Edition 1.0
Edition date: 27/08/2009
Reference nr: EUROCONTROL-SPEC-132
ISBN: 978-2-87497-041-2

EUROCONTROL Specifications

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Edition Number	:	1.0
Edition Date	:	27/08/2009
Status	:	Released Issue
Intended for	:	CND Stakeholders

DOCUMENT CHARACTERISTICS

TITLE		
EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training		
Document Identifier	**Edition Number:**	1.0
	Edition Date:	27/08/2009

Abstract

This document contains the Specification for ATSEP Common Core Content Initial Training.

It includes a main body of text, explaining the background, context, applicability and principles applied to implementation of the Specification, and seven annexes which detail the training objectives for the various Basic and Qualification syllabi.

Keywords

Specification	Basic	Communication	Navigation
Surveillance	Data Processing	SMC	Safety

Contact Persons	Tel	Unit
Ashley LAURYSSEN	+352-43.60.61.942	Training Development and Harmonisation (TDH) Unit

STATUS, AUDIENCE AND ACCESSIBILITY					
Status		**Intended for**		**Accessible via**	
Working Draft	☐	General Public	✓	Intranet	☐
Draft	☐	CND Stakeholders	☐	Extranet	☐
Proposed Issue	☐	Restricted Audience	☐	Internet (www.eurocontrol.int)	✓
Released Issue	✓				

DOCUMENT APPROVAL

The following table identifies all management authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE
Chairman HRT Training Focus Group (TFG)	Michel PISTRE	22/07/2009
Chairman Human Resource Team (HRT)	Alexander SKONIEZKI	22.7.2009
Deputy Director Single European Sky Implementation	Jean-Luc GARNIER	26/08/09
On behalf of the Director General, by special delegation. Director CND	Bo REDEBORN	27/8/09

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION NUMBER	EDITION DATE	INFOCENTRE REFERENCE	REASON FOR CHANGE	PAGES AFFECTED
1.0	27/08/09		Released Issue	All

CONTENTS

FIGURE LOCATION

EXECUTIVE SUMMARY

The **EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training** contains the minimum training requirement for Air Traffic Safety Electronics Personnel (ATSEP) Basic and Qualification Training.

Initial Training (Basic + Qualification) is the phase prior to System/Equipment Rating Training; therefore the training received during Initial Training will not be sufficient to permit operational competence.

For the purposes of this Specification, the term ATSEP is used to describe “engineering and technical personnel undertaking operational safety related tasks”.

This document is the first edition of an ATSEP training document that has been classified as a EUROCONTROL Specification and is the result of a major review conducted by the ATM Technical Staff Task Force. It replaces the following training guideline documents:

- Guidelines for a Common Basic Level of Technical Training for Air Traffic Safety Electronics Personnel. Edition 3.0
- Guidelines for a Common Qualification Level of Technical Training for Air Traffic Safety Electronics Personnel. Edition 2.0

This Specification shall be used by Training Providers and Regulators to ensure that all relevant training objectives have been included in any courses that are intended to be Common Core Content compliant.

The main body of the Specification contains information relevant to the background, context, applicability and use. It is necessary to understand the fundamental principles covered in this document prior to examining the specific training syllabi.

Associated with the Specification are seven separate Annexes. Each Annex contains a syllabus –

Annex 1: Basic

Annex 2: Qualification: Communication

Annex 3: Qualification: Navigation

Annex 4: Qualification: Surveillance

Annex 5: Qualification: Data Processing

Annex 6: Qualification: SMC

Annex 7: Qualification: Shared

Page intentionally left blank

1. Introduction

The **EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training** contains the minimum training requirement for Air Traffic Safety Electronics Personnel (ATSEP) Basic and Qualification Training. It consists of a main body of text (i.e. this document), explaining the fundamental principles for understanding and applying the various syllabi and seven Annexes. The annexes contain the syllabi.

It is anticipated that through a future amendment to the Commission Regulation (EC) No 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation services, the objectives contained within this Specification, will become referenced as the minimum training requirement to be applied to learner ATSEPs undertaking Initial Training.

2. Drafting Conventions

The following drafting conventions are used within this document:

- "Shall" – indicates a statement of specification, the compliance with which is mandatory to achieve the implementation of the EUROCONTROL Specification.
- "Should" – indicates a recommendation, the compliance with which is encouraged to achieve best possible implementation of the EUROCONTROL Specification.
- "May" – indicates a discretionary element.

3. Background

The main objective of the **EATMP Human Resources Programme (HRS) Stage 1** document was to develop an ATM[1]-specific human resources/human factors toolbox (concept, methods and tools), which would –

- *enable an adequate number of qualified staff to provide a harmonised and consistent service delivery;*
- *ensure the best use of new technology;*
- *provide for a smooth transition towards the evolving European ATM systems*.

The HRS Programme Stage 1 included the Training Sub-Programme, defined as follows –

To provide ANS Providers for all ATM areas with training material, methods and tools, in order to enable a common minimum standard of training which will evolve to meet the future

[1] Where ATM is referenced in this document, it is drawn from previous material and in the context of this document should be taken to mean CNS/ATM

introduction of system changes and will enable the implementation of regulatory requirements for ATM services personnel licensing.

Under the auspices of the EATCHIP Programme and later EATM Programme, the Human Resources Team delegated responsibility for the Air Traffic Services training to its Training Sub-Group, today known as the Training Focus Group.

TSG initiated a task force which produced, in 1996, the “Guidelines for a Common Basic level of Technical Training for ATM Technical Staff”.

In 1998, a second task force named the Working Group for ATM Technical Staff (WGATMTS) was formed and tasked with the development of the “Guidelines for a Common Qualification Level of Technical Training for Air Traffic Safety Electronics Personnel” (published in October 2003) and producing a revised edition of the original basic level document (published in April 2004).

> Note: - To ensure consistency with other international working groups and documentation, the term “technical staff” was replaced, in 2003, with the term “Air Traffic Safety Electronics Personnel” (ATSEP).

At its 11th Air Navigation Conference in September 2003, ICAO expressed the view that the training, qualification and competency of Air Traffic Safety Electronics Personnel (ATSEP) needed to be addressed.

In 2004, ICAO released the ICAO Training Manual Doc 7192-AN/857 **Part E-2** for ATSEP as a Guideline under the responsibility of the ICAO Secretary General. The EUROCONTROL Basic and Qualification Guidelines were used as an input into this manual.

The manual addresses the training requirements for this technical group or personnel that are recognised as Air Traffic Safety Electronics Personnel (ATSEP) and has been developed to be generic, as much as possible to provide the flexibility needed to address future systems/equipment.

To complete the training documents for ATSEP, the task force developed the “Guidelines for a Common System/Equipment Rating Training for Air Traffic Safety Electronics Personnel” which was published in April 2006.

In 2007, the ATM Technical Staff Task Force (formerly the WGATMTS) amended the “Guidelines for a Common Qualification Level of Technical Training for Air Traffic Safety Electronics Personnel” to include an additional but optional System Monitoring and Control domain syllabus.

In November 2007, the ATM Technical Staff Task Force started a major review of the objectives contained within the Basic and Qualification Training syllabi, with a view to integrating and upgrading the documents from Guidelines to a EUROCONTROL Specification. This review was completed in January 2009. The result of this review and the subsequent formal consultation is the current EUROCONTROL Specification for ATSEP Common Core Content Initial Training (ATSEP CCC Initial Training Specification).

4. Status and Relationship with other documents

The ATSEP CCC Initial Training Specification has been produced with the expectation that it will be referenced in an amendment to the Commission Regulation (EC) No 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation

services, as the minimum training standard for Initial Training of ATSEPs.

It is important to understand the status of this document before it is referenced in the EC Regulation 2096/2005, and its anticipated applicability after the regulation has been amended.

4.1 Status as a EUROCONTROL Specification

This document is classified within the EUROCONTROL Regulatory and Advisory Framework (ERAF) as a EUROCONTROL Specification.

EUROCONTROL Specifications are defined as “detailed technical specifications for physical characteristic, configuration, material, data, performance, personnel or procedure, the compliance with which is recognised as meeting requirements for safe and efficient systems and services for ATM in the EUROCONTROL Member States, as defined by EUROCONTROL regulatory material”.

EUROCONTROL Specifications are normally used as means of compliance with EUROCONTROL Rules, and as Community Specifications when they have been introduced into the EC legal order.

However, in the case of the ATSEP CCC Initial Training Specification, currently there is no explicit link with a EUROCONTROL Rule. Having taken into consideration the anticipated amendment to the EC Regulation 2096/2005, a EUROCONTROL Specification was deemed to be the most appropriate classification for this document.

4.1.1 Relationship with ESARR5

The ATSEP CCC Initial Training Specification was published well after the release of ESARR5 Ed. 2.0. Consequently, there is no explicit reference to this Specification as either a minimum training requirement or a means of compliance. Therefore, in relation to ESARR5, the applicability of ATSEP CCC Initial Training Specification is not detailed.

The ATSEP CCC Initial Training Specification provides support for the ESARR5 requirement that “*technical and engineering personnel are properly trained and qualified to perform the assigned tasks*.”[2] This support is limited to the Initial Training of ATSEPs.

ESARR5 has provided definitions for “ATM engineering and technical personnel undertaking operational safety related tasks” and “ATM equipment approved for operational use”. These definitions have been respected in this Specification and will be used in Section 6 when dealing with the applicability of the minimum training requirement.

4.1.2 Relationship with ESARR5 Guidance Material

There is no explicit relationship between ESARR5 Guidance Material and the ATSEP CCC Initial Training Specification. Any information in the guidance material that was considered applicable to the Specification has been included as appropriate.

[2] ESARR5 Ed. 2.0 para 5.3.2 a).

4.2 Future Relationship with Commission Regulations

As has been stated previously in this document, it is anticipated that through an amendment to the EC Regulation 2096/2005, this Specification will be referenced as the minimum training requirement for ATSEPs undergoing Initial Training. It is most likely that any amendment made to the EC Regulation 2096/2005 will not duplicate the contents of this Specification, but rather reference this Specification as the minimum training requirement.

Since the precise text for the amendment to the EC Regulation is not available at the time of publishing this Specification, it is not yet possible to definitively describe the impact of the changed Regulation. However, Member States should be aware that the amendment to the Regulation is very likely to change the applicability of this Specification from a non-mandatory to a mandatory application.

4.3 Relationship with other EUROCONTROL ATSEP documents

There are two additional EUROCONTROL documents that are concerned with ATSEP training and competence activities. ATSEP CCC Initial Training Specification interacts with these documents in the manner described below –

4.3.1 Guidelines for a Common System/Equipment Rating Training for ATSEP

The ATSEP CCC Initial Training Specification relates to the S/E Rating Training Guideline in the context of a learner completing their Initial Training and then continuing their training towards operational competence. The completion of the training objectives in the Initial Training phase is considered to be the minimum required to enable a learner ATSEP to start the S/E Rating training. S/E Rating Training is also the final training phase before undertaking assessment to achieve operational competence on particular systems and/or equipment.

4.3.2 EUROCONTROL Specification – Competence Assessment of ATSEP

The Competence Assessment of ATSEP document is also a EUROCONTROL Specification and therefore, in ERAF terms, has the same classification as the ATSEP CCC Initial Training Specification. These two documents are intended to complement each other.

5. Training Context

ATSEP training is divided into four phases. Initial training is comprised of the Basic and Qualification Training. The following section briefly describes overall ATSEP training, so as to put the Initial Training phase in its correct context.

Note – the term “learner” is the generic term for the person performing a learning activity without any reference to his/her status.

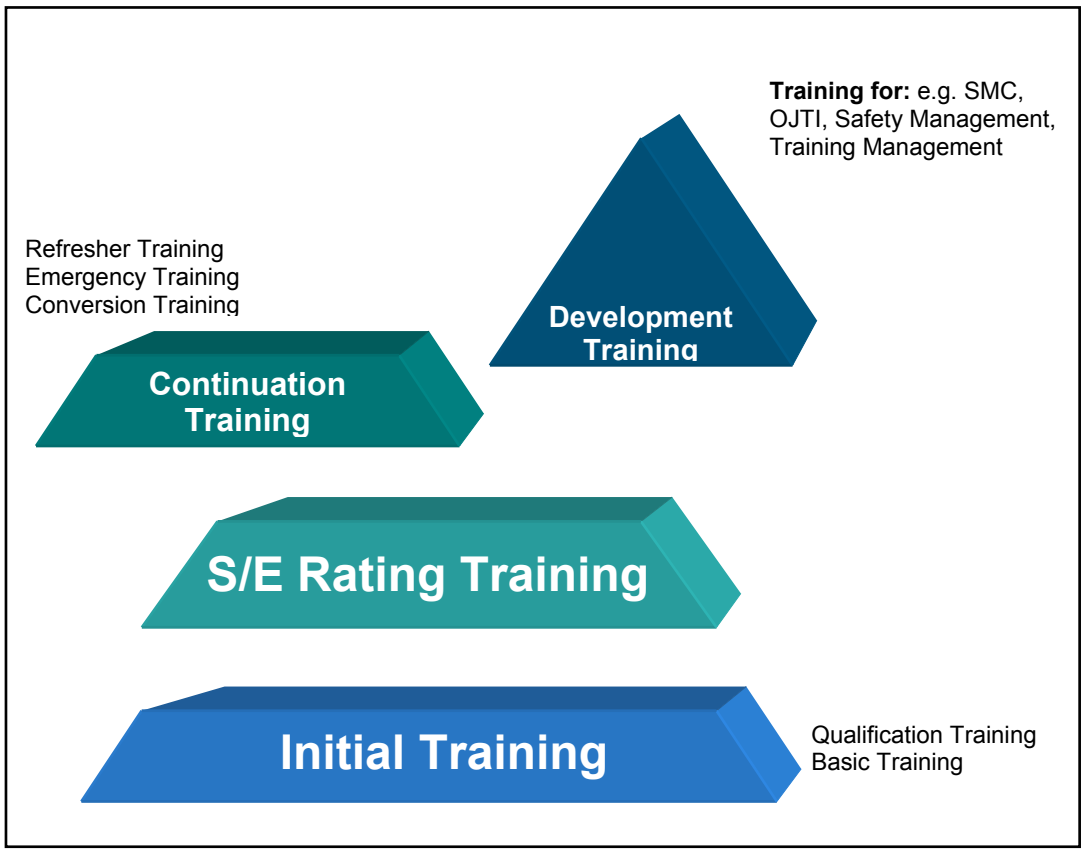

Figure 1: Progression of ATSEP Training

5.1 Initial Training

Training that precedes the System/Equipment Rating Training. It includes Basic Training and Qualification Training.

5.1.1 Basic Training

Training designed to impart fundamental knowledge of the CNS/ATM environment and skills applicable to all learner ATSEPs.

5.1.2 Qualification Training

Training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control (SMC). In addition a group of generic subjects were identified that are applicable to all ATSEPs.

16 streams have been identified and represent generic profiles built according to the ATSEP roles.

Note: - A stream is a cluster of training objectives that support a particular area of work within a domain.

The streams described in this document are –

- COM – Voice Stream
- COM – Data Stream
- NAV – NDB Stream
- NAV – DF Stream
- NAV – VOR Stream
- NAV – DME Stream
- NAV – ILS Stream
- NAV – MLS Stream
- SUR – PSR Stream
- SUR – SSR Stream
- SUR – ADS Stream
- DAT – DP Stream
- SMC – COM Stream
- SMC – NAV Stream
- SMC – SUR Stream
- SMC – DAT Stream

In a minimum of one specialised technical domain, ATSEPs are trained for one or more streams that correspond with the system/s and equipment that they will eventually work with.

At the end of Qualification Training a learner ATSEP shall have the ability to identify and solve generic but realistic problems related to an area of expertise. The learner ATSEP should be able to act efficiently when faced with a set of scenarios. These scenarios are mastered because the ATSEP has acquired the required knowledge and the ability to use this knowledge at an appropriate time and in a relevant manner.

5.2 System/Equipment Rating Training

Training designed to impart system/equipment-related knowledge and skills leading towards operational competence.

With respect to the ATSEP role/s, training progression is performed through the completion of Initial Training and the series of actions described as S/E Rating training (additional academy or manufacturer training, On-site Training, mentoring and consolidation of experience).

5.3 Continuation Training

Training designed to augment existing knowledge and skills and/or to prepare for new technologies. This training is given to operationally competent personnel and it includes Refresher, Emergency and Conversion training.

5.3.1 Refresher Training

Training designed to review, reinforce or upgrade existing knowledge and skills (including team skills).

5.3.2 Emergency Training

Training designed to broaden knowledge, skills and behaviour in the case of an emergency, unusual or degraded situation. Most of the training will be site-specific or may make use of incident or accident analysis:

Emergency

A serious, unexpected and potentially dangerous situation requiring immediate action/s.

e.g. Complete loss of any of the following – radar display picture, Electronic Flight Progress Strip system, loss of main, standby and emergency communications on multiple frequencies due to external interference blocking the R/T channels.

Unusual situation

A set of circumstances which are neither habitually nor commonly experienced and for which an ATSEP has not developed a practiced response.

The essential difference to an emergency situation is that the element of danger or serious risk is not necessarily present in an unusual situation.

e.g. Pilots are reporting received 'pre-departure clearance' data communications are corrupt and reverting to ATC - Pilot R/T departure clearances.

Degraded situation

A situation that is the result of a technical system failure or malfunction or a set of circumstances arising from human error or violation of rules affecting the quality of the service provided (i.e. the service continues to be available, even though in a reduced or limited fashion).

e.g. External mains supply failure to a Category III ILS localiser field site cabin. A normally dual channel DME having a fault on one channel.

5.3.3 Conversion Training

Training designed to provide knowledge and skills appropriate to a change in domain (new stream or new S/E rating), environment (new procedures, new location) or system (system upgrade or change).

5.4 Development Training

Training designed to provide additional knowledge and skills demanded by a change in job profile, e.g. safety management, OJT, training management, SMC.

6. Applicability of the Minimum Training Requirement

This section first explains the complexities involved in determining an Initial Training minimum training requirement and then describes who this minimum training requirement shall apply to.

ATSEPs work on a wide range of CNS/ATM systems and equipment, each of which requires training to achieve specific skills that will eventually lead to operational competence. However, the ways in which ATSEP functions and/or tasks are defined and assigned to individuals, will vary from one organisation to another.

These differences in the way the ATSEP job is characterised throughout Europe makes it impractical to prescribe a "one-size-fits-all" minimum training requirement that will satisfy all the various different organisational arrangements and, at the same time achieve a relevant and valid range of competences for all.

What is agreed is that all ATSEPs achieve a minimum required level of operational competence that allows them to perform safety related tasks with the specific equipment or systems they will be working with. These competencies apply to all ATSEPs, irrespective of the organisation they work for, their location or the composition of their functions. This competence is achieved at the end of S/E Rating Training. Initial Training is the phase prior to S/E Rating Training; therefore the minimum training received during Initial Training will not be sufficient to permit operational competence. It will however, be sufficient to prepare a learner to start the S/E Rating Training.

Furthermore, the minimum training requirement, as described in this "Initial Training" document does not encompass all the possible roles and responsibilities that engineers and technicians may eventually be in involved with. It is acknowledged that in some organisations, ATSEPs may have additional responsibilities that are outside the scope and applicability of this Specification.

For the purposes of this Specification, the term ATSEP is used to describe "*engineering and technical personnel undertaking operational safety related tasks*".

This Specification has adopted, from ESARR5, the definition for "engineering and technical personnel undertaking operational safety related tasks", namely –

> **Personnel who operate and maintain ATM equipment approved for operational use**.
>
> (*Note: this definition is not intended to cover other equipment related functions, such as design, testing, commissioning and institutional training.*)

And, "ATM equipment approved for operational use" is defined as –

> **All engineering systems, facilities or devices that have been operationally released to be used either by airspace users (e.g. ground navigation facilities) directly, or are used in the provision of operational air traffic management services.**
>
> (*Note: These comprise the systems, facilities and devices operated or supervised by the Operating Organisation and serving the purpose of air navigation, regardless of whether the products used to fulfil the tasks involved in air traffic management are generally available on the market or have been specifically developed to air traffic management requirements.*)

The minimum training requirement, contained within the Initial Training, shall apply to all learner ATSEPs. This minimum training requirement (and how it is put into practice) is defined in Section 7.

Note 1: - The minimum training requirement is not applied retrospectively to currently rated ATSEPs.

Note 2: - When an ATSEP converts from one stream to another, the objectives contained within the new qualification stream that have not previously been achieved, shall be completed.

Note 3: - For future or emerging technologies (e.g. GBAS, Multi Static PSR) , where the procedures and training have not reached a level of maturity that enables a dedicated stream to be developed, ANSPs may determine their own training and/or use an appropriate existing stream. Later reviews of this Specification will take into consideration these technologies.

Note 4: - There are various references in this document to systems and equipment. All references relate to the ESARR5 definition above for "ATM equipment approved for operational use."

6.1 Applicability of SMC Training

There are two recognised routes to achieving SMC competence and organisations are free to choose which route is most appropriate for their environment.

Note: - Both SMC routes may be used by individuals/operating organisations at different times during the individual's career.

In some organisations, system monitoring and control of operational CNS/ATM system/equipment tasks are performed after initial domain competence (C, N, S, or DP) has been achieved, and appropriate SMC development training completed. This route is considered to be the **development route** to SMC competence. Development training is not described in this document; however the objectives in the SMC stream shall be completed as part of the training.

The alternative option, employed by some organisations, is to train for SMC duties, directly after Basic Training. This is based on an arrangement where SMC operators perform level A tasks. If level B tasks are required, these are performed under supervision or are delegated to appropriately qualified staff (see Appendix 2 where level rated tasks A to C are defined). This route is considered to be the **direct route** to SMC competence. Organisations that elect this route shall be required to comply with the minimum training requirement specified in one or more of the SMC streams specified in Figure 3 (Granulation Table).

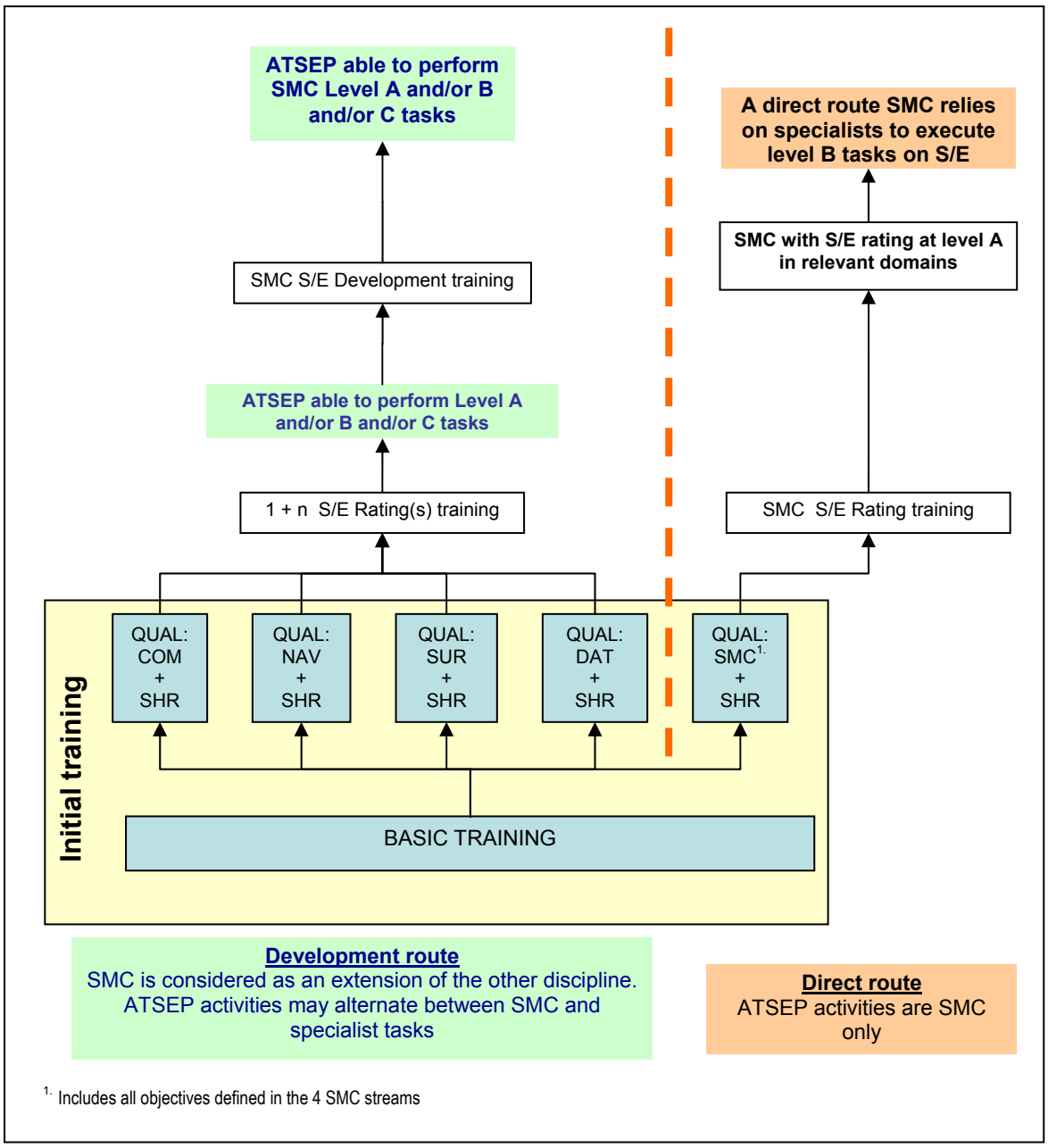

Figure 2: SMC Development and Direct routes

7. Minimum Training Requirement

The minimum training requirement is the minimum that learner ATSEPs shall satisfy.

The following sub-sections describe the minimum training requirement for the Initial Training i.e. Basic + Qualification Training.

In some instances, particularly where the learner ATSEPs have previously obtained technical or engineering-related qualifications (e.g. engineering degrees and/or other diplomas), the objectives contained within this Specification need not be re-taught. If it can be verified and/or demonstrated that a learner ATSEP has already satisfied the performance requirements of the appropriate objectives, then these need not be retaught. The verification and/or demonstration of performance requirements shall be recorded.

Note: This document is intended to describe the minimum training requirement only. The manner in which the above the objectives are verified or demonstrated are outside of the scope of the document.

7.1 Basic Training

The training objectives detailed in the Basic Training syllabus are common to all learner ATSEPs undergoing Initial Training.

Completion of all Basic Training objectives is not a pre-requisite to starting Qualification Training. Basic Training objectives shall be satisfied by the end of Initial Training. Nonetheless, for pedagogical reasons, it is recommended that the sequence of Basic then Qualification training is respected.

7.2 Qualification Training

The minimum training requirement is applied to learner ATSEPs during Qualification Training by determining which equipment and system/s the ATSEP will ultimately be working with and then associating these systems and/or equipment with the appropriate stream/s in the Granulation Table in Figure 3.

An ATSEP whose tasks and activities will require him/her to work with a combination of systems and/or equipment shall, during the Qualification Training, satisfy all the objectives in all the relevant streams, however, objectives that are common to both columns need only be satisfied once.

Single stream example – An ATSEP, who once operationally competent, is going to be responsible for data processing functions, will be required to complete all the objectives in the yellow stream column called "**DAT – DP"** which includes all the objectives in the Data Processing and Shared domains, and also some appropriate objectives from the Communication and Surveillance domains

Multiple stream example - An ATSEP who, once operationally competent, will be responsible for ILS, DME and PSR, will be required to complete all the objectives in the light brown stream columns called "**NAV – ILS"** and **"NAV – DME"** plus the light blue stream column called **"SUR-PSR"**.

Most of the objectives in the two light brown columns are common and therefore need only be taught once. Within the Navigation domain, only the objectives from the subjects "GBS-ILS" and "GBS- DME" are not common.

The SUR-PSR stream objectives will also need to be taught, however the objectives contained within the Shared domain (Safety, Health and Safety, Human Factors) need only be taught once because they are common to all streams.

Domain	Subject	Topic	Sub-Topic	COM – Voice Strm	COM – Data Strm	NAV – NDB Stream	NAV - DF Stream	NAV - VOR Stream	NAV – DME Stream	NAV - ILS Stream	NAV – MLS Stream	SUR – PSR Stream	SUR – SSR Stream	SUR – ADS Stream	DAT – DP Stream	SMC– COM Stream	SMC – NAV Stream	SMC – SUR Stream	SMC – DAT Stream
COMMUNICATION	1 Voice	1 Air-Ground	1.1 to 1.3	x															
			1.4 Controller Working Position	x												x			
			1.5 Radio Interfaces	x															
		2 Ground-Ground	2.1 Interfaces	x												2.1.1			
			2.2 Protocols	x															
			2.3 Switch	x												x			
			2.4 Communication Chain	x															
			2.5 Controller Working Position	x												x			
	2 Data	1 Introduction to Networks	ALL		x										x				
		2 Protocols	ALL		x										x				
		3 National Networks	3.1 National Networks		x										x				
		4 European Networks	4.1 Network Technologies		x											x	x	x	x
		5 Global Networks	5.1 to 5.5		x											x	x	x	x
			5.6 Networks on board of Aircraft		x														
			5.7 Air-Ground Applications		x											x	x	x	x
	3 Transmission Path	1 Lines	ALL	x	x														
		2 Specific Links	ALL	x	x														
	4 Recorders	1 Legal Recorders	ALL	x	x											x	x	x	x
	5 Functional Safety	ALL	ALL	x	x														
NAVIGATION	1 Performance Based Navigation	1 Nav Concepts	1.1 to 1.3			x	x	x	x	x	x								
			1.4 NOTAM			x	x	x	x	x	x					x	x	x	x
	2 GBS - NDB	1 NDB/Locator	1.1 Use of the System			x											x		
			1.2 to 1.7			x													
	3 GBS - DF	1 DF	1.1 Use of the System				x										x		
			1.2 to 1.6				x												
	4 GBS - VOR	1 VOR	1.1 Use of the System					x									x		
			1.2 to 1.8					x											
	5 GBS - DME	1 DME	1.1 Use of the System						x								x		
			1.2 to 1.10						x										
	6 GBS - ILS	1 ILS	1.1 Use of the System							x							x		
			1.2 to 1.9							x									
	7 GBS- MLS	1 MLS	ALL								x								
	8 GNSS	1 GNSS	1.1 General View			x	x	x	x	x	x								
	9 On board Equip	ALL	ALL			x	x	x	x	x	x								
	10 Functional Safety	ALL	ALL			x	x	x	x	x	x								

SURVILLANCE	1 Primary	1 ATC Surveillance	1.1 Use of PSR for ATS									x			1.1.1			1.1.1	1.1.1
			1.2 to 1.8									x							
		2 SMR	ALL									x							
		3 Test and Measurement	3.1 Test and Measurement									x							
	2 Secondary	1 SSR and MSSR	1.1 Use of SSR for ATS										x		1.1.1			1.1.1	1.1.1
			1.2 to 1.8										x						
		2 Mode S	2.1 Introduction to Mode S										x		x			x	x
			2.2 Mode S System										x						
		3 Multilateration	3.1 MLAT in use										x						
			3.2 MLAT Principles										x		x			x	x
		4 SSR Environment	4.1 SSR Environment										x						
	3 ADS	1 General view on ADS	ALL											x					
		2 ADS-B	ALL											x					
		3 ADS-C	ALL											x					
	4 HMI	1 HMI	1.1 ATCO HMI									x	x	x	x			x	x
			1.2 to 1.4									x	x	x					
	5 Surveillance Data Transmission	1 Surveillance Data Transmission	1.1 Technology and Protocols									x	x	x	x			x	x
			1.2 Verification Methods									x	x	x					
	6 Functional Safety	1 Safety Attitude	ALL									x	x	x					
		2 Functional Safety	ALL									x	x	x					
DATA PROCESSING	1 Functional Safety	1 Functional Safety	1.1 Functional Safety												x				
			1.2 Software Integrity and Security												x				
		2 Safety Attitude	ALL												x				
	2 DP Systems	1 User Requirements	ALL												x				x
		2 System Components	2.1 to 2.2												x				
			2.3 Surveillance DP Systems									x	x	x	x				
	3 Process	1 Software Process	ALL												x				
		2 Hardware Platform	2.1 to 2.3												x				x
			2.4 Maintainability												x				
		3 Testing	3.1 Testing												x				
	4 Data	1 Data Essential Features	ALL												x				x
		2 ATM Data – D Structure	ALL												x				
SMC	1 ANS Structure	ALL	ALL													x	x	x	x
	2 ANS S/E	ALL	ALL													x	x	x	x
	3 SMC TPP	ALL	ALL													x	x	x	x
	4 Technology	1 Technology & Principles	1.1 General													x	x	x	x
			1.2 Communication													x			
			1.3 Navigation														x		
			1.4 Surveillance															x	
			1.5 Data Processing																x
			1.6 Facilities													x	x	x	x

Figure 3: Granulation Table

8. How to use this document

8.1 Training Provision

This document shall be used as a traceable reference when designing Common Core Content compliant courses.

The structure, duration and composition of these courses shall be decided by ANSP organisations and/or their training providers and approved by the NSA. The final course(s) that are developed shall ensure that, as a minimum, all the objectives from the Basic Training and each Qualification stream selected, are satisfied.

Courses may include additional objectives that are deemed necessary e.g. objectives specific to the national or local environment.

The Basic Training course may be provided as a stand-alone course, or as part of a larger Initial Training course.

The Qualification Training may be provided as a stand-alone course/s, or as part of a larger course.

8.2 Regulators

Regulators shall use this document as a reference when approving or auditing courses, to ensure that training courses contain the required elements of the ATSEP CCC Initial Training.

So as to ensure that the CCC minimum training requirement has been applied correctly, regulators shall be familiar with the fundamental principles pertaining to CCC training.

8.3 Specification Structure

The ATSEP CCC Initial Training Specification consists of a main body of text (i.e. this part of the document), explaining the fundamental principles for understanding and applying the Specification, and seven separate Annexes containing the syllabi.

It is necessary to understand the fundamental principles of the Common Core Content before proceeding to the syllabi.

BASIC	BSC	Annex 1 – Basic
QUALIFICATION	QUAL:COM	Annex 2 – Qualification: Communication
	QUAL:NAV	Annex 3 – Qualification: Navigation
	QUAL:SUR	Annex 4 – Qualification: Surveillance
	QUAL:DAT	Annex 5 - Qualification: Data Processing
	QUAL:SMC	Annex 6 - Qualification: SMC
	QUAL:SHR	Annex 7 - Qualification: Shared

8.4 Syllabi Structure

The syllabi do not indicate times, training techniques nor order of teaching to achieve the training objective/s.

Each syllabus is divided into subjects, which are divided into topics that are in turn divided into sub-topics. This structure is used to create and classify the objectives: one general objective is linked to each subject. One or several objectives are linked to each sub-topic.

Objectives are assigned to the specific subject that deals with the knowledge and skills fundamentally needed to accomplish the General objective.

Topics, sub-topics and objectives are organised and ordered within each subject for the sole purpose of analysing the document. This clustering is not necessarily always a chronological sequence. It is not an organisation of the instructor duties. The structure of the CCC does not dictate the sequence of a training course.

The number of objectives contained within a sub-topic do not necessarily signify how long it should take to teach that sub-topic. (For example, a sub-topic containing five relatively straight forward objectives, may take a shorter period of time to teach, than another sub-topic containing two complex objectives.)

Each subject is shown as a header to a table. The subject's general objective is attached to this header.

Topics are laid out in rows and may include a topic objective. Sub-topics are laid out in rows. Sub-topics contain objectives. An objective consists of a corpus, taxonomy level and content.

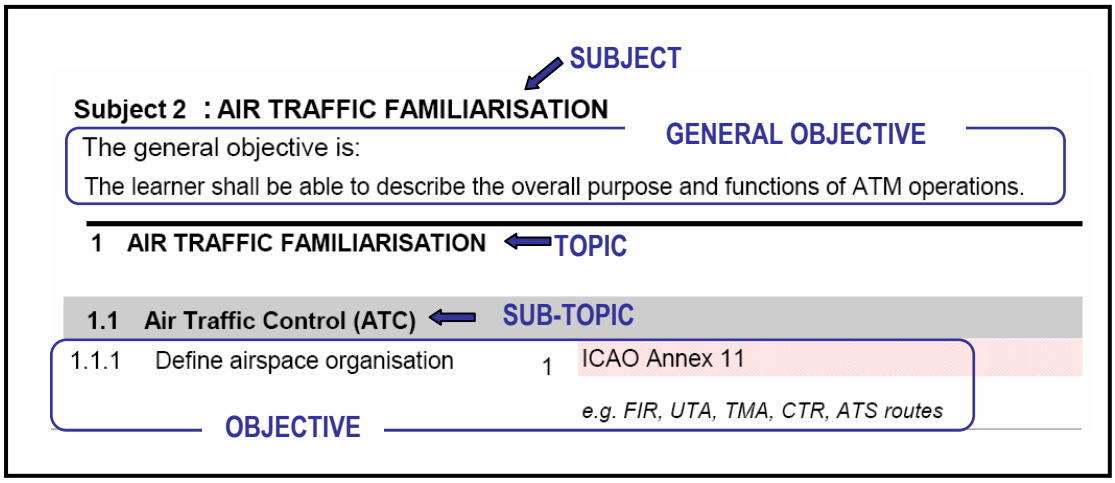

Figure 4: CCC Syllabus lay-out

Objectives, which are also laid out in rows, consist of three parts:

- The first part shows the objective number and corpus
- The second part shows the taxonomy level
- The third part shows the content (explicit or implicit) with a clear indication which items of the content are mandatory (the red shaded area) and which are optional (*small italics*).

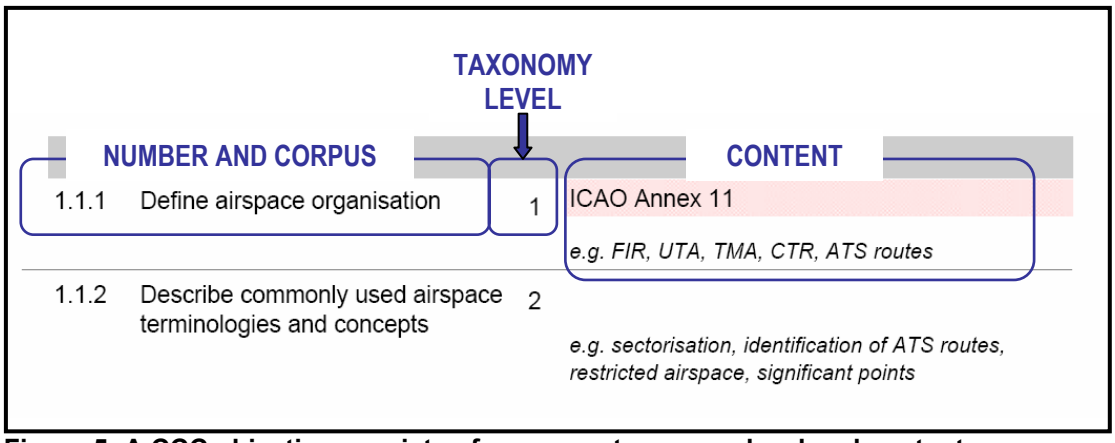

Figure 5: A CCC objective consists of a corpus, taxonomy level and content

8.5 Objectives – Terminology and Use

The CCC syllabi refer to several categories of training objectives which are defined below:

General Objective:		Describes the direction to move in rather than a detailed quantitative objective
Objective:		A clear statement based on a corpus, level and content
	Corpus:	A description of the learner's performance. It always contains an action verb to ensure that the outcome is observable. The action verb is always associated with a defined taxonomy
	Level:	Highlights numerically the taxonomy level of the action verb
	Content:	May be implicit or explicit. (This concept will be explained below)

8.5.1 Corpus

The corpus is a description of the learner performance. Where possible, objectives relate to single activities.

A number of the objectives refer to "generic equipment" within the corpus. In this context, generic equipment is considered to be a piece of equipment and/or didactic device which can be used to meet the objective. The equipment/device is not necessarily identical or similar to the operational equipment.

Note: Generic equipment gives flexibility to the course designer. In some instances, operating organisations may, as an alternative to the above, choose to conduct the training on equipment that is similar or identical to the operational equipment that will be used during S/E Rating training.

1.1.2	Adjust a generic radio transmitter	4	Noise, intermodulation, harmonics, power, bandwidth

Figure 6: A CCC objective with generic equipment

The above objective may be achieved through the use of any type of radio transmitter.

8.5.2 Level

The level contained in this column, relates directly to a defined taxonomy for classifying training objectives. The level is always associated with an action verb contained within the corpus.

There are five levels which are defined below.

Level 1	A basic knowledge of the subject. It is the ability to remember essential points, to memorise data and retrieve it
Level 2	The ability to understand and to discuss the subject matter intelligently in order to represent and act upon certain objects and events
Level 3	A thorough knowledge of the subject and the ability to apply it with accuracy. The ability to make use of the repertoire of knowledge to develop plans and activate them
Level 4	Ability to establish a line of action 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
Level 5	Ability to analyse a 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

See Appendix 3 for a list of action verbs (and their associated taxonomy levels) that are used in the Specification

8.5.3 Content

The content illustrates and details the performance.

The content may be composed of two parts – implicit and explicit. The explicit content is what is written in the content field proper to the objective, while the implicit content is not written in the content field of each objective but rather implied in the corpus of the objective and other elements (domain, subject, etc.).

Some conventions are applied to the wording of the explicit content:

- When the items are in a list, each of them is to be addressed. (According to the basic principles of CCC, local items may however be added subject to local training designer judgement.)

- When the items are in a list and terminated by **etc.**, each of them is to be addressed; and it is indicated to the training designer that additional items are foreseen but not of common interest all over the ECAC area.

- In a list, items following **e.g.** are optional. (These are more an illustration of the performance than a detailed specification.)

Even when all of the items are optional the objective has to be performed according to the action verb included.

1.1.2	Describe commonly used airspace terminologies and concepts	2	*e.g. sectorisation, identification of ATS routes, restricted airspace, significant points*

Figure 7: Example with the optional content (e.g.)

In addition to the above mentioned conventions the content is divided in two rows with a clear indication which items of the content are mandatory (the red shaded area) and which are optional (*e.g. italics*)

1.1.1	Define airspace organisation	1	ICAO Annex 11 *e.g. FIR, UTA, TMA, CTR, ATS routes*

Figure 8: Example of mandatory and optional content

9. Additional Note in Content

Contained within the content of some objectives that have been assigned the action verb "Appreciate", is an additional note that elaborates on the ultimate intentions of the objective. The additional note states that – "For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training."

2.4.1	Appreciate the replacement of components in a communication chain in a safe way	3	Continuity of service, communication chain integrity **Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training**

Figure 9: Example of an objective with "Appreciate + additional note"

The choice to use the word “appreciate” instead of the higher taxonomy level objectives that clearly denote practical application or demonstration of complex skills came about when some training providers expressed concern as to whether the practical teaching of these objectives could always be achieved during Initial Training and maintained their position that some of the practical elements could also be taught during S/E Rating training without any negative effect on the final competence of the learner ATSEPs. As a result, a compromise solution was found that will allow training providers to decide for their own training schemes, which training phase it is most appropriate to conduct some of the practical training.

When the verb “appreciate” is used with the additional note, course designers may, as a minimum allow this objective to be taught as a theoretical objective (which is permitted when using “appreciate” i.e. students shall be able to understand a situation and know what is involved in a problem-solving situation, to state a plan without applying it). However, it is acknowledged that these objectives, without any practical application are of extremely limited operational competence value. These objectives shall ultimately be achieved practically before an ATSEP can be considered operationally competent. Since the scope of this Specification does not include the training that shall take place during S/E Rating training, the additional note serves as a reminder that ANSP organisations shall take care to include this practical training in their S/E Rating training schemes.

Additionally, training providers are strongly encouraged, but not obliged, to include as much practical training as possible into the teaching of the “appreciate + additional note” objectives. (As with any CCC objective, it is the minimum that is being specified and training providers can add or improve on the stated objective.)

10. References to other documents

10.1 Document versions

Where an objective or its content refers to other documents (e.g. ICAO Standards and Recommended Practices), users shall take care to use the most recent version of the referenced document/s, or its parts.

10.2 Document references

Where other documents are referenced in the content of an objective, only the title of the document will be stated. It is expected that the course designer will have sufficient knowledge of the subject to be able to extract the relevant information from the document to teach the objective.

10.3 ICAO versus National differences

If an objective or its content is governed by National standards and procedures, which are notified as different to ICAO, the National regulations may be taught instead of ICAO and, as appropriate, applied practically to ensure pedagogical consistency with S/E Rating training. This difference shall be notified to the learner ATSEP, and when practicable, should be explained.

11. Entry Level

There is no entry level qualification prescribed for starting Initial Training. Member States are free to determine the most suitable entry level for their ATSEP learners.

As stated in Section 7, in some instances, not all training objectives will need to be taught to learner ATSEPs. This is usually the case when the entry level of the learner includes some form of previous qualification (e.g. engineering degree or diploma). In this instance, the length of the training and the number of training objectives taught during the Initial Training course will be less than that of a course directed at learners who have little or no engineering or technical qualifications.

The opposite is also true. If the entry level of the learner ATSEP is decided so that no engineering or technical qualifications are required prior to starting the Initial Training, then it may be necessary to include additional objectives in the course that will prepare the learner to deal with the objectives that comprise the minimum training requirement.

12. Assessment

The scope of this Specification is limited to the provision of the minimum training requirement for the Initial Training phase.

Formal assessment shall be undertaken and results shall be recorded for individual ATSEPs to verify that training objectives have been met in accordance with this specification.

Note: For assessment of operational competence, following S/E Rating training, refer to the EUROCONTROL Specification for the Competence Assessment of Air Traffic Safety Electronics Personnel (ATSEP). Ed. 1.0.

13. Document Update Procedures

This document is subject to continuous review and improvement to ensure that the training objectives reflect current training requirements. The document is also expected to evolve following real implementation, as well as advances in technology.

Mechanisms will be established by EUROCONTROL to allow all Stakeholders to actively participate in a continuous review (e.g. through the establishment of electronic or other means to gather feedback). The main objectives of the continuous review are –

- To ensure that new training requirements for new technologies and procedures are identified
- To verify that the content and level of detail of the training remains appropriate

It will be necessary to routinely check this EUROCONTROL Specification for consistency with referenced material and technological developments.

REFERENCES

- EATM Human Resources Team (2008) – *Guidelines for a Common Basic Level of Technical Training for Air Traffic Safety Electronics Personnel.* HRS/TSP-002-GUI-03. Ed. 3.0. Brussels: EUROCONTROL.
- EATM Human Resources Team (2008) – *Guidelines for a Common Qualification Level of Technical Training for Air Traffic Safety Electronics Personnel.* HRS/TSP-002-GUI-02. Ed. 2.0. Brussels: EUROCONTROL.
- EATM Human Resources Team (2008) – *Guidelines for a Common System/Equipment Rating Training for Air Traffic Safety Electronics Personnel.* HRS/TSP-002-GUI-02. Ed. 2.0. Brussels: EUROCONTROL.
- EATM Human Resources Team (2004) – T38. *EATM Training Progression and Concepts*. HRS/TSP-006-GUI-07. Ed. 1.0. Brussels: EUROCONTROL.
- EATMP (2000a) - O3. *Human Resources Programme - Stage 1: Programme Management Plan*. Ed. 1.0. Brussels: EUROCONTROL.
- REGULATION (EC) No 552/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
- COMMISSION REGULATION (EC) No 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation services
- EUROCONTROL Safety Regulation Commission (SRC) (2004). *EUROCONTROL Safety Regulatory Requirements (ESARR) – ESARR1: Safety Oversight in ATM*. Ed. 1.0. Brussels: EUROCONTROL
- EUROCONTROL Safety Regulation Commission (SRC) (2002). *EUROCONTROL Safety Regulatory Requirements (ESARR) – ESARR2: Reporting ad Assessment of Safety Occurrences in ATM*. Ed. 2.0. Brussels: EUROCONTROL
- EUROCONTROL Safety Regulation Commission (SRC) (2000a). *EUROCONTROL Safety Regulatory Requirements (ESARR) – ESARR3: Use of Safety Management Systems by ATM Service Providers*. Ed. 1.0. Brussels: EUROCONTROL
- EUROCONTROL Safety Regulation Commission (SRC) (2001a). *EUROCONTROL Safety Regulatory Requirements (ESARR) – ESARR4: Risk Assessment and Mitigation in ATM*. Ed. 1.0. Brussels: EUROCONTROL
- EUROCONTROL Safety Regulation Commission (SRC) (2002). *EUROCONTROL Safety Regulatory Requirements (ESARR) – ESARR5: ATM Services' Personnel*. Ed. 2.0. Brussels: EUROCONTROL.
- EUROCONTROL Safety Regulation Commission (SRC) (2006). *EAM2/GUI6. Establishment of "Just Culture" Principles in ATM Safety Data Reporting and Assessment*. Ed. 1.0. Brussels: EUROCONTROL.
- ICAO Annex 3 (2007). *Meteorological Services for International Air Navigation*. 16th Ed.

- ICAO Annex 10. *Aeronautical Telecommunications*. Vol I 6th Ed. (2006). Vol II 6th Ed. (2001). Vol III 2nd Ed. (2007). Vol IV 4th Ed. (2007). Vol V 5th Ed. (2001).
- ICAO Annex 11 (2001). *Air Traffic Services*. 13th Ed.
- ICAO Annex 14. *Aerodromes*. Vol I 4th Ed. (2004). Vol II 2nd Ed. (1995)
- ICAO Doc 4444 (2007). *Air Traffic Management*. 15th Ed.
- ICAO Doc 8071 Vol II (2007). *Manual on Testing of Radio Navigation Aids*. 5th Ed.
- ICAO Doc 9613. *Performance Based Navigation Manual*
- ICAO Doc 9849. *Global Navigation Satellite System Manual*.
- EATMP (2003) – *Voice Communication Systems Procurement Guidelines*. Ed. 1.0. Brussels: EUROCONTROL.
- SESAR Consortium. *SESAR Master Plan - D5*. April 2008
- EUROCONTROL (2008) - *Navigation Application & NAVAID Infrastructure for the ECAC Area up to 2020*. Ed. 2.0. Brussels: EUROCNTROL
- EUROCONTROL GNSS Policy SCG/8/AP10 (28/04/08)

CONTRIBUTORS

ATM Technical Staff Task Force (ATM TS TF)

CHAIRPERSON

Ms Ashley Lauryssen	EUROCONTROL IANS

MEMBERS

Mr Thomas BIERWAGEN	Germany, DFS
Ms Teresa BOURBOULI	Greece, HCAA
Mr Jan BRUTSAERT	EUROCONTROL, IANS
Mr Vincent CHENU	France, DSNA
Ms Nuria ESCOFET MARIAS	IFATSEA
Mr John FIELDING	UK, NATS
Mr Peter FIELDING	UK, NATS
Mr Otto GRIMM	Switzerland, Skyguide
Ms Olga KRAVCHENKO	Ukraine, UkSATSE
Mr Francois LEBAILLY	France, DCS/NAS
Mr Frans LIGTHART	The Netherlands, LVNL
Mr Frederic LIORZOU	ETF-JATMWG
Mr Nicolas MARTIN	Spain, Aena
Mr Max MOULIN	France, ENAC
Mr Thomas OSTER	EUROCONTROL CMAC
Mr Michel PISTRE	EUROCONTROL, IANS
Mr Dario SIMUNOVIC	Croatia, Crocontrol
Mr Terry SMITH	UK, CAA SRG
Ms Elisabeth STEINMANN	Switzerland, Skyguide
Mr Philippe TICHADELLE-JUE	France, ENAC
Mr Dany VAN DER BIEST	Belgium, Belgocontrol

PART TIME CONTRIBUTORS

Mr Bart BANNING	The Netherlands, LVNL
Ms Fanny BENAIM	France, ENAC
Mr Jeano DE BOCK	The Netherlands, LVNL
Mr Henri DENIS	France, ENAC
Mr Charlie ELIOT	EUROCONTROL IANS
Mr Jean Michel GROS	France, ENAC
Mr Jean-Marc LOUIS	France, ENAC
Mr Eric MONATE	ETF-JATMWG
Mr Volodymyr OSTANIN	Ukraine, UkSATSE
Ms Helena RAMOS	Portugal, Nav Portugal
Mr Erik SCHEIRLINCKX	IFATSEA
Mr Martin SCHWITTER	Switzerland, Skyguide
Mr Oleksiy SMOLSKYY	Ukraine, UkSATSE
Mr Bertrand SPITZ	France, ENAC

APPENDIX 1 – ABBREVIATIONS AND ACRONYMS

For the purposes of this document the following abbreviations and acronyms shall apply:

AAIM	Aircraft Autonomous Integrity Monitoring
ABAS	Aircraft-Based Augmentation System
ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
A/D	Analogue/Digital
ADEX-P	ATS Data Exchange Presentation
ADS	Automatic Dependent Surveillance
ADS B	ADS - Broadcast
ADS C	ADS – Contract
ADF	Automatic Direction Finder
AFDX	Avionics Full-duplex Ethernet Switch
AFTN	Aeronautical Fixed Telecommunications Network
AGC	Automatic Gain Control
AIC	Aeronautical Information Circular
AIDC	ATS Interfacility Data Communications
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Practicable
AMAN	Arrival Manager
AMHS	Aeronautical Message Handling System
AMSS	Automatic Message Switching System
ANS	Air Navigation Services
ANSP	ANS Provider
APV	Approach Procedure with Vertical guidance
APW	Area Proximity Warning

ARINC	Aeronautical Radio incorporated
ARTAS	ATC Radar Tracker and Server
ASAS	Airborne Separation Assistance/Assurance System
ASM	Airspace Management
ASMGCS	Advanced SMGCS
ASTERIX	All purpose Structured EUROCONTROL Radar Information exchange
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSEP	Air Traffic Safety Electronics Personnel
AUGUR	EUROCONTROL RAIM Prediction Tool
BATAP	“Type-B” Application-to-application Protocol
BDS	Binary data Store
BER	Bit Error Rate
BITE	Built In Test Equipment
B-RNAV	Basic-RNAV
CAA	Civil Aviation Authority
CB	Cumulonimbus
CBT	Computer-based Training
CCC	Common Core Content
CDM	Collaborative Decision Making
CDTI	Cockpit Display of Traffic Information
CFMU	Central Flow Management Unit
CIDIN	Common ICAO Data Interchange Network
CISM	Critical Incident Stress Management
CIV	Civil

CLAM	Cleared Flight Level Adherence Monitoring
CLIMAX	*Multi-station carrier offset mode, with voting override*
CMS	Control and Monitoring System
CNS/ATM	Communication Navigation and Surveillance/Air Traffic Management
CORA	COnflict Resolution Advisory
CORBA	Common Object Request Broker Architecture
COTS	Commercial off-the-Shelf
CPDLC	Controller-Pilot Datalink Communications
CRT	Cathode Ray Tube
CSU	Control Sector Unit
CTR	Control Zone
CVOR	Conventional VOR
CWP	Controller Work Position
DCL	Departure Clearance
DDF	Doppler DF
DDM	Difference of Depth of Modulation
DF	Direction Finding
DLIC	Datalink Initiation Capability
DMAN	Departure Manager
DME	Distance Measuring Equipment
DME/N	DME/Normal
DME/P	DME/Precision
DPSK	Differential Phase Shift Keying
DTMF	Dual tone Modulation-frequency
DVOR	Doppler VOR
EAD	European Aeronautical Database
EAN	European ANSP Network
EASA	European Aviation Safety Agency
EATCHIP	European ATC Harmonisation and Integration Programme

EATM(P)	European ATM (Programme)
EC	European Commission
ECAC	European Civil Aviation Conference
EFQM	European Foundation for Quality Management
EGNOS	European Geostationary Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EHS	Enhanced Mode S
EHT	Extremely High Tension
EJB	Enterprise Java Bean
ELS	Elementary Mode S
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ERAF	EUROCONTROL Regulatory and Advisory Framework
ESARR	EUROCONTROL Safety Regulatory Requirement(s)
ETFMS	Enhanced Tactical FMS
EU	European Union
EUROCAE	European Civil Aviation Electronics
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration *(US)*
FANS	Future Air Navigation Systems
FDP	Flight Data Processing
FDPS	FDP System
FFM	Far Field Monitor
FHA	Functional Hazard Assessment
FIR	Flight Information Region
FMS	Flight Management System
FMTP	Flight Plan Messaging Transport Protocol
FoM	Figures of Merit
FPL	(Filed) Flight Plan

FRUIT	False Reply Unsynchronised in Time
FUA	Flexible Use of Airspace
GALILEO	*Satellite radio navigation system*
GBAS	Ground-Based Augmentation System
GLONASS	GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Global Navigation Satellite System)
GNSS	Global Navigation Satellite System
GP	Glide Path
GPS	Global Positioning System
GRAS	Ground-based Regional Augmentation System
GSA	GNSS Supervisory Authority
GTC	Gain/Time Control
HF	High Frequency
HFDL	High Frequency Datalink
HMI	Human-Machine Interface
HPA	High Power Amplifier
HSI	Horizontal Situation Indication
HV	High Voltage
HW	Hardware
Hz	Hertz
ICAO	International Civil Aviation Organization
IDF	Interferrometric DF
IF	Intermediate Frequency
IFF	Identification Friend/Foe
IFPS	(Integrated) Initial Flight Plan Processing System
ILS	Instrument Landing System
INS	Inertial Navigation System
I/O	Input/Output
IP	Internet Protocol

IRS	Inertial Reference System
IRVR	Instrument Runway Visual Range
I/Q	In phase and Quadrature
ISDN	Integrated Services Digital Network
ISLS	Interrogator Side Lobe Suppression
IISLS	Improved Interrogator Side Lobe Suppression
iTEC	Interoperability Through European Collaboration
ITU	International Telecommunication Union
ISO	International Standards Organisation
JAA	Joint Aviation Authorities
LAM	Local Area Multilateration
LAN	Local Area Network
LAPB	Link Access Protocol, Balanced
LCD	Liquid-Crystal Display
LLZ	Localiser
LNA	Low Noise Amplifier
LVP	Low Visibility Procedures
MDS	Minimum Detectable Signal
MET	Meteorology
METAR	Meteorological Actual Report
MFC	Multi-Frequency Coding
MHz	Megahertz
MIL	Military
MLAT	Multilateration
MLS	Microwave Landing System
MOTNE	Meteorological Operational Telecommunications Network Europe
MRP	Multi-radar Processing
MRT	Multi-radar Tracker
MSAW	Minimum Safe Altitude Warning

MSSR	Mono-pulse SSR
MTBF	Mean Time Between Failure
MTCD	Medium-Term Conflict Detection
MTD	Moving Target Detection
NAVAID	Navigation(al) Aid
ND	Navigation Display
NEAN	North European ADS-B Network
NDB	Non-Directional Beacon
NOP	Network Operations Plan
NOTAM	Notice to Airmen
NPA	Non-Precision Approach
NRA	Non – Radar Area
NSA	National Supervisory Authority
OJTI	On-The-Job-Training Instructor
OLDI	On-Line Data Interchange
OS	Operating System
OSI	Open System Interconnection
OST	On-site Training
OTM	Object Transaction Monitor
PA	Precision Approach
PABX	Private Automatic Branch Exchange
PBN	Performance Based Navigation
PCM	Pulse Code Modulation
PD	Probability of Detection
PENS	Pan-European Fixed Network Services
PFD	Primary Flight Display
PPI	Plan Position Indicator
PRF	Pulse Repetition Frequency
P-RNAV	Precision RNAV

PSD	Phase Sensitive Detector
PSSA	Preliminary System Safety Assessment
PSR	Primary Surveillance Radar
PTT	Post, Telephone and Telegraph *(generic term to identify the provider)*
QoS	Quality of Service
QNH	Q-code for atmospheric pressure at sea level
Qsig	Quality of signal
RAIM	Receiver Autonomous Integrity Monitoring
RAPNET	(European) Regional Aeronautical Packet switched Network *(CBN + DAKOS)*
RAPS	Recording, Analysis, Playback and Simulation system for radar data *(COMSOFT)*
RDP	Radar Data Processing
RCA	Remote Client Application
RF	Radio Frequency
RMI	Relative Magnetic Indicator
RNAV	Area Navigation
RNP	Required Navigation Performance
RPL	Repetitive Flight Plan
RSLS	Receiver Sidelobe Suppression
R/T	Radiotelephony
RTCA	Radio Technical Commission for Aeronautics
RUP	Rational Unified Process
RVR	Runway Visual Range
RX	Receiver
SAR	Specific Energy Absorption Rate
SARPS	Standards And Recommended Practices
SASS	Surveillance Analysis Support System
SASS-C	SASS - Centre
SASS-S	SASS – Sensor

SATCOM	Satellite Communications
SBAS	Space/Satellite-Based Augmentation System
SCAS	Surveillance Coverage Analysis Suite
SCAT-1	Special Category 1
SDM	Sum of Depth of Modulation
SDP	Surveillance Data Processing
S/E	System/Equipment
SELCAL	Selective Calling
SESAR	Single European Sky AM Research
SID	Standard Instrument Departure
SITA	Société Internationale de Télécommunications Aéronautiques *(France)*
SMC	System Monitoring and Control
SMR	Surface Movement Radar
SMS	Safety Management System
S/N	Signal/Noise
SNOWTAM	NOTAM on Snow conditions
SNMP	Simple Network Management Protocol
SPI	Special Pulse Identification *or* Special Position Identification Pulse *(SSR)*
SRC	Safety Regulation Commission *(EUROCONTROL)*
SSA	System Safety Assessment
SSR	Secondary Surveillance Radar
STC	Sensitivity Time Control
STCA	Short-Term Conflict Alert
SV	Supervisor
SW	Software
SWALs	Software Assurance Levels
SWIM	System Wide Information Management
SWR	Standing Wave Ratio

TACAN	UHF Tactical Air Navigation aid
TAF	Terminal Area Forecast
TCAS	Transponder Collision Avoidance System
TCP	Transmission Control Protocol
TDOA	Time Difference on Arrival
TFT	Thin Film Transistor
TIS	Traffic Information Service
TMA	Terminal Area
TRM	Team Resource Management
TX	Transmitter
UAT	Universal Access Transceiver
UBSS	Unix Basic System Software
UHF	Ultra High Frequency
UPS	Uninterruptable Power Supply
UTA	Upper (Traffic) Control Area
VCS	Voice Communications System
VDF	VHF DF Station
VDL	VHF Digital/DataLink
VESDA	Very Early Smoke Detection Alarm
VHF	Very High Frequency
VOLMET	Routine Voice broadcasts for Meteorological Information
VOR	VHF Omnidirectional Radio Range
VORTAC	VOR and TACAN combination
WAAS	Wide Area Augmentation System (US)
WAM	Wide Area Multilateration
WAN	Wide Area Network
WGS84	World Global System 84
X25	Packet Switched Data Network Protocol

APPENDIX 2 – DEFINITIONS

Definitions of Level Rated Tasks

Level-rated tasks represent the categorisation by complexity, knowledge, skills and operational impact. Three categories will usually suffice but could be further sub-divided for highly complex or diverse systems:

- **Level A tasks:** Level A maintenance tasks are primarily associated with immediate service restoration or reconfiguration (“front-panel level”). They are appropriate for staff that has been trained to understand the elements of equipment or system, their interrelationships and functional purpose, but does not require an in-depth knowledge of these elements.
- **Level B tasks:** Level B maintenance tasks involve in-depth fault analysis at the system/equipment level (“functional level”). They are usually carried out by staff that has been trained for the more complicated maintenance tasks on the equipment/system.
- **Level C tasks:** Level C maintenance tasks involve the detailed diagnosis of a software problem, of a faulty Line Replacement Unit (LRU), Printed Circuit Board (PCB) or module (“component level”). They usually require the use of automated test equipment at a suitable location and are usually carried out by staff that has been trained in detailed fault diagnosis and repair techniques.

Other definitions

- **On-the-job Training (OJT)** – The integration in practice of previously acquired job-related knowledge and skills on operational systems and equipment under the supervision of a qualified on-the-job training instructor.
- **On-the-Job Training Instructor (OJTI)** – A term used to describe an instructor whose role depends on the instructional objectives and the instructional problems to be resolved. The training will be done on operational systems and equipment. This role can be lecturing, reviewing, guiding and consulting.

APPENDIX 3 – ACTION VERBS

The tables below list the actions verbs and their associated taxonomy levels that are used in the ATSEP CCC Initial Training Specification.

Definition of verbs – Level 1

Level 1:	A basic knowledge of the subject. It is the ability to remember essential points, to memorise data and retrieve it.

Verb	Definition	Example
Define	State what it is and what its limits are; state the definition	Define airborne safety nets
Draw	Produce a picture, pattern or diagram	Draw the MLAT system architecture
List	Say one after the other	List the most common weather messages
Name	Give name of objects or procedures	Name a range of air-ground aviation related network concepts
Recognise	To know what it is because you've seen it before	Recognise surveillance information on a display
State	Say or write in a formal or definite way	State the function of a network management system

Definition of verbs – Level 2

Level 2:	The ability to understand and to discuss the subject matter intelligently in order to represent and act upon certain objects and events.

Verb	Definition	Example
Characterise	To describe the quality of features in something	Characterise navigation methods
Consider	To think carefully about it	Consider the benefits of Critical Incident Stress Management (CISM).
Demonstrate	Describe and explain; logically or mathematically proves the truth of a statement	Demonstrate the use of middleware in an AM environment.

Describe	Say what it is like or what happened	Describe the elements of GNSS in Europe
Differentiate	Show the differences between things	Differentiate convention navigation and area navigation
Explain	Give details about something or describe so that it can be understood	Explain the function of FDP.
Take account of	Take into consideration before deciding	Take account of hardware/software compatibility

Definition of verbs – Level 3

Level 3:	A thorough knowledge of the subject and the ability to apply it with accuracy. The ability to make use of the repertoire of knowledge to develop plans and activate them.

Verb	Definition	Example
Apply	Use something in a situation or activity	Apply the principles of layers
Appreciate	To understand a situation and know what is involved in a problem-solving situation, to state a plan without applying it	Appreciate how to troubleshoot a network
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 parameters of a line
Check	Make sure the information is correct (satisfactory)	Check the conformity of a system to ITU and national regulation
Decode	Turn into ordinary writing, decipher	Decode a typical OLDI message
Estimate	Form an approximate judgement of a number, form an opinion	Estimate the impact of security and integrity failure to the operational service
Identify	Associate oneself inseparably with, establish the identity	Identify the major elements of the ADS-C system
Operate	Conduct work on equipment	Operate measuring equipment
Perform	Carry into effect, go through, execute	Perform measurements with generic radio test equipment
Use	Employ for a purpose, handle as instrument, put into operation	Use appropriate vocabulary to communicate effectively on technical matters

Definition of verbs – Level 4

Level 4:	Ability to establish a line of action 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
Adjust	Change to a new position, value or setting	Adjust a generic radio receiver
Analyse	Examine minutely the constitution of	Analyse the block diagram of a generic radio receiver
Justify	Show the rightness of a choice or of an option	Justify the occasions when it is necessary to downgrade an ILS Facility Performance Category
Relate	Establish link with	Relate VOR station design to operational requirements

Definition of verbs – Level 5

Level 5:	Ability to analyse a 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
Interpret	To decide on something's meaning or significance when there is a choice	Interpret ILS Facility Performance Categories

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 1
BASIC Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 1 BASIC Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 1 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Basic syllabus**.

Basic training is defined as ***training designed to impart fundamental knowledge of the CNS/ATM environment and skills applicable to all learner ATSEPs.***

The Basic syllabus contains the following:

- SUBJECT 1: Induction (IND)
- SUBJECT 2: Air Traffic Familiarisation (ATF)
- SUBJECT 3: Aeronautical Information Services (AIS)
- SUBJECT 4: Meteorology (MET)
- SUBJECT 5: Communication (COM)
- SUBJECT 6: Navigation(NAV)
- SUBJECT 7: Surveillance (SUR)
- SUBJECT 8: Data Procesing (DAT)
- SUBJECT 9: System Monitoring & Control (SMC)
- SUBJECT 10: Maintenance Procedures (MTN)
- SUBJECT 11: Facilities (FAC)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating the **Basic training course,** training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1 : INDUCTION

Learners shall describe the ATM work environment

1 INDUCTION			
1.1 Training and Assessment Overview			
1.1.1	Describe the training scheme and progression towards ATSEP competence	2	Initial (Basic and Qualification), S/E Rating, Continuation and Development training. Course aims, objectives and topics
1.1.2	State the assessment requirements, procedures and methods	1	
1.2 National Organisation			
1.2.1	Describe the organisational structure, purpose and functions of the national service provider/s and regulatory structures	2	*e.g. headquarters, control centres, training facilities, airports, outstations, civil/military interfaces, regulatory interfaces*
1.2.2	Describe the structure and functions of the major departments within the national organisation	2	*e.g. organisational handbook (plans, concepts and structure, finance model)*
1.2.3	State appropriate accountabilities and responsibilities of the service provider and regulator	1	
1.3 Workplace			
1.3.1	State the role of trade unions and professional organisations	1	*e.g. International, European, national, local level*
1.3.2	Consider security of site facilities and personnel against unlawful interference	2	Environmental, physical and information security measures, employee vetting and reference checks *e.g. EC2096/05 Annex 1*
1.3.3	Describe actions when suspecting a security breach	2	*e.g. Inform Police, Security Agencies and Managers. Security Manual and/or Contingency plan*
1.4 ATSEP Role			
1.4.1	Describe the key responsibilities of an ATSEP	2	

1.5	**European/Worldwide Dimension**		
1.5.1	Explain the relationship between States and its relevance to ATM operations	2	*e.g. harmonisation, flow management, bilateral agreement, sharing of ATM relevant data, major studies, research programmes and policy documents*
1.5.2	Define the regulatory framework of international and national ATM	1	*e.g. ICAO, European and national concepts, responsibilities*
1.5.3	State the purpose of a range of international bodies	1	ICAO *e.g. ECAC, EUROCONTROL, FAA, EASA, JAA, RTCA, EUROCAE, EU*
1.6	**International Standards and Recommended Practices**		
1.6.1	Explain how ICAO notifies and implements legislation	2	Annexes, SARPS
1.6.2	State which major/key ATM engineering "standards" and "practices" are applicable	1	*e.g. ICAO Annex 10, ICAO Doc 8071, ICAO Doc 9426-3, available EUROCONTROL standards, guidance material on reliability, maintainability and availability*
1.7	**Data Security**		
1.7.1	Explain the importance of ATM security	2	*e.g. EC2096/05 Annex 1*
1.7.2	Describe the security of operational data	2	Secure, restricted access by authorised personnel
1.7.3	Explain security policies and practices for information and data	2	Backup, storing, hacking, confidentiality, copyright
1.7.4	Describe the possible external interventions which may interrupt or corrupt ATM services	2	Introduction of software viruses, illegal broadcasts, jamming, spoofing
1.8	**Quality Management**		
1.8.1	Explain the need for quality management	2	*e.g. ISO, EFQM*
1.8.2	Explain the need for configuration management	2	Importance for safe operations *e.g. S/E build state, software adaption/version*

1.9	**Safety Management System**		
1.9.1	Explain why there is a need for high level safety requirements for aeronautical activities	2	Safety policy and rules, System Safety Cases, System Safety Requirements *e.g. EC Reg 2096/2005*
1.10	**Health and Safety**		
1.10.1	Explain personal safety responsibilities in the work environment	2	Safety statement, first aid, rules about climbing
1.10.2	Explain potential hazards to health and safety generated by equipment, or contained within, the work environment	2	*e.g. health consequences of electric shock and static discharges, precautions with chemical products (batteries), mechanical hazards (rotating machinery/antennas), toxic materials (beryllium), biological hazards, faulty earthing*
1.10.3	Describe fire safety and first aid regulations and practices	2	Requirements and rules *e.g. standards*
1.10.4	State any applicable legal requirements and safety rules	1	National, international regulations *e.g. for working on power supply and/or air conditioning*
1.10.5	Describe the main features and uses of the different types of fire detectors and extinguishants	2	*e.g. VESDA, Type A,B,C,D extinguishers*

Subject 2 : AIR TRAFFIC FAMILIARISATION

Learners shall describe the role of ATC in the ATM environment

1 AIR TRAFFIC FAMILIARISATION

1.1	**Air Traffic Management**		
1.1.1	Define Air Traffic Management	1	ICAO
1.1.2	Describe operational ATM functions	2	ATFCM, ATS, ASM
1.1.3	Describe ATM concepts and associated terminology	2	*e.g. Concepts: FUA, free flight, gate-to-gate, performance-based ATM operations (PBN, RCP), operational concepts (ICAO, EUROCONTROL, SESAR)* *Terminology - Glossary*
1.1.4	Explain the operational importance of technical services required for ATM	2	*e.g. EC Reg 552/2004 Annex 1*
1.1.5	State those future developments in systems and/or ATM practices which may impact upon services provided	1	*e.g. datalink, satellite-based navigation, gate-to-gate (CDM), ATC tools, continuous approach, 4D trajectory, business trajectory, SWIM, NOP, SESAR (UDPP, Modes of separation), ASAS*
1.1.6	List the standard units of measurement used in aviation	1	Speed, distance, vertical distance, time, direction, pressure, temperature
1.2	**Air Traffic Control**		
1.2.1	Define airspace organisation	1	ICAO Annex 11 *e.g. FIR, UTA, TMA, CTR, ATS routes*
1.2.2	Describe commonly used airspace terminologies and concepts	2	*e.g. sectorisation, identification of ATS routes, restricted airspace, significant points*
1.2.3	State the general organisation of aerodromes	1	*e.g. obstacle limitation surfaces, different departure and arrival trajectories, approach and landing categories, operational status of radio navigation aids*
1.2.4	State the purpose of ATC	1	ICAO Doc 4444
1.2.5	State the organisation of the ATC services	1	ICAO Doc 4444 *e.g. area, approach, aerodrome control services*

1.3	**Ground-based Safety Nets**		
1.3.1	Describe the purpose of ground-based safety nets	2	*e.g. STCA, MSAW, APW, runway incursion alerts*
1.4	**Air Traffic Control Tools and Monitoring Aids**		
1.4.1	Explain the main characteristics and use of ATC support and monitoring tools	2	*e.g. MTCD, sequencing and metering tools (AMAN, DMAN), A-SMGCS, CLAM, RAM, CORA*
1.5	**Familiarisation**		
1.5.1	Take account of the tasks of ATC	2	*e.g. simulation, role play, PC, Part Task Trainer, observations in the operational environment*
1.5.2	Explain the need for good communications, coordination and cooperation between operational staff	2	*e.g. handovers, MIL/CIV, planner/tactical, SV Tech (SMC) and SV ATCO*
1.5.3	Consider the purpose, function and role of various operational stations in respect to ATM related operations	2	Site visit/s to ATC units *e.g. MET Office, Remote sites, Airport operations*
1.5.4	Define the phases of flight	1	Take off, climb, cruise, descent and initial approach, final approach and landing
1.5.5	Recognise the cockpit environment and associated equipment, in relation to ATC	1	Relevant pilot HMI *e.g. by familiarisation flight or cockpit simulator training (where practicable), antenna*
1.5.6	Define airborne collision avoidance systems	1	ACAS, EGPWS *e.g. TCAS*

Subject 3 : AERONAUTICAL INFORMATION SERVICES

Learners shall define the organisation of AIS

1 AERONAUTICAL INFORMATION SERVICES

1.1 Aeronautical Information Services

1.1.1	State the organisation of the AIS	1	
1.1.2	Define the AIP service	1	*e.g. data contents of AIP, Supplimentary, AIC and types of publication: AIRAC, non-AIRAC, data collection and preparation, data format, distribution channels, supporting systems and tools*
1.1.3	Define the aeronautical charting service	1	Types of aeronautical charts, operational use of charts, supporting systems and tools
1.1.4	Define the NOTAM services	1	
1.1.5	Define the ATS Reporting Office	1	*e.g. purpose of flight plans and other ATS messages, types of flight plans (FPL and RPL), contents of flight plans and other ATS messages, distribution of flight plans and other ATS messages, supporting systems and tools*
1.1.6	Define the European AIS Database	1	*e.g. paper/data, central single source, validated, redundancy, EAD structure*
1.1.7	Define procedures for providing Communications, Navigation and Surveillance (CNS) data to AIS	1	Information of a permanent nature, information of a temporary nature, status report of NAVAIDs

Subject 4 : METEOROLOGY

Learner shall state the impact of meteorology on aircraft and ATS operations and explain the importance of meteorological information in ATM

1 METEOROLOGY

1.1	**Introduction to Meteorology**		
1.1.1	State the relevance of meteorology in aviation	1	Influence on the operation of aircraft, flying conditions, aerodrome conditions
1.1.2	State the weather prediction and measurement systems available	1	
1.2	**Impact on Aircraft and ATS Operation**		
1.2.1	State the meteorological conditions and their impact on aircraft operations	1	*e.g. atmospheric circulation, wind, visibility, temperature/humidity, clouds, precipitation*
1.2.2	State the meteorological conditions hazardous to aircraft operations	1	*e.g. turbulence, thunderstorms, icing, microbursts, squall, macro bursts, wind shear, standing water on runways (aquaplaning)*
1.2.3	Explain the impact of meteorological conditions and hazards on ATS operations	2	*e.g. effects on equipment performance (e.g. temperature inversion, rain density), Increased vertical and horizontal separation, low visibility procedures, anticipation of flights not adhering to tracks, diversions, missed approaches*
1.2.4	Explain the effects of weather on propogation	2	*e.g. anaprop, rain noise, sunspots*
1.3	**Meteorological Parameters and Information**		
1.3.1	List the main meteorological parameters	1	Wind, visibility, temperature, pressure, humidity
1.3.2	List the most common weather messages and broadcasts used in aviation	1	*e.g. ICAO Annex 3* *Meteorology messages: TAF, METAR, SNOWTAM* *Broadcasts: ATIS/flight meteorology broadcast (VOLMET)*

1.4 Meteorological Systems

1.4.1	Explain the basic principles of the main meteorological systems in use	2	*e.g. Weather display and information systems, Wind speed (anemometer), wind direction (weather vane), visibility (types of IRVR, forward scatter), temperature probes, pressure (aneroid barometers), humidity, cloud base (laser ceilometers)*

Subject 5 : COMMUNICATION

Learners shall explain the principles used in Voice and Data Communications

1 GENERAL INTRODUCTION

1.1 Introduction to Communications

1.1.1	State the structure of the communication domain	1	Voice communication, data communication
1.1.2	State major sub-structures of the communication domain	1	Air-ground, ground-ground, air-air communications
1.1.3	State ATS requirements for safe communications	1	Safety, reliability, availability, coverage, QoS, latency
1.1.4	State the aeronautical communication services	1	Mobile, fixed

2 VOICE COMMUNICATIONS

2.1 Introduction to Voice Communications

2.1.1	Describe system architecture	2	
2.1.2	Explain the purpose, principles and role of voice communication systems in ATS	2	*e.g. audio bandwidth, dynamic range, fidelity, routing, switching, lineside/deskside, coverage, communication chain between controller and pilot*
2.1.3	Describe the way in which voice communication systems function	2	Analogue/digital comparisons, distortion, harmonics
2.1.4	State methods used to route and switch voice communications	1	*e.g. multi-channels, multi-users, party lines, VHF/ UHF linkage, HF, SELCAL*
2.1.5	State how systems interface to produce an integrated service to ATS	1	
2.1.6	State radio spectrum and frequency allocation constraints and procedures	1	Spectrum, interference sources, commercial allocations, World radio conference, ITU, Common Aviation Position, efficient uttilisation of frequency bands, channel spacing
2.1.7	State voice recording systems in use	1	*e.g. digital recording equipment, analogue recording*
2.1.8	State ICAO and local legal requirements regarding recording and retention of voice communications	1	Regulatory requirements, incident recording and playback, recording equipment
2.1.9	State the purpose of ATIS and VOLMET	1	

2.2	**Air-Ground Communication**		
2.2.1	State the functions and basic operation of routing and switching equipment in use in the ATS environment	1	Voice switching
2.2.2	Describe the purpose and operation of the elements of a communication chain in use in the ATS environment	2	Functionality, emergency systems, transmission/reception, CWP, on-board equipment *e.g. channel spacing, antenna switching, CLIMAX, voting systems*
2.2.3	State some ways of achieving quality of service	1	*e.g. importance of coverage and redundancy of equipment, overlapping coverage, backup system, functional redundancy vs element redundancy*
2.2.4	Recognise the elements of the CWP that are used for air-ground communication	1	Frequency selection, emergency, station selection, coupling, microphone, headset, loudspeaker, footswitch, PTT
2.2.5	List future developments and techniques which may have an impact on ATS voice communications	1	*e.g. CPDLC, VDL Modes 2*
2.3	**Ground-Ground Communication**		
2.3.1	State the functions and the basic operations of routing and switching equipment in use in ATS environment	1	General architecture
2.3.2	Describe how ground-ground systems interface to provide an integrated service to ATS environment	2	International/national links, ACC interoperability, voice and data intergration
2.3.3	Describe the purpose and operation of the elements of a system	2	Functionality, emergency systems, PTT interfaces *e.g. MFC and ATS-Qsig, switching, local PABX equipment*
2.3.4	Recognise the elements of the CWP used for ground-ground communication	1	Selection, emergency, loudspeaker, headset, microphone
2.3.5	List developments in ground-ground technologies which may impact on ATS voice communication	1	*e.g. protocols (TCP/IP, voice over IP) future development*

3 DATA COMMUNICATIONS

3.1 Introduction to Data Communications

3.1.1	Explain the purpose, principles and role of data communication systems in ATS	2	*e.g. terminology, principles and theory of networks, layering (e.g. OSI or TCP/IP), datalinks, LAN, WAN*
3.1.2	Define the concept of data transmission	1	*e.g. packet switching, protocols, multiplexing, de-multiplexing, error detection and correction, routing, switching, hops, cost, bandwidth/speed*
3.1.3	Describe the function of various elements of the data systems in use in the ATS environment	2	Switch, router, gateways, end systems, redundancy
3.1.4	Define protocols in current use	1	*e.g. TCP/IP, X.25, Frame Relay, Asynchronous Transfer Mode*

3.2 Networks

3.2.1	State ATS requirements for safe data communications	1	Reliability, availability
3.2.2	Describe the different types of networks	2	LAN, WAN, ATN, national network for ATM *e.g. satellite-dedicated networks, AFTN*
3.2.3	State the functions of a network management system	1	Priorities, rights *e.g. SNMP*

3.3 Aviation Specific Networks, Applications and Service Providers

3.3.1	Name a range of air-ground aviation related network concepts	1	ATN *e.g. Sub-networks: ATN air-ground sub-network, AMSS, VDL, HFDL* *Protocols: ACARS* *Communication service providers: ARINC, SITA, States, LINK16*
3.3.2	Name a range of ground-ground aviation related network concepts	1	ATN, PENS *e.g. Physical Networks: PENS, AFTN/CIDIN, RAPNET* *Communication Protocols: IP, X.25, ASTERIX, FMTP* *Communication Service Providers: SITA, ARINC, National carriers, ANSP's* *Applications: AMHS, AIDC, OLDI*

Subject 6 : NAVIGATION

Learners shall explain the basic principles of navigation and navigational aids and describe their use in ATM

1 INTRODUCTION

1.1 Purpose and use of Navigation

1.1.1	Explain the need for navigation in aviation	2	Positioning, guidance, planning
1.1.2	Characterise navigation methods	2	*e.g. historical overview, visual, celestial, electronic (on-board, radio, space-based and relative)*

2 THE EARTH

2.1 Form of the Earth

2.1.1	Name the shape of the Earth	1	Oblate spheroid *e.g. earth's parameters*
2.1.2	Explain the Earth's properties and their effects	2	East, West, North and South, polar axis, direction of rotation
2.1.3	State the accepted conventions for describing 2D position on a globe	1	Meridians, parallels of latitude, equatorial plane

2.2 Coordinate systems, direction and distance

2.2.1	State the general principles of reference systems	1	Geoid, Reference Ellipsoids, WGS 84 Latitude and longitude, undulation
2.2.2	Explain why a global reference system is required for aviation	2	

2.3 Earth's Magnetism

2.3.1	State the general principles of Earth's magnetism	1	True North, magnetic North *e.g. variation, declination, deviation, inclination*

3 NAVIGATIONAL SYSTEM PERFORMANCE

3.1 Factors affecting electronic navigation performance

3.1.1	State how radio waves propagate	1	Ground, sky, direct
3.1.2	State why the siting of a terrestrial navigation aid is important	1	Multipath, blanking

3.2 Performance of Navigation Systems

3.2.1	State the performance of navigation systems	1	Coverage, accuracy, integrity, continuity of service, availability
3.2.2	Explain the need for redundancy in navigation systems	2	Ensuring continuity of service, maintainability, reliability

3.3	**Means of Navigation**		
3.3.1	State the different means of navigation	1	Sole, primary, supplementary
4	**NAVIGATION SYSTEMS**		
4.1	**Terrestrial Navigation Aids**		
4.1.1	Explain the basic working principles of electronic positioning	2	Distance measurements (time and phase), angular measurements
4.1.2	Describe the ground-based navigation systems	2	NDB, VOR, DME, ILS, DF, MLS *e.g. Loran C, MLS, TACAN, marker beacons*
4.1.3	Recognise how the navigation information is displayed on the relevant pilot HMI	1	
4.1.4	Explain the operational use of ground-based navigation systems in the different phases of flight	2	NDB, VOR, DME, ILS, DF, MLS
4.1.5	Recognise the frequency bands used by the ground-based navigation systems	1	
4.1.6	State the need for calibration	1	Flight calibration, ground-based calibration and/or maintenance
4.2	**On-board Navigation Systems**		
4.2.1	State the use of on-board navigation systems	1	*e.g. barometric altimetry, radio altimetry, INS/IRS, compass*
4.3	**Space-Based Navigation Systems**		
4.3.1	Explain the basic working principles of satellite positioning	2	GPS *e.g.Galileo*
4.3.2	Recognise the basic architecture of a core satellite positioning system	1	GPS *e.g.Galileo*
4.3.3	Recognise the frequency bands used by the space-based navigational systems	1	
4.3.4	State the benefits of Satellite-based navigation	1	Global coverage, accuracy, time dissemination *e.g. redundancy, interoperability, single set of avionics*
4.3.5	State the current limitations of space-based navigation systems	1	*e.g. single frequency, weak signal, ionospheric delay, institutional, military, multipath*

4.3.6	State the basic working principles of satellite augmentation	1	*e.g. ABAS (RAIM, AAIM), SBAS (WAAS, EGNOS), GBAS (GRAS, S-CAT 1)*
4.3.7	State the current implementations of satellite-based navigation systems	1	GPS, GLONASS, GALILEO and augmentations *e.g. ABAS, GBAS, SBAS*

5 PERFORMANCE-BASED NAVIGATION

5.1 PBN

5.1.1	Describe the basic principle of area navigation	2	ICAO RNAV definition and PBN concept Conventional and area navigation *e.g. navigation computer and FMS functionality*
5.1.2	List the navigation applications in use in Europe	1	B-RNAV, P-RNAV, RNP approaches

5.2 Future Developments

5.2.1	State future navigation developments	1	*e.g. 4D-RNAV, free routes, rationalisation plans, advanced RNP1*

Subject 7 : SURVEILLANCE

Learners shall explain the principles used in Primary, Radar, Secondary Radar and other Surveillance systems, and describe their use in ATM operations

1 SURVEILLANCE

1.1	**Introduction to Surveillance**		
1.1.1	Define surveillance in the context of ATM	1	What (positioning/identification) and why (maintain separation)
1.1.2	Define the various Surveillance domains	1	Air-air, ground-air, ground-ground
1.1.3	List the surveillance techniques	1	Non-Cooperative, Cooperative, Dependent, Independent Techniques
1.1.4	Define the current and emerging surveillance systems in use in ATM	1	Radar technology, ADS technology, multilateration, TIS
1.1.5	Explain the role and the current use of surveillance equipment by ATM	2	Separation, vectoring, data acquistion Detection and ranging, safety nets *e.g. weather mapping*
1.1.6	State ICAO and any local legal requirements	1	*e.g. SARPS, Annex 10 Vol IV*
1.1.7	List the main users of surveillance data	1	HMI, Safety Nets, FDPS, Air Defence Systems, Flow Management
1.2	**Avionics**		
1.2.1	State the avionics used for the surveillance in ATM and their interdependencies	1	Transponder, GNSS, datalink equipment, ACAS, ATC control panel *e.g. FMS*
1.2.2	Define the role of TCAS as a safety net	1	
1.3	**Primary Radar**		
1.3.1	Describe the need for and the use of primary radar in ATC	2	Non-cooperative detection, improvement of detection and tracking *e.g. types of PSR (En-route, Terminal, SMR, weather)*
1.3.2	Explain the principles of operation, basic elements and overall architecture of a primary radar	2	Detection, range measurement, azimuth indication Doppler Shift Antenna system, TX/RX, signal processing, plot-extraction, local tracking, data transmission *e.g. use of the parameters of the radar equation*

1.3.3	State the limitations of primary radar	1	Line of sight, environmental, clutter, no identification of the target, no height information (in case of 2D radar)
1.4	**Secondary Radars**		
1.4.1	Describe needs for and the use of secondary radar in ATC	2	Cooperative detection, ICAO-defined standard, IFF, Military and Civil Modes (include Mode S) and related code protocols, code limitations *e.g. identification, SPI, flight level, BDS, specific and emergency codes*
1.4.2	Explain the principles of operation, basic elements and overall architecture of a secondary radar	2	SSR,MSSR, Mode S Antenna, TX/RX, extractor, tracking processor *e.g. use of the parameters of the radar equations*
1.4.3	State the limitations of secondary radar	1	FRUIT, garbling, ghost reply, code shortage, cooperation by the aircraft needed
1.5	**Surveillance Data Message Format**		
1.5.1	State the need for harmonisation	1	Surveillance data sharing, interoperability
1.5.2	State the techniques used for transmission of surveillance data	1	*e.g. point-to-point, network, microwave, satellite*
1.5.3	State main formats in use	1	ASTERIX, etc.
1.6	**Automatic Dependent Surveillance (ADS)**		
1.6.1	State surveillance-related FANS concepts and their impact on ATM	1	Sources of aircraft parameters (e.g. FMS outputs), communication mediums Application within oceanic and other non-radar airspace, ATC requirements
1.6.2	Explain the principles of operation, basic elements and overall architecture of ADS-C and ADS-B and the differences between them	2	Advantages/disadvantages, standards, data update rates
1.6.3	State the datalink technologies proposed and the current situation of deployment	1	Extended squitter 1090 MHz *e.g. VDL 4, HFDL,UAT, AMSS*
1.7	**Weather Radar**		
1.7.1	Define the use of weather radar in ATM	1	*e.g. role in adverse weather in dense airspace, antenna, coverage, polarisation, multi-elevation scanning, frequency band*
1.8	**Integration of Surveillance Information**		
1.8.1	Describe complementary use of different sensors	2	

1.9 Multilateration			
1.9.1	State the use of MLAT in ATC	1	LAM and WAM
1.9.2	Explain the principles of operation, basic elements and overall architecture of MLAT	2	TDOA principle, hyperboloic positioning, accuracy, transmissions used
1.10 Airport Surface Surveillance			
1.10.1	State typical ATC requirements	1	*e.g. Safety (aircraft and mobiles), clear runway, low visibility, collision warnings, displays, mapping, data merging, aircraft identification, ground mobiles*
1.10.2	State the current technologies for airport surface surveillance	1	Radar based and MLAT based technologies, example layout of airport surveillance infrastructure *e.g. other systems (acoustic, vibration, induction loop, video, infrared, GNSS, ADS-B)*
1.11 Display of Surveillance Information			
1.11.1	Recognise surveillance information on a display	1	*e.g. PSR and MSSR Tracks, position Identification, FL, Speed vector, RDP and FDP information*
1.12 Analysis Tools			
1.12.1	State analysis tools	1	*e.g. SASS-C, SASS-S, RAPS*

Subject 8 : DATA PROCESSING

Learners shall explain the principles used in data processing and describe their use in ATM operations

1 DATA PROCESSING

1.1	**Introduction to Data Processing**		
1.1.1	Describe the functions and generic architecture of the systems	2	Generic FDP and SDP overall functional block diagrams
1.1.2	Describe how the systems interface with other systems	2	Surveillance sensors, displays, CFMU, recording, international ATM networks *e.g. safety nets, military interfaces*
1.1.3	Define basic software functions/ applications	1	FDP (IFPS, route processing, code/callsign correlation, code allocation, strip distribution, track labelling) SDP(coordinate conversion, plot and track processing, MRP, Safety nets, track labelling)
1.1.4	State the legal aspects for data processing in ATM	1	Traceability and recording of data and actions, configuration control
1.1.5	State current developments and future possibilities	1	*e.g. Coflight, iTEC, SESAR, multi-sensor tracking*
1.2	**System Software and Hardware Principles**		
1.2.1	Describe the current hardware configurations used in ATM	2	Redundancy and backup *e.g. driver, interfaces, hardware platforms, fault tolerant systems*
1.2.2	Describe the current software platforms, used in ATM	2	Operating Systems
1.3	**Surveillance Data Processing**		
1.3.1	State ATC requirements	1	QoS, mandatory data recording, dependability
1.3.2	Explain the principles of surveillance data processing	2	*e.g. single, multi-, plot, track*
1.3.3	Describe the functions of SDP	2	Plot processing, tracking, single- and multi-sensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multi-sensor tracker, recording *e.g. ARTAS tracker*
1.3.4	Describe the radar data inputs/ outputs	2	tracks, plots, messages, code/callsign, time, control and monitoring, conflict alerts, FDP interface, maps, adaptation

1.3.5	Describe the surveillance data based monitoring functions	2	Safety nets, ATC tools *e.g. Safety nets:STCA, MSAW, APW, runway incursion alerts* *ATC Tools: MTCD, AMAN, DMAN, A-SMGCS*
1.4	**Flight Data Processing (FDP)**		
1.4.1	State ATC requirements	1	QoS, unambiguous, accurate, error free, timely
1.4.2	Explain the function of FDP	2	Flight strip production, flight plan data updates, code/callsign correlation, flight progress monitoring, co-ordination and Transfer *e.g. CIV/MIL coordination*
1.4.3	Define the inputs and outputs	1	Flow control (CFMU/IFPS/FMP, ETFMS), flight strips/data displays, MRT, environmental data, static data, airspace adaptation
1.4.4	Describe the basic software functions/applications	2	FDP (IFPS, route processing, code/callsign correlation, code allocation, strip distribution, track labelling)
1.4.5	Describe the FPL data update process	2	Automatic and Manual update
1.5	**Human Machine Interface Systems**		
1.5.1	Describe the different display technologies	2	Raster scan, common graphic display interface, LCD, plasma, TFT, Touch Input Device
1.5.2	Recognise what information is normally displayed on the ATCO and ATSEP HMI	1	
1.6	**Miscellaneous Information**		
1.6.1	State the additional data used by ATM System	1	*e.g. MET, airlines*

Subject 9 : SYSTEM MONITORING & CONTROL

Learners shall define the SMC function and describe its basic principles

1 SYSTEM MONITORING AND CONTROL (SMC)

1.1	**Overview of SMC Function**		
1.1.1	Describe the principles and purpose of the operational management of the technical services	2	Service requirements, interfaces, boundaries of tactical responsibility *e.g. hierarchy of authority for the technical and ATC structures*
1.1.2	Describe the technical system architecture of the SMC function and its subordinate systems	2	Main monitoring and control architecture *e.g.* *Surveillance: Radar stations, communications, processing, display* *Communications: TX/RX, circuit management, networks, HMI, standby facilities, recording* *Navigation: NDB, VOR, ILS, DF* *DP: FDPS, data communications* *Facilities: Power, generators, UPS, battery, environmental (heating, cooling), fire and security*
1.1.3	Describe the transfer of responsibility for a service	2	Operational and technical responsibility. Configuration and monitoring access and responsibility
1.2	**System Configuration**		
1.2.1	Describe the range of configurations that can be used	2	Equipment or channel switching, parameter settings
1.2.2	Describe the general techniques that are employed to make configuration changes	2	*e.g. physical switching*
1.2.3	State procedures required to implement a planned major system change	1	*e.g. safety requirement, authorisation, coordination, implementation plan, fallback strategies* *Major system change, activation of new version of software in a subordinate system, transfer of a service to a new system, change of a database*
1.3	**Monitoring and Control Functions**		
1.3.1	State the monitoring functions that are available	1	*e.g. BITE, status, parameters, software and hardware watchdogs*
1.3.2	State the control functions that are available	1	*e.g. switching, parameters, set configurations*
1.3.3	Explain the importance of SMC management and coordination of maintenance activities	2	

1.3.4	State analysis tools associated with SMC	1	*e.g. possible malfunctions (SASS-C, SASS-S, RAPS, track and noise monitoring tools)*
1.4	**Coordination and Reporting**		
1.4.1	State why coordination and reporting is required and how it is achieved	1	Facility interrupts, deconflict multiple outages, legal requirements *e.g. Causes: service failure, planned outage, loss of backup, software upgrade* *Relevant parties: external service providers, ATC, other centres* *Relevant information: NOTAM, logbook*
1.5	**Emergency Coordination**		
1.5.1	Describe situations where coordination and reporting will be necessary	2	*e.g. hijack, mayday, R/T fail, loss of aircraft, MIL action, fire, flood, security, terrorist threat or action, medical*
1.5.2	State which parties may be involved in the coordination and reporting of emergency situations	1	*e.g. ATC supervisors (local and remote), ATSEP supervisors (local and remote), management, police, MIL, medical, accident investigation branch*
1.5.3	Explain the responsibilities and/or duties of SMC members during an emergency situation by using an example scenario	2	
1.5.4	State the succession of authorities and responsibilities in the event that the nominated person or function is not available	1	Hierarchy of responsibility
1.6	**Equipment Operating**		
1.6.1	Define the principles and ergonomics of the HMI of the SMC central system and its subordinate systems	1	Permissions, control tokens, ergonomic conventions *(e.g. green is good or safe, red is fail or unsafe)*
1.6.2	State the routine tasks required and the criticality of their completion and any legal requirements	1	*e.g. audio circuit voice checking, audio recording checking, archive media changing and storage, VOLMET*

Subject 10: MAINTENANCE PROCEDURES

Learners shall describe general maintenance strategy and procedures

1 MAINTENANCE PROCEDURES

1.1 Maintenance Procedures

1.1.1	Explain handling precautions to be taken to ensure equipment protection	2	Isolation, protection devices, electrostatic sensitive devices, power supplies, heavy loads, high voltage.
1.1.2	Explain the classifications of maintenance	2	*e.g. preventative, corrective, service configuration*
1.1.3	Explain the maintenance strategy and rules	2	Organisation and planning of maintenance, rules controlling deviation from planned maintenance, intervention tracking, return to service
1.1.4	State the scope or responsibility of a S/E Rated person	1	*e.g. tracing maintenance actions and objectives, liability of maintenance personnel actions, safety of service, safety of equipment*

Subject 11: FACILITIES

Learners shall describe facilities and define the level of peformance required

1 FACILITIES			
1.1 Power Supplies			
1.1.1	Define the performance for power supply systems in the operational environment	1	Availability, quality, Continuity of Service
1.1.2	Define the main features of current power supply systems	1	*e.g. UPS systems, batteries and emergency generators, high voltage, earthing techniques, power provider(s)*
1.1.3	Describe the power distribution system at an example operational site	2	*e.g. power distribution redundancy, input, output, protections, measurements and monitoring, block schematic*
1.2 Air Conditioning			
1.2.1	State the function, appropriate terminology and performance of current air conditioning systems in use	1	*e.g. air conditioning, water cooling, humidity control, air filtering system, visit to stations*
1.2.2	State the importance and criticality of maintaining a controlled environment	1	Short- and long-term effect on people and equipment

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 2
QUALIFICATION: COMMUNICATION Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 2 QUALIFICATION: COMMUNICATION Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 2 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: COMMUNICATION syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the Communication domain training objectives.

The Qualification: Communication syllabus contains the following:

- SUBJECT 1: Voice (COM VCE)
- SUBJECT 2: Data (COM DAT)
- SUBJECT 3: Transmission Path (COM TRP)
- SUBJECT 4: Recorders (COM REC)
- SUBJECT 5: Functional Safety (COM FST)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: Communication-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : VOICE

1. AIR-GROUND

1.1	**Transmission/Reception**		
1.1.1	Perform typical measurements on a transmitter	3	Frequency (single carrier, offset carrier), modulation, channel spacing, output power, SWR
1.1.2	Adjust a generic radio transmitter	4	Noise, intermodulation, harmonics, power, bandwidth
1.1.3	Analyse the block diagram of a generic radio transmitter	4	Characteristics (modulation, single carrier, channel spacing) functionalities
1.1.4	Perform typical measurements on a receiver	3	Frequency, modulation, channel spacing, sensitivity, selectivity
1.1.5	Adjust a generic radio receiver	4	Signal to noise ratio, harmonics
1.1.6	Analyse the block diagram of a generic radio receiver	4	Characteristics (single carrier, channel spacing, sensitivity, selectivity)
1.2	**Radio Antenna Systems**		
1.2.1	Explain antenna parameters	2	Impedance, polar diagram, bandwidth, polarisation, types of antennas
1.2.2	Characterise the coverage of the radio system	2	Polar diagram, types of antennas, frequency bands, propagation mode
1.2.3	Characterise budget link according to various conditions	2	Output power, antennae, propagation, geographic, meteorological, day and night
1.2.4	Characterise the elements of a generic antenna system	2	Filters, combiners, multicavity system
1.2.5	Check the conformity of a system to ITU and national regulation	3	Ref: ICAO Annex 10 (VHF, UHF)
1.2.6	Perform measurements with generic radio test equipment	3	Spectrum analyser *e.g. scanner*
1.3	**Voice Switch**		
1.3.1	Analyse switching functionalities	4	General architecture, digital, analogue, multiplex types, PCM *e.g. cross-coupling, split headset (radio both ears, telephone single ear)*
1.3.2	Explain the principles of non blocking switches	2	Advantages, disadvantages, delays (digital)
1.3.3	Describe the signal processing all along the chain	2	Signal tracing treatment, protocols (a few), data flow

1.4	**Controller Working Position**		
1.4.1	Describe the most common features of a controller working position	2	Frequency selection, emergency, station selection, coupling, headset, loudspeaker, footswitch, Push to Talk *e.g. microphone (noise cancelling),short time recording*
1.5	**Radio Interfaces**		
1.5.1	Describe the different types of interface	2	Internal, external, phantom keying, inband signal
2.	**GROUND-GROUND**		
2.1	**Interfaces**		
2.1.1	Describe the different types of interfaces	2	Analog (2, 4, 6 and 8 wires), digital (ISDN; 64Kb, 2Mb)
2.1.2	Explain the advantages and disadvantages of each type	2	Analog (2, 4, 6 and 8 wires), digital (ISDN; 64Kb, 2Mb)
2.1.3	Operate measuring equipment	3	*e.g. dB meters, level meters, generators, sniffer*
2.2	**Protocols**		
2.2.1	Operate standard protocol analysers	3	*e.g. MFC R2 and/or ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN*
2.2.2	Analyse communication protocol with appropriate tools and documentation	4	*e.g. MFC R2 , ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN, national protocols*
2.3	**Switch**		
2.3.1	State the similarities between ground-ground and air-ground switches	1	Switching techniques
2.3.2	Describe the most commonly used functionality of PABX	2	General architecture, digital, analog, multiplex types, PCM30
2.3.3	Analyse conversion analog-digital, digital-analog	4	General architecture, analog-digital- analog

2.4	**Communication Chain**		
2.4.1	Appreciate the replacement of components in a communication chain in a safe way	3	Continuity of service, communication chain integrity **Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training**
2.5	**Controller Working Position**		
2.5.1	Describe the most common features of a controller working position and the HMI	2	

Subject 2. : DATA

1. INTRODUCTION TO NETWORKS

1.1	**Types**		
1.1.1	State the evolution of network topologies	1	LAN, WAN *e.g. architectures, size of the segments, length of the systems, quality of service*
1.1.2	Explain how networks meet requirements	2	Redundancy, bandwidth, BER, time delay, network security
1.2	**Networks**		
1.2.1	Analyse the features of a network	4	Routing scheme, rate, internal networking, routers, bridges, gateways, modems, switches, firewalls *e.g. wireless networks*
1.2.2	Describe network standards and devices	2	Ethernet, fibre optic, wireless
1.2.3	Appreciate the replacement of components in a network in a safe way	3	Continuity of service, network integrity **Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training**
1.3	**External Network Services**		
1.3.1	Define aspects of external network services	1	Provided QoS *e.g. SLAs*
1.4	**Measuring Tools**		
1.4.1	Operate the usual set of network measuring or monitoring tools to find the values of the main parameters	3	Data analyser (sniffer) *e.g. net scout*
1.4.2	Perform analysis to support fault-finding for correction	3	Data analyser (sniffer) *e.g. net scout*
1.5	**Troubleshooting**		
1.5.1	Appreciate how to troubleshoot a network	3	**Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training** *e.g. broken lines, unusable network components, overload, integrity problems*

2. PROTOCOLS

2.1 Fundamental Theory

2.1.1	Apply the principles of layers	3	Differences between layers *e.g. layer/s of sniffer information*
2.1.2	Apply the principles of the addressing strategy	3	Masks, sub-nets IP addressing, MAC addressing *e.g. same logical network computers and systems*
2.1.3	Apply the principles of the routing strategy	3	Routing tables, priorities, fault tolerance, management of routing strategy, static and dynamic routing *e.g. Unicast, multicast, broadcast*

2.2 General Protocols

2.2.1	Describe the general protocols	2	TCP/IP (segments, packets, addressing) *e.g. X25, LAPB, pdH, sdH*
2.2.2	Analyse the general protocols using the appropriate tools and documentation	4	TCP/IP *e.g. X25, LAPB*

2.3 Specific Protocols

2.3.1	Describe the specific protocols	2	*e.g. BATAP – ARINC 620, FMTP*

3. NATIONAL NETWORKS

3.1 National Networks

3.1.1	Name the national networks to which the organisation is connected	1	*e.g. ANSP, MET,Military, PTT, airlines, National network(s)*
3.1.2	Describe the interfaces between national and global networks	2	

4. EUROPEAN NETWORKS

4.1 Network Technologies

4.1.1	State emerging network technologies	1	*e.g. as used in EAN, NEAN, AMHS, PENS*
4.1.2	Describe the characteristics of the current networks	2	Surveillance data, Flight Plan data and AIS networks *e.g. CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP,AMHS*

5. GLOBAL NETWORKS

5.1	**Networks and Standards**		
5.1.1	List the global networks and the standards on which they are based	1	*e.g. ICAO for AFTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)*
5.2	**Description**		
5.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service
5.3	**Global Architecture**		
5.3.1	Describe the architecture of the ATN	2	Air-ground sub-networks, ground-ground sub-networks, airborne networks
5.4	**Air-Ground Sub-networks**		
5.4.1	Describe the air-ground sub-networks	2	VDL (mode 2), HFDL, AMSS, SATCOM
5.5	**Ground-Ground sub-networks**		
5.5.1	Describe the composition of ground-ground sub-networks	2	PTT, commercial telecom providers, ARINC, SITA
5.6	**Networks on Board of the Aircraft**		
5.6.1	State the existence of sub-networks inside the aircraft relevant for ATM communications	1	*e.g. AFDX – ARINC 429*
5.7	**Air-Ground Applications**		
5.7.1	State the main communication applications using Data link systems	1	*e.g. CPDLC, DLIC/AFN, ATIS, DCL*

Subject 3. : TRANSMISSION PATH

1. LINES

1.1 Lines Theory

1.1.1	Calculate parameters of a line	3	*e.g. equation, attenuation, impedance, S-parameters, Smith chart, bandwidth, HF specifics (dipoles, multi-poles), SWR*

1.2 Digital Transmission

1.2.1	Calculate parameters for digital transmission	3	*e.g. signal definition, Fourier Theory, signal processing (sampling etc.), bandwidth, carrier, modulation, noises, S/N, delays, group delay, line quality (signal distortion, rate of failure), transmission speed*

1.3 Types of Lines

1.3.1	Describe the different types of lines and their physical characteristics	2	*e.g. copper wires (twisted pairs, symmetrical cables), optic fibres (mono- or multi-modes, connectors, splicer), coaxial* *Attenuation, losses, bending, characteristic impedance, EMC and noise immunity*
1.3.2	Appreciate the appropriate type of line for a given specific application	3	*e.g. bandwidth, noise immunity*
1.3.3	Check the typical parameters of lines	3	*e.g. impedance, insulation, signal level, time delay*

2. SPECIFIC LINKS

2.1 Microwave Link

2.1.1	Describe a microwave link	2	*e.g. carrier frequency, type of modulation, Fresnel Theory, loss, atmospheric influences*

2.2 Satellite

2.2.1	Describe the parameters of a satellite link	2	Uplinks, downlinks, antennas, footprint, delays, atmospheric influences

Subject 4. : RECORDERS

1. LEGAL RECORDERS

1.1	**Regulations**		
1.1.1	Explain the international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how the service provider complies with the regulations	2	*e.g. storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information.*
1.2	**Principles**		
1.2.1	Explain the principles of recording and reproducing	2	*e.g. storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 ... 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

Subject 5. : FUNCTIONAL SAFETY

1. SAFETY ATTITUDE

1.1 Safety Attitude

1.1.1	State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to communication system, safety reports and occurrences, safety monitoring

2. FUNCTIONAL SAFETY

2.1 Functional Safety

2.1.1	Describe the implications of functional failures in terms of exposure time, environment, effect on controller and effect on pilot	2	Total or partial, premature or delayed operation, spurious, intermittent, loss or corruption of data, missing or incorrect input or output. Ref: Safety policy and implementation, ESARR

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 3
QUALIFICATION: NAVIGATION Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 3 QUALIFICATION: NAVIGATION Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 3 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: NAVIGATION syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the Navigation domain training objectives.

The Qualification: Navigation syllabus contains the following:

- SUBJECT 1: Performance Based Navigation (NAV PBN)
- SUBJECT 2: Ground-based Systems - NDB (NAV NDB)
- SUBJECT 3: Ground-based Systems - DFI (NAV DFI)
- SUBJECT 4: Ground-based Systems - VOR (NAV VOR)
- SUBJECT 5: Ground-based Systems - DME (NAV DME)
- SUBJECT 6: Ground-based Systems - ILS (NAV ILS)
- SUBJECT 7: Ground-based Systems - MLS (NAV MLS)
- SUBJECT 8: Global Navigation Satellite System (NAV GNS)
- SUBJECT 9: On Board Equipment (NAV OBE)
- SUBJECT 10: Functional Safety (NAV FST)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: Navigation-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : PERFORMANCE BASED NAVIGATION

1. NAV CONCEPTS

1.1	**Operational Requirements**		
1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *e.g. Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613
1.2	**Performance-based Navigation**		
1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	Onboard Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613
1.3	**Area Navigation Concept (RNAV)**		
1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure
1.4	**NOTAM**		
1.4.1	Explain the need for NOTAMs	2	

Subject 2. : GROUND-BASED SYSTEMS-NDB

1. NDB/LOCATOR

1.1	**Use of the System**		
1.1.1	Appreciate the principles of NDB	3	Relative bearing, measuring method
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.3	Explain the technical limitations of NDB	2	Lack of accuracy, lack of integrity, sensitivity to interference
1.1.4	Describe the current situation	2	*e.g. number, type, users, user groups, European context*
1.2	**Ground Station Architecture**		
1.2.1	Describe the main components of an NDB ground station	2	Electronic cabinet, antennas, power supply, remote controls and monitoring *e.g. auto tune antenna units*
1.2.2	Relate NDB station design to operational requirements	4	Coverage, id code, VOR backup, double beacon approach, siting
1.3	**Transmitter Sub-system**		
1.3.1	Characterise the main NDB signal parameters	2	Carrier and ident frequency, output power, depth of modulation
1.3.2	Perform typical measurements on the main NDB signal parameters	3	*e.g. carrier and ident frequency, power measurements, depth of modulation, audio distortion, antenna current, spectrum measurements, id code*
1.4	**Antenna Sub-system**		
1.4.1	Explain NDB antenna characteristics	2	Impedance, polar diagram, polarisation, ground reflections
1.4.2	Appreciate the interface between power stage and the antenna	3	SWR, radiated power
1.5	**Monitoring and Control Sub-systems**		
1.5.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.5.2	Describe which parameters are used for the monitoring	2	Antenna current, id-code, depth of modulation

1.5.3	Appreciate how the operational status of the NDB monitoring system is checked	3	System status **Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training**
1.5.4	Describe the issues associated with NDB obstacle limitations and obstacle removal	2	Siting
1.6	**On-board Equipment**		
1.6.1	Describe the on-board equipment (ADF)	2	Receiver, antenna, displays
1.6.2	Describe how NDB information is used on-board	2	ADF indicator, RMI, HSI, ND
1.7	**System Check and Maintenance**		
1.7.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *e.g. European regulations*
1.7.2	Appreciate calibration tasks and flight inspection results	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance and flight inspection manuals, procedures and reports*
1.7.3	Appreciate troubleshooting of an NDB	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance and flight inspection manuals, procedures and reports*
1.7.4	Appreciate the origins of NDB errors	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. multipath, EMC, interference with radio broadcast transmissions*

Subject 3. : GROUND-BASED SYSTEMS-DFI

1. DF

1.1	**Use of the System**		
1.1.1	State the different types of DF	1	VDF, DDF, IDF
1.1.2	Describe the user HMI	2	Indication on radar picture, DF indicator
1.1.3	Appreciate the principles of DF	3	Bearing, measuring method (standard, Doppler, interferometry)
1.1.4	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.5	Explain the technical limitations of DF	2	Sensitivity to interference
1.1.6	Describe the current situation	2	*e.g. number, type, users, National context*
1.2	**VDF/DDF Equipment Architecture**		
1.2.1	Describe the main components of DF equipment	2	Electronic cabinet, antennas, power supply, remote controls and monitoring
1.3	**Receiver Sub-system**		
1.3.1	Explain the main signal parameters	2	Frequency band (UHF, VHF)
1.4	**Antenna Sub-system**		
1.4.1	Explain DF antenna characteristics	2	Impedance, polar diagram, polarisation, types of antennas
1.4.2	Appreciate protection areas	3	Obstacles, ICAO Annexes 10 *e.g. manufacturers manuals*
1.5	**Monitoring and Control Sub-systems**		
1.5.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.5.2	Describe which parameters are used for the monitoring	2	Noise figure, stability of measurement
1.5.3	Appreciate how the operational status of the DF monitoring system is checked	3	System status **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training**
1.5.4	Describe the issues associated with DF obstacle limitations and obstacle removal	2	Surrounding environment, protection of bearing accuracy

1.6	**System Check and Maintenance**		
1.6.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMV + SAR), ICAO Annex 10 *e.g. European regulations*
1.6.2	Perform typical measurements on a DF system	3	Frequency, channel spacing, sensitivity, selectivity, bearing accuracy
1.6.3	Appreciate calibration tasks and flight inspection results	3	Ground-based bearing checks, test oscillator **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. North setting, range, multipath* *Maintenance and flight inspection manuals, procedures and reports*
1.6.4	Appreciate troubleshooting of DF	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. sensitivity, local oscillator level* *Maintenance and flight inspection manuals, procedures and reports*
1.6.5	Appreciate the origin of DF errors	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. multipath, EMC, interference with radio broadcast transmissions*

Subject 4. : GROUND-BASED SYSTEMS-VOR

1. VOR

1.1	**Use of the System**		
1.1.1	State the types of VOR Systems	1	Conventional, Doppler
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.3	Explain the technical limitations of CVOR	2	Type of information (azimuth), accuracy, integrity, suitable for a network of fixed routes
1.1.4	Appreciate the differences between CVOR and DVOR	3	Signal broadcast differences, bearing information robustness
1.1.5	Describe the current situation	2	*e.g. number, type, users, user groups, National context, European context*
1.2	**Fundamentals of CVOR and/or DVOR**		
1.2.1	Appreciate the mathematical signal description	3	Declination, equations of CVOR and/or DVOR, reference and variable signals
1.2.2	Appreciate the principles for generating the variable signal	3	CVOR Rotating antenna principle Generating a rotating radiation pattern with static antennas and/or DVOR Frequency modulation through switching antennae
1.3	**Ground Station Architecture**		
1.3.1	Describe the main components of a CVOR and/or DVOR ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring
1.3.2	Relate VOR station design to operational requirements	4	Siting, coverage, id code, NDB backup
1.4	**Transmitter Sub-system**		
1.4.1	Characterise main signal parameters for a CVOR and/or DVOR	2	Carrier frequency stability, output power, signals generated
1.4.2	Perform typical transmitter measurements on VOR signals	3	Radiation pattern accuracy, power and modulation measurements, spectrum measurements, ID Coding

1.5	**Antenna Sub-system**		
1.5.1	Explain VOR antenna characteristics	2	Impedance, polar diagram, polarisation, types of antennas
1.5.2	Appreciate the interface between power stage and the antennae	3	SWR, radiated power
1.5.3	Appreciate protection areas	3	Obstacles, ICAO Annexes 10 *e.g. manufacturers manuals*
1.6	**Monitoring and Control Sub-system**		
1.6.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.6.2	Describe which VOR parameters are monitored	2	ICAO and RTCA/EUROCAE requirements *e.g. NSA requirements*
1.6.3	Describe the principles of the CVOR and/or DVOR monitoring systems	2	Near field sensors, far field sensors, recombination Local and remote monitoring
1.6.4	Appreciate how the operational status of the CVOR and/or DVOR monitoring systems are checked	3	Near field sensors, far field sensors, recombination Local and remote monitoring **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. BITE, Watchdog*
1.6.5	Describe the issues associated with VOR obstacle limitations and obstacle removal	2	Surrounding environment, multipath prevention
1.6.6	Explain the optional ILS interface	2	
1.7	**On-board Equipment**		
1.7.1	Describe the on-board equipment	2	Antenna, receiver HMI *e.g. CDI, RMI, HSI, ND, PFD*
1.7.2	Describe how the VOR information is used on board	2	*e.g. single VOR, VOR-VOR, approach procedures, manual mode, automatic mode*
1.8	**System Check and Maintenance**		
1.8.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10

1.8.2	Perform typical system measurements	3	In space modulation, phase sideband/carrier, ground check for bearing errors
1.8.3	Appreciate calibration tasks and flight inspection results	3	Flight inspection (coverage, flight check for bearing errors and modulation) **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance manuals, procedures and reports*
1.8.4	Appreciate troubleshooting of a CVOR and/or DVOR	3	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance and flight inspection manuals, procedures and reports*
1.8.5	Analyse the origins of CVOR and/ or DVOR errors	4	<u>CVOR</u> System dependent, adjustments, drifts, multipath, on-board errors and/or DVOR North Adjustment *e.g. DVOR - antenna feeding* *DVOR and CVOR - multipath, EMC, interference with radio broadcast transmissions*

Subject 5. : GROUND-BASED SYSTEMS-DME

1. DME

1.1	**Use of the System**		
1.1.1	Describe the overall performances for DME	2	Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the limitations of DME	2	Accuracy, integrity, capacity
1.1.3	Describe the current situation	2	*e.g. number, types, users, user groups, national context, European context*
1.1.4	State the role of the DME infrastructure in the future navigation applications	1	PBN
1.1.5	Explain the differences between DME and TACAN for civilian use	2	*e.g. azimuth and range*
1.2	**Fundamentals of DME**		
1.2.1	Describe the key elements of DME system operation	2	Two-way ranging technique, slant range, time measurement A/c interrogation, pulse pairs, ground reply, fixed time delay, interrogation stagger, "X" and "Y" channels
1.2.2	Explain the frequency spectrum and the channel spacing allocated	2	ICAO Annex 10, L-band
1.3	**Ground Station Architecture**		
1.3.1	Describe the main components of a DME ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring
1.3.2	Relate DME station design to operational requirements	4	Coverage, id code, siting
1.4	**Receiver Sub-system**		
1.4.1	Explain the main receiver parameters for a DME	2	Sensitivity, selectivity, dynamic range, jamming immunity
1.4.2	Perform the typical measurements on the interrogation signals	3	Sensitivity, selectivity, dynamic range, jamming immunity
1.5	**Signal Processing**		
1.5.1	Explain the functions performed by a DME/N signal processor	2	Decode, Reply Delay, Automatic Reply Rate Control, Encode, priority (Ident, DME signal, Squitter)
1.5.2	Perform the typical measurement on the DME/N transponder signals	3	Reply Delay, Reply Delay offset, decode parameters, rate of replies

1.6	**Transmitter Sub-system**		
1.6.1	Characterise the main signal parameters from the ground station	2	Carrier frequency, output power, pulse shape, pulse spacing, pulse repetition frequency, main delay, ID code
1.6.2	Perform the typical measurements on a DME	3	Power and pulse measurements, spectrum measurements, modulation measurements
1.7	**Antenna Sub-system**		
1.7.1	Explain DME antenna characteristics	2	Patterns, antennas
1.7.2	Appreciate the interface between power stage and the antenna	3	SWR, radiated power, propagation delay, distribution circuit (e.g. duplexer, circulator)
1.7.3	Appreciate protection areas	3	ICAO Annexes 10, protection area criteria and enforcement *e.g. manufacturers manuals*
1.8	**Monitoring and Control Sub-system**		
1.8.1	Describe the purpose of monitoring	2	Integrity, continuity of service
1.8.2	Describe which DME parameters are monitored	2	ICAO and RTCA/EUROCAE requirements *e.g. NSA requirements*
1.8.3	Appreciate how the operational status of the DME monitoring system is checked	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training**
1.8.4	Describe the issues associated with DME obstacle limitations and obstacle removal	2	Multipath, blanking
1.9	**On-board Equipment**		
1.9.1	Describe the on-board equipment	2	Transmitter, antenna, receiver, HMI *e.g. HSI, DME range indication, ND*
1.9.2	Describe how the DME information is used on board	2	*e.g. single DME, multi-DME navigation (rho rho), approach procedures, manual mode, automatic mode*
1.10	**System Check and Maintenance**		
1.10.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *e.g. European regulations*

1.10.2	Appreciate calibration tasks and flight inspection results	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance and flight inspection manuals, procedures and reports*
1.10.3	Appreciate troubleshooting of a DME	3	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. main delay and monitor shutdown errors, interference* *Maintenance and flight inspection manuals, procedures and reports*
1.10.4	Appreciate the origin of DME errors	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Multipath, EMC, interference with radio broadcast transmissions (harmonics)*

Subject 6. : GROUND-BASED SYSTEMS-ILS

1. ILS

1.1	**Use of the System**		
1.1.1	Describe the overall performance for ILS	2	Annex 10 and 14 Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the technical limitations of ILS	2	Annex 10 and 14 Only 40 channels, no segmented paths of approach, beam corruption due to multi-path
1.1.3	Interpret ILS Facility Performance Categories	5	Annex 10 and 14 Cat I, Cat II, Cat III Different operational category depending on operational minima, equipment and airport facilities
1.1.4	Define obstacle free zones for ILS components	1	ICAO Annex 10 and 14 Dimensions *e.g. National regulations*
1.1.5	Explain the importance and need for ILS obstacle free zones	2	ILS beam protection, increased significance during LVP conditions
1.1.6	Explain the current situation	2	*e.g. number, type, users, National context*
1.1.7	Consider the need for ATC ILS status indications	2	No continuous monitoring by ATSEP
1.2	**Fundamentals of ILS**		
1.2.1	Explain how to obtain a change in depth of modulation of an amplitude-modulated signal as a function of angular position	2	Addition of a carrier signal and a side band signal in space
1.2.2	Characterise the signals to be radiated	2	Amplitude and phase relationship, antenna systems
1.2.3	Relate the adjustment of signals generated to the resulting beam patterns and standards	4	Phases and amplitudes in antenna array, modulations on carrier signal, phase and amplitude of sideband
1.2.4	Describe the required performance of an antenna array	2	Beam bend potential, coverage, impact on location of critical and sensitive area
1.3	**2F-Systems**		
1.3.1	Explain the limitations of a 1F system	2	Multipath in adverse environment and terrain
1.3.2	Describe the capture effect	2	Capture effect in receiver circuits
1.3.3	Describe radiation parameters for 2F-LOC and 2F-GP	2	Types of antenna arrays, patterns, coverage, signal distribution, radiated power

1.4	**Ground Station Architecture**		
1.4.1	Describe the layout of an ILS	2	
1.4.2	Describe the main components of the LOC (1F and 2F), GP (1F and 2F), markers and field monitors	2	Electronic cabinet, antennas, power supply, remote controls and monitoring, tower indication *e.g. DME*
1.4.3	Relate ILS station design to operational requirements	4	Coverage, id code, siting
1.5	**Transmitter Sub-systems**		
1.5.1	Appreciate main signal parameters for LOC (1F and 2F), GP (1F and 2F) and markers	3	Carrier frequency, output power, signals generated
1.5.2	Explain the block diagram of the ILS transmitters	2	LOC, GP, Marker beacons Synthesizer, modulator, power amplifier, control coupler, RF changeover
1.6	**Antenna Sub-system**		
1.6.1	Explain ILS antenna characteristics: LOC, GP and Marker Beacons	2	Types, position, polarisation, patterns, coverage, antenna matching, distribution circuits, radiated power, ground reflection
1.7	**Monitoring and Control Sub-systems**		
1.7.1	Describe purpose of the monitoring	2	Integrity, continuity of service
1.7.2	Describe the parameters for the monitoring according to ICAO Annex 10: LOC, GP and Marker Beacons	2	RF level, DDM, SDM on position and width
1.7.3	Explain the key additional required monitoring: LOC and GP	2	External, internal and integral monitoring
1.7.4	Explain the purpose, advantages and disadvantages of the FFM system	2	*e.g. content position, width, requirement for Cat III operations (some States)*
1.7.5	Draw a diagram of the monitoring system: LOC, GP, FFM and Marker Beacons	1	Near-field, integral network, internal network, monitor signal processor *e.g. DME*
1.7.6	Explain the optional DME interface	2	Identity coding ratio
1.8	**On-board Equipment**		
1.8.1	Describe the on-board equipment associated with LOC, GP and Marker Beacon	2	Antennas, receiver, pilot interface (cross pointer) *e.g. FMS*

1.8.2	Describe how ILS information is used on-board	2	*e.g. approach procedures, landing, roll-out, manual, automatic mode (auto-pilot)*
1.9	**System Check and Maintenance**		
1.9.1	Appreciate the conformity of LOC, GP and Marker Beacons to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *e.g. European regulations*
1.9.2	Justify the occasions when it is necessary to downgrade an ILS Facility Performance Category	4	*e.g. system failures, environmental changes/ disturbance*
1.9.3	Explain the implications of ILS Facility Performance Categories to the pilot	2	Link with prevailing Instrument RVR, weather dictating Decision Height
1.9.4	Perform some typical measurements	3	Output power, spectrum analysis, modulation, id code
1.9.5	Appreciate calibration tasks and flight inspection results	3	LOC, GP and Marker Beacons Flight inspection and ground calibration results LOC Centreline measurement, width and centreline field measurements **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. RF interference monitoring* *Maintenance and flight inspection manuals, procedures and reports*
1.9.6	Appreciate troubleshooting of ILS LOC, GP and Marker Beacons	3	DDM and SDM mis-alignment, coverage Pilot reported errors,field checks, monitor checks **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. lack of power, carrier frequency deviation, harmonic ratio, depth of modulation* *Maintenance and flight inspection manuals, procedures and reports*
1.9.7	Appreciate the origin of ILS errors	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Multipath, EMC, interference with radio broadcast transmissions (harmonics)*

Subject 7. : GROUND-BASED SYSTEMS-MLS

1. MLS

1.1	**Use of the System**		
1.1.1	Describe approach and landing path	2	Azimuth station, elevation station, back azimuth station, approach DME, equipment layout, ICAO defined benchmarks
1.1.2	Describe the overall performances for MLS	2	Coverage, accuracy, availability of the system, integrity, continuity, category and level
1.1.3	Explain the technical limitations of MLS	2	Sensitivity to weather conditions, complexity, sensitively to multipath, criticality of signal at edge of coverage
1.1.4	Explain the advantages of MLS	2	Type of information, accuracy, small critical and sensitive areas, number of channels, complex approach paths, less prone to interference, reduced sensitivity to multipath, size of antennae array
1.1.5	Interpret MLS Facility Performance Categories	5	Cat 1,2,3 Different operational category depending on operational minima, equipment and airport facilities
1.1.6	Define MLS Critical and Sensitive Areas	1	Critical and sensitive area dimensions
1.1.7	Explain the importance and need for MLS Critical and Sensitive areas	2	MLS beam protection, increased significance during LVP conditions
1.1.8	Describe the current situation	2	Multi-mode receivers, ground and aircraft equipment *e.g. low equipage, users, number of manufacturers*
1.1.9	Consider the need for ATC MLS status indications	2	No continuous monitoring by ATSEP
1.2	**Fundamentals of MLS**		
1.2.1	Explain the principle for generating a scanning beam	2	Phase changes, phase relations
1.2.2	Describe the relationship between beam pattern and accuracy	2	Beam width, side lobe level reduction
1.2.3	Explain why data transmission is necessary	2	Station co-ordinates, ident, function synchronisation, time reference
1.2.4	Describe the data transmission structure	2	ICAO specification
1.3	**Ground Station Architecture**		
1.3.1	Describe the layout of an MLS	2	

1.3.2	Describe the main components of the azimuth, elevation, back azimuth and DME stations	2	Electronic cabinet, antennas, power supply, remote controls and monitoring, tower indication
1.3.3	Relate MLS station design to operational requirements	4	Coverage, id code, siting
1.4	**Transmitter Sub-system**		
1.4.1	Characterise main signal parameters for azimuth, elevation and back azimuth station	2	Carrier frequency, output power, signals generated, timing
1.4.2	Explain the main components of the transmitters	2	Azimuth, elevation, back azimuth station Synthesiser, modulator, power amplifier, control coupler, RF changeover
1.5	**Antenna Sub-system**		
1.5.1	Explain MLS antenna characteristics: azimuth, elevation and back azimuth stations	2	Types, location, polarisation, pattern, coverage, distribution circuits, radiated power
1.6	**Monitoring and Control Sub-systems**		
1.6.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.6.2	Describe the parameters for the monitoring according to ICAO Annex 10: azimuth, elevation and back azimuth stations	2	RF level, beam width, scan speed
1.6.3	Explain how the parameters are monitored: azimuth, elevation and back azimuth station	2	External and internal monitoring
1.6.4	Explain the FFM system	2	Requirements for CAT 3 operations
1.6.5	Draw a diagram of the monitoring system	1	
1.7	**On-board Equipment**		
1.7.1	Describe the on-board equipment	2	Antennas, receiver, pilot interface, HMI *e.g. FMS*
1.7.2	Describe how the MLS information is used on board	2	Approach procedures, ILS-like display
1.8	**System Check and Maintenance**		
1.8.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMV + SAR), ICAO Annex 10 *e.g. European regulations*
1.8.2	Justify the occasions when it is necessary to downgrade an MLS Facility Performance Category	4	

1.8.3	Explain the implications of MLS Facility Performance Categories to the pilot	2	Link with prevailing Instrument RVR, weather dictating Decision Height
1.8.4	Consider the need for ATSEP MLS Remote Maintenance and Monitoring Systems	2	Control, status, performance monitoring including alarm logging
1.8.5	Perform the typical system measurements	3	Output power, spectrum analysis, datalink modulation, id code, Ground field checks
1.8.6	Appreciate calibration tasks and flight inspection results	3	Azimuth, back azimuth, azimuth centreline measurement, width and centreline measurements, elevation Flight inspection and ground calibration results **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance manuals, procedures and reports*
1.8.7	Appreciate troubleshooting of an MLS	3	Lack of power, carrier frequency deviation, harmonic ratio, beam pattern **Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Maintenance and flight inspection manuals, procedures and reports*
1.8.8	Appreciate the origin of MLS errors	3	**Additional - For achievement of competence, this objective shall be applied practically ,at the latest by the end of S/E Rating training** *e.g. Multipath, EMC, weather influence*

Subject 8. : GLOBAL NAVIGATION SATELLITE SYSTEM

1. GNSS

1.1 General View

1.1.1	Explain the importance and continuing development of GNSS	2	FANS CNS/ATM concept, ICAO Doc 9849, Navigation Application & NAVAID Infrastructure Strategy for the ECAC Area up to 2020, EUROCONTROL GNSS Policy, SESAR ATM Master Plan
1.1.2	Describe the elements of GNSS within Europe	2	Core constellations, ABAS, SBAS(EGNOS) *e.g. GBAS, SCAT 1, APV, Annex 10*
1.1.3	Appreciate the sources of interference to GNSS signals	3	Intentional, unintentional, ionospheric interference, solar activity
1.1.4	Explain who has responsibility for GNSS oversight in your State and how it is carried out	2	*e.g EASA, GSA, NSA, ANSP*
1.1.5	Appreciate the impact of the modernisation of GNSS on the ARNS bands	3	Introduction of L5, E5A, E5B *e.g. COMPASS*
1.1.6	Explain the need for a minimum number of visible satellites needed to provide integrity monitoring	2	*e.g AUGUR*
1.1.7	Describe the purpose of the GNSS NOTAM	2	Annex 10 Vol 1

Subject 9. : ON BOARD EQUIPMENT

1. ON-BOARD SYSTEMS			
1.1	**On-Board Systems**		
1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database
1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays
2. AUTONOMOUS NAVIGATION			
2.1	**Inertial Navigation**		
2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating
3. VERTICAL NAVIGATION			
3.1	**Vertical Navigation**		
3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *e.g. air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

Subject 10: FUNCTIONAL SAFETY

1. SAFETY ATTITUDE

1.1 Safety Attitude

1.1.1	State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to navigation systems, safety monitoring

2. FUNCTIONAL SAFETY

2.1 Functional Safety

2.1.1	Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial, premature or delayed operation, spurious, intermittent, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 4
QUALIFICATION: SURVEILLANCE Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 4 QUALIFICATION: SURVEILLANCE Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 4 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: *Surveillance* syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the Surveillance domain training objectives.

The Qualification: *Surveillance* syllabus contains the following:

- SUBJECT 1: Primary (SUR PSR)
- SUBJECT 2: Secondary (SUR SSR)
- SUBJECT 3: ADS (SUR ADS)
- SUBJECT 4: HMI (SUR HMI)
- SUBJECT 5: Surveillance Data Transmission (SUR SDT)
- SUBJECT 6: Functional Safety (SUR FST)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: Surveillance-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : PRIMARY

1. ATC SURVEILLANCE

1.1	**Use of PSR for Air Traffic Services**		
1.1.1	Describe the operational requirements of an en-route or an approach PSR	2	Range, resolution, coverage, availability
1.1.2	Relate key parameters of PSR to system performance	4	Key parameters: PRF, Signal energy, frequency diversity, antenna gain, update rate, polarisation, receiver MDS,beamwidth Performance: range, accuracy, resolution, extractor minimum target threshold, weather influence, PD, blind speed, ambiguities, capacity *e.g. weather channel*
1.2	**Antenna (PSR)**		
1.2.1	Describe antenna types, accuracy and problems	2	Antenna beam(s), side lobes, reflector antenna, active (phased array) antenna, rotating joints, waveguide interface, pressurisation de-humidification, polarisation, azimuth encoding, drive systems
1.3	**Transmitters**		
1.3.1	Describe the basic characteristics of a transmitter	2	Timing, coherence, modulation, pulse width, pulse compression, pulse energy, frequency diversity/agility
1.3.2	Describe the signals at all key points	2	Supply, EHT, RF source (appropriate to type chosen), modulation, interlocks
1.3.3	Describe a generic transmitter block diagram for both compressed and non-compressed system	2	*e.g. solid state, klystron, magnetron, travelling wave tube*
1.3.4	State possible failures and where they can occur in the transmitter system	1	*e.g. solid state modules, Arcing, corona discharge, component stress, control loops, isolation*
1.3.5	State constraints and problems on the High Voltage circuitry	1	*e.g. corona discharge, dielectric stress, isolation, arcing, ageing, interlocks, stability (including control loop)*
1.4	**Characteristics of Primary Targets**		
1.4.1	Appreciate the characteristics of targets detected by PSR	3	Backscatter, radar cross section (such as reflectivity, stealth technologies, aspect), Doppler shift, Ground Speed, Wind Turbines *e.g. Swerling Case*

1.5	**Receivers**		
1.5.1	Describe the basic characteristics of a receiver	2	Low noise, high dynamic range, bandwidth, detection, frequency, sensitivity, selectivity
1.5.2	Describe the basic elements of a generic receiver	2	LNA, local oscillator, coherent oscillator, down-converter, filtering, rejection, IF, PSD, AGC, STC, beam switching
1.5.3	Appreciate the importance of STC	3	Saturation, RF-IF dynamic range
1.6	**Signal Processing and Plot Extraction**		
1.6.1	Describe the basic function of data processing	2	Plot extraction (range bin reports, range correlation, azimuth correlation), target reports, sliding window, weighted centre, local tracking
1.6.2	Appreciate the basic functions of a current radar signal processor	3	A/D conversion, I/Q matching, target detection, detection criteria (fixed, adaptive), MTD and clutter maps
1.6.3	Describe the processing techniques to improve the quality of target reports using scan to scan information	2	Tracking, environment mapping, adaptive feedback to extraction parameters
1.7	**Plot Combining**		
1.7.1	Describe the basic function of plot combining	2	Secondary/primary combining, secondary/ primary assigning, prime target, range and azimuth collimation
1.7.2	Describe the basic functions of a current radar plot combiner	2	Scan to scan correlation, angel filtering, vehicle filtering, output format
1.8	**Characteristics of Primary Radar**		
1.8.1	Explain the basic principles of electromagnetism, propagation, signal detection, RF power generation and distribution	2	Frequency and phase, electromagnetic radiation, spectrum and bandwidth, noise, HPA, waveguide problems
2.	**SMR**		
2.1	**Use of SMR for Air Traffic Services**		
2.1.1	Describe the operational requirements of SMR	2	Range, resolution, coverage, MTBF, availability
2.1.2	Relate key parameters and necessity to achieve performances	4	Specific equations for Ranging and power budget, PRF, frequency with respect to range and accuracy, PD, frequency diversity, range with respect to TX power, antenna gain, receiver MDS, update rate, beamwidth, extractor minimum target threshold, polarisation, influence to meteorology

2.2	**Radar Sensor**		
2.2.1	Explain the layout of the SMR	2	Dual system, service display
2.2.2	Describe the basic functions of the receiver/transmitter unit	2	Hardware/function overview
2.2.3	Describe how to operate a sensor	2	*e.g. block diagram, timing relations, video path, frequency diversity, polarisation, controller structure*
2.2.4	Describe the basic functions of the antenna unit	2	*e.g. hardware function overview, control/switch unit, external interface, azimuth encoding, monopulse techniques*
3.	**TEST AND MEASURMENT**		
3.1	**Test and Measurement**		
3.1.1	Appreciate how measurements can be made on PSR and SMR	3	**Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training** *e.g. spectrum analyser, vector voltmeter, oscilloscope, SWR meter, sensor analysis tools*

Subject 2. : SECONDARY

1. SSR AND MSSR

1.1	**Use of SSR for Air Traffic Services**		
1.1.1	Describe the operational requirements of an en-route or a approach SSR	2	Range, coverage, resolution, performance, update rate ICAO Doc 9684
1.1.2	Relate key parameters of SSR to system performance	4	**Key parameters**: Rotation rate, PRF, interlaced modes, capacity, frequencies, power budget (uplink, downlink), Monopulse techniques **Consequences**: FRUIT, Garbling, Side Lobes reception and transmission, Transponder availability, PD, 2nd recurrence replies
1.2	**Antenna (SSR)**		
1.2.1	Describe the principles of SSR/ MSSR antenna	2	Mono-pulse antenna techniques, coaxial connection,sum, difference and control pattern, error angle measurement, azimuth encoding, beam sharpening, side lobes
1.3	**Interrogator**		
1.3.1	Describe the characteristics of an interrogator	2	Frequency, spectrum, interrogation modes, Duty cycle, ISLS, IISLS, staggering
1.3.2	Explain a generic Interrogator	2	Timing, interface, modulator, BITE
1.3.3	Explain the need for integrity monitoring	2	Safeguards against erroneous transmission, BITE
1.4	**Transponder**		
1.4.1	Explain the operational use of the transponder	2	Diagram of interaction between transponder and aeroplane
1.4.2	Define the global performances	1	Range, accuracy, fixed delay to respond
1.4.3	Describe the basic characteristics of a transponder	2	Transceiver, aerial location, switching and polar diagram, size ACAS Mode S and ADS compatibility, maximum reply rate, ISLS compatibility
1.4.4	Explain the advantages of the transponder	2	Longer range, more information
1.4.5	Explain the limitations of the transponder	2	Hundreds of feet precision, 3A limited codes
1.4.6	Describe the conformity to regulations	2	Equipage obligations, ICAO Annex 10
1.4.7	Describe the data format of the received transponder messages	2	P1, P2, P3, P4, P5, P6 signals and DPSK modulation (P6)

1.4.8	Describe the data format of the transmitted transponder messages	2	Field lengths, data bits, Gray code, unused bits, Mode S reply (preamble and data)
1.4.9	Describe the basic characteristics of a transmitter	2	Timing, modulation, pulse width, power output
1.4.10	Describe the use of the transponder as a field monitor	2	
1.5	**Receiver**		
1.5.1	Describe the basic characteristic of a SSR receiver	2	Standard/MSSR receiver, sensibility, bandwidth, dynamic range, GTC (normal, sectorised), monopulse processor, RSLS, multi-path and interferences
1.6	**Signal Processing and Plot Extraction**		
1.6.1	Describe mono-pulse extraction	2	Phase and amplitude modulation, off boresight angle calculation, azimuth encoding
1.6.2	Describe sliding window SSR extraction	2	Leading edge, trailing edge, azimuth accuracy, azimuth encoding
1.6.3	Describe the signal processing	2	Video digitizer, pulse processor, reply decoder (bracket pair detector) synchronous reply correlator
1.6.4	Decode a transponder message	3	Standard message with SPI set *e.g. Mode S*
1.6.5	Describe the SSR processing techniques	2	Discrete code correlation, general association, zones, categories, code swapping, general correlation Mode A code data, Mode C data, target position report
1.6.6	Explain the reasons for surveillance processing and the key options	2	False target identification and elimination, data validation, data correction, reflection identification and processing, enhanced resolution performance
1.7	**Plot Combining**		
1.7.1	Describe the basic function of plot combining	2	Secondary/primary combing, secondary/ primary assigning, prime target, range and azimuth collimation
1.7.2	Describe the basic functions of a current radar plot combiner	2	Describe the basic functions of a current radar plot combiner
1.8	**Test and Measurement**		
1.8.1	Appreciate how measurements can be made on SSR	3	**Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training** *e.g. spectrum analyser, vector voltmeter, oscilloscope, SWR meter, sensor analysis tools*

2. MODE S

2.1 Introduction to Mode S

2.1.1	Explain the need for and benefits of Mode S	2	Classical SSR limitations, resolution, accuracy, integrity, enhanced data (e.g. 25ft resolution, aircraft ID, BDS information)
2.1.2	Explain the working principles of Mode S	2	Mode S interrogation, Mode S reply, Mode S uplink and downlink capability, Mode S formats/protocols, ELS, EHS
2.1.3	Explain the complementary use of Mode S and conventional SSR	2	Mode Interlace Pattern, Operational use of All-call, Roll-call
2.1.4	Explain Mode S implementation	2	Elementary and enhanced surveillance, II and SI codes, use of BDS

2.2 Mode S System

2.2.1	Describe the theory of operation of Mode S hardware and software	2	Performance of the system, theory of operation of the system, interfaces to customer equipment
2.2.2	Describe testing possibilities for Mode S	2	*e.g. SASS-C, SASS-S*

3. MULTILATERATION

3.1 MLAT in use

3.1.1	Explain how pilot and controller operations are impacted by the use of an MLAT system	2	Mode A assigned at gate, coverage of MLAT
3.1.2	Describe the ground mode of Transponders	2	Aircraft interrogations, squitters, change of transponder mode

3.2 MLAT Principles

3.2.1	Explain the MLAT system architecture	2	Standards, transmitters and receivers, data processing/fusion, redundancy, performance, costs, timing solutions, etc
3.2.2	Appreciate the principles of MLAT system	3	Triangulation, coverage, position calculation *e.g. SCAS*
3.2.3	Describe how to operate the system	2	Tracking, map creation and blanking
3.2.4	Describe testing possibilities for MLAT	2	*e.g. SASS-C*

4. SSR ENVIRONMENT

4.1 SSR Environment

4.1.1	Explain the operational use of ACAS and implications for pilots and controllers	2	Traffic Advisories, Resolution Advisories, pilot responses and controller information
4.1.2	Describe the users of the 1030 MHz 1090 MHz channels	2	Modes 1, 3, A, C and S, military, Mode S uplink and downlink capability, ACAS (TCAS), acquisition and extended squitter, PRF-FRUIT ratios, DME and other interference

Subject 3. : ADS

1. GENERAL VIEW ON ADS

1.1	**Definition of ADS**		
1.1.1	Describe the basic characteristics of a ADS	2	Performance, integrity, latency, QoS, implementation options (e.g. ATN/FANS)
1.1.2	List the types of navigation sensors	1	GNSS, INS, radio NAVAIDs, navigation solutions from FMS, FoM
1.1.3	State the latest developments, implementation plans and projects	1	*e.g. current and recent test and trials, ICAO status, EUROCONTROL, FAA and other authorities positions, airline and equipment manufacturer positions, ATC procedures, time scales*

2. ADS-B

2.1	**Introduction to ADS-B**		
2.1.1	Explain the basic principles of ADS B	2	Autonomous operation, navigation solutions, link options, aircraft situation awareness
2.1.2	Identify the major elements of ADS-B	3	*e.g. ADS-B global chain (from the aircraft to the controller HMI), GNSS, FMS, encoding, scheduling, link*
2.2	**Techniques of ADS B**		
2.2.1	Explain the characteristics of the data links used in ADS B	2	VDL Mode 4, Mode S extended squitter, UAT
2.2.2	Describe the major ADS-B applications	2	*e.g. ADS-B-NRA, ADS-B-RAD, ASAS*
2.3	**VDL Mode 4 (STDMA)**		
2.3.1	Describe the use of VDL Mode 4	2	High-level description
2.4	**Mode S Extended Squitter**		
2.4.1	Describe the use of the Mode S extended squitter	2	High-level description
2.4.2	Explain the principles related to signals in space	2	Modulation scheme, signal structure, key data and frequency
2.4.3	Explain the principles related to random access technology	2	Consequences on the RF environment (1090 MHz)
2.4.4	Explain the relevant messages	2	Information in each field, information encoding and decoding

2.4.5	Recognise the structure of a Mode S extended squitter signal	1	Signal timing and sequencing, data encoding
2.4.6	Explain the interface between the BDS and the extended squitter message	2	
2.5 UAT			
2.5.1	State the use of the UAT	1	High-level description
2.6 ASTERIX			
2.6.1	Decode and analyse a signal coded according to the ASTERIX category 21 standard	3	Reference to ASTERIX standard Decode position, CallSign, ModeS address etc.
3. ADS-C			
3.1 Introduction to ADS-C			
3.1.1	Explain the basic principles of ADS-C	2	Contract, multi-contract, time, event triggering
3.1.2	Identify the major elements of the ADS-C system	3	ADS-C global chain (from the aircraft to the controller HMI), GNSS, processor, link, ground station
3.2 Techniques in ADS-C			
3.2.1	Explain the characteristics of the data links used in ADS-C	2	*e.g. sub-networks (VDLs, AMSS, HFDL)*

Subject 4. : HMI

1. HMI

1.1	**ATCO HMI**		
1.1.1	Describe the display types available	2	Video, synthetic, mixed
1.1.2	State the type of selections available	1	Source, range, maps, filters
1.1.3	Describe the advantages of different display types	2	Clarity, configurability, fallback, data integration
1.2	**ATSEP HMI**		
1.2.1	Describe the user interface scope and ergonomics as seen by different users and at different locations	2	System management displays characteristics both control and monitoring
1.2.2	Describe the analytical and status data available to the users	2	Radar video, front panel and CMS data, HMI on each sub-system
1.3	**Pilot HMI**		
1.3.1	Describe the transponder interface	2	Mode A, change procedure, SPI, Mode C, deselection, hijack
1.3.2	Be aware of the ACAS/TCAS display and future potential developments	0	Characteristics, accuracy, alerts, ADS B, CDTI
1.3.3	Be aware of the EGPWS display and of future potential developments	0	
1.4	**Displays**		
1.4.1	Describe the display types available and their advantages and disadvantages	2	Raster/rotating, raw/synthetic,monochrome/ colour, CRT/LCD, performances (cost, availability, maintainability, ergonomics)

Subject 5. : SURVEILLANCE DATA TRANSMISSION

1. SURVEILLANCE DATA TRANSMISSION

1.1	**Technology and Protocols**		
1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks (e.g. RADNET), messages CAT 1+
1.1.2	Decode ASTERIX messages	3	*e.g. categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multi-sensor environment	3	Fault tolerance, redundancy of line equipment *e.g. software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*e.g. saturation, excess latency*
1.2	**Verification Methods**		
1.2.1	Identify the causes for a fault, based on test tool measurements	3	**Additional - For achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training** *e.g. data analyser, line analyser*

Subject 6. : FUNCTIONAL SAFETY

1. SAFETY ATTITUDE

1.1 Safety Attitude

1.1.1	State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to the surveillance systems, safety reports and occurrences, safety monitoring

2. FUNCTIONAL SAFETY

2.1 Functional Safety

2.1.1	Describe the implications of functional failures in terms of exposure time, environment, effect on controller and effect on pilot	2	Total or partial, premature or delayed operation, spurious, intermittent, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 5
QUALIFICATION: DATA PROCESSING Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 5 QUALIFICATION: DATA PROCESSING Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/02009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 5 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: Data Processing syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the Data Processing domain training objectives.

The Qualification: Data Processing syllabus contains the following:

- SUBJECT 1: Functional Safety (DAT FSA)
- SUBJECT 2: Data Processing Systems (DAT DPS)
- SUBJECT 3: Process (DAT PRO)
- SUBJECT 4: Data (DAT DAT)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: Data Processing-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : FUNCTIONAL SAFETY

1. FUNCTIONAL SAFETY

1.1 Functional Safety

1.1.1	Describe the implications of functional failure in terms of exposure time, environment, effect on controller and effect on pilot	2	Total or partial, premature or delayed operation, spurious, intermittent, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR

1.2 Software Integrity and Security

1.2.1	Appreciate how a system can be defended against potential hostile intent via the data processing systems	3	Input verification, secure sources *e.g. leased lines, private networks, eligibility*
1.2.2	Explain how the normal output of a system could be used by non-authorised persons with hostile intent	2	*e.g. terrorists using radar data to coordinate an attack*
1.2.3	Estimate the impact of security and integrity failure to the operational service	3	*e.g. system crashes due to incorrect input data, main and standby and fallback systems all have same input, possible loss in total of system, results in capacity reductions and safety consequences*
1.2.4	Appreciate error detection and handling in data, hardware and process	3	Identification, consequence, scope, reporting, fault tolerance, soft fail, failsafe, monitoring, fallback

2. SAFETY ATTITUDE

2.1 Safety Attitude

2.1.1	State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to data processing systems, safety monitoring

Subject 2. : DATA PROCESSING SYSTEMS

1. USER REQUIREMENTS

1.1	**Controller requirements**		
1.1.1	Explain ATCO missions and services needed in an Area Control Centre	2	Operational requirements *e.g. separation, flight progress monitoring and coordination, trajectory prediction, coordination with adjacent centres*
1.1.2	Explain ATCO missions and services needed in an Approach Control Unit	2	Operational requirements *e.g. vectoring, sequencing, AMAN, CDM*
1.1.3	Explain ATCO missions and services needed in an Aerodrome Control Tower	2	Operational requirements *e.g. runway management, DMAN*
1.2	**Trajectories, Prediction and Calculation**		
1.2.1	State different types of trajectories	1	*e.g. FPL-based, surveillance data-based, FMS-based*
1.2.2	Explain the main processes for trajectory prediction	2	SDP trajectory, FPL trajectory, merged trajectory, predicted trajectory
1.3	**Ground Safety Nets**		
1.3.1	Describe the function of safety nets and their legal status	2	STCA, APW, MSAW, ASMGCS-based safety nets
1.4	**Decision Support**		
1.4.1	Explain the major steps in the air traffic planning process	2	ATFCM with strategic, pre-tactical and tactical, ATC sector planning, tactical control
1.4.2	Explain the principles of trajectory prediction, conformance monitoring and medium term conflict detection processes	2	Route adherence monitoring *e.g. CORA, MTCD, CLAM, Level adherence monitoring*
1.4.3	Explain the benefit of these tools for safety and efficiency	2	

2. SYSTEM COMPONENTS

2.1	**Data Processing Systems**		
2.1.1	Describe all major components of a data processing system	2	Functional architecture, technical architecture, supervision

2.2	**Flight Data Processing Systems**		
2.2.1	Identify all functions of a FDP system	3	FDPS Reference Model, Message Handling, Initial Flight Data Handling, Relationship with Other Functions, Air Ground Datalink Processing, Trajectory Prediction, Flight Data Management and Distribution, SSR Mode A Code Assignment and Management, Correlation, Co-ordination and Transfer
2.2.2	Describe all major components of a FDP	2	Functional architecture, technical architecture *e.g. HMI, ATC Tools, support tools (technical supervision, QoS monitors and logging)*
2.2.3	Differentiate FDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
2.2.4	Appreciate how to operate the system	3	*e.g. configuration, adjust parameters, start up and shut down, monitoring*
2.2.5	Explain the principles of emergency switching	2	
2.3	**Surveillance Data Processing Systems**		
2.3.1	Identify all functions of a SDP system	3	Plot processing, tracking, single- and multi-sensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multi-sensor tracker, recording *e.g. ARTAS tracker*
2.3.2	Describe all major components of a SDP	2	Functional architecture, technical architecture
2.3.3	Differentiate SDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
2.3.4	Appreciate how to operate the system	3	*e.g. configuration, adjust parameters, start up and shut down, monitoring*
2.3.5	Explain the principles of emergency switching	2	

Subject 3. : PROCESS

1. SOFTWARE PROCESS

1.1	**Middleware**		
1.1.1	Define middleware	1	Additional specialised functional built on the OS
1.1.2	List the middleware used on the national major systems	1	*e.g. CORBA, UBSS, OTM, EJB*
1.1.3	Demonstrate the use of a middleware in an ATM environment	2	Duel processing system
1.2	**Operating Systems**		
1.2.1	Describe the major aspects of a relevant operating system	2	*e.g. design, start-up, configuration, back-up and restore*
1.2.2	Perform relevant operating system commands	3	
1.2.3	Characterise typical consequences of an OS upgrade	2	Some possible implications on HW (performance, memory), middleware (compatibility) and SW components
1.2.4	Explain downward compatibility	2	Checks on embedded SW modules ability to run under new OS version
1.2.5	Take account of hardware/software compatibility	2	Examples of HW requirements of specific SW implementations
1.2.6	Describe interactions between application and OS	2	Examples of OS calls by the application software if no middleware is in use
1.2.7	Describe the life cycle management of an operating system	2	*e.g. versions, releases, patches, migration*
1.3	**Configuration Control**		
1.3.1	Describe the principles of configuration control	2	Clear identifcation of all versions, proof of testing and "build state", tool and mechanisms to aid control, authorisation, audit trail, appropriate quality standard requirements of the administration
1.4	**Software Development Process**		
1.4.1	State the main software development processes	1	SWALs *e.g. life cycle, waterfall model, RUP*
1.4.2	List the main steps of two of the main software development processes	1	

1.4.3	Explain the main differences between two software development processes	2	*e.g. advantages/ disadvantages*
2. HARDWARE PLATFORM			
2.1 Equipment Upgrade			
2.1.1	Explain the key factors that have to be considered when data processing equipment is upgraded or changed	2	Specification, compatibility, 'proven technology' or 'state-of-the-art', maintenance and operating consequence (e.g. personnel, training, spares, procedures), environmental requirements (e.g. size, power requirements, temperature, interfaces), testing
2.2 COTS			
2.2.1	Explain the advantages and disadvantages of commercial off-the-shelf equipment	2	Cost, multiplicity of suppliers, quality, maintainability, life cycle, liability
2.3 Interdependence			
2.3.1	Describe the technical issues regarding the interdependence of various equipment and systems	2	Interface requirements, common point of failure, data conditioning, response time
2.4 Maintainability			
2.4.1	Identify the issues that will affect the maintainability of hardware for the planned life of a system	3	Commercial product life, commercial support commitments, company volatility, spares provision, shelf life and logistics
3. TESTING			
3.1 Testing			
3.1.1	Appreciate the techniques available for system and performance requirements testing	3	*e.g. code walkthrough, modelling, simulation real time and fast time, black box testing, formal methods, use of independent test personnel, data corruption simulation, hardware failure simulation*
3.1.2	Appreciate the techniques available for system testing and integration	3	*e.g. system integration testing, load testing, regression testing*

Subject 4. : DATA

1. DATA ESSENTIAL FEATURES

1.1 Data Significance

1.1.1	Explain the significance of data	2	Criticality (critical / non critical), legality (ICAO, CAA, company), use (advisory, control)

1.2 Data Configuration Control

1.2.1	Explain the control procedures for changes to operational data	2	Designated roles/persons for authorising changes and verifying/checking changes

1.3 Data Standards

1.3.1	Name the authority responsible for standards	1	*e.g. EUROCONTROL, ICAO, ISO*
1.3.2	State the standards related to ATM data, their sources and their status	1	*e.g. ASTERIX, WGS84, OLDI, FMTP, AMHS, ADEX-P, FPL*
1.3.3	Decode a typical OLDI message	3	*e.g. ACT, PAC*
1.3.4	State the nature of ATM processing requirements	1	Data volatility (e.g. radar), system integrity; consequence of failure

2. ATM DATA - DETAILED STRUCTURE

2.1 System Area

2.1.1	Describe how a system area is defined	2	*e.g. size, system centre (reference point)*
2.1.2	Describe the data related to system area	2	*e.g. radar data, flight plan data, maps, coordinates*

2.2 Characteristic Points

2.2.1	State types of characteristic points used in an ATM system and their structure	1	Geographic, Routing, Sector *e.g. Geographic: Airports and runways, ILS, radar, limit points* *Routing and Sectors: coded routes, SID allocation parameters, area navigation waypoints, adjacent FIRs, holding, sectors*
2.2.2	Explain the importance of characteristic points in the correct presentation of data	2	
2.2.3	Describe the process by which amended adaptation files are introduced	2	

2.3	**Aircraft Performances**		
2.3.1	List the performance data used in FDPS	1	Example of data from in-house system
2.3.2	Describe the structure of aircraft performance data	2	
2.3.3	Define speeds, rates and levels	1	
2.3.4	Explain the consequences of the use of the wrong type of aircraft	2	
2.4	**Screen Manager**		
2.4.1	Describe how the screen manager is used to set-up the ATC HMI	2	
2.5	**Auto-coordination Messages**		
2.5.1	Describe the meaning of coordination messages in the control process	2	Coordination parameters, conditions groups, OLDI conditions groups, characteristics of remote centres
2.5.2	Describe the characteristics of the remote centres relevant to OLDI	2	Civil and military
2.6	**Configuration Control Data**		
2.6.1	Explain the structure of the configuration data	2	Sector CSU link, sectorisation plan, control parameters
2.7	**Physical Configuration Data**		
2.7.1	Explain the structure of the physical configuration data	2	External configuration, device configuration
2.8	**Relevant Meteo Data**		
2.8.1	Explain the organisation of the data related to meteorology	2	Meteo, QNH TL areas, CB activity
2.9	**Alert and Error Messages to ATSEP**		
2.9.1	Explain the importance of alert and error messages	2	
2.9.2	Describe different categories of alert and error messages	2	
2.10	**Alert and Error Messages to ATCO**		
2.10.1	Describe the structure of the data used in these types of message	2	MSAW, conflict alert parameters
2.10.2	Explain alerts and error messages, and their importance from an ATCO point of view	2	*e.g. MSAW, conflict alert, MTCD*

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 6
QUALIFICATION: SMC Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 6 QUALIFICATION: SMC Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 6 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: SMC syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the SMC domain training objectives.

The Qualification: SMC syllabus contains the following:

- SUBJECT 1: ANS Structure (SMC ANS)
- SUBJECT 2: SMC System/Equipment (SMC ASE)
- SUBJECT 3: SMC Tools, Processes and Procedures (SMC TPP)
- SUBJECT 4: Technology (SMC TEC)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: SMC-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : ANS STRUCTURE

1. ANSP ORGANISATION AND OPERATION			
1.1	**ANSP Organisation and Operation**		
1.1.1	Describe the SMC function within the organisation	2	What does the SMC do, interfaces with other functions, similarities and major differences between SMC function at different sites
1.1.2	Describe the structure, roles and responsibilities of the SMC team and any direct interfaces	2	
1.1.3	Explain the duties of the ATC Supervisor	2	
2. ANSP MAINTENANCE PROGRAM			
2.1	**Policy**		
2.1.1	Describe, in general terms, the ANSP Maintenance Policy	2	
2.1.2	Describe the aspects of the Maintenance Policy that apply specifically to SMC	2	
3. ATM CONTEXT			
3.1	**ATM Context**		
3.1.1	Describe the ATM requirements and the related services provided by the SMC	2	Service Level Agreements, working arrangements *e.g. ASM, AFTCM*
4. ANSP ADMINISTRATIVE PRACTICES			
4.1	**Administration**		
4.1.1	Describe any ANSP administrative procedures, specifically applicable to SMC	2	Any non-technical practices *e.g. security, access control (building and platform), safety, fire*

Subject 2. : ANS SYSTEM/EQUIPMENT

1. OPERATIONAL IMPACTS

1.1 Degradation or Loss of System/Equipment Services

1.1.1	Describe the importance of monitoring system performance	2	
1.1.2	Describe possible ways in which the SMC may become aware of degradation of services and/or systems	2	*e.g. monitoring systems, telephone calls, aural alerts, user complaint*
1.1.3	Take account of the end users/ customers affected	2	*e.g. ATC Units, Airports, Airlines*
1.1.4	Appreciate the implications for end users/customers	3	
1.1.5	Appreciate the appropriate actions to restore service	3	*e.g switching, replacing, reconfiguration, calling external service provider*
1.1.6	Appreciate the need for appropriate communication before and after restoring service	3	*e.g. users, customers, external and internal providers*

2. USER POSITION FUNCTIONALITY AND OPERATION

2.1 User Working Position

2.1.1	Appreciate working position performance to agreed parameters	3	*e.g. ATCO, Met, ATSEP, Airport positions*

2.2 SMC Working Position

2.2.1	Appreciate SMC working position performance to agreed parameters	3	

Subject 3. : SMC TOOLS, PROCESSES AND PROCEDURES

1. REGULATORY REQUIREMENTS

1.1 SMS

1.1.1	Describe the ICAO and European requirements and the national and ANSP SMS plans	2	EC/2096, ESARRs, Annex 10 *e.g. National regulations*

1.2 QMS

1.2.1	Describe the quality management system requirements	2	*e.g. ISO, EFQM*

1.3 SMS application in the working environment

1.3.1	Describe the relationship between the SMS and the application of SMC	2	Reporting procedures *e.g. ESARR2*
1.3.2	Explain which occurrences require incident reporting and follow-up action/s	2	*e.g. national categories for reporting, Safety Event Processing*
1.3.3	Apply incident reporting procedures to example occurrence/s	3	*e.g. Safety Event Procedure*

2. MAINTENANCE AGREEMENTS WITH OUTSIDE AGENCIES

2.1 Principles of agreements

2.1.1	Describe the principles and need for maintenance agreements	2	*e.g. types of service level provided*
2.1.2	Describe within which functional areas maintenance agreements will occur.	2	*e.g. network providers, facilities management, communications*
2.1.3	Describe where in the SMS Manual these agreements are included or referenced	2	

3. SMC GENERAL PROCESSES

3.1 Roles and responsibilities

3.1.1	Describe the role and general method of operations of the SMC	2	
3.1.2	Describe the need to monitor service conditions and the way to take appropriate action to ensure service performance	2	*e.g. process to interrupt services for planned maintenance purposes, management of service provision during corrective maintenance Continuity of service, availability*

3.1.3	Describe the coordination role of the SMC	2	*e.g. ATSEPs, ATCOs, external Service Providers, ATM stakeholders*
3.1.4	Describe how risk analysis can contribute toward decision-making	2	*e.g. assessing risk, handling of service interventions*

4. MAINTENANCE MANAGEMENT SYSTEMS

4.1 Reporting

4.1.1	Describe how maintenance activities and SMC events/actions are recorded	2	*e.g. procedures to follow, terminology to use, record keeping for traceability*
4.1.2	Explain the importance of accurate record keeping and dissemination for handover and quality management purposes	2	*e.g. information is logged in database or report is generated and distributed according to defined procedures*

Subject 4. : TECHNOLOGY

1. TECHNOLOGIES AND PRINCIPLES

1.1	**General**		
1.1.1	Describe the principles of control and monitoring systems used	2	*e.g national basis, color codes, ergonomics*
1.2	**Communication**		
1.2.1	Describe the key aspects of control and monitoring system capability	2	*e.g. parameters presented to the SMC and types of actions that can be taken*
1.2.2	Appreciate the impact of the replacement of components in a communication chain	3	Continuity of service, communication chain integrity
1.3	**Navigation**		
1.3.1	Describe the key aspects of control and monitoring system capability	2	*e.g. parameters presented to the SMC and types of actions that can be taken*
1.3.2	Appreciate the impact of the replacement of components in navigation equipment	3	Continuity of service, navigation aid integrity
1.4	**Surveillance**		
1.4.1	Describe the key aspects of control and monitoring system capability	2	*e.g. parameters presented to the SMC and types of actions that can be taken*
1.4.2	Appreciate the impact of the replacement of components in a surveillance chain	3	Continuity of service, surveillance chain integrity
1.5	**Data Processing**		
1.5.1	Describe the key aspects of control and monitoring system capability	2	*e.g. parameters presented to the SMC and types of actions that can be taken*
1.5.2	Appreciate the impact of the replacement of components in a data processing chain	3	Continuity of service, data processing chain integrity
1.6	**Facilities**		
1.6.1	Describe the key aspects of system management capability	2	*e.g. parameters presented to the SMC and types of actions that can be taken*

1.6.2	Appreciate the impact of the loss of supply and/or replacement of components in facility equipment	3	Continuity of service, integrity

EUROCONTROL

www.eurocontrol.int

Edition 1.0
Edition date: 27.08.2009
Reference nr: EUROCONTROL-SPEC-132

EUROCONTROL Specification

EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training

Annex 7
QUALIFICATION: Shared Syllabus

EUROCONTROL

EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

EUROCONTROL

EUROCONTROL Specification for ATSEP Common Core Content Initial Training

ANNEX 7 QUALIFICATION: Shared Syllabus

Edition Number	**:**	**1.0**
Edition Date	**:**	**27/08/2009**
Status	**:**	**Released Issue**
Intended for	**:**	**CND Stakeholders**

Page intentionally left blank

CONTENTS

Page intentionally left blank

EXECUTIVE SUMMARY

Annex 7 of the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training details the training objectives for the **Qualification Training: Shared syllabus**.

Qualification Training is defined as ***training designed to impart domain related knowledge and skills appropriate to the qualification stream to be pursued in the CNS/ATM environment.***

Five specialised domains have been identified. They are Communication, Navigation, Surveillance, Data Processing and System Monitoring & Control.

This syllabus contains the Shared training objectives that are common to all domains.

The Qualification: Shared syllabus contains the following:

- SUBJECT 1: Safety (SHR SAF)
- SUBJECT 2: Health and Safety (SHR HAS)
- SUBJECT 3: Human Factors (SHR HUM)

The order of subjects and objectives is not intended to convey a pedagogical sequence nor to indicate a relative level of importance. No recommendation is made in this area. When teaching the objectives, it is envisaged that different training methodologies will be used.

Prior to developing or updating a Qualification Training: Shared-related course, training providers must be familiar with the information contained in the EUROCONTROL Specification for the ATSEP Common Core Content Initial Training, particularly Section 7 (Minimum Training Requirement) which specifies the required training for each "qualification stream" and Section 8 (How to use this document) which contains, amongst other items, the fundamental principles that are applied to the Specification.

Page intentionally left blank

Subject 1. : SAFETY

1 SAFETY MANAGEMENT

1.1 Policy and Principles

1.1.1	Explain the underlying need for safety management policy and principles	2	Lessons learnt from events, evolving environment, regulatory requirements
1.1.2	State the safety management policy	1	Priority of safety, the safety objective of ATM, roles and responsibilities
1.1.3	Explain safety management principles	2	Safety achievement, safety assurance, safety promotion
1.1.4	Appreciate the reactive and proactive nature of safety management policy and principles	3	*e.g. Nature of events, Reason Model, events investigation, safety assessment*
1.1.5	Explain the link between safety management principles and the life cycle of an ATM system	2	Safety occurrences, setting of safety levels, system safety assessment, safety surveys, safety monitoring, system safety assessment documentation, lesson dissemination, safety improvement, use of safety data to assist in decommissioning or replacement of system
1.1.6	Relate the ATSEP role and responsibilities to safety management	4	Competency, occurence reporting (ESARR2 and 5) *e.g. "just culture" (ref:EAM2 GUI 6), risk assessment*
1.1.7	State the role and content of a typical SMS within an ANSP	1	
1.1.8	Explain the "Just Culture" concept	2	Benefits, prerequisites,constraints *e.g. EAM2 GUI6*

1.2 Concept of Risk and Principles of Risk Assessment

1.2.1	Describe the concept of risk	2	Types of risk, components of risk, risk contributors (people, procedure, organisations and equipment)
1.2.2	State ways of assessing risk	1	Risk comparisons, risk analysis
1.2.3	Describe the concept of risk tolerability	2	Risk assessment and mitigation, ALARP principle *e.g. Risk perception, risk management*

1.3 Safety Assessment Process

1.3.1	Explain the methods for the assessment of hazards and possible failures	2	*e.g. Failure and hazard brainstorm session, Fault tree Analysis*

1.3.2	Appreciate the importance of adopting a total system approach covering human, procedure, organisation and equipment elements	3	ATM system description (including scope definition and limitation), end to end integrity of safety assessment *e.g. Concept of TRM*
1.3.3	Describe the overall safety assessment process and its relationships with risk assessment during the total life cycle of ANS system	2	Collection and presentation of results, contingency arrangements, back-up procedures *e.g. Risk-based process, FHA, (safety objectives), preliminary system safety assessment PSSA (safety requirements), system safety assessment SSA (safety monitoring and evidence)*
1.4	**Air Navigation System Risk Classification Scheme**		
1.4.1	Describe the ATM system risk classification scheme	2	ESARR4 *e.g. Scenario of failure of air navigation system (incident chain), component of a risk classification scheme, severity classes, probability classes (qualitative and quantitative)*
1.5	**Safety Regulation**		
1.5.1	Describe the role of safety regulation	2	The purpose of regulation, objectives of the Safety Regulation Commission, objective of the national regulator
1.5.2	Explain the relationship between the safety regulation documents	2	ICAO documentation (SARPS), ESARRs, regulatory advisory documentation, national regulation
1.5.3	Explain how the safety regulation documents affect ATM service provision	2	ICAO documentation (SARPS), EUROCONTROL Safety Regulatory Requirements (ESARR), regulatory advisory documentation, national regulation
1.5.4	Explain the interface between the safety regulator and the ANSP	2	Information to be provided to regulator by ANSP and *vice versa*, importance of incident reporting

Subject 2. : HEALTH AND SAFETY

1. HAZARD AWARENESS AND LEGAL RULES

1.1	**Hazard Awareness**		
1.1.1	State potential hazards to health and safety generated by equipment used in CNS/ATM	1	*e.g.* *COM/SUR/SMC - Mechanical hazards, electrical hazards (LV, HV, EMI), chemical hazards* *NAV - includes - RF energy* *DP - None*
1.2	**Regulations and Procedures**		
1.2.1	State applicable international requirements	1	*e.g. European Norms, CENELEC, DIN*
1.2.2	State any applicable national regulatory requirements	1	
1.2.3	State safety procedure for the persons working on or near relevant equipment	1	*e.g.* *COM/NAV/SUR/SMC - Isolation (clothing, tools), fire extinction types, safety man presence, safety interlocks, isolating switches, security of the site, climbing procedures, earthing, direct or indirect contact with HV*
1.3	**Handling of Hazardous Material**		
1.3.1	State European and local regulations for electronic device disposal	1	Protection of environment *e.g. recycling*

Subject 3. : HUMAN FACTORS

1. INTRODUCTION TO HUMAN FACTORS

1.1 Introduction

1.1.1	Explain why Human Factors are particularly important in the ATM environment	2	Historical background, safety impact on ATM, incidents
1.1.2	Define human factors	1	*e.g. ICAO Human Factors Training Manual*
1.1.3	Explain the concept of systems and its relevance in the ATM environment	2	People, procedures, equipment
1.1.4	Explain the use of the SHELL model	2	*e.g. ICAO Human Factors Training Manual, visits to OPS and technical rooms*
1.1.5	State the factors which can affect personal and team performance	1	*e.g. psychological, medical,physiological, social, organisational, communication, stress, human error, working knowledge and skills*

2. WORKING KNOWLEDGE AND SKILLS

2.1 ATSEP knowledge, skills and competence

2.1.1	Explain the importance of maintaining and updating professional knowledge and skills	2	Assure safety
2.1.2	Explain the importance of maintaining non-technical skills and professional competence	2	*e.g. communication, human relationship, knowledge of environment, human limit awareness*
2.1.3	State the available means to maintain professional knowledge and skills	1	*e.g. practice, personal study, briefing, seminars, courses, technical periodicals, technical books, OJT, simulation, CBT, E-learning, visits, feedback, TRM*

3. PSYCHOLOGICAL FACTORS

3.1 Cognition

3.1.1	Describe major aspects of human information processing	2	Perception, attention, memory, judgement, decision making, response execution, control of execution

3.1.2	Describe the factors which influence information processing	2	*e.g. stress and strain, experience, knowledge, distraction, interpersonal relations, working environment, risk perception, attitude, workload, fatigue, confidence, job security,*
3.1.3	Appreciate factors which influence information processing	3	*e.g. case study, Simulation, Role playing*

4. MEDICAL

4.1 Fatigue

4.1.1	Describe the effect of fatigue on human performance	2	Physiological, cognitive and relational effects *e.g. lack of concentration, irritability, frustration*
4.1.2	Recognise the signs of fatigue in self and in others	1	*e.g. making frequent mistakes, unable to concentrate, lack of normal humour, sleeping and/ or eating disorders*
4.1.3	Explain how to respond to indications of fatigue in an appropriate manner	2	Take time off, rest for short periods of time, seek professional help

4.2 Fitness

4.2.1	Describe signs of lack of personal fitness	2	
4.2.2	Describe actions to prevent or resolve a lack of personal fitness	2	Healthy lifestyle *e.g. healthy diet, sleeping, physical and mental activities*
4.2.3	Explain the influence of psychoactive substances on human performance	2	*e.g. nervous system, medication, smoking, alcohol, habitual and occasional use of psychoactive substances*

4.3 Work Environment

4.3.1	Describe the influence of the work environment on human performance	2	Ergonomics, effects of noise, electromagnetic waves, temperature, working circumstances

5. ORGANISATIONAL AND SOCIAL FACTORS

5.1 Basic Needs of People at Work

5.1.1	Explain basic needs of people at work	2	*e.g. balance between: individual ability and workload, working time and rest periods. Adequate working conditions, positive working environment*

5.1.2	Characterise the factors of work satisfaction	2	*e.g. money, achievement, recognition, advancement, challenge*
5.2	**Team Resource Management**		
5.2.1	State the objectives of TRM	1	Experience sharing, feedback, improved interpersonal relations, indirect increase in safety
5.3	**Teamwork and Team Roles**		
5.3.1	Describe the differences between social human relations and professional interactions	2	
5.3.2	Identify reasons for loss of team effectiveness and actions to prevent it and prevent repetition	3	*e.g. roles poorly defined, goals poorly identified, bad planning, too many leaders or not enough, respect for others, divergence in values, misunderstanding*
5.3.3	Describe the principles of teamwork	2	*e.g. team membership, group dynamics, advantages/disadvantages of teamwork*
5.3.4	Identify reasons for conflict	3	
5.3.5	Describe actions to prevent human conflicts	2	
5.3.6	Describe strategies to cope with human conflict	2	*e.g. in your team*
6.	**COMMUNICATION**		
6.1	**Written Report**		
6.1.1	Appreciate the importance of recording information by writing effectively	3	ATSEP technical report, log-books, system degradation reports, specification, System manager report
6.1.2	Use appropriate terminology to communicate effectively in writing	3	Be concise, clear, common technical terms, convey key points
6.2	**Verbal and Non-verbal Communication**		
6.2.1	Describe the human communication process	2	

6.2.2	Characterise the factors which affect verbal communication	2	*e.g. Cognitive: lack of knowledge of the procedures, of technical terms, Workload, poor receiver references* *Affective: being shy, feelings of not being listened to, not being part of the group, not being assertive, poor eye contact while talking, stress* *Physiological: stuttering, low voice level*
6.2.3	Describe factors which affect non-verbal communication	2	*e.g. touch, noise, interruption, body language*
6.2.4	Use appropriate vocabulary to communicate effectively on technical matters	3	Technical “jargon”, language differences, standard words/phrases
6.2.5	Use appropriate language for professional communication with non-ATSEP	3	Term sharing, translation, being concise, simple words, selection of information and detail level according to the receiver

7. STRESS

7.1 Stress

7.1.1	Explain the process of stress	2	Causes, stress mechanism, consequences in different work situations *(e.g. online intervention, maintenance, training)*
7.1.2	State the symptoms of stress	1	*e.g. frustration, anger, irritability, aggressive and/or irrational behaviour, helplessness*

7.2 Stress Management

7.2.1	Act to relieve or minimise stress in self and/or others	3	The effect of personality in coping with stress, benefits of active stress management
7.2.2	Appreciate how assistance is obtained in stressful situations	3	Benefits of asking, offering and accepting help in stressful situations *e.g. CISM*
7.2.3	Recognise the effects of shocking and stressful situations	1	For self and for others, abnormal situations,
7.2.4	Consider the benefits of Critical Incident Stress Management	2	

8. HUMAN ERROR

8.1 Human Error

8.1.1	Describe human error	2	
8.1.2	Explain the relationship between human error and safety	2	Mechanism, error-prone conditions , consequences *e.g. Reason model, feedback (ESARR 2)*

8.1.3	State different types of errors using an appropriate model	1	*e.g. Rasmussen model, Gagne model*
8.1.4	Differentiate between errors and violations	2	
8.1.5	Explain how to detect errors	2	*e.g. individual and collective strategy, event report, procedure*
8.1.6	Explain, in general terms, how errors are mitigated	2	
8.1.7	Appreciate two significant ATM incidents/accidents involving ATSEP/engineering contributory factors	3	

EUROCONTROL

www.eurocontrol.int