EUROPEAN ORGANISATION
FOR THE SAFETY OF AIR NAVIGATION

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Guidelines for a Common Qualification Level of Technical Training for Air Traffic Safety Electronics Personnel

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Abstract

This document enables the creation of qualification training for Air Traffic Safety Electronics Personnel (ATSEP). The purpose is to start harmonisation of ATSEP training throughout the European Civil Aviation Conference (ECAC) area within the frame of the European Air Traffic Management Programme (EATMP).

The qualification training phase follows the basic training already described in the frame of EATMP.

The qualification training is based on a division of the training matter into five domains: Communication, Navigation, Surveillance, Data Processing and Safety. It provides an organisation of the studies into four qualification training courses: Communication, Navigation, Surveillance and Data Processing. Some elements are common to the four options (e.g. safety).

Keywords

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1.0	06.10.2003	0306017-02	Released Issue (agreed at HRT19 on 26.03.2003) (advanced document configuration + final editorial changes)	All

CONTENTS

EXECUTIVE SUMMARY

This document is the final report of the Working Group of ATM Technical Staff (WGATMTS) created by the Training Sub-Group (TSG) of the EATCHIP\EATMP[1] Human Resources Team (HRT), now known as the Training Focus Group (TFG).

It presents the training syllabus for Phase 2 of Air Traffic Safety Electronics Personnel (ATSEP) training called 'qualification training'.

The training need is defined as a preparation to safety-related tasks performed in a non-exceptional manner by the ATSEP. Section 2 lists the required skills and defines the training.

The detailed specification of the qualification training is in Section 3: a syllabus for each of the five training domains (Communication, Navigation, Surveillance, Data Processing and Safety). Timetables are added to illustrate the objectives.

Section 4 proposes four training courses (Communication, Navigation, Surveillance and Data Processing) from the elements of the five above-listed training domains. Timetables of relevant exemplar training are added.

The common qualification level should have the flexibility to adapt to the Air Navigation Service Providers' (ANSPs) realities, and priority should be given to the qualifications and type ratings related to the equipment in use or foreseen in the near future.

Annex A, 'EATMP Common Core Content Training Concepts', defines the concepts of training events, taxonomy and phases.

A bibliography, further reading, a list of the abbreviations and acronyms used in this document, and the names of those who contributed to its development are provided at the end of the publication.

[1] In 1999 the 'European Air Traffic Control Harmonisation and Integration Programme (EATCHIP)' was renamed the 'European Air Traffic Management Programme (EATMP)'. Today it is known simply as the 'European Air Traffic Management (EATM)'.

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1. INTRODUCTION

1.1 Background

The main objective of the EATMP Human Resources Programme (HRS), Stage 1 (see EATMP, 2000a – O3), is to further develop an ATM-specific human resources / human factors toolbox (concepts, methods and tools), which will:

- 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.

HRS Programme Stage 1 includes the Training Sub-Programme (TSP), 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 introduction of system changes and will enable the implementation of regulatory requirements for ATM services personnel licensing.*

1.2 Working Group for ATM Technical Staff

Under the auspices of the EATCHIP Programme and later the EATMP Programme the Human Resources Team (HRT) delegated responsibility for the Air Traffic Services (ATS) training to its Training Sub-Group (TSG), today known as the Training Focus Group (TFG).

First, the TSG initiated the creation of an international task force which produced the ‘Guidelines for a Common Basic Level of Technical Training for ATM Staff’ (see EATCHIP, 1996 – T2).

Then, in 1998 a second task force named ‘Working Group for ATM Technical Staff (WGATMTS)’ was created at the initiative of the TSG. The term ‘Air Traffic Safety Electronics Personnel (ATSEP)’ replaced the term ‘technical staff’ to ensure consistency with other international working groups, such as the group working under the auspices of the International Civil Aviation Organization (ICAO) on the ATSEP Training Manual.

Air Traffic Safety Electronics Personnel (ATSEP)

The principal duties of the ATSEP are:

a) Performing preventive maintenance on CNS/ATM system/ equipment which include:
   - calibrating, flight and ground, radio navigation aids,
   - certification of CNS/ATM system/equipment,
   - modification of operational CNS/ATM equipment;

b) Performing corrective maintenance on CNS/ATM system/ equipment;

c) Performing installation of CNS/ATM system/equipment;

d) Operational monitoring and control of CNS/ATM system/ equipment.

Meanwhile, the following two definitions were included in Edition 2.0 of the fifth EUROCONTROL Safety Regulatory Requirement (ESARR 5): ATM Services' Personnel (see SRC, 2002):

> ***1. ATM Equipment Approved for Operational Use***
>
> *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.*
>
> ***2. Engineering and technical personnel undertaking operational safety-related tasks***
>
> *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.*

For the purpose of this document, the locution 'technical staff' is used and frequently abbreviated by the acronym ATSEP.

1.3 Training Phases in Technical Training

The training was divided into phases, namely (see EATCHIP, 1996 – T2):

- Phase 1 initial training: basic training,
- Phase 2 initial training: qualification training.

A detailed description can be found in Annex A.

1.4 Structure of the EATMP Training Documentation

The structure of the training documentation was defined in the document entitled 'Specifications on Training Methods and Tools' (EATMP, 2000b – T16). It is based on the use of the method 'training by objectives', the use of a taxonomy and that of commonly agreed definitions of media, method, rate of learning and modes of delivery.

1.4.1 Syllabus

A syllabus is a list of training objectives classified by subjects, topics and sub-topics showing the training necessary to fill the training gap and achieve the course aim. An unstructured content helps to detail the objectives. Syllabus does not indicate times, training techniques nor order to achieve the training objective.

1.4.2 Training plan

A training plan is a syllabus with additional information. The training plan details for each subject or topic and for each objective the training requirements (type of training event, educational material needed, method and mode of delivery). It also mentions the time scale for achievement and states performance objectives or tests to increase the accuracy of the specifications.

1.4.3 Time scale

Timetables are in hours.

Note: More generally, in EATMP documents the duration of a training event is written in 'periods'. In order to satisfy the various practices in different training institutes and according to the subject, the period is defined as lasting from forty to sixty minutes. For the technical training, it was agreed that the upper limit of sixty minutes would be used in all timetables.

1.4.4 Training event plan

A training event is a set of actions identified in the training plan as the smaller unit of training. The training event has a type but is more accurately described

by the association of a training technique, a media, a learning rate and a mode of delivery.

The training event plan is the document to be used by the instructor when preparing and when providing the training. It recalls the objectives of the training event and its type. It gives a timeline and indicates material references and hints for the performance.

1.5 Purpose of this Document

The purpose of this document is to define the qualification training for ATSEP.

The expected benefits are:

- the reduction of time and effort to develop training,
- the possible reuse of off-the-shelf training materials,
- the guidance for the demonstration of compliance with the guidelines.

To achieve this and according to the EATMP training documentation definition, this document includes:

- the list of subjects corresponding to safety-related tasks which are part of the training modules;
- five training syllabi covering respectively the domains on Communications, Navigation, Surveillance, Data Processing and Safety;
- five training timetables provided as an example of training plans covering each of these domains;
- the organisation of the five domains into four training courses in order to prepare a learner to one of the four qualifications: Communications, Navigation, Surveillance or Data Processing; this organisation enables a planner to prepare the conversion training to ensure bridges between the qualifications.

2. DEFINITION OF TRAINING

2.1 Use of the List of Safety-related Tasks

The list is based on the work on the final report of the study group on the licensing requirements of ATS personnel presented at the twelfth meeting of the Human Resources Team (HRT12) on 19-20 October 1999.

The group extracted from the list of the study group a list of safety-related tasks. The criteria were that these tasks have to be ‘current operational tasks’ (for instance, project management was not included).

Based on the complexity of the various ATM systems, there may be additional safety-related tasks added to this non-exhaustive list. The list represents a common minimum requirement.

From this non-exhaustive list, the group deleted the subjects not relevant to qualification training (e.g. training) in order to obtain the four technical domains of qualification training:

- Communication,
- Data Processing,
- Navigation,
- Surveillance.

Each of these is the core part of one of the four qualifications.

The fifth domain, Safety, was identified as a stand-alone subject but an integral part of the four qualifications.

The results are shown overleaf.

Qualifications for the common core qualification training

Tasks (according to Study Group)	**Need of regulation** (according to Study Group)	**Safety-related operational task for ATSEP** (minimum according to WGATMTS)	**Resulting subject for common core qualification training** (minimum according to WGATMTS)
Maintenance policy (approval)	Possible	No	No
Software management and Data Processing	Yes	Yes for Data Processing: DP, FDP, RDP	Data Processing
System management / performance analysis / certification	Should	Should	Not a stand-alone subject. The operational part should be covered by 'functional safety' and SMC
Human resource management	Partial	No	No
Training	Partly (OJT)	Yes when OJT	Not in qualification training
Project management	Partly (late stages and introduction into service)	No	No
R&D	Partly	No	No
Maintenance support	Partly	No	No
Preventive and corrective maintenance	Yes	Yes	▪ Communication ▪ Navigation ▪ Surveillance
System Monitoring and Control (SMC)	Should	Yes	SMC (Includes performance analysis and system management)
Project training and testing	Partial	No	No
Commissioning	▪ Testing: partly regulated ▪ Certification: fully regulated	No	No
Decommissioning	Regulated	No	No

To conclude, the main purpose of the qualification training is to prepare the learner to enter into the proper type rating for the following tasks:

- calibrating radio navigation aids,
- modification of operational CNS/ATM equipment,
- corrective maintenance,
- preventive maintenance.

In addition, qualification training provides some fundamental prerequisites to partly prepare for further training in view of the other duties listed above.

2.2 Modularity of Qualification Technical Training

ATSEP qualification training addresses five domains: Communications, Navigation, Surveillance, Data Processing and Safety. For each of these five domains, a domain syllabus has been created composed of subjects, main topics, topics and attached objectives. These syllabi are used to describe the content of the modules composing the course.

There are four disciplines or specialisations to become a qualified ATSEP: Communication, Navigation, Surveillance and Data Processing. We have described four courses corresponding to each of these qualifications: Qualification training for Communication (QCOM), Qualification training for Navigation (QNAV), Qualification training for Surveillance (QSURV) and Qualification training for Data Processing (QDP). Each of these courses is described in the tables by the domains that it addresses and the detail in these domains.

The principle is that a learner will be trained through basic plus at least one of the four qualification training courses. He/she is then able to start the training for type rating in the corresponding discipline. It is possible to provide qualification training just after basic training or to insert a familiarisation period between them. It is also possible to provide one or several of the four qualification courses before starting type rating in one of the disciplines. In other words, each course lists the recommended objectives for one qualification; the other objectives are optional. (An optional objective is an objective which is nor considered as a prerequisite to next training phase (type rating) neither as a prerequisite to another objective of the same phase. The training in view to perform optional objectives is desirable but not strictly necessary.) In addition, for Navigation the topics MLS and VDF/DDF/IDF are optional, even for the QNAV if such equipment is not locally used. (A short definition and an awareness of working principles are enough.)

The conversion training need in case of movement from one discipline to another is identified by the description of the two courses.

2.3 System Monitoring and Control (SMC)

Monitoring and control of operational CNS/ATM system/equipment tasks are usually not performed immediately after qualification training but later, when competence has been increased by the acquisition of experience, On-the-Job Training (OJT) and type training, and proper development training.

In order to early prepare the ATSEP for this competence, the relevant part does not require a ‘stand-alone’ subject in qualification training but the extension of some objectives within the other subjects to a broader knowledge than the one strictly necessary to perform this subject only.

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3. SYLLABUS AND TIME SCALE FOR EACH DOMAIN

3.1 Introduction

A separated syllabus and a separated timetable are provided for each domain.

3.2 Syllabus

All the objectives of the syllabus are considered as prerequisite to type rating with the exception of the 'optional' objectives.

The optional objectives are generally grouped within optional topics. When a topic is identified as optional and when the equipment is not used locally, the objectives are not prerequisite to further training. For instance, in the Navigation Domain, MLS and VDF/DDF/IDF are optional. These training courses may be performed later, during type rating training, and are not necessarily part of qualification training.

It will be useful to the reader unfamiliar with the EATMP Common Core Content training concepts to read Annex A before going through the syllabus.

3.3 Timetable

For each domain the timetables indicate the duration of exemplar training in periods of one hour. These numbers have to be treated with caution. On average they include 10-15% global provision for overheads such as:

- time for assessment,
- travel time,
- time buffer for constraints due to training equipment capacity.

They do not include time for extra training in areas such as aeronautical English or specific local training.

It is also essential to note that the requirements are the objectives rather than the way to achieve them. In particular, the timetables provided in the document presuppose that the learner attended the basic technical training with success, but do not take into account additional skills and knowledge. Therefore, if some learners are recruited at a higher level in one domain, it may not be necessary to include the related topic in their training. Judgement has to be exercised case by case to identify the topics to be taken out. The example of timetable provided in the document needs then to be adjusted accordingly if one wants to get a useful information from it.

3.4 Safety

3.4.1 Objective

The learner will explain the concepts of System Safety Assessment (SSA) in the overall context of the EATMP Safety Policy.

In doing so he/she will address the central concepts underlying the SSA methodology, explain the proposed risk, classification scheme for air navigation systems and describe the Functional Hazard Assessment (FHA) process, which is the first step of the EATMP safety assessment process.

3.4.2 Time scale

Qualification training - SAFETY		Number of periods in the exemplar common core
TOTAL		**17**
Subject 1:	Principles of Safety Management	2
Subject 2:	EATMP Safety Policy Statements and Principles	1
Subject 3:	Concept of Risk and Principles of Risk Assessment	3
Subject 4:	EATMP Safety Assessment Process	2
Subject 5:	EATMP Air Navigation System Risk Classification Scheme	4
Subject 6:	Functional Hazard Assessment Process Description	3
Subject 7:	Safety Regulation	2

3.4.3 Syllabus

Safety Training Domain

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	
1 Safety: Main Topic for ATSEP Qualification Training				
1.1 Principles of Safety Management	1.1.1 Describe the underlying need for safety management policy and principles	2	Lessons learnt from accidents, rising traffic levels, best practice	
	1.1.2 Appreciate the reactive and proactive nature of safety management policy and principles	3	Nature of accidents, Reason Model, incident investigation, safety assessment	
	1.1.3 Explain why safety management policy and principles have to be implemented, not just documented	2	Principles of safety management, the means of managing safety	
1.2 EATMP Safety Policy Statements and Principles	1.2.1 Describe the EATMP Safety Policy statement	2	Safety management, safety responsibility, the priority of safety, the safety objective of air navigation system	
	1.2.2 Describe the EATMP safety management principles	2	Safety achievement, safety assurance, safety promotion	
	1.2.3 Relate the EATMP safety management principles with the life cycle of an air navigation system	4	Competency, safety occurrences, quantitative safety levels, system safety assessment, safety surveys, safety monitoring, system safety assessment documentation, lesson dissemination, safety improvement	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	
1.3 Concept of Risk and Principles of Risk Assessment	1.3.1 Describe the concept of risk	2	Types of risk, components of risk	
	1.3.2 Describe ways of measuring risk	2	Risk comparisons, risk analysis	
	1.3.3 Describe the concept of risk tolerability	2	Risk perception, risk management, risk tolerability, ALARP principle	
	1.3.4 Appreciate how risk assessment can aid decision-making	3	Risk assessment, risk contributors (people, procedure and equipment), strengths and limitations of risk assessment	
1.4 EATMP Safety Assessment Process	1.4.1 Describe the concepts of hazard and failure condition	2		
	1.4.2 Appreciate the importance of adopting a total system approach covering human, procedure and equipment elements	3	ATM system description, the need for safety assessment, end to end integrity of safety assessment	
	1.4.3 Appreciate the importance of systematic safety assessment for the new generation of air navigation systems	3	Major characteristics of the new generation of air navigation systems	
	1.4.4 Describe the overall safety assessment process and its relationships with risk assessment	2	Risk-based process, FHA, preliminary system safety assessment, system safety assessment	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	
1.5 EATMP Air Navigation System Risk Classification Scheme	1.5.1 Describe the EATMP air navigation system risk classification scheme	2	Scenario of failure of air navigation system (incident chain), component of a risk classification scheme, severity classes, probability classes (qualitative and quantitative)	
	1.5.2 Describe the application of the ALARP principle	2	Risk classification matrix, ALARP application	
1.6 Functional Hazard Assessment Process Description	1.6.1 Describe the process of functional hazard assessment, including the derivation of safety objectives	2	Description of the FHA process, application of the process of ANS function	
1.7 Safety Regulation	1.7.1 Describe the role of safety regulation	2	The purpose of regulation, objectives of the safety regulation commission, objectives of safety regulation unit, objective of the national regulator	
	1.7.2 Describe the safety regulation documents and their impact on ANS	2	ICAO documentation, EUROCONTROL Safety Regulatory Requirements (ESARR), regulation advisory documentation, national regulation	

3.5 Communication

Communication systems provide means of relaying essential information for the purpose of a safe an orderly operation of ANS. They are governed by international and national standards.

3.5.1 Training objective

Performance: On the communication systems covered in this section, the learner will perform:

- preventive maintenance,
- corrective maintenance,
- calibration.

Condition: In a laboratory environment, given an exposure to a generic communication equipment along with the appropriate and pertinent training material, reference documentation, test equipment and tools. Alternatively, use of simulation or of mocked calibration reports enables the performance of the objective without the need for the real equipment.

Standard of accomplishment: All maintenance should be performed as per the approved standards and procedures.

3.5.2 Time scale

Qualification training - COMMUNICATION		Number of periods in the exemplar common core
TOTAL		**466**
Subject 1:	Voice	169
Subject 2:	Data	146
Subject 3:	Transmission Path	109
Subject 4:	Recorders	29
Subject 5:	Functional Safety	5
Subject 6:	Heath and safety	8

3.5.3 Syllabus

Subject 1: Voice

TOPIC/ SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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 Analyse and troubleshoot a generic radio transmitter	5	Noise, intermodulation, harmonics	
	1.1.3 Design and interpret the block diagram of a transmitter	5	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 Analyse and troubleshoot a generic radio receiver	5	Noise, intermodulation, harmonics	
	1.1.6 Design and interpret the block diagram of a receiver	5	Characteristics (modulation, single carrier, channel spacing, sensitivity, selectivity) functionalities	
	1.1.7 Interpret remote monitoring and control systems information	5	PTT, squelch, station information/control functions, SWR, field strength, data of equipment, line quality (S/N)	

TOPIC/ SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.2 Radio Antenna Systems	1.2.1 Explain and describe antenna parameters	2	Impedance, polar diagram, bandwidth, polarisation, types of antennas (HF, VHF, UHF, LF)	
	1.2.2 Analyse the coverage of the radio system	4	Impedance, polar diagram, polarisation, types of antennas (HF, VHF, UHF)	
	1.2.3 Calculate propagation according to various conditions	3	Output power, geographic, meteorological, ionosphere influences, day and night (HF, VHF, UHF)	
	1.2.4 Appreciate criticality of the conditions	3	Output power, geographic, meteorological, ionosphere influences, day and night (HF, VHF, UHF)	
	1.2.5 Calculate the values of the elements of a simple generic antenna system	3	Filters, combiners, RF relays, multi-cavity system	
	1.2.6 Check the conformity of a system to ITU	3	ITU (HF, VHF, UHF) Ref.: ICAO Annex 10	
	1.2.7 Check the conformity of a system to national regulations	3	National regulations (HF, VHF, UHF)	
	1.2.8 Identify and measure cross modulation	3	Cross modulation, measuring tools and methods	
	1.2.9 Detect and analyse disturbances	4	Spectrum analyser, scanner, noise, figure, BITE	

TOPIC/ SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.3 Voice Switch	1.3.1 Describe and interpret switching functionalities with a block diagram	5	General architecture, digital, analog, multiplex types, PCM30	
	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, microphone (noise cancelling), headset, loudspeaker, short time recording, footswitch, PTT	
1.5 Radio Interfaces	1.5.1 List and describe the different types of interface	2	Internal, external, phantom keying, inband signal	
1.6 Digital Voice Communication	1.6.1 Explain the latest developments and projects in voice communication	2	e.g. digital radio, VDL Mode 3 Ref.: ICAO Annex 10	
2 Ground-Ground				
2.1 Interfaces	2.1.1 Describe the different types of interface	2	Analog (2, 4, 6 and 8 wires), digital (ISDN; 64 Kb, 2 Mb)	
	2.1.2 Explain the advantages and disadvantages of each type	2	Analog (2, 4, 6 and 8 wires), digital (ISDN; 64 Kb, 2 Mb)	
	2.1.3 Operate measuring equipment	3	dB meters, level meters, generators, sniffer, special, e.g. 2 Mb	

TOPIC/ SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.2 Protocols	2.2.1 Operate standard protocol analysers	3	MFC R2 (EUROCONTROL), ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN	
	2.2.2 Decode a signal codes according to the standard protocols	3	MFC R2 (EUROCONTROL), ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN	
	2.2.3 Analyse a signal coded according to the standard protocols	4	MFC R2 (EUROCONTROL), ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN	
	2.2.4 Decode and analyse a signal coded according to the national protocols	4	National protocols	
2.3 Switch	2.3.1 State that ground-ground switches are based on same techniques than air-ground switches	1	See 1.3.1, 1.3.2 and 1.3.3	
	2.3.2 Describe the most commonly used functionalities of PABX	2	General architecture, digital, analog, multiplex types, PCM30	
	2.3.3 Describe and analyse conversion analog-digital, digital-analog	4	General architecture, analog-digital-analog, specific aviation requirements (CODEC, rate, receiver architecture)	
2.4 Controller Working Position	2.4.1 Describe the most common features of a controller working position and the HMI	2	Ref.: EATMP VCS procurement guidelines	

Subject 2: Data

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Introduction to Networks				
1.1 Types	1.1.1 Define LAN and WAN	1	Architectures, size of the segments, length of the systems, quality of service	
	1.1.2 Design network matching the quality of service requirements	4	Redundancy, bandwidth, BER, time response, data security	
1.2 LAN	1.2.1 Analyse the features of a LAN network	4	Routing scheme, rate, internal networking, routers, bridges, gateways, modems, switches, firewalls	
	1.2.2 Integrate adequately components into a LAN	4	Network management	
1.3 WAN	1.3.1 Analyse the features of a WAN network	4	Routing scheme, rate, internal networking, routers, bridges, gateways, modems, switches, firewalls	
	1.3.2 Integrate adequately components into a WAN	4	Network management	
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), net scout	
1.5 Monitoring Tools	1.5.1 Analyse the traffic	4	Data analyser (sniffer), net scout	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.6 Trouble Shooting	1.6.1 Troubleshoot a network	5	Broken lines, unusable network components, overload, integrity problems	
2 National Networks				
2.1 Proper Networks	2.1.1 Describe the characteristics of the networks	2	National network(s), interoperability	
2.2 Surrounding Networks	2.2.1 Be aware of the existence of the other national networks	0	Military, PTT, airlines, e.g. SITA, ARINC, etc.	
3 European Networks				
3.1 Emerging	3.1.1 Be aware of emerging European networks	0	e.g. EAN, NEAN	
3.2 In Use	3.2.1 Describe the characteristics of the CIDIN, OLDI, CFMU-RCA, AIS (EAD) networks	2	Users and data, architectures, quality of service	
3.3 Hands On	3.3.1 Analyse traffic of the CIDIN, OLDI, CFMU-RCA, AIS (EAD) networks	4	Proprietary analysers, system specific analysers	
	3.3.2 Troubleshoot problems at a national level on a segment of CIDIN, OLDI networks	5	Broken lines, unusable network components, overload, integrity problems	
4 Global Networks				
4.1 List and Standards	4.1.1 List the global networks and the standards on which they are based	1	ICAO for AFTN, ICAO for ATN (SARPS-ATM package 1), FANS 1 and FANS A for ACARS applications (SITA and ARINC)	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
4.2 Description	4.2.1 Describe the characteristics of the AFTN, MOTNE, SITA, ARINC networks	2	Users and data, architectures, quality of service	
4.3 Hands On	4.3.1 Analyse traffic of the AFTN, MOTNE, SITA, ARINC networks	4	Using the appropriate tools	
	4.3.2 Troubleshoot problems at a national level on a segment of AFTN, MOTNE, SITA, ARINC networks	5	Broken lines, unusable network components, overload, integrity problems	
4.4 ATN Architecture	4.4.1 Describe the architecture of the ATN	2	Air-ground sub-networks, ground-ground sub- networks, airborne networks	
4.5 ATN Air-Ground	4.5.1 Describe the air-ground sub-networks	2	VDL (Mode 2, Mode 3, Mode 4), HDL, AMSS, SSR Mode S, SATCOM	
4.6 ATN Ground-Ground	4.6.1 State that the ground-ground sub-networks are composed of many private or public components	1	PTT, commercial telecom providers, ARINC	
4.7 ATN on Board of the Aircraft	4.7.1 Be aware of the existence of ATN sub-networks inside the aircraft	0	SATCOM Note: Wait further development for higher level objective	
4.8 ATN Applications	4.8.1 List the main communication application over ATM system	1	CPDLC, DLC	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
5 Protocols				
5.1 Fundamental Theory	5.1.1 Explain the principles of layers	2	Differences between layers	
	5.1.2 Explain the principles of the addressing strategy	2	Routing strategies, masks, sub-nets	
	5.1.3 Explain the principles of the routing strategy	2	Routing tables, point to point, connection less, name servers, priorities, fault tolerance, management	
5.2 General Protocols	5.2.1 Describe and decode the general protocols	3	TCP/IP, X25, LAPB	
	5.2.2 Analyse and interpret the general protocols	5	TCP/IP, X25, LAPB	
5.3 Specific Protocols	5.3.1 Describe and decode the specific protocols	3	ACARS, ATN	
	5.3.2 Analyse and interpret the specific protocols	5	ACARS, ATN	
5.4 Met Data Protocol from Satellite	5.4.1 Describe and decode the met data protocol	3	SADIS	

Subject 3: Transmission Path

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Lines				
1.1 Providers	1.1.1 State who are the local telecom providers and the service characteristics	1	Type of lines, rules, type of services, global national organisation and rules	
1.2 Lines Theory	1.2.1 List, describe and calculate parameters of a line	3	Equation, attenuation, impedance, S-parameters, Smith Diagram, bandwidth, HF specifics (dipoles, multi-poles)	
1.3 Digital Transmission	1.3.1 List, describe and calculate parameters for digital transmission	3	Signal definition, Fourier Theory, (spectrum), signal processing (sampling, etc.), bandwidth, carrier, modulation, noises, S/N, delays, group delay, line quality (signal distortion, rate of failure), transmission speed	
1.4 Types of Lines	1.4.1 Describe and calculate the typical parameters of lines	3	Copper wires (twisted pairs, symmetrical cables), optic fibres (mono- or multi-modes, connectors, splicer), coaxial (attenuation, losses, bending, characteristic impedance)	
	1.4.2 Choose the appropriate type of line for a given specific application	3	Bandwidth, noise immunity, availability, proximity, duality of supplier, installation cost, running cost	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.4.3 Measure the typical parameters of lines	3	Impedance, insulation, signal level, signal generator, reflectometer, vector analyser, spectral delay	
	1.4.4 Analyse and troubleshoot a line installation	5	Signal generator, signal level, automatic line analysers, BITE	
2 Specific Links				
2.1 Optical	2.1.1 Describe the parameters of an optical link	2	Frequency spectrum	
	2.1.2 Explain the performances and the limitations of an optical link	2	Distances, weather conditions, obstruction, EMI immunity	
2.2 Microwave Link	2.2.1 Describe the parameters of a microwave link	2	Carrier frequency, type of modulation, Fresnel Theory, loss, atmospheric influences	
2.3 Satellite	2.3.1 Describe the parameters of a satellite link	2	Uplinks, downlinks, antennas, footprint, delays, atmospheric influences	

Subject 4: Recorders

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Legal Recorders				
1.1 Regulations	1.1.1 Explain the international regulations	2	ICAO regulations (recording and reproducing)	
	1.1.2 Explain the national regulations	2	Appropriate national regulations	
	1.1.3 Explain the company regulations	2	Store tapes, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information.	
1.2 Analog	1.2.1 Explain the principles of analog recording and reproducing	2	Storage media (tape), duration tape, number of tracks, time synchronisation, noise reduction	
	1.2.2 Analyse and troubleshoot the analog recording and reproducing	5	Replace tapes, calibration, cleaning heads, search information	
1.3 Digital	1.3.1 Explain the principles of digital recording and reproducing	2	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	
	1.3.2 Analyse and troubleshoot the digital recording and reproducing	5	Search information, change storage media	

Subject 5: Functional Safety

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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	

Subject 6: Health and Safety

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Hazard Awareness and Legal Rules				
1.1 Hazard Awareness	1.1.1 Be aware of potential hazards to health and safety generated by communication equipment	0	Mechanical hazards, electrical hazards (HV, EMI), chemical hazards	
1.2 Rules and Procedures	1.2.1 State applicable international requirement	1	Relevant international documents	
	1.2.2 State any applicable legal national requirement	1	Relevant national documents	
	1.2.3 State safety procedure for the persons working on or near a communication equipment	1	Isolation (clothing, tools) fire extinction types, safety man presence, safety interlocks, isolating switches, security of the site, climbing procedures	
2 Application of Health and Safety				
2.1 Practical Situations	2.1.1 In a practical situation, apply and demonstrate the procedures and techniques to be followed	3	e.g. changing wave guide, replacing fuses or boards, start up / shut down a station, climbing procedures	
2.2 Resuscitation Techniques	2.2.1 Apply and demonstrate resuscitation techniques	3	First aid, rescue procedures, resuscitation	

3.6 Navigation

Navigation systems provide means of relaying essential information for the purpose of a safe and orderly operation of ANS. They are governed by international and national standards, in particular by required navigation performances.

3.6.1 Training objective

Performance: On the navigation systems covered in this section the learner will be able to perform:

- preventive maintenance,
- corrective maintenance,
- calibration.

Condition: In a laboratory environment, given an exposure to a generic navigation equipment along with the appropriate and pertinent training material, reference documentation, test equipment and tools. Alternatively, use of simulation or of mocked calibration reports enables the performance of the objective without the need for the real equipment.

Standard of accomplishment: All maintenance should be performed as per the approved standards and procedures.

3.6.2 Time scale

Qualification training - NAVIGATION		Number of periods in the exemplar common core
TOTAL		**390**
Subject 1:	Required Navigation Performances & (B/P) NAV Concepts	62
Subject 2:	Ground-based Systems	483 (155)
Subject 3:	Satellite-based Navigation Systems	65
Subject 4:	On-board Equipment	10
Subject 5:	Functional Safety	4
Subject 6:	Health and Safety	9

3.6.3 Syllabus

Subject 1: Required Navigation Performance & (B/P) NAV Concepts

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 NAV Concepts				
1.1 Operational Requirements	1.1.1 State, define and explain the main performances of a navigation system	2	Accuracy (CEP, RMS, 2D-RMS, SEP, etc.), integrity, availability, continuity of services, coverage, robustness, Time To First Fix (TTFF), etc.	
	1.1.2 Describe and explain the links between performances and a type of navigation system	2	Sole mean, primary mean, supplementary mean	
	1.1.3 Describe and explain the dependency of performances and the phases of flight	2	ICAO standards table	
1.2 Required Navigation Performance (RNP)	1.2.1 State, define and explain the RNP concept	2	Risk of collision, Target Level of Safety (TLS), confinement area	
	1.2.2 Describe the standard values of RNP	2	RNP4, RNP1, ICAO and EUROCONTROL tables	
	1.2.3 Be aware of the potential extension of the RNP concept	0	Required Communication Performances (RCP), Required Surveillance Performances (RSP), Required Global Performances (RGP)	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.3 Area Navigation Concept (RNAV)	1.3.1 State, describe and explain the area navigation concept	2	ICAO and EUROCONTROL documents, operational impact on national and transition airspace	
	1.3.2 Describe the standard values of RNAV	2	Basic RNAV (B-RNAV) and Precision RNAV (P-RNAV)	
	1.3.3 Describe the implementation plans of RNAV	2	ICAO plan, regional plan, national plan	

Subject 2: Ground-based Systems

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 NDB/Locator				
1.1 Use of the System	1.1.1 Explain the operational use of NDB	2	En-route, terminal area, procedures	
	1.1.2 Theorise the principles of NDB	5	Relative bearing, measuring method	
	1.1.3 Explain the advantages of NDB	2	Simplicity, cost, coverage	
	1.1.4 Explain the disadvantages of NDB	2	Lack of accuracy, lack of integrity, sensitivity to interference	
	1.1.5 Describe the current situation	2	Density of NDB in use in Europe, percentage of equipped aircraft	
	1.1.6 Describe the role of NDB according to European Navigation Strategy	2	NDB not part of RNAV	
1.2 Ground Station Architecture	1.2.1 Draw and explain the block diagram of a generic NDB ground station	2	Electronic cabinet, antennas, power supply, remote controls and monitoring	
	1.2.2 Design a NDB station according to operational requirements	4	Coverage, id code, VOR backup, double beacon approach	
1.3 Transmitter Sub-system	1.3.1 Design main signal parameters	4	Carrier frequency stability, output power, controls	
	1.3.2 Perform the typical measurements on the main signal parameters	3	Power measurements, spectrum measurements	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.4 Antenna Sub-system	1.4.1 Explain and describe antenna parameters for NDB	2	Impedance, polar diagram, polarisation, types of antennas	
	1.4.2 Calculate the interface between power stage and the antenna (tuning coil)	3	Standing Waves Ratio (SWR), radiated power	
1.5 Implementation	1.5.1 Verify the impact of the requirements on the choice of the ground station location	3	En-route, terminal requirements procedures	
	1.5.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	1.5.3 Check the conformity to national regulations	3	National regulations	
1.6 On-board Equipment	1.6.1 Describe the on-board equipment (ADF) and the current procedures	2	Receiver, antenna, pilot check	
	1.6.2 Describe the various HMI	2	ADF indicator, RMI, HIS, ND	
1.7 Compliance with Standards	1.7.1 Define the global performances	1	Coverage, accuracy, availability of the system, integrity, continuity	
	1.7.2 Perform typical measurements	3	Spectrum analysis, modulation, output power, id code	
	1.7.3 Calibrate	5	Flight inspection	
	1.7.4 Troubleshoot	5	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2 VDF/DDF/IDF (Optional)				
2.1 Use of the System	2.1.1 Explain the operational use of DF	2	Terminal and approach procedures, emergency, backup	
	2.1.2 Describe the user HMI	2	Indication on radar picture, DF indicator	
	2.1.3 Theorise the principles of DF	5	Bearing, measuring method (standard, Doppler, interferometry)	
	2.1.4 Explain the advantages of DF	2	Simplicity, cost	
	2.1.5 Explain the disadvantages of DF	2	Sensitivity to interference	
	2.1.6 Describe the current situation	2	Density and types of DF in use in Europe, effective use of DF	
2.2 VDF/DDF Equipment Architecture	2.2.1 Draw and explain the block diagram of a VDF/DDF equipment	2	Electronic cabinet, antennas, power supply, remote controls and monitoring	
	2.2.2 Design a VDF/DDF equipment according to operational requirements	4	Coverage, accuracy	
2.3 Receiver Sub-system	2.3.1 Design main signal parameters	4	Frequency band (UHF, VHF)	
	2.3.2 Perform typical measurements on the receiver	3	Frequency, channel spacing, sensitivity, selectivity	
2.4 Antenna Sub-system	2.4.1 Explain and describe antenna parameters for VDF/DDF	2	Impedance, polar diagram, polarisation, types of antennas	
	2.4.2 Design protection areas	4	Obstacles, ICAO Annexes 10 and 14, manuals	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.5 Monitoring and Control Sub-system	2.5.1 Describe and explain which parameters are used for the monitoring	2	Noise figure, stability of measurement	
	2.5.2 Check the operational status of the monitor system	3	BITE, system status, e.g. watchdog	
	2.5.3 Troubleshoot wrong bearing indications	5	Readjust antenna systems	
2.6 Implementation	2.6.1 Verify the impact of the requirements on the choice of the VDF/DDF location	3	Protection of receivers	
	2.6.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	2.6.3 Check the conformity to national regulations	3	National regulations	
2.7 Compliance with Standards	2.7.1 Define the global performances	1	Accuracy, coverage, ICAO Annex 10 recommendations	
	2.7.2 List VHF/UHF receiver procedures	1		
	2.7.3 Calibrate the system	5	Flight inspection	
3 VOR				
3.1 Use of the System	3.1.1 Explain the operational use of VOR	2	En-route, terminal area, procedures	
	3.1.2 Theorise the principles of the CVOR	5	Bearing information, phase measurements methods	
	3.1.3 Explain the advantages of VOR	2	Type of information (azimuth), accuracy, integrity, suitable for a network of fixed routes	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.1.4 Explain the disadvantages of VOR	2	Multi-path, sensitivity to interference, limited coverage, not ideal for free routes, accuracy depending on distance	
	3.1.5 Justify and theorise the DVOR versus the CVOR	5	CVOR, DVOR, signal broadcast differences, bearing information	
	3.1.6 Describe the current situation	2	Density of CVOR and DVOR in use in Europe	
3.2 Ground Station Architecture	3.2.1 Draw and explain the block diagram of a CVOR ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring	
	3.2.2 Design a CVOR station according to operational requirements	4	Coverage, id code	
3.3 Transmitter Sub-system	3.3.1 Design main signal parameters for a CVOR	4	Carrier frequency stability, output power, signals generated	
	3.3.2 Design main signal parameters for a DVOR	4	Output power, signals generated	
	3.3.3 Perform the typical measurements on the signals by using standard equipment	3	Power measurements, spectrum measurements, modulation measurements	
3.4 Antenna Sub-system	3.4.1 Explain and describe the generic radiated signals requirements for CVOR	2	Patterns antennas, distribution circuits, standard implementations	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.4.2 Explain and describe the generic radiated signals requirements for DVOR	2	Patterns antennas, distribution circuits, standard implementations	
	3.4.3 Analyse the interface between power stage and the antenna	4	Standing Waves Ratio (SWR), radiated power	
	3.4.4 Analyse the most typical signal errors due to the antenna	4	Error expression components	
3.5 Monitoring and Control Sub-system	3.5.1 Describe and explain which parameters are used for the monitoring	2	Near-field monitor, BITE	
	3.5.2 Check the operational status of the monitor system	3	BITE, system status, e.g. watchdog	
	3.5.3 Troubleshoot wrong bearing indications	5	Readjust antenna systems	
3.6 Implementation	3.6.1 Verify the impact of the requirements on the location and the type of the ground station	3	En-route, terminal requirements procedures	
	3.6.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	3.6.3 Check the conformity to national regulations	3	National regulations	
3.7 On-board Equipment	3.7.1 Describe the on-board equipment	2	Antenna, receiver, (MMEL/RNP)	
	3.7.2 Describe the various HMI	2	CDI, RMI, HSI, ND, PFD	
	3.7.3 Describe how the VOR information is used on board	2	Single VOR, VOR-VOR, approach procedures, manual mode, automatic mode	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
3.8 Compliance with Standards	3.8.1 Define the global performances for CVOR and DVOR	1	Coverage, accuracy, availability of the system, integrity, continuity	
	3.8.2 Perform typical measurements	3	Spectrum analysis, modulation, output power, id code	
	3.8.3 Calibrate	4	Flight inspection	
	3.8.4 Troubleshoot	5	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio	
4 DME				
4.1 Overview	4.1.1 Describe the measurements	2	Distance, time measurement	
	4.1.2 Describe the basic principle of the system	2	A/c interrogation ground reply, interrogation stagger, station frequency	
	4.1.3 Explain the TACAN equipment and the VORTAC configuration	2	DME compatible, amplitude modulated at 135 Hz and 15 Hz bearing information	
	4.1.4 Explain the frequency spectrum and the channel spacing allocated	2	ICAO Annex 10, links to other navigation systems	
4.2 Use of the System	4.2.1 Explain the operational use of DME	2	En-route, terminal area, procedures, instrument approaches, multi-DME navigation (rho-rho)	
	4.2.2 Theorise the principles of the DME/N	5	Pulse carrier modulation, coding principles, channels definitions	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	4.2.3 Explain the advantages of DME	2	Accuracy, integrity	
	4.2.4 Explain the disadvantages of DME	2	Saturation level, minimum interrogation number, sensitivity to interference, limited coverage	
	4.2.5 Justify and theorise the DME/N versus the DME/P	5	Technical differences	
	4.2.6 Describe the current situation	2	Density of DME/N and DME/P in use in Europe	
	4.2.7 Describe the role of DME according to the European Navigation Policy	2	Part of the RNAV concept	
4.3 System Architecture	4.3.1 Describe the Air / Ground link	2	Elements of the avionics fit, nature of air-ground and ground-air transmissions	
4.4 Ground Station Architecture	4.4.1 Draw and explain the block diagram of a DME ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring	
	4.4.2 Design a DME station according to operational requirements	4	Coverage, id code	
4.5 Transmitter Sub-system	4.5.1 Design main signal parameters for a DME	4	Carrier frequency stability, output power, signals generated	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	4.5.2 Perform the typical measurements on the signals by using standard equipment	3	Power measurements, spectrum measurements, modulation measurements	
4.6 Antenna Sub-system	4.6.1 Explain and describe the generic radiated signals requirements for DME	2	Patterns antennas, distribution circuit, standard implementations	
	4.6.2 Analyse the interface between power stage and the antenna	4	Standing Waves Ratio (SWR), radiated power	
	4.6.3 Analyse the most typical signal errors due to the antenna	4	VSWR	
4.7 Monitoring and Control Sub-system	4.7.1 Describe and explain which parameters are used for the monitoring	2	BITE, power, interrogation rates	
	4.7.2 Check the operational status of the monitor system	3	BITE, system status, e.g. watchdog	
	4.7.3 Troubleshoot error indications	5	Replace faulty LRU	
4.8 Implementation	4.8.1 Verify the impact of the requirements on the location and the type of the ground station	3	En-route, terminal requirements procedures	
	4.8.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	4.8.3 Check the conformity to national regulations	3	National regulations	
4.9 On-board Equipment	4.9.1 Describe the on-board equipment	2	Antenna, receiver, (MMEL/RNP)	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	4.9.2 Describe the various HMI	2	CDI, RMI, HSI, ND, PFD	
	4.9.3 Describe how the DME information is used on board	2	Single DME, multi-DME navigation (rho rho), approach procedures, manual mode, automatic mode	
4.10 Compliance with Standards	4.10.1 Define the global performances for DME	1	Coverage, accuracy, availability of the system, integrity, continuity	
	4.10.2 Perform typical measurements	3	Spectrum analysis, modulation, output power, id code	
	4.10.3 Calibrate	4	Flight inspection	
	4.10.4 Troubleshoot	5	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio	
5 ILS				
5.1 Use of the System	5.1.1 Explain the operational use of ILS	2	Approach and landing procedures, localiser and glide path	
	5.1.2 Theorise the principles of ILS	5	Azimuth and elevation by DDM measurements, dipole arrays, localiser and glide path beam construction, 90 and 150 Hz modulation, multiple course indications, runway offset arrangements	
	5.1.3 Explain the advantages of ILS	2	Type of information, accuracy, integrity	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	5.1.4 Explain the disadvantages of ILS	2	Only 40 channels, no segmented paths of approach, beam corruption due to multi-path	
	5.1.5 Describe the current situation	2	Different operational category depending on weather, equipment and airport facilities	
5.2 Ground Station Architecture	5.2.1 Draw and describe all components of ILS	2	Location of the antennas and shelters	
	5.2.2 Describe the special performance of the antenna area	2	Location of critical and sensitive area	
	5.2.3 Draw and explain the block diagram of LLZ, GS, OM, MM and FFM	2	Electronic cabinet, antennas, power supply, remote controls and monitoring	
5.3 Transmitter Sub-system	5.3.1 Analyse main signal parameters for LLZ, GS, OM and MM	4	Carrier frequency, output power, signals generated	
	5.3.2 Draw and explain the block diagram of the transmitter	2	Synthesizer, modulator, power amplifier, control coupler, RF changeover	
5.4 Antenna Sub-system	5.4.1 Analyse and describe antenna parameters	4	Types, position, polarisation, patterns, coverage, distribution circuits, radiated power, monitoring antennas	
5.5 Monitoring Sub-system	5.5.1 Describe and explain the parameters for the monitoring according to ICAO Annex 10	2	RF level, DDM, SDM on position and width	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	5.5.2 Describe and explain the additional monitoring parameters	2	External, internal and integral monitoring	
	5.5.3 Describe and explain the far field monitoring system	2	Position, width	
	5.5.4 Draw and explain the block diagram	2	Near-field, integral network, internal network, monitor signal processor	
5.6 Implementation	5.6.1 Verify the impact of the requirements on the location and the type of the ground station	3	Approach and airport requirements and procedures	
	5.6.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	5.6.3 Check the conformity to national regulations	3	National regulations	
5.7 On-board Equipment	5.7.1 Describe the on-board equipment	2	Antennas, receiver, pilot interface (cross pointer), FMS	
5.8 Compliance with Standards	5.8.1 Define the global performances for ILS	2	Coverage, accuracy, availability of the system, integrity, continuity, category and level	
	5.8.2 Perform the typical measurements	3	Output power, spectrum analysis, modulation, id code	
	5.8.3 Perform appropriate calibration tasks and assess flight inspection results	5	Flight inspection and ground calibration results	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	5.8.4 Troubleshoot	5	Lack of power, carrier frequency deviation, harmonic ratio, depth of modulation	
5.9 2F-Systems	5.9.1 Describe and explain the capture effect	2	Capture effect in receiver circuits	
	5.9.2 Describe and explain antenna parameters for 2F-LLZ	2	Types, position, polarisation, patterns, coverage, distribution circuits, radiated power	
	5.9.3 Describe and explain antenna parameters for 2F-GS	2	Multi-path	
6 MLS (Optional)				
6.1 Use of the System	6.1.1 Explain the operational use of MLS	2	Approach and landing procedures	
	6.1.2 Theorise the principles of MLS	5	Azimuth, back azimuth and elevation by TRSB (Time Reference Scanning Beam)	
	6.1.3 Explain the advantages of MLS	2	Type of information, accuracy, datalink, small critical and sensitive areas, number of channels, complex approach paths, less prone to interference; comparison with conventional ILS	
	6.1.4 Explain the disadvantages of MLS	2	Low equipage, complexity, cost	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	6.1.5 Describe the current situation	2	Multi-mode receivers, ground and a/c equipment	
6.2 Ground Station Architecture	6.2.1 Draw and describe all components of MLS	2	Locations of the sub-systems	
	6.2.2 Draw and explain the block diagram of azimuth, elevation and back azimuth station	2	Electronic cabinet, antennas, power supply, remote controls and monitoring	
6.3 Transmitter Sub-system	6.3.1 Design main signal parameters for azimuth, elevation and back azimuth station	4	Carrier frequency, output power, signals generated, timing	
	6.3.2 Draw and explain the block diagram of the transmitter	2	Synthesiser, modulator, power amplifier, control coupler, RF changeover, BITE	
6.4 Antenna Sub-system	6.4.1 Describe and explain antenna parameters	2	Types, position, dimensions, polarisation, pattern, coverage, distribution circuits, radiated power, scan speed	
6.5 Monitoring Sub-system	6.5.1 Describe and explain the parameters for the monitoring according to ICAO Annex 10	2	RF level, beam width, scan speed	
	6.5.2 Describe and explain the additional monitoring parameters	2	External and internal monitoring	
	6.5.3 Draw and explain the block diagram	2	Monitor signal processor	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
6.6 Implementation	6.6.1 Verify the impact of the requirements on the location and the type of the ground station	3	Approach and airport requirements and procedures	
	6.6.2 Check the conformity of the system to ITU	3	ITU regulation, ICAO Annex 10	
	6.6.3 Check the conformity to national regulations	3	National regulations	
6.7 On-board Equipment	6.7.1 Describe the on-board equipment	2	Antennas, receiver, cross pointer, FMS, MMR	
	6.7.2 Describe how the MLS information is used on board	2	Approach procedures, ILS like display	
6.8 Compliance with Standards	6.8.1 Define the global performances for MLS	2	Coverage, accuracy, availability of the system, integrity, continuity, category and level	
	6.8.2 Perform the typical measurements	3	Output power, spectrum analysis, datalink modulation, id code	
	6.8.3 Calibrate	5	Flight inspection	
	6.8.4 Troubleshoot	5	Lack of power, carrier frequency deviation, harmonic ratio	

Subject 3: Satellite-based Navigation Systems

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 GNSS1				
1.1 General View	1.1.1 Explain civil aviation requirements for navigation	2	GNSS panel	
	1.1.2 Define all the components of the GNSS1	1	GPS, GLONASS, augmentations	
	1.1.3 Draw a diagram illustrating the architecture of GNSS1 and the interdependencies	1		
	1.1.4 Explain how GNSS1 fulfils the civil aviation requirements	2		
1.2 GPS	1.2.1 Describe the architecture of the system	2	Space segment, control segment, user segment, current situation of the constellation	
	1.2.2 Recognise the institutional issues related to GPS	1	Ownership, control, users, security	
	1.2.3 Describe and calculate the main performances of the GPS system	3	Link budget, receiver performances, coverage, integrity, availability, time to fix, Selective Availability (SA)	
	1.2.4 Monitor how GPS performances compare to civil aviation requirements and demonstrate the limited use of GPS	3		

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.2.5 Being given an aircraft route, estimate using a software package or/and GPS receiver the availability of the constellation	3	Software, GPS, receiver	
1.3 GLONASS	1.3.1 Describe the architecture of the system	2	Space segment, control segment, user segment, current situation of the constellation	
	1.3.2 Recognise the institutional issues related to GLONASS	1	Ownership, investment, security, continuity	
	1.3.3 Describe and calculate the main performances of the GLONASS system	3	Link budget, receiver performances, coverage, integrity, availability, time to fix	
	1.3.4 Monitor how GLONASS performances compare to civil aviation requirements and demonstrate the limited use of GLONASS	3	Number of satellites, coverage, investment, continuity	
2 GBAS				
2.1 General View	2.1.1 Describe the improvements of GBAS concept	2	Accuracy, integrity within a local coverage	
	2.1.2 Monitor how GBAS performances compare to civil aviation requirements and demonstrate the possible use of GBAS for approach and landing	3	Integrity, accuracy; appropriate designators	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.2 Reference GNSS Ground Station	2.2.1 Describe the principles of local differential augmentation	2	Space and time errors correlation	
	2.2.2 Describe the architecture of a reference station	2	Reference ground station (redundancy level of receivers and antennas, monitoring systems, datalink, service volume, frequencies)	
	2.2.3 Consider Institutional issues and service provider responsibilities	2	Liability, integrity, monitoring and test	
2.3 GRAS	2.3.1 Be aware of the GRAS proposal and of its application to area navigation	0		
3 SBAS				
3.1 General View	3.1.1 Describe the architecture of the SBAS systems	2	Definitions, explain, ICAO implementation plan	
	3.1.2 Explain message structure of SBAS systems	2	Messages defined in the MOPS and MASPS	
	3.1.3 Explain expected performance of the SBAS	2	Performance defined in the SARPS	
	3.1.4 List strengths and weaknesses of the SBAS	1	Large area, limited infrastructure but dependency on GPS and coverage at high latitudes	
	3.1.5 Explain intended usage of the SBAS	2	Phases of flight in which SBAS can be used, and types of operations	
	3.1.6 Explain message structure of SBAS	2	Messages defined in the MOPS and MASPS	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.1.7 Explain expected performance of the SBAS	2	Performance defined in the SARPS	
	3.1.8 List strengths and weaknesses of the SBAS	1	Large area, limited infrastructure but dependency on GPS and coverage at high latitudes	
	3.1.9 Explain intended usage of the SBAS	2	Phases of flight in which SBAS can be used and types of operations	
3.2 EGNOS	3.2.1 State EGNOS history	1	Timeline from inception to now	
	3.2.2 Draw and explain a diagram illustrating the EGNOS architecture	2	Segments of EGNOS	
	3.2.3 Explain EGNOS current status	2	Validation through ESTB	
	3.2.4 Explain EGNOS operational concept	2	EGNOS operational concept document	
	3.2.5 Explain EGNOS institutional issues	2	EOIG, tripartite, agreement (ETG), relation to GALILEO	
3.3 WAAS	3.3.1 Be aware of the existence of WAAS	0		
	3.3.2 List WAAS architecture	1		
	3.3.3 Explain WAAS current status	2	WAAS operational	
	3.3.4 Explain WAAS issues	2	Cost overrun, future	
3.4 MSAS	3.4.1 Be aware of the existence of MSAS	0		
	3.4.2 List MSAS architecture	1		
	3.4.3 Explain MSAS current status	2	MSAS operational	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.4.4 Explain MSAS Issues	2	Cost overrun, future	
3.5 Interoperability	3.5.1 Explain the interoperability needs of the 3 SBAS	2		
	3.5.2 Describe the GNSS receivers	2		
	3.5.3 Describe the signal in space (SIS) for the 3 SBAS	2		
4 ABAS				
4.1 General View	4.1.1 State that the improvement of integrity is the main purpose of ABAS	1	Definitions	
4.2 Principles	4.2.1 Explain the principles of ABAS	2	RAIM, AAIM	
4.3 Impact	4.3.1 Demonstrate how the principles of ABAS impact on the navigation performances (integrity, continuity and availability)	2		
5 Modernized GPS				
5.1 Improvement of GPS	5.1.1 List the improvements of GPS between now and 2015	1	L2 and L5	
	5.1.2 Describe and explain the signal structure of L2 and L5	2		
	5.1.3 Explain the impact of L2 and L5 on the receiver	2		
	5.1.4 List the modernisation schedule	1		

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	5.1.5 List the future accuracy of the GPS system	1		
	5.1.6 List the limitations of the future GPS system (no integrity, single nation, military control)	1		
6 GALILEO				
6.1 GALILEO	6.1.1 Describe the European satellite navigation policy	2	EU documents	
	6.1.2 List the sequence of events that lead to the development of GALILEO	1	EU decisions	
	6.1.3 List the GALILEO schedule	1	The plan	
	6.1.4 Describe the GALILEO Cost/Benefit Analysis (CBA)	2	Costs, jobs, market, revenues	
	6.1.5 Define the current GALILEO architecture	2	GALILEO documents, ground segment , space segment (constellation, signals and frequencies),control segment.	
	6.1.6 Discuss the distribution of integrity information through GALILEO	5	Compare to GPS	
	6.1.7 Define the GALILEO services	2	GALILEO documents	
	6.1.8 Define the performances of GALILEO	2		
	6.1.9 Discuss the aviation views of GALILEO	5	The aviation views document	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	6.1.10 Discuss the US views of GALILEO	5	Military and FAA views	
	6.1.11 Discuss the interoperability of GALILEO and GPS	5		
	6.1.12 Discuss the integration of EGNOS in GALILEO	5	Political views and technical views	
	6.1.13 Discuss the interoperability of GALILEO and GPS	5		
	6.1.14 Discuss the integration of EGNOS in GALILEO	5	Political views and technical views	
7 GNSS2				
7.1 General View	7.1.1 Explain performance improvements over GNSS1	2		
	7.1.2 Define all components of GNSS2	1	Modernised GPS, GALILEO	
	7.1.3 Explain the institutional issues of GNSS2	2	Control of system, levels of service	
7.2 Modernised GPS	7.2.1 State the US satellite navigation policy	1		
	7.2.2 List the improvements provided by modernised GPS	1	New civil frequencies (L2 and L5), new signal structure, new control segment, etc.	
	7.2.3 Evaluate the impact of these improvements	5	Performances, receiver architecture	
7.3 GALILEO	7.3.1 Explain GALILEO's role in GNSS2 with specific reference to European policy	2	EU documents	

Subject 4: On-board Equipment

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 On-board Navigation Architecture				
1.1 Architecture	1.1.1 Describe the current navigation architecture	2	Sensors, HMI, FMS, navigation database	
2 Display Systems				
2.1 HMI	2.1.1 Be aware of the presentation of different HMI	0	Horizontal Situation Indicator (HSI), Navigation Display (ND), Primary Flight Display (PFD)	
3 Inertial Navigation				
3.1 Inertial Navigation	3.1.1 Describe the principles and key features of INS navigation	2	Sensors and process	
4 Vertical Navigation				
4.1 Barometry	4.1.1 Describe the principles and key features	2	QFE, QNH, flight level, ICAO standard atmosphere, phases of flight, link to SSR Mode C and Mode S	
	4.1.2 Describe the performances	2	Accuracy, integrity, availability, requirements, recent improvements (RVSM) capability	
4.2 Radio Altimetry	4.2.1 Describe the principles and key features	2	Phases of flight (approach and landing), safety net, aural warning	
	4.2.2 Describe the performances	2	Accuracy, integrity, availability, requirements	

Subject 5: Functional Safety

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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 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	

Subject 6: Health and Safety

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Hazard Awareness and Legal Rules				
1.1 Hazard Awareness	1.1.1 Be aware of potential hazards to health and safety generated by navigation equipment	0	Mechanical hazards (HV, EMI), chemical hazards, RF energy	
1.2 Rules and Procedures	1.2.1 State applicable international requirement	1		
	1.2.2 State any applicable legal national requirement	1		
	1.2.3 State safety procedure for the persons working on or near a navigation equipment	1	Isolation (clothing, tools), fire extinction types, safety man presence, safety interlocks, isolating switches, security of the site, climbing procedures	
2 Application of Health and Safety				
2.1 Practical Situations	2.1.1 In a practical situation, apply and demonstrate the procedures and techniques to be followed	3	e.g. replacing fuses or boards, start up / shut down a station, climbing procedures	
2.2 Resuscitation Techniques	2.2.1 Apply and demonstrate resuscitation techniques	3	First aid, rescue procedures, resuscitation	

3.7 Surveillance

Surveillance systems provide essential information for the purpose of a safe an orderly operation of ANS. They are governed by international and national standards.

3.7.1 Training objective

Performance: On the surveillance systems covered in this section, the learner will be able to perform:

- preventive maintenance,
- corrective maintenance,
- calibration.

Condition: In a laboratory environment, given an exposure to a generic surveillance equipment along with the appropriate and pertinent training material, reference documentation, test equipment and tools. Alternatively, use of simulation or of mock calibration reports enables the performance of the objective without the need for the real equipment.

Standard of accomplishment: All maintenance should be performed as per the approved standards and procedures.

3.7.2 Time scale

Qualification training - SURVEILLANCE	Number of periods in the exemplar common core
TOTAL	**396**
Subject 1: Primary	191
Subject 2: Secondary	140
Subject 3: ADS	35
Subject 4: HMI	21
Subject 5: Health and Safety	9

3.7.3 Syllabus

Subject 1: Primary

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 ATC Surveillance				
1.1 Functional Safety of PSR	1.1.1 State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to primary surveillance system, safety reports and occurrences, safety monitoring	
	1.1.2 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	
1.2 Use of PSR for En-route services	1.2.1 Define the operational requirements of an en-route radar and calculate the key parameters necessary to achieve this performance	3	Range, resolution, coverage, PD, MTBF, availability, PRF, frequency with respect to range, blind speed, frequency diversity, range with respect to TX power, antenna gain, receiver MDS, update rate, PD with respect to resolution, PRF, beamwidth, extractor minimum target threshold	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.2.2 State the key parameters of an en-route primary radar	1	Frequency, PRF, rotation rate, power	
1.3 Use of PSR for Terminal and Approach Services	1.3.1 Define the operational requirements and special parameters of an approach radar and calculate the key parameters necessary to achieve this performance	3	ASR, SMR, range, resolution, coverage, update rate, PD, MTBF availability, PRF, frequency with respect to range, blind speed, frequency diversity, range with respect to TX power, antenna gain, receiver MDS, update rate, PD with respect to resolution, PRF beamwidth, extractor minimum target threshold, PD with respect to weather, polarisation	
	1.3.2 State the key parameters of an approach primary radar	1	Frequency, PRF, rotation rate, power	
1.4 Antenna (PSR)	1.4.1 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	
1.5 Data Transmission (PSR)	1.5.1 Describe the requirements of radar data transmission	2	Latency, redundancy, quality, error detection	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.5.2 Describe the implementation options	2	ASTERIX, RADNET, RMCDE, HDLC, X25, ETHERNET, FDDI	
	1.5.3 Decode all the details from an ASTERIX message	3	Type range, azimuth and time, etc.	
	1.5.4 Decode data from a locally used message format	3	As appropriate to local format	
	1.5.5 Describe the specialist test tools and their purposes to maintain the correct operation of the system	2	Data analyser, line analyser, debug, BITE, spectrum analyser, vector voltmeter, oscilloscope, etc.	
	1.5.6 Interpret fault report based on various test tool measures	5	Data analyser, line analyser, debug, BITE, spectrum analyser, vector voltmeter, oscilloscope, etc.	
	1.5.7 Operate test tools to analyse the system	3	Vector voltmeter, oscilloscope	
	1.5.8 Design a radar network comprising of 4 radar sites feeding 2 control units with full redundancy	4	Fault tolerance, redundancy of line equipment, software fallback capability	
	1.5.9 Characterise the degradations of the system	2	Saturation, late plots, DRC, latency	
	1.5.10 Describe basic architecture of RADNET	2	A high-level description of a RMCDE implementation	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.6 Transmitters	1.6.1 Describe the basic characteristics of a transmitter	2	Timing, coherency, modulation, pulse width, pulse energy, frequency agility power output devices (details of pro-cons)	
	1.6.2 Describe the signals at all key points in a block diagram	2	Supply, EHT, RF source (appropriate to type chosen), modulation, interlocks, BITE	
	1.6.3 Draw and explain a generic transmitter block diagram for both a compressed and non-compressed system	2	Klystron, magnetron, travelling wave tube, solid state	
	1.6.4 List the possible failures and where they can occur in the block diagram	1	Arcing, corona discharge, component stress, control loops, isolation, example design for HV stabilisation	
	1.6.5 Describe the constraints and problems on the High voltage circuitry	2	Corona discharge, dielectric stress, isolation, arcing, ageing, interlocks, stability (including control loop), health and safety	
	1.6.6 Describe methods to diagnose faults	2	Crystal detectors, spectrum analyser, calorimeter, power-meters, BITE	
	1.6.7 Operate measuring equipment	3	Crystal detectors, spectrum analyser, calorimeter, power-meters, BITE	
	1.6.8 Using special techniques, detect faults	4	Crystal detectors, spectrum analyser, calorimeter, power-meters, BITE	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.7 Characteristics of Primary Targets	1.7.1 Describe the characteristics of a primary target	2	Backscatter, radar cross section, reflectivity, stealth technologies, aspect, Doppler shift	
1.8 Receivers	1.8.1 Describe the basic characteristics of a receiver	2	Low noise, high dynamic range, bandwidth, detection, frequency, sensitivity, selectivity	
	1.8.2 Draw and explain a generic receiver block diagram	2	LNTA, local oscillator, coherent oscillator, down-mixing, filtering, rejection, IF, PSD, AGC, STC, beam switching, BITE	
	1.8.3 Explain the importance of STC	2	Saturation, RF-IF dynamic range	
	1.8.4 Describe the special testing methods and techniques which are required	2	Termination, crystal detector, range azimuth triggering, test target injection, power measurement, spectrum analyser	
1.9 Plot Extractions	1.9.1 Describe the basic function of a data processor	2	Plot extraction (range bin reports, range correlation, azimuth correlation), target reports, weather vector generation, sliding window, centre of gravity	
1.10 Signal Processing	1.10.1 Describe the basic functions of a modern radar signal processor	2	A/D conversion, I/Q matching, target detection, detection criteria (fixed, adaptive), MTD and clutter maps	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.11 Surveillance Processing	1.11.1 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	
1.12 Displays	1.12.1 Describe the basics of PPI displays with long persistence phosphor and electronic re-timing	2	Plan Position Indicator (PPI), time basis, re-scanners, video data	
1.13 Control Tests and Monitoring	1.13.1 Describe testing possibilities	2	BITE system in modern equipment (online, offline), SASS (C&S)	
1.14 Unique Characteristics of Primary Radar	1.14.1 Explain the basics principles of electromagnetism, propagation, signal detectability, power generation and distribution, problems on transmitters and receivers (general)	2	Basic fundamentals Frequency and phase, electromagnetic radiation, spectrum and bandwidth, noise, powertubes, waveguide problems	
	1.14.2 Describe the radar in the ATC environment	2	Non- safety-critical element, target identification, operational coverage area, relative and absolute accuracy	
1.15 PAR	1.15.1 Explain the basic principles of PAR	2	Elevation and azimuth scanning (mechanical, electronic) capable of approach guidance independently of avionics	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2 Meteorology				
2.1 Meteorological Radar	2.1.1 List the main type of information provided by weather radar	1	Weather radar, wind profile radar, windshear radar	
	2.1.2 Describe the combining of a weather channel in a surveillance radar	2	Scan rate, polarisation, limited height estimation frequency, intensity levels	
	2.1.3 State the characteristics of a meteorological radar	1	Range, power, scan rate, AE type, RX processing	
3 SMR				
3.1 Functional Safety of SMR	3.1.1 State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to SMR, safety reports and occurrences, safety monitoring	
	3.1.2 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
3.2 Use of Radar for Aerodrome Services	3.2.1 Define the operational requirements of a SMR and calculate the key parameters necessary to achieve this performance	3	Range, resolution, coverage, update rate, probability of detection, MTBF availability, PRF, frequency, range with respect to TX power, antenna gain, receiver MDS, update rate, PD with respect to resolution, PRF beamwidth, PD with respect to weather, polarisation	
3.3 Radar Sensor	3.3.1 Draw and explain the layout of the SMR sensor system	2	Dual system, service display	
	3.3.2 Describe the basic functions of the receiver/transmitter unit	2	Hardware / function overview	
	3.3.3 Describe how to operate a sensor	2	Block diagram, timing relations, video path, frequency agility, frequency diversity, polarisation, controller structure	
	3.3.4 Describe the basic functions of the antenna unit	2	Hardware function overview, control/switch unit, external interface, azimuth encoding	
3.4 SMR Display System	3.4.1 Describe the layout of the SMR display system and its capabilities	2	Hardware block diagram, software structure, external interfaces	
	3.4.2 Describe the basic functions of the display SMR system	2	Video processing and tracking, map creation and blanking	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.4.3 Describe how to operate the system	2	Sensor interface, scan to scan correlator processor, identification and alerting, display sub-system, control and monitoring system	

Subject 2: Secondary

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 SSR and MSSR				
1.1 Functional Safety of SSR	1.1.1 State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to secondary surveillance system, safety reports and occurrences, safety monitoring	
	1.1.2 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	
1.2 Use of SSR for En-route Services	1.2.1 Define the operational requirements for an en-route radar and to calculate the key parameters necessary to achieve this performance	1	Range, coverage, PD, resolution, performance, update rate, PRF, interlace, rotational speed, power budget (uplink, downlink) Ref.: ICAO Manual of the SSR systems (Doc 9684)	
	1.2.2 State the key parameters of an en-route secondary radar	1	Rotation rate, PRF, interlace, capacity	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.2.3 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	
1.3 Use of SSR for Terminal and Approach Services	1.3.1 State the key parameters of an approach SSR radar	1	TX power, receiver MDS, rotation speed, PRF, interlace, electronic scanning	
	1.3.2 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	
1.4 Antenna (SSR)	1.4.1 Describe the principle of SSR/MSSR antenna	2	Active antenna, mono-pulse antenna, LVA , waveguide, phasing - mono-pulse antenna, sum, difference and control pattern, error angle measurement, beam sharpening	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.5 Data Transmission (SSR)	1.5.1 State that primary radar and secondary radar data transmissions are using the same techniques	1	See PSR data transmission for details (this objective requires that PSR transmission objectives have been covered)	
	1.5.2 Describe data message output from secondary equipment	2	Type, range, azimuth, A and C codes (12 bits), emergency, validation, garble	
	1.5.3 Decode all the details of an ASTERIX message	3	Callsign, range, azimuth, height, time, SPI and emergency, etc.	
1.6 Interrogator	1.6.1 Describe the characteristics of an interrogator	2	Frequency, spectrum, interrogation modes, Duty cycle, SLS, IISLS, rotational interlock	
	1.6.2 Draw and explain a generic Interrogator block diagram	2	Timing, interface, modulator, BITE	
	1.6.3 Explain the need for integrity monitoring	2	Safeguards against erroneous transmission, BITE	
1.7 Transponder	1.7.1 Explain the operational use of the transponder	2	Diagram of interaction between transponder and aeroplane	
	1.7.2 Define the global performances	1	Range, accuracy, fixed delay to respond	
	1.7.3 Describe the basic characteristics of a transponder	2	Dual electronics, aerial location/ switching and polar diagram, size, ACAS Mode S compatibility, maximum reply rate, ISLS	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.7.4 Explain the advantages of the transponder	2	Longer range, more information	
	1.7.5 Explain the limitations of the transponder	2	hundreds of feet precision, 3A limited codes, squat switch	
	1.7.6 Describe the HMI presented to the pilot	2	Mode 3A switch settings, Special Position Indicator (SPI)	
	1.7.7 Check the conformity to national regulations	3	National regulations corresponding to ICAO Annex 10	
	1.7.8 Describe the data format of the received transponder messages	2	P1, P2, P3 signals	
	1.7.9 Describe the data format of the transmitted transponder messages	2	Field lengths, data bits, grey code, unused bits	
	1.7.10 Decode a transponder message	3	Standard message with SPI set	
	1.7.11 Describe the basic characteristics of a transmitter	2	Timing, modulation, pulse width, power output, sectorised power switching, ISLS, IISLS	
1.8 Receiver	1.8.1 Describe the basic characteristic of a SSR receiver	2	Standard/MSSR receiver, sensibility, bandwidth, dynamic range, STC (normal, sectorised), amplitude processor, phase processor, RSLS, multi-path and interferences	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.9 Extraction	1.9.1 Describe mono-pulse extraction	2	Phase and amplitude modulation, off boresight angle calculation, azimuth encoding	
	1.9.2 Describe sliding window SSR extraction	2	Leading edge, trailing edge, azimuth accuracy, azimuth encoding	
1.10 Signal Processing	1.10.1 Describe the signal processing	2	Video digitizer, pulse processor, reply decoder (bracket pair detector) synchronous reply correlator	
1.11 Surveillance Processing for Reply Verification	1.11.1 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	
1.12 Displays (SSR)	1.12.1 Describe the SSR display options	2	Video, video + label, synthetic	
1.13 Surveillance Processing for Plot Verification	1.13.1 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	
2 Mode S				
2.1 Introduction to Mode S	2.1.1 Explain the working principles of Mode S	2	Mode S interrogation, Mode S reply, Mode S uplink and downlink capability, Mode S formats/ protocols	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	2.1.2 List the advantages of Mode S	1	Resolution, integrity, enhanced data (e.g. 25 feet resolution, callsign)	
	2.1.3 Explain how Mode S is compatible with MSSR	2	RF signals in space, the operational use of P1 to P4, the use of side lobe suppression to control a/c response, all-call and lockout facility, time scales	
	2.1.4 Explain EUROCONTROL Mode S implementation strategy	2	Elementary surveillance, clusters and II codes	
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, other Mode S station clusters	
	2.2.2 Describe testing possibilities for Mode S	2	SASS-C, SASS-S, Poems Test Environment (PTE), Radar Environment Simulator (RES)	
3 SSR Environment				
3.1 SSR Environment	3.1.1 Explain the operational use of ACAS and implications for pilots and controllers	2	Traffic Advisories (TA), Resolution Advisories (RA), pilot responses and controller information	
	3.1.2 Explain the working principles of ACAS	2	Aircraft interrogations, whisper/shout, cockpit displays and warnings, multi-path effects	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.1.3 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	
	3.1.4 Explain the working principles of Multilateration (MLT)	2	Principles of MLT, use of Mode S squitter, benefits for the airport	

Subject 3: ADS

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 General View on ADS				
1.1 Definition of ADS	1.1.1 Recognise on a diagram all the elements of the ADS	1	Navigation solution, link, scheduling Contract/broadcast	
	1.1.2 Describe the basic characteristics of a ADS	2	Performance, integrity, latency, QS, implementation options (e.g. ATN/FANS)	
	1.1.3 List the types of navigation sensors	1	GNSS, INS, radio NAVAIDs, navigation solutions from FMS, FoM	
	1.1.4 Be aware of latest developments, implementation plans and projects	0	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 Functional Safety of ADS B	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 failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.2 Introduction to ADS B	2.2.1 Explain the basic principles of ADS B	2	Autonomous operation, navigation solutions, link options, Aircraft situation awareness	
	2.2.2 Differentiate on a diagram all the possible elements of ADS B	2	Navigation solution, FMS, encoding, scheduling, link	
	2.2.3 Define the ASAS concept	1		
	2.2.4 Explain the use of ADS in support of the ASAS concept	2		
2.3 Techniques in ADS B	2.3.1 Explain the characteristics of the techniques possibly used in ADS B	2	VDL Mode 4, Mode S extended squitter, UAT	
	2.3.2 List the advantages / limitations of ADS B	1	Advantages (global situation awareness, minimum ground investments, remote areas); limitations (level of confidence, use according to density of traffic)	
2.4 VDL Mode 4 (STDMA)	2.4.1 Describe the use of VDL Mode 4	2	High-level description	
	2.4.2 Use the ICAO documentation to explain the principles related to signals in space	3	Modulation scheme, signal structure, key data and frequency channels	
	2.4.3 Use the ICAO documentation to explain the principles related to access technology	3	Timing, self-organising reservation mechanism	
	2.4.4 Explain the relevant protocols	2	Burst structure (fields, fixed part, variable part)	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	2.4.5 Explain the relevant messages	2	Information in each field, information encoding and decoding	
	2.4.6 Describe a VDL Mode 4 signal	2	Show signal timings (remark: it is not a single package, it is a set of messages)	
	2.4.7 Decode and analyse a signal coded according to the ASTERIX relevant standard	4	Reference to ASTERIX standard	
2.5 Mode S Extended Squitter	2.5.1 Describe the use of the Mode S extended squitter	2	High-level description	
	2.5.2 Use the ICAO documentation to explain the principles related to signals in space	3	Modulation scheme, signal structure, key data and frequency	
	2.5.3 Use the ICAO documentation to explain the principles related to random access technology	3	Consequences on the RF environment (1090 MHz)	
	2.5.4 Explain the relevant messages	2	Information in each field, information encoding and decoding	
	2.5.5 Decode and analyse a Mode S extended squitter signal	4	Signal timing and sequencing, position encoding	
	2.5.6 Decode and analyse a signal coded according to the ASTERIX relevant standard	4	Reference to ASTERIX standard	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.6 UAT	2.6.1 Describe the use of the UAT	2	High-level description (details to follow when ICAO standards are available)	
3 ADS C				
3.1 Functional Safety of ADS C	3.1.1 State the role of ATSEP in safety management routines and in reporting processes	1	Safety assessment documentation related to ADS C technique, safety reports and occurrences, safety monitoring	
	3.1.2 Describe in terms of exposure time, environment, effect on controller and effect on pilot the types of functional failures	2	Total or partial failure, premature or delayed operation implementation, spurious and intermittent failure or degradation, loss or corruption of data, missing or incorrect input or output Ref.: Safety policy and implementation, ESARR	
3.2 Introduction to ADS C	3.2.1 Explain the basic principles of ADS C	2	Contract, multi-contract, time, event triggering, long latency	
	3.2.2 Differentiate on a diagram all the possible elements of the ADS C system	2	Navigation solution, processor, link, ground station	
3.3 Techniques in ADS C	3.3.1 Explain the characteristics of the techniques possibly used in ADS C	2	e.g. ATN application, ATN air-ground sub-networks (VDLs, Mode S datalink, AMSS, HDL)	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.3.2 List advantages/ limitations of the ADS C system	1	Advantages (minimum ground investment, remote area); limitations (quality of service, latency, common mode of failure)	
	3.3.3 Explain the relevant messages	2	Information in each field, information encoding and decoding	
	3.3.4 Decode the ADS C messages coming from the ATN router	3	Decode and analyse a signal coded according to the relevant standard (ADS panel documentation)	
	3.3.5 Identify and locate data transmission problems	3	Subject to system development and availability	

Subject 4: HMI

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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: Health and Safety

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Hazard Awareness and Legal Rules				
1.1 Hazard Awareness	1.1.1 Be aware of potential hazards to health and safety generated by surveillance equipment	0	Mechanical hazards, electrical hazards (HV, EMI), chemical hazards	
1.2 Rules and Procedures	1.2.1 State applicable international requirement	1	Relevant international documents	
	1.2.2 State any applicable legal national requirement	1	Relevant national documents	
	1.2.3 State safety procedure for the persons working on or near a surveillance equipment	1	Isolation (clothing, tools), fire extinction types, safety man presence, safety interlocks, isolating switches, security of the site	
	1.2.4 State the rules and procedures relevant to the manipulation and the storing of hazardous products and to environmental protection	1	Relevant company procedures	
2 Application of Health and Safety				
2.1 Practical Situations	2.1.1 In a practical situation apply and demonstrate the procedures and techniques to be followed	3	e.g. changing wave guide, replacing fuses or boards, start up / shut down a station	
2.2 Resuscitation Techniques	2.2.1 Apply and demonstrate resuscitation techniques	3	First aid, rescue procedures, resuscitation	

3.8 Data Processing

3.8.1 Training objective

The learner will explain the nature, use, life cycle and criticality of the data and software process in aviation, in particular in terms of safety and security.

He/she will perform software coding and make use of EATMP standards.

3.8.2 Time scale

Qualification training - DATA PROCESSING		**Number of periods in the exemplar common core**
	TOTAL	**206**
Subject 1:	Functional Safety for Aeronautical Data	35
Subject 2:	User Functional View	54
Subject 3:	Process	44
Subject 4:	Data	73

3.8.3 Syllabus

Subject 1: Functional Safety for Aeronautical Data

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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, etc.	
	1.2.2 Appreciate how the normal output of a system could be used by non-authorised persons with hostile intent	3	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, etc.	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	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	

Subject 2: User Functional View

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1 Tools for ATM 2000+ Strategy Note :The topics are similar to the ones of the IANS course : DPS-AADP See details on www.ians.lu				
1.1 ATM 2000+ Strategy	1.1.1 Explain the main features of the ATM 2000+ Strategy	2		
1.2 Controller Role Development	1.2.1 Explain the controller role development	2		
1.3 ATC Data Processing Directions for Change Overview	1.3.1 Be aware of the projects concerning ATC data processing	0		
1.4 Trajectories-Prediction, Calculation and Negotiation	1.4.1 Explain the main process	2		
	1.4.2 State what decisions are predicated on these calculations	1		
1.5 Collaborative Planning and Decision-making	1.5.1 Be aware of the current state of research and regulation in this area	0		
1.6 FMS Development	1.6.1 Be aware of the current state of the art in this area	0		
1.7 Ground Safety Nets	1.7.1 List the safety nets, their functions and their legislative status	1		
1.8 Decision Support	1.8.1 List the steps in ATM traffic planning process	1	ATFM with strategic, pre-tactical and tactical, ATC sector planning, tactical control	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	1.8.2 List the four areas of improvement for ATC decision support	1	Conflict detection, conflict resolution, traffic complexity reduction, acquisition of aircraft data	
	1.8.3 Explain the principles of trajectory prediction, conformance monitoring, and medium & short-term conflict detection	2		
	1.8.4 Discuss the benefit of these tools for safety and efficiency	5		
1.9 Arrival, Departure and Surface Movement Management	1.9.1 Be aware of current developments and future possibilities	0		
1.10 Operational Aspects of Future Communication and Surveillance Support	1.10.1 Be aware of current developments and future possibilities	0		
1.11 Collaborative ATC, Delegation of Separation	1.11.1 Be aware of current developments and future possibilities	0		
2 Data Processing Chain				
2.1 Flight Data Processing	2.1.1 Be aware of the system scope of FDPS and the life cycle of FPL	0	Automation levels, FDPS, core FDP functions, added FDP functions	
2.2 Surveillance Data Processing	2.2.1 Be aware of the system scope of SDPS and the life cycle of the major data items	0	Data distribution, radar plots, mono-radar tracks, multi-radar tracks, ADS report	
2.3 Associated DPC functions	2.3.1 List the associated DPC functions	0	Correlation, vertical tracking, conflict prediction	

Subject 3: Process

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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 Perform operating systems commands, exercising the major features of a target OS	3	e.g. Unix, Linux, Windows, etc. according the systems in use	
	1.2.2 Characterise consequences of an OS upgrade	2	List the possible implications on HW (performance, memory, etc.), middleware (compatibility) and SW components	
	1.2.3 Explain downward compatibility	2	Checks on embedded SW modules ability to run under new OS version	
	1.2.4 Take account of hardware/software compatibility	2	HW requirements of specific SW implementations	
	1.2.5 Describe interactions between application and OS	2	Examples of OS calls by the application software if no middleware is in use	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
1.3 Software Development Process	1.3.1 List the main software development processes used in industries	1	e.g. life cycle, waterfall model, Rational Unified Process (RUP)	
	1.3.2 List the main steps of the classical process	1	Specification, analysis, design, realisation, test	
	1.3.3 List the main elements of RUP	1	Iterative development, management, Unified Modelling Language (UML)	
	1.3.4 List the main differences between RUP and classical process	1	Advantages/ disadvantages of the different methods	
	1.3.5 List the main differences of the various methods	1	Advantages/ disadvantages of the different methods	
	1.3.6 Discuss the advantages, disadvantages and constraints from the RUP and procedural process	5		
2 Hardware Platform				
2.1 Equipment Upgrade	2.1.1 Identify the key points that have to be considered when DP equipment is upgraded (or changed)	3	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	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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	
2.5 Awareness to Details of Hardware Platform	2.5.1 Be aware that further studies shall be done during type rating	0		

Subject 4: Data

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
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 Name who is designated to authorise changes in operational data	1	Mechanisms and procedures	
	1.2.2 Name who verifies and check the changes	1	Appropriate details from a system used in house	
	1.2.3 Explain the control procedure on data	2	Appropriate details from a system used in house	
1.3 Data Responsible Authority	1.3.1 Name the authority responsible for standards	1	e.g. speed of light, nautical mile, world geodesic model, aircraft performance	
1.4 Data Standards	1.4.1 List the standards related to aviation, their sources and their status	1	e.g. ASTERIX, WGS84, OLDI, FPL, etc.	
	1.4.2 Use defining documents to encode and decode a typical ACT data item	3	e.g. EUROCONTROL official defining documents to encode and decode typical plot data in ASTERIX	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2 Life Cycle				
2.1 Appropriate Model	2.1.1 Apply the appropriate model to the analysis of a relevant aviation system	3	e.g. V Model, waterfall, requirements, design, coding, testing, maintenance, cover detailed description of approved model(s) used in the administration	
2.2 Domain Orientation	2.2.1 Be aware of nature of aviation processing requirements	0	Data volatility (e.g. radar), system integrity; consequence of failure	
2.3 Coding Practice	2.3.1 Describe the coding practices in own ATM environment	2		
	2.3.2 Demonstrate the application of coding practice on a target language	3	e.g. C, C++, ADA, Pascal, etc.	
2.4 Configuration Control	2.4.1 Describe the principles of configuration control	2	Clear identification 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	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
2.5 Testing	2.5.1 Identify the techniques available in software testing, for both functional and integrity testing	3	Test specifications, user requirements, performance requirements, code walkthrough, modelling, simulation real time and fast time, black box testing, regression testing, formal methods, use of independent test personnel	
	2.5.2 Identify the techniques available system testing and integration	3	System integration testing, load testing, hardware failure simulation, data corruption simulation	
3 Aviation Data Detailed Structure				
3.1 System Area	3.1.1 List the elements of system area	1		
	3.1.2 Describe the structure of the data related to system area	2		
3.2 Characteristics Points Related to Geography	3.2.1 List the type of variables	1	Airports and runways, ILS, radar, limit points, etc.	
	3.2.2 Describe the structure of all these variables	2	Airports and runways, ILS, radar, limit points, etc.	
	3.2.3 Choose constants and variables	3		
3.3 Characteristics Points Related to Routing and Sectors	3.3.1 Describe the structures of the variables	2	Coded routes, SID allocation parameters, adjacent FIRs, sectors, holding	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.3.2 List the type of variable	1	Coded routes, SID allocation parameters, adjacent FIRS, sectors, holding	
	3.3.3 Choose constants and variables	3		
3.4 Aircraft Performances	3.4.1 List the performance data used in FDPS	1	Example of data from in-house system	
	3.4.2 Describe the structure of aircraft performance data	2		
	3.4.3 Define speeds, rates, levels	1		
	3.4.4 Explain the consequences of the use of the wrong type of aircraft	2		
	3.4.5 Be aware of the latest developments in FMS and DL	0		
3.5 HMI Interface Parameters (Screen Manager Descriptives)	3.5.1 Describe the basic functions of the display SMR system	2	Screen manager description, strip format, function eligibility, HCP header information, SDD parameters, descriptive line numbers	
	3.5.2 Describe the layout of the display system and its capabilities	2	Screen manager description, strip format, function eligibilities, HCP header information, SDD parameters, descriptive line numbers	
	3.5.3 Describe how to operate the system	2		

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.5.4 Handle the operational HMI and assist in the tuning of the screens	3		
3.6 Auto-coordination Messages	3.6.1 Describe the meaning of every coordination message in the control process	2	Coordination parameters, conditions groups, OLDI conditions groups, characteristics of remote centres (civil and military)	
	3.6.2 Describe the characteristics of the remote centres relevant to OLDI	2		
3.7 Configuration Control Data	3.7.1 Explain the structure of the configuration data	2	Sector CSU link, sectorisation plan, control parameters	
3.8 Physical Configuration Data	3.8.1 Explain the structure of the physical configuration data	2	External configuration, device configuration	
3.9 Relevant Meteo Data	3.9.1 Explain the organisation of the data related to meteorology	2	Meteo, QNH TL areas, CB activity	
3.10 Alert and Error Messages to ATSEP	3.10.1 Characterise the importance of each message	2		
	3.10.2 Describe one message of each category of importance	2		
3.11 Alert and Error Messages to ATCO	3.11.1 Describe the structure of the data used in these types of message	2	MSAW, conflict alert parameters	
	3.11.2 List the alerts and messages and explain their importance from an ATCO point of view	2	MSAW, conflict alert	

TOPIC SUBTOPIC	OBJECTIVES Students shall ...	L	CONTENT	TASK No.
	3.11.3 Identify the importance of alert and error messages through studies of real or mocked cases	3		

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4. TRAINING FOR EACH QUALIFICATION

4.1 Introduction

Each qualification always includes the corresponding domain. In addition, it may include specific areas from the other domains. The table below gives an overview of this distribution. Sections 4.2 to 4.5 provide additional details.

Qualification training for	Domain	Subjects	Duration of modules*	Duration of training*
Communication	Communication	All	466	483
	Safety	All	17	
Navigation	Communication	Data	146	796 (155)
	Navigation	All	633 (155)	
	Safety	All	17	
Surveillance	Communication	▪ Data	146	673
		▪ Transmission Path	109	
	Surveillance	All	401	
	Safety	All	17	
Data Processing	Communication	▪ Data	146	574
		▪ Transmission Path	109	
		▪ Recorders	19	
	Navigation	▪ Ground-based Systems	2	
		▪ Satellite-based Navigation Systems	4	
	Surveillance	▪ Primary	26	
		▪ Secondary	16	
		▪ ADS	8	
		▪ HMI	21	
	Data Processing	All	206	
	Safety	All	17	

** in hours*

4.2 Communication

Qualification training	Domain	Subjects	Topics	Sub-topics	Duration of modules*
Communication	Communication	All	All		466
	Safety	All	All		17

** in hours*

4.3 Navigation

Qualification training	Domain	Subjects	Topics	Sub-topics	Duration of modules*
Navigation	Communication	Data	All		146
	Navigation	All	All		633 (155)
	Safety	All	All		17

** in hours*

4.4 Surveillance

Qualification training	Domain	Subjects	Topics	Sub-topics	Duration of modules*
Surveillance	Communication	▪ Data ▪ Transmission Path	All All		146 109
	Surveillance	All	All		401
	Safety	All	All		17

** in hours*

4.5 Data Processing

Qualification training	Domain	Subjects	Topics	Sub-topics	Duration of modules*
Data Processing	Communication	▪ Data	All		146
		▪ Transmission Path	All		109
		▪ Recorders	Legal Records	1.1 Regulations	9
				1.3 Digital	10
	Navigation	▪ Ground-based Systems	MLS	MLS datalink reference	2
		▪ Satellite-based Navigation Systems	GBAS	2.2 Reference GNSS Ground Station	4
				Architecture - datalink	
	Surveillance	Primary	ATC Surveillance	1.1 Functional Safety of PSR (only 1.1.2)	1
				1.5 Data Transmission (PSR) (except 1.5.7 & 1.5.9)	20
				1.12 Displays	2
			SMR	3.4 SMR Display System	3
		Secondary	SSR & MSSR	1.1 Functional Safety of SSR (only 1.1.2)	2
				1.5 Data Transmission (SSR)	1
				1.12 Displays (SSR)	3
			Mode S	2.1 Introduction (except 2.1.3 & 2.2. System)	10
				2.2.1 (theory of operation)	
		ADS	ADS B	2.3 Techniques in ADS B	3
			ADS C	3.3 Techniques in ADS C	5
		HMI	All	All	21
	Data Processing	All	All		206
	Safety	All	All		17

** in hours*

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ANNEX A: EATMP COMMON CORE CONTENT TRAINING CONCEPTS

1. Concept of Training Events

The objectives indicate what is expected from the learner. How to train him/her to achieve the objectives is indicated in the training plans by the choice of training events.

Training events are the elementary unit of a training plan. Through their type the training designer indicates to the instructor which method and media are the more adequate to teach an objective.

The choice of these main media and method does not exclude the use of additional ones within the same training event, if they suit its quality and efficiency. The training plans are a help to prepare training and to plan resources but their implementation requires flexibility, interpretation and adaptation by the instructor.

The list of training events provided in 1.2 includes those currently used in Common Core Content for ATCO training. It is not exhaustive and should benefit from validation and upgrading to incorporate best practices and latest didactical or technological progress. This list should be used as a guideline for the development of future training plans. It will then be necessary to adapt it to the new requirements and the specific target population, i.e. ATSEP.

Definitions for the training methods, media, learning rates and modes of delivery listed in 1.2 can be found in 1.3. For further detail the reader shall refer to the document entitled 'Specifications on Training Methods and Tools' (EATMP, 2000b – T16). It is to be noted that some topics have been added or updated since the publication of this reference document.

As essential principles it is acknowledged that:

- During a single training event several methods or media might be used. In the plans the one indicated is the most significant (for instance, a simulation includes briefing but the only indicated method is simulation) or the most dependent on the adequate equipment (for instance, in a lesson both paper documents and projector displaying computer presentation are used; only Visual Aid (Vsl) is indicated as a media, Text (Txt) is not mentioned).

- Using his judgement, the instructor might deviate from these plans according to the group feedback.

In addition to the accurate definitions of the training events, additional locutions may be used to define wide modes of training (for instance, E-Learning (EL) may be used to group Computer-/Web-based Training (CWBT) and Virtual Classroom (VC), and Problem-based Learning (PBL) to define a pedagogical strategy).

1.1 Definitions of Training Events Used in Common Core Content

The following definitions provide a quick reference for the hurried reader on the basis of a detailed description contained in the reference document 'Specifications on Training Methods and Tools' (EATMP, 2000b – T16).

Case (Case)

Training event based on the case study method (in which a real or fictional situation or series of events are presented to learners for their analysis and proposal of possible solutions). Most of the time it is a group session with the support of texts, visual aids and multimedia computer; sometimes it is individual training.

Computer-based Practical Exercises (CBPE)

The exercises are presented to the group by an instructor using visual aids and deciding, from learners' answers, when and how moving to next exercises.

Computer-/Web-based Training (CWBT)

The provision of knowledge and skills by means of a computer with numerous interactions, learner response analysis and free individual rhythm of learning (self-paced manner). The source is indifferently local or accessed through a network (Intranet or Internet).

Group Work (GrW)

The instructor facilitates the discovery of problems and the study of reference solutions by a group of learners, with the help of text or visual aids.

Hands On (HO)

Supervised practice on real equipment that is not in operation. Emulation on multimedia computer is sometimes sufficient. Text is used as additional data (instructions, operating manual, questionnaire, etc.).

Multimedia or sound Laboratory (Lab)

Lessons or exercises are provided in a room equipped with a set of individual positions. Instructor can monitor learners individually. Rhythm of learning is self-paced or restricted according to training material and instructor interventions.

Lecture (Lec)

A straight talk or exposition, possibly using visual or other aids, but without group participation other than questions, usually at the conclusion.

Lesson (Les)

A training technique incorporating a number of instructional techniques designed to ensure the participation of the learners in reaching the specified behavioural objectives. The instructor is able to ascertain whether material is being assimilated.

Part-Task Practice (PTP)

Pre-simulation which allows restricted or real-time practice of a part of the skills that are necessary for the operational task in a realistic environment (PTT or Sim).

Skill Acquisition (SA)

Pre-simulation which allows self-pace, restricted or real-time practice of a part of the skills necessary for the operational task in a possibly non-realistic environment (e.g. 2D aerodrome).

Individual Simulation (ISimul)

Real-time full-task simulation involving one single learner.

Team Simulation (TSimul)

Real-time full-task simulation involving an individualised cell made of several learners. A team consists of two or more learners who are required to work together on related or interacting tasks.

Group Simulation (GSimul)

Real-time full-task simulation involving several individual or team simulations simultaneously.

Structured Briefing (StBf)

The training event StBf (Structured Briefing) is a planned group introduction for a simulation (or a series of simulations) stating the objectives of the exercise, the simulated operational procedures, the operation of the simulator, the expected role of each team member, including the instructor, and possibly demonstrations of simulation exercises. The training event StDf (Structured Debriefing) is a planned group review and discussion of the outcome of a simulation (or a series of simulations). The discussion is centred on the strategies chosen and their results. At the level of the training plan, StBf includes both StBf and StDf. Differentiation is done at the implementation.

Supervised Practices (Sup Pract)

Manipulations of equipment where the instructor provides the necessary feedback.

Visit (Vis)

Is considered as individual when each learner has the opportunity to develop questions and discussions, and to practise handover individually. If this activity is not important enough the visit is considered as a group activity.

Virtual Classroom (VC)

Distance training of a group of persons connected in synchronous mode and facilitated or lectured by an instructor.

1.2 List of Training Events Used in Common Core Content

Training events are as often as possible based on a unique occurrence of parameters (for instance, CBPE is always Ex + Vsl + Rstd + G). In this case the detailed indication of the parameters in the training plans could be omitted (when this is not possible the training event name and the complex area are in bold).

Sometimes one of the parameters is so prevailing that its name is given to the training event (e.g. 'lecture').

Training event[1]	**Training event**[2]	**Method**[2]	**Media**[2]	**Rate**[2]	**Mode**[2]
Case	Case	Case	Vid, MMC, Vsl (Backup Txt)	Rstd	I, G
Computer-based Practical Exercises	CBPE	Ex	Vsl	Rstd	G
Computer-/Web-based Training	CWBT	Inter	MMC	Self	I
Group Work	GrW	Facil	Vsl (Backup Txt)	Rstd	G
Hands On	HO	Sup Pract	RE	Rstd, Real	G
Multimedia or sound Laboratory	Lab	Les, Ex	MMC, sound	Self, Rstd	I
Lecture	Lec	Lec	Vsl (Backup Txt)	Rstd	G
Lesson	Les	Les	Vsl (Backup Txt)	Rstd	G
Part-Task Practice	PTP	Pre-Simul	PTT	Rstd	I
Skill Acquisition	SA	Pre-Simul	OTD	Self	I
Structured Briefing	StBf	Brief	Vsl	Rstd	G
Individual Simulation	ISimul	Simul	Sim, Hi Fi Sim	Real	I
Team Simulation	TSimul	Simul	Sim, Hi Fi Sim	Real	I
Group Simulation	GSimul	Simul	Sim, Hi Fi Sim	Real	G
Supervised Practices	Sup Pract	Sup Pract	Vsl (Backup Txt), MMC, RE	Rstd	G
Virtual Classroom	VC	Facil, Ex, Les, Lec	Net	Rstd	G
Visit	Vis	Sup Pract	RE	Rstd	G, I

[1] In full – [2] Abbreviated

1.3 The Four Parameters of the Training Event

1.3.1 Introduction

Our methodology to design training strategy is based on the answers to the following questions:

- What are the relations between the matter, the learner and the instructor? (training method)
- Which media is used to carry the training message? (media)
- Is the learning rate free or restricted or real? (learning rate)
- Is the training individual or in group? (mode of delivery)

To use the methodology the training designer will first try to find the appropriate type of training event within the existing list. If not found, a thought should be given to the possibility that the same type could be used with a local different denomination; the four parameters should help to sort this out. If this is not the case, the additional type of training event should be characterised by its four parameters.

1.3.2 Training methods

The training methods characterise the relations between the matter, the learner and the instructor.

Lecture (Lec)

A straight talk or exposition, possibly using visual or other aids, but without group participation other than questions, usually at the conclusion.

Lesson/Demonstration (Les)

A training technique incorporating a number of instructional techniques designed to ensure the participation of the learners in reaching the specified behavioural objectives. The instructor is able to ascertain whether material is being assimilated.

Case Study (Case)

A training method in which a real or fictional situation or series of events are presented to learners for their analysis and consideration of possible solutions or problems identified. Their findings in a real situation can be compared with what actually occurred.

Exercises (Ex)

The provision and consolidation of knowledge and skills through the performances of series of exercises.

Facilitation (Facil)

Process facilitation means helping people to achieve results using facilitation techniques.

Interactive Training (Inter)

The provision of knowledge and skills by means of a computer with numerous interactions, learner response analysis and allowing, when appropriate, free individual rhythm of learning (self-paced manner).

Supervised Practices (Sup Pract)

Manipulations of equipment where the instructor provides the necessary feedback.

Pre-Simulation (Pre-Simul)

The practice in restricted or real time of a part of the skills necessary for the operational task in a possibly unrealistic environment (e.g. 2D aerodrome).

Two types of pre-simulation are detailed at the level of the training event: Skill Acquisition (SA) and Part-Task Practice (PTP).

Simulation (Simul)

The provision of knowledge, skills and attitudes by means of representation of air traffic responding to any learner action as real air traffic. It always includes briefing, tutoring and debriefing.

Three types of simulation are detailed at the level of the training event: Individual Simulation (ISimul), Team Simulation (TSimul) and Group Simulation (GSimul).

Briefing (Brief)

An introduction to a training event during which interruption of the learner's activity is not normally anticipated (e.g. OJT and simulation). The method is used during the simulation (briefing) or planned separately (structured briefing).

Debriefing (Debrief)

A review and discussion on the outcome of a training event based on a formative assessment of that event. The technique is used during the simulation (debriefing) or planned separately (structured debriefing).

Tutoring (Tut)

The act of giving additional knowledge and guidance to an individual or small group of learners in an off-the-job, informal training situation. Tutoring is considered as a supplementary training event and may be automated in the case of guided simulation.

Role-Play (Role)

Learners act out a working model of some real-world human situation in interacting group. They are provided with background data and roles to play together with constraints which may change as the play proceeds.

1.3.3 Media

Media is the physical means by which an instructor or a training designer communicates a message. One media can use several supports (for instance, a Multimedia Computer (MMC) could use a diskette or CD-ROM, and video can use tape, CD or DVD). In this document we are going to define the media related to simulation but shall not attempt to make an exhaustive list of the many types of support and educational materials.

Real Equipment (RE)

Equipment such as CWP, NAVAIDs, avionics or even official documents such as charts or maps, either used in operational conditions (On-the-Job Training [OJT]) or in non-operational conditions (shadowing or demonstration). High-fidelity simulator may sometimes be used as a backup.

High-Fidelity Simulator (Hi Fi Sim)

A full-size replica of Controller Working Position (CWP) including all equipment and computer programmes necessary to represent full tasks of the sector or the tower and their environment. A spare operational position used as simulator is a good example of Hi Fi Sim. In the case of aerodrome it includes an out-of-the-tower view.

Simulator (Sim)

A device that presents the learner with a representation of the important features of the real situation and reproduces the operational conditions under which the learner can practise real-time tasks directly.

Part-Task Trainer (PTT)

A training machine for the learner to practise some operational functions independently of other functions not represented there, although they are necessarily associated to the first ones in the operational task.

Other Training Device (OTD)

A training machine which presents the learner with some operational functions on a non-realistic reproduction of the operational devices. It includes a generic MMC.

Multimedia Computer (MMC)

A (networked or stand-alone) multimedia computer or workstation dedicated to one learner or to a small cell. The hardware is off-the-shelf and has not been deeply modified for specific ATC purposes.

Network (Net)

A system of computers and terminals connected by communications lines.

Video (Vid)

Aids such as camera, camcorder, recorder, player, TV, monitor, projector and screen used for the generation, storage and reproduction of visual animated images and associated sounds (video, films, DVD and other). In particular, it enables to record a learner performance and to replay it.

Visual Aids (Vsl)

Aids such as projectors or screens used to display computer-based presentations, animations, slides, overhead, mock-up, models and video clips, possibly associated to loud speakers or headset for the sound.

Audio Aids (Aud)

Aids to communication that utilise the sense of hearing.

Text (Txt)

The provision of written documents including handouts, books, manuals, training documents, etc.

1.3.4 Learning rate

Self-paced Learning (Self)

A learning/teaching system whereby the learner is able to control the pace at which he/she works.

Time-restricted Learning (Rstd)

A learning/teaching system whereby the course developer or instructor controls the pace at which the learner has to work.

Real Time (Real)

A learning/teaching system whereby the pace at which the learner has to work is the same as in real operation.

1.3.5 Mode of delivery

Individualised Training (I)

Features of the individualised training are the provision of possibly different stimuli to each learner, the separated analysis of their response and the provision of consequent new stimuli independent of the answers of other learners.

Note: Instruction of a small group of learners considered as an entity (for example planner and executive) is classed as individualised training. In ATC training this consideration of team building and the operational conditions very often imply that the learner is a team rather than an individual.

A team is:

> *… a group of two or more persons who interact dynamically and interdependently within assigned specific roles, functions and responsibilities. They have to adapt continuously to each other to ensure the establishment of a safe, orderly and expeditious flow of traffic.*

There is of course an apparent contradiction between the terms 'individualised' and 'team interaction'. This has to be understood by differentiation between team and group.

A typical example is a radar simulation, in area radar control, provided to twelve learners, working in six teams of two (planner plus executive) on six control positions simulating the same airspace sector.

Even if the proposed air traffic is the same for the six teams and even if the training objectives are the same, the simulations will progress differently for each of the teams. In addition, the simulations are not necessarily happening at the same time. This is not 'group' training. It might be considered as 'small-group training' if the teams were always composed of the same learners. Generally, this is not the case: in fact, most of the training is addressed to each individual who has to cope with a very close and very complex element (his partner in the team) among other more distant elements (other sectors, units, aircraft, etc.). The fact that each partner sometimes reacts differently

increases the individualisation of the training because none of the learners can be confronted with the same situation.

Group Training (G)

All the participants are presented the same learning material under the same conditions.

1.3.6 Global strategies

Training events are useful to describe elements of training. Additional locutions might be used to define a strategy globally applied to training. Problem-based learning and e-learning are two examples:

Problem-based Learning (PBL)

A pedagogical strategy for posing significant, contextualised, real-world situations and providing resources, guidance, instruction and self-directed learning strategies to learners as they develop content knowledge, problem-solving skills and team participation skills.

E-Learning (EL)

Encompasses a set of methods and media characterised by the use of network and computers and the possibility of distance learning. Virtual classroom and CWBT in particular are e-learning training events.

1.3.7 List of training events parameters

Method	
Full name	**Abbreviation or Acronym**
Case Study	Case
Exercises	Ex
Lecture	Lec
Lesson/Demonstration	Les
Facilitation	Facil
Interactive Training	Inter
Pre-Simulation	Pre-Simul
Role-Play	Role
Simulation	Simul
Briefing	Brief
Debriefing	Debrief
Tutoring	Tut

Media	
Full name	**Abbreviation or Acronym**
Real Equipment	RE
High-Fidelity Simulator	Hi Fi Sim
Simulator	Sim
Part-Task Trainer	PTT
Other Training Device	OTD
Multimedia Computer	MMC
Network	Net
Video	Vid
Visual Aids	Vsl
Audio Aids	Aud
Text	Txt

Learning Rate	
Full name	**Abbreviation or Acronym**
Self-paced Learning	Self
Time-restricted Learning	Rstd
Real Time	Real

Mode	
Full name	**Abbreviation or Acronym**
Individualised Training	I
Group Training	G

2. Concept of Taxonomy

A taxonomy is a classification based on explicit principles. The purpose of taxonomies in the training domain is to classify training objectives.

2.1 Levels

Five levels are identified, numbered 1 to 5 plus an initial level (named 0) of pure information. They are defined as follows:

Level 0 'To be aware of'.

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

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

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

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

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

2.2 Definition of Action Verbs

Defining action verbs becomes increasingly difficult as the level increases for several reasons:

(i) Higher levels (4-5) and even 3 are the culmination of many actions, and can only be described by either a breakdown into component actions or by a few high-level words, which are not exclusive to a particular level.

(ii) This could be compounded by making some verbs belong to several levels. This solution was rejected in order to keep things simple for the operational use (one verb - one level).

(iii) The main difference between levels 4 and 5 is novelty (qualitative) of the problem.

(iv) As each level subsumes those previous to it, as it is hierarchical, then you must naturally start running out of words.

The list is not complete, but a guideline only. In the future ATM-specific terms known to refer to that level of performance can be added. The examples chosen to illustrate the verbs are specific to ATSEP in this document. In other documents examples are chosen to match the learner population.

2.3 Action Verbs

2.3.1 Definition of verbs – Level 1

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

(L = Level)

Verb	Definition	Example	L
Define	State what it is and what its limits are; state the definition	Define the global performances for CVOR and DVOR	1
Draw	Produce a picture, pattern or diagram	Draw the block diagram of the transmitter	1
List	Say one after the other	List the main software development processes used in industries	1
Name	Give name of objects or procedures	Name who is designated to authorise changes in operational data	1
Quote	Repeat of what is written or said to underline	Quote ICAO definition of ATC service	1
Recognise	To know what it is because you've seen it before	Recognise on a diagram all the elements of the ADS	1
State	Say or write in a formal or definite way	State who are the local telecom providers and the service characteristics	1

2.3.2 Definition of verbs – Level 2

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

(L = Level)

Verb	Definition	Example	L
Characterise	To describe the quality of features in something	Characterise consequences of an OS upgrade	2
Consider	To think carefully about it	Consider institutional issues and service provider responsibilities	2
Demonstrate	Describe and explain; logically or mathematically proves the truth of a statement	Demonstrate the possible use of GBAS for approach and landing	2
Describe	Say what it is like or what happened	Describe the architecture of the ATN network	2
Differentiate	Show the differences between things	Differentiate on a diagram all the possible elements of the ADS C system	2
Explain	Give details about something or describe so that it can be understood	Explain the principles of non blocking switches	2
Take account of	Take into consideration before deciding	Take wind influence into account when calculating a ground speed	2

2.3.3 Definition of verbs – Level 3

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

Verb	Definition	Example	L
			(L = Level)
Act	Carry out, execute		3
Apply	Use something in a situation or activity	Apply the appropriate model to the analysis of a relevant aviation system	3
Appreciate	To understand a situation and know what is involved in a problem-solving situation, to state a plan without applying it	Appreciate criticality of the conditions	3
Assist	Help somebody to do a job by doing part of it	Handle the operational HMI and assist in the tuning of the screens	3
Calculate	To discover from information you already have by arithmetic; to think about a possible cause of action in order to form an opinion or decide what to do	Calculate the values of the elements of a simple generic antenna system	3
Check	Make sure the information is correct (satisfactory)	Check the operational status of the monitor system	3
Choose	Select out of number, decide to do one thing rather than another	Choose the appropriate type of line for a given specific application	3
Collect	Assemble, accumulate, bring or come together		3
Conduct	Lead, guide	Conduct coordination	3

Definition of verbs – Level 3 (continued)

Verb	Definition	Example	L
			(L = Level)
Confirm	Establish more firmly, corroborate	Confirm sequence order	3
Decode	Turn into ordinary writing, decipher	Decode a transponder message	3
Encode	Put into code or cipher		3
Estimate	Form an approximate judgement of a number, form an opinion	Being given an aircraft route, estimate thanks to a software package or/and GPS receiver the availability of the constellation	3
Execute	Perform action		3
Extract	Copy out, make extracts from, find, deduce	Extract data from a flight plan	3
Identify	Associate oneself inseparably with, establish the identity	Identify and locate data transmission problems	3
Inform	Inspire, tell	Inform the planning controller	3
Initiate	Begin, set going, originate	Initiate a coordination procedure	3
Input	Enter in the system	Input data	3
Issue	Send forth, publish	Issue ATC clearance	3
Maintain	Carry on, keep up, refresh	Maintain flight data display	3
Measure	Ascertain extent or quality of (thing) by comparison with fixed unit or with object of know size	Measure the typical parameters of lines	3

Definition of verbs – Level 3 (continued)

Verb	Definition	Example	L
			(L = Level)
Monitor	Keep under observation	Monitor traffic	3
Notify	Make known, announce, report	Notify runway in use	3
Obtain	Acquire easily, without research	Obtain aeronautical information	3
Operate	Conduct work on equipment	Operate test tools to analyse the system	3
Pass	Move, cause to go, transmit	Pass essential traffic information without delay	3
Perform	Carry into effect, go through, execute	Perform typical measurements on a receiver	3
Record	Register, set down for remembrance or reference	Record information by writing effectively	3
Relay	Arrange in, provide with, replace by ...	Relay pilot message	3
Respond	Make answer, perform answering or corresponding action	Respond to the loss of aircraft radar identification	3
Scan	Look intently at all parts successively	Scan data display	3
Transfer	Hand over	Transfer information to receiving controller	3
Update	Refresh, make up to date	Update	3
Use	Employ for a purpose, handle as instrument, put into operation	Use the ICAO documentation to explain the principles related to signals in space	3
Verify	Establish truth of	Verify the impact of the requirements on the location and the type of the ground station	3

2.3.4 Definition of verbs – Level 4

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

Verb	Definition	Example	L
			(L = Level)
Acquire	Gain by oneself and for oneself, obtain after research	Acquire relevant aeronautical information	4
Adjust	Change to a new position, value or setting	Adjust antenna system	4
Allocate	Assign, devote	Allocate the responsibility of separation during transfer	4
Analyse	Examine minutely the constitution of	Analyse the coverage of the radio system	4
Assign	Allot as a share, make over	Assign take off number	4
Coordinate	Bring part into proper relation	Coordinate with RCC	4
Comply	Act in accordance with	Comply with rules	4
Delegate	Commit authority to somebody	Delegate separation in case of aircraft continuing visually	4
Design	Conceive mental plans for	Design a NDB station according to operational requirements	4
Detect	Discover existence of	Detect disturbances	4
Ensure	Make safe, make certain	Ensure the agreed course of action in carried out	4

Definition of verbs – Level 4 (continued)

Verb	Definition	Example	L
			(L = Level)
Expedite	Assist the progress of, do speedily		4
Integrate	Combine into a whole, complete by addition of parts	Integrate adequately components into a LAN	4
Justify	Show the rightness of a choice or of an option	Justify and theorise the DME/N versus the DME/P	4
Manage	Handle, wield, conduct	Manage aerodrome surface movements	4
Organise	Give orderly structure to, frame and put into working order	Organise arrival sequence	4
Predict	Forecast	Predict evolution of a conflict situation	4
Provide	Supply, furnish	Provide separation	4
Relate	Establish link with	Relate a pressure setting to an altitude	4

2.3.5 Definition of verbs – Level 5

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

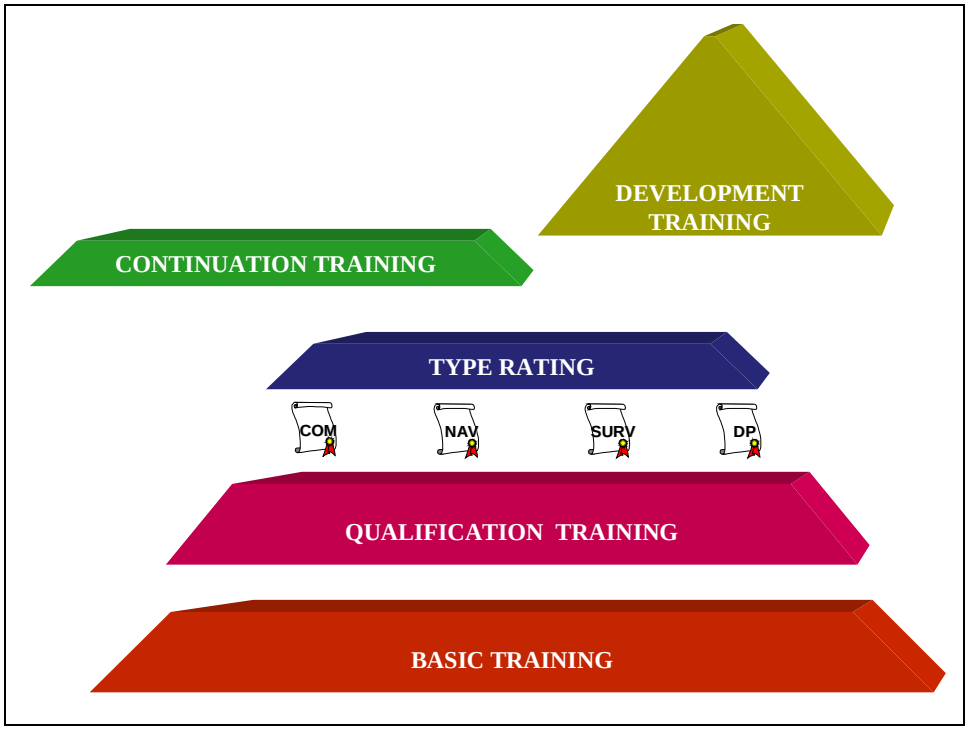
(L = Level)

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

Definition of verbs – Level 5 (continued)

Verb	Definition	Example	L
			(L = Level)
Review	Survey, look back on	Review previous clearance according to the latest aircraft relative positions	5
Select	Pick out as best or most suitable	Select the runway in use	5
Solve	Find answer to	Solve separation problems	5
Theorise	Extract general principles from a particular experience	Theorise the principles of ILS	5
Troubleshoot	Trace and correct faults	Troubleshoot wrong bearing indications of a VOR	5
Validate	Make valid, ratify, confirm	Validate one radar vectoring option to expedite the traffic	5

3. Concept of ATSEP Training Progression



Progression of ATSEP Training

3.1 Initial Training

Training preceding type rating. It includes basic and at least one of the four modules of qualification training.

⇨ **Basic training**

Fundamental knowledge and skills appropriate to the discipline to be pursued in the CNS/ATM environment.

⇨ **Qualification training**

Job category related knowledge and skills appropriate to the discipline to be pursued in the CNS/ATM environment.

Four disciplines have been identified through the four corresponding qualifications: Communication, Navigation, Surveillance and Data Processing.

⇨ **Type rating**

Equipment/system-related knowledge and skills leading to recognised competency. It includes OJT.

⇨ **On-the-Job Training (OJT)**

The integration in practice of previously acquired job-related routines and skills under the supervision of a qualified On-the-Job-Training Instructor (OJTI) in an operational environment.

3.2 Continuation Training

Training given to personnel designed to augment existing knowledge and skills and/or to prepare for new technologies. It includes refresher, emergency and conversion training. (Refresher and emergency training are sometimes named ‘recurrent training’.)

⇨ **Refresher training**

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

⇨ **Emergency training**

Training including training in emergencies, in unusual situations and in degraded systems. Most of this training will be site-specific or may make use of incidents or accidents analysis:

Emergency

A serious, unexpected and often dangerous situation requiring immediate action.

Unusual situation

A set of circumstances which are neither habitually nor commonly experienced. The essential difference with an emergency is that the element of danger or serious risk is not necessarily present in an unusual situation.

Degraded systems

Unusual situations which are the result of a system failure or malfunction.

⇨ **Conversion training**

Training designed to provide knowledge and skills appropriate to a change in either job category (new discipline or new type rating), environment (new procedures) or system (system upgrade or change).

3.3 Development Training

Training designed to provide additional knowledge and skills demanded by a change in job profile, e.g. system monitoring and control, safety manager, OJTI, instructor, training manager, or any other career development.

3.4 Denomination of the Learner

'Learner' is the generic term for the person performing a learning activity without any reference to his/her statute.

In the case of ATSEP training, 'learner' will be systematically used as there is a large variety of specific names according to the training phase and the country.

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ABBREVIATIONS AND ACRONYMS

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

2D	Two dimensional
AAIM	Aircraft Autonomous Integrity Monitoring
ABAS	Aircraft-Based Augmentation System
ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACT	ACTivation message designator
A/D	Analog-to-Digital
ADF	Automatic DF equipment
ADLP	Aircraft DataLink Processor
ADS	Automatic Dependent Surveillance
ADS B	ADS - Broadcast
ADS C	ADS - Contract
AE	Antenna
AFTN	Aeronautical Fixed Telecommunications Network
AGC	Automatic Gain Control
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Possible
AMSS	Automatic Message Switching System
ANS	Air Navigation Services
ANSP	ANS Provider
ARINC	Aeronautical Radio INCorporated
ASAS	Airborne Separation Assurance System

ASM	Airspace Management
ASR	Airport Surveillance Radar
ASTERIX	All purpose STructured EUROCONTROL Radar Information eXchange
ATC	Air Traffic Control
ATCO	Air Traffic Controller / Air Traffic Control Officer *(US/UK)*
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATS QSIG	*Standard for ATC G/G voice communications*
ATSEP	Air Traffic Safety Electronics Personnel
ATSO	Air Traffic Service Operator
Aud	Audio Aids
AVASI	Abbreviated Visual Approach Slope Indicator
BER	Bite Error Rate
BITE	Built In Test Equipment
BPS	Bits Per Second
Brief	Briefing
B-RNAV	Basic RNAV
CAA	Civil Aviation Administration
Case	Case *(training event) or* case study *(training method)*
CB	CumulonimBus
CBA	Cost/Benefit Analysis
CBPE	Computer-Based Practical Exercises
CDI	Course Deviation Indicator

CDTI	Cockpit Display of Traffic Information
CEP	Circular Error Probable
CFMU	Central Flow Management Unit
CIDIN	Common ICAO Data Interchange Network
CISC	Complex Instruction Set Computer
CMS	Central Message Switch
CNS/ATM	Communication Navigation and Surveillance/Air Traffic Management
CODEC	Code-Decoder
COM	COMmunications
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-the-Shelf Equipment
CPDLC	Controller-Pilot Datalink Communications
CRT	Cathode Ray Tube
C&S	Communication and Surveillance
CSU	Control Sector Unit
CVOR	Conventional VOR
CWBT	Computer-/Web-based Training
CWP	Controller Work Position
D/A	Digital-to-Analog
DAS	Directorate ATM Strategies *(EUROCONTROL Headquarters, SD)*
DAS/HUM *or just* HUM	Human Factors Management Business Division *(EUROCONTROL Headquarters, SD; formerly known as 'DIS/HUM' or just 'HUM')*
dB	Decibel
DDF	Digital Direction Finder
DDM	Data Display Monitor

Debrief	Debriefing
DF	Direction Finding
DIS	Director(ate) Infrastructure, ATC Systems and Support *(EUROCONTROL Headquarters, SDE)*
DIS/HUM *or just* HUM	Human Factors and Manpower Unit *(EUROCONTROL Headquarters, SDE; formerly stood for 'ATM Human Resources Unit'; now known as 'DAS/HUM' or just 'HUM')*
DL	DataLink
DLC	DataLink Communication
DME	Distance Measuring Equipment
DME/N	Normal DME
DME/P	Precision DME
DP	Data Processing
DPC	Data Processing Chain
DRC	Dynamic Route Change
DTMF	Dual Tone Multi-Frequence
DVD	Digital Versatile Disk
DVOR	Doppler VOR
EAD	European Aeronautical Database
EAN	European ATSO Network
EATCHIP	European ATC Harmonisation and Integration Programme *(now EATM(P))*
EATM(P)	European ATM (Programme) *(formerly EATCHIP)*
ECAC	European Civil Aviation Conference
EGNOS	European Global Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EHT	Extremely High Tension
EJB	Enterprise JavaBeans

EL	E-Learning
EMI	ElectroMagnetic Interference
EOIG	EGNOS Operators and Infrastructure Group
ESARR	EUROCONTROL SAfety Regulatory Requirement(s) *(SRC)*
ESTB	European Satellite Test Bed
ET	Executive Task *(EATCHIP)*
ETG	European GNSS Tripartite Group
ETHERNET	*Network standard*
EU	European Union
EUROCONTROL	European Organisation for the Safety of Air Navigation
Ex	Exercises
FAA	Federal Aviation Administration
Facil	Facilitation
FANS	Future Air Navigation Systems
FDDI	Fiber Distributed Data Interface
FDP	Flight Data Processing
FDPS	Flight Data Processing System
FFM	Far Field Modulator
FHA	Functional Hazard Assessment
FIR	Flight Information Region
FMS	Flight Management System
FoM	Figure of Merit
FPL	(Filed) Flight Plan
FRUIT	False Replies Unsynchronised In Time
G	Group Training

GALILEO	*Satellite radio navigation system*
GBAS	Ground-Based Augmentation System
G/G	Ground-Ground
GLONASS	GLObal NAvigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRAS	GPS (or GNSS) Regional Augmentation System
GrW	Group Work
GS	GlideSlope
GSimul	Group Simulation
GUI	GUIdelines *(EATCHIP\EATM(P))*
HCP	Hard-Copy Printer
HDL	High-frequency DataLink
HDLC	High-level DataLink Communication
HF	High Frequency
Hi Fi Sim	High-Fidelity Simulator
HIS	Horizontal Situation Indicator
HMI	Human-Machine Interface
HO	Hands On
HRS	Human Resources Programme *(EATMP)*
HRT	Human Resources Team *(EACHIP/EATM(P))*
HSI	Horizontal Situation Indicator
HUM	HUMan Resources (Domain*) (EATCHIP/EATMP)*
HV	High Voltage
HW	HardWare
Hz	Hertz

I	Individualised Training
I/Q	In-phase and Quadrature channels
IANS	Institute of Air Navigation Services *(EUROCONTROL, Luxembourg)*
ICAO	International Civil Aviation Organisation *(US)*
IDF	Instantaneous DF
IF	Intermediate Fix *or* Intermediate Frequency
IFATSEA	International Federation of Air Traffic Safety Electronic Associations
IISLS	Improved ISLS
ILS	Instrument Landing System
INS	Inertial Navigation System
Inter	Interactive Training
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISimul	Individual Simulation
ISLS	Interrogation SLS
ITU	International Telecommunications Union
KB	Kilo Byte
L	Locator
Lab	Multimedia or sound Laboratory
LAN	Local Area Network
LAPB	Link Access Procedure B *or* Balanced
LCD	Liquid-Crystal Display
Lec	Lecture *(both in the sense of training event and training method)*
Les	Lesson (*training event) or* Lesson/Demonstration *(training method)*

LF	Low Frequency
LLZ	LocaLiZer
LRU	Line Replaceable Unit *or* Lowest Replaceable Unit
LVA	Large Vertical Aperture
MASPS	Minimum Aircraft Systems Performance Specifications
Mb	Megabyte
MDS	Minimum Detectable Signal
MFC	Multi-Frequency Coding
MHz	MegaHertz
MLS	Microwave Landing System
MLT	MultiLaTeration
MM	Middle Marker
MMC	MultiMedia Computer
MMEL	Master Minimum Equipment Lists
MMR	Multi-Mode Receiver
MODEM	MOdulator/DEModulator
MOPS	Minimum Operational Performance Standards *or* Specifications *(FAA)*
MOTNE	Meteorological Operational Telecommunications Network Europe
MSAS	MTSAT Satellite-based Augmentation System
MSAW	Minimum Safe Altitude Warning
MSSR	Mono-pulse Secondary Surveillance Radar
MTBF	Mean Time Between Failure
MTD	Moving Target Detection
MTSAT	Multi-functional Transport SATellite
NAV	NAVigation

NAVAID	NAVigation(al) AID
ND	Navigation Display *or* Network Digit
NDB	Non-Directional Beacon
NEAN	North European ADS-B Network
Net	Network
OJT	On-The-Job-Training
OJTI	On-The-Job-Training Instructor
OLDI	On-Line Data Interchange
OM	Outer Marker
OS	Operating System
OTD	Other Training Device
OTM	Overall Transaction Manager
PAR	Precision Approach Radar
PBL	Problem-based Learning
PCM	Pulse Code Modulation
PD	Probability of Detection
PFD	Primary Flight Display
PM	Programme Manager *(EATM(P))*
Poems	Pre-operational (development) European Mode S enhanced surveillance
PPI	Plan Position Indicator
Pre-Simul	Pre-Simulation
PRF	Pulse Repetition Frequency
P-RNAV	Precision RNAV
PSD	Phase Sensitive Detector
PSR	Primary Surveillance Radar
PTE	Poems Test Environment

PTP	Part-Task Practice
PTT	Part-Task Trainer
QCOM	Qualification training for COM
QDP	Qualification training for DP
QNAV	Qualification training for NAV
QSUR	Qualification training for SUR
RA	Resolution Advisory
RADNET	RADar NETwork (*Benelux-Germany)*
RAIM	Receiver Autonomous Integrity Monitoring
RCA	Remote Communication Application
RCC	Rescue Coordination Centre
RCP	Required Communication Performances
R&D	Research and Development
RDP	Radar Data Processing
RE	Real Equipment
Real	Real Time
RES	Radar Environment Simulator
RF	Radio Frequency *or* Radius to a Fix *(ARINC 424 Path Terminator)*
RGP	Required Global Performances
rho-rho	*Symbol for range*
RMCDE	Radar Message Conversion and Distribution Equipment
RMI	Radio Magnetic Indicator
RMS	Root Mean Square
RNAV	aRea NAVigation
RNP	Required Navigation Performance

Role	Role-Play
RSLS	Receiver SLS
RSP	Required Surveillance Performances
Rstd	Time-restricted Learning
RVP	Rational Unified Process
RVSM	Reduced Vertical Separation Minimum
RX	Receiver Station
SA	Skill Acquisition *or* Selective Availability
SADIS	SAtellite DIStribution of world area forecast system
SARPS	Standards And Recommended PracticeS *(ICAO)*
SASS	Surveillance Analysis Support System
SASS-C	SASS - Centre
SASS-S	SASS - Sensor
SATCOM	SATellite COMmunications
SBAS	Space/Satellite-Based Augmentation System
SD	Senior Director, EATM Service Business Unit *(EUROCONTROL Headquarters; formerly known as 'SDE')*
SDD	Synthetic Data Display
SDE	Senior Director, Principal EATMP Directorate *or, in short,* Senior Director(ate) EATMP *(EUROCONTROL Headquarters; now known as 'SD')*
SDM	System Definition Manual
SDPS	Surveillance Data Processing System
Self	Self-paced Learning
SEP	Spherical Error Probable
SID	Standard Instrument Departure *(Route)*
Sim	Simulator

Simul	Simulation
SIS	Signal In Space
SITA	Société Internationale de Télécommunications Aéronautiques *(France)*
SLS	Side Lobe Suppression
SMC	System Monitoring and Computer/Control
SMR	Surface Movement Radar
S/N	Signal/Noise
SPI	Special Pulse Identification *or* Special Position Identification Pulse *(SSR)*
SRC	Safety Regulation Commission *(EUROCONTROL)*
SSA	System Safety Assessment
SSR	Secondary Surveillance Radar
ST	Specialist Task *(EATCHIP)*
StBf	Structured Briefing
STC	Sensitivity Time Control
StDf	Structured Debriefing
STDMA	Self-organising Time Division Multiple Access
Sup Pract	Supervised Practices
SUR	SURveillance
SW	SoftWare
SWR	Standing Waves Ratio
TA	Traffic Advisory
TACAN	UHF TACtical Air Navigation aid
TCAS	Transponder Collision Avoidance System
TCP	Transmission Control Protocol
TDH Unit	Training Development and Harmonisation Unit *(EUROCONTROL, IANS)*

TFG	Training Focus Group *(EATM, HRT; formerly known as 'TSG')*
TLS	Target Level of Safety
TRSB	Time Reference Scanning Beam
TSG	Training Sub-Group *(EATCHIP/EATMP, HRT; today known as 'TFG')*
TSimul	Team Simulation
TSP	Training Sub-Programme *(EATMP, HRS)*
TTFF	Time To First Fix
Tut	Tutoring
TV	TeleVision
TX	Transmitter
Txt	Text
UAT	Universal Access Transceiver
UBSS	Unix Basic System Software
UHF	Ultra High Frequency
UML	Unified Modelling Language
US	United States (of America)
VC	Virtual Classroom
VCS	Voice Communications System
VDF	VHF DF station
VDL	VHF Digital/DataLink
VHF	Very High Frequency
Vid	Video
Vis	Visit
VOR	VHF Omnidirectional Radio Range
VORTAC	VOR and TACAN combination

Vsl	Visual Aids
WAAS	Wide Area Augmentation System *(US)*
WAN	Wide Area Network
WGATMTS	Working Group ATM Technical Staff *(EATCHIP/ EATM(P), HRT, TSG/TFG)*
WGS84	World Global System 84
X25	*Packet Switched Data Network Protocol*

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