make a significant change to an instrument flight procedure unless a safety risk assessment shows that an acceptable level of safety will be met by the aircraft operator when using that instrument flight procedure.

(3) The safety risk assessment must consider as a minimum the following:

- (a) identification of hazards;
- (b) ensure the implementation of remedial action to address the safety risks of the consequences of hazards;
- (c) continuous maintenance and periodic review of instrument flight procedure implemented; and
- (d) continuous improvement of the overall performance of the safety management system.

(4) The ANSP must ensure that all safety management activities of a new or changed instrument flight procedure are documented.

Instrument flight procedure design documentation

12.— (1) The ANSP must provide the following documents at the request of the ANS Regulator:

- (a) documentation that is required to be published in the Aeronautical Information Publication in accordance with Annex 4 and Annex 15 to the Chicago Convention;
- (b) documentation required to maintain transparency concerning the details and assumptions used by the person responsible for the design of the instrument flight procedure, which should include supporting information or data used in the design, such as:
 - (i) controlling obstacle for each segment of the instrument flight procedure, where applicable;
 - (ii) effect of environmental considerations on the design of the instrument flight procedure;
 - (iii) infrastructure assessment;
 - (iv) airspace constraints;
 - (v) modifications or amendments to the existing instrument flight procedure, including the reasons therefor; and
 - (vi) the reasons for any deviation from the existing design criteria specified in paragraph 9 and details of the mitigation measures applied to ensure continued safe operations;
- (c) any other documentation as may be required to facilitate validation of the instrument flight procedure.

(2) The ANSP must present all calculations and results of calculations of the instrument flight procedure design in a form and manner that clearly sets out the logic and resultant design.

(3) The ANSP must take all reasonably practicable measures and develop and apply appropriate procedures to ensure that every instrument flight procedure design documentation is verified by another qualified person for accuracy and completeness prior to validation and publication of that instrument flight procedure.

Automating the application of PANS-OPS criteria in instrument flight procedure Design

13.— (1) The ANSP must ensure that all automation tools or software used in the design of an instrument flight procedure are in accordance with Volume 3 of ICAO Doc 9906.

(2) The ANSP must take all reasonably practicable measures and develop and apply appropriate procedures to ensure that all equipment, including software, used in the design of every instrument flight procedure, are operated in accordance with the manufacturer's operating instructions and manuals.

Publication of instrument flight procedure

14.— (1) The ANSP must take all reasonably practicable measures and develop and apply appropriate procedures for the timely provision to the Aeronautical Information Services provider of a new instrument flight procedure or a change to an existing instrument flight procedure including the design, charts and accompanying narratives for publication in the Aeronautical Information Publication.

(2) The ANSP must ensure that the intended effective date for operational use of the instrument flight procedure is included in the document narrative.

Division 3 — Resource Requirements

Resources

15. The ANSP must acquire and maintain resources necessary for the instrument flight procedure design process, including:

- (a) the equipment appropriate for the design, design verification, validation of instrument flight procedure and maintenance of the types of instrument flight procedure;
- (b) relevant and up-to-date data including aeronautical data, land contour data, and obstacle data for the design, design verification, validation of instrument flight procedure and maintenance of the instrument flight procedure;
- (c) copies of relevant documentation, including technical standards, practices, and instructions;
- (d) any other documentation that may be necessary for the design, design verification, validation of instrument flight procedure and maintenance of the types of instrument flight procedure; and
- (e) persons who are qualified in instrument flight procedure design.

Personnel qualifications and training

16.— (1) The ANSP must ensure that every person responsible for its instrument flight procedure design (“IFP designer”) satisfies the minimum standards and possesses the training and qualifications specified in this paragraph.

(2) The ANSP must ensure that such an IFP designer undergoes initial training that includes at least the following elements:

- (a) completion of an ICAO PANS-OPS instrument procedures design course as specified by the ANS Regulator, for the design of instrument flight procedure; and
- (b) an overview of relevant ICAO Standards and Recommended Practices.

(3) The ANSP must ensure that every of its new IFP designers undergoes on-the-job training and is assessed to be competent in instrument flight procedure design in accordance with the instrument flight procedure operations manual and under the supervision of a qualified IFP designer.

(4) The ANSP must ensure that every of its IFP designers maintains the required competency level for instrument flight procedure design through training in accordance with the ANSP’s instrument flight procedure operations manual.

(5) The ANSP must ensure that the interval between the initial training and the first recurrent training, and subsequent recurrent training for each of its IFP designers does not exceed 3 years.

Division 4 — Documents and Records Control

Control of data and documentation

17.— (1) The ANSP must take all reasonably practicable measures to ensure the accuracy of all data and documentation required under this Manual relating to the design of an instrument flight procedure.

(2) The ANSP must develop and apply appropriate policies and procedures to ensure:

- (a) that all the data and documentation mentioned in paragraph 12 be retained:
 - (i) for as long as an instrument flight procedure is in use; and
 - (ii) for at least 5 years after the associated instrument flight procedure is permanently withdrawn from use;
- (b) the timely review and updating of all data and documentation;
- (c) that amendments to the data and documentation are approved by an appropriate person before issue, and the reasons for the amendment are documented;
- (d) that up-to-date versions of all relevant data and documents are accessible to the personnel of the ANSP’s instrument flight procedure design office at all locations where the personnel require access to such documentation;
- (e) that the current version of each data and document is identifiable such that the use of obsolete material is precluded;
- (f) that documentation of the safety risk assessment is maintained throughout the life cycle of the instrument flight procedure; and
- (g) that all obsolete data and documentation are clearly marked and promptly removed from circulation.

(3) The ANSP must, at the ANS Regulator's request, make the up-to-date versions of its data and documentation available in a timely manner.

Control of personnel records

18.— (1) The ANSP must keep and maintain an accurate and up-to-date record of every personnel responsible for instrument flight procedure design in its instrument flight procedure design office.

(2) The record mentioned in sub-paragraph (1) must contain the following information:

- (a) the person's full name;
- (b) documentation demonstrating the person's qualifications and training records.

FIRST SCHEDULE – DEFINITIONS

Paragraph 2

“Chicago Convention” means the Convention on International Civil Aviation concluded at Chicago on 7 December 1944 (as in force and amended from time to time).

“ICAO Doc 9905” means the Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual (Doc 9905), approved and published under the authority of the Secretary General of the International Civil Aviation Organization.

“ICAO Doc 9906” means the Quality Assurance Manual for Flight Procedure Design (Doc 9906), approved and published under the authority of the Secretary General of the International Civil Aviation Organisation.

“Instrument flight procedure” means a procedure used by aircraft flying in accordance with the instrument flight rules (“IFR”) which is designed to achieve and maintain an acceptable level of safety in operations and includes an instrument approach procedure, a standard instrument departure, a planned departure route and a standard instrument arrival.

“Instrument approach procedure” means a series of pre-determined manoeuvres by reference to flight instruments with specific protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply.

“PANS-OPS (Doc 8168)” means the Procedures for Air Navigation Services – Aircraft Operations (Doc 8168), approved and published in accordance with the procedure established by the Council of the International Civil Aviation Organization.

“Planned departure route” means a notified IFR departure route linking the aerodrome or a specific runway of the aerodrome with a specified significant point, normally on the boundary of controlled airspace associated with the aerodrome.

“Standard instrument departure” means a designated IFR departure route linking the aerodrome or a specific runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the enroute phase of a flight commences.

“Standard instrument arrival” means a designated IFR arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

“Survey data” means vertical and horizontal data obtained from an obstacle and terrain survey and other sources or originators, including terrain data, obstacle data and aerodrome data.