NAMIBIAN CIVIL AVIATION AUTHORITY

Advisory Pamphlet (AP)

ANSSO-FPD-AP173/01

GUIDANCE ON MINIMUM QUALIFICATION AND TRAINING FOR FLIGHT PROCEDURE DESIGN PERSONNEL

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3. Effective date: 27/07/2020

NAMIBIA CIVIL AVIATION AUTHORITY
NCAA
27 JUL 2020
WINDHOEK
OFFICE OF THE EXECUTIVE DIRECTOR

27/07/2020

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GUIDANCE ON MINIMUM QUALIFICATION AND TRAINING FOR FLIGHT PROCEDURE DESIGN PERSONNEL

1. PURPOSE

The purpose of this Advisory Pamphlet (AP) is to provide guidance and information on minimum qualification and training requirements for flight procedure design personnel to meet the requirements of NAMCAR Part 173.

2. BACKGROUND

(a) The NAM-CARs Part 175 requires a flight procedure design (FPD) organisation to engage, employ or contract sufficient qualified and competent flight procedure designers to plan, design, verify and maintain the flight procedures covered by the approval.

(b) The NAM-CAR Part 175 also requires a flight procedure design (FPD) organisation to ensure that its personnel meet complete approved training in the construction of visual and instrument flight procedures and meet minimum qualification requirements before being assigned duties related to flight procedure design.

(c) The NAM-CARs Parts 175 further requires a flight procedure design organisation to establish and maintain a training and checking programme that includes initial and recurrent training for all personnel that will ensure such personnel are adequately trained and qualified to perform their assigned duties.

(d) In addition, the NAM-CARs Parts 175 requires a flight procedure design organisation to:

- (i) maintain training records for its personnel;
- (ii) ensure trainings attended by its personnel are approved taking into account the syllabus and the duration of training;
- (iii) ensure human factors and human performance considerations are applied in the training for, and provision of, flight procedure design services.

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

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

173.03.3 Personnel and qualification requirements

(1) A flight procedure design organisation must engage, employ or contract -

(a) a person identified as the senior accountable manager (chief flight procedure designer) of the organisation concerned, to whom contractual authority has been granted to ensure that -

(i) all activities undertaken by the organisation are carried out in accordance with the applicable requirements prescribed in this Part; and

(ii) any flight procedure design covered by the approval is performed as prescribed in this Part;

(b) a senior person responsible to the chief flight procedure designer to ensure that the organisation complies with its approved manual of procedures; and

(c) sufficient qualified and competent flight procedure designers to plan, design, verify and maintain the flight procedures covered by the approval.

(2) The chief flight procedure designer, senior personnel and other personnel involved in flight procedure design must meet the minimum qualification requirements as set out in Document NAM-CATS-FPD.

(3) A flight procedure design organisation may not engage, employ or contract a person to design flight procedures for use in a designated airspace or at aerodromes within Namibia unless that person has completed approved training in the construction of visual and instrument flight procedures and has been approved by the Executive Director to do so.

(4) A flight procedure design organisation must -

(a) establish a procedure for initially assessing, and for maintaining the competence of those personnel involved in planning, design, verification and maintenance of the flight procedures;

(b) develop job descriptions for its flight procedure design technical staff;

(c) ensure that the personnel referred to in paragraph (a) meet the minimum qualifications
set out in Document NAM-CATS-FPD;

(d) carry out initial, periodic and recurrent training of the flight procedure design personnel in accordance with the standards set out in Document NAM-CATS-FPD; and

(e) ensure that newly employed or engaged flight procedure design personnel undergo, supervised on-the-job training before undertaking unsupervised flight procedure design tasks.

173.03.6 Training and checking

(1) A flight procedure design organisation must establish and maintain a training and checking programme for all personnel referenced in this Subpart that will ensure such personnel are adequately trained and qualified to perform their assigned duties.

(2) The Executive Director must approve the training programme referred to in subregulation (1), if the training and checking programme meets the requirements of this regulation
and of Part 170.

(3) A flight procedure design organisation must ensure that –

(a) prior to assignment to duty, each person required to receive training in accordance with this Subpart, must, whether employed on a full or part time basis, receive such training as appropriate to his or her duties; and

(b) the training facilities, equipment and personnel are acceptable to the Executive Director and, in the case of training facility has been approved by the Executive Director in accordance with the standards set out in Document NAM-CATS-FPD.

(4) The training and checking programme referred to in subregulation (1) must include a system for maintaining of training records for flight procedure design personnel.

(5) A flight procedure design organisation must develop and maintain the training and checking programme referred to in subregulation (1).

(6) A flight procedure design organisation must submit for the approval of the Executive Director its training and checking programme and any amendments to the programme.

(7) A flight procedure design organisation must provide training to its personnel that includes at least the following training components:
(a) Flight procedure design training on an initial basis pertinent to the design type listed in the approval; and
(b) Recurrent flight procedure training;

(8) Only approved trainings must be considered for the initial and recurrent training referred to in sub-regulation (7).

(9) The training required by sub-regulation (8)(b) must be provided on a recurrent basis and at specified intervals not exceeding three years (or any period as may be determined by the Executive Director).

4. EXTRACTS FROM NAM-CATS-FPD

173.03.3 PERSONNEL AND QUALIFICATION REQUIREMENTS

1. Personnel Requirements

1.1 An approved design organisation must employ, contract, or otherwise engage:
(c) sufficient competent and qualified technical personnel to inspect, supervise, and maintain any facilities listed in the Manual of Procedure; and

(d) sufficient competent and qualified operational staff to ensure the effective provision of IFP design services covered by the designer’s approval and the Manual of Procedure.

173.03.6 TRAINING AND CHECKING PROGRAM

1. General

1.1 An approved design organisation must establish a training and checking program to ensure that all operational staff are appropriately qualified, and that they remain competent and current in instrument flight procedure design requirements and techniques.

1.2 Particular attention must be given to ensuring that qualified designers are developed so that they are sufficiently experienced to assume the role of Chief Designer should that person be absent for any period of time.

2. Instrument Flight Procedure Design Courses - Approval of Courses

2.1 In determining whether a course will be considered as an approved course, the following will be taken into consideration:

(a) an appropriate syllabus;
(b) adequate duration;
(c) appropriately qualified and experienced course lecturer(s);
(d) the provider/institution.

2.2 Approval of a course may require on-site inspection and observation of the conduct of the course.

2.3 Where assessment of a course is not possible due to the lapse in time since the course was provided, the Executive Director may consider a course to be approved if:

(a) sufficient evidence exists that the course was completed satisfactorily; and
(b) the course could reasonably have been expected to meet the minimum requirements of an approved course applicable at the time that it was completed; and
(c) the applicant can provide evidence of additional training or practical experience which enable the applicant to satisfy the syllabus requirements of an approved course.

3. Human Factors and Human Performance

3.1 In developing training requirements, an approved designer must ensure that human factors and human performance considerations are applied in the training for, and provision of, flight procedure design services.

GUIDANCE ON MINIMUM QUALIFICATION AND TRAINING FOR FLIGHT PROCEDURE DESIGN PERSONNEL

1. GENERAL

1.1 Introduction

1.1.1 The flight procedure development process involves input from a variety of personnel including design personnel, ground validation personnel, flight validation pilots who all play a key role in the development of a quality flight procedure. To ensure quality it is essential to provide competency-based training and assessment to all contributors to the flight procedure development process.

1.1.2 The activities of flight procedure designers are considered critical to the safety of aviation. The provision of erroneous, incomplete or badly designed flight procedures and associated minima has direct consequences for the users. Procedure design work is critical due to increasing complexity of air traffic operations, increased need for accuracy and integrity of data required for modern area navigation and Satellite-based navigation, and the introduction of avionics.

1.1.3 Approaches and departures are the most critical phases of flight considering that the aircraft is operated in close proximity to obstacles at low speeds and in some cases in adverse weather conditions. The need to develop procedures to facilitate a safe transfer of flight from en-route to landing and departure to en-route cannot be overemphasized.

1.1.4 The NAMCAR part 173 prescribes requirements for training and qualification for flight procedure designers. The provision of functions related to flight procedure design process require a competency-based training and assessment to ensure that flight procedures designers can attain and maintain the necessary skills and competencies as required by the regulations.

1.1.5 The primary and main goal of this advisory pamphlet (AP) is to provide guidance to organizations that are providing flight procedure designers training, particularly on developing, implementing and validating training. The AP also provides guidance on training courses and programmes and evaluation of such training courses and programmes.

1.1.6 This advisory pamphlet adopts a competency-based approach to training to enable flight procedure design organisations meet the requirements of the regulations. While this AP provides general guidance and information on competency-based training curriculum, it is assumed that flight procedure design training courses attended by flight procedure designers will be developed with the participation of experienced and qualified course developers.

The primary and main goal of the manual is to provide guidance to organizations that are providing flight procedure designers training, particularly on developing, implementing and validating training.

1.1.7 Organizations providing flight procedure designer training including independent training providers and FPD organisations that provide training for their own procedure designers, can use this AP to:

a) complete the job and task analysis with the competency framework as a starting point;
b) Develop training courses/programmes;
c) evaluate training courses/programmes; and

1.1.8 Organizations that dispatch procedure designers to training providers can evaluate the training course or programme by checking if the course/training has been developed using a competency-based approach as described in this AP. The curriculum and material of well-developed training must adequately cover the competency elements in the procedure designer competency framework.

1.2 Role of the NCAA

1.2.1 The role of the NCAA is to ensure the safety of all instrument flight procedures used within the Namibian airspace through by ensuring the application of the technical criteria in PANS-OPS and associated ICAO provisions. The responsibility of the NCAA is to ensure that measures are in place to control the quality of the flight procedure design process including the design criteria, ground validation and flight validation.

1.2.2 One of the measures to control the quality of the flight procedure design process is to ensure maintenance of training standards for personnel involved in the flight procedure design process. The training standards for the flight procedure design personnel are developed by the NCAA in Document NAM-CATS-FPD. The role of NCAA is to ensure, through oversight, that FPD personnel acquire and maintain the required competency level through training, supervised on-the-job training (OJT), recurrent and refresher training.

1.3 Functions and responsibilities of Flight Procedure Designers

1.3.1 The functions of a flight procedure design organisation are to ensure:-

a) provision of accurate and operationally useable procedures in an environment that is increasingly dynamic and sensitive to the intrusive nature of aircraft operations

b) continued professional development in the fields of air navigation, PANS-OPS criteria and tools and methods for design and evaluation of flight procedures

1.3.2 Designated Procedure Designers must be able to accomplish the following responsibilities:-

a) Design, revise and maintain all types of instrument flight procedures when called upon for all airports and ATS routes within the Windhoek Flight Information Region, according to the specifications contained in NAM-CAR Part 173 and related standards;

b) Review, verify, maintain and guarantee a quality assurance in the flight procedure design;

c) Maintain a well-structured database for obstacles assessment;

d) Preparation for and where requested, participation in, flight validation of new or amended procedures;

e) Assessments of the impact of man-made obstructions and of hazardous activities on instrument flight procedures;

f) Assessments of airspace requirements for protection of the IFR flight procedures and technical input in airspace design process;

g) Preparation of submissions to NCAA and AIM for publication of the developed FPD;

h) Perform other related duties as assigned by the Chief Designer.

2. MINIMUM QUALIFICATION AND EXPERIENCE OF FLIGHT PROCEDURE DESIGNERS

2.1 The FPD organisation must ensure that a person designing or amending an instrument flight procedure demonstrates required competency level for flight procedure design. IFP designers must acquire and maintain this competency level through training and supervised on-the-job training (OJT).

2.2 Before an IFP designer is assigned any design duties she/he should meet the minimum qualification and experience requirements.

2.3 Chief Designer

2.3.1 The minimum standard for the qualification and experience of a Chief Flight Procedure Designer is:

(a) the qualification and experience requirements for a qualified flight procedures designer; and

(b) appropriate experience in the design of the type of procedures to be designed under the Instrument Flight Procedure Design approval; and

(c) satisfactorily completed an advanced course in PANS-OPS procedure design.

2.3.2 The minimum standard of recent experience for appointment as a Chief Designer is:

(a) relevant design experience within the previous one year; or

(b) satisfactory completion of an approved PANS-OPS procedures design course or an advanced course on PANS-OPS procedure design within the previous two years.

2.3.3 In addition, a chief designer should have at least 10 years' experience in the application of instrument flight (IFP) through experience gained in air traffic control, as a flight crew member on IFR operations, in operational control of IFR operations, or other experience accepted by the Executive Director as equivalent. Experience may include time spent in the design of IFPs.

2.3.3 In addition, the Chief Designer must be able to demonstrate competency and experience relevant to the management of safety systems and the activities of the approval holder.

2.4 Qualified Designer

2.4.1 The minimum standard for the qualifications and experience of a Qualified Designer is:

(a) satisfactory completion of an approved PANS-OPS procedures design course or a training course accepted by the Executive Director as an equivalent; and

(b) satisfactory completion of a course of in-service training in procedures design as detailed in the designer's Manual of Procedure; and

(c) required minimum experience in accordance with paragraph 2.4.2; and

2.4.2 In addition, a qualified designer must have at least 5 years' general experience in the application of instrument flight procedures through experience gained in air traffic control, as a flight crew member on IFR operations, in operational control of IFR operations, or other experience accepted by the Executive Director as equivalent. Experience may include time spent in the design of IFPs.

2.4.3 Familiarity with the relevant software applications used in the design of flight procedures will be necessary

2.5. Unqualified Persons (trainee designers)

2.5.1 Personnel who are not qualified must not:

(a) design a procedure for which an approval is required under this Part, except under direct supervision; or

(b) verify or check a procedure for which a certificate of approval is required

2.5.2 Direct supervision means supervision by a qualified designer who is engaged on a full-time basis in the same premises.

2.6. Supervisors

2.6.1 The minimum standard for the qualifications and experience of persons responsible for the supervision of other design staff is:

(a) must be a Qualified Designer;

(b) substantial experience in the design of instrument flight procedures; and

(c) competency and experience relevant to the management of safety systems and the activities of the approval holder.

2.7. Minimum Design Experience

2.7.1 Minimum design experience is required for each type of procedure to be designed.

2.7.2 The minimum practical design experience required is three designs of a particular procedure type, checked and approved by a Chief Designer, and completed within any six consecutive months.

2.7.3 Once a designer has completed three designs of a particular type as indicated in 2.7.2 above, and provided he has satisfied the other requirements, he may act as a qualified designer – but may only work unsupervised on those IFP types for which he has completed the experience and recency requirement.

2.8. Recency

2.8.1 An instrument procedure designer should not design or verify a procedure, unless he has designed, checked or been directly involved in the detailed review of a procedure of the same type within the previous year. The designer can however design or verify such a procedure under direct supervision of another person who is qualified to design, check or verify the procedure.

3. GENERAL REQUIREMENTS FOR TRAINING

3.1 Training

3.1.1 NAMCAR Part 173 requires a flight procedure design (FPD) organisation to establish a procedure for initially assessing, training, and maintaining the competence of those personnel involved in the planning, design, verification, and maintenance of instrument flight procedures. The training for flight procedure designers must include an initial training and recurrent training at periodic intervals as described in this AP.

3.1.2 The FPD organisation must ensure that the flight procedure designer is able to demonstrate a basic level of competency through training that includes at least the following elements:

a) overview of ICAO Standards and Recommended Practices (SARPs) relating to FPD design and promulgation;

b) knowledge of information contained in ICAO Doc 8168 – PANS-OPS, and other related ICAO provisions relevant to procedure designs;
c) general criteria in instrument flight procedure designing;
d) non-precision approach design;
e) precision approach design;
f) instrument departure designs;
g) criteria for RNAV, GNSS and PBN; and
h) practical exercises in the design of procedures.

3.1.3 The FPD design organisation must ensure that the FPD designer is able to demonstrate a basic level of competency through recurrent training that includes at least the following elements:

a) knowledge about updates in ICAO provisions and other provisions pertaining to procedure design; and
b) maintenance and enhancement of knowledge and skills in the design of procedures.

3.1.4 FPD organisations have the ultimately responsibility for the validity of the procedures they design. It is recognised that the use of automated tools in the design of flight procedures reduce errors, save time and provide for standardized application of criteria. However, the use of automated tools (whether a hand calculator, a spreadsheet or fully automated software) does not waive the requirement for the designer to meet the competency standards as set out in the competency framework.

3.1.5 OJT is aimed at permitting the new FPD designer to integrate his basic knowledge with actual practice. The FPD organisation must ensure that new FPD designers undergo an adequate, supervised OJT.

3.1.6 The competency of the FPD designer must be subject to periodic verification by the NCAA to ensure continued compliance with the requirements in this manual.

3.2 Approved training organisations

3.2.1 A number of organizations provide training in flight procedure design. The FPD organisation must submit a request to the NCAA to approve/accept the training organizations which it intends to use for the training of its flight procedure designers.

3.3 Training records

3.3.1 The FPD organisation should ensure that training records, including OJT are properly kept for inspection by the CAA as may be required.

3.3.2 The records maintained should include records of:

(a) personnel qualifications and courses attended;
(b) OJT tasks performed
(c) staff training and approval of jobs performed;
(d) proficiency checks conducted;
(e) staff approvals/certificates; and
(f) staff recency training; and
(g) any other documents related to training.

4. COMPETENCY BASED TRAINING AND ASSESSMENT

4.1 Introduction

This Section describes the principles and procedures to be followed in the design and implementation of a competency-based approach to training and assessment. It outlines the key features of a competency-based approach to training and assessment and briefly describes how the competency-based approach is to be used by course developers, instructors and examiners, where applicable.

4.2 Competency-based approach to training and assessment

4.2.1 The development of competency-based training and assessment must be based on a systematic approach whereby competencies and their standards are defined; training is based on the competencies identified and assessments are developed to determine whether these competencies have been achieved. Competency-based approaches include mastery learning, performance-based training, criterion-referenced training and instructional systems design.

4.2.2 Competency-based approaches to training and assessment must include at least the following features:

(a) the justification of a training need through a systematic analysis and the identification of indicators for evaluation;

(b) the use of a job and task analysis to determine performance standards, the conditions under which the job is carried out, the criticality of tasks, and the inventory of skills, knowledge and attitudes;
(c) the identification of the characteristics of the trainee population;
(d) the derivation of training objectives from the task analysis and their formulation in an observable and measurable fashion;
(e) the development of criterion-referenced, valid, reliable and performance-oriented tests;
(f) the development of a curriculum based on adult learning principles, with a view to achieving an optimal path to the attainment of competencies;
(g) the development of material-dependent training; and
(h) the use of a continuous evaluation process to ensure the effectiveness of training and its relevance to line operations.

4.2.3 The course development methodology must comprise nine phases which can be subdivided in three broad categories of analysis, design and production, and evaluation as follows:

Analysis is covered through:

Phase 1 – Preliminary study
Phase 2 – Job analysis
Phase 3 – Population analysis

Design and Production is covered in:

Phase 4 – Design of curriculum
Phase 5 – Design of modules
Phase 6 – Production

Evaluation is covered by:

Phase 7 – Validation and revision
Phase 8 – Implementation
Phase 9 – Post-training evaluation.

4.2.4 A brief description of the specific outputs of the nine phases is summarized in the following table:

Category	Phases	Outputs
Analysis	Phase 1 – Preliminary study	Training proposals, their justification and proposed course of action.
	Phase 2 – Job analysis	Task description and performance standards
	Phase 3 – Population analysis	Trainees' characteristics and their existing skills and knowledge.
Design and Production	Phase 4 – Design of curriculum	Training objectives, mastery tests and sequence of modules
	Phase 5– Design of modules	Mode of delivery, training techniques and media, draft training material.
	Phase 6 – Production	Production of all trainee materials
Evaluation	Phase 7 – Validation and revision	Try-out of course and revision as required
	Phase 8 – Implementation	Human resources trained.
	Phase 9 – Post-training evaluation	Evaluation of training effectiveness; plans for remedial action.

4.3 The Competency framework

4.3.1 The competency framework consists of competency units, competency elements, performance criteria, evidence and assessment guide, and range of variables. The competency framework for procedure designers must be based on the following competency units:

1. Design departure procedure
2. Design en-route procedure
3. Design arrival route procedure
4. Design approach procedure
5. Design reversal and holding procedures
6. Review instrument flight procedures.

4.3.2 Competency units, competency elements and performance criteria must be derived from job and task analyses of procedure designers and describe observable outcomes:
Competency unit means a discrete function consisting of a number of competency elements

Competency element means an action that constitutes a task that has a triggering event and a terminating event that clearly defines its limits, and has an observable outcome.

Performance criteria means a simple, evaluative statement on a required outcome of the competency element and a description of the criteria used to judge if the required level of performance has been achieved. Several performance criteria can be associated to a competency element.

4.3.3 The competency framework consisting of competency units, competency elements and performance criteria is described in Appendix 1 to this AP.

5. DESIGNING CURRICULUM

5.1 Introduction

5.1.1 This Section describes different types of flight procedure design training. All types are interdependent. Therefore, when planning the most effective and efficient training path, training providers and other stakeholders need to bear in mind the interdependence of these different types of training. Each organization will achieve training effectiveness and efficiency in different ways.

5.1.2 The duration of a course should be derived from a course plan that is competency-based. It is recognized, however, that the duration of a course impacts cost-effectiveness for both training providers and their clients. As the duration of a course is lengthened, the client organization faces a human resource planning challenge. As the duration of a course is shortened, the training provider faces a training quality and training effectiveness challenge. For longer training phases (e.g. four weeks or longer) consideration should be given to breaking the long period into multiple shorter training periods.

5.1.3 Training providers can address these challenges by determining more or less stringent prerequisite skills, knowledge and attitudes for ab initio and initial training. This will impact the time required to achieve training objectives. The course duration can then be adjusted accordingly.

5.1.4 The final goal of training is to ensure flight procedure designers perform to the requirements specified in the competency framework. This cannot be achieved solely through initial training; on-the-job training is critical. The interdependence of initial and on-the-job training also impacts course duration. More or less time will be needed for on the-job training depending on the stringency of performance standards to be achieved during initial training.

5.1.5 In addition, training needs vary due to the emergence or obsolescence of technologies for which a flight procedure design is required. Therefore, training providers may include or exclude parts of training depending on the training needs. This again will impact course duration and prerequisite skills, knowledge and attitudes.

5.1.6 It will be up to each training provider to establish a balance between the factors described above while ensuring the quality and effectiveness of training.

5.1.7 Course developers, course instructors and trainees are all stakeholders in the instructional process.

a) Course developers are responsible for the development and production of all course materials. Their goal is to produce training packages that can stand alone, are material-dependent and performance oriented.
b) Course instructors are responsible for delivery of all course content and instructional events. They are responsible for completing all activities involved in the instructional process as well as guiding and counselling trainees.
c) Trainees are responsible for actively engaging in the training and the successful completion of all course module activities and assessment materials.

5.1.8 In order for a trainee to achieve full competency on the job, he or she will go through a training programme consisting of several phases of training. These phases of training are described in 5.2 below. Depending on the trainee’s entry level of skill and knowledge, he or she may forego parts of some phases of training. Each phase of training will involve a curriculum development process. The steps to carry out curriculum development are to:

a) state the aim of the training;
b) derive terminal and enabling objectives from the competency framework;
c) design a competency-based mastery test for each terminal objective;
d) ensure that all skills, knowledge and attitude required for each enabling objective are covered;

e) sequence terminal and enabling objectives; and

f) group objectives into modules.

5.2 Training Phases

5.2.1 The training programmes is conducted in phases as follows:

a) Ab initio training
b) Initial training
c) On-the-job training
d) Advance training
e) Recurrent training
f) Refresher training

5.2.2 An example of a flight procedure designers training programme is given in Appendix 2 of this advisory pamphlet. The Phases may be conducted in Steps as indicated in the Example. The example given should take approximately fifteen months.

5.2.3 The developed or designed training programme should be approved by the NCAA before implementation.

Ab Initio Training

5.2.4 Before conducting initial training, the skills and knowledge of the trainees are assessed. Procedure designers can be recruited from different domains (ATM, AIS, engineer, technician, pilots, just to name a few) therefore their skills and knowledge vary, and ab initio training may be necessary to meet the entry level required in the different domains to be able to successfully complete initial training.

5.2.5 Ab initio training will not cover any procedure design technique or criteria, but basic skills and knowledge that need to be mastered prior to commencing initial training. The purpose of ab initio training is to harmonize trainees' entry skills and knowledge before they start initial training. The programme for this phase of training should not be developed from the competency framework.

5.2.6 Pre-test at the beginning of the course to identify the level of skill and knowledge of each trainee and post ab initio training test to ensure trainees meet initial training entry levels, lectures and practical exercises may be conducted.

5.2.7 The venue of the course can be either at the training provider or at the FPD organisation premises for a duration of one week depending on the entry level required.

Initial training

5.2.8 Initial training is the first phase of training where actual procedure design topics and criteria (Doc 8168) are covered. The purpose of initial training is to provide basic skills and knowledge to procedure designers who have been recently recruited or transferred from another job. The curriculum of initial training is derived from the competency framework. The associated duration and mastery test are relevant to the programme.

5.2.9 Initial training should be followed by on-the-job training in order to ensure that the acquired skills and knowledge from initial training are consolidated.

5.2.10 The venue of the course can be either at the training provider or at the Procedure Design Service Providers (PDSPs) for a duration of six weeks.

5.2.11 The goal of the training is to enable the trainee design non-RNAV PA and NPA approach procedures and non-RNAV arrival and departure procedures.

On-the-job-training (OJT)

5.2.12 While on-the-job training cannot be considered to be a specific training course, it is an essential phase in a training programme. Its purpose is to reinforce formal training and support the achievement of competency standards.

5.2.13 Similar to initial training, the on-the-job training curriculum will be derived from the competency framework and driven by training objectives. If appropriate, OJT phases can also follow advanced or refresher training.

Advanced training

5.2.14 The purpose of advanced training is to augment the skills and knowledge of active procedure designers in dealing with more complex procedure design problems. The curriculum of advanced training should be derived from the competency framework.

5.2.15 The venue of the course can be either at the training provider or at the FPD organisation premises for a duration of three weeks. The goal must be that given a more constrained environment the trainee must be able to design procedures involving advanced criteria for departures and approach procedures in accordance with competency standards.

Recurrent training

5.2.16 The purpose of recurrent training is to address changes in the available criteria and regulations. It is essential that the procedure designer updates his or her knowledge and skills in accordance with the latest criteria and technologies and benchmarks his or her usual design process against identified best practices. The FPD organisation is required to plan accordingly regular recurrent training so as to ensure that the procedure designers remain current.

Refresher training

5.2.17 The purpose of refresher training is to strengthen skills and knowledge that have weakened through disuse and the passage of time. Given the safety-critical nature of the flight procedure design function, it is strongly recommended that the FPD organisation identify skills and knowledge that have weakened with time and that refresher training be planned accordingly. Refresher courses may range from in-house to fully fledged training in specialized training organizations.

5.3 Determining the prerequisite Skills, Knowledge and Attitude

5.3.1 Personnel intending to attend initial training need to meet the prerequisites described herein. Training providers are encouraged to deliver ab initio training to ensure that trainees meet the entry prerequisites. Entry prerequisites are established mainly to assure that the training objectives set for the training can be met within the duration established for the training. Failure to comply with the prerequisites established by the training provider may impact a trainee’s ability to meet training objectives within the duration of the training.

5.3.2 It should be noted that it is the responsibility of the training provider to establish and assess prerequisites for initial training. The prerequisite skills listed herein refer to knowledge and skills which will be used during the initial training.

5.3.3 Training providers of advanced, recurrent or refresher training for experienced designers must be responsible for establishing entry prerequisites according to the training objectives and duration of the respective training.

5.3.4 Such prerequisites can vary depending on whether training providers offer advanced, recurrent or refresher training as "open" courses where participants come from a variety of States and backgrounds or as "tailored" courses aimed at a specific client where personnel have similar homogeneous expertise.

5.3.5 The prerequisites for entry into the initial training should include:

a) *Mathematics*: competency in algebra, geometry, trigonometry, probability and statistics;

b) *Aviation or aviation-related prerequisites*: The job profile of an instrument flight procedure designer requires knowledge in various fields of activity in aviation. Training providers are encouraged to offer ab initio training covering the following prerequisites that should be met by the trainee so as to ensure that the length of the procedure design training can be optimized:

(i) *Air traffic management* – trainees should demonstrate fundamental knowledge of air traffic management (ATM) in accordance with the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444) as well as understanding the broad concept of ATM which consists of ATS including air traffic control, air traffic flow management, airspace management and other fields related to ATM such as route spacing, ATC separation and aviation weather.

(ii) *Navigation, navigation systems and geography* - trainees should demonstrate knowledge of navigation, navigation systems and geography to the level of any pilot's licence with instrument rating (IR). It is not, however, a requirement to hold such a license.

(iii) *Aircraft operations* – trainees should demonstrate knowledge of the basics of flying and aerodynamics. It is not, however, a requirement to hold a pilot's license.

(iv) *Aircraft performance* – trainees should demonstrate knowledge of aircraft performance to the level of any pilot's license with instrument rating (IR). It is not, however, a requirement to hold such a license.

(v) *Aeronautical information services* – trainees should demonstrate fundamental knowledge of Annex 15 — Aeronautical Information Services.

(vi) *Aerodrome safeguarding* – trainees should be familiar with the basic requirements for aerodrome safeguarding (Annex 14, Obstacle limitation surfaces, Aerodrome reference codes)

(vii) *Geodetics* - this is the scientific discipline that deals with the measurement and representation of the Earth, its gravitational field and geodynamic phenomena (polar motion, earth tides and crustal motion) in three-dimensional, time-varying space. Geodesy is primarily concerned with positioning and the gravity field and geometrical aspects of their temporal variations, although it can also include the study of the Earth's magnetic field

5.3.6 In order to progress through the competency-based training outlined above, trainees need to demonstrate their ability to achieve the terminal objective related to the competency elements. As training will be delivered within a certain timeframe, it is important that trainees learn the material within the time allocated. For this reason, proficiency in the English language is essential.

Note. As an example for courses in English, training providers could require a score of 550 in the written TOEFL (Test of English as a Foreign Language), 213 in the TOEFL Computer-Based Test, 79 in the TOEFL Internet-Based Test and 750 in TOEIC (Test of English for International Communication) for trainees whose native language is not English. Alternatively, a score of 6.5 in the IELTS Academic Module (International English Language Testing System) can be accepted. Trainees having studied at an English-speaking institution for one year or longer can be exempted from providing a TOEFL or IELTS score.

5.4 Process to derive training objectives from the competency framework

5.4.1 Training providers must establish training objectives for all courses offered. Training objectives must be established using the competency framework. The training provider must define which competency elements must be mastered at the end of course modules and establish training objectives for each module accordingly. It should be noted that training providers can use different courses and different methods to support trainees in achieving similar objectives. Course durations, course titles and course content will vary depending on the training provider. It is emphasized that establishing the training objectives for a course with a given duration will always have an impact on entry requirements (prerequisite skills) for the course.

5.4.2 Training objectives should comprised three parts: conditions of performance, expected behaviour and a standard. There are two types of training objectives: terminal objectives and enabling objectives.

5.4.2.1 Terminal objectives are derived from competency elements.

Example:

Conditions of performance	Given maps and other documents containing validated data,
Expected behaviour	the trainee will design a VOR or NDB FAF procedure
Standard	in accordance with Doc 8168

5.4.2.2 In order to achieve the terminal objective, there are several enabling objectives the trainee needs to master. Enabling objectives may be derived from performance criteria.

Example:

Conditions of performance	Using standard forms and/or software,
Expected behaviour	the trainee will collect, validate and incorporate electronic/paper data
Standard	with accuracy upon prescribed confidence level, within an acceptable time period.

5.4.2.3 To be able to achieve this enabling objective, the trainee will require specific knowledge and skills. For example the trainee is required to:

Skills	– apply methods to identify corrupt data; and – verify that the latest edition of such data is received and used.
Knowledge	Identify all sources of necessary data such as maps, charts, obstacles, navigation aids, digital terrain, obstacle database extracts, etc., as well as the format in which the data are to be collected.
Attitude	Ensure accuracy of data

5.4.3 *Establishing OJT objectives*

5.4.3.1 The purpose of the OJT phases is to consolidate the knowledge and skills acquired during initial training. Training objectives for OJT phases must be established from the competency framework. The difference between the training objectives and the OJT objectives is the standard which trainees should achieve to demonstrate that they have mastered the competency. Often it is not possible to achieve full mastery of a competency through training alone. Experience and practice on the job are required to meet the full performance standard stated in the competency framework. When deriving training objectives, especially for initial training, the course development team should determine the performance standard they expect trainees to achieve. For example, it may not be possible to expect a trainee to design a VOR or NDB FAF procedure without errors. There may be a minimum number of errors that are acceptable in the achievement of this objective. The acceptable number and type of errors should be discussed by the course development team with input from subject matter experts. Some errors, even during training, may not be acceptable because they indicate a lack of skill, knowledge or positive attitude that may impact safety. Other types of errors are less critical and may be acceptable in initial training. OJT objectives, however, need to be as close or equivalent to the expected job performance. Therefore the standards for OJT objectives are more demanding.

5.4.3.2 The terminal objective for the OJT phase following a training course is derived from the competency elements. In order to achieve the OJT terminal objective, there are several enabling objectives the trainee needs to master. Enabling objectives can be derived from the performance criteria.

5.4.4 *Skills, knowledge and attitudes required to achieve training objective*

When a training provider has established training objectives for a course, it will be necessary to establish entry requirements for that course in order to assure that the objectives can be achieved in the time given. Training objectives, course length and prerequisite skills, knowledge and attitudes are always directly related.

5.5 Process of sequencing objectives and organizing modules of training

5.5.1 The different training courses can be divided into modules. The flexibility of a modular approach allows training providers to cope with a variety of entry levels, to establish the most effective duration for the course, to address individual learning styles and characteristics, and to measure results on job performance.

5.5.2 The grouping of the objectives into modules and the sequencing of the modules define the training strategy. The objectives will describe what the trainees must be able to do after training. Objectives should be expressed in terms of measurable performance, i.e., elements derived from the competency unit or competency element of the framework.

5.5.3 A given module can have several terminal objectives, and each terminal objective will have several enabling objectives which describe the desired performance derived from performance criteria. Finally, OJT objectives describe what the trainee should be able to do after a defined period of practice on the job.

5.5.4 Each module should be designed to ensure that trainees are capable of performing the objectives to the standard required at the end of the module. This will normally require that the module follow the sequence described as:

a) defining what the trainee will be able to accomplish after learning (the objective);
b) explaining how the accomplishment will be tested (methodology);
c) stimulating the recall of prerequisite learning;
d) presenting the subject-matter content to be learnt, piece by piece (based on competency unit and performance criteria);
e) providing opportunities for the trainee to practice (laboratory exercises, projects, etc.);
f) reinforcing learning by providing feedback on the trainees' practice (enabling objective test, presentation);
g) assessing the performance of the trainee (mastery test); and
h) enhancing retention of what has been learnt so that it can be transferred to other situations (example of the trainee's strategy, presentation and listening to different projects by other trainees).

5.5.5 A variety of instructional techniques can be used to achieve training objectives including lectures, guided group discussions, case studies/projects, laboratory exercises, supervised practice, leaderless groups, field visits, e-learning, tutorials and on-the-job practice. For each training technique there are usually several alternative media for presenting information to the trainees, and these should be selected to suit the training objectives.

5.6 Developing mastery tests

Purpose of mastery test

5.6.1 A mastery test evaluates a trainee's ability to perform on the job. All trainees must be tested on their level of mastery of terminal objectives identified throughout the course. Training programmes must provide an appropriate level of assessment. As much as possible, mastery tests should match conditions, behaviours and standards of terminal objectives. While in certain types of training, for example flight crew training, this may not always be advisable, feasible or safe; in other types of training, such as flight procedure design training, it may be possible to closely approximate actual job performance conditions in classroom conditions

5.6.2 Wherever possible the mastery test should require trainees to demonstrate the necessary ability to perform on the actual equipment. Test items should require trainees to demonstrate desired performance based on the terminal objective(s) being covered. Testing items must match the performance standard and conditions under which trainees are being evaluated as closely as possible.

5.6.3 Design of the mastery test should not take place until all terminal objectives have been clearly defined. Mastery tests can then be developed or outlined before putting together the training curriculum. Outlining the mastery test before producing a course structure allows for greater alignment between training and on-the-job performance. It is important to remember that trainees are being tested on their ability to perform specific tasks on the job. By designing tests before the curriculum is designed, tests can focus on the "need to know" rather than the "nice to know" thereby ensuring an efficient and effective use of training time.

Validity and reliability

5.6.4 The most important requirements of the mastery test are that it must be valid and reliable. A mastery test is considered valid if it measures what itis intended to measure. A valid test must therefore reproduce faithfully the conditions, behaviour and standards identified by the objectives and cover all skills, knowledge and attitudes required to achieve these.

5.6.5 A reliable test refers to the capability of yielding the same scores with different people scoring the test. The test should also yield comparatively similar results when administered at different points in time to equally competent trainees. The reliability of a mastery test is dependent on the quality of instructions provided to the trainee. It is important that test instructions are always complete, clear and unambiguous.

Mastery test format

5.6.6 Ideally, mastery tests would reproduce the conditions of a job performance. Simulations and case scenarios are a good example of a test format that reproduces these conditions. However, it may not always be possible to design mastery tests in these formats. Multiple choice or short-answer tests can be designed in such a way as to present a case in which the test-taker should demonstrate his or her ability to perform given terminal objectives. There are several advantages as well as disadvantages to the various types of test a training provider chooses to provide. An outline of test selection criteria is in Appendix 3 of this AP.

5.6.7 A mastery test should be based on the training objectives covered throughout the course. Developers of the course must describe the context in which observable and measurable outcomes will be identified. For each desired level of mastery, training programmes must structure testing materials on the basis of the competency framework.

5.6.8 Mastery tests should:

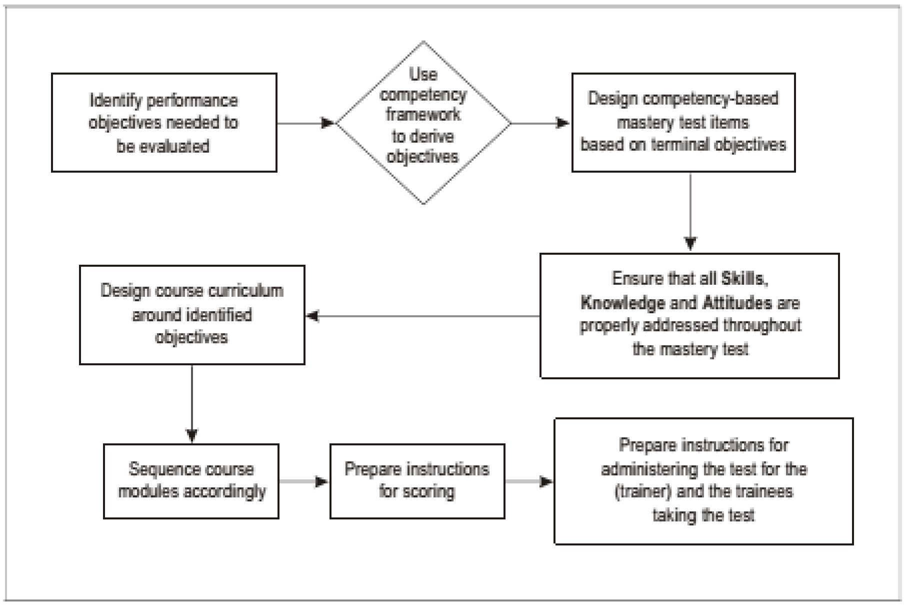
a) be balanced so that the distribution of items reflects the relative importance of the objectives being covered;
b) be efficient so delivery of the exam is not too time-consuming; it should allow for quick but efficient scoring and the processing of results; and
c) include a scoring key and a model answer (if appropriate) so that a minimum amount of interpretation is needed when scoring the trainee's responses.

Mastery Test design

5.6.9 For a given terminal objective, trainees will undergo a corresponding module or modules of training, and they will go through a mastery test at the end. During the mastery test the trainee will be required to perform the terminal objective as formulated by the training provider. Each terminal objective should be developed in accordance with the competency framework.

5.6.10 Based on the context of each training environment, it is up to the training provider to establish appropriate test items for the mastery test.

5.6.11 The figure below identifies the mastery test design process.



Progress test

5.6.12 The purpose of a progress test is to measure a trainee's ability to meet key enabling objectives. It provides immediate feedback to trainees regarding their success or failure to meet enabling objectives. During this part of the module, and through the feedback they obtain from trainees, instructors should consult with them on areas of difficulty or where additional clarification is necessary. Instructors use the feedback to assess the effectiveness of their instruction.

5.6.13 It is not feasible or advisable to administer progress tests for every enabling objective. However, the administration of a progress test should be considered for enabling objectives that are difficult or critical to the successful achievement of terminal objectives. The number of progress tests should therefore be based on a criticality analysis of enabling objective

5.6.14 Progress tests should be designed to address specific skills, knowledge and attitudes required to support enabling objectives. SKAs can be assessed in the following manner:

a) skills are best measured when a performance test is utilized (the task must be assigned to match the outlined objective);
b) knowledge may be tested through written or oral tests; and

c) attitudes are measured through observations of specific performance or questionnaires.

5.6.15 Testing can be administered orally, in a written format or a combination of both modes. Each test item, irrespective of the form, should fulfil the following requirements:

a) test appropriate level of skills, knowledge and attitude required by the objective;
b) not be identifiable from similar or related questioning;
c) clearly stated and unambiguous;
d) arranged in an encouraging sequence to motivate trainees; and
e) arranged by the type of testing item.

5.7 Considerations in designing modules and course materials

5.7.1 The structure of each module must take into consideration the SKAs necessary to perform the desired objective(s). Module design should address any prerequisites necessary for trainees to reach the optimum level of performance or desired objective(s). Course modules and all learning materials should be developed using a systematic step-by-step approach.

Module design

5.7.2 The following instructional steps should be used throughout the course module for each enabling objective:

a) presentation of the objective and the mastery test;
b) indication of the relevance of the module content;
c) presentation of content;
d) clarification of main points;
e) provision of a practice opportunity or reinforcement;
f) provision of feedback for participants (progress test, etc.); and
g) performance of the objective and assessment of the achievement.

5.7.3 Course objective(s) and a description of the mastery test should be introduced at the beginning of the course module. This allows trainees to know exactly what is expected of them and how they will be evaluated at the end of the course. This will also reduce the level of anxiety for trainees but also help to keep instruction focused on the desired level of performance. At a minimum, the introduction should include:

a) the presentation of terminal or end-of-module objectives and the mastery test;

b) intermediate objectives;

c) activities provided in the module; and

d) any reference material on the subject matter and intended length of time of the module.

5.7.4 During the presentation of the module, it may be useful to provide a brief demonstration or sample of the desired performance. This may help motivate participants and provide relevant context for expected levels of proficiency. The relevance of the content being presented could be identified several different ways. One way is to ask participants: "What will happen if this is done?"

5.7.5 Presentation of content should be divided into manageable pieces of information. Course modules should be sequenced in a logical and interesting manner. The main points of module content should be clarified immediately after the elements of content have been presented.

5.7.6 Activities and practice items should be provided to support the successful achievement of training objectives(s). Trainees must be provided with several opportunities to review and practice the skills and knowledge being covered before taking a mastery or progress test. This will help to ensure trainees have mastered all enabling objectives leading to the desired performance of a terminal objective.

5.7.7 Once critical enabling objective(s) are completed a progress test may be necessary. Not in every situation will a course instructor need to test for the trainee's progress. For further description of when to test a trainee's progress, refer to 5.5.11 and 5.5.12.

6. FLIGHT PROCEDURE DESIGN INSTRUCTOR COMPETENCIES

6.1 Flight procedure design competencies

6.1.1 In competency-based programmes, instructor competencies are made explicit, and instructors have to demonstrate their instructional skills and their knowledge in subject matter expertise and training course content.

6.1.2 Instructors must also meet all competency standards listed in the competency framework developed for flight procedure designers. The instructor must be able to provide rationales for the criteria provided in ICAO manuals. Furthermore, an appropriate level of experience in the practical field of flight procedure design is desirable.

6.1.3 The instructor must demonstrate mastery of all mathematical and geometrical problems associated with flight procedure design.

6.2 Instructional competencies

The instructor must have appropriate knowledge of the following fields:

a) techniques of applied instruction;
b) assessment of trainee performance;
c) the learning process;
d) elements of effective teaching;
e) trainee evaluation and testing, training and learning theories;
f) training programme development;
g) lesson planning;
h) classroom instructional techniques;
i) use of training aids; and
j) analysis and correction of trainee errors.

6.3 Maintaining instructional competency standards

6.3.1 It is considered essential that the instructors be given the opportunity to maintain their competency standards. This should be the responsibility of the training provider, and the instructors should be given adequate means to maintain both their flight procedure design and instructional competencies.

7. VALIDATION AND POST-TRAINING EVALUATION OF FLIGHT PROCEDURE DESIGNERS

7.1 Introduction

This Section describes the process concerning validation and post-training evaluation of flight procedure designer training. The purpose of this process is to ensure a harmonized level of effective training. Four levels of evaluation have been identified; each of the four levels will discuss the role and responsibilities of the following organizations:

a) The CAA which is responsible for approving the FPD training programme
b) The FPD organisation
c) The FPD training providers

7.2 Purpose of Evaluation

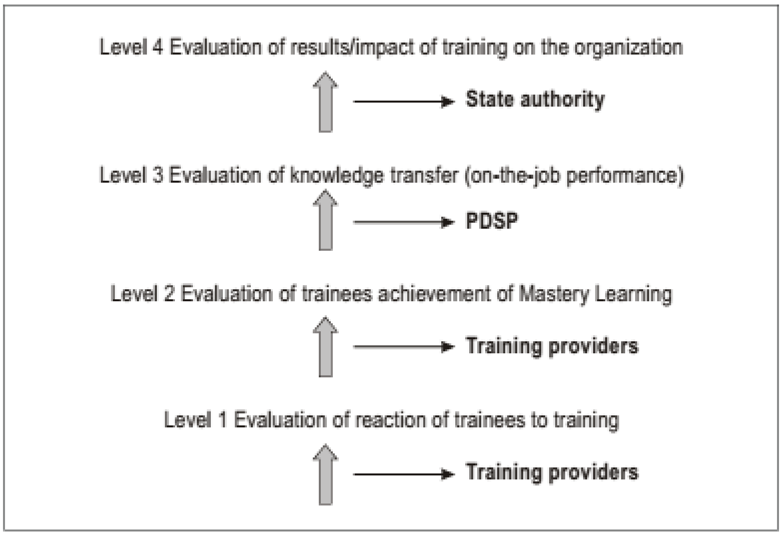
7.2.1 The evaluation should focus on how well terminal objectives are met and how their achievement will impact performance on the job. The evaluation structure should be aligned with a competency-based approach described in Section 4, paragraphs 4.1 and 4.2 of this AP.

7.2.2 The principal goal of evaluation is to ensure a level of consistency between all organizations involved in implementation of flight procedure designer training. It is critical that all organizations that design flight procedures comply with the same competency standards to ensure safety. To properly monitor the effects of training, evaluation must be considered before, during and after training. This will provide organizations with a comprehensive look at the results of evaluation.

7.3 Evaluation approach

7.3.1 In order to properly evaluate the impact of flight procedure designer training, a four-level evaluation model is used (Kirkpatrick’s Model of Evaluation). This model considers trainee reaction, mastery learning, job performance and organizational impact. Each level is assessed in sequential order, providing essential feedback on specific aspects linking training and performance outcomes. The evaluations in Levels 1 and 2 provide immediate feedback on the design, development and administration of all courses. Level 3 provides critical feedback to training providers regarding on-the-job performance of trainees who have successfully completed an approved course. Level 4 is the highest level of evaluation; it requires a direct line of communication between all parties involved with flight procedure training.

7.3.2 The Figure below provides a description of the four levels of evaluation:



Level 1 - Evaluation of trainee reaction

7.3.3 Level 1 identifies the trainee’s reactions to and opinions of the training course. At this level of the evaluation, training providers are able to obtain feedback on the learning environment. Level 1 surveys are an easy and effective tool for assessing how to improve trainee motivation and provide the best possible learning environment. Training providers are responsible for the design and administering of a Level 1 survey. This level of evaluation must be used for all newly designed training courses. Below are some guidelines to consider in developing a Level 1 survey:

a) identify what information is needed and the goals of the evaluation;
b) design a form that captures needed information while minimizing the time required to complete and evaluate forms;
c) encourage written comments or suggestions. Even excellent “check the box” surveys are limited in information provided. Comments can point to issues that could otherwise be missed;
d) allow enough time for trainees to respond. Once training is complete, trainees are ready to leave. Therefore surveying participants at the very end of the session might promote a hurried response;

e) allow for an anonymous survey or optional signature as this will provide more reliable data collection;
f) objectives of the survey should be closely aligned with the objectives of the course; and
g) results of the evaluation are used to revise course materials as necessary. A clearly established distribution process must be in place for the dissemination of information to anyone who needs it. A suitable level of confidentiality should also be in place for all parties involved in the handling of such documentation.

7.3.4 Where the course is delivered for the first time (validation delivery), feedback should be collected from trainees after completion of each training module. At the end of the course, overall feedback should be obtained from trainees. Level 1 evaluation forms for the collection of end-of-module and end-of course information.

Level 2 – Evaluation of trainee mastery learning

7.3.5 Level 2 determines to what extent training has changed attitudes, increased knowledge and improved skills. Training providers use Level 2 evaluations to ensure that trainees have gained the desired skills, knowledge and attitudes to achieve terminal objectives. Level 2 evaluations should be based on mastery test results and apply the following principles:

a) measure trainees' performance before and after training. Comparing data on trainees' pre-course to post-course knowledge, skill and attitude helps shape course content and structure. For example, if a significant number of trainees already had the required skills and knowledge prior to the course, then the terminal objectives may need to revised;
b) mastery tests should be criterion-referenced. A criterion-referenced test helps determine if trainees meet the standard of performance as established by the terminal objectives;
c) ensure that terminal objectives are used to design mastery tests that call trainees to demonstrate successful performance on the job as well as provide valid and reliable measures of performance; and
d) ensure statistics are collected on mastery test results for each module of a course. Analysis of these statistics can be used to determine whether course materials should be modified or not.

Level 3 – Evaluation of the on-the-job performance

7.3.6 Level 3 evaluation instruments help to analyse whether trainees have transferred the skills, knowledge and attitudes they acquired through training to actual job performance.

7.3.7 A Level 3 instrument collects data on the following questions:

a) Is the task for which training was provided performed on the job?
b) How confident are trainees in their ability to perform the task once training has been completed?
c) How often do the trainees perform the trained task?
d) Will on-the-job training reinforce the needs of the trainee or is formal training required again?
e) Additional comments (should be open-ended questions)

7.3.8 While a Level 2 evaluation is carried out by training providers, a Level 3 evaluation requires some coordination between training providers and on-the-job instructors and supervisors. A Level 3 evaluation identifies limitations and barriers to a trainee's performance following the delivery of training. Feedback from a Level 3 evaluation is used to revise training courses and programmes to ensure a better fit between training and job performance.

A. Training providers must:

a) ensure that all newly designed or revised terminal objectives are based on current job performance. Without appropriate alignment of course materials with terminal objectives and competencies, a Level 3 evaluation cannot effectively identify gaps between a trainee's performance on the job and the performance required by terminal objectives;
b) complete the appropriate steps to ensure training quality; and
c) review and analyse programme reports and modify training materials accordingly.

B. Procedure design service providers must:

a) ensure that all newly designed or revised training materials are based on required job performance and safety standards; and
b) review and analyse programme reports and recommend modifications to training programmes, as necessary.

Level 4 – Evaluation of result/impact

7.3.9 Level 4 seeks to measure, where possible, how training has benefited the FPD organization.

7.3.10 Where possible, statistics and reports are summarized to evaluate the overall impact of training on the FPD organization especially as it relates to safety management. A steering committee including those responsible for safety management should be established to carry out this level of evaluation. Based on performance and safety goals set by the organization, this level of evaluation measures how training supports achievement of these goals. In this context, training is one component of a Safety Management System (SMS) that must be balanced with other organizational components.

7.3.11 Level 4 evaluation identifies the impact of training on the organization's overall performance. Implementation of flight procedure training should be monitored through results-based evaluations. Flight procedure designers, the CAA and training providers should partner in constructing and analysing Level 4 evaluations. This partnership will help link validation and post-training evaluations of flight procedures with organizational goals and business objectives.

A. The CAA must:

a) ensure the FPD organisation is utilizing a current competency framework that can be reflected in terminal objectives :
b) review data provided by the FPD organisation;
c) analyse statistical data based on performance goals and eventual outcome;
d) review and establish performance indicators of the flight procedure design system indicating job performance of flight procedure designers; and
e) oversee the flight procedure design system.

APPENDIX 1
COMPETENCY FRAMEWORK OF FLIGHT PROCEDURE DESIGNER

Note:

X. Competency unit

X.X Competency Element

X.X.X Performance Criteria

1. Design departure procedure

1.1 Design straight departure non-RNAV procedure

1.1.1 Collect, validate and incorporate electronic/paper data for straight departure non-RNAV procedure
1.1.2 Apply criteria for straight departure non-RNAV procedure
1.1.3 Establish Minimum Sector Altitudes (MSA)
1.1.4 Document and store straight departure non-RNAV procedure
1.1.5 Ground verify and validate straight departure non-RNAV procedure
1.1.6 Flight verify and validate straight departure non-RNAV procedure
1.1.7 Promulgate straight departure non-RNAV procedure
1.1.8 Maintain straight departure non-RNAV procedure

1.2 Design turn departure non-RNAV procedure

1.2.1 Collect, validate and incorporate electronic/paper data for turn departure non-RNAV procedure
1.2.2 Apply criteria for turn departure non-RNAV procedure
1.2.3 Establish Minimum Sector Altitudes (MSA)
1.2.4 Document and store turn departure non-RNAV procedure
1.2.5 Ground verify and validate turn departure non-RNAV procedure
1.2.6 Flight verify and validate turn departure non-RNAV procedure
1.2.7 Promulgate turn departure non-RNAV procedure
1.2.8 Maintain turn departure non-RNAV procedure

1.3 Design omnidirectional departure non-RNAV procedure

1.3.1 Collect, validate and incorporate electronic/paper data for omnidirectional departure non-RNAV procedure
1.3.2 Apply criteria for omnidirectional departure non-RNAV procedure
1.3.3 Establish Minimum Sector Altitudes (MSA)

1.3.4 Document and store omnidirectional departure non-RNAV procedure
1.3.5 Ground verify and validate omnidirectional departure non-RNAV procedure
1.3.6 Flight verify and validate omnidirectional departure non-RNAV procedure
1.3.7 Promulgate omnidirectional departure non-RNAV procedure
1.3.8 Maintain omnidirectional departure non-RNAV procedure

1.4 Design straight departure RNAV/RNP procedure

1.4.1 Collect, validate and incorporate electronic/paper data for straight departure RNAV/RNP procedure
1.4.2 Apply criteria for straight departure RNAV/RNP procedure
1.4.3 Establish Minimum Sector Altitudes (MSA)
1.4.4 Document and store straight departure RNAV/RNP procedure
1.4.5 Ground verify and validate straight departure RNAV/RNP procedure
1.4.6 Flight verify and validate straight departure RNAV/RNP procedure
1.4.7 Promulgate straight departure RNAV/RNP procedure
1.4.8 Maintain straight departure RNAV/RNP procedure

1.5 Design turn departure RNAV/RNP procedure

1.5.1 Collect, validate and incorporate electronic/paper data for turn departure RNAV/RNP procedure
1.5.2 Apply criteria for turn departure RNAV/RNP procedure
1.5.3 Establish Minimum Sector Altitudes (MSA)
1.5.4 Document and store turn departure RNAV/RNP procedure
1.5.5 Ground verify and validate turn departure RNAV/RNP procedure
1.5.6 Flight verify and validate turn departure RNAV/RNP procedure
1.5.7 Promulgate turn departure RNAV/RNP procedure
1.5.8 Maintain turn departure RNAV/RNP procedure

1.6 Design omnidirectional departure RNAV procedure

1.6.1 Collect, validate and incorporate electronic/paper data for omnidirectional departure RNAV procedure
1.6.2 Apply criteria for omnidirectional departure RNAV procedure
1.6.3 Establish Minimum Sector Altitudes (MSA)
1.6.4 Document and store omnidirectional departure RNAV procedure
1.6.5 Ground verify and validate omnidirectional departure RNAV procedure
1.6.6 Flight verify and validate omnidirectional departure RNAV procedure

1.6.7 Promulgate omnidirectional departure RNAV procedure
1.6.8 Maintain omnidirectional departure RNAV procedure

1.7 D*esign simultaneous operations on parallel instrument runways departure procedure*

1.7.1 Collect, validate and incorporate electronic/paper data for simultaneous operations on parallel instrument runways departure procedure
1.7.2 Apply criteria for simultaneous operations on parallel instrument runways departure procedure
1.7.3 Establish Minimum Sector Altitudes (MSA)
1.7.4 Document and store simultaneous operations on parallel instrument runways departure procedure
1.7.5 Ground verify and validate simultaneous operations on parallel instrument runways departure procedure
1.7.6 Flight verify and validate simultaneous operations on parallel instrument runways departure procedure
1.7.7 Promulgate simultaneous operations on parallel instrument runways departure procedure
1.7.8 Maintain simultaneous operations on parallel instrument runways departure procedure

1.8 Design simultaneous operations on near parallel instrument runways departure procedure

1.8.1 Collect, validate and incorporate electronic/paper data for simultaneous operations on near parallel instrument runways departure procedure
1.8.2 Apply criteria for simultaneous operations on near parallel instrument runways departure procedure
1.8.3 Establish Minimum Sector Altitudes (MSA)

2. Design Enroute procedure

2.1 Design en route RNAV/RNP procedure

2.1.1 Collect, validate and incorporate electronic/paper data for en route RNAV/RNP procedure
2.1.2 Apply criteria for en route RNAV/RNP procedure MM
2.1.3 Document and store en route RNAV/RNP procedure
2.1.4 Ground verify and validate en route RNAV/RNP procedure

2.1.5 Flight verify and validate en route RNAV/RNP procedure Design en route non-RNAV/RNP procedure

2.1.6 Promulgate en route RNAV/RNP procedure

2.1.7 Conduct continuous maintenance of en route RNAV/RNP procedure

2.2 Design en route non-RNAV/RNP procedure

2.2.1 Collect, validate and incorporate electronic/paper data for en route non RNAV/RNP procedure

2.2.2 Apply criteria for en route non-RNAV/RNP procedure

2.2.3 Document and store en route non-RNAV/RNP procedure

2.2.4 Ground verify and validate en route non-RNAV/RNP procedure

2.2.5 Flight verify and validate en route non-RNAV/RNP procedure

2.2.6 Promulgate en route non-RNAV/RNP procedure

2.2.7 Maintain en route non-RNAV/RNP procedure

3. Design arrival route

3.1 Design non-RNAV standard instrument arrival procedure

3.1.1 Collect, validate and incorporate electronic/paper data for non-RNAV standard instrument arrival procedure

3.1.2 Apply criteria for non-RNAV standard instrument arrival procedure

3.1.3 Establish Minimum Sector Altitudes (MSA)

3.1.4 Document and store non-RNAV standard instrument arrival procedure

3.1.5 Ground verify and validate non-RNAV standard instrument arrival procedure

3.1.6 Flight verify and validate non-RNAV standard instrument arrival procedure

3.1.7 Promulgate non-RNAV standard instrument arrival procedure

3.1.8 Maintain non-RNAV standard instrument arrival procedure

3.2 Design RNAV/RNP standard instrument arrival procedure

3.2.1 Collect, validate and incorporate electronic/paper data for RNAV/RNP standard instrument arrival procedure

3.2.2 Apply criteria for RNAV/RNP standard instrument arrival procedure

3.2.3 Establish Minimum Sector Altitudes (MSA)

3.2.4 Document and store RNAV/RNP standard instrument arrival procedure

3.2.5 Ground verify and validate RNAV/RNP standard instrument arrival procedure
3.2.6 Flight verify and validate RNAV/RNP standard instrument arrival procedure
3.2.7 Promulgate RNAV/RNP standard instrument arrival procedure
3.2.8 Maintain RNAV/RNP standard instrument arrival procedure

3.3 Design non-RNAV omnidirectional arrival procedure

3.3.1 Collect, validate and incorporate electronic/paper data for non-RNAV omnidirectional arrival procedure
3.3.2 Apply criteria for non-RNAV omnidirectional arrival procedure
3.3.3 Establish Minimum Sector Altitudes (MSA)
3.3.4 Document and store non-RNAV omnidirectional arrival procedure
3.3.5 Ground verify and validate non-RNAV omnidirectional arrival procedure
3.3.6 Flight verify and validate non-RNAV omnidirectional arrival procedure

3.4 Design RNAV/RNP omnidirectional arrival procedure

3.4.1 Collect, validate and incorporate electronic/paper data for RNAV/RNP omnidirectional arrival procedure
3.4.2 Apply criteria for RNAV/RNP omnidirectional arrival procedure
3.4.3 Establish Minimum Sector Altitudes (MSA)
3.4.4 Document and store RNAV/RNP omnidirectional arrival procedure
3.4.5 Ground verify and validate RNAV/RNP omnidirectional arrival procedure
3.4.6 Flight verify and validate RNAV/RNP omnidirectional arrival procedure
3.4.7 Promulgate RNAV/RNP omnidirectional arrival procedure
3.4.8 Maintain RNAV/RNP omnidirectional arrival procedure

4. Design approach procedure

4.1 Design VOR or NDB FAF procedure

4.1.1 Collect, validate and incorporate electronic/paper data for VOR or NDB FAF procedure
4.1.2 Apply criteria for VOR or NDB FAF procedure
4.1.3 Establish Minimum Sector Altitudes (MSA)
4.1.4 Document and store VOR or NDB FAF procedure
4.1.5 Ground verify and validate VOR or NDB FAF procedure
4.1.6 Flight verify and validate VOR or NDB FAF procedure
4.1.7 Promulgate VOR or NDB FAF procedure

4.1.8 Maintain VOR or NDB FAF procedure

4.2 Design VOR/NDB no-FAF procedure

4.2.1 Collect, validate and incorporate electronic/paper data for VOR/NDB no-FAF procedure
4.2.2 Apply criteria for VOR/NDB no-FAF procedure
4.2.3 Establish Minimum Sector Altitudes (MSA)
4.2.4 Document and store VOR/NDB no-FAF procedure
4.2.5 Ground verify and validate VOR/NDB no-FAF procedure
4.2.6 Flight verify and validate VOR/NDB no-FAF procedure
4.2.7 Promulgate VOR/NDB no-FAF procedure
4.2.8 Maintain VOR/NDB no-FAF procedure

4.3 Design SRE procedure

4.3.1 Collect, validate and incorporate electronic/paper data SRE procedure
4.3.2 Apply criteria for SRE procedure
4.3.3 Establish Minimum Sector Altitudes (MSA)
4.3.4 Document and store SRE procedure
4.3.5 Ground verify and validate SRE procedure
4.3.6 Flight verify and validate SRE procedure
4.3.7 Promulgate SRE procedure
4.3.8 Maintain SRE procedure

4.4 Design DF procedure

4.4.1 Collect, validate and incorporate electronic/paper data DF procedure
4.4.2 Apply criteria for DF procedure
4.4.3 Establish Minimum Sector Altitudes (MSA)
4.4.4 Document and store DF procedure
4.4.5 Ground verify and validate DF procedure
4.4.6 Flight verify and validate DF procedure
4.4.7 Promulgate DF procedure
4.4.8 Maintain DF procedure

4.5 Design visual manoeuvring

4.5.1 Collect and validate electronic/paper data visual manoeuvring
4.5.2 Apply criteria for visual manoeuvring
4.5.3 Document and store visual manoeuvring

4.5.4 Ground verify and validate visual manoeuvring
4.5.5 Flight verify and validate visual manoeuvring
4.5.6 Promulgate visual manoeuvring
4.5.7 Maintain visual manoeuvring

4.6 Design visual manoeuvring with prescribed track

4.6.1 Collect and validate electronic/paper data for visual manoeuvring with prescribed track
4.6.2 Apply criteria for visual manoeuvring with prescribed track
4.6.3 Establish Minimum Sector Altitudes (MSA)
4.6.4 Document and store visual manoeuvring with prescribed track
4.6.5 Ground verify and validate visual manoeuvring with prescribed track
4.6.6 Flight verify and validate visual manoeuvring with prescribed track
4.6.7 Promulgate visual manoeuvring with prescribed track
4.6.8 Maintain visual manoeuvring with prescribed track

4.7 Design RNAV DME/DME procedure (stations prior 1 January 1989)

4.7.1 Collect and validate electronic/paper data for RNAV DME/DME procedure
4.7.2 Apply criteria for RNAV DME/DME procedure
4.7.3 Establish Minimum Sector Altitudes (MSA, if applicable)
4.7.4 Apply the T/Y-Bar concept (if applicable)
4.7.5 Establish Terminal Arrival Altitudes (TAA, if applicable)
4.7.6 Document and store RNAV DME/DME procedure
4.7.7 Ground verify and validate RNAV DME/DME procedure
4.7.8 Flight verify and validate RNAV DME/DME procedure
4.7.9 Promulgate RNAV DME/DME procedure
4.7.10 Maintain RNAV DME/DME procedure (stations prior 1 January 1989)

4.8 Design RNAV DME/DME procedure (stations post 1 January 1989)

4.8.1 Collect and validate electronic/paper data for RNAV DME/DME procedure
4.8.2 Apply criteria for RNAV DME/DME procedure
4.8.3 Establish Minimum Sector Altitudes (MSA, if applicable)
4.8.4 Apply the T/Y-Bar concept (if applicable)
4.8.5 Establish Terminal Arrival Altitudes (TAA, if applicable)
4.8.6 Document and store RNAV DME/DME procedure

4.8.7 Ground verify and validate RNAV DME/DME procedure

4.8.8 Flight verify and validate RNAV DME/DME procedure

4.8.9 Promulgate RNAV DME/DME procedure

4.8.10 Maintain RNAV DME/DME procedure (stations post 1 January 1989)

4.9 Design RNP approach (RNP APCH) procedure

4.9.1 Collect and validate electronic/paper data for RNP approach (RNP APCH) procedure

4.9.2 Apply criteria for RNP approach (RNP APCH) procedure

4.9.3 Establish Minimum Sector Altitudes (MSA, if applicable)

4.9.4 Apply the T/Y-Bar concept (if applicable)

4.9.5 Establish Terminal Arrival Altitudes (TAA, if applicable)

4.9.6 Document and store RNP approach (RNP APCH) procedure

4.9.7 Ground verify and validate RNP approach (RNP APCH) procedure

4.9.8 Flight verify and validate RNP approach (RNP APCH) procedure

4.9.9 Promulgate RNP approach (RNP APCH) procedure

4.9.10 Maintain RNP approach (RNP APCH) procedure

4.10 Design RNP procedure

4.10.1 Collect and validate electronic/paper data for RNP procedure

4.10.2 Apply criteria for RNP procedure

4.10.3 Establish Minimum Sector Altitudes (MSA, if applicable)

4.10.4 Apply the T/Y-Bar concept (if applicable)

4.10.5 Establish Terminal Arrival Altitudes (TAA, if applicable)

4.10.6 Document and store RNP procedure

4.10.7 Ground verify and validate RNP procedure

4.10.8 Flight verify and validate RNP procedure

4.10.9 Promulgate RNP procedure

4.10.10 Maintain RNP procedure

4.11 Design ILS approach

4.11.1 Collect and validate electronic/paper data for ILS approach

4.11.2 Apply criteria for ILS approach

4.11.3 Apply criteria for steep approach angle (if applicable)

4.11.4 Establish Minimum Sector Altitudes (MSA)

4.11.5 Document and store ILS approach

4.11.6 Ground verify and validate ILS approach

4.11.7 Flight verify and validate ILS approach

4.11.8 Promulgate ILS approach

4.11.9 Maintain ILS approach

4.12 Design ILS localizer only approach

4.12.1 Collect and validate electronic/paper data for ILS localizer only approach

4.12.2 Apply criteria for ILS localizer only approach

4.12.3 Establish Minimum Sector Altitudes (MSA)

4.12.4 Document and store ILS localizer only approach

4.12.5 Ground verify and validate ILS localizer only approach

4.12.6 Flight verify and validate ILS localizer only approach

4.12.7 Promulgate ILS localizer only approach

4.12.8 Maintain ILS localizer only approach

4.13 Design ILS approach with offset localizer

4.13.1 Collect and validate electronic/paper data for ILS approach with offset localizer

4.13.2 Apply criteria for ILS approach with offset localizer

4.13.3 Establish Minimum Sector Altitudes (MSA)

4.13.4 Document and store ILS approach with offset localizer

4.13.5 Ground verify and validate ILS approach with offset localizer

4.13.6 Flight verify and validate ILS approach with offset localizer

4.13.7 Promulgate ILS approach with offset localizer

4.13.8 Maintain ILS approach with offset localizer

4.14 Design MLS approach

4.14.1 Collect and validate electronic/paper data for MLS approach

4.14.2 Apply criteria for MLS approach

4.14.3 Establish Minimum Sector Altitudes (MSA)

4.14.4 Document and store MLS approach

4.14.5 Ground verify and validate MLS approach

4.14.6 Flight verify and validate MLS approach

4.14.7 Promulgate MLS approach

4.14.8 Maintain MLS approach

4.15 Design MLS azimuth only approach

4.15.1 Collect and validate electronic/paper data for MLS azimuth only approach

4.15.2 Apply criteria for MLS azimuth only approach
4.15.3 Establish Minimum Sector Altitudes (MSA)
4.15.4 Document and store MLS azimuth only approach
4.15.5 Ground verify and validate MLS azimuth only approach
4.15.6 Flight verify and validate MLS azimuth only approach
4.15.7 Promulgate MLS azimuth only approach
4.15.8 Maintain MLS azimuth only approach

4.16 Design MLS approach with offset azimuth alignment

4.16.1 Collect and validate electronic/paper data for MLS approach with offset azimuth alignment
4.16.2 Apply criteria for MLS approach with offset azimuth alignment
4.16.3 Establish Minimum Sector Altitudes (MSA)
4.16.4 Document and store MLS approach with offset azimuth alignment
4.16.5 Ground verify and validate MLS approach with offset azimuth alignment
4.16.6 Flight verify and validate MLS approach with offset azimuth alignment
4.16.7 Promulgate MLS approach with offset azimuth alignment
4.16.8 Maintain MLS approach with offset azimuth alignment

4.17 Design PAR approach

4.17.1 Collect and validate electronic/paper data for PAR approach
4.17.2 Apply criteria for PAR approach
4.17.3 Establish Minimum Sector Altitudes (MSA)
4.17.4 Document and store PAR approach
4.17.5 Ground verify and validate PAR approach
4.17.6 Flight verify and validate PAR approach
4.17.7 Promulgate PAR approach
4.17.8 Maintain PAR approach

4.18 Design APV/Baro VNAV approach procedure

4.18.1 Collect and validate electronic/paper data for APV/Baro VNAV approach procedure
4.18.2 Apply criteria for APV/Baro VNAV approach procedure
4.18.3 Document and store APV/Baro VNAV approach procedure
4.18.4 Ground verify and validate APV/Baro VNAV approach procedure
4.18.5 Flight verify and validate APV/Baro VNAV approach procedure
4.18.6 Promulgate APV/Baro VNAV approach procedure

4.18.7 Maintain APV/Baro VNAV approach procedure

4.19 Design RNP AR approach procedure

4.19.1 Collect and validate electronic/paper data for RNP AR approach procedure

4.19.2 Apply criteria for RNP AR approach procedure

4.19.3 Establish Minimum Sector Altitudes (MSA)

4.19.4 Document and store RNP AR approach procedure

4.19.5 Ground verify and validate RNP AR approach procedure

4.19.6 Flight verify and validate RNP AR approach procedure

4.19.7 Promulgate RNP AR approach procedure

4.19.8 Maintain RNP AR approach procedure

4.20 Design SBAS APV approach procedure

4.20.1 Collect and validate electronic/paper data for SBAS APV approach procedure

4.20.2 Apply criteria for SBAS APV approach procedure

4.20.3 Establish Minimum Sector Altitudes (MSA)

4.20.4 Document and store SBAS APV approach procedure

4.20.5 Ground verify and validate SBAS APV approach procedure

4.20.6 Flight verify and validate SBAS APV approach procedure

4.20.7 Promulgate SBAS APV approach procedure

4.20.8 Maintain SBAS APV approach procedure

4.21 Design GBAS cat I approach

4.21.1 Collect and validate electronic/paper data for GBAS cat I approach

4.21.2 Apply criteria for GBAS cat I approach

4.21.3 Establish Minimum Sector Altitudes (MSA)

4.21.4 Document and store GBAS cat I approach

4.21.5 Ground verify and validate GBAS cat I approach

4.21.6 Flight verify and validate GBAS cat I approach

4.21.7 Promulgate GBAS cat I approach

4.21.8 Maintain GBAS cat I approach

4.22 Design GBAS off set approach

4.22.1 Collect and validate electronic/paper data for GBAS off set approach

4.22.2 Apply criteria for GBAS off set approach

4.22.3 Establish Minimum Sector Altitudes (MSA)

4.22.4 Document and store GBAS off set approach

4.22.5 Ground verify and validate GBAS off set approach

4.22.6 Flight verify and validate GBAS off set approach

4.22.7 Promulgate GBAS off set approach

4.22.8 Maintain GBAS off set approach

5. Design reversal and holding procedures

5.1 Design base-turn

5.1.1 Collect and validate electronic/paper data for base-turn

5.1.2 Apply criteria for base-turn

5.1.3 Document and store base-turn

5.1.4 Ground verify and validate base-turn

5.1.5 Flight verify and validate base-turn

5.1.6 Promulgate base-turn

5.1.7 Maintain base-turn

5.2 Design 45/180 procedure-turn

5.2.1 Collect and validate electronic/paper data for 45/180 procedure-turn

5.2.2 Apply criteria for 45/180 procedure-turn

5.2.3 Document and store 45/180 procedure-turn

5.2.4 Ground verify and validate 45/180 procedure-turn

5.2.5 Flight verify and validate 45/180 procedure-turn

5.2.6 Promulgate 45/180 procedure-turn

5.2.7 Conduct continuous maintenance of 45/180 procedure-turn

5.3 Design 80/260 procedure-turn

5.3.1 Collect and validate electronic/paper data for 80/260procedure-turn

5.3.2 Apply criteria for 80/260 procedure-turn

5.3.3 Document and store 80/260 procedure-turn

5.3.4 Ground verify and validate 80/260 procedure-turn

5.3.5 Flight verify and validate 80/260 procedure-turn

5.3.6 Promulgate 80/260 procedure-turn

5.3.7 Maintain 80/260 procedure-turn

5.4 Design racetrack reversal procedure

5.4.1 Collect and validate electronic/paper data for racetrack reversal procedure

5.4.2 Apply criteria for racetrack reversal procedure

5.4.3 Document and store racetrack reversal procedure

5.4.4 Ground verify and validate racetrack reversal procedure

5.4.5 Flight verify and validate racetrack reversal procedure

5.4.6 Promulgate racetrack reversal procedure

5.4.7 Maintain racetrack reversal procedure

5.5 Design conventional overhead holding procedure

5.5.1 Collect and validate electronic/paper data for conventional overhead holding procedure

5.5.2 Apply criteria for conventional overhead holding procedure

5.5.3 Document and store conventional overhead holding procedure

5.5.4 Ground verify and validate conventional overhead holding procedure

5.5.5 Flight verify and validate conventional overhead holding procedure

5.5.6 Promulgate conventional overhead holding procedure

5.5.7 Maintain conventional overhead holding procedure

5.6 Design conventional VOR/DME fix holding procedure

5.6.1 Collect and validate electronic/paper data for conventional VOR/DME fix holding procedure

5.6.2 Apply criteria for conventional VOR/DME fix holding procedure

5.6.3 Document and store conventional VOR/DME fix holding procedure

5.6.4 Ground verify and validate conventional VOR/DME fix holding procedure

5.6.5 Flight verify and validate conventional VOR/DME fix holding procedure

5.6.6 Promulgate conventional VOR/DME fix holding procedure

5.6.7 Maintain conventional VOR/DME fix holding procedure

5.7 Design RNAV holding procedure (VOR/DME, DME/DME, GNSS)

5.7.1 Collect and validate electronic/paper data for RNAV holding procedure

5.7.2 Apply criteria for RNAV holding procedure

5.7.3 Document and store RNAV holding procedure

5.7.4 Ground verify and validate RNAV holding procedure

5.7.5 Flight verify and validate RNAV holding procedure

5.7.6 Promulgate RNAV holding procedure

5.7.7 Maintain RNAV holding procedure (VOR/DME, DME/DME, GNSS)

5.8 Design RNP holding procedure

5.8.1 Collect and validate electronic/paper data for RNP holding procedure

5.8.2 Apply criteria for RNP holding procedure

5.8.3 Document and store RNP holding procedure

5.8.4 Ground verify and validate RNP holding procedure

5.8.5 Flight verify and validate RNP holding procedure

5.8.6 Promulgate RNP holding procedure

6. Review Instrument Flight Procedures (periodic checks, stakeholder request)

6.1 Review procedure on a periodic basis

6.1.1 (Re-)collect and validate and integrate electronic/paper data for the maintenance of the procedure

6.1.2 Apply latest criteria to procedure

6.1.3 Document and store maintained procedure

6.1.4 Ground verify and validate maintained procedure

6.1.5 Flight verify and validate maintained procedure

6.1.6 Promulgate maintained procedure (if necessary)

6.2 Review procedure based on a stakeholder's request

6.2.1 Collect, validate and incorporate latest electronic/paper data for the maintenance of the procedure

6.2.2 Apply latest criteria to procedures

6.2.3 Assure integration into ATM system (procedural separation, capacity)

6.2.4 Document and store maintained procedure

6.2.5 Ground verify and validate maintained procedure

6.2.6 Flight verify and validate maintained procedure

6.2.7 Promulgate maintained procedure (if necessary)

APPENDIX 2
EXAMPLE OF A FLIGHT PROCEDURE DESIGNER TRAINING PROGRAMME

1. General presentation of the training programme

1.1 This programme comprises training courses delivered by a training provider for initial, advanced, recurrent and refresher training and on-the-job training tutored by a qualified procedure design team. Ongoing competency-based assessments are conducted throughout the training programme.

1.2 It is strongly recommended that the trainee puts into practice what has been learnt as soon as possible after completion of the training courses. It would be useless to attend a training programme in procedure design if no application is planned in the short or medium term.

Note 1. It is essential that procedure design be carried out by a team rather than a single person. A team approach is critical in ensuring that all points of view and assumptions are taken into consideration as well as to ensure quality.

Note 2. Training flight procedure designers is a resource-intensive and lengthy exercise. Therefore, given the average expected duration of training, turnover should be limited as much as possible, as it will affect the efficiency and productivity of the flight procedure design team. It is suggested that a qualified procedure designer should work at least three years to balance the training cost. To limit this effect, it is recommended that the employing organization develop a recruitment plan, a training policy and a career development plan for procedure designers.

2. Training programme goal

2.1 On completion of training in accordance with this training programme, he or she will be able to design IFR procedures, more specifically non-precision approach procedures, precision approach procedures, standard instrument arrivals (STAR), standard instrument departures (SID) using conventional means of navigation and RNAV information (VOR/DME, DME/DME, GNSS), RNP procedures and APV procedures in accordance with standards specified in PANS-OPS (Doc 8168), Doc 9905 for RNP AR procedures, or any other applicable criteria.

3. Training programme duration

3.1 The training programme outlined in this example has a duration of approximately fifteen months, starting from ab initio training.

Note. Depending on the FPD organisation, the training steps proposed herein can be programmed in different ways, for instance, beginning with RNAV/RNP procedures.

4. Training Programme Steps

Step 0 - Ab initio training

- **Location**: Training provider, PDSPs.
- **Duration**: One week. This duration depends on the entry level required.
- ***Goal***: Review basic knowledge and skills required for entry in initial training course.
- ***Means***: Pre-test at the beginning of the course to identify the level of skill and knowledge of each trainee and post ab initio training test to ensure trainees meet initial training entry levels. Lectures and practical exercises.
- **Course Topics**:
  - Mathematics
  - System units
  - Basics of navigation
  - Basics of avionics
  - Altimetry
  - Cartography, scale, WGS-84 system, projection
  - Computer science

Step 1 - Initial training

- ***Location****: Training provider, PDSPs.*
- ***Duration****: Six weeks.*
- ***Goal****: Design non-RNAV PA and NPA approach procedures and non-RNAV arrival and departure procedures.*

- ***Programme Description***:- A six-week course is provided in procedure design criteria NPA, PA, departure and arrival procedures for conventional means of navigation, finishing with a two-week practical work training period very close to "on-the-job" work. During the first four weeks of initial training in PANS-OPS, lectures and practical exercises are programmed to enable the trainees to acquire the knowledge and skills necessary to apply criteria for the design of the IFR non-RNAV procedures. During the last two weeks, the trainees will work in groups of two to perform the connection between STAR and approaches, then to design one NPA and one PA and one SID procedure. Then they will have to write the associated report and produce the corresponding instrument approach charts, SID and STAR charts. Part of the training should emphasize the attitude of the procedure designers as team players and their skill at communicating and presenting their work.

- ***Training Modules*** *(from competency elements)*
  - Module 1: Design Non RNAV NPA
  - Module 2: Design Non RNAV Arrival
  - Module 3: Design Non RNAV PA
  - Module 4: Design Non RNAV Departure

- Teaching points (from the evidence and assessment guide in competency framework):

  Module 1
  - Fix and tolerance calculation
  - Segment and protection area, MOC
  - Initial segment (racetrack, reversal procedure…)
  - Intermediate segment
  - Connection between segment and turn protection
  - Minimum altitude/procedure altitude computation – Holding pattern
  - NPA Straight in approach - final segment
  - NPA missed approach
  - OCH computation
  - Circling
  - Charting NPA – Annex 4

  Module 2
  - MSA
  - En-route and arrival criteria

- Charting – Annex 4

Module 3

- Precision approach segment
- OAS, Basic ILS Surface, CRM
- Connection with intermediate segment
- PA missed approach
- OCH computation
- ILS GP inoperative
- Charting – Annex 4

Module 4

- Straight departure criteria
- Turning departure criteria
- Guided or dead reckoning track
- Omnidirectional departure
- Charting – Annex 4

- **Additional units:**
  - Annex 14 surfaces
  - Pilot point of view: flight simulation

- ***Assessment***: Progress test and mastery tests administered as planned in the course module plan.

- ***Expected levels*****:** In accordance with the competency standards set in the terminal objectives for initial training.

Step 2 - On-the-job training (Initial)

- ***Location:*** *On site, tutored by a qualified procedure designer or a designated procedure design instructor*
- ***Duration:*** *Fifteen weeks*
- ***Goal:*** *Within the workplace, using the means available, improve the knowledge and skill on design of non-RNAV PA and NPA approach procedures and non-RNAV arrival and departure procedures in accordance with standards established in competency framework.*

- ***Programme Description***:
  - Under the supervision of an OJT instructor, the trainee will design one NPA and PA procedure taking into account constraints such as noise abatement, airspace management and the airline's request.
  - The trainee should collect the data, design the selected procedures with the tools/means available at the local procedure design unit, and acquire the employing organization's method to integrate his/her work in the quality process, validation process and archiving process specific to the company/organization.
  - As part of his/her OJT, the trainee can technically handle some issues related to continuous maintenance of SID and STAR.
  - Where the programme is done at the PDSP the use of local data (data originating from the trainees' organization) is highly encouraged.
- ***Competency elements***: Design non-RNAV SID, STAR, NPA, and PA.
- Additional units:
  - Use of the specific tools such as excel sheet, software, geodetic calculator.
  - Use of the regulation documents, official websites dedicated to the activities.
- ***Assessment*****:** Ongoing assessment against performance criteria for each competency element as work is carried out.
- ***Expected level***: Non-RNAV NPA and PA can be designed for selected procedures in accordance with the terminal objective.

Step 3 - Advanced Training I

- ***Location:*** Training provider, PDSPs**.**
- ***Duration:*** Three weeks**.**
- ***Goal***: Given a more constrained environment such as ….., design procedures involving advanced criteria for departures and approach procedures in accordance with competency standards.
- ***Programme Description*****:** During the first week of training, instructional events such as lectures and practical exercises will provide skill and knowledge. During the last two weeks, the trainees will work in teams of two to design procedures on an airport with an obstacle-rich environment and/or operational constraints. Sharing of experience with other procedure designers will be encouraged in order to facilitate learning.
- ***Training Modules*** (from Competency elements;

- Module 1: Departure for parallel runway
- Module 2: NPA in obstacle-rich environment
- Module 3: Non-standard ILS approaches

- ***Teaching points*** (from the evidence and assessment guide in competency framework):
  - For SID: Departure for parallel runways
  - For NPA:
    a. Use of step-down fixes in NPA
    b. Turn at the missed approach point
  - For PA:
    a. Missed approach procedure as soon as possible
    b. ILS with steep angle
    c. Offset LOC
- ***Additional unit***:
  - Noise abatement
  - Airspace management
  - Aeronautical study
- ***Assessment***: Progress test and mastery tests administered as planned in course module plan.
- **Expected level**: Advanced criteria and design process for non-RNAV SID NPA and PA must be acquired in accordance with the standard specified in terminal objectives for this course.

Step 4 - On the Job Training – Advanced I

- ***Location***: on site or at the FPD organisation premises, tutored by a qualified procedure designer or designated procedure design instructor.
- ***Duration***: twelve weeks
- ***Goal***: Non-RNAV SID and STAR can be designed for selected procedures in accordance with competency standards.
- ***Programme Description***:
  - Under the supervision of an OJT instructor, the trainee will design a selected STAR and SID omnidirectional departure and arrival among the procedures to be reviewed.

- The trainee will participate with the OJT instructor in meetings and studies to be aware of and to take into account the constraints related to noise abatement, airspace management and airlines' requests.
- The trainee should collect the data and design the selected procedures taking into account the constraints expressed.
- Comply with the quality process, validation process and archiving process specific to the company/organization.
- In the meantime, the trainee can technically deal with issues related to continuous maintenance of PA and NPA even in an obstacle-rich environment or constraining airspace.

- ***Units of competency***:
  - Design non-RNAV SID/STAR omnidirectional departure and arrival.
- ***Additional units***:
  - Noise abatement
  - Airspace management
  - Aeronautical study
- ***Assessment***: Ongoing assessment against performance criteria for each competency element as work is carried out.

Step 5 - Advanced Training II

- ***Location***: at the site of the training provider
- ***Duration***: Three weeks
- ***Goal***: The trainee will be able to design RNAV and RNP SID STAR NPA and Design RNAV (VOR/DME, DME/DME and GNSS) and RNP NPA SID and STAR.
- ***Programme Description***: This course will be three weeks long and will consist of instructional events such as lectures, practical exercises and practical work conducted in teams of two. The flyability and efficiency of the RNAV/RNP procedure will be highlighted.
- ***Training Modules***: (from competency element)
  - Module 1: Design RNAV NPA based on sensor VOR/DME, DME/DME, GNSS
  - Module 2: Design RNAV terminal procedures (based on sensor)
  - Module 3: Design RNP procedures
- **Teaching points** (from the evidence and assessment guide in competency framework):

- Nominal track: strategy, minimum length, path terminator, flyability of a procedure, constraint, procedure altitude, minimum altitude
- T and Y concept
- Tolerance of the waypoint according to the different sensors
- Fly by turn followed by TF
- Fly-over turn followed by TF, DF
- Connection between segment for wide and small turn
- Protection area for each segment according to each sensor, e.g. initial, intermediate, final approach and missed approach
- Critical navaid assessment for DME/DME sensor
- Departure procedure
- Departure with a turning altitude followed by a DF path terminator
- Arrival criteria
- Terminal arrival altitude
- RNP criteria
- Charting criteria
- Waypoint coordinate calculation, resolution
- Data encoding information

- ***Additional units***:
  - GNSS concept (ABAS, SBAS, GBAS)
  - Information about the existing or ongoing system, time schedule
  - Airworthiness information
  - Pilot point of view: Flight simulation of the designed procedure in a flight simulator
  - CDA (Continuous Descent Approach).
- ***Assessment***: Progress test and mastery tests administered as planned in course module plan.

Step 6 – On the Job Training – Advanced II

- ***Location***: On site, tutored by a qualified procedure designer or designated procedure design instructor.
- ***Duration***: Twenty weeks with a period of one week at the mid-point to attend the GBAS and APV Baro-VNAV, SBAS training course.
- ***Goal***: The training will be able the trainee to design different types of RNAV/RNP approaches and arrivals/ departures. Through this training, they

will improve, practice and gain confidence in the application of RNAV procedure criteria.

- ***Programme Description***:
  - Under the supervision of an OJT instructor, the trainee will design a selected RNAV NPA, PA and APV approaches, SID and STAR among the procedures to be reviewed, or propose the study of the improvement of the airspace management by implementation of an RNAV/RNP procedure.
  - The trainee should collect all the information by contacting and meeting with the ATC, airlines and airport authorities to define the present difficulties analyse the issues and propose assumptions for enhancement of efficiency in the airspace management.
  - The trainee should collect the data, design the selected procedures with the tools/means available at the local procedure design unit, present the solutions, and amendments if necessary, and integrate the work in the quality process, validation process and archiving process specific to the company/organization.
  - In the meantime, the trainee can technically deal with issues related to continuous maintenance of NPA SID and STAR.
- ***Units of competency***: Design RNAV SID STAR NPA.
- ***Additional units***: Airspace management.
- ***Assessment***: Ongoing assessment against performance criteria for each competency element as work is carried out.

Step 7 - Advanced Training III

- ***Location***: Training provider
- ***Duration***: One week in the middle of the previous on-the-job training
- ***Goal***: Design GBAS, APV Baro-VNAV, APV SBAS procedure.
- Programme Description: This course will be one week long and will consist of instructional events such as lectures, practical exercises and practical work conducted in teams of two.
- ***Training Modules***: The training must be able to cover the following modules
  - Design APV SBAS final and missed approach segment
  - Design APV Baro-VNAV final and missed approach segment
  - Design GBAS final and missed approach segment
- Teaching points(from the evidence and assessment guide in competency framework)

  - GBAS OAS, basic surface, CRM – SBAS OAS
  - Extension of OAS – VSS
  - Baro VNAV surfaces
  - Intermediate and final segment connection
  - Straight-in missed approach
  - FAS data block
  - Data encoding
  - Waypoint coordinate calculation, resolution
  - Earth curvature impact
- ***Additional units***:
  - Airworthiness information
  - VNAV avionic information
  - Pilot point of view: Flight simulation in a flight simulator of the designed procedure
- ***Assessment***: Progress test and mastery tests administered as planned in course module plan.

Step 8 - Recurrent Training

- ***Goal***: Maintain competency standards for newly developed procedure design features.
- ***Programme Description***: Update knowledge according to each PANS-OPS (Doc 8168) amendment by following a seminar/course/workshop and by meeting procedure designers and sharing experiences.

Step 9 - Refresher Training

- ***Goal***: Maintain and upgrade skills and knowledge in accordance with competency framework.
- ***Programme Description***: Update knowledge and strengthen skill after a long period of non-application of specific criteria.

APPENDIX 3

Test Selection Criteria

TYPE OF TEST	ADVANTAGE(S)	DISADVANTAGE(S)	SKAs TESTED	EXAMPLES
Simulation (a) Real performance in simulated situation	- Reduces consequence(s) of mistakes - Can create realistic dangerous situations - Reduces stress on trainees	- Scoring may be subjective (biased) if the scoring key is not explicit enough	All SKAs (application and transfer of learnt skills to novel situations)	- Design straight departure non-RNAV procedure - Design omnidirectional departure RNAV procedure
(b) Simulated performance in simulated situation	- Can create realistic portable and dangerous situation - No risk attendant on mistake - Little stress on trainees	- Further removed from real conditions (raises issue of validity)	All SKAs (Except physical skills)	- Case studies (varying degrees of complexity) - Identify best practices for an en-route procedure design - Recognize appropriate instruments for the design of VOR or NDB FAF procedure
Objective-Type (a) Alternate response (binary choice)	- Easy to construct - Permits coverage of many points (wide coverage) - Efficient (easy to take and score)	- Possibility of guessing the answer (reliability?) - Memorization of unrelated facts is encouraged - Cannot tell whether trainee has learnt or not	Knowledge Discrimination Classifying	True/False Test - Sequence of design preparation - Meaning of technical terms
(b) Multiple choice	- Can measure trainee's ability to make judgements of predetermined exactness - Easy to score and comparatively free from guessing	- Susceptible to clues (within construction of item, item choices) - Time-consuming and somewhat difficult to construct	Problem solving Classifying Discrimination Knowledge	- Choosing a particular procedure design based on a given problem situation among several alternatives - Recognize the proper criteria for RNAV/RNP standard instrument arrival procedure among a list provided.
(c) Matching	- Measures ability to recognize relationships and make associations - Economical - Requires less construction time than multiple choice items of equal quality	- Inferior to multiple choice in measuring fine discrimination understanding and judgement - Can provide clues, especially if the choice is limited to the number of items to be matched	Knowledge Discrimination Classifying	- Diagrams and specific measurements - Technical terms and their meanings - Sequencing order of specific design procedures - Sample design procedures requesting appropriate labels and terminology
Open Question	- Sharp and accurate evaluation - No introduction of erroneous items that can be then reminded by the trainees (as in, for example, multiple choice) - Easy to implement	- Scoring may be subjective - Time-consuming for correction	Comprehension versus memorization	- Modeling sophisticated obstacles as Hangar or Hill or railroad for CRM OCH calculation (in that case a figure is often provided)
Open question with short answer	- Sharp evaluation - Easy scoring - Particularly adapted when numerical answers are expected	- Not all items can be tested in this way	Knowledge Discrimination	- On an IAC indicate the item corresponding to the identification of procedures

TYPE OF TEST	ADVANTAGE(S)	DISADVANTAGE(S)	SKAs TESTED	EXAMPLES
Oral question	– Evaluation by « saying » versus « writing » – Direct contact with the assessor who can reword the question to really test the knowledge	– Often stressful – Scoring may be subjective	Knowledge Rapidity Ability to express, to present	– Using an IAC displayed, the trainee is questioned on the feasibility of the procedure if aircraft are coming from specific directions and why. Or application of specific criteria and why.
Project/thesis redaction and presentation (often in a team)	– Evaluation by saying and writing – Simulate real case – Develop team-player mindset	– Time-consuming for the realization by the trainee – Time-consuming for the assessor(s) – Scoring may be subjective – When it is a team project, sometimes difficult to score the trainee individually	Comprehension Process Link between all the different types of knowledge taught. Ability to take decisions and make choices regarding the hypothesis and to discuss and promote them. Synthesis ability Oral expression	– Design an RNP 0.3 procedure on a specific environment.