AIS TRAINING GUIDANCE MANUAL

USING A COMPETENCY-BASED APPROACH

PREFACE

OVERVIEW

This manual has been created to provide guidance in developing competency based training for Aeronautical Information Services (AIS) personnel at various levels yet be generic enough to address the diversity in AIS delivery across the world. As AIS organization delivery and individual personnel responsibilities vary among the States, it was decided to use a competency based approach in order to be flexible enough to address this diversity.

The development of competency based training and assessment is based on a systematic approach whereby knowledge, skills, and abilities and their standards are defined; performance is measured against the standards; training is based on the gaps between the competency standards and performance; and assessment tools for these competencies are developed to determine whether these competencies have been achieved after the training is conducted. This method had already been introduced in other fields of aviation activities such as flight crew training and licensing. The underlying principle for this approach uses performance as the measurement for identifying the need for training and how the training can address gaps in performance to ensure a fully competent workforce is developed and maintained.

While this manual provides guidance on how to develop a competency-based training curriculum specifically for AIS personnel, it should not be used or considered as a textbook on course development. It is assumed that experienced and qualified course developers will participate in the development of AIS personnel training.

GOALS OF THE MANUAL

The primary and main goal of the manual is to provide guidance to organizations that are developing, implementing and validating training.

A secondary goal of the manual is to provide guidance to regulators who certify and/or approve training courses/programs, as well as organizations that dispatch trainees to training providers and who have to evaluate training courses/programs. Since training will be gap specific, certifying training will be based on whether the training follows the competency-based approach.

TARGET AUDIENCE OF THE MANUAL

AIS personnel or staff generally means anyone who is responsible for any, or all, of the functions required by the AIS provider as a general part of his or her employment. This may include:

- threat and error management,
- managing static and dynamic data,
- charting,
- publishing,
- operational control, and

- complex coordination functions.

To ensure quality it is essential to provide competency-based training and assessment to all contributors to AIS. While this training manual focuses on the methodology for developing training to address in gaps in competency requirements that AIS staff should achieve, it should be understood that the AIS staff member's work depends on other personnel also meeting competency standards. This manual is designed to assist a training developer in identifying the gap between the competencies required and work performance, in order to develop training to meet that gap in knowledge, skills or abilities. While attitudes are also important for job performance, it is understood that training cannot generally address attitude changes.

The activities of the AIS staff are considered critical to the safety of aviation. The provision of erroneous or incomplete data and associated publishing has direct consequences for the users.

Recently, AIS data management has become more critical as part of the delivery of AIS products as a result of:

- increasing complexity;
- increased importance of data integrity, especially for modern area navigation (RNAV) and satellite based navigation;
- introduction of new avionics;
- and the gradual transition from being product centric to focusing as a higher priority on the data those products require.

As AIS is dependent on other organizations outside itself, the audience for training should be broad enough to include not only the staff of the AIS provider, but also members of any of the following organizations:

- Regulatory authorities that approve training courses/programs, conducted by AIS providers, training providers, etc., where applicable[1]; and
- Organizations/institutes that provide training course/program for AI.

REGULATORS

As a regulator, a State authority can:

- utilize the manual as a guideline to establish approval/certification criteria of a training course/program conducted by training providers,
- use this manual as a guideline to establish its own training course/program,
- use the manual as a guideline to evaluate potential courses, or
- for the approval/ certification criteria of AIS providers.

At the present, ICAO regulations do not include provisions for certification criteria or guidelines. Therefore, it is beyond the scope of this manual to provide guidance for these systems.

Regulators that intend to approve/certify a training course/program can use this manual as a part of their approval/certification of the training process. For instance, they can establish standards which state that: "The proposed training shall be developed, implemented and evaluated in accordance with a competency-based

approach." However, it should be noted that this use of the manual is not its primary goal.

EXTERNAL TRAINING PROVIDERS

AIS Providers who dispatch personnel to a training provider can utilize the manual as a guideline to evaluate potential courses, or to develop their own more specific training courses/programs.

TRAINING PROVIDERS

Training Providers can use the manual as a guideline to develop their training courses/programs.

STRUCTURE OF THE MANUAL

The manual consists of the following four sections:

Part One: Competency Based Training Basics
- Introduction
- Competency Basics
- Taxonomy
- Steps to developing competencies

Part Two: Designing a Competency-Based Curriculum
- Curriculum
- Case Study #1 (More in-depth version of Example from Section One)
- Case Study #2

Part Three: Appendices
- Appendix 1: A collection of competencies specific to AIS (Competency Model)
- Appendix 2: Competency Framework
- Appendix 3: Abbreviations and Definitions
- Appendix 4: Bibliography
- Appendix 5: Feedback Form

Ed note: We seem to be missing enabling tasks for the terminal objectives?

Ed notes:

- Shorten up preface
- Find home for orphan items in preface
- Insert Table of Contents Here

PART ONE — THE BASICS OF COMPETENCY BASED TRAINING

INTRODUCTION

(Need intro to this directive and source) *"Each State is responsible for the provision of AIS and shall take all necessary measures to ensure that the Aeronautical Information (AI) data is adequate, of required quality and timely."*

By inference, this directive should include arrangements for the timely provision of acquired information/data to the AIS by each of the State services associated with aircraft operations. Annex 15 and Doc 8126 further indicates the need for each State to with quality assurance in data management, as provided in each States quality management procedures. Quality management should be applicable to the whole aeronautical information/data chain from data origination to distribution to the next intended user, taking into consideration the intended use of the data.[2]

The guidance provided in this manual has been developed to be one component to aid an AIS organization to meet the stated objectives through training the workforce to become and remain, competent in the roles and responsibilities that they have been assigned. The training should focus each workforce members' knowledge, skills, abilities (KSA) and attitudes that allows for quality data in all functional areas of AIS. Since training is one of the most important elements of quality assurance, each State must establish standards for the required competency level for the workforce. When the standards are identified, then training can be one effective component that has a direct result on the performance level of individual members of the workforce.

Members of the AIS workforce may come from a variety of backgrounds such as air traffic or commercial aviation and as a result bring different levels of knowledge, skills, abilities and attitudes to the organization. Others come with very specific skills such as charting or information technology where they will need to learn about AIS more generally in order to be most effective in their role. The skills of all members of the AIS need ongoing refresher and recurrent training as AIS organizations evolve and technology changes.

COMPETENCIES

What is a competency?

Often people refer to an individuals' knowledge, skills, abilities, and attitudes that are reflected in their behavior. Training generally focuses on obtaining a change in an individual's behavior.

Competencies generally therefore are behaviors that can be observed as you go about your work and they can be measured against your performance. These competencies are applied skills, knowledge, abilities and attitudes that make you able to perform your job. Therefore, a person who has and uses the right competencies will have competence in the job as evidenced by his or her performance in that job.

A competency statement should consist of the following:

- Action verb (observable or measurable activity related to the job)
- Content (subject matter, type of performance, specific task)
- Context (limitations or conditions)

Several specific definitions of a competency are:

A competency is "any underlying characteristic of a person which results in an effective and/or superior performance in a job" (Boyzatis 1982.)

A combination of observable and measurable skill, knowledge, performance behavior and personal attributed that continued to enhanced employee performance and organization success (World at Work.)

Examples of AIS competencies would include "produce an AIP supplement", "process foreign dynamic data", etc.

(Ed note: Place in appendix – or here – or elsewhere - the competency chart from AIS training manual and cross-check with Kathryn's model before finalization)

TRAINING PHASES

Training can be further defined into phases from beginner to advanced; however, since KSAs vary from individual to individual and job requirements often change, training may not always be delivered sequentially. For example, it is perfectly reasonable to expect that as a new technology is introduced to an AIS organization, the first training provided might be initial training for some where for others it might be provided at an advanced phase.

For purposes of this document, we are defining the training phases as follows:

Ab Initio Training

Ab initio training may not cover any AIS criteria, but rather cover beginner level skills and knowledge that need to be mastered prior to commencing initial training. The purpose of ab initio training is to harmonize trainees' entry competencies, skills and knowledge before they start Initial training. The program for this phase of training should not be developed from the competency framework.

Initial/Basic training

Initial training is the first phase of training where actual AIS or AIM topics and criteria are covered. The purpose of initial training is to provide basic skills and knowledge to AI personnel who have been recently recruited or transferred from another non-AIS or non-AIM position. The curriculum of initial training is derived from the competency framework. The associated duration and mastery test are relevant to the program.

On-the-job training (OJT) may be coincident with or follow initial training to ensure that the acquired skills and knowledge from initial training are appropriately applied.

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

The purpose of advanced training is to augment the skills and knowledge of AIS personnel in dealing with either more specific, complex problems or a wider breadth of issues. The curriculum of advanced training should be derived from the competency framework.

Recurrent training

The purpose of recurrent training is to address changes in the available criteria and regulations. It is essential that AIS personnel update his or her KSAs and competencies in accordance with the latest legislative or regulatory requirements, technologies, and benchmarks identified by their AIS organization and professional practices. Regular recurrent training should therefore be planned accordingly.

Refresher training

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 AIS, it is strongly recommended that all staff be part of identifying KSAs that have weakened with time or are rarely or seasonally used, and that refresher training is planned accordingly. The refresher training curriculum should be derived from the competency framework.

GETTING FROM COMPETENCIES TO CURRICULA TO TRAINING

A high-level summary is as follows:

Step One:	Analyze/Identify the job responsibilities and associated performance and measurement criteria
Step Two:	Identify and document the competencies to meet the job responsibilities and performance expectations/standards
Step Three:	Identify and document the gaps between actual and expected competencies (performance) to the standards
Step Four:	Design the training to address the gaps through the development of the learning objectives for each competency that needs to be addressed (generally 4 – 5)
Step Five:	Conduct the Training
Step Six:	Evaluate the training and outcomes against performance on the job

COMPETENCY-BASED TRAINING

Simply, the goal of competency based training is to focus training to specific competencies that an individual has not yet attained, and to see evidence of a change in their behavior following that training. That change in behavior should be evidenced as a progression from the pre-training status to a post trained status and a more advanced competency level has been attained and reflected in job performance.

Competency-based training provides specific training that is AIS organization specific, that neither over-trains or under-trains an individual, ensuring an effective use of time and resources, and that the individual being trained stays motivated in the training period and subsequently on the job.

Step One: Analyze/Identify the job responsibilities and associated performance and measurement criteria

The first step in designing training is to determine what the competencies are of a fully competent staff member. Items that may be needed to perform this analysis could include:

- the specific job or position description or summary,
- specific AIS organization performance requirements or competencies,
- list of experience required as documented in a job advertisement,
- AIS performance evaluation form, and/or
- standard operating procedures from the QMS that apply to an individual's position or responsibilities.

Step Two: Identify and document the competencies to meet the job responsibilities and performance expectations/standards

After thoroughly analyzing the job responsibilities and expected performance, it is important to identify the associated competencies and the type of training the gap requires. AIS examples can be extracted from the sample competency framework in Appendix A (Ed note: or wherever we place it). It is important to ensure that the competency includes an action verb based on the type of training, the content and the context. A new hire training example is shown below:

Background:
Leonard is a new hire. He is a former air traffic controller and he has been hired as an AIS Specialist

Step One: As a course developer, we analyze his job description and the team performance evaluation form which outlines the standards and expectations for a fully-competent AIS specialist in Leonard's organization. We

compare this to the AIS competency framework/model (Ed note: update this reference) located in xxx to use a reference.

► Step Two:
We identify all of the competencies needed for Leonard's position.

Step Three: Identify and document the gaps between actual and expected competencies (performance) to the standards

Now that we know what competencies are required for a fully competent performer for a specific position by completing steps one and two, we are ready to identify and document the competency gaps. This step requires a measurement of the difference between the performance of an existing employee in each of the competencies, or, the assumed performance for a new hire.

In the case of an existing employee, as a training developer you may need a conversation with his or her supervisor depending on the type of training. If you have an employee identified as being ready to prepare for a promotion, his or her supervisor will need to identify for you the new competencies that will be required for the promotion to take place. The current competence of the individual against current and future competencies needs to be identified by his or her supervisor through the use of testing or previous performance evaluations so that appropriate training can be provided.

Background:
Leonard is a new hire. He is a former air traffic controller and he has been hired as an AIS Specialist

Step One: As a course developer, we analyze his job description and the team performance evaluation form which outlines the standards and expectations for a fully-competent AIS specialist in Leonard's organization.

Step Two: We identify all of the competencies needed for Leonard's position.

►Step Three: Identify and document the gaps between actual and expected competencies (performance) to the standards

In our previous example of our new hire Leonard, in this step we would evaluate Leonard's background on his resume (or previous performance evaluations if available) against the competencies required. For illustrative purposes, we see that he has already mastered some of the competencies required such as the required level of English language ability because he was an air traffic controller.

Upon completion of the analysis, one of the competencies we identify that Leonard does not have, is the "produce the AIP supplement" competency and decide to develop training for him for this competency.

Step Four: Design the training to address the gaps through the development of the learning objectives for each competency that needs to be addressed (generally 4 – 5)

Each competency should include learning objectives that clearly outline the KSAs that are needed to master this competency. Examples are shown in Appendix A. It is at this step that the phase of training (initial vs. advanced for example) and should be addressed.

Step four is a two-fold process, first you need to identify the learning objectives, and then you need to design the curriculum.

In our example for Leonard, we have identified the competency "produce the AIP supplement" and need to identify the learning objectives associated with this competency (curriculum and training methods will be discussed in Part 2 of this manual).

Background:
Leonard is a new hire. He is a former air traffic controller and he has been hired as an AIS Specialist

Step One:
As a course developer, we analyze his job description and the team performance evaluation form which outlines the standards and expectations for a fully-competent AIS specialist in Leonard's organization.

Step Two: We identify all of the competencies needed for Leonard's position.

Step Three: Identify and document the gaps between actual and expected competencies (performance) to the standards

►Step Four: Design the training to address the gaps through the development of the learning objectives for each competency that needs to be addressed (generally 4 – 5)

Competency: Produce the AID Supplement

Learning Objectives: At the end of the training, Leonard should be able to produce the AID Supplement by completing the following learning objectives:

> produce text in accordance with procedures

> liaise with other authorities as necessary
> verify text in accordance with procedures
> compile text and charts in accordance with procedures
> verify compiled product in accordance with procedures
> make compiled produce available in accordance with recognized distribution means

*Note that curriculum development that is required for learning objectives is discussed in Part 2 of this manual.

Step Five: Conduct the Training

The details of curriculum development and how the training should be conducted are discussed in Part 2 of this manual.

Step Six: Evaluate the training and outcomes against performance on the job

This last step in training determines whether the training was ultimately successful. There are two phases to training evaluation.

First, did the trainee master the learning objectives? This can be tested for during, and at the end of, the training period by a variety of methods including verbal testing, quizzes, essays, or other evaluation methods. The type and method of testing is determined during curriculum development as described in Part 2 of this manual.

The second phase of training evaluation occurs after the staff member returns to their position and the supervisor or peers (or both), are able to discern a change in the staff members' behavior as demonstrated through his or her KSAs. The staff member may return to a formal on-the-job training or return to their regular work where a discernable difference is noted.

In our example for our new hire Leonard, it is likely that he will return to a formal on-the-job training period where his knowledge will be put to the test in a real environment with a coach, mentor, or peer.

TAXONOMY FOR TRAINING OBJECTIVES

Taxonomy is a classification based on explicit principles. The purpose of taxonomies in the training domain is to classify training objectives into different levels as described as shown below.

The reason for various levels of training include situations where competencies need to build over time from level 1 to level 5 as experience is gained. Therefore, limiting training to a specific level is appropriate. Another reason for various training levels is that competency levels may be different based on the job responsibilities of the

individual. For example a Level 1 may be all that is required for one competency for a new hire, yet a Level 4 is required for someone who is a seasoned Practioner.

Training Objective Levels

Five learning objective levels are identified, numbered 1 to 5, plus an initial level (named 0) of pure information. These levels are similar to the phases of training in their progression of required ability. Each learning or training objective should have and associated training level identified (more fully explored in Part 2 of this manual in curriculum development.)

The training levels are defined as follows:

Training Levels	Description
Level 0	'To be aware of'
Level 1	Requires a basic knowledge of the subject. It is the ability to remember essential points; the learner is expected to memorize and call data.
Level 2	Requires an understanding of the subject sufficient to enable the learner to discuss intelligently. The individual is able to represent for himself certain objects and events, and to act upon these objects and events.
Level 3	Requires a thorough knowledge of the subject and the ability to apply it with accuracy. The learner should be able to make use of his repertoire of knowledge to develop plans and activate them.
Level 4	The ability to establish a line within a unit of known applications following the correct chronology and the adequate method to resolve a problem situation. This involves the integration of known applications in a familiar situation.
Level 5	The ability to analyze new situations in order to elaborate and apply one or other relevant strategy to solve a complex problem. The defining feature is that the situation is qualitatively different to those previously met, requiring judgment and evaluation of options.

Note**:** *Action Verbs* — performance objectives contain an action verb to ensure that the outcome is observable and that the difficulty level is stated according to a defined taxonomy.

(Ed note: Retype graphic into word)

Level 1: Requires a basic knowledge of the subject. It is the ability to remember essential points; the learner is expected to memorise data and to retrieve it.

Verb	Definition	Example	Level
Define	State what it is and what its limits are; state the definition	Define the global performances for CVOR and DVOR; Define the term 'alerting service'	1
Draw	Produce a picture, pattern or diagram	Draw the block diagram of the transmitter; Draw a holding pattern	1
List	Say one after the other	List the main software development processes used in industries; List the main structure components of an aircraft	1
Name	Give name of objects or procedures	Name who is designated to authorise changes in operational data; Name some components on a graphic	1
Quote	Repeat of what is written or said to underline	Quote ICAO definition of ATC service	1
Recognise	To know what it is because you've seen it before	Recognise on a diagram all the elements of the ADS; Recognise the information disseminated through AFTN like NOTAM, SNOWTAM	1
State	Say or write in a formal or definite way	State who are the local telecom providers and the service characteristics; State the major wind systems on earth	1

Level 2: Requires an understanding of the subject sufficient to enable the learner to discuss intelligently. The individual is able to represent for himself or herself certain objects and events in order to act upon these objects and events.

Verb	Definition	Example	Level
Characterise	To describe the quality of features in something	Characterise consequences of an OS upgrade; Characterise various items of ATC equipment	2
Consider	To think carefully about it	Consider institutional issues and service provider responsibilities; Consider radar range	2
Demonstrate	Describe and explain; logically or mathematically proves the truth of a statement	Demonstrate the possible use of GBAS for approach and landing; Demonstrate how the earth is projected as a map	2
Describe	Say what it is like or what happened	Describe the architecture of the ATN network; Describe the methods by which telecommunication regulations are implemented	2
Differentiate	Show the differences between things	Differentiate on a diagram all the possible elements of the ADS C system; Differentiate between the various relevant charts	2
Explain	Give details about something or describe so that it can be understood	Explain the principles of non-blocking switches; Explain the purpose and function of ICAO	2
Report	Give an account, provide a detailed statement about an occurrence or situation	Report on the performance of a maintenance task	2
Take account of	Take into consideration before deciding	Take wind influence into account when calculating a ground speed	2

Level 3: Requires a thorough knowledge of the subject and the ability to apply it with accuracy. The learner should be able to make use of his/her repertoire of knowledge to develop plans and activate them.

Verb	Definition	Example	Level
Act	Carry out, execute		3
Apply	Use something in a situation or activity	Apply the appropriate model to the analysis of a relevant aviation system. Apply national requirements in abnormal situations	3
Appreciate	To understand a situation and know what is involved in a problem-solving situation, to state a plan without applying it	Appreciate criticality of the conditions; Appreciate the necessary (*sic*) for coordination. The learner says that the co-ordination will be done and with whom, he/she does not perform the actual co-ordination	3
Assist	Help somebody to do a job by doing part of it	Handle the operational HMI and assist in the tuning of the screens; Assist the pilot	3
Calculate	To discover from information you already have by arithmetic; to think about a possible cause of action in order to form an opinion or decide what to do	Calculate the values of the elements of a simple generic antenna system; Calculate transition level	3
Check	Make sure the information is correct (satisfactory)	Check the operational status of the monitor system; Check and maintain the integrity of the working position	3
Choose	Select out of number, decide to do one thing rather than another	Choose the appropriate type of line for a given specific application; Choose which aircraft should be vectored	3
Collect	Assemble, accumulate, bring or come together		3
Conduct	Lead, guide	Conduct co-ordination	3
Confirm	Establish more firmly, corroborate	Confirm sequence order	3
Decode	Turn into ordinary writing, decipher	Decode a transponder message; Decode weather reports and forecast	3
Encode	Put into code or cipher		3
Estimate	Form an approximate judgement of a number, form an opinion	Being given an aircraft route, estimate thanks to a software package or/and GPS receiver the availability of the constellation; Estimate distance between two points	3

Execute	Perform action		3
Extract	Copy out, make extracts from, find, deduce	Extract data from a flight plan	3
Identify	Associate oneself inseparably with, establish the identity	Identify and locate data transmission problems; Identify a radar blip	3
Inform	Inspire, tell	Inform the planning controller	3
Initiate	Begin, set going, originate	Initiate a coordination procedure	3
Input	Enter in the system	Input data	3
Issue	Send forth, publish	Issue ATC clearance	3
Maintain	Carry on, keep up, refresh	Maintain flight data display 3	3
Measure	Ascertain extent or quality of (thing) by comparison with fixed unit or with object of know(n) size	Measure the typical parameters of lines; Measure cross modulation in radio antenna system	3
Monitor	Keep under observation	Monitor traffic	3
Notify	Make known, announce, report	Notify runway in use	3
Obtain	Acquire easily, without research	Obtain aeronautical information	3
Operate	Conduct work on equipment	Operate test tools to analyse the system; Operate electronic data transfer equipment	3
Pass	Move, cause to go, transmit	Pass essential traffic information without delay	3
Perform	Carry into effect, go through, execute	Perform typical measurements on a receiver; Perform coordination effectively	3
Record	Register, set down for remembrance or reference	Record information by writing effectively	3
Relay	Arrange in, provide with, replace by ...	Relay pilot message 3	3
Respond	Make answer, perform answering or corresponding action	Respond to the loss of aircraft radar identification	3
Scan	Continuously observe rapidly, sequentially and selectively in order to extract relevant data	Scan data display	3
Transfer	Hand over	Transfer information to receiving controller	3
Update	Refresh, make up-to-date	Update	3

Level 4: Ability to establish a line within a unit of known applications following the correct chronology and the adequate methods to resolve a problem situation. This involves the integration of known applications in a familiar situation.

Verb	Definition	Example	Level
Acquire	Gain by oneself and for oneself, obtain after research	Acquire relevant aeronautical information	4
Adjust	Change to a new position, value or setting	Adjust antenna system	4
Allocate	Assign, devote	Allocate the responsibility of separation during transfer	4
Analyse	Examine minutely the constitution of	Analyse the coverage of the radio system; Analyse traffic	4
Assign	Allot as a share, make over	Assign take off number	4
Co-ordinate	Bring part into proper relation	Co-ordinate with RCC	4
Comply	Act in accordance with	Comply with rules	4
Delegate	Commit authority to somebody	Delegate separation in case of aircraft continuing visually	4
Design	Conceive mental plans for	Design a NDB station according to operational requirements; Design… appropriate clearances and instructions	4
Detect	Discover existence of	Detect disturbances; Detect deviation from track	4
Ensure	Make safe, make certain	Ensure the agreed course of action is carried out	4
Expedite	Assist the progress of, do speedily		4
Integrate	Combine into a whole, complete by addition of parts	Integrate adequately components into a LAN; Integrate a transferred aircraft into the controlled traffic	4

Justify	Show the rightness of a choice or of an option	Justify and theorise the DME/N versus the DME/P; Justify and theorise the DVOR	4
Manage	Handle, wield, conduct	Manage aerodrome surface movements	4
Organise	Give orderly structure to, frame and put into working order	Organise arrival sequence	4
Predict	Forecast	Predict evolution of a conflict situation	4
Provide	Supply, furnish	Provide separation	4
Relate	Establish link with	Relate a pressure setting to an altitude	4

Level 5: Ability to analyse new situation in order to elaborate and apply one or other relevant strategy to solve a complex problem. The defining feature is that the situation is qualitatively different to those previously met, requiring judgement and evaluation of options.

Verb	Definition	Example	Level
Appraise	Estimate, determine the benefit	Appraise the interest of a traffic management option	5
Assess	Estimate value or difficulty, evaluate	Assess flight inspection results; Assess workload	5
Balance	Weigh (a question, two arguments, etc., against each other)	Balance two control actions	5
Calibrate	Correct and adjust to enable the provision of accurate data	Calibrate the NDB system according to flight inspection	5
Discuss	Investigate by reasoning or argument	Discuss the distribution of integrity information through GALILEO; Discuss the impact of regulation	5
Evaluate	Ascertain amount of, find numerical expression for	Evaluate workload	5
Extemporise	Produce without preparation, improvise	Extemporise phraseology in abnormal situations	5
Imagine	Form mental image of, conceive	Imagine possible actions to cope with unusual situations	5
Interpret	To decide on something's meaning or significance when there is a choice	Interpret fault report based on various test tool measures; Interpret ICAO annexes	5
Resolve	Solve, clear up, settle	Resolve conflict	5

AIS COMPETENCY ELEMENTS AND PERFORMANCE CRITERIA – THE FRAMEWORK (ED NOTE: IS THIS THE FRAMEWORK OR THE MODEL??? SHOULD IT BE HERE OR IN THE APPENDIX?)

Terminology is that used in Doc 9868, Appendix 2 to Chapter 3 and Doc 9906, 2.3. Terminology in brackets in the first three rows is to aid the development of the CFM and will be removed.

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
1	Manage Data				
	1.1	Receive Data			
		1.1.1	Evaluate whether the raw data is from an authorized source	ICAO Annex 15, Chap. 7 and Appendix 1; Local procedures, Doc 8126	
		1.1.2	Evaluate whether the data meets the protection requirements		
		1.1.3	Store raw data in accordance with procedures	Local procedures	
		1.1.4	Identify if there is a need for translation of the raw data	ICAO Doc 9713	
		1.1.5	Analyze the appropriateness of the data		
		1.1.6	Verify the quality of the raw data in accordance with procedures	ICAO Annex 15, Chap. 3;	
		1.1.7	Analyze the data for completeness, coherence and ambiguity		
		1.1.8	Analyze the data for possible duplication		
		1.1.9	Take corrective action		
		1.1.10	Coordinate with data sources in accordance with formal arrangements		
	1.2	Process Data			
		1.2.1	Identify any discrepancies and misinterpretations of the data introduced by translation	ICAO Annex 15, Chap. 4 to 7	
		1.2.2	Take corrective action		
		1.2.3	Coordinate with other relevant parties		
		1.2.4	Assess the impact of the data on existing publications, the significance and complexity of the data and its temporality.		
		1.2.5	Select the means of publication		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
		1.2.6	Schedule the publication process, taking into consideration the main milestones, proposed publication/effective date and the AIRAC cycle	ICAO Annex 15 and Local procedures, Doc 8126	
		1.2.7	Perform calculations e.g., data conversions		
		1.2.8	Apply appropriate data formatting rules		
		1.2.9	Compile statistical data		
		1.2.10	Identify the next actor in the data chain and distribute data		
	1.3	Operate Database			
		1.3.1	Apply database maintenance operations.		
		1.3.2	Identify faults in the operation of the database and apply fault reporting procedures		
		1.3.3	Operate the database in accordance with procedures		
	1.4	Process data for other databases			
		1.4.1	Select the required data for other internal/external databases	Local procedures	
		1.4.2	Provide data for other internal/external databases in accordance with procedures	Local procedures	
	1.5	Maintain Foreign AIS Publications			
		1.5.1	Maintain foreign AIS publications in accordance with procedures and taking into consideration the media used	Local procedures	
2	Produce Static Products				
	2.1	Produce AIP / AIP Amendment			
		2.1.1	Liaise with other authorities as necessary		
		2.1.2	Produce text in accordance with procedures	ICAO Annex 15, Doc 8126, Local procedures	
		2.1.3	Liaise with other authorities as necessary		
		2.1.4	Identify if there is a need for translation of the text		
		2.1.5	Verify text in accordance with procedures		
		2.1.6	Approve text in accordance with procedures		
		2.1.7	Compile text, charts and other data sets		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
			in accordance with procedures		
		2.1.8	Verify compiled product in accordance with procedures		
		2.1.9	Approve compiled product in accordance with procedures		
		2.1.10	Make compiled product available in accordance with recognized distribution means		
	2.2	Produce AIP Supplement			
		2.2.1	Produce text in accordance with procedures		
		2.2.2	Liaise with other authorities as necessary		
		2.2.3	Verify text in accordance with procedures		
		2.2.4	Approve text in accordance with procedures		
		2.2.5	Compile text and charts in accordance with procedures		
		2.2.6	Verify compiled product in accordance with procedures		
		2.2.7	Approve compiled product in accordance with procedures		
		2.2.8	Make compiled product available in accordance with recognized distribution means		
	2.3	Produce Aeronautical Information Circular			
		2.3.1	Produce text in accordance with procedures		
		2.3.2	Liaise with other authorities as necessary		
		2.3.3	Verify text in accordance with procedures		
		2.3.4	Approve text in accordance with procedures		
		2.3.5	Compile text and charts in accordance with procedures		
		2.3.6	Verify compiled product in accordance with procedures		
		2.3.7	Approve compiled product in accordance with procedures		
		2.3.8	Make compiled product available in accordance with recognized distribution means		
	2.4	Produce Chart			
		2.4.1	Produce chart in accordance with procedures		
		2.4.2	Liaise with other authorities as necessary		
		2.4.3	Verify chart in accordance with		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
			procedures		
		2.4.4	Approve chart in accordance with procedures		
		2.4.5	Make chart available in accordance with recognized distribution means		
	2.5	Produce Data Sets			
		2.5.1	Compile other data sets in accordance with procedures	e.g., terrain and obstacle data sets	
		2.5.2	Liaise with other authorities as necessary		
		2.5.3	Verify data sets in accordance with procedures		
		2.5.4	Approve data sets in accordance with procedures		
		2.5.5	Make data sets available in accordance with recognized distribution means		
	2.6	Produce Printed Plain-Language List of Valid NOTAM			
		2.6.1	Compile indications of latest AIP Amendments, AIC issued and a checklist of AIP Supplements		
		2.6.2	Produce printed plain-language list of valid NOTAM in accordance with procedures		
		2.6.3	Liaise with other authorities as necessary		
		2.6.4	Verify printed plain-language list of valid NOTAM in accordance with procedures		
		2.6.5	Approve printed plain-language list of valid NOTAM in accordance with procedures		
		2.6.6	Make Printed plain-language list of valid NOTAM available in accordance with recognized distribution means		
3	Produce Dynamic Products				
	3.1	Produce NOTAM			
		3.1.1	Produce NOTAM in accordance with procedures		
		3.1.2	Liaise with other authorities as necessary		
		3.1.3	Verify NOTAM in accordance with procedures		
		3.1.4	Approve NOTAM in accordance with procedures		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
		3.1.5	Make NOTAM available in accordance with recognized distribution means		
	3.2	Produce Checklist of Valid NOTAM			
		3.2.1	Compile indications of latest AIP Amendments, AIP Supplements and internationally distributed AIC		
		3.2.2	Produce checklist of valid NOTAM in accordance with procedures		
		3.2.3	Liaise with other authorities as necessary		
		3.2.4	Verify checklist of valid NOTAM in accordance with procedures		
		3.2.5	Approve checklist of valid NOTAM in accordance with procedures		
		3.2.6	Make checklist of valid NOTAM available in accordance with recognized distribution means		
	3.3	Process SNOWTAM			
		3.3.1	Process SNOWTAM in accordance with procedures		
		3.3.2	Liaise with other authorities as necessary		
		3.3.3	Verify SNOWTAM in accordance with procedures		
		3.3.4	Make SNOWTAM available in accordance with recognized distribution means		
	3.4	Produce ASHTAM			
		3.4.1	Produce ASHTAM in accordance with procedures		
		3.4.2	Liaise with other authorities as necessary		
		3.4.3	Verify ASHTAM in accordance with procedures		
		3.4.4	Approve ASHTAM in accordance with procedures		
		3.4.5	Make ASHTAM available in accordance with recognized distribution means		
	3.5	Produce PIB			
		3.5.1	Produce PIB in accordance with procedures		
		3.5.2	Liaise with other authorities as necessary		
		3.5.3	Verify PIB in accordance with procedures		
		3.5.4	Approve PIB in accordance with procedures		
		3.5.5	Make PIB available in accordance with recognized distribution means		
	3.6	Process Foreign Dynamic Data			
		3.6.1	Process foreign dynamic data in accordance with procedures		
		3.6.2	Verify foreign dynamic data in		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
			accordance with procedures		
		3.6.3	Coordinate with other relevant parties		
		3.6.4	Make foreign dynamic data available in accordance with recognized distribution means		
4	Produce Additional Products				
	4.1	Produce Additional Products			
		4.1.1	Produce additional products in accordance with procedures, taking into consideration the media used, e.g., digital data products, such as tailored terrain and obstacle data sets, Data Product Specifications, aerodrome mapping data, etc		
		4.1.2	Liaise with other authorities as necessary		
		4.1.3	Verify additional products in accordance with procedures		
		4.1.4	Approve additional products in accordance with procedures		
		4.1.5	Make additional products available in accordance with recognized distribution means		
5	Perform Aerodrome AIS Functions				
	5.1	Provide information for flight preparation			
		5.1.1	Provide information for flight preparation in accordance with procedures, e.g., NOTAM, AIP, MET, etc.		
		5.1.2	Make information for flight preparation available in accordance with recognized distribution means		
	5.2	Process Post-flight Information			
		5.2.1	Process post-flight information in accordance with procedures		
		5.2.2	Process post-flight data queries in accordance with procedures		
6	Perform ARO Functions				
	6.1	Process FPL and associated messages			
		6.1.1	Process FPL and associated messages in accordance with procedures		
		6.1.2	Liaise with other authorities as necessary		
		6.1.3	Verify FPL		
	6.2	Provide information for flight preparation			
		6.2.1	Provide information for flight preparation in accordance with procedures, e.g., NOTAM, AIP, MET, etc.		
		6.2.2	Make information for flight preparation available in accordance with recognized		

X	Competency Unit (*Organizational Level*)				
	x.x	Competency Element (*Functional (Departmental) Objective*)			
		x.x.x	Performance Criteria (*Individual Objective – Terminal Task?)*		
				In accordance with:	Annexes
			distribution means		
	6.3	Process Post-flight Information			
		6.3.1	Process post-flight information in accordance with procedures		
		6.3.2	Process post-flight data queries in accordance with procedures		

PART TWO: Competency-Based Curriculum Design

DESIGNING THE CURRICULUM

Once the gaps in performance and associated competencies have been identifies, the learning objectives will be set and you will be ready to design the curriculum. The following paragraphs describe different types of AI Personnel 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.

Course Development Considerations

The duration of a course should not be determined in advance but derived from a course plan that is competency-based. The duration of a course generally 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 modules with each period including a refresher from the previous module.

Training providers can address these challenges by determining more or less stringent prerequisite skills, knowledge and abilities for ab initio training. This will impact the time required to achieve training objectives, the size and cost-effectiveness of the training, and the course duration can then be adjusted accordingly.

The final goal of all training is to ensure AI personnel can perform to the requirements specified in the competency framework. This cannot be achieved solely through knowledge-based training; on-the-job training is critical. The interdependence of training objectives impacts course duration. The amount of time needed for on-the-job training will depend on how stringent the performance standards are set.

In addition, training needs vary among States due in part to:

- Level of automation,
- Organizational structure,
- Levels of expertise of staff,
- Complexity of the State airspace,

- Resources,
- Transition of AIS to AIM,
- Regulatory requirements, and
- Institutional requirements.

Training providers may include or exclude training modules depending on the training needs. This again will impact course duration and prerequisite knowledge, skills and abilities.

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. Course developers, course instructors and trainees are all stakeholders in the instructional process. 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 based. 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 counseling trainees. Trainees are responsible to be actively engaged in training and the successful completion of all course module activities and assessment materials, as required.

In order for a trainee to be successful on the job, he or she will go through different modules of training that are based on the gap identified between their level of competence and job requirements. There may be several courses of training for each level or set of required competencies. These phases of training are described in earlier. Training required will be dependent on the trainee's entry level of KSAs. All training will involve a curriculum development process. The steps to carry out curriculum development are to:

- assess the competencies of the trainees;
- derive terminal objectives from the competency framework;
- ensure that all KSAs required for each enabling objective are covered;
- sequence terminal and enabling objectives;
- group objectives into modules; and
- design a competency-based mastery test for each terminal objective;

Training Levels

Before conducting training, the KSAs of the trainees are assessed. AI personnel can be recruited from different domains (AIS, engineers, technicians, pilots, cartographers, air traffic controllers, etc., just to name a few). As a consequence recruits' KSAs may vary and therefore the level of training that they need may vary. For example, recruits who have no prior knowledge with

AI, based on their KSAs they may be required to complete ab-Initio training for certain aspects of the position requirements.

Ab-Initio Training

Before conducting initial training, the competencies and KSAs of the trainees are assessed. AIS personnel can be recruited from different domains (ATM, engineering, technician, pilots, just to name a few) therefore their competencies and KSAs vary. Some ab initio training may be necessary to meet the entry level pre-requisites in the different domains to be able to successfully complete initial training (see 3.2.2). Ab initio training may not cover any AIS criteria, but rather cover beginner level skills and knowledge that need to be mastered prior to commencing initial training. The purpose of ab initio training is to harmonize trainees' entry competencies, skills and knowledge before they start Initial training. The program for this phase of training should not be developed from the competency framework.

Initial/Basic training

Initial training is the first phase of training where actual AIS or AIM topics and criteria are covered. The purpose of initial training is to provide basic skills and knowledge to AI personnel who have been recently recruited or transferred from another non-AIS or non-AIM position. The curriculum of initial training is derived from the competency framework. The associated duration and mastery test are relevant to the program.

On-the-job training (OJT) may be coincident with or follow initial training to ensure that the acquired skills and knowledge from initial training are appropriately applied. While on-the-job training cannot be considered a specific training course in the formal sense, it is an essential phase in a training program. Its purpose is to reinforce formal training and support the achievement of competency standards. 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

The purpose of advanced training is to augment the skills and knowledge of AIS personnel in dealing with either more specific, complex problems or a wider breadth of issues. The curriculum of advanced training should be derived from the competency framework.

Recurrent training

The purpose of recurrent training is to address changes in the available criteria and regulations. It is essential that AIS personnel update his or her KSAs and competencies in accordance with the latest criteria, technologies, and

benchmarks identified as best practices. Regular recurrent training should therefore be planned accordingly.

Refresher training

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 AIS, it is strongly recommended that all staff be part of identifying KSAs that have weakened with time or are rarely or seasonally used, and that refresher training is planned accordingly. The refresher training curriculum should be derived from the competency framework.

Determining the pre-requisite KSAs

Personnel intending to attend initial training need to meet the requirements. Training providers may be required to deliver ab initio training to ensure that trainees meet the entry prerequisites (it is understood that each State should define their State-specific job requirement pre-requisites.) Ab initio training is designed to meet the pre-requisites required by initial training. Not attending ab initio training may impact a trainee's ability to meet initial training objectives within the duration of initial training.

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 refer to KSAs and competencies used during the initial training.

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

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.

Mathematics

Arithmetic

Trainees should be competent in basic arithmetic skills (addition, subtraction, multiplication and division.) Depending on their specialty area, an entry level individual may also be required to have more advanced mathematical skills as defined at the position level.

Software

Trainees should be familiar with basic email systems, word-processing, and spreadsheet software. It is assumed that all trainees will also have experience keyboarding.

Aviation or aviation-related prerequisites

The job profile of an AI individual 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 AIS training can be optimized.

Ab Initio Training	Comments
Air traffic management	Trainees should demonstrate a basic knowledge and understanding of local State air traffic management (ATM), 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.
Navigation, navigation systems and geography	Trainees should demonstrate knowledge of navigation, navigation systems and geography to the level of any pilot's license with instrument rating (IR). It is not, however, a requirement to hold such a license.
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.
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.
Aerodrome safeguarding	Trainees must be familiar with the basic requirements for aerodrome safeguarding (Annex 14, Obstacle limitation surfaces, Aerodrome reference codes).
Geodesy	Geodesy, also called geodetics, 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. Trainees should demonstrate fundamental knowledge in the following areas of geodesy:

	– geoid and reference ellipsoid; – coordinate systems in space; – coordinate systems in the plane; – heights; – geodetic datums and datum conversion; – point positioning; – units and measures on the ellipsoid; – geodetic principal problem; and – geodetic inverse problem.

Language

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 language in which training will be delivered (instruction and training materials) is essential.

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.

Training providers offering courses in languages other than English should establish similar prerequisites.

Unless otherwise stated, the structure of this chapter is based on ICAO Doc 9906 (Quality Assurance Manual for Flight Procedure Design and this will be used as the primary source of its content).

Process to derive training objectives from the competency framework

Refer to ICAO Doc 9906, 3.4

Established using competency framework provided in this document. There are terminal objectives and enabling objectives.

For terminal objectives, a trainee will undergo a module of training and then will be required to perform the terminal objective as formulated in a mastery test.

In order to achieve a terminal objective, there are several enabling objectives the trainee needs to mater. Enabling objectives may be derived from performance criteria. The trainee will require specific knowledge and skills.

SAMPLE TRAINING OBJECTIVES

This is in line with Attachment B to Chapter 3 of Doc 9868 and I would propose that this is inserted as an attachment to Chapter 2 of out draft structure, to support section 3.4 – "Process to derive training objectives from the Competency Framework"

	Condition	**Behavior**	**Standard**
Terminal Objective		**Comply with Legal Principles**	Annexes, SARPS, PANS, SUPPS, Documents, ICAO Annex 15
Enabling Objective 1	As above	Explain the purpose, organization and function of ICAO, including ICAO Convention, ICAO Council, ANC, ICAO Regional offices	As above
Enabling Objective 2		Explain the purpose, organization and function of other international organizations, e.g., regional bodies	
Enabling Objective 3		Explain the purpose, organization and function of national organizations, e.g. CAA	
Enabling Objective 4		Explain the responsibilities in respect to ICAO requirements	

	Condition	Behavior	Standard
Terminal Objective		**Demonstrate Basic Knowledge of Aviation**	
Enabling Objective 1	As above	Demonstrate basic knowledge of ATS	As above
Enabling Objective 2		Demonstrate basic knowledge of airspace management	
Enabling Objective 3		Demonstrate basic knowledge of flow management	
Enabling Objective 4		Demonstrate basic knowledge of aerodromes	
Enabling Objective 5		Demonstrate basic knowledge of MET	
Enabling Objective 6		Demonstrate basic knowledge of geodesy	
Enabling Objective 7		Demonstrate basic knowledge of air components	

	Condition	Behavior	Standard
Terminal Objective		**Describe the Principles of AIS**	
Enabling Objective 1	As above	Recognize the need for aeronautical information in aviation	As above
Enabling Objective 2		Explain the purpose of AIS	
Enabling Objective 3			
Enabling Objective 4		Describe the information handled by AIS, including the obligations with regards to foreign data	
Enabling Objective 5		Describe ICAO charging mechanisms and the funding of AIS	
Enabling Objective 6		Describe regional charging mechanisms	
Enabling Objective 7		Explain the charging scheme for AIS products	
Enabling Objective 8		Describe the safety implications associated with the use of incorrect data	
Enabling Objective 9		Recognize the need for global harmonization	
Enabling Objective 10			
Enabling Objective 11		Describe the AIM concept, the transition from AIS to AIM and the components of AIM	

	Condition	Behavior	Standard

Terminal Objective		**Describe the Responsibilities and Functions of AIS**	ICAO Annex 15
Enabling Objective 1	As above	Describe the responsibilities and functions of the AIS	As above

	Condition	**Behavior**	**Standard**
Terminal Objective		**Describe the AIS Products**	ICAO Annex 15, ICAO Annex 4
Enabling Objective 1	As above	Describe the elements of the IAIP, including their structure, and their purpose	As above
Enabling Objective 2		Describe the aeronautical charts	
Enabling Objective 3		Describe the difference between digital data and digital data products	
Enabling Objective 4		Describe the digital data products	
Enabling Objective 5		Describe other AIS products e.g. VFR manual, local charts, data sets for other databases	
Enabling Objective 6		Describe the different means employed to make data available	
Enabling Objective 7		Identify the users of AIS products	

	Condition	**Behavior**	**Standard**
Terminal Objective		**Describe the Organization of AIS**	
Enabling Objective 1	As above	Describe the status of AIS within the regulatory and service provision frameworks	As above
Enabling Objective 2		Describe the relationship of AIS with external organizations	
Enabling Objective 3		Describe the relationship with internal units	
Enabling Objective 4		Explain the AIS internal organization	
Enabling Objective 5			
Enabling Objective 6		Explain the arrangements for exchange of aeronautical	

		information with other States	
Enabling Objective 7		Explain the liaison with other related services	

	Condition	Behavior	Standard
Terminal Objective		**Describe the Quality Management System**	
Enabling Objective 1	As above	Explain the purpose of the Quality Management System	As above
Enabling Objective 2		Describe the policies, processes and procedures used in AIS	
Enabling Objective 3		Describe the need for the traceability of aeronautical data/information and the role of metadata	
Enabling Objective 4		Describe the need for the protection of data	
Enabling Objective 5		Describe the range of data quality requirements that must be met, i.e., accuracy, resolution, integrity, completeness, etc.	
Enabling Objective 6		Explain the importance of the timeliness of information	
Enabling Objective 7		Explain the importance of validation and verification procedures	
Enabling Objective 8		Describe the role of formal arrangements in the data chain	

	Condition	Behavior	Standard
Terminal Objective		**Describe the Aeronautical Data Chain**	
Enabling Objective 1	As above	Describe the complete data chain, from data origination through to end-use	As above
Enabling Objective 2		Describe the technology/systems employed in AIS including the relationships between the technology/systems and the end products	

	Condition	Behavior	Standard
Terminal Objective		**Describe Coordination Activities**	
Enabling Objective 1	As above	Outline the coordination with data sources	As above
Enabling Objective 2		Outline the coordination between internal AIS departments	
Enabling Objective 3		Outline the coordination between external AIS offices	
Enabling Objective 4		Outline the coordination with internal customers, e.g., ARO, ATS	
Enabling Objective 5		Outline the coordination with external customers, e.g. airlines, State administrations	

	Condition	Behavior	Standard
Terminal Objective		**Documentation**	ICAO SARPS, Annexes, Docs, Manuals,
Enabling Objective 1	As above	Identify the basic reference material and frequently used documents in AIS	As above
Enabling Objective 2		List national documentation used in AIS	
Enabling Objective 3		List internal documentation used in AIS	

	Condition	Behavior	Standard
Terminal Objective		**AIS Standards and Conventions**	ICAO, regional, national
Enabling Objective 1	As above	Demonstrate knowledge of the application of abbreviations, codes and symbols	As above
Enabling Objective 2		Demonstrate the ability to correctly apply ICAO terminology	
Enabling Objective 3		Explain the ICAO requirements for the presentation of information	
Enabling Objective 4		Describe the need to consider human factors in presenting information	
Enabling Objective 5		Describe the purpose of the notification of differences to ICAO	
Enabling Objective 6		Explain the AIRAC system	

		and the need for it	
Enabling Objective 7		Describe the ISO 19100 standards used for geographical information	

Establishing OJT Training Objectives

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. In fact, 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 process a NOTAM 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.

Knowledge, skills and attitudes required to achieve training objectives

Refer to ICAO Doc 9906, 3.4.4

Considerations in developing training tests and assessments based on competency framework

(Ed note: Put in examples, discuss)

Refer to ICAO Doc 9906, 1.1

Purpose of Tests

Refer to ICAO Doc 9906, 3.6.1

Validity and Reliability

Refer to ICAO Doc 9906, 3.6.2

Test Format

Refer to ICAO Doc 9906, 3.6.3

Test Design

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.

Based on the context of each training environment, it is up to the training provider to establish appropriate test items for the mastery test. Based on the example provided, the following example is provided as an outline of a sample test:

a) Terminal objective:

Given valid sets of electronic/paper data, the trainee will be able to produce AIP amendment using the following criteria: a) using standard forms and/or software, b) establish the minimum sector of altitudes, c) document and store VOR or NDB FAF procedures d) within an acceptable time period identified by the course instructor. All criteria are in accordance with the competency framework as derived from Doc 8168, Volume II.

b) Before writing a test item for this objective, the following questions should be answered:

- In what context is the terminal objective being carried out?
- What conditions are being stated for the trainee to complete the objective?
- What is the expected behaviour for this objective?
- To what standards should the behaviour be carried out?

Conditions.

Behaviour.

Training standard. I.

c) Sample test item based on the above terminal objective:

Given a valid set of electronic/paper data design for a VOR or NDB FAF approach procedure, design a procedure using the appropriate standard forms and/or the use of electronic software, with the minimum sector altitudes established. Be sure to document and store designated procedures as appropriate within the time allotted by the test instructions.

Note. — Differences in avionics systems need to be considered during the

processing of aeronautical data. As a result, records from different automated systems may not always be consistent.

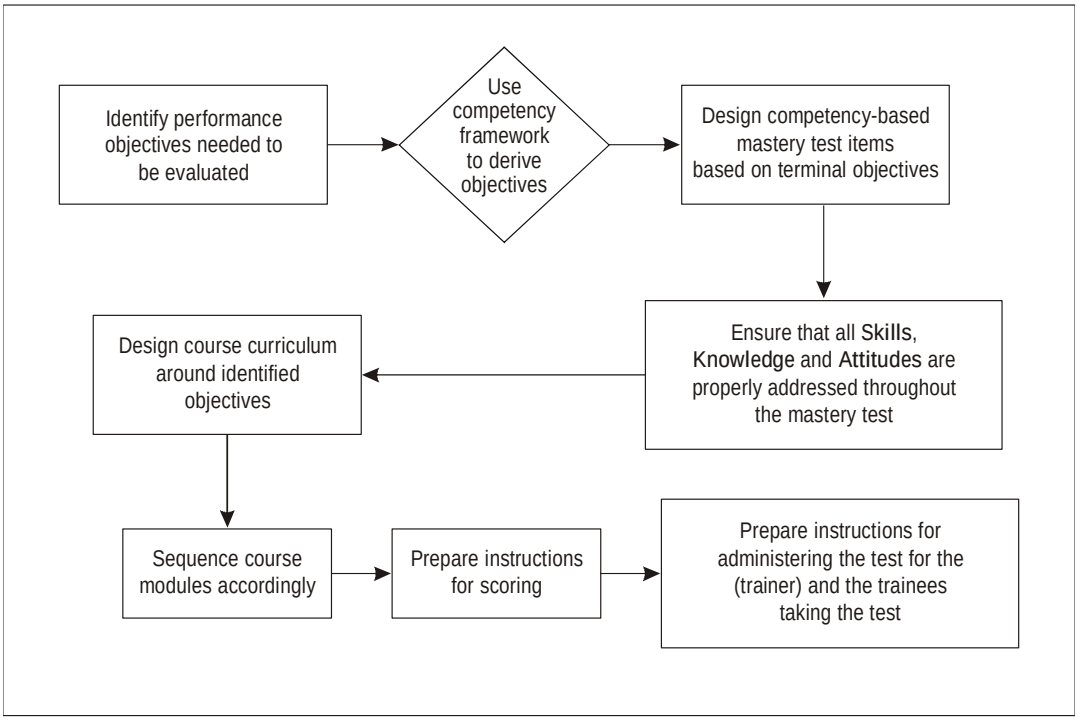

Figure 3-1 identifies the mastery test design process.

Figure 3-1. Mastery test design process

Progress Test

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.

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 objectives.

Progress tests should be designed to address specific KSAs required to support enabling objectives. KSAs can be assessed in the following manner:

- skills are best measured when a performance test is utilized (the task must be assigned to match the outlined objective);
- knowledge may be tested through written or oral tests; and
- abilities are measured through observations of specific performance or questionnaires.

Testing can be administered verbally, in a written format or a combination of both modes. Each test item, regardless of the form, should fulfill the following requirements:

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

Considerations in designing modules and course materials

Module Design. The structure of each module must take into consideration the KSAs 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.

Instructional Steps. 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.

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.

During the presentation of the module, it may be useful to provide a brief demonstration or example of the desired performance or outcome. 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?"

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. 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. 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.

Instructional Events

Instructional events are identified as "any action, which moves the trainee towards the accomplishment of any instructional objective". When designing instructional events, course developers should ensure that they address any of the following functions:

a) gain attention of and motivate trainee;

b) demonstrate what the trainee will be able to accomplish after learning;

c) demonstrate how accomplishments will be tested;

d) stimulate the recall of the learning;

e) present subject-matter content;

f) provide opportunity for trainees to make appropriate responses (activities to be performed by the trainee, partial practice, global practice);

g) reinforce learning by providing feedback (progress test etc.);

h) assess performance of trainees (mastery test, progress test etc.); and

i) enhance what has been learned and transfer it to other situations (case studies, scenarios, simulations, etc.).

Instructional events may combine two or three of these functions at a time. For example, if a course instructor wants to gain attention and motivate trainees, he or

she can simultaneously demonstrate what the trainee will be able to do after learning has occurred.

Presenting instructional events can vary depending on the content, materials or the trainees themselves. Regardless, instructional events should be described and documented. For example, specific instructions should be provided on how instructors summarize discussions, how to organize a role-playing situation, or how to administer a mastery or progress test. When designing course modules, materials can be instructor-dependent or material-dependent. To ensure a more consistent delivery of course content, course developers should design content that is material-dependent. Material-dependent courses are courses where the instructor requires minimum interpretation of course content. In this situation, instruction is dictated by the materials. This focuses the instructor's work on course facilitation. Instructor-dependent courses are courses where the instructional process is not documented. In this case, an inexperienced or new instructor will need to interpret and adapt the course materials. Material-dependent courses ensure that training is delivered in a consistent and reliable manner.

Production and Development of Material

In order to validate the complete training process, the technical accuracy of all training materials should be verified by subject matter experts; this helps to assure that all information presented is not only accurate but also current. This subject matter review will provide further assurance that the training materials actually meet the standards of the task(s) trainees will eventually perform on the job.

A sample of individuals from the target population should be trained using a draft version of the instructional materials. The feedback from this validation delivery will be used to address any major flaws in course design and correct materials. All instruction and module terminology should be clearly defined and closely matched with the learning styles of trainees.

Attachment B to Chapter 3 – Example of an AI Training Programme

Refer to ICAO Doc 9906, Attachment A to Chapter 3

- *Background*
- *Training Programme Steps*
    - *Step 0 – Ab Initio*
    - *Step 1 – Initial Training*
    - *Step 2 – On-the-job Training – Initial*
    - *Step 3 – Advanced Training 1*
        - *To be split into separate steps, as required.*
    - *Step 4 - On-the-job Training – Advanced*

        - *To be split into separate steps, to follow the different levels of advanced training, as required.*

    - *Step 5 – Recurrent Training*

    - *Step 6 – Refresher Training*

SECTION THREE — APPENDICIES

Need to add missing appendices

APPENDIX C

ABBREVIATIONS

ABAS	Aircraft-based augmentation system
AI	Aeronautical Information
AD	Aeronautical Data
AIP	Aeronautical Information Publication
AIRAC	Aeronautical information regulation and control
AIS	Aeronautical Information Service
ANSP	Air Navigation Service Provider
APV	Approach procedure with vertical guidance
ARP	Aerodrome reference point
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
Baro-VNAV	Barometric vertical navigation
CAA	Civil Aviation Authority
CAT	I/II/III Category of approach
CDA	Continuous descent approach
CRM	Collision risk model
DEM	Digital elevation model
DF	Direction finding
DME	Distance measuring equipment
DTM	Digital terrain model
EUROCAE	European Organization for Civil Aviation Equipment
FAF	Final approach fix
FAS	Final approach segment
FMS	Flight management system
FPD	Flight procedure design
GBAS	Ground-based augmentation system
GIS	Geographical Information System
GNSS	Global navigation satellite system
GP	Glide path
GPS	Global Positioning System
HRP	Heliport reference point
IAC	Instrument approach chart
ICAO	International Civil Aviation Organization
IELTS	International English language testing system
IF	Intermediate fix
IFR	Instrument flight rules
ILS	Instrument landing system
IR	Instrument rating
ISD	Instructional system design
ISO	International Organization for Standardization
LOC	Localizer

MLS	Microwave landing system
MOC	Minimum obstacle clearance
MSA	Minimum sector altitude
NDB	Non-directional radio beacon
NM	Nautical mile
NOTAM	Notice to airmen
NPA	Non-precision approach
OAS	Obstacle assessment surface
OCA(H)	Obstacle clearance altitude/height
OJT	On-the-job training
PA	Precision approach
PAR	Precision approach radar
PDSP	Procedure design service provider
QMS	Quality Management System
RASS	Remote altimeter setting source
RNAV	Area navigation (also, random area navigation)
RNP	Required navigation performance
RNP	AR required navigation performance authorization required
RTCA	RTCA (formerly Radio Technical Commission for Aeronautics)
SBAS	Satellite-based augmentation system
SID	Standard instrument departure
SKA	Skills, knowledge, attitudes
SMS	Safety management system
SRE	Surveillance radar equipment
STAR	Standard terminal arrival
TAA	Terminal arrival altitude
TOEFL	Test of English as a foreign language
VNAV	Vertical navigation
VOR	Very high frequency omnidirectional radio range
VORTAC	Combination VOR and TACAN
VSS	Visual segment surface
WGS-84	World Geodetic System 1984*To be developed*

APPENDIX D – DEFINITIONS

When the following terms are used in the Standards and Recommended Practices for aeronautical information services, they have the following meanings:

Accuracy. A degree of conformance between the estimated or measured value and the true value.
Note. — For measured positional data the accuracy is normally expressed in terms of a distance from a stated position within which there is a defined confidence of the true position falling.
*Aerodrome***.** A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.
Aeronautical data. A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.
*Vector data***.** The digitized version of graphic or rasterized data, usually having three-dimensional attributes.

Aeronautical information. Information resulting from the assembly, analysis and formatting of aeronautical data.
Aeronautical Information Circular (AIC). A notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative or legislative matters.
Aeronautical Information Publication (AIP). A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.
Aeronautical Information Personnel. Anyone who is generally responsibility for any of or all of the functions required by the AIS or AIM provider as a general part of their employment.
Aeronautical information service (AIS). A service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity and efficiency of air navigation.
Aeronautical Information Management (AIM). A management function established
AIP Amendment. Permanent changes to the information contained in the AIP.
AIP Supplement. Temporary changes to the information contained in the AIP which are published by means of special pages.
AIRAC. An acronym (aeronautical information regulation and control) signifying a system aimed at advance notification based on common effective dates, of circumstances that necessitate significant changes in operating practices.
Air defense identification zone (ADIZ). Special designated airspace of defined dimensions within which aircraft are required to comply with special identification and/or reporting procedures additional to those related to the provision of air traffic services (ATS).
*Air traffic management (ATM)***.** A generic term relating to the management of air traffic services (ATS).

AIS product. Aeronautical information provided in the form of the elements of the Integrated Aeronautical Information Package (except NOTAM and PIB), including aeronautical charts, or in the form of suitable electronic media.
Application. Manipulation and processing of data in support of user requirements (ISO 19104*).
* All ISO Standards are listed at the end of this chapter.
Area navigation (RNAV). A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.
Note. — Area navigation includes performance-based navigation as well as other operations that do not meet the definition of performance-based navigation.

ASHTAM. A special series NOTAM notifying by means of a specific format change in activity of a volcano, a volcanic eruption and/or volcanic ash cloud that is of significance to aircraft operations.

Assemble. A process of merging data from multiple sources into a database and establishing a baseline for subsequent processing.

Note. — The assemble phase includes checking the data and ensuring that detected errors and omissions are rectified

ATS surveillance service. Term used to indicate a service provided directly by means of an ATS surveillance system.

ATS surveillance system. A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

Note.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

Automatic dependent surveillance — broadcast (ADS-B). A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link.

Automatic dependent surveillance — contract (ADS-C). A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

Note. — The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.

Automatic terminal information service (ATIS). The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof:

Data link-automatic terminal information service (D-ATIS). The provision of ATIS via data link.

Voice-automatic terminal information service (Voice-ATIS). The provision of ATIS by means of continuous and repetitive voice broadcasts.

Bare Earth. Surface of the Earth including bodies of water and permanent ice and snow, and excluding vegetation and man-made objects.

Calendar. Discrete temporal reference system that provides the basis for defining temporal position to a resolution of one day (ISO 19108*).

Canopy. Bare Earth supplemented by vegetation height.

Cartographic map. A representation of a portion of the Earth, its culture and relief, with properly referenced terrain, hydrographic, hypsometric and cultural data depicted on a sheet of paper.

Competency. A combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.

Competency-based training and assessment. Training and assessment that are characterized by a performance orientation, emphasis on standards of performance and their measurement, and the development of training to the specified performance standards.

Competency element. 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.

Competency framework. A competency framework consists of *competency units*, *competency elements*, *performance criteria*, *evidence and assessment guide* and *range of variables.* Competency units, competency elements and performance criteria are derived from job and tasks analyses of AIS personnel and describe observable outcomes.

Competency unit. A discrete function consisting of a number of competency elements.

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Civil Aviation Authority (CAA). The relevant aviation authority designated by the State responsible for providing air traffic services in the airspace concerned; sometimes referred to as the "State Authority".

Competency framework. A competency framework consists of *competency units*, *competency elements*, *performance criteria*, *evidence and assessment guide* and *range of variables.* Competency units, competency elements and performance criteria are derived from job and tasks analyses of AIS personnel and describe observable outcomes.

Controller-pilot data link communications (CPDLC). A means of communication between controller and pilot, using data link for ATC communications.

Culture. All man-made features constructed on the surface of the Earth, such as cities, railways and canals.

Cyclic redundancy check (CRC). A mathematical algorithm applied to the digital expression of data that provides a level of assurance against loss or alteration of data.

Danger area. An airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

Data: *Obtain definition from study group*

Database. One or more files of data so structured that appropriate applications may draw from the files and update them.

Note.— This primarily refers to data stored electronically and accessed by computer rather than in files of physical records.

Data product. Data set or data set series that conforms to a data product specification (ISO 19131*).

Data product specification. Detailed description of a data set or data set series together with additional information that will enable it to be created, supplied to and used by another party (ISO 19131*).

Note. — A data product specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a data set. It may be used for production, sales, end-use or other purpose.

Data quality. A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity.

Data set. Identifiable collection of data (ISO 19101*).

Data set series. Collection of data sets sharing the same product specification (ISO 19115*).

Datum. Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities (ISO 19104*).

Digital Elevation Model (DEM). The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum.

Note.— Digital Terrain Model (DTM) is sometimes referred to as DEM.
Direct transit arrangements. A special arrangement approved by the public authorities concerned by which traffic that is pausing briefly in its passage through the Contracting State may remain under their direct control.

Ellipsoid height (Geodetic height). The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.
Enabling objective. A training objective derived from performance criteria in the competency framework. In order to achieve enabling objectives, a trainee requires skills, knowledge and attitudes.

Error. An action or inaction by an AIS staff member that leads to deviations from criteria.

Error management. The process of detecting and responding to errors with countermeasures that reduce or eliminate the errors or the consequence of errors.

Evidence and assessment guide. A guide that provides detailed information (e.g. tolerances) in the form of evidence that an instructor or an evaluator can use to determine if a candidate meets the requirements of the competency standard.

Feature. Abstraction of real world phenomena (ISO 19101*).
Feature attribute. Characteristic of a feature (ISO 19101*).
Note. — A feature attribute has a name, a data type and a value domain associated with it.
Feature operation. Operation that every instance of a feature type may perform (ISO 19110*).
Note.— An operation upon the feature type dam is to raise the dam. The result of this operation is to raise the level of water in the reservoir.
Feature relationship. Relationship that links instances of one feature type with instances of the same or a different feature type ISO 19101*).
Feature type. Class of real world phenomena with common properties (ISO 19110*).
Note.— In a feature catalogue, the basic level of classification is the feature type.

Geodesic distance. The shortest distance between any two points on a mathematically defined ellipsoidal surface.
Geodetic datum. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.
Geoid. The equipotential surface in the gravity field of the Earth which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.
Note. — The geoid is irregular in shape because of local gravitational disturbances (wind tides, salinity, current, etc.) and the direction of gravity is perpendicular to the geoid at every point.
Geoid undulation. The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.
Note. — In respect to the World Geodetic System — 1984 (WGS-84) defined ellipsoid, the difference between the WGS-84ellipsoidal height and orthometric height represents WGS-84 geoid undulation.
Gregorian calendar. Calendar in general use; first introduced in 1582 to define a year that more closely approximates the tropical year than the Julian calendar (ISO 19108*).
Note. — In the Gregorian calendar, common years have 365 days and leap years 366 days divided into twelve sequential months.

Height. The vertical distance of a level, point or an object considered as a point, measured from a specific datum.

Heliport. An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.
Human Factors principles. Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

Integrated Aeronautical Information Package. A package which consists of the following elements:
— AIP, including amendment service;
— Supplements to the AIP;
— NOTAM and PIB;
— AIC; and
— checklists and lists of valid NOTAM.
Integrity (aeronautical data). A degree of assurance that an aeronautical data and its value have not been lost or altered since the data origination or authorized amendment.
International airport. Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.
International NOTAM office (NOF). An office designated by a State for the exchange of NOTAM internationally.

Knowledge, skills, attitudes (KSA). The skills/knowledge/attitudes are what an individual requires to perform an enabling objective derived from performance criteria. A skill is the ability to perform an activity that contributes to the effective completion of a task. Knowledge is specific information required for the trainee to develop the skills and attitudes for the effective accomplishment of tasks. Attitude is the mental state of a person that influences behavior, choices and expressed opinions.

Logon address. A specified code used for data link logon to an ATS unit.

*Maintenance (continuous)***.** The continuous maintenance of an instrument procedure is an ongoing process triggered by the State aeronautical information services (AIS) through notification of any critical changes to the instrument procedure environment that would necessitate timely revision of the instrument procedure design.

Maintenance (cyclical). The cyclical maintenance of an instrument procedure is a planned systemic review at a predetermined interval of the procedure design.

Mastery test. A test that evaluates a trainee's ability to perform a terminal objective. A mastery test should match as closely as possible the conditions, behaviors and standards of terminal objectives.

Material-dependent training. A well-documented and repeatable training package that has been tested and proven to be effective.

Maneuvering area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.
Metadata. Data about data (ISO 19115*).

Note. — Data that describes and documents data.
Minimum en-route altitude (MEA). The altitude for an en-route segment that provides adequate reception of relevant navigation facilities and ATS communications, complies with the airspace structure and provides the required obstacle clearance.
Minimum obstacle clearance altitude (MOCA). The minimum altitude for a defined segment of flight that provides the required obstacle clearance.
Movement area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the maneuvering area and the apron(s).

Navaid data. Data relating to both ground-based and space-based navigational aids including service volume, frequency, identification, transmission power and limitations of operation.

Navigation specification. A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

> *Required navigation performance (RNP) specification.* A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.
> *Area navigation (RNAV) specification.* A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.
> *Note 1. — The* Performance-based Navigation (PBN) Manual *(Doc 9613), Volume II, contains detailed guidance on navigation specifications.*
> *Note 2. — The term RNP, previously defined as "a statement of the navigation performance necessary for operation within a defined airspace", has been removed from this Annex as the concept of RNP has been overtaken by the concept of PBN. The term RNP in this Annex is now solely used in the context of navigation specifications that require performance monitoring and alerting, e.g. RNP 4 refers to the aircraft and operating requirements, including a 4 NM lateral performance with on-board performance monitoring and alerting that are detailed in Doc 9613.*

NOTAM. A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:
a) are located on an area intended for the surface movement of aircraft; or
b) extend above a defined surface intended to protect aircraft in flight; or
c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.
Obstacle data. Any man-made fixed or temporary object which has vertical significance in relation to adjacent and surrounding features and which is considered as a potential hazard to the safe passage of aircraft, or man-made fixed or temporary objects that extend above a defined surface intended to protect aircraft in flight.

Obstacle/terrain data collection surface. A defined surface intended for the purpose of collecting obstacle/terrain data.
Orthometric height. Height of a point related to the geoid, generally presented as an MSL elevation.

Performance criteria. 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.

Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.
Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.
Portrayal. Presentation of information to humans (ISO 19117*).
Position (geographical). Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid which define the position of a point on the surface of the Earth.
Post spacing. Angular or linear distance between two adjacent elevation points.
Progress test. A test that measures a trainee's ability to meet key enabling objectives.

Precision. The smallest difference that can be reliably distinguished by a measurement process.
Note. — In reference to geodetic surveys, precision is a degree of refinement in performance of an operation or a degree of perfection in the instruments and methods used when taking measurements.
Pre-flight information bulletin (PIB). A presentation of current NOTAM information of operational significance, prepared prior to flight.
Prohibited area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

Quality. Degree to which a set of inherent characteristics fulfils requirements (ISO 9000*).
Note 1. — The term "quality" can be used with adjectives such as poor, good or excellent.
Note 2.— "Inherent", as opposed to "assigned", means existing in something, especially as a permanent characteristic.
Quality assurance. Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000*).
Quality control. Part of quality management focused on fulfilling quality requirements (ISO 9000*).
Quality management. Coordinated activities to direct and control an organization with regard to quality (ISO 9000*).

Radio navigation service. A service providing guidance information or position data for the efficient and safe operation of aircraft supported by one or more radio navigation aids.
Range of variables (conditions). The conditions under which the competency units must be performed.

*Raster map***.** An electronic representation of a cartographic map with properly referenced terrain, hydrographic, hypsometric and cultural data.

Recognized source. A source of data that is either recognized by the State or a source that has professional credentials to provide a specific type of data.

*Reference geodetic datum***.** The numerical or geometrical quantity or set of such quantities (mathematical model) which serves as a reference for computing other quantities in a specific geographic region such as the latitude and longitude of a point. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

Relief. The inequalities in elevation of the surface of the Earth represented on aeronautical charts by contours, hypsometric tints, shading or spot elevations.
Requirement. Need or expectation that is stated, generally implied or obligatory (ISO 9000*).
Note 1.— "Generally implied" means that it is custom or common practice for the organization, its customers and other interested parties, that the need or expectation under consideration is implied.
Note 2.— A qualifier can be used to denote a specific type of requirement, e.g. product requirement, quality management requirement, customer requirement.
Note 3. — A specified requirement is one which is stated, for example, in a document.
Note 4. — Requirements can be generated by different interested parties.
Resolution. A number of units or digits to which a measured or calculated value is expressed and used.
Restricted area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.
Route stage. A route or portion of a route flown without an intermediate landing.

SNOWTAM. A special series NOTAM notifying the presence or removal of hazardous conditions due to snow, ice, slush or standing water associated with snow, slush and ice on the movement area, by means of a specific format.
Stakeholder. An individual or party with vested interests in AIS data and products.

Standard instrument departure (SID). A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of flight can be commenced.

Standard terminal arrival (STAR). A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

Station declination. An alignment variation between the zero degree radial of a VOR and true north, determined at the time the VOR station is calibrated.

Terminal arrival altitude (TAA). The lowest altitude that will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an arc of a circle defined by a 46 km (25 NM) radius centered on the initial approach fix (IAF), or where there is no IAF on the intermediate approach fix (IF), delimited by straight lines joining the extremity of the arc to the IF. The combined TAAs associated with an approach procedure shall account for an area of 360 degrees around the IF.

Terminal objective. A training objective derived from a competency element in the competency framework which a trainee will achieve when successfully completing instruction.

*Terminating event***.** A cue or indicator that a task has been completed.

Terrain. The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles.
Note.— In practical terms, depending on the method of data collection used, terrain represents the continuous surface that exists at the bare Earth, the top of the canopy or something in-between, also known as "first reflective surface".
*Terrain data***.** Data pertaining to the natural surface of the Earth excluding man-made obstacles, and

can be represented as a cartographic map, an electronic raster map, an electronic vector data map or an electronic Digital Elevation Model (DEM).

Traceability. Ability to trace the history, application or location of that which is under consideration (ISO 9000*).
Note. — When considering product, traceability can relate to the:

- *— origin of materials and parts;*
- *— processing history; and*
- *— distribution and location of the product after delivery.*

*Training objective***.** A clear statement that is comprised of three parts, i.e. the *desired performance* or what the trainee is expected to be able to do at the end of particular stages of training, the *performance standard* that must be attained to confirm the trainee's level of competence and the *conditions* under which the trainee will demonstrate competence.

*Training provider***.** In the context of this manual, a body that provides AIS personnel training.

*Triggering event***.** A cue or indicator that a task should be initiated.

Validation. Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled (ISO 9000*).
*Vector data***.** The digitized version of graphic or rasterized data, usually having three-dimensional attributes.

Verification. Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled (ISO9000*).
Note 1. — The term "verified" is used to designate the corresponding status.
Note 2. — Confirmation can comprise activities such as:

- *— performing alternative calculations;*
- *— comparing a new design specification with a similar proven design specification;*
- *— undertaking tests and demonstrations; and*
- *— reviewing documents prior to issue.*

* ISO Standard
9000 — *Quality Management Systems — Fundamentals and Vocabulary*
19101 — Geographic information — Reference model
19104 — Geographic information — Terminology
19108 — Geographic information — Temporal schema
19109 — Geographic information — Rules for application schema
19110 — Geographic information — Feature cataloguing schema
19115 — Geographic information — Metadata
19117 — Geographic information — Portrayal
19131 — Geographic information — Data product specification

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ADD ANY ADDITIONAL TERMS

[1] This statement in the manual does not imply that the State authority must approve/certify the training course/program
[2] Refer to ICAO Annex 15 Chapter 3, 3,2 Quality Management System