European Aviation Safety Agency — Rulemaking Directorate

Notice of Proposed Amendment 2013-08 (C)

Requirements for ATM/ANS providers and the safety oversight thereof

(Acceptable Means of Compliance (AMC) & Guidance Material (GM))

RMT.0148 (ATM.001 (A))/ RMT.0149 (ATM.001(B)) AND
RMT.0157 (ATM.004(A))/ RMT.0158 (ATM.004(B)) — 10/05/2013

EXECUTIVE SUMMARY

This Notice of Proposed Amendment (NPA) addresses safety, proportionality and regulatory coordination issues related to provision of ATM/ANS by providers and to the safety oversight by competent authorities thereof.

It consists of 5 parts. This is Part C and deals with the Acceptable Means of Compliance (AMC) & Guidance Material (GM).

The main objectives are to maintain a high level of safety, provide for a smooth transition, and ensure cost-efficient rules in the field of ATM/ANS. The specific objective is to mitigate the risks linked to the increase of air traffic and also the increase of the complexity in the ATM/ANS system.

This NPA proposes an amendment and replacement of the Commission Implementing Regulations (EU) No 1034/2011 and No 1035/2011.

The proposals aim at:

— implementing Regulation (EC) No 216/2008 (hereinafter referred to as the 'Basic Regulation') and at transposing certain ICAO SARPs provisions contained in Annex 3 in relation to the meteorological services providers requirements;

— aligning Safety Management Systems (SMS) requirements in Commission Implementing Regulation (EU) No 1035/2011 with SMS requirements within the ICAO SMS framework and Management Systems requirements in Commission Implementing Regulation (EU) No 1034/2011 with SSP requirements required by ICAO;

— aligning the scope of the requirements for competent authorities with the requirements for ATM/ANS providers;

— introducing management systems requirements and streamlining the requirements for quality management systems for all ATM/ANS providers;

— implementing the essential requirements on human factors for air traffic controllers; and

— introducing training and competence assessment requirements for ATSEPs.

Applicability	
Affected regulations and decisions:	Commission Implementing Regulation (EU) No 1034/2011 and Commission Implementing Regulation (EU) No 1035/2011
Affected stakeholders:	Member States, Competent authorities/ National Supervisory Authorities, ATM/ANS providers, Network Manager and the Agency
Driver/origin:	Legal obligations (Basic Regulation, EASp and ICAO SARPs)
Reference:	N/A

Process map3	
Concept Paper:	No
Terms of Reference:	30/08/2010
Rulemaking group:	Yes
RIA type:	Full
Technical consultation during NPA drafting:	No
Duration of NPA consultation:	3 months
Review group:	Yes
Focussed consultation:	TBD
Publication date of the Opinion:	2014/Q1
Publication date of the Decision:	2015/Q1

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AMC/GM to Cover Regulation

AMC1 Article 5(4) Oversight capabilities

GENERAL

The competent authority should:

(a) define and document the education, training, technical and operational knowledge, experience, and qualifications relevant to the duties of each position involved in oversight activities within their structure;

(b) ensure specific training for those involved in oversight activities within their structure; and

(c) ensure that personnel designated to conduct safety regulatory audits, including auditing personnel from qualified entities, meet specific qualification criteria defined by the competent authority. The criteria shall address:

(1) the knowledge and understanding of the requirements related to ATM/ANS and other network functions against which safety regulatory audits may be performed;

(2) the use of assessment techniques;

(3) the skills required for managing an audit; and

(4) the demonstration of competence of auditors through evaluation or other acceptable means.

AMC1 Article 7.5(c) Means of compliance

GENERAL

The information to be provided to other Member States following approval of an alternative means of compliance should contain a reference to the Acceptable Means of Compliance (AMC) to which such means of compliance provides an alternative, where such AMC exists, as well as a reference to the corresponding Implementing Rule (IR), indicating as applicable the subparagraph(s) covered by the alternative means of compliance.

GM1 Article 7 Means of compliance

GENERAL

Alternative means of compliance used by a competent authority or by organisations under its oversight may be used by other competent authorities or ATM/ANS providers only if processed again in accordance with Articles 7.5 and 7.6.

AMC/GM to ANNEX I — Requirements for competent authorities in ATM/ANS (Part-TM/ANS.AR)

SUBPART A — GENERAL REQUIREMENTS (ATM/ANS.AR.A)

GM1 ATM/ANS.AR.A.010 Information to the Agency

Safety significant information should be considered information on:

(a) occurrences associated with the provision of services provided by ATM/ANS providers for which the Agency is the competent authority in accordance with Article 3(1)(c) and (d) of this Regulation when:

(1) a competent authority considers that the occurrence has not been properly addressed by that ATM/ANS provider; or

(2) a competent authority has certainty that the occurrence has not been reported to that ATM/ANS provider; and

(b) studies on safety issues that would launch rulemaking activities or provide information to the EASp. This information should contain at least the description of the safety issue, the exposure, its severity and probability, the risk assessment performed, the description of existing barriers and their effectiveness, and the proposals on how to address the identified safety issue.

SUBPART B — MANAGEMENT (ATM/ANS.AR.B)

AMC1 ATM/ANS.AR.B.005(a)(2) Management System

TRAINING PROGRAMME AND RECURRENT TRAINING

(a) The competent authority should establish a training programme for its personnel, including its ATM/ANS inspectors, and a plan for its implementation. The training programme should include, as appropriate to the role, current knowledge, experience and skills, of the personnel, at least the following:

(1) organisation and structure of the aviation legislation;

(2) the Chicago Convention, relevant ICAO annexes and documents, the applicable requirements of Regulation (EC) No 216/2008[1], its IRs and related AMC, Certification Specifications (CSs), and Guidance Material (GM), as well as assessment methodology of the alternative means of compliance and the applicable national legislation;

(3) the applicable requirements and procedures; and

(4) areas of particular interest.

(b) The training programme and the training plan should be updated, as needed, to reflect at least changes in aviation legislation and industry. The training programme should also cover specific needs of the personnel and the competent authority.

(c) The competent authority should ensure that its personnel, including its ATM/ANS inspectors, undergo recurrent training at regular intervals as defined by the competent authority or whenever deemed necessary in order to keep up to date.

[1] Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1), as amended by Regulation (EC) No 1108/2009 (OJ L 309, 24.11.2009, p. 51).

GM1 ATM/ANS.AR.B.005(a)(2) Management system
SUFFICIENT PERSONNEL

(a) This guidance material for the determination of the required personnel is limited to the performance of certification and oversight tasks, excluding personnel required to perform tasks subject to any national regulatory requirements.

(b) The elements to be considered when determining required personnel and planning their availability may be divided into quantitative and qualitative:

(1) Quantitative elements:

(i) number of initial certificates to be issued,

(ii) number of ATM/ANS providers certified by the competent authority, and

(iii) number of FIS providers having declared their activity to the competent authority.

(2) Qualitative elements:

(i) size, nature, and complexity of activities of ATM/ANS providers,

(ii) results of past oversight activities, including audits, inspections, and reviews, in terms of risks and regulatory compliance:

(A) number and level of findings, and

(B) implementation of corrective actions,

(iii) size of the Member State's aviation industry and potential growth of activities in the field of civil aviation, which may be an indication of the number of new applications and changes to existing certificates to be expected.

(c) Based on existing data from previous oversight planning cycles and taking into account the situation within the Member State's aviation industry, the competent authority may estimate:

(1) the standard working time required for processing applications for new certificates;

(2) the standard working time required for processing declarations;

(3) the number of new declarations or changed declarations;

(4) the number of new certificates to be issued for each planning period; and

(5) the number of changes to existing certificates and changes to functional systems to be processed for each planning period.

(d) In line with the competent authority's oversight policy, the following planning data should be determined specifically for each ATM/ANS provider, certified or declared, as well as for the network manager:

(1) standard number of audits/inspections to be performed per oversight planning cycle,

(2) standard duration of each audit/inspection,

(3) standard working time for audit/inspection preparation, on-site audit/inspection, reporting and follow-up, per ATM/ANS inspector, and

(4) minimum number and required qualification of ATM/ANS inspectors for each audit/inspection.

(e) Standard working time could be expressed either in working hours per ATM/ANS inspector or in working days per ATM/ANS inspector. All planning calculations should then be based on the same unit (hours or working days).

(f) For each ATM/ANS provider the number of working hours/days per planning period for each qualified ATM/ANS inspector that may be allocated for certification, oversight, and enforcement activities should be determined taking into account:

(1) purely administrative tasks not directly related to oversight and certification;

(2) training;

(3) participation in other projects;

(4) planned absence; and

(5) the need to include a reserve for unplanned tasks or unforeseeable events.

(g) The determination of working time available for certification, oversight, and enforcement activities should also take into account the possible use of third parties.

AMC1 ATM/ANS.AR.B.010 Allocation of tasks to qualified entities
GENERAL

(a) The qualified entity should accept the possibility of being audited by the competent authority or anybody acting on its behalf.

(b) All personnel concerned with the conduct of audits or reviews should be adequately trained and qualified and meet the qualification criteria of Article 5(4) of this Regulation.

GM1 ATM/ANS.AR.B.010 Allocation of tasks to qualified entities
GENERAL

The tasks that may be performed by a qualified entity on behalf of the competent authority include those related to the initial certification and continuous oversight of ATM/ANS providers as defined in this Regulation, with the exclusion of the issuance of certificate.

SUBPART C — OVERSIGHT, CERTIFICATION, AND ENFORCEMENT (ATM/ANS.AR.C)

GM1 ATM/ANS.AR.C.015 Oversight
IMPLEMENTING ARRANGEMENTS

Implementing arrangemnets should be considered ATM/ANS provider's manuals, terms of conditions or certificate or the content of the declaration.

GM2 ATM/ANS.AR.C.015 Oversight
OBSERVATIONS

The observation should be a way to communicate and draw third parties' (e.g. ATM/ANS providers) and future audit teams' attention on specific matters that deserve scrutiny.

AMC1 ATM/ANS.AR.C.015(c) Oversight
AUDITS AND INSPECTIONS

The competent authority should establish a schedule of audits and inspections appropriate to each provider. The planning of audits and inspections should take into account the safety performance of ATM/ANS providers to be audited. ATM/ANS inspectors should work in accordance with the schedule provided to them.

Having regard to the performance of ATM/ANS providers, the competent authority may vary the frequency of an audit or inspection while ensuring that operations are periodically audited and inspected in accordance with the schedule.

When defining the oversight programme, the competent authority should assess the risks related to the activity of each ATM/ANS provider, certified or declared, or network manager, and adapt the oversight means to the level of risk identified.

GM1 ATM/ANS.AR.C.020 Changes to ATM/ANS providers
GENERAL

(a) The competent authority should be informed of any changes to personnel specified in ATM/ANS.OR.B.010(b)(1) and the changes that may affect the certificate or type(s) of service(s) attached to it.

(b) The competent authority should receive from the ATM/ANS provider each management system documentation amendment, including amendments that do not require prior approval by the competent authority.

(1) Where the amendment requires the competent authority's approval, the competent authority, when satisfied, should approve it in writing.

(2) Where the amendment does not require prior approval, the competent authority should acknowledge receipt of the notification in writing within 10 working days.

(c) For changes requiring prior approval, the competent authority may conduct an audit of the ATM/ANS provider in order to verify the provider's compliance with applicable requirements.

(d) In case of any non-compliance, the competent authority should:

(1) notify the ATM/ANS provider about the non-compliance and request further changes; and

(2) act in accordance with ATM/ANS.AR.C.025 in case of level 1 or level 2 findings.

GM2 ATM/ANS.AR.C.020 Changes to ATM/ANS providers
CHANGE OF NAME OF ATM/ANS PROVIDERS

(a) Upon receipt of the application and the relevant parts of the ATM/ANS provider's documentation as required by Part-ATM/ANS.OR, the competent authority should reissue the certificate.

(b) A name change alone does not require the competent authority to audit the organisation, unless there is evidence that other aspects of the organisation have changed.

GM3 ATM/ANS.AR.C.020 Changes to ATM/ANS providers
APPROPRIATE ACTION

Appropriate action by the competent authority may include suspension, limitation or revocation of the ATM/ANS provider's certificate.

GM1 ATM/ANS.AR.C.025 Findings, corrective actions, and enforcement measures
CATEGORIES OF FINDINGS — DOCUMENTARY EVIDENCE

Documentary evidence may include:

(a) operations or technical manuals;

(b) contracts or other types of arrangements;

(c) training, qualification or medical records;

(d) inspection records;

(e) test or exercise results;

(f) internal audit results;

(g) maintenance records;

(h) other similar material required to be maintained by the ATM/ANS provider, etc.

AMC/GM to ANNEX II — General organisation common requirements for the provision of ATM/ANS (Part-ATM/ANS.OR)

SUBPART A — GENERAL COMMON REQUIREMENTS (ATM/ANS.OR.A)

GM1 ATM/ANS.OR.A.005 Scope

DEFINITIONS AND SCOPE IN RELATION TO ATM/ANS

(a) In order to understand which of the annexes applies to which service, it is necessary to understand how services are defined. These definitions have determined the structure and content of Annexes II to XII.

(b) Article 3(q) of Regulation (EC) No 216/2008 defines ATM/ANS as 'the air traffic management functions as defined in Article 2(10) of Regulation (EC) No 549/2004, air navigation services defined in Article 2(4) of that Regulation, and services consisting in the origination and processing of data and formatting and delivering data to general air traffic for the purpose of safety-critical air navigation'.

(c) It should therefore be noted that ATM/ANS include more services than 'Air Traffic Management' and 'Air Navigation Services' together.

(d) In this Regulation, 'services' means those specified in Annex Vb(2) to Regulation (EC) 216/2008. This Annex includes an additional service (airspace design) that is neither directly included in the definition of ATM/ANS nor in the definition of 'Air Traffic Management' or 'Air Navigation Service'.

(e) Where ATM is used in this Regulation, it means air traffic management. Similarly, where ANS is used it means air navigation service. When used in combination (i.e. ATM/ANS), the definition in Article 3(q) of Regulation (EC) No 216/2008 prevails.

(f) The definition of ATM/ANS providers includes airspace design. Airspace design service is a service for the design, survey, and validation of airspace structures and flight procedures before being deployed and used by aircraft.

(g) The definition of ATM/ANS provider also includes ATM network functions. As already defined, ATM network functions refers to functions performed by the network manager in accordance with Commission Regulation (EU) No 677/2011.[2]

(h) Figure 1 below presents a pictorial representation of the services and how they interrelate through the various definitions.

[2] Commission Regulation (EU) No 677/2011 of 7 July 2011 laying down detailed rules for the implementation of air traffic management (ATM) network functions and amending Commission Regulation (EU) No 691/2010 (OJ L 185, 15.7.2011, p. 1).

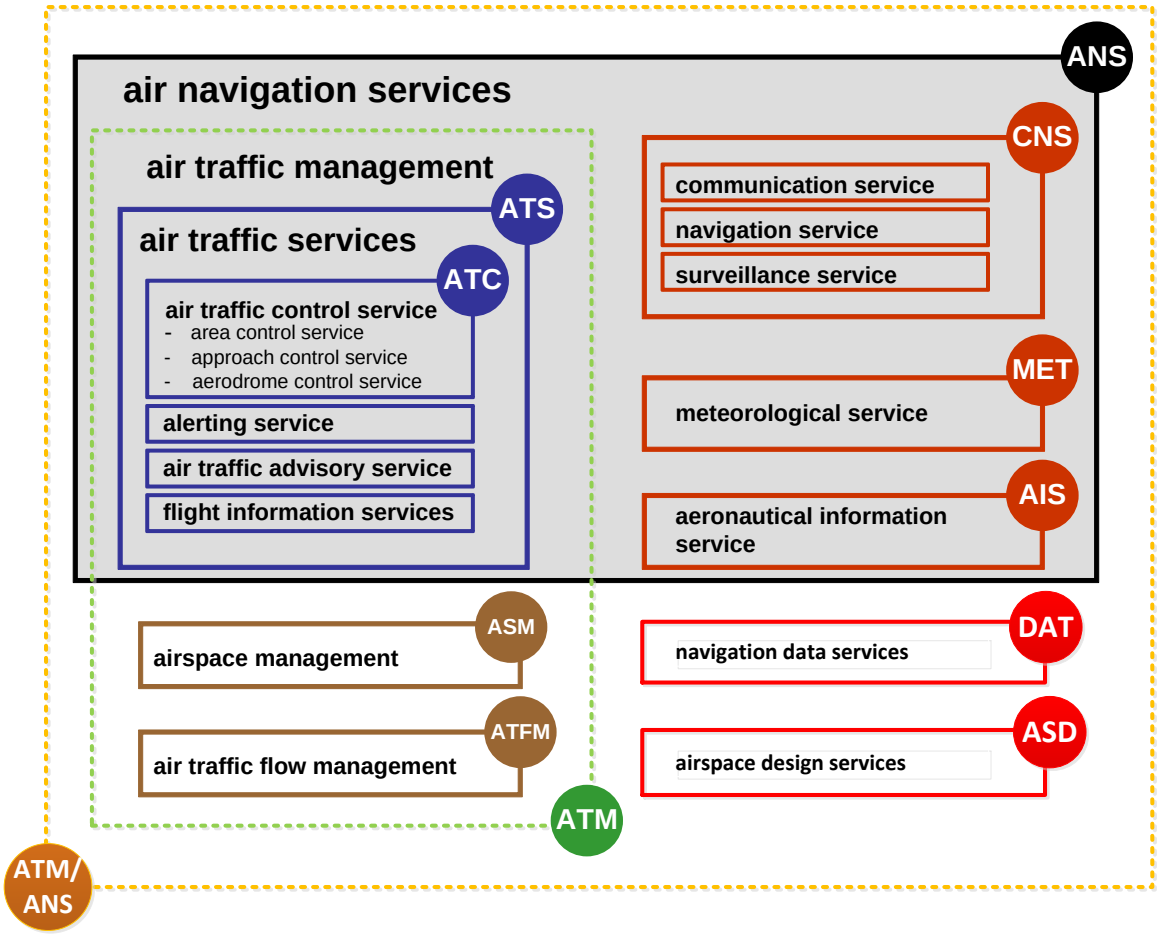

Figure 1: The scope of ATM/ANS services as specified in Annex Vb to Regulation (EC) No 216/2008 and in the definition of ATM/ANS in Article 3 of the same Regulation.

(i) Figure 1 indicates both a further breakdown of ATS into air traffic control service (ATC), alerting service, air traffic advisory service, and flight information services and groupings of:

(1) air traffic management (ATM): comprising ATS, ASM, and ATFM;

(2) air navigation services (ANS): comprising ATS, CNS, MET, and AIS; and

(3) airspace design (ASD) and navigation data provider (DAT).

(j) It is important to note that ATS is included in ATM and ANS.

(k) It is also important to note that ATM network functions have not been included in this picture because it covers the relationship of ATM/ANS with ATM and ANS but it does not address the wider scope of the term ATM/ANS provider.

ATM/ANS — SERVICES

(l) Annex II (Part-ATM/ANS) applies to all ATM/ANS providers and contains the common requirements for the provision of ATM/ANS. This annex is broken down into three subparts:

(1) Subpart A — General common requirements (ATM/ANS.OR.A)

(2) Subpart B — Management (ATM/ANS.OR.B)

(3) Subpart C — Specific organisational requirements for ANS and ATFM providers (ATM/ANS.OR.C).

(m) Subpart C applies only to ANS and ATFM providers (and not to ASM, DAT, and ASD providers).

(n) Thereafter each service is allocated to an annex (Annexes III to XI) which contains specific requirements for that service. Table 1 below indicates which annexes are applicable to each service.

(o) Annex XII is not specific to any ATM/ANS. It contains requirements for ATM/ANS providers regarding personnel training and competence assessment.

AIR TRAFFIC SERVICES FOR FLIGHT TEST

(p) ATS providers providing services to flight testing need a specific privilege within the certificate issued by the competent authority because of the specificities of the ATS services to be provided to this type of operations and because of the need to ensure safe operations in the airspace in which flight tests are being conducted.

(q) Flight tests are characterised by the following:

(1) Frequent changes in levels and headings, depending upon the tests which are carried out with certain unpredictability;

(2) Unless necessary for the purpose of the flight tests, navigation in general (route/destination, etc.) is not the primary objective of these flights;

(3) Specific aircraft configurations sometimes resulting in reduced ability to manoeuvre;

(4) Technical constraints, including airborne and ground testing facilities;

(5) Airborne equipment is not proven to be up to the required certification level; and

(6) The planning for conducting flight tests can be of a very ad hoc nature giving little timing for carrying out strategy or pre-tactical air traffic flow management. (e.g. the need to test under specific weather conditions which would require flexibility for allocation of slots for these flight tests).

(r) Given the characteristics in (b), flight tests can be made in cohabitation with other airspace users in controlled or non-controlled airspace, and sometimes in temporarily reserved areas when necessary.

	Annex II (Part-ATM/ANS)			Annex III (Part-ATS)	Annex IV (Part-MET)	Annex V (Part-AIS)	Annex VI (Part-DAT)	Annex VII (Part-CNS)	Annex VIII (Part-ATFM)	Annex IX (Part-ASM)	Annex X (Part-ASD)	Annex XI (Part-NM)	Annex XII PER
	Subpart A	Subpart B	Subpart C										
Air traffic services (see note 1)	**X**	**X**	**X**	**X**									
Meteorological services	**X**	**X**	**X**		**X**								
Aeronautical information services	**X**	**X**	**X**			**X**							
Data providers	**X**	**X**					**X**						
Communication, navigation and surveillance service	**X**	**X**	**X**					**X**					
Air traffic flow management service	**X**	**X**	**X**						**X**				
Airspace management service	**X**	**X**								**X**			
Airspace design service	**X**	**X**									**X**		
Network manager	**X**	**X**	**X**									**X**	
ATM/ANS providers (see note 2)													**X**

X = Applicable annexes for each service.

Table 1: Applicability of annexes to ATM/ANS providers of service(s) specified in Annex Vb to Regulation (EC) No 216/2008 and in the definition of ATM/ANS in Article 3 of Regulation (EC) No 216/2008.

Note 1: Section 3 of Annex III (Part-ATS) only applies to providers of air traffic control services and not to providers of alerting, air traffic advisory, and flight information services.

Note 2: The applicability of Annex XII is dependent upon the scope as specified within each of the subparts of Annex XII. For example, Annex XII, Subpart A, Section 1 (ATSEP), only relates to air traffic management and to communication, navigation and surveillance systems as used by ATM/ANS providers.

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GM1 ATM/ANS.OR.A.015 Application for a limited certificate
GENERAL

The relationship between the type of service provision, criteria to be complied with, and the applicable rules are indicated in table 1 below.

Type of service	Type of approval	Criteria to be complied with	Applicable Rules
Air traffic service providers	Limited Certificate	ATM/ANS.OR.A.015(a)	ATM/ANS.OR.B.005 ATM/ANS.OR.B.015 ATM/ANS.OR.B.025 ATM/ANS.OR.C.030 Annex III
Air navigation service providers (gross annual turnover of EUR 1 000 000 or less)	Limited Certificate	ATM/ANS.OR.A.015(b)(1)	ATM/ANS.OR.B.005 ATM/ANS.OR.B.015 ATM/ANS.OR.B.025 ATM/ANS.OR.C.030 Annexes III, IV, V and VII depending upon service provision
Air navigation service providers (aerodrome flight information service operating regularly not more than one working position at any aerodrome)	Limited Certificate	ATM/ANS.OR.C.015(b)(2)	ATM/ANS.OR.B.005 ATM/ANS.OR.B.015 ATM/ANS.OR.B.025 ATM/ANS.OR.C.030 Annex III (except ATS.OR.205(a)(2) and (c)(1)(ii) as well as ATS.OR.210)

Table 1: Type of service provision, criteria to be complied with, and the applicable rules

AMC1 ATM/ANS.OR.A.035(b) Changes
PROCEDURE FOR DEALING WITH PLANNED CHANGES

(a) The procedure agreed by the ATM/ANS provider and the competent authority should not include any change affecting:

(1) any of the key elements of the ATM/ANS provider's management system as required in ATM/ANS.OR.B.015(a), or

(2) any additional elements as found necessary by the ATM/ANS provider in agreement with the competent authority and approved by that competent authority.

The changes specified above are changes requiring prior approval.

(b) For any changes requiring prior approval in accordance with Regulation (EC) No 216/2008 and its Implementing Rules, the procedure should define how the organisation should apply for and obtain an approval issued by the competent authority:

(1) Applications should be submitted before any such change is made in order to enable the competent authority to determine continued compliance with Regulation (EC) No 216/2008 and its Implementing Rules and also to amend, if necessary, the certificate and related conditions attached to it.

(2) Changes should only be implemented upon receipt of approval by the competent authority in accordance with the procedure established by that authority.

(3) The ATM/ANS provider should operate under the conditions prescribed by the competent authority during such changes, as applicable.

GM1 ATM/ANS.OR.A.035(b) Changes
PROCEDURE FOR DEALING WITH PLANNED CHANGES

The procedure agreed by the ATM/ANS provider and the competent authority may also include the process for the reaction by the ATM/ANS provider to an unplanned change that may arise with the need for urgent action that would normally require prior approval of the competent authority. This is the case in which the ATM/ANS provider responds immediately to a safety problem as required in ATM/ANS.OR.A.055.

AMC1 ATM/ANS.OR.A.050(b) Findings and corrective actions
GENERAL

The corrective action plan defined by the organisation should address the effects of the non-conformity and its root cause.

GM1 ATM/ANS.OR.A.050 Findings and corrective actions
GENERAL

(a) Corrective action is the action taken to eliminate or mitigate the root cause(s) and prevent recurrence of existing detected non-compliance or other undesirable condition or situation.

(b) Proper determination of the root cause is crucial for defining effective corrective actions.

AMC1 ATM/ANS.OR.A.060(a) Occurrence reporting
GENERAL

ATM/ANS providers should report all occurrences:

(a) defined in AMC 20-8 and the list defined in Annex I, Section D, Annex II and Appendix to Annex II to Directive 2003/42/EC[3] for providers for ATM/ANS providers for which the Agency is the competent authority, and

(b) defined in AMC 20-8 and required by the applicable national rules implementing Directive 2003/42/EC of the European Parliament and of the Council on occurrence reporting in civil aviation for all other ATM/ANS providers.

GM1 ATM/ANS.OR.A.060(b) Occurrence reporting
SYSTEMS AND CONSTITUENTS

[3] Directive 2003/42/EC of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation (OJ L 167, 4.7.2003, p. 23).

(a) When determining which failures of systems and constituents are to be reported, a degree of practicality is required as it is not intended that every failure is reported. Only those that have or may have an impact on the safety of the provision of ATM/ANS are reported.

(b) When nothing is defined in European or national legislation, the determination of the failures of systems and constintuents that need to be reported is done by the ATM/ANS provider and needs to be approved by the competent authority. This determination can be done as a result of an assessment of the installations or changes to the systems and constituents.

(c) The entity responsible for the design of the system and constituent may no longer exist or may no longer support the design. In this case, the ATM/ANS provider will have made arrangements to ensure that the safety of the system and constituent can be assured by appropriate and practical means. In many cases, this means that the ATM/ANS provider has taken on the design responsibilities.

(d) Within the application of Regulation (EC) No 552/2004, the entity responsible for the design of the constituent will be the entity that signs the Declaration of Conformity or Suitability for use.

SUBPART B — MANAGEMENT (ATM/ANS.OR.B)

GM1 ATM/ANS.OR.B.015 Management system

RELATIONSHIP BETWEEN THE TYPE OF SERVICE AND SAFETY MANAGEMENT-QUALITY MANAGEMENT

(a) All services under ATM/ANS are needed for the safe flight of aircraft. Therefore, all ATM/ANS providers are required to establish and maintain a management system. However, only ATS and CNS providers can have managerial control over functions directly affecting the safety of the flight (e.g. the ATCO to separate aircraft from each other). Hence, the management system requirements in Annex II, which apply to all ATM/ANS providers, are more broadly associated to the quality of the service rather than the safety of the service. Annex III (Part-ATS) has specific safety management requirements for the provision of ATS. In addition, a reference is made in Annex VII applicable to CNS providers to Section 2 of Annex III applicable to ATS provider. Therefore, only ATS and CNS providers (those providing air traffic control, alerting service, air traffic advisory service or flight information service, communication, navigation and surveillance services) are required to have a safety management system, undertake risk assessment and mitigation with regard to changes and comply with safety requirements for engineering and technical personnel undertaking operational safety related tasks.

(b) ATM/ANS providers, other than ATS or CNS providers, can still affect the safety of the flight through functions or services they provide, but this will always be influenced by the way in which the ATS provider or airspace user are using those functions or services. Therefore, ATM/ANS providers other than ATS or CNS providers have a management system which manages the performance of service (rather than safe use of their services for flight navigation and control which is beyond the managerial control of the service provider). This performance of the service refers to such properties of the service provided such as accuracy, reliability/integrity, availability, timeliness, etc.

(c) It is quite likely that ATS and CNS providers have contractual arrangements in place with other ATM/ANS providers whose services they use specifying the required performance and requiring the ATM/ANS provider to inform, in a timely manner, the ATS or CNS provider of any impact on the performance of services supplied.

(d) When an ATM/ANS provider other than an ATS or CNS provider provides services or functions directly to a flight (e.g. MET) without involving ATS, then the safe use of those services is the responsibility of the users of the service.

(e) When ATS and CNS providers also provides other ATM/ANS, they may choose to combine the necessary performance and safety management into an integrated management system covering all services.

AMC1 ATM/ANS.OR.B.015 Management system
ISO 9001 CERTIFICATE FOR AIR NAVIGATION SERVICE PROVIDERS

An EN ISO 9001 certificate, issued by an appropriately accredited organisation, addressing all the elements required in this Subpart should be considered as a sufficient means of compliance for air navigation service providers. In this case, the air navigation service provider should accept the disclosure of the documentation related to the certification to the competent authority upon the latter's request.

AMC1 ATM/ANS.OR.B.010(b)(1) Organisational structure
GENERAL

Senior management should appoint a member of the ATM/ANS provider's management who, irrespective of other responsibilities, should have responsibility and authority that includes:

(a) ensuring that processes needed for the management system are established, implemented, and maintained;

(b) reporting to senior management on the performance of the management system and any need for improvement; and

(c) ensuring the promotion of awareness of performance and service requirements throughout the ATM/ANS provider and of the impact it has on safety.

GM1 ATM/ANS.OR.B.015(a)(1) Management system
RESPONSIILITIES AND ACCOUNTABILITIES

Senior management should ensure that responsibilities and accountabilities are defined and communicated within the ATM/ANS provider and documented within the management system.

AMC1 ATM/ANS.OR.B.015(a)(2) Management system
POLICY

(a) The policy should:

(1) be endorsed by the accountable manager;

(2) reflect organisational commitments regarding performance of their service and safety, where applicable, and its proactive and systematic management;

(3) include a commitment:

(i) to improve towards the highest performance standards so as to support the achievement of the highest level of safety;

(ii) to comply with all applicable legislation and requirements, meet all applicable standards, and consider best practices;

(iii) to continually improve the effectiveness of the management system;

(iv) to provide appropriate resources;

(v) to enforce the performance of the service, required to support the achievement of the highest level of safety in the airspace where the service is provided, as one primary responsibility of all managers; and

(vi) not to blame someone for reporting something which would not have been otherwise detected;

(4) include reporting principles.

(b) Senior management should:

(1) ensure that the policy:

(i) is appropriate to the purpose of ATM/ANS providers;

(ii) provides a framework for establishing and reviewing objectives in relation to the provision of the service;

(iii) is communicated and understood within ATM/ANS providers; and

(iv) is reviewed for continuing suitability;

(2) continually promote the policy to all personnel and demonstrate their commitment to it;

(3) provide necessary and appropriate human and financial resources for its implementation; and

(4) establish objectives in relation to the provision of the services and performance standards.

GM1 ATM/ANS.OR.B.015(a)(2) Management system

POLICY FOR ATS AND CNS PROVIDERS VERSUS POLICY FOR ALL OTHER ATM/ANS PROVIDERS

If ATM/ANS providers do not undertake the provision of ATS, or CNS, then the policy will be more recognisable as a quality policy that is concerned with the performance of the service and conformance to the service provision requirements supporting the achievement of the highest level of safety in the airspace where the service is provided. Should the ATM/ANS providers undertake the provision of ATS and CNS, then ATS.OR.205 also applies and the policy will need to be expanded to include both the safety of the service and the quality.

AMC1 ATM/ANS.OR.B.015(a)(3) Management system

MANAGEMENT OF METEOROLOGICAL SERVICES PERFORMANCE

(a) The management system of meteorological service providers should provide users with assurance that the meteorological information supplied complies with the stated requirements in terms of geographical and spatial coverage, format and content, time and frequency of issuance and period of validity, as well as the accuracy of measurements, observations, and forecasts.

(b) When the management system indicates that meteorological information to be supplied to users does not comply with stated requirements, and automatic error correction procedures are not appropriate, such information should not be supplied to users unless it is validated with the originator.

(c) In regard to the exchange of meteorological information for operational purposes, the management system should include verification and validation procedures and resources for monitoring adherence to the prescribed transmission schedules for individual messages and/or bulletins required to be exchanged as well as the times of their filing for transmission. The management system should be capable of detecting excessive transit times of messages and bulletins received.

AMC1 ATM/ANS.OR.B.015(a)(3) Management system

SAFETY PERFORMANCE MONITORING AND MEASUREMENT — ATS PROVIDERS

(a) Safety performance monitoring and measurement should be the process by which the safety performance of ATS providers is verified in comparison to the safety policy and the safety objectives established by the ATS provider.

(b) This process should include:

(1) safety reporting;

(2) safety studies, that is, rather large analyses encompassing broad safety concerns;

(3) safety reviews including trends reviews, which would be conducted during introduction and deployment of new technologies, change or implementation of procedures, or in situations of structural change in operations;

(4) safety audits focussing on the integrity of providers of ATS management system, and periodically assessing the status of safety risk controls; and

(5) safety surveys, examining particular elements or procedures of a specific operation, such as problem areas or bottlenecks in daily operations, perceptions and opinions of operational personnel, and areas of dissent or confusion.

GM1 ATM/ANS.OR.B.015(a)(3) Management system
SAFETY PERFORMANCE MONITORING AND MEASUREMENT — ATS PROVIDERS

(a) The means of performance monitoring is often through one or more leading or lagging indicators.

(b) Indicators and performance measures provide feedback on what is happening so that the ATs provider can take appropriate actions to respond to changing circumstances. The indicators provide information on:

(1) what is happening around the ATS provider;

(2) how well the ATS provider is doing;

(3) what has happened so far; and

(4) warning of impending problems or dangers that ATS provider may need to take action to avoid.

(c) Although 'lagging' performance indicators that measure the final outcomes resulting from the ATS provider's activities are often considered as the most interesting, lagging indicators themselves may not provide enough information to guide the ATS providers' actions and ensure success.

(d) By measuring the inputs to a process, leading performance indicators can complement the use of lagging indicators and compensate for some of their shortcomings. Leading indicators can be used to monitor the effectiveness of control systems and give advance warning of any developing weaknesses before problems occur. One purpose of leading performance indicators is therefore to show the condition of systems before accidents, incidents, harm, damage or failure occurs. In this way, they can help to control risks and prevent mishaps.

(e) There is good evidence that when leading performance indicators are used correctly, they are effective in improving performance. However, there is also good evidence that they can be misused.

(f) For leading performance indicators to play an effective role in the improvement process, there should be an association between the inputs that the leading performance indicators measure and the desired lagging outputs. There needs to be a reasonable belief that the actions taken to improve leading performance indicators will be followed by an improvement in the associated lagging output indicators.

(g) The process for effective use of leading performance indicators can be summarised as:

(1) Identify where there are potential weaknesses or opportunities for improvement;

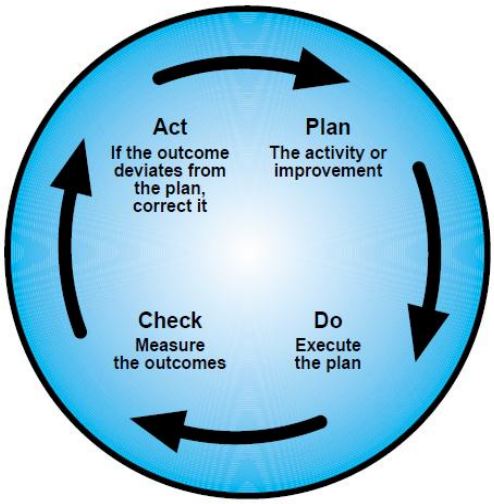
(2) Identify what can be done to counter weaknesses or deliver improvement;

(3) Set performance standards for the actions identified;

(4) Monitor performance against the standards;

(5) Take corrective actions to improve performance; and

(6) Repeat the process by using the following continuous improvement model:



(h) For any performance indicator to be effective, it is important that it is:

(1) objective and easy to measure and collect;

(2) relevant to the ATS provider whose performance is being measured;

(3) capable of providing immediate and reliable indications of the level of performance;

(4) cost efficient in terms of the equipment, personnel, and additional technology required to gather the information;

(5) understood and owned by the ATS provider whose performance is being measured;

(6) related to activities considered to be important for future performance;

(7) amenable to intervention/influence by the ATS provider whose performance is being measured;

(8) related to something where there is scope to improve; and

(9) a clear indication of a means to improve performance.

AMC1 ATM/ANS.OR.B.015(a)(5) Management system
ASSESSMENT OF THE MANAGEMENT SYSTEM

(a) Senior management should assess the ATM/ANS provider's management system, at planned intervals, to ensure its continuing suitability, adequacy, and effectiveness.

(b) The review should include assessing opportunities for improvement and the need for changes to the management system, including the policy and objectives.

(c) Records from management assessments should be maintained.

AMC1 ATM/ANS.OR.B.015(a)(6) Management system
TRAINING AND COMPETENCY

ATM/ANS providers should:

(a) determine the necessary competence for personnel performing activities supporting ATM/ANS provisions;

(b) where applicable, provide training or take other actions to achieve the necessary competence;

(c) evaluate the effectiveness of the actions taken;

(d) ensure that personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives; and

(e) maintain appropriate records of education, training, skills, and experience.

AMC1 ATM/ANS.OR.B.015(a)(7) Management system
COMMUNICATION

Senior management should ensure that appropriate communication processes are established within the ATM/ANS provider and that communication takes place regarding the effectiveness of the management system.

AMC1 ATM/ANS.OR.B.015(b) Management system
ATM/ANS PROVIDERS' MANAGEMENT SYSTEM DOCUMENTATION

(a) The ATM/ANS providers' management system documentation should at least include the following information:

(1) a statement signed by the accountable manager to confirm that the ATM/ANS provider will continuously work in accordance with the applicable requirements and the ATM/ANS providers' documentation as required by this Part and other applicable Parts;
(2) the ATM/ANS providers' scope of activities;

(3) the titles and names of nominated post holders referred to in ATM/ANS.OR.B.010(b)(1);

(4) an ATM/ANS provider chart showing the lines of responsibility between the persons referred to in ATM/ANS.OR.B.010(b)(2);

(5) a general description and location of the facilities referred to in ATM/ANS.OR.B.030;

(6) procedures describing the function and specifying how ATM/ANS providers monitor and ensure compliance with the applicable requirements referred to in ATM/ANS.OR.B.015(c); and

(7) the amendment procedure for the ATM/ANS providers' management system documentation.

GM1 ATM/ANS.OR.B.015(b) Management system
ATM/ANS PROVIDERS' MANAGEMENT SYSTEM DOCUMENTATION

(a) It is not required to duplicate information in several manuals. The information may be contained in ATM/ANS provider manuals (e.g. operations manual, training manual), which may also be combined.

(b) ATM/ANS providers may also choose to document some of the information required to be documented in separate documents (e.g. procedures). In this case, they should ensure that manuals contain adequate references to any document kept separately. Any such documents are then to be considered an integral part of the ATM/ANS providers' management system documentation.

(c) The ATM/ANS providers' management system documentation may be included in a separate manual or in (one of) the manual(s) as required by the applicable subpart(s). A cross reference should be included.

AMC1 ATM/ANS.OR.B.015(c) Management system
COMPLIANCE MONITORING — GENERAL

(a) Compliance monitoring

The implementation and use of a compliance monitoring function should enable ATM/ANS providers to monitor compliance with the relevant requirements of this Part and other applicable Parts.

(1) ATM/ANS providers should specify the basic structure of the compliance monitoring function applicable to the activities conducted.

(2) The compliance monitoring function should be structured according to the size of ATM/ANS providers and the complexity of the activities to be monitored.

(b) ATM/ANS providers should monitor compliance with the procedures they have designed to ensure that services are provided with the required safety levels and quality, as applicable. In doing so, they should as a minimum, and where appropriate, monitor:

(1) manuals, logs, and records;

(2) training standards; and

(3) management system procedures.

(c) Organisational set-up

(1) To ensure that ATM/ANS providers continue to meet the requirements of this Part and other applicable Parts, the accountable manager should designate a compliance monitoring manager. The role of the compliance monitoring manager is to ensure that the activities of ATM/ANS providers are monitored for compliance with applicable regulatory requirements, and any additional requirements established by ATM/ANS providers, and that these activities are being carried out properly under the supervision of other relevant nominated post holders and line managers.

(2) The compliance monitoring manager should be responsible for ensuring that the compliance monitoring programme is properly implemented, maintained, and continually reviewed and improved.

(3) The compliance monitoring manager should:

(i) have direct access to the accountable manager;

(ii) not be one of the line managers;

(iii) be able to demonstrate relevant knowledge, background, and appropriate experience related to the activities of ATM/ANS providers, including knowledge and experience in compliance monitoring; and

(iv) have access to all parts of ATM/ANS providers and, as necessary, any contracted organisation.

(4) In the case of non-complex ATM/ANS providers, this task may be exercised by the accountable manager, provided that he or she has demonstrated having the related competence as defined in (c)(3)(iii).

(5) In the case the same person acts as compliance monitoring manager and as safety manager, the accountable manager, with regards to his or her direct accountability for safety, should ensure that sufficient resources are allocated to both functions, taking into account the size of the ATM/ANS provider and the nature and complexity of its activities.

(6) The independence of the compliance monitoring function should be established by ensuring that audits and inspections are carried out by personnel not directly involved in the activity being audited.

(d) Compliance monitoring documentation

(1) Relevant documentation should include relevant part(s) of ATM/ANS providers' management system documentation.

(2) In addition, relevant documentation should also include:

(i) terminology;

(ii) specified activity standards;

(iii) a description of ATM/ANS providers;

(iv) allocation of duties and responsibilities;

(v) procedures to ensure compliance;

(vi) the compliance monitoring programme, reflecting:

(A) schedule of the monitoring programme;

(B) audit procedures;

(C) reporting procedures;

(D) follow-up and corrective action procedures; and

(E) record keeping system;

(vii) the training syllabus referred to in (e)(2); and

(viii) document control.

(e) Training

(1) Correct and thorough training is essential to optimise compliance in every ATM/ANS provider. In order to achieve significant outcomes of such training, ATM/ANS providers should ensure that all personnel understand the objectives as laid down in ATM/ANS providers' management system documentation.

(2) Those responsible for managing the compliance monitoring function should receive training on this task. Such training should cover the requirements of compliance monitoring, manuals and procedures related to the task, audit techniques, reporting, and recording.

(3) Time should be provided to train all personnel involved in compliance management and for briefing the remainder of the personnel.

(4) The allocation of time and resources should be governed by the volume and complexity of the activities concerned.

GM1 ATM/ANS.OR.B.015(c) Management system

COMPLIANCE MONITORING — GENERAL

(a) The compliance monitoring manager may perform all audits and inspections himself/herself or appoint one or more auditors by choosing personnel having the related competence as defined in AMC1 ATM/ANS.OR.B.015(c), point (c)(3)(iii), either from within or outside the ATM/ANS provider.

(b) Regardless of the option chosen, it needs to be ensured that the independence of the audit function is not affected, in particular in cases where those performing the audit or inspection are also responsible for other activities within ATM/ANS providers.

(c) In case external personnel are used to perform compliance audits or inspections:

(1) any such audits or inspections are performed under the responsibility of the compliance monitoring manager; and

(2) the compliance monitoring manager remains responsible for ensuring that the external personnel has relevant knowledge, background, and experience as appropriate to the activities being audited or inspected; including knowledge and experience in compliance monitoring.

(d) ATM/ANS providers retain the ultimate responsibility for the effectiveness of the compliance monitoring function, in particular for the effective implementation and follow-up of all corrective actions.

AMC1 ATM/ANS.OR.B.015(d) Management system
SIZE, NATURE, AND COMPLEXITY OF THE ACTIVITY

(a) An ATS provider should be considered as complex unless it is eligible to apply for a limited certificate and fulfils the criteria set out in ATM/ANS.OR.A.015(a).

(b) An ANS provider, other than an ATS provider, should be considered as complex unless it is eligible to apply for a limited certificate and fulfils the criteria set out in ATM/ANS.OR.A.015(b)(1).

(c) An FIS provider should be considered as complex unless it is eligible to apply for a limited certificate and fulfils the criteria set out in ATM/ANS.OR.010(b)(2)

(d) An ATM/ANS provider, other than ATS providers and other than ANS providers, should be considered as complex when it has a workforce of more than 20 full-time equivalents (FTEs) involved in the activity subject to Regulation (EC) No 216/2008 and its Implementing Rules.

GM1 ATM/ANS.OR.B.015(d) Management system
SIZE, NATURE, AND COMPLEXITY OF THE ACTIVITY

(a) In consideration of the EUR 1 000 000 gross annual turnover referred to in ATM/ANS.OR.A.015(b)(1), this is assessed against the income ANS providers generate in the provision of the services specified in Annex Vb to Regulation (EC) No 216/2008 and does not include any income generated by ANS providers who undertake other commercial activity that generates income.

(b) In consideration of operating regularly not more than one working position at any aerodrome referred to in ATM/ANS.OR.A.015(b)(2), this means that for the majority (i.e. greater than 50 %) of time an aerodrome is operational, only one working position is used.

(c) Table 1 below illustrates the circumstances under which ATM/ANS providers can be considered as not complex.

Type of service	Criteria to be complied with	Complex
Air traffic service providers	Eligible for limited certificate and meets criteria in ATM/ANS.OR.A.015(a)	No
CNS/MET/AIS providers	Eligible for limited certificate and meets criteria in ATM/ANS.OR.A.015(b)(1) or ATM/ANS.OR.A.015(b)(2)	No
ASM/ATFM/ASD/DAT providers	Workforce of 20 or less FTEs	No

Table 1: Non-complex ATM/ANS providers

AMC1 ATM/ANS.OR.B.020 Contracted activities
RESPONSIBILITY WHEN CONTRACTING ACTIVITIES

(a) A contract should exist between ATM/ANS providers and the contracted organisation clearly defining the contracted activities and the applicable requirements.

(b) The contracted related activities relevant to the agreement should be included in the ATM/ANS providers' assurance process.

(c) ATM/ANS providers should ensure that the contracted organisation has the necessary authorisation, declaration or approval when required, and commands the resources and competence to undertake the task.

GM1 ATM/ANS.OR.B.020 Contracted activities
RESPONSIBILITY WHEN CONTRACTING ACTIVITIES

(a) Regardless of the approval status of the contracted organisation, ATM/ANS providers are responsible for ensuring that all contracted activities are subject to compliance monitoring as required by ATM/ANS.OR.B.015(c) and in the case of ATS and CNS providers also to hazard identification and risk management as required by ATS.OR.205(b)(1).

(b) When the contracted organisation is itself certified to carry out the contracted activities, the ATM/ANS providers' compliance monitoring should at least check that the approval effectively covers the contracted activities and that it is still valid.

(c) If an ATM/ANS provider requires a contracted organisation to conduct an activity which exceeds the privileges of the contracted organisation's approval, this will be considered as the contracted organisation working under the approval of the contracting ATM/ANS provider.

AMC1 ATM/ANS.OR.B.035 Record keeping
GENERAL

(a) The record keeping system should ensure that all the records required in ATM/ANS.OR.B.035(a) are accessible whenever needed. These records should be organised in a way that ensures traceability and retrievability throughout the required 5-year retention period.

(b) Records should be kept in paper form or in electronic format or a combination of both provided that they are protected against damage, alteration and theft. Records stored on microfilm or optical disc format are also acceptable. Records should remain legible throughout the required retention period. The retention period starts when records have been created or last amended.

(c) Paper systems should use robust material which can withstand normal handling and filing.

(d) Computer systems should have at least one backup system which should be updated within 24 hours of any new entry. Computer systems should include safeguards against the ability of unauthorised personnel to alter the data.

(e) All computer hardware used to ensure data backup should be stored in a different location from that containing the working data and in an environment that ensures they remain in good condition. When hardware or software changes take place, special care should be taken that all necessary data continues to be accessible at least through the full retention period.

AMC/GM to ANNEX III — Specific requirements for the provision of air traffic services (Part-ATS)

SUBPART A — ADDITIONAL ORGANISATION REQUIREMENTS FOR THE PROVISION OF AIR TRAFFIC SERVICES (ATS.OR)

Section 2 — Safety of services

AMC1 ATS.OR.205 Safety management system

GENERAL — NON-COMPLEX ATS PROVIDERS

(a) The safety policy should include a commitment to improve towards the highest safety standards, comply with all applicable legal requirements, meet all applicable standards, consider best practices, and provide appropriate resources.

(b) In cooperation with other stakeholders, ATS providers should, develop, coordinate, and maintain an emergency response plan (ERP) that ensures orderly and safe transition from normal to emergency operations and return to normal operations. The ERP should determine the actions to be taken by ATS providers or specified individuals in an emergency and reflect the size, nature, and complexity of the activities performed by ATS providers.

(c) Safety risk management may be performed using hazard checklists or similar risk management tools or processes, which are integrated into the activities of ATS providers.

(d) ATS providers should manage safety risks related to changes. Management of changes should be a documented process to identify external and internal changes that may have an adverse effect on safety. It should make use of providers of ATS's existing hazard identification, risk assessment, and mitigation processes.

(e) ATS providers should identify persons who fulfil the role of safety managers and who are responsible for coordinating the safety management system. These persons may be accountable managers or individuals with an operational role in ATS providers.

(f) Within ATS providers, responsibilities should be identified for hazard identification, risk assessment, and mitigation.

AMC1 ATS.OR.205(a)(1)(i) Safety management system

SAFETY POLICY — COMPLEX ATS PROVIDERS

(a) The safety policy should:

(1) be endorsed by the accountable manager;

(2) reflect organisational commitments regarding safety and its proactive and systematic management;

(3) be communicated, with visible endorsement, throughout ATS providers; and

(4) include safety reporting principles.

(b) The safety policy should include a commitment:

(1) to improve towards the highest safety standards;

(2) to comply with all applicable legislation, meet all applicable standards, and consider best practices;

(3) to provide appropriate resources;

(4) to enforce safety as one primary responsibility of all managers; and

(5) not to blame someone for reporting something which would not have been otherwise detected.

(c) Senior management should:

(1) continually promote the safety policy to all personnel and demonstrate their commitment to it;

(2) provide necessary human and financial resources for its implementation; and

(3) establish safety objectives and performance standards.

GM1 ATS.OR.205(a)(1)(i) Safety management system
GENERAL

(a) Safety policy — Statements

(1) The safety policy is the means whereby ATS providers state their intention to maintain and, where practicable, improve safety levels in all their activities and to minimise their contribution to the risk of an aircraft accident as far as is reasonably practicable.

(2) The safety policy should state that the purpose of safety reporting and internal investigations is to improve safety, not to apportion blame to individuals.

(3) ATS providers may combine the safety policy with the policy required by ATM/ANS.OR.B.015(a)(2).

(b) Just culture

The safety policy should actively encourage effective safety reporting and, by defining the line between acceptable performance (often unintended errors) and unacceptable performance (such as negligence, recklessness, violations or sabotage), provide fair protection to reporters. A safety or just culture may not however preclude the 'criminalisation of error', which is legally, ethically, and morally within the sovereign rights of any Member State, provided that European Union law and established international agreements are observed. A judicial investigation, and consequences of some form, may be expected following an accident or serious incident especially if a system failure resulted in lives lost or property damaged, even if no negligence or ill intent existed. A potential issue could therefore exist if voluntary hazard reports, which relate to latent deficiencies of a system or its performance, are treated in the same way as those concerning accident and serious incident investigations. The intent of protecting hazard reports should not challenge the legitimacy of a judicial investigation or demand undue immunity.

GM1 ATS.OR.205(a)(1)(ii);(iii);(iv)
SAFETY OBJECTIVES

These provisions are commonly known as safety objectives and support the implementation of the high level safety policy in a more meaningful way that can be monitored, measured and improved. Safety objectives are implemented through ATS providers' safety management system.

AMC1 ATS.OR.205(a)(2) Safety management system
ORGANISATION AND ACCOUNTABILITIES — COMPLEX ATS PROVIDERS

The management system of ATS providers should encompass safety by including a safety manager and a safety review board in the organisational structure.

(a) Safety manager

(1) The safety manager should act as the focal point and be responsible for the development, administration, and maintenance of an effective safety management system.

(2) The functions of the safety manager should be to:

(i) facilitate hazard identification, risk analysis, and management;

(ii) monitor the implementation of actions taken to mitigate risks, as listed in the safety action plan;

(iii) provide periodic reports on safety performance;

(iv) ensure maintenance of safety management documentation;

(v) ensure that there is safety management training available and that it meets acceptable standards;

(vi) provide advice on safety matters; and

(vii) ensure initiation and follow-up of internal occurrence/accident investigations.

(b) Safety review board

(1) The safety review board should be a high level committee that considers matters of strategic safety in support of the accountable manager's safety accountability.

(2) The board should be chaired by the accountable manager and composed of heads of functional areas.

(3) The safety review board should:

(i) monitor safety performance against safety policy and objectives;

(ii) ensure that any safety action is taken in a timely manner; and

(iii) monitor the effectiveness of the providers of ATS' safety management processes.

(4) The safety review board should ensure that appropriate resources are allocated to achieve the established safety performance.

(5) The safety manager or any other relevant person may attend, as appropriate, safety review board meetings. He or she may communicate to the accountable manager all information, as necessary, to allow decision making based on safety data.

GM1 ATS.OR.205(a)(2) Safety management system

SAFETY ACTION GROUP — COMPLEX ATS PROVIDERS

(a) A safety action group may be established as a standing group or as an ad hoc group to assist or act on behalf of the safety review board.

(b) More than one safety action group may be established depending on the scope of the task and specific expertise required.

(c) The safety action group should report to and take strategic direction from the safety review board and should be comprised of managers, supervisors, and personnel from operational areas.

(d) The safety action group should:

(1) monitor operational safety;

(2) resolve identified risks;

(3) assess the impact on safety of operational changes; and

(4) ensure that safety actions are implemented within agreed timescales.

(e) The safety action group should review the effectiveness of previous safety recommendations and safety promotion.

GM2 ATS.OR.205(a)(2) Safety management system
SAFETY MANAGER

(a) Depending on the size of ATS providers and the nature and complexity of their activities, safety managers may be assisted by additional safety personnel for the performance of all safety management related tasks.

(b) Regardless of the organisational set-up, it is important that safety managers remain the unique focal point as regards the development, administration, and maintenance of the providers of ATS' safety management system.

GM3 ATS.OR.205(a)(2) Safety management system
SMALL ORGANISATIONS

Small organisations are non-complex ATS providers as specified in AMC1 TM/ANS.OR.B.015(d).

AMC1 ATS.OR.205(a)(3) Safety management system
EMERGENCY RESPONSE PLAN (ERP) FOR ATS PROVIDERS — COMPLEX ATS PROVIDERS

(a) An ERP should be established that provides the actions to be taken by the organisation or specified individuals in an emergency. The ERP should reflect the nature and complexity of the activities performed by the organisation.

(b) The ERP should ensure:

(1) an orderly and safe transition from normal to emergency operations;

(2) safe continuation of operations or return to normal operations as soon as practicable; and

(3) coordination with the emergency response plans of other organisations, where appropriate.

AMC1 ATS.OR.205(a)(4) Safety management system
SAFETY MANAGEMENT MANUAL (SMM) — COMPLEX ATS PROVIDERS

(a) The safety management manual should be the key instrument for communicating the approach to safety for all ATS providers. The SMM should document all aspects of safety management, including the safety policy, objectives, procedures, and individual safety responsibilities.

(b) The contents of the SMM should include all of the following:

(1) scope of the safety management system;

(2) safety policy and objectives;

(3) safety accountability of the accountable manager;

(4) safety responsibilities of key safety personnel;

(5) documentation control procedures;

(6) hazard identification and risk management schemes;

(7) safety action planning;

(8) safety performance monitoring;

(9) incident investigation and reporting;

(10) emergency response planning;

(11) management of change (including organisational changes with regard to safety responsibilities and changes to functional systems); and

(12) safety promotion.

(c) The SMM may be contained in (one of) the manual(s) of ATS providers.

AMC1 ATS.OR.205(b) Safety management system
SAFETY RISK MANAGEMENT — COMPLEX ATS PROVIDERS

(a) Hazard identification processes

(1) Reactive and proactive schemes for hazard identification should be the formal means of collecting, recording, analysing, acting on, and generating feedback about hazards and the associated risks that affect the safety of the operational activities of the organisation.

(2) All reporting systems, including confidential reporting schemes, should include an effective feedback process into the hazard identification process.

(b) Risk assessment and mitigation processes

(1) A formal risk management process should be developed and maintained ensuring analysis (in terms of likelihood and severity of occurrence), assessment (in terms of tolerability), and control (in terms of mitigation) of risks to an acceptable level.

(2) The levels of management who have the authority to make decisions regarding the tolerability of safety risks, in accordance with (b)(1), should be specified.

(c) Management of changes

ATS providers should manage safety risks related to changes. Management of change should be a documented process to identify external and internal change that may have an adverse effect on safety. The process of management of changes should make use of providers' existing hazard identification, risk assessment, and mitigation processes.

GM1 ATS.OR.205(c) Safety management system
SAFETY ASSURANCE — COMPLEX ATS PROVIDERS

(a) Leading indicators

(1) Metrics that measure inputs to the safety system (either within an organisation, a sector or across the total aviation system) to manage and improve safety performance.

(2) Leading indicators indicate good safety practices being introduced, developed, and adapted, which by their inclusion seek to establish a proactive safety environment that engenders continuous improvement. They provide useful information when accident and incident rates are low to identify latent hazards and potential threats, and consequent opportunities for improvement.

(b) Lagging indicators

(1) Metrics that measure events that have already occurred and that impact on safety performance.

(2) As lagging indicators only reflect system failures their use can only result in determining a reactive response. Although they do measure failure to control hazards, they do not normally reveal why the system failed or if there are any latent hazards.

(c) Precursor events

These metrics can be considered as a subset of lagging indicators that do not manifest themselves in accidents or serious incidents. They indicate less severe system failures or 'near misses', which when combined with other events may lead to an accident or serious incident.

(d) Safety management system

In complex ATS providers, SMS should include all of these measures. Risk management efforts, however, should be targeted at leading indicators and precursor events. The aim of doing this is to reduce the number of accidents and serious incidents.

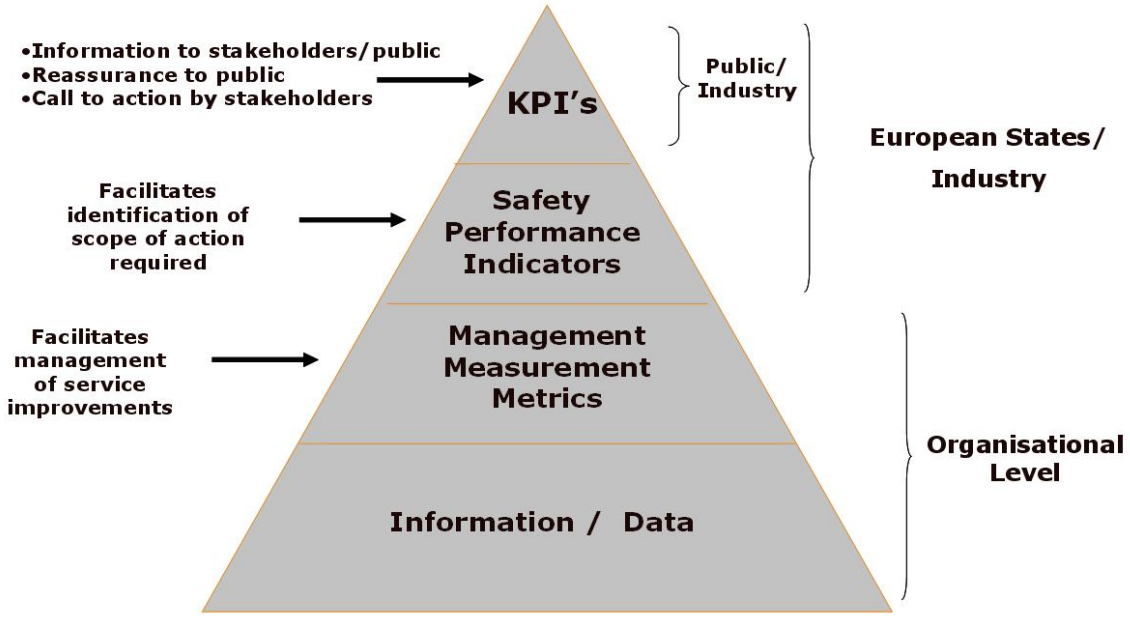
(e) Differing levels of safety performance monitoring

(1) Measurements of safety in terms of undesirable events, such as accidents and incidents, are examples of 'lagging indicators', which can capture safety performance 'a posteriori'. Such indicators give valuable signals to all involved in air traffic services — providers, regulators, and recipients — of the levels of safety being experienced, and the ability of the organisations concerned to take appropriate mitigation action.

However, other types of measurement — 'leading indicators' — can give a wider perspective of the safety 'health' of the ATM/ANS system, and focus on systemic issues, such as safety maturity and SMS performance.

(2) A holistic approach to performance monitoring is an essential input to decision-making with regard to safety. It is important to ensure that good safety performance is attributable to good performance of the safety system, not simply to lack of incidents or accidents. It is also essential that the metrics chosen match the requirements of the stakeholders and decision-makers involved in safety improvement.

(3) As shown in the diagram, stakeholders in the wider aviation industry and the general public require relatively small numbers of safety indicators (safety performance indicators or key performance indicators) which can give an instant 'feel' for the overall position regarding safety performance. Conversely, those involved in the management of services concerned need a more detailed set of metrics on which to base decisions regarding the management of the services and facilities being reviewed.



Monitoring Metrics

AMC1 ATS.OR.205(c)(1)(i) Safety management system
SAFETY SURVEYS — COMPLEX ATS PROVIDERS

(a) ATS providers should:

(1) initiate safety surveys and ensure that all safety related activities within scope are addressed periodically;

(2) appoint an appropriate survey leader and survey team whose expertise is in accordance with the particular requirements of the intended survey, taking due account of the desirability of including staff from outside areas where relevant, and mindful of the opportunity such an activity provides for staff development and engagement;

(3) define an annual safety survey plan;

(4) take immediate remedial action as soon as any shortcomings are identified;

(5) ensure that the actions identified in the action plans are carried out within specified timescales;

(6) ensure that examples of lesson learning and good practice arising from safety surveys are disseminated and acted upon;

(b) The survey leader shall:

(1) carry out the survey;

(2) record the results;

(3) make recommendations; and

(4) agree actions with the relevant operational management.

(c) The survey team shall assist the survey leader in completing their responsibilities as determined by the survey leader.

GM1 ATS.OR.205(c)(1)(i) Safety management system
SAFETY SURVEYS — COMPLEX ATS PROVIDERS

(a) Safety surveys may be initiated by a number of means such as occurrence reports, safety performance, suggestions from members of staff, etc.

(b) Safety surveys may be documented in a safety survey report which should also contain the specific actions that will be taken to address the recommendations. The actions should specify those responsible for completion and the target dates. The actions should be tracked to closure through an action plan. This action plan may be implemented as part of an existing locally or centrally managed action tracker.

(c) A typical safety survey report would require the following content:

(1) Front sheet:

(i) reference number,

(ii) title,

(iii) survey period,

(iv) team members and team leader, and

(v) survey initiator,

(2) Survey description:

(i) introduction,

(ii) objective,

(iii) scope,

(iv) record of results,

(v) conclusions, and

(vi) recommendations and actions.

(d) Survey leader

The survey leader should be adequately trained and competent for the subject of the survey. Where this is not possible at least one member of the survey team should be competent in the subject of the survey.

(e) Survey team

It is advantageous for the survey team to be multi-disciplined and, where possible, be drawn from differing parts of the ATS provider's organisation.

GM1 ATS.OR.205(c)(1)(ii) Safety Management system

(a) Functional systems

(1) The in-service performance of a functional system should be monitored so that any deviations that the functional system exhibits that are out with its defined design envelope are detected and the cause identified and remedial action undertaken.

(2) Very often the first indication is where trends are monitored and deviations begin to arise even within the design envelope. Timely action should be taken so that the functional system continues to operate within its design envelope.

(3) Typical indicators are integrity, reliability and availability requirements which will have been specified for the functional system, and monitoring reliability and availability provide good indication (leading indicators) of any future potential adverse changes to the performance of the functional system which may have an impact upon safety.

(4) Data on reliability and availability may be gathered either by observation or automatically by the functional system itself.

(b) Operations

(1) Changes to operation that have an impact on safety tend to be detected in occurrences requiring a reactive (lagging indicator) rather than proactive response by the ATS provider. Therefore, establishing and managing operational safety performance leading indicators is key to minimising the operational risk.

(2) Such leading indicators may be surrogates for the actual change to the operation such that poor performance is detected before it becomes an operational risk. For example, the Short Term Conflict Alert (STCA) alerts air traffic controllers (ATCO) to a possible loss of separation (which is a prerequisite for an accident) therefore allowing ATCO intervention.

AMC1 ATS.OR.205(c)(1)(iii) Safety management system
SAFETY RECORDS — COMPLEX ATS PROVIDERS

Safety records that should be maintained and retained include, but are not limited to:

(a) certificates,

(b) limited certificates,

(c) declarations,

(d) safety policy,

(e) safety objectives,

(f) safety accountabilities/responsibilities,

(g) safety occurrences,

(h) emergency response plan,

(i) safety surveys,

(j) SMS documentation,

(k) training and competence,

(l) occurrence reports,

(m) safety risk assessments,

(n) safety surveys,

(o) determination of whether complex or non-complex organisation, and

(p) approved alternative means of compliance.

AMC1 ATS.OR.205(c)(1)(iv) Safety management system
INTERNAL SAFETY INVESTIGATION — COMPLEX ATS PROVIDERS

The scope of internal safety investigations should extend beyond the scope of occurrences required to be reported to the competent authority.

GM1 ATS.OR.205(c)(1)(iv) Safety management system
INTERNAL SAFETY INVESTIGATION — COMPLEX ATS PROVIDERS

(a) The overall purpose of the internal safety investigation scheme is to use reported information to improve the level of safety performance of the ATS provider and not to attribute blame.

(b) The objectives of the internal safety investigation scheme are to:

(1) enable an assessment to be made of the safety implications of each relevant incident and accident, including previous similar occurrences, so that any necessary action can be initiated; and

(2) ensure that knowledge of relevant incidents and accidents is disseminated, so that other persons and organisations may learn from them.

(c) The internal safety investigation scheme is an essential part of the overall monitoring function and it is complementary to the normal day-to-day procedures and control systems and is not intended to duplicate or supersede any of them. The scheme is a tool to identify those instances where routine procedures have failed.

(d) All occurrence reports judged reportable in accordance with the internal procedures by the person submitting the report should be retained as the significance of such reports may only become obvious at a later date.

AMC1 ATS.OR.205(c)(2) Safety management system
CONTINUOUS IMPROVEMENT OF THE SMS — COMPLEX ATS PROVIDERS

ATS providers should continuously improve the effectiveness of their SMS by:

(a) developing and maintaining a formal process to identify the causes of substandard performance of the SMS;

(b) establishing a mechanism(s) to determine the implications of substandard performance of the SMS in operations;

(c) establishing one or more mechanisms to eliminate or mitigate the causes of substandard performance of the SMS;

(d) developing and maintaining a process for the proactive evaluation of facilities, equipment, documentation, processes and procedures (through audits and surveys, etc.); and

(e) developing and maintaining a process for the proactive evaluation of the individual's performance, to verify the fulfilment of their safety responsibilities.

GM1 ATS.OR.205(c)(2) Safety management system
CONTINUOUS IMPROVEMENT OF THE SMS – COMPLEX ATS PROVIDERS

(a) Substandard performance of the SMS can manifest itself in two ways. Firstly, where the SMS processes themselves do not fit their purpose (e.g. through not adequately enabling ATS providers to identify, manage, and mitigate hazards and their associated risks) such that the safety performance of the service is impacted in a negative way. Secondly, where the SMS processes fit their purpose but are not applied correctly or adequately by the personnel whose safety accountabilities and responsibilities are discharged through the application of the SMS. Personnel who have safety accountabilities and responsibilities are considered an essential part of the effectiveness of the SMS and viewed as part of the SMS.

(b) Therefore by detecting substandard performance of the SMS, ATS providers can take action to improve the SMS processes themselves or to improve the application of the SMS processes by those with safety accountabilities and responsibilities resulting in an improvement to the safety performance of the ATS.

(c) Continuous improvement of the effectiveness of the safety management processes can be achieved through:

(1) proactive and reactive evaluations of facilities, equipment, documentation, processes and procedures through safety audits and surveys;

(2) proactive evaluation of individuals' performance to verify the fulfilment of their safety responsibilities; and

(3) reactive evaluations in order to verify the effectiveness of the system for control and mitigation of risks.

(d) In the same way that continuous improvement is sought through safety performance monitoring and measurement (see GM1 ATM/ANS.OR.B.015(a)(3) and GM1 ATS.OR.205(c)) by the use of leading and lagging indicators, continuous improvement of the SMS provides ATS providers safety assurance for the service.

(e) As with safety performance monitoring, the continuous improvement of the SMS lends itself to a process that can be summarised as:

(1) identify where there are potential weaknesses or opportunities for improvement;

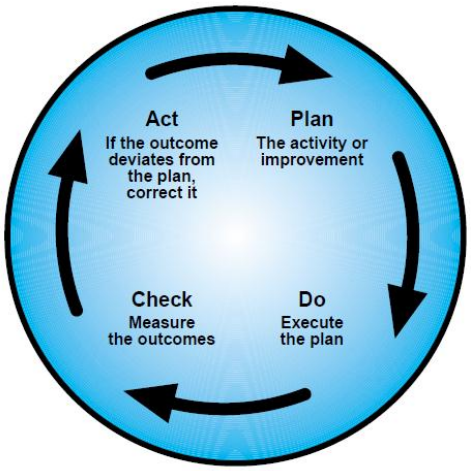
(2) identify what can be done to counter weaknesses or deliver improvement;

(3) set performance standards for the actions identified;

(4) monitor performance against the standards;

(5) take corrective actions to improve performance; and

(6) repeat the process by using the continuous improvement model below:



(f) Taking into account that SMS is being required to manage safety, it can be assumed that by continuously improving the effectiveness of the SMS, ATS providers should be able to better manage and mitigate and ultimately control the safety risks associated to the provisions of their services.

GM1 ATS.OR.205(d)(2)(3)(4) Safety management system
TRAINING — COMPLEX ATS PROVIDERS

(a) Training

(1) All personnel should receive safety training as appropriate for their safety responsibilities.

(2) Adequate records of all safety training provided should be kept.

(b) Communication

(1) The ATS provider should establish communication about safety matters that:

(i) ensures that all personnel are aware of the safety management activities as appropriate for their safety responsibilities;

(ii) conveys safety critical information, especially relating to assessed risks and analysed hazards;

(iii) explains why particular actions are taken; and

(iv) explains why safety procedures are introduced or changed.

(2) Regular meetings with personnel where information, actions, and procedures are discussed may be used to communicate safety matters.

(c) The safety training programme may consist of self-instruction via a media (newsletters, flight safety magazines), class-room training, e-learning or similar training provided by training organisations.

Section 3 — Human factors: principles for the provision of air traffic control (ATC) services

AMC1 ATS.OR.315(a) Responsibilities of providers of ATC services with regard to problematic use of psychoactive substances by ATCOs
POLICY

Within the content policy, ATC providers should:

(a) provide training and/or educational material to ATCOs relating to:

(1) the effects of psychoactive substances on individuals and subsequently on ATC service provision;

(2) established procedures within their organisations regarding this issue; and

(3) their individual responsibilities with regard to legislation and policies on psychoactive substances.

(b) provide support for ATCOs who are dependent on psychoactive substances;

(c) encourage ATCOs who think that they may have such a problem to seek and accept help from their ATC provider's services;

(d) ensure that ATCOs are treated in a consistent, just, and equitable manner as regards the problematic use of psychoactive substances.

GM1 ATS.OR.315(a) Responsibilities of providers of ATC services with regard to problematic use of psychoactive substances by ATCOs
POLICY

(a) Guidance for the development and implementation of the policy is contained in ICAO Doc 9654 'Manual on Prevention of Problematic Use of Substances in the Aviation Workplace', first edition 1995, in particular:

(1) Attachment A (pages 27-34) as regards elements for the definition and the implementation of policy and programme;

(2) Chapter 3 (pages 9-12) as regards the identification, treatment, and rehabilitation of staff, with related supporting material, available in attachment C (pages 61-68); and

(3) Attachment D (pages 69-75) as regards the employment consequences of problematic use of substances.

TRAINING AND EDUCATION PROGRAMMES

(b) Guidance for the development and implementation of training and education programmes is contained in ICAO Doc 9654 'Manual on Prevention of Problematic Use of Substances in the Aviation Workplace', first edition 1995, in particular:

(1) Chapter 2 (pages 6-7) as regards the education of the workforce and educational material, with related supporting material available in Attachment A (page 35-48); and

(2) Attachment B (pages 49-59) and Attachment F (pages 87-94), where extracts from the ICAO manual of Civil Aviation Medicine are reported.

AMC1 ATS.OR.315(b) Responsibilities of providers of ATC services with regard to problematic use of psychoactive substances by ATCOs
PROCEDURE FOR THE DETECTION OF CASES OF PROBLEMATIC USE OF PSYCHOACTIVE SUBSTANCES

The procedure should fit the organisation in an applicable way and be in line with applicable EU and/or national legislation on personal rights. It should specify:

(a) the mechanisms and responsibilities for its initiation;

(b) the applicability of the procedure in terms of timing and locations;

(c) the person(s)/body responsible for testing the individual;

(d) the testing process;

(e) thresholds for psychoactive substances; and

(f) the process to be followed in case of detection of problematic use of psychoactive substances by an ATCO.

GM1 ATS.OR.315(b) Responsibilities of providers of ATC services with regard to problematic use of psychoactive substances by ATCOs

PROCEDURE FOR THE DETECTION OF CASES OF PROBLEMATIC USE OF PSYCHOACTIVE SUBSTANCES

Guidance for the development and implementation of the procedure for detection of cases of psychoactive substances is contained in ICAO Doc 9654 'Manual on Prevention of problematic use of Substances in the Aviation Workplace', first edition 1995, particularly chapter 5 (pages 15-23) and attachment E (pages 77-85) as regards biochemical testing programmes, with related supporting material.

GM1 ATS.OR.320 Stress

(a) Introduction

(1) ATC is generally considered to be a responsible and demanding job which at times can lead to the experience of high levels of stress. The combination of skills and knowledge required to complete ATC tasks is wide. Visual spatial skills, perception, information processing, image and pattern recognition, prioritising, logical problem solving, application of rules and procedures, and decision making form core skills to which we can add interpersonal communication, teamwork, and technical vocabulary usage.

(2) ATC also requires controllers to constantly adapt to an ever changing traffic picture and work environment within restricted time constraints. This has the potential to lead to considerable work pressure and with this comes the potential for high levels of stress. In contrast there may be times when traffic flows are low and controllers experience relatively low levels of activity. For some controllers this may bring its own kind of stress due to the increased efforts required to maintain vigilance under light traffic load. Indeed it is during light traffic load and low arousal that an increased frequency of errors can be observed.

(3) Thus the work of an air traffic controller has the potential to induce high levels of stress; however, the stress experienced by controllers is always unique to the individual and their interaction with their environment.

(4) Stress is a term that is in common use within everyday language and can mean different things to different people depending on the context in which it is used. In lay terms, stress is often used to describe an external pressure experienced by an individual whilst at the same time encompassing the subjective experience of this pressure. Usually the term is used in a negative way. In this sense, the lay use of the term stress encompasses both the cause and the effect, and this can lead to confusion as to its meaning.

(b) Technical definitions of stress

(1) Even in its technical use, the word stress is sometimes used when the term 'stressor' (or pressure) would be more appropriate, referring to the cause of a stress experience. Stressors can be internal (cognitive or physical) or external (environmental) to the individual and may be defined as any activity, event or other stimulus that causes the individual to experience stress.

(2) It is helpful to clarify the way we are using the term stress and other technical terms. For the purposes of this guidance material, stress is defined following the Transactional Model of Stress (Lazarus and Folkman, 1984). This views stress as the outcomes experienced by an individual when faced with a potentially stressful event. The experience of the event as negatively stressful (distress), neutral or positive (eustress) is based on the individual's perception of their ability to manage the event. Under this definition, stress is a manifestation in the individual of usually negative effects, which can lead to a decrease in performance and negative health effects.

(3) A stressor can also act to improve performance acting as a stimulus to increase arousal and improving the outputs of an individual in the short to medium term. Too much arousal paradoxically leads to and inverse effect and subsequent detriment in performance.

(4) Acute stress is as its name suggests, episodic and occurring for short periods of time. In most cases, the cause of the stress is eliminated by the controller taking action to manage the situation leading to stress. High levels of acute stress may lead to hyper-arousal and may leave a controller feeling exhausted. It is important to identify work situations that lead to this acute stress and plan for this within the work schedule.

(5) Chronic stress differs from acute stress only in that it is ongoing and even low levels of continuous chronic stress can lead to performance degradation and serious health implications if it is not addressed. Chronic stress is insidious in its nature and a sufferer may become so accustomed to the sensations that they are unaware of the long term negative effects. Chronic stress commonly leads to a sense of inability to cope.

(6) Both acute and chronic stresses have the potential to lead individuals into hyper-aroused states which may result in panic where task and skill performance, planning, reasoning, and judgement are significantly impaired. In such instances, a well-practiced but incorrect action, for that particular circumstance, may be performed when an alternative and more appropriate response is required.

(7) Prolonged chronic stress may result in a condition known as burnout. Burnout is generally identified by the following characteristics: disaffection with the job leading to a decrease in motivation with an associated decrease, perceived or otherwise, in performance.

(c) Sources of stress

Broadly speaking the stress experienced by a controller at work is a function of their underlying background levels of stress, related to: lifestyle, health and well-being, personality, organisational/work environment, levels of satisfaction with life generally, and the acute stress imposed by and operational conditions at any given time. There are three major sources of stress: environmental, work-related, and personal.

(d) Environmental/physical stressors

(1) 'Physical stressors are underlying conditions that can either be internal to the body (e.g. pain, hunger, lack of sleep exhaustion), or external environmental factors (e.g. noise pollution, over-crowding, excess heat). The common factor among all of these stressors is that they all create a physically uncomfortable environment that can cause stress. Stress is not solely dependent on the intensity of a stimulus but

also on the duration of exposure. For example, a low-pitched but persistent noise can cause as much stress as a sudden loud noise.' (Source: Skybrary, 2011).

(2) In the air traffic control room, some common environmental/physical stressors could be:

(i) uncomfortable temperature,

(ii) cramped workspace,

(iii) air quality,

(iv) lighting conditions, and

(v) intrusive noise or vibration.

(e) Work-related stressors

(1) Stress in the workplace can come from a variety of sources besides physical stimuli. Some of these include:

(i) continuing high levels of workload near or above the maximum traffic handling capacity of a controller;

(ii) a heterogeneous traffic mix where aircraft have varying levels of equipment and considerable variability in pilot skills;

(iii) unsuitable or unreliable equipment;

(iv) inappropriate, vague procedures;

(v) complex equipment which is insufficiently understood or mistrusted;

(vi) supervision of trainees or less experienced colleagues;

(vii) workload and task breakdown not being matched to the level of technical skill of the controller, lack of support or too much support (interference);

(viii) role ambiguity, where it is unclear where the responsibilities lie;

(ix) interpersonal conflict with colleagues, other professionals;

(x) poor management relations (social dialogue), working conditions, e.g. rostering; and

(xi) abnormal or emergency situations.

(2) Incidents, including emergencies and accidents, that lead controllers to feel that they are not coping may lead to the experience of critical incident stress; this in turn may impair performance in varying degrees.

(f) Personal stressors

(1) Personal stressors include the range of events that occur throughout people's lives but external to the workplace. The belief that such stressors can be left at home however, is a myth, and these personal stressors accompany controllers to work everyday.

(2) Personal issues such as health, personal life, living situation, and major life events (deaths, births, marriages, and moving house) add to the background level of stress that individuals have to cope with. Where these are excessive, they can interfere with work due to the distraction they cause and mental effort they require to resolve them.

(3) Stress is also considered to have a contagious quality, which happens when a stressed person or persons create stressful situations for those around them.

(g) Signs of stress in the individual

Signs of stress are many and varied. Some of the more commonly observed are shown below:

(1) Physiological

(i) Cardiovascular: increased pulse rate, elevated blood pressure, chest pains

(ii) Respiratory: shortness of breath, tightness of chest, hyperventilation, dizziness

(iii) Gastrointestinal: loss of appetite, gas pain, abdominal cramps, indigestion, diarrhoea, nausea

(iv) Sweaty palms

(v) Aching neck, jaw, and back muscles

(vi) Trembling

(vii) Sleep disturbance, tiredness

(viii) Itching

(ix) Easily startled

(x) Susceptibility to minor illnesses

(xi) Other: headaches, muscular tension, general weakness, psychosomatic symptoms

(2) Psychological

(i) Emotional: anger, guilt, mood swings, and low self-esteem, depression and anxiety

(ii) Concentration problems, forgetfulness

(iii) Pessimism

(iv) Difficulty in making decisions

(v) Irritability

(vi) Loss of interest

(vii) Loss of self-control

(viii) Loss of confidence

(3) Behavioural

(i) Self-medication, drugs or alcohol

(ii) Excess fatigue

(iii) Sleep disruption

(iv) Social withdrawal

(v) Absenteeism

(vi) Staff turnover rates

(vii) Job performance decrements

(h) Impact of stress on air traffic controllers' performance of ATC tasks

Any source of stress has the potential to create unique subjective experiences in different individuals, and these may be positive or negative experiences or something in between.

(i) Negative experiences of stress

There are a number of ways in which stress experienced by air traffic controllers can manifest in the performance of ATC tasks. Some of these are listed in Table 1, but in general terms performance on tasks decreases due to the detrimental effects that high levels of stress can have on perception, awareness, decision making, and judgement. In the longer term, health and well-being may also be compromised leading to decreased performance of air traffic controllers.

Table 1 below shows that the effects of stress on controller performance can have potentially very significant implications for the safety performance of an operation.

Difficulty concentrating and reduced vigilance — easily distracted.
Errors, omissions, mistakes, incorrect actions, poor judgment and memory.
Tendency to cut corners, skip items, and look for the easiest way out.
Either slowness (due to lack of interest) or hyperactivity (due to adrenaline).
Focusing on easily manageable details while ignoring serious threats.
Tendency to pass responsibility on to others.
Fixation on single issues or even a mental block.
Unwillingness to make decisions — decisions are postponed or take longer to be made.
Fewer plans and backup plans are made.
Increase in risk-taking leading to an increase in the number of violations, especially when frustrated with failures.
Excessively hurried actions — due to adrenaline and alertness level, there is a tendency to act very quickly even when there is no time pressure. Hurried actions increase the chance of errors.
In cases of significantly high stress a controller will often:
return to old procedures that may no longer be applicable, *appropriate or safe* (italics added);
use of non-standard phraseology when communicating;
return to the use of one's native language; and/or
look for items in a place where they used to be but are no longer located.

Table 1: Effects of stress on physical and mental performance of ATC tasks

(j) Mitigation of stress in the individual and the organisation

(k) Air navigation service providers (ANSPs) have a duty of care to their employees and the customers of their services. They should aim to mitigate the negative effects of stress. This is best achieved by ensuring that a range of preventative and counter measures are in place. These include:

(1) adoption of a stress policy and/or critical incident stress management (CISM) policy within the organisation;

(2) completing regular risk assessment on sources of occupational stress and its effects on individuals and operations;

(3) employee stress level monitoring;

(4) adopting stress intervention/mitigation/prevention practices where the organisation identifies a source of stress, use of a stress team/committee;

(5) stress management training for all levels of employees;

(6) education and prevention programmes on stress; and

(7) staff support mechanisms (peer counselling, professional support from health practitioners, CISM).

GM1 ATS.OR.320(a) Stress
CRITICAL INCIDENT STRESS MANAGEMENT

CISM is a programme with a view to preparing organisations for the potential aftermath of a serious incident or accident. These come in a number of different forms, but have the added benefit of providing education on the effects of stress, how it affects performance, and its management, even when the incident is relatively minor and perhaps personal to the individual.

Guidance for the implementation of the CISM programme may be found in the EUROCONTROL document: 'Human Factors — Critical Incident Stress Management: User Implementation Guidelines', edition 2.0 of 24/10/2008.

GM1 ATS.OR.320(c) Stress
TRAINING AND EDUCATION PROGRAMMES

Scientific material proposed as guidance for training and education programmes on stress may be found in the EUROCONTROL document 'Human Factors Module — Stress', edition 1.0 of 15/3/1996.

AMC1 ATS.OR.325 Fatigue
Providers of ATC services should provide ATCOs with staff support mechanisms and facilities in order to mitigate effects of fatigue.

GM1 ATS.OR.325 Fatigue
INTRODUCTION

(a) In a very general way, fatigue can be considered as a physiological and psychological state reflecting a need for recovery (Figure 1).

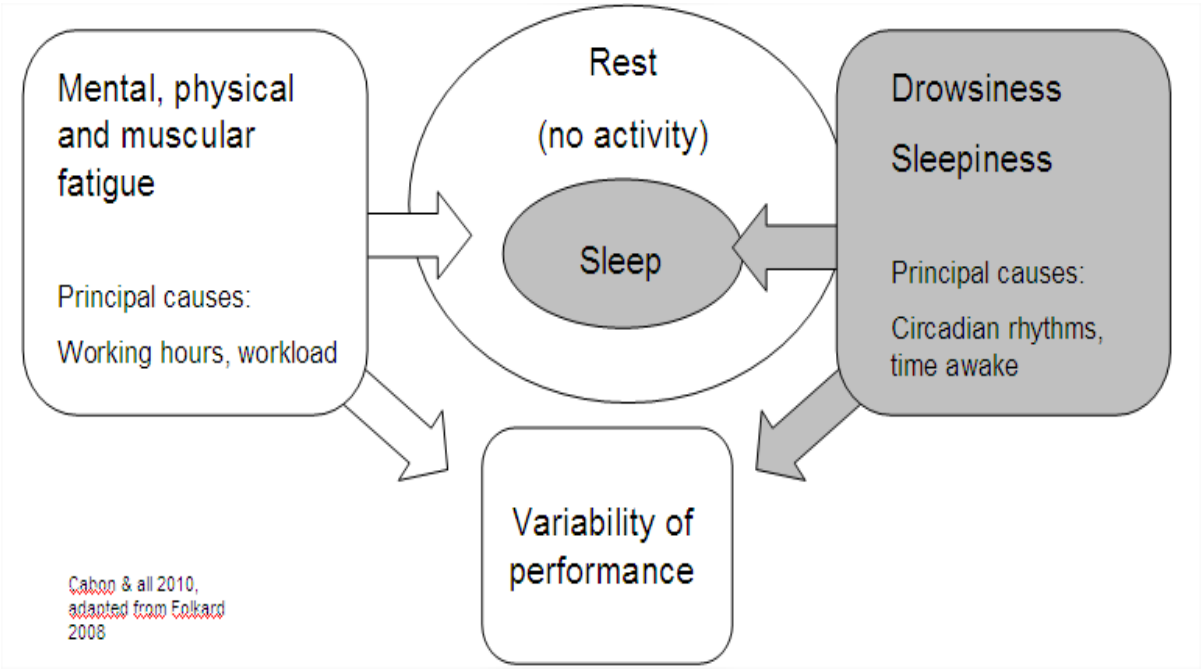


Figure 1: General definition of fatigue.

A more refined definition of fatigue is a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness and/or physical activity that can impair operational staff's alertness and ability to safely perform their tasks.

The recovery process reflects the two kinds of manifestations of fatigue:

(1) Events associated with drowsiness or tendency to sleepiness. These events are generated mainly by three processes:

(i) Process C, regulated by the circadian clock, which induces a time variation of arousal with a reduction mainly between midnight and 6 a.m.;

(ii) Process S, or Sleep pressure, which increases with the length of sleep; and

(iii) Process W, which corresponds to a state of sleep inertia (transient state of sleepiness after waking up and dissipates gradually).

The recovery process associated with drowsiness corresponds to the onset of sleep. These processes are affected by many internal factors (individual 'morning' or 'evening' type, 'small' or 'big sleeper', personal concerns) and by the external environment (ambient temperature, noise).

(2) Events like mental, physical, and muscle fatigue associated with the amplitude of work shift and workload. The recovery process is by stopping the activity.

In most situations, these two forms of fatigue coexist. However, most scientific work has concentrated on the aspects of drowsiness and fatigue. Recent developments of this work have enabled the development of tools for predicting fatigue (fatigue predictive models).

ACUTE FATIGUE VERSUS CHRONIC FATIGUE

(b) Another distinction should also be made in the manner of installation and recovery of fatigue over time:

(1) Acute fatigue, on a 24-hour scale, results from the deprivation of all or part of sleep. Depending on the extent of sleep debt, recovery occurs in one or more nights; and

(2) Chronic fatigue, across a week or a month. One recovers slowly and requires more rest for several days.

(c) Recent studies suggest that chronic fatigue can have similar effects on cognitive performance as is the case with acute fatigue. And repeated deprivation of sleep over several days leads to the same performance degradation that deprivation of a whole night sleep (Van Dongen et al., 2003).

(d) It is essential to remember that fatigue, in most cases (apart from fatigue related diseases), is a normal physiological phenomenon that is reversible and reflects a need for recovery (such as hunger, which reflects the need to eat). However, deprivation of sleep or shifts of circadian rhythms repeated over several years are likely to lead to pathological conditions under the remit of occupational medicine.

SLEEP

(e) Sleep is vital for recovery from fatigue. Two aspects of sleep are important: the amount of sleep and the quality of sleep.

(f) Two main physiological processes interact to regulate sleep:

(1) the homeostatic sleep process is evident in the pressure for slow-wave sleep that builds up across waking and discharges across sleep; and

(2) the circadian body clock regulates the timing of REM sleep and dictates the preference for sleep at night.

SHIFT WORK

(g) Shift work can be defined as any duty pattern that may require a person to be awake during the time in the circadian body clock cycle where they would normally be asleep.

(h) The ability of the circadian clock to 'lock on' to the 24-hour day/night cycle makes it resist adaptation to any pattern other than sleep at night.

(i) The fact that the circadian body clock does not adapt fully to altered sleep/wake patterns has two main consequences:

(1) duty days that overlap usual sleep times (particularly all-night shifts) tend to cause sleep restriction; and

(2) people who are working through the window of circadian low (WOCL, which is the period between 2 a.m. and 5.59 a.m. in the time zone to which one is acclimatised) can be expected to be sleepy and have to make additional effort to maintain their performance.

(j) The further sleep is displaced from the optimum part of the circadian body clock cycle, the more difficult it becomes for people to get adequate sleep. The frequency of recovery breaks (e.g. two consecutive nights of unrestricted sleep) needs to reflect the rate of accumulation of sleep debt.

REGULATORY APPROACH TO FATIGUE

(k) The traditional regulatory approach to managing fatigue has been to prescribe limits on maximum daily, monthly, and yearly working hours, and require minimum breaks within and between active operational periods. This approach reflects early understanding that long unbroken periods of work could produce fatigue (now known as 'time-on-task'

fatigue) and that sufficient time is needed to recover from work demands and to attend to non-work aspects of life.

(l) In the second half of the 20th century, scientific evidence implicating other causes of fatigue in addition to time-on-task, particularly in 24/7 operations, began accumulating. The most significant new understanding concerns:

(1) the vital importance of adequate sleep (not just rest) for restoring and maintaining all aspects of waking function; and

(2) daily rhythms in the ability to perform mental and physical work, and in sleep propensity (the ability to fall asleep and stay asleep), that are driven by the daily cycle of the circadian rhythms.

(m) In parallel, understanding of human error and its role in accident causation has increased. In complex systems such as aviation and ATM, accidents seldom result from errors made by a single human being. Typically, they result from interactions between organisational processes, workplace conditions that contribute to people committing active failures, and latent conditions that can penetrate current defences and have adverse effects on safety.

(n) Prescriptive working time limits have the advantage that they provide clear limits that help simplify decisions about the organisation of shifts. They also make it relatively easy for a competent authority to identify non-compliance. However, they represent a somewhat simplistic view of safety — being inside the limits is safe while being outside the limits is unsafe — and they represent a single defensive strategy. Indeed they do not take into account operational and organisational differences or differences among operational staff.

(o) In contrast, an SMS employs multi-layered defensive strategies to manage operational risks.

(p) An SMS represents a performance-based regulatory approach (in contrast to the prescriptive regulatory approach of working time limits). In essence, this means that SMS regulations tell ANSPs what they have to achieve in managing risk, but do not prescribe in detail exactly how they should achieve this. Such an approach has been implemented in some industries, including several airlines, in the form of a Fatigue Risk Management System (FRMS). It includes data-driven, ongoing adaptive processes that can identify fatigue hazards and then develop, implement, and evaluate controls and mitigation strategies. These include both organisational and personal mitigation strategies. However, an FRMS may incur costs and require resources which might not be proportionate to the risks of the service provided.

FATIGUE AND SAFETY

(q) Although fatigue constitutes a risk to safety in the sense of safety management systems, it does differ in some respects from other risks. Briefly, five particular properties must be considered to ensure that the fatigue risk is adequately controlled:

(1) sources of fatigue are both occupational and extra-occupational;

(2) occupational sources of fatigue are multidimensional and relate just as much to work hours as to the nature and context of the activity;

(3) there are significant individual differences in susceptibility to fatigue and ability to manage fatigue;

(4) the link between fatigue and the safety level is not linear: fatigue management strategies change according to the level of fatigue; and

(5) bearing in mind the interactions among team members, it would also seem relevant to analyse the fatigue risk for the team as a whole.

(r) Several scientific studies suggest that this relationship is not completely linear: an increase in the level of fatigue does not systematically and proportionally increase risk. Folkard and Akerstedt (2004) postulate that low levels of fatigue could create a high level of confidence in the operator which then would tend to less monitor his or her performance. People and teams assisted by the systems are likely to 'absorb' the impact of fatigue on performance.

(s) One critical element that seems to impact the relationship between fatigue and safety is the degree of awareness of his or her own fatigue (Cabon et al., 2008). Indeed, when an individual is aware of his or her fatigue, he or she tends to develop strategies to either reduce their level of fatigue or to ensure that this level of fatigue does not degrade his or her performance. Of course, these strategies are developed only for intermediate levels of fatigue.

(t) At high levels, fatigue presents a safety risk because of performance degradation (increased response times, degradation of situational awareness, deterioration in mood, reduction of communication within the team).

GM1 ATS.OR.325(c) Fatigue
TRAINING AND EDUCATION PROGRAMMES

Scientific material proposed as guidance for training and education programmes on fatigue may be found in the document 'Fatigue and Sleep Management: Personal strategies for decreasing the effects of fatigue in air traffic control' (Brussels: Human Factors Management Business Division (DAS/HUM), EUROCONTROL, 2005)[4].

GM1 ATS.OR.330(b) ATCOs' rostering system(s)
ATCOS' INVOLVEMENT

The contribution of the ATCOs, the duty periods of which will be effectively regulated by the proposed rostering system, is required in order to ensure that such rostering system is acceptable and not inducing fatigue and stress to individuals and, consequently, generating risks to the safety of the service provided. Additional guidance concerning the involvement of ATCOs in the definition of rostering systems is available at EUROCONTROL Study on Shiftwork practices — ATM and related Industries, edition 1.0 of 14/4/2006.

AMC1 ATS.OR.330(c) ATCOs' rostering system(s)
ELEMENTS AND SAFETY CRITERIA OF THE ROSTERING SYSTEM(S)

When addressing the elements of the rostering system(s), the provider of air traffic control should specify the following safety criteria:

(a) maximum consecutive working days with duties,

(b) maximum hours per duty period,

(c) maximum time providing ATC services without breaks

(d) the ratio of duty periods to breaks when providing ATC services

(e) minimum rest period,

(f) maximum consecutive ATCO duty periods encroaching the time from midnight to 5.59 a.m., if applicable depending upon the operating hours of the ATC unit concerned,

(g) minimum rest period after an ATCO duty period encroaching the time from midnight to 5.59 a.m., and

[4] This document is available at: http://www.skybrary.aero/bookshelf/books/220.pdf.

(h) minimum number of rest periods within a roster cycle.

GM ATS.TR.105(b) Working methods and operating procedures

SPECIAL AND ALTERNATIVE CONDITIONS AND OPERATING PRCEDURES FOR ATS PROVIDERS PROVIDING SERVICES TO FLIGHT TEST

(a) While flight tests are regularly conducted in compliance with the Standards and Regulation specified in ATS.TR.105 (a), some of them need to obey specific additional or alternative conditions and procedures approved by the competent authority, to meet the needs of flight tests carried out during the flight. It is also the case, for flight tests involving more than one aircraft in the same flight test. These special provisions will not jeopardise other airspace users' and over flown population's safety.

(b) In order to ensure safe operations within the provision of ATS for flight tests control, the air traffic controllers providing these services need to have specific competence in flight tests.

(c) Air traffic controllers that provide air traffic services to flight test (flight test ATCOs) need to obtain their specific competence through a dedicated training as specified in the Implementing Rule for air traffic controller.

(d) Air traffic services for flight test should be provided through dedicated and specific procedures. These procedures are described as follows:

(1) Compatibility with other airspace users

(i) In order to ensure the compatibility of the flight test with other airspace users and to ensure safe operations and an acceptable rate of success of flight test, coordinations are carried out at all management levels, including strategic, pre-tactical and real-time coordination.

(ii) ATS Units providing services to flight test are responsible for ensuring compatibility of their activities with other airspace users.

(2) Flight Plan

(i) All the necessary details related to flight tests are communicated by the design organisation or the entity wishing to carry out the flight test to air traffic services units providing services to flight tests, in the form of 'specific flight test plan' which replaces a normal flight plan.

(ii) For a test flight which is carried out with an air traffic service provider not being certified with the privilege to provide services to flight tests, before or after the flight tests phases, and under normal conditions, the need to file a normal flight plan by the design organisation or entity wishing to carry out the flight tests remains unchanged.

(3) Flight tests with impossible immediate manoeuvrability

During certain phases of the flight test, the capability to normally perform manoeuvres may only be possible after a necessary period of time, for the flight crew to get into a configuration that allows the execution of these manoeuvres.

These phases of flight and the duration if known, shall be clearly indicated in the 'specific flight test plan' and confirmed by the flight tests crew to the concerned ATS unit that providers services for the flight tests.

For the realisation of these flights, the use of a temporarily reserved area is preferred. If unable, after prior coordination with the relevant air traffic services units neighbouring the flight tests, the use of a fully operational transponder in real time is mandatory.

This real-time information does not relieve the air traffic service unit responsible for providing services to the flight tests from the obligation to ensure traffic separation and assure compatibility with all airspace users.

(e) The above procedures are not exhaustive and additional provisions may be necessary to meet the needs of flight tests. The paramount principle is anyhow to make provisions without contradicting the the Standards and Regulation specified in ATS.TR.105(a).

AMC/GM to ANNEX IV

Specific requirements for the provision of meteorological services (Part-MET)

SUBPART A — ADDITIONAL ORGANISATION REQUIREMENTS FOR THE PROVISION OF METEOROLOGICAL SERVICES (MET.OR)

GM1 MET.OR.005(b) Scope and objective of meteorological services

OTHER ENTITIES IN SCOPE OF ATM/ANS

The requirement in MET.OR.005(b) foresees the case where other entities must also be considered as users entitled to receive meteorological information. It is important to include these organisations in the list of users because they contribute to ensure safe, efficient, continuous, and sustainable ATM/ANS. However, these users are not considered providers of meteorological information.

Section 1 — General requirements

GM1 MET.OR.100 Quality of the data and information

DATA AND INFORMATION RELIABILITY

Owing to the variability of meteorological elements in space and time, to limitations of observing and forecasting techniques, and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in an observation or forecast report provides the best approximation to the actual conditions at the time of observation or the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time of occurrence or change of an element is given in a forecast, this time indicates the most probable time.

Section 2 — Specific requirements

Chapter 1 — Requirements for meteorological watch offices

GM1 MET.OR.200(a) Watch and other meteorological information

BOUNDARIES

The boundaries of the area over which meteorological watch is to be maintained by a meteorological watch office should be coincident with the boundaries of a flight information region or a control area or a combination of flight information regions and/or control areas.

GM1 MET.OR.200(e) Watch and other meteorological information

INFORMATION RECEIVED ON ACCIDENTAL RELEASE OF RADIOACTIVE MATERIALS

The information is provided by regional specialized meteorological centres (RSMCs) of the World Meteorological Organisation (WMO) for the provision of transport model products for radiological environmental emergency response, at the request of the Member State in which the radioactive material was released into the atmosphere or the International Atomic Energy Agency (IAEA). The information is sent by the RSMC to a single contact point of the provider of meteorological service in each Member State. This contact point has the responsibility of

redistributing the RSMC products within the Member State concerned. Furthermore, the information is provided by the IAEA to RSMCs co-located with the London Volcanic Ash Advisory Centre (VAAC), designated as the focal point, which in turn notifies the Area Control Centres (ACCs) concerned about the release.

AMC1 MET.OR.205(a) SIGMET
MULTIPLE FLIGHT INFORMATION REGIONS (FIR) OR CONTROL AREA (CTA)

Meteorological watch offices whose area of responsibility encompasses more than one FIR and/or CTA should provide separate SIGMET messages for each FIR and/or CTA.

AMC1 MET.OR.205(d) SIGMET
SOURCE OF SIGMET MESSAGES

SIGMET messages concerning volcanic ash clouds and tropical cyclones should be based on advisory information provided by VAACs and Tropical Cyclone Advisory Centres (TCACs), respectively.

Chapter 2 — Requirements for aerodrome meteorological offices

AMC1 MET.OR.215(a) Forecasts and other meteorological information — General
USE OF WAFC FORECASTS

Meteorological offices should use forecasts issued by WAFCs in the preparation of flight documentation, whenever these forecasts cover the intended flight path in respect of time, altitude and geographical extent.

GM1 MET.OR.215(a) Forecasts and other meteorological information — General
PREPARATION OF FORECASTS

The extent of the aerodrome meteorological office responsibilities to prepare forecasts may relate to the local availability and use of en-route and aerodrome forecast material received from other offices.

GM1 MET.OR.215(c) Forecasts and other meteorological information — General
AUTOMATIC CANCELLATION

The issue of a new forecast by an aerodrome meteorological office, such as a routine aerodrome forecast, automatically cancels any forecast of the same type previously issued for the same place and for the same period of validity or part thereof.

GM1 MET.OR.215(c) Forecasts and other meteorological information — General
TAF CONTINUOUS REVIEW GUIDANCE

Guidance on methods to keep TAF under continuous review is given in chapter 3 of the Manual of Aeronautical Meteorological Practice (ICAO Doc 8896).

GM1 MET.OR.215(d) Forecasts and other meteorological information — General
BRIEFING AND CONSULTATION,

(a) Briefing should be understood as being a preparatory information on existing and/or expected meteorological conditions.

(b) Consultation should be understood as discussion, including answers to questions with a meteorologist or another qualified person of existing and/or expected meteorological conditions relating to flight operations.

GM1 MET.OR.225 Aerodrome forecasts — landing (TREND)
RANGE OF LANDING FORECASTS

Landing forecasts are intended to meet the requirements of local users and of aircraft within about one hour's flying time from the aerodrome.

GM2 MET.OR.225 Aerodrome forecasts — landing (TREND)
TREND FORECAST

A trend forecast is understood as being a concise statement of the expected significant changes in the meteorological conditions at that aerodrome to be appended to a local routine or local special report, or a METAR or SPECI. The period of validity of a trend forecast shall be two hours from the time of the report which forms part of the landing forecast.

AMC1 MET.OR.235(b) Warnings and alerts
WIND SHEAR FOLLOW-UP

Wind shear alerts should be updated at least every minute. They should be cancelled as soon as the headwind/tailwind change falls below 7.5 m/s (15 kt).

GM1 MET.OR.235(d) Warnings and alerts
WIND SHEAR ALERTS

Wind shear alerts are expected to complement wind shear warnings and together are intended to enhance situational awareness of wind shear.

GM1 MET.OR.235(e) Warnings and alerts
CANCELLATION OF WARNINGS

The criteria for the cancellation of a wind shear warning are defined locally for each aerodrome, as agreed between the aerodrome meteorological office, the appropriate ATS units, and the operators concerned.

GM1 MET.OR.245 Notification of discrepancies to the World Area Forecast Centre (WAFC)
GUIDANCE ON REPORTING SIGNIFICANT DISCREPANCIES

Guidance on reporting significant discrepancies is provided in the Manual of Aeronautical Meteorological Practice (ICAO Doc 8896).

Chapter 3 — Requirements for meteorological stations

AMC1 MET.OR.250(a)(1) Reports and other information
ROUTINE OBSERVATIONS

Meteorological stations should make routine observations throughout the 24 hours each day.

AMC1 MET.OR.250(a)(2) Reports and other information
METAR AT AERODROMES NOT CONTINUOUSLY OPERATIONAL

At aerodromes that are not operational throughout the 24 hours, the issuance of a METAR should commence at least two hours prior to the aerodrome resuming operations, or as agreed between the Member State and the operator, to meet pre-flight and in-flight planning requirements for flights due to arrive at the aerodrome as soon as it is opened for use.

GM1 MET.OR.250(a) Reports and other information
TYPES OF METEOROLOGICAL STATIONS

(a) A meteorological station may be a separate station or may be combined with a synoptic station.

METEOROLOGICAL INSTRUMENTS

(b) Meteorological stations may include sensors installed outside the aerodrome.

AMC1 MET.OR.250(b) Reports and other information
RUNWAY VISUAL RANGE (RVR) ASSESSMENTS

RVR assessments should be representative of:

(a) the touchdown zone and the mid-point of the runway intended for Category II instrument approach and landing operations; and

(b) the touchdown zone, the mid-point, and stop-end of the runway intended for Category III instrument approach and landing operations.

AMC1 MET.OR.250(b)(3) Reports and other information
CONTENT OF THE VOLCANIC ACTIVITY REPORT

The report of occurrence of pre-eruption volcanic activity, volcanic eruptions, and volcanic ash clouds should be made in the form of a volcanic activity report comprising the following information in the order indicated:

(a) message type, VOLCANIC ACTIVITY REPORT,

(b) station identifier, location indicator or name of station,

(c) date/time of message,

(d) location of volcano and name if known, and

(e) concise description of event including, as appropriate, level of intensity of volcanic activity, occurrence of an eruption and its date and time, and the existence of a volcanic ash cloud in the area together with direction of ash cloud movement and height.

Chapter 5 — Requirements for World Area Forecast Centres

AMC1 MET.OR.265(a)(1) WAFC responsibilities
FREQUENCY OF GRIDDED GLOBAL FORECASTS

Gridded global forecasts should be prepared four times a day.

GM1 MET.OR.265(a)(1) WAFC responsibilities
GENERAL

Gridded global forecasts of cumulonimbus clouds, icing, and turbulence are currently of an experimental nature, labelled as 'trial forecasts' and only distributed through the Internet based file transfer protocol (FTP) services.

AMC/GM to ANNEX XII

Specific Requirements for ATM/ANS providers regarding personnel training and competence assessment

SUBPART A — TECHNICAL AND ENGINEERING ELECTRONIC PERSONNEL

Section 1 — Air traffic safety electronics personnel (ATSEP)
Chapter 1 — General

GM1 ATSEP.OR.005(b) Scope

AUTHORISED PERSONNEL

(a) Achievement of competence is independent of the permission to perform any task. Therefore, the ATSEP should be authorised to work on safety-related ATM/ANS systems.

(b) It is intentionally not specified who is responsible for providing this authorisation. However, this is usually done bythe ATM/ANS providers but it might be done by another entity depending on the national arrangements for managing the competence and performance of ATSEP.

OPERATE, MAINTAIN, RELEASE FROM, AND RETURN INTO OPERATIONS

(a) The term 'operate' refers to the ability of the ATSEP to actively control a system and should not be confused with, for example, the air traffic controllers' (ATCOs) function to operate particular equipment in order to provide air traffic services. However, it is necessary for ATSEP to have an understanding of how ATCOs operate or make use of *safety-related* systems, in order to repair and maintain them appropriately. An ATSEP tactically manages the engineering operation of safety-related systems, for example by:

  (1) making an radiotelephony test transmission to check a voice communication and control system or a recording system;

  (2) switching between system A and B, or switching off the stand-by system, in case of duplicated systems;

  (3) forcing an Instrument Runway Visual Range (IRVR) system into a calibration checking routine; or

  (4) changing the range and gating maps of a radar system processor.

(b) The term 'maintain' refers to planned, preventative, and corrective maintenance, including fault-finding.

(c) The term 'release from operations' refers to the process of withdrawal from use of a system/equipment from the operational environment, and 'return into operations' refers to the process whereby the system/equipment is checked and restored to operational use, both in accordance with risk assessment and mitigation.

GM1 ATSEP.OR.005(c) Scope

DESIGN OF OPERATIONAL SYSTEMS AND EQUIPMENT

Design also includes software.

COMMISSIONING OF OPERATIONAL SYSTEMS AND EQUIPMENT

The term 'commissioning' is understood to be the process by which a system/equipment, which has been installed, is tested to ensure that it works according to its design objectives or specifications, and that it is ready to be operated and maintained in accordance with users' operational requirements.

GM1 ATSEP.OR.015(a) Training and competence assessment programme
GENERAL

The training and competence assessment programme should include:

(a) training policy;

(b) description of all training activities and the interrelations between different training activities;

(c) description of the function/role of the phase/course supervisor, instructors, and assessors;

(d) description of the qualifications of instructional and competence assessment personnel;

(e) the target group of learners;

(f) description of the minimum qualification of trainees or required entry levels;

(g) description of knowledge outcome and performance objectives;

(h) record of supervisory, instructional, and competence assessment personnel participating in a course;

(i) training environment (e.g. infrastructure, equipment, etc.);

(j) training methodology (e.g. classroom instruction, self-study, computer based training (CBT), on-the-job training (OJT), etc.);

(k) training material;

(l) training schedule;

(m) competence assessment method (e.g. pre-course, on-training evaluation, post-course, etc.);

(n) record of individual learners training and competence assessment; and

(o) feedback mechanisms.

GM1 ATSEP.OR.015(b) Training and competence assessment programme
CHANGE OF ORGANISATION

When already qualified and experienced ATSEP move from one ATM/ANS provider to another, the receiving ATM/ANS provider may conduct an analysis and/or competence assessment of their previous training. Any identified training shortcomings, relative to their new duties assignments should be addressed through additional training.

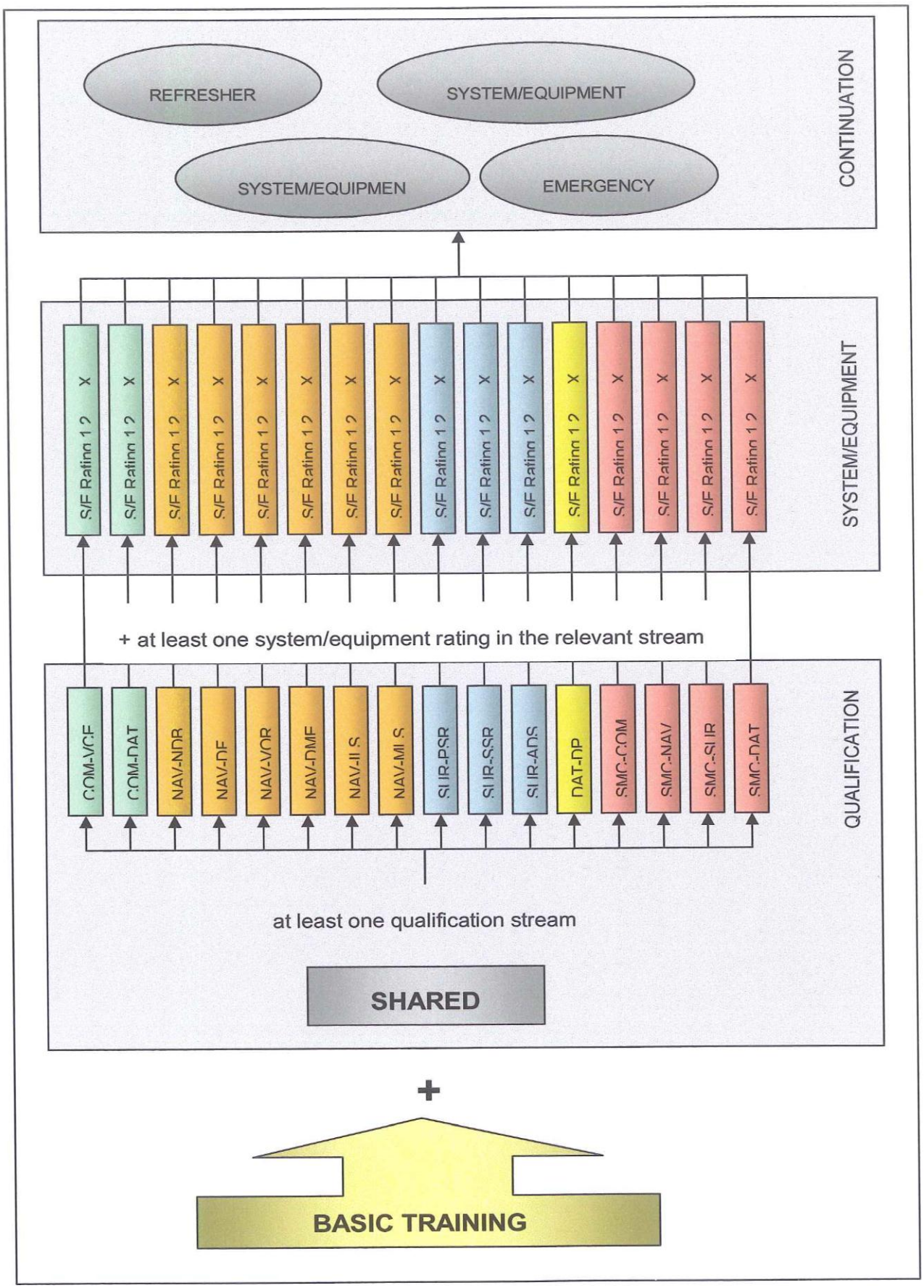
AMC1 ATSEP.OR.020 Language proficiency
DETERMINATION OF THE LANGUAGE LEVEL

ATM/ANS providers should determine the level of language proficiency based on the particular ATSEP duties and taking into account the language requirements related to operating instructions, manuals, and the need to communicate across operational boundaries that require a common language.

Chapter 2 — Training requirements

GM1 ATSEP.OR.100 Training requirements — General
ATSEP TRAINING PHASES

The following diagram illustrates the phases of ATSEP training:


CONTINUATION
REFRESHER
SYSTEM/EQUIPMENT
SYSTEM/EQUIPMEN
EMERGENCY
SYSTEM/EQUIPMENT
+ at least one system/equipment rating in the relevant stream
QUALIFICATION
at least one qualification stream
SHARED
+
BASIC TRAINING

GM1 ATSEP.OR.100(a) Training requirements — General
BASIC TRAINING

For the purpose of this section, 'basic training' is understood as being training designed to impart fundamental knowledge of the ATM/ANS environment.

QUALIFICATION TRAINING

For the purpose of this section, 'qualification training' is understood as being training designed to impart knowledge and skills appropriate to the qualification stream to be pursued in the ATM/ANS environment.

CONTINUATION TRAINING

For the purpose of this section, 'continuation training' is understood as being training designed to maintain and/or augment existing knowledge and skills related to the ATSEP assigned responsibilities and duties.

AMC1 ATSEP.OR.105(a)(1) Basic training

The Acceptable Means of Compliance associated to this rule can be found in Appendix 1a to Annex XII.

AMC1 ATSEP.OR.105(a)(2) Basic training

The Acceptable Means of Compliance associated to this rule can be found in Appendix 2a to Annex XII.

GM1 ATSEP.OR.105(b) Basic training
ENTRY LEVEL

In some instances, only a limited number of training objectives will need to be taught to learner ATSEPs. This is usually the case when the entry level of learners includes some form of previous qualification (e.g. engineering degree or diploma). In this instance, the length of training and the number of objectives taught during the basic (and qualification) training may be less than that of a course directed at learners who have little or no engineering or technical qualifications. If no engineering or technical qualifications are required prior to starting the basic training, then it may be necessary to include additional objectives in the training that will prepare learners to deal with the basic (and qualification) training.

GM1 ATSEP.OR.105 Basic training and GM1 ATSEP.OR.110 Qualification training
MINIMUM TRAINING

The basic and qualification training contained within the requirement is the minimum training that needs to be followed by all who aim at becoming ATSEP. However, ATM/ANS providers may decide to add additional subjects or topics that may be specific to their national or local environment. For example, ground handling, special working conditions, project management, etc.

COMPOSITION OF COURSES

(a) Basic training may be provided as a stand-alone course or as part of a larger initial training course (i.e. basic plus qualification training).

(b) Qualification training may be provided as a stand-alone course(s) or as part of a larger course.

AMC1 ATSEP.OR.110 Qualification training

The Acceptable Means of Compliance associated to this rule can be found in Appendix 3a to Annex XI.

AMC1 ATSEP.OR.110(a) Qualification training

The Acceptable Means of Compliance associated to this rule can be found in Appendix 4a to Annex XI.

GM1 ATSEP.OR.110(a) Qualification training
STREAMS

For the purpose of this section, 'streams' is understood as being a cluster of training objectives that support a particular area of work.

GM1 ATSEP.OR.110(a) Qualification training
SYSTEM MONITORING AND CONTROL (SMC)

(a) There are two recognised routes to achieving SMC competence. Organisations may choose which route is most appropriate for their environment.

(b) Both SMC competence routes may be used by individuals and/or ATM/ANS providers at different times during their careers.

(c) In some organisations, system monitoring and control of operational ATM/ANS system and equipment tasks are performed after initial competence in a stream or collection of streams that make up a domain (e.g. the Communication domain comprises of the COMMUNICATION-VOICE and COMMUNICATION-DATA streams) has been achieved and appropriate SMC development training has been completed. This route is considered to be the development route to SMC competence. The objectives contained within the four Qualification training SMC stream(s) may be completed as part of this development training.

(d) The alternative option, used by some organisations, is to provide training for SMC duties directly after basic training. This is based on an arrangement where SMC operators perform level A tasks. If level B tasks are required, these are performed under supervision or are delegated to appropriately qualified personnel. This route is considered to be the direct route to SMC competence, and the four Qualification training streams relating to SMC apply, such as, for instance, SMC Communication, SMC Navigation, SMC Surveillance and/or SMC Data. To start S/E rating training on level A tasks for the monitored and/or controlled S/E, no additional qualification training stream (e.g. QUAL NAV-VOR) is required because the relevant information is contained in the related SMC qualification training stream(s) already.

(e) Level tasks represent the categorisation by complexity, knowledge, skills and operational impact. Three categories will usually suffice but could be further subdivided for highly complex or diverse systems:

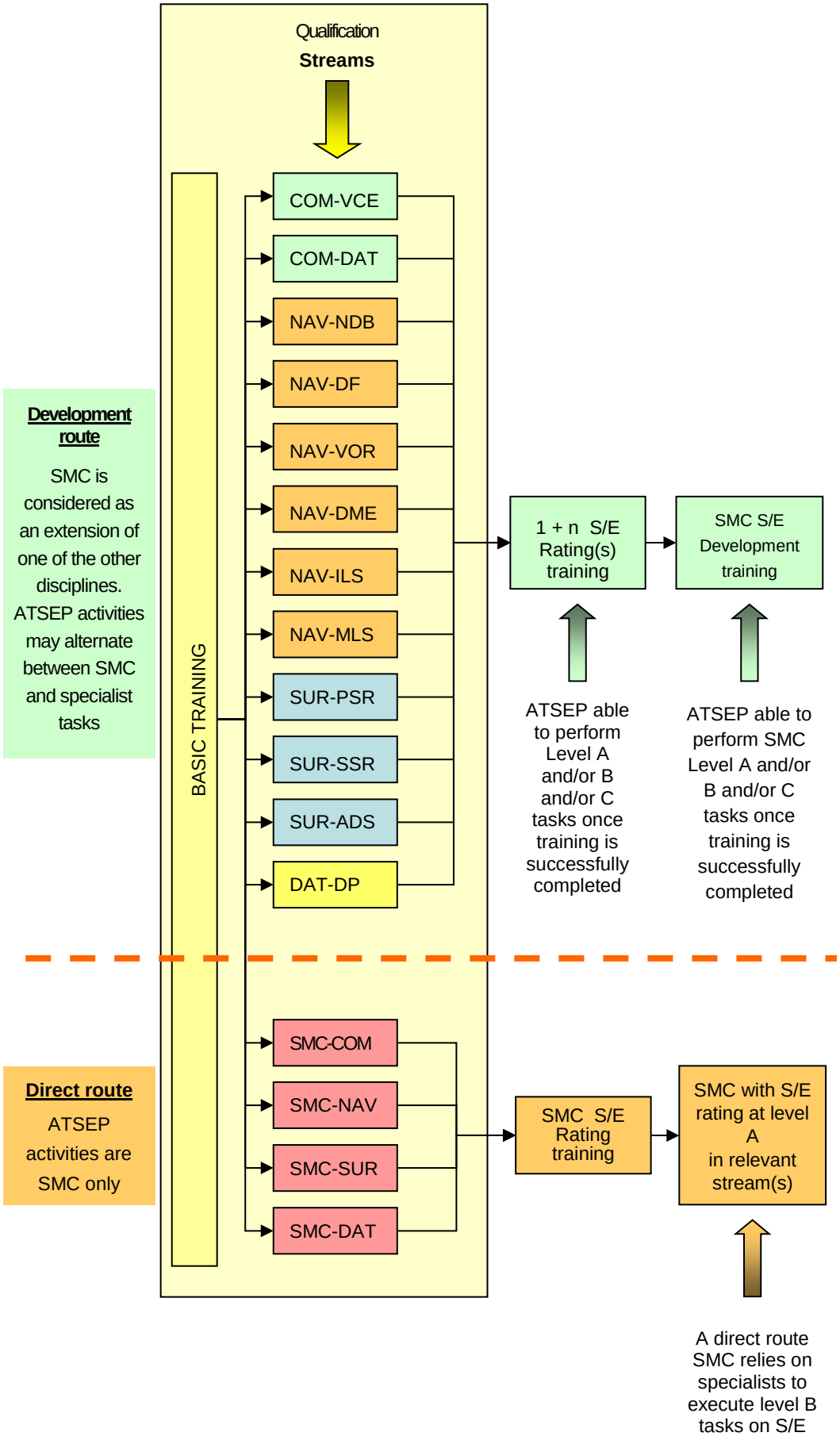
(1) Level A tasks: Level A maintenance tasks are primarily associated with immediate service restoration or reconfiguration ('front-panel level'). They are appropriate for personnel that have been trained to understand the elements of an equipment or system(s), their interrelationships, and functional purpose, but do not require in-depth knowledge of these elements.

(2) Level B tasks: Level B maintenance tasks involve in-depth fault analysis at the system/equipment level ('functional level'). They are usually carried out by

personnel that have been trained for the more complicated maintenance tasks on the equipment/system.

(3) Level C tasks: Level C maintenance tasks involve the detailed diagnosis of a software problem, of a faulty Line Replacement Unit (LRU), Printed Circuit Board (PCB) or module ('component level'). They usually require the use of automated test equipment at a suitable location and are usually carried out by personnel that have been trained in detailed fault diagnosis and repair techniques. If a Level C task is carried out in an offline environment (e.g. a workshop), it is not mandatory that the personnel carrying out this task is trained as ATSEP. However, an organisation may choose to train that personnel as ATSEP.

(f) The diagram below illustrates the SMC competence routes.


Qualification
Streams
BASIC TRAINING
COM-VCE
COM-DAT
NAV-NDB
NAV-DF
NAV-VOR
NAV-DME
NAV-ILS
NAV-MLS
SUR-PSR
SUR-SSR
SUR-ADS
DAT-DP
SMC-COM
SMC-NAV
SMC-SUR
SMC-DAT
Development route
SMC is considered as an extension of one of the other disciplines. ATSEP activities may alternate between SMC and specialist tasks
Direct route
ATSEP activities are SMC only
1 + n S/E Rating(s) training
SMC S/E Development training
ATSEP able to perform Level A and/or B and/or C tasks once training is successfully completed
ATSEP able to perform SMC Level A and/or B and/or C tasks once training is successfully completed
SMC S/E Rating training
SMC with S/E rating at level A in relevant stream(s)
A direct route SMC relies on specialists to execute level B tasks on S/E

GM1 ATSEP.OR.115 System and equipment rating training
RATING

The term 'rating' in the definition of 'system/equipment rating training' should not be associated with the definition of 'rating' in Regulation (EC) No 216/2008.

AMC1 ATSEP.OR.120 Continuation training
GENERAL

The frequency and duration of continuation training should be determined by taking into account the ATSEP task exposure (recency) as well as the complexity of the operation and of the maintenance of ATM/ANS systems.

GM1 ATSEP.OR.120 Continuation training
REFRESHER TRAINING

(a) For the purpose of this section, 'refresher training' is understood as being training designed to review, reinforce or upgrade existing knowledge and skills (including team skills).

(b) Refresher training may periodically include training to refresh and augment ATSEP team skills. Team skills include, but are not limited to communication, negotiation, decision-making, conflict resolution, and listening skills.

EMERGENCY TRAINING

(a) 'Emergency training' is understood as being training designed to broaden knowledge, skills, and behaviour in case of emergency, unusual or degraded situation. Most of the training will be site-specific or may make use of incident or accident analysis.

(b) The term 'emergency' is considered as a serious, unexpected, and/or potentially dangerous situation requiring immediate action(s), e.g. complete loss of any of the following — radar display picture; Electronic Flight Progress Strip system; loss of main, standby and emergency communications on multiple frequencies due to external interference blocking the radiotelephony channels.

(c) The term 'unusual situation' is considered as a set of circumstances which are neither habitually nor commonly experienced and for which an ATSEP has not developed a practiced response.

(d) The term 'degraded situation' is considered as a situation that is the result of a technical system failure or malfunction or a set of circumstances arising from human error or violation of rules affecting the quality of the service provided (i.e. the service continues to be available, even though in a reduced or limited way). For instance, external mains supply failure to a Category III ILS localiser field site cabin or a normally dual channel DME having a fault on one channel.

Chapter 3 — Competence assessment requirements

GM1 ATSEP.OR.125(a) Competence assessment — General

COMPETENT

'Competent' is understood as a situation where ATSEP possess the required level of knowledge, technical and behavioural skills and experience, and language proficiency when required, to permit the safe and efficient provision of ATM/ANS services.

GM1 ATSEP.OR.130(a)(1) Assessment of initial and ongoing competence

INITIAL COMPETENCE ASSESSMENT

If the competence assessment is done by the same person training the ATSEP learner during the S/E equipment training phase, the SP should have in place a process to reduce biases.

GM1 ATSEP.OR.130(a)(3) Assessment of initial and ongoing competence

SUPERVISION OF NON-COMPETENT PERSONNEL

Supervision of personnel for lack of competence may be necessary due to a number of circumstances including, but not restricted to:

(a) the ATSEP still being trained;

(b) the ATSEP undergoing remedial training due to loss of competence; and

(c) the ATSEP having lost competence due to extended absence from tasks that require competence.

GM1 ATSEP.OR.130(b)(2) Assessment of initial and ongoing competence

BEHAVIOURAL SKILLS

Behavioural skills are the so called 'soft skills' and attitudes that ATSEP need to perform effectively. Examples of potential behavioural skills criteria related to initial and ongoing competence are:

(a) cooperation within a team;

(b) attitudes towards safety and security;

(c) intercultural competence;

(d) flexibility;

(e) analytical thinking; and

(f) ability to communicate effectively.

Chapter 4 — Instructors and assessors

AMC1 ATSEP.OR.140 Technical skills assessors

SUITABLE

To be considered suitable, technical skills assessors should:

(a) have clear understanding of the SP's assessment process and procedures applicable;

(b) have clear understanding of the performance required of the ATSEP during the assessment and/or ongoing assessment;

(c) have the ability to evaluate, in an objective and independent manner, whether the ATSEP has achieved or is maintaining the level of performance required;

(d) have the ability to assess and, if required, act when intervention is necessary to ensure that safety is not compromised;

(e) have the ability to analyse and accurately describe and/or record strengths and weaknesses of an ATSEP performance; and

(f) use appropriate interpersonal and communication skills to brief and debrief an ATSEP, if required.

GM1 ATSEP.OR.140 Technical skills assessors

GENERAL

The technical skills assessor is the person who is considered suitable to determine whether an ATSEP is technically competent to operate, maintain, release from, and return into operations safety-related ATM/ANS systems. This assessment may be in any context where assessment of technical skills is required, e.g. assessment of first competence, ongoing competence.

GM2 ATSEP.OR.140 Technical skills assessors

ASSESSMENT RESPONSIBILITIES

(a) Where a technical skills assessor works regularly with an ATSEP, he/she is required to assess the ATSEP. Continuous assessment may be appropriate, i.e. assessment may be achieved by the technical assessor observing the standard of an ATSEP's work on a continuous basis as he/she works with the ATSEP during normal operational duties.

(b) If the appointed technical assessor also acts as line manager to the individual ATSEP, the SP should have in place a process to reduce biases. Responsibility for determining competence lies with the person having the safety accountability for the ATSEP function.

APPENDIX 1a to ANNEX XII

SUBPART A — TECHNICAL AND ENGINEERING ELECTRONIC PERSONNEL

Section 1 — Air Traffic Safety Electronics Personnel

AMC to ATSEP.OR.105(a)(1)

Basic training

AMC1 ATSEP.OR.105(a)(1) Basic training

1. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **Training and Assessment Overview** course:

1.1.1	Describe the training scheme and progression towards ATSEP competence	2	Initial (Basic and Qualification), S/E Rating and Continuation training. Course aims, objectives, and topics
1.1.2	State the assessment requirements, procedures, and methods	1	—

2. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **National Organisation** course:

1.2.1	Describe the organisational structure, purpose and functions of the national ATM/ANS provider(s) and regulatory structures	2	*Optional content: headquarters, control centres, training facilities, airports, outstations, civil/military interfaces, regulatory interfaces*
1.2.2	Describe the structure and functions of the major departments within the national organisation	2	*Optional content: organisational handbook (plans, concepts and structure, finance model)*
1.2.3	State appropriate accountabilities and responsibilities of the ATM/ANS provider(s) and competent authority	1	—

3. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **Workplace** course:

1.3.1	State the role of trade unions and professional organisations	1	*Optional content: international, European, national, local level*
1.3.2	Consider security of site facilities and personnel against unlawful interference	2	Environmental, physical and information security measures, employee vetting, and reference checks

			Optional content: Annex 1 to Commission Implementing Regulation (EU) No 1035/2011[5]
1.3.3	Describe actions when suspecting a security breach	2	*Optional content: inform police, security agencies and managers. Security manual and/or contingency plan.*

4. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objective should be included in the **ATSEP Role** course:

1.4.1	Describe the key responsibilities of an ATSEP	2	Initial (Basic and Qualification), S/E Rating and Continuation training. Course aims, objectives, and topics

5. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **European/Worldwide Dimension** course:

1.5.1	Explain the relationship between States and its relevance to ATM operations	2	*Optional content: harmonisation, flow management, bilateral agreement, sharing of ATM relevant data, major studies, research programmes, and policy documents*
1.5.2	Define the regulatory framework of international and national ATM	1	*Optional content: ICAO, European and national concepts, responsibilities*
1.5.3	State the purpose of a range of international bodies	1	ICAO, EU, EASA *Optional content: ECAC, EUROCONTROL, FAA RTCA, EUROCAE*

6. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **International Standards and Recommended Practices** course:

1.6.1	Explain how ICAO notifies and implements legislation	2	Annexes, SARPS
1.6.2	State which major/key ATM engineering 'standards' and 'practices' are applicable	1	*Optional content: ICAO Annex 10, ICAO Doc 8071, ICAO Doc 9426-3, available EUROCONTROL standards, guidance material on reliability, maintainability and availability*

7. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **Data Security** course:

1.7.1	Explain the importance of ATM	2	*Optional content: Commission Implementing*

[5] Commission Implementing Regulation (EU) No 1035/2011 of 17 October 2011 laying down common requirements for the provision of air navigation services and amending Regulations (EC) No 482/2008 and (EU) No 691/2010 (OJ L 18.10.2011, p. 271).

	Security		*Regulation (EU) No 1035/2011*
1.7.2	Describe the security of operational data	2	Secure, restricted access by authorised personnel
1.7.3	Explain security policies and practices for information and data	2	Backup, storing, hacking, confidentiality, copyright
1.7.4	Describe the possible external interventions which may interrupt or corrupt ATM services	2	Introduction of software viruses, illegal broadcasts, jamming, spoofing

8. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objectives should be included in the **Quality Management** course:

1.8.1	Explain the need for quality management	2	*Optional content: ISO, EFQM*
1.8.2	Explain the need for configuration management	2	Importance for safe operations *Optional content: S/E build state, software adaption/version*

9. SUBJECT 1: INDUCTION — TOPIC 1: BASIND

The following objective should be included in the **Safety Management System** course:

1.9.1	Explain why there is a need for high level safety requirements for aeronautical activities	2	Safety policy and rules, system safety cases, system safety requirements *Optional content: Commission Implementing Regulation (EU) No 1035/2011*

10. SUBJECT 1: INDUCTION — TOPIC 1: **Basic training**

1. SUBJECT 2: AIR TRAFFIC FAMILIARISATION — TOPIC 1: BASATF

The following objectives should be included in the **Air Traffic Familiarisation** course:

1.1.1	Define Air Traffic Management	1	ICAO
1.1.2	Describe operational ATM functions	2	ATFCM, ATS, ASM
1.1.3	Describe ATM concepts and associated terminology	2	*Optional content* *Concepts: FUA, free flight, gate-to-gate, performance-based ATM operations (PBN, RCP), operational concepts (ICAO, EUROCONTROL, SESAR)* *Terminology: glossary*
1.1.4	Explain the operational importance of technical services required for ATM	2	*Optional content: Regulation (EC) No 552/2004*

1.1.5	State future developments in systems and/or ATM/ANS practices which may impact on services provided	1	*Optional content: datalink, satellite-based navigation, gate-to-gate (CDM), ATC tools, continuous approach, 4D trajectory, business trajectory, SWIM, NOP, SESAR (UDPP, modes of separation), ASAS*
1.1.6	List the standard units of measurement used in aviation	1	Speed, distance, vertical distance, time, direction, pressure, temperature

2. SUBJECT 2: AIR TRAFFIC FAMILIARISATION — TOPIC 1: BASATF

The following objectives should be included in the **Air Traffic Control** course:

1.2.1	Define airspace organisation	1	ICAO Annex 11 *Optional content: FIR, UTA, TMA, CTR, ATS routes*
1.2.2	Describe commonly used airspace terminologies and concepts	2	*Optional content: sectorisation, identification of ATS routes, restricted airspace, significant points*
1.2.3	State the general organisation of aerodromes	1	*Optional content: obstacle limitation surfaces, different departure and arrival trajectories, approach and landing categories, operational status of radio navigation aids*
1.2.4	State the purpose of ATC	1	ICAO Doc 4444
1.2.5	State the organisation of ATC services	1	ICAO Doc 4444 *Optional content: area, approach, aerodrome control services*

3. SUBJECT 2: AIR TRAFFIC FAMILIARISATION — TOPIC 1: BASATF

The following objective should be included in the **Ground-Based Safety Nets** course:

1.3.1	Describe the purpose of ground-based safety nets	2	*Optional content: STCA, MSAW, APW, runway incursion alerts*

4. SUBJECT 2: AIR TRAFFIC FAMILIARISATION — TOPIC 1: BASATF

The following objective should be included in the **Air Traffic Control Tools and Monitoring Aids** course:

1.4.1	Explain the main characteristics and use of ATC support and monitoring tools	2	*Optional content: MTCD, sequencing and metering tools (AMAN, DMAN), A-SMGCS, CLAM, RAM, CORA*

5. SUBJECT 2: AIR TRAFFIC FAMILIARISATION — TOPIC 1: BASATF

The following objectives should be included in the **Familiarisation** course:

1.5.1	Take account of ATC tasks	2	*Optional content: simulation, role play, PC, Part Task Trainer, observations in the operational environment*
1.5.2	Explain the need for good communication, coordination and cooperation between operational staff	1	*Optional content: handovers, MIL/CIV, planner/tactical, SV Tech (SMC) and SV ATCO, site visit(s) to ATC units*
1.5.3	Consider the purpose, function and role of various operational stations in respect to ATM related operations	2	*Optional content: meteorological providers, remote sites, airport operations*
1.5.4	Define the phases of flight	1	Take-off, climb, cruise, descent and initial approach, final approach and landing
1.5.5	Recognise the cockpit environment and associated equipment, in relation to ATC	1	Relevant pilot HMI *Optional content: familiarisation flight or cockpit simulator training (where practicable), antenna*
1.5.6	Define airborne collision avoidance systems	1	ACAS, EGPWS *Optional content: TCAS*

APPENDIX 2a to ANNEX XII

SUBPART A — TECHNICAL AND ENGINEERING ELECTRONIC PERSONNEL

Section 1 — Air Traffic Safety Electronics Personnel

AMC to ATSEP.OR.105(a)(2)

Basic training

AMC3 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 3: AERONAUTICAL INFORMATION SERVICES (AIS) — TOPIC 1: BASAIS

The following objectives should be included in the **Aeronautical Information Service** course:

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

AMC4 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 4: METEOROLOGY — TOPIC 1: BASMET

The following objectives should be included in the **Introduction to Meteorology** course:

1.1.1	State the relevance of	1	Influence on the operation of aircraft,

	meteorology in aviation		flying conditions, aerodrome conditions
1.1.2	State the weather prediction and measurement systems available	1	—

2. SUBJECT 4: METEOROLOGY — TOPIC 1: BASMET

The following objectives should be included in the **Impact on Aircraft and ATS Operation** course:

1.2.1	State the meteorological conditions and their impact on aircraft operations	1	*Optional content: atmospheric circulation, wind, visibility, temperature/humidity, clouds, precipitation*
1.2.2	State the meteorological conditions hazardous to aircraft operations	1	*Optional content: turbulence, thunderstorms, icing, microbursts, squall, macro bursts, wind shear, standing water on runways (aquaplaning)*
1.2.3	Explain the impact of meteorological conditions and hazards on ATS operations	2	*Optional content: effects on equipment performance (e.g. temperature inversion, rain density), increased vertical and horizontal separation, low visibility procedures, anticipation of flights not adhering to tracks, diversions, missed approaches*
1.2.4	Explain the effects of weather on propagation		—

3. SUBJECT 4: METEOROLOGY — TOPIC 1: BASMET

The following objectives should be included in the **Meteorological Parameters and Information** course:

1.3.1	List the main meteorological parameters	1	Wind, visibility, temperature, pressure, humidity
1.3.2	List the most common weather messages and broadcasts used in aviation	1	*Optional content:* *ICAO Annex 3* *Meteorology messages: TAF, METAR, SNOWTAM* *Broadcasts: ATIS/flight meteorology broadcast (VOLMET)*

4. SUBJECT 4: METEOROLOGY — TOPIC 1: BASMET

The following objective should be included in the **Meteorological Systems** course:

1.4.1	Explain the basic principles of the main meteorological systems in use	2	*Optional content: weather display and information systems, wind speed (anemometer), wind direction (weather vane), visibility (types of IRVR, forward scatter), temperature probes, pressure (aneroid barometers), humidity, cloud base*

			(laser ceilometers)

AMC5 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 5: COMMUNICATION — TOPIC 1: BASCOM

The following objectives should be included in the **Introduction to Communications** course:

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

2. SUBJECT 5: COMMUNICATION — TOPIC 2: BASCOM

The following objectives should be included in the **Introduction to Voice Communications** course:

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

2.1.9	State the purpose of ATIS and VOLMET	1	—

3. SUBJECT 5: COMMUNICATION — TOPIC 2: BASCOM

The following objectives should be included in the **Air-Ground Communication** course:

2.2.1	State the functions and basic operation of routing and switching equipment in use in the ATS environment	1	Voice switching
2.2.2	Describe the purpose and operation of the elements of a communication chain in use in the ATS environment	2	Functionality, emergency systems, transmission/reception, CWP, on-board equipment *Optional content: channel spacing, antenna switching, CLIMAX, voting systems*
2.2.3	State ways of achieving quality of service	1	*Optional content: importance of coverage and redundancy of equipment, overlapping coverage, backup system, functional redundancy vs element redundancy*
2.2.4	Recognise the elements of the CWP that are used for air-ground communication	1	Frequency selection, emergency, station selection, coupling, microphone, headset, loudspeaker, footswitch, PTT
2.2.5	List future developments and techniques which may have an impact on ATS voice communications	1	*Optional content: CPDLC, VDL Modes 2*

4. SUBJECT 5: COMMUNICATION — TOPIC 2: BASCOM

The following objectives should be included in the **Ground-Ground Communication** course:

2.3.1	State the functions and the basic operations of routing and switching equipment in use in ATS environment	1	General architecture
2.3.2	Describe how ground-ground systems interface to provide an integrated service to ATS environment	2	International/national links, ACC interoperability, voice and data integration
2.3.3	Describe the purpose and operation of the elements of a system	2	Functionality, emergency systems, PTT interfaces *Optional content: MFC and ATS-Qsig, switching, local PABX equipment*
2.3.4	Recognise the elements of the CWP used for ground-ground	1	Selection, emergency, loudspeaker, headset, microphone

	communication		
2.3.5	List developments in ground-ground technologies which may impact on ATS voice communication	1	*Optional content: protocols (TCP/IP, voice-over IP) future development*

5. SUBJECT 5: COMMUNICATION — TOPIC 3: BASCOM

The following objectives should be included in the **Introduction to Data Communications** course:

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

6. SUBJECT 5: COMMUNICATION — TOPIC 3: BASCOM

The following objectives should be included in the **Networks** course:

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

7. SUBJECT 5: COMMUNICATION — TOPIC 3: BASCOM

The following objectives should be included in the **Aviation Specific Networks, Applications and ATM/ANS Providers** course:

3.3.1	Name a range of air-ground aviation related network concepts	2	ATN *Optional content* *Subnetworks: ATN air-ground subnetwork, AMSS, VDL, HFDL*

			Protocols: ACARS *Communication service providers: ARINC, SITA, States, LINK16*
3.3.2	Name a range of ground-ground aviation related network concepts	2	ATN, PENS *Optional content* *Physical networks: PENS, AFTN/CIDIN, RAPNET* *Communication protocols: IP, X.25, ASTERIX, FMTP* *Communication service providers: SITA, ARINC, national carriers, ANSPs* *Applications: AMHS, AIDC, OLDI*

AMC6 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 6: NAVIGATION — TOPIC 1: BASNAV

The following objectives should be included in the **Purpose and Use of Navigation** course:

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

2. SUBJECT 6: NAVIGATION — TOPIC 2: BASNAV

The following objectives should be included in the **Form of the Earth** course:

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

3. SUBJECT 6: NAVIGATION — TOPIC 2: BASNAV

The following objectives should be included in the **Coordinate Systems, Direction and Distance** course:

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

4. SUBJECT 6: NAVIGATION — TOPIC 2: BASNAV

The following objective should be included in the **Earth's Magnetism** course:

2.3.1	State the general principles of Earth's magnetism	1	True North, magnetic North *Optional content: variation, declination, deviation, inclination*

5. SUBJECT 6 NAVIGATION — TOPIC 3 BASNAV

The following objective should be included in the **Factors Affecting Electronic Navigation Performance** course:

3.1.1	State how radio waves propagate	1	Ground, sky, direct

6. SUBJECT 6: NAVIGATION — TOPIC 3: BASNAV

The following objectives should be included in the **Performance of Navigation Systems** course:

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

7. SUBJECT 6: NAVIGATION — TOPIC 3: BASNAV

The following objective should be included in the **Means of Navigation** course:

3.3.1	State the different means of navigation	1	Sole, primary, supplementary

8. SUBJECT 6 NAVIGATION — TOPIC 4 BASNAV

The following objectives should be included in the **Terrestrial Navigation Aids** course:

4.1.1	Explain the basic working principles of electronic positioning	2	Distance measurements (time and phase), angular measurements
4.1.2	Describe ground-based navigation systems	2	NDB, VOR, DME, ILS, DF, MLS *Optional content: Loran C, MLS, TACAN, marker beacons*
4.1.3	Recognise how the navigation information is displayed on the relevant pilot HMI	1	
4.1.4	Explain the operational use of ground-based navigation systems in the different phases of flight	2	NDB, VOR, DME, ILS, DF, MLS

4.1.5	Recognise the frequency bands used by the ground-based navigation systems	1	
4.1.6	State the need for calibration	1	Flight calibration, ground-based calibration and/or maintenance

9. SUBJECT 6: NAVIGATION — TOPIC 4: BASNAV

The following objective should be included in the **On-Board Navigation Systems** course:

4.2.1	State the use of on-board navigation systems	1	*Optional content: barometric altimetry, radio altimetry, INS/IRS, compass*

10. SUBJECT 6: NAVIGATION — TOPIC 4: BASNAV

The following objectives should be included in the **Space-Based Navigation Systems** course:

4.3.1	Explain the basic working principles of satellite positioning	2	GPS *Optional content: Galileo*
4.3.2	Recognise the basic architecture of a core satellite positioning system	1	GPS *Optional content: Galileo*
4.3.3	Recognise the frequency bands used by the space-based navigational systems	1	—
4.3.4	State the benefits of satellite-based navigation	1	Global coverage, accuracy, time dissemination *Optional content: redundancy, interoperability, single set of avionics*
4.3.5	State the current limitations of space-based navigation systems	1	*Optional content: single frequency, weak signal, ionospheric delay, institutional, military, multipath*
4.3.6	State the basic working principles of satellite augmentation	1	*Optional content: ABAS (RAIM, AAIM), SBAS (WAAS, EGNOS), GBAS (GRAS, S-CAT 1)*
4.3.7	State the current implementations of satellite-based navigation systems	1	GPS, GLONASS, GALILEO and augmentations *Optional content: ABAS, GBAS, SBAS*

11. SUBJECT 6: NAVIGATION — TOPIC 5: BASNAV

The following objectives should be included in the **PBN** course:

5.1.1	Describe the basic principle of area navigation	2	ICAO RNAV definition and PBN concept Conventional and area navigation *Optional content: navigation computer and FMS functionality*
5.1.2	List the navigation applications in	1	B-RNAV, P-RNAV, RNP approaches

	use in Europe		

8. SUBJECT 6: NAVIGATION — TOPIC 5: BASNAV

The following objective should be included in the **Future Developments** course:

5.2.1	State future navigation developments	2	*Optional content: 4D-RNAV, free routes, rationalisation plans, advanced RNP1*

AMC7 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Introduction to Surveillance** course:

1.1.1	Define surveillance in the context of ATM	1	What (positioning/identification) and why (maintain separation)
1.1.2	Define the various surveillance domains	1	Air-air, ground-air, ground-ground
1.1.3	List the surveillance techniques	1	Non-cooperative, cooperative, dependent, independent techniques
1.1.4	Define the current and emerging surveillance systems in use in ATM	1	Radar technology, ADS technology, multilateration, TIS
1.1.5	Explain the role and the current use of surveillance equipment by ATM	2	Separation, vectoring, data acquistion Detection and ranging, safety nets *Optional content: weather mapping*
1.1.6	State ICAO and any local legal requirements	1	*Optional content: ICAO SARPS, Annex 10 Vol. IV*
1.1.7	List the main users of surveillance data	1	HMI, Safety Nets, FDPS, Air Defence Systems, Flow Management

2. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Avionics** course:

1.2.1	State the avionics used for the surveillance in ATM and their interdependencies	1	Transponder, GNSS, datalink equipment, ACAS, ATC control panel
1.2.2	Define the role of TCAS as a safety net	1	*Optional content: FMS*

3. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Primary Radar** course:

1.3.1	Describe the need for and the use	2	Non-cooperative detection, improvement

	of primary radar in ATC		of detection and tracking *Optional content: types of PSR (en-route, terminal, SMR, weather)*
1.3.2	Explain the principles of operation, basic elements and overall architecture of a primary radar	2	Detection, range measurement, azimuth indication Doppler Shift Antenna system, TX/RX, signal processing, plot extraction, local tracking, data transmission *Optional content: use of the parameters of the radar equation*
1.3.3	State the limitations of primary radar	1	Line of sight, environmental, clutter, no identification of the target, no height information (in case of 2D radar)

4. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Secondary Radars** course:

1.4.1	Describe needs for and the use of secondary radar in ATC	2	Cooperative detection, ICAO-defined standard, IFF, Military and Civil Modes (include Mode S) and related code protocols, code limitations *Optional content: identification, SPI, flight level, BDS, specific and emergency codes*
1.4.2	Explain the principles of operation, basic elements and overall architecture of a secondary radar	2	SSR, MSSR, Mode S Antenna, TX/RX, extractor, tracking processor *Optional content: use of the parameters of the radar equations*
1.4.3	State the limitations of secondary radar	1	FRUIT, garbling, ghost reply, code shortage, cooperation by the aircraft needed

5. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Surveillance Data Message Format** course:

1.5.1	State the need for harmonisation	1	Surveillance data sharing, interoperability
1.5.2	State the techniques used for transmission of surveillance data	1	*Optional content: point-to-point, network, microwave, satellite*
1.5.3	State main formats in use	1	ASTERIX, etc.

6. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Automatic Dependent Surveillance (ADS)** course:

1.6.1	State surveillance-related FANS	1	Sources of aircraft parameters (e.g. FMS

	concepts and their impact on ATM		outputs), communication mediums Application within oceanic and other non-radar airspace, ATC requirements
1.6.2	Explain the principles of operation, basic elements and overall architecture of ADS-C and ADS-B and the differences between them	2	Advantages/disadvantages, standards, data update rates
1.6.3	State the datalink technologies proposed and the current situation of deployment	1	Extended squitter 1090 MHz *Optional content: VDL 4, HFDL,UAT, AMSS*

7. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objective should be included in the **Weather Radar** course:

	Define the use of weather radar in ATM	1	*Optional content: role in adverse weather in dense airspace, antenna, coverage, polarisation, multielevation scanning, frequency band*

8. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objective should be included in the **Integration of Surveillance Information** course:

1.8.1	Describe complementary use of different sensors	2	

9. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Multilateration** course:

1.9.1	State the use of MLAT in ATC	1	LAM and WAM
1.9.2	Explain the principles of operation, basic elements and overall architecture of MLAT	1	TDOA principle, hyperboloic positioning, accuracy, transmissions used

10. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objectives should be included in the **Airport Surface Surveillance** course:

1.10.1	State typical ATC requirements	1	*Optional content: safety (aircraft and mobiles), clear runway, low visibility, collision warnings, displays, mapping, data merging, aircraft identification, ground mobiles*
1.10.2	State the current technologies for airport surface surveillance	1	Radar based and MLAT based technologies, example layout of airport surveillance infrastructure *Optional content: other systems (acoustic, vibration, induction loop, video, infrared, GNSS, ADS-B)*

11. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objective should be included in the **Display of Surveillance Information** course:

1.11.1	Recognise surveillance information on a display	1	*Optional content: PSR and MSSR tracks, position identification, FL, speed vector, RDP and FDP information*

12. SUBJECT 7: SURVEILLANCE — TOPIC 1: BASSUR

The following objective should be included in the **Analysis Tools** course:

1.12.1	State analysis tools	1	*Optional content: SASS-C, SASS-S, RAPS*

AMC8 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objectives should be included in the **Introduction to Data Processing** course:

1.1.1	Describe the functions and generic architecture of the systems	2	Generic FDP and SDP overall functional block diagrams
1.1.2	Describe how the systems interface with other systems	2	Surveillance sensors, displays, CFMU, recording, international ATM networks *Optional content: safety nets, military interfaces*
1.1.3	Define basic software functions/applications	1	FDP (IFPS, route processing, code/call sign correlation, code allocation, strip distribution, track labelling) SDP (coordinate conversion, plot and track processing, MRP, safety nets, track labelling)
1.1.4	State the legal aspects for data processing in ATM	1	Traceability and recording of data and actions, configuration control
1.1.5	State the additional data used by ATM system	1	*Optional content: MET, airlines*
1.1.6	State current developments and future possibilities	1	*Optional content: coflight, iTEC, SESAR, multisensor tracking*

2. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objectives should be included in the **System Software and Hardware Principles** course:

1.2.1	Describe the current hardware configurations used in ATM	2	Redundancy and backup *Optional content: driver, interfaces, hardware platforms, fault tolerant systems*
1.2.2	Describe the current software platforms, used in ATM	2	Operating systems

3. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objectives should be included in the **Surveillance Data Processing** course:

1.3.1	State ATC requirements	1	QoS, mandatory data recording, dependability
1.3.2	Explain the principles of SDP	2	*Optional content: single, multi, plot, track*
1.3.3	Describe the functions of SDP	2	Plot processing, tracking, single sensor and multisensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multisensor tracker, recording *Optional content: ARTAS tracker*
1.3.4	Describe radar data inputs/outputs	2	Tracks, plots, messages, code/call sign, time, control and monitoring, conflict alerts, FDP interface, maps, adaptation
1.3.5	Describe the surveillance data based monitoring functions	2	Safety nets, ATC tools *Optional content* *Safety nets: STCA, MSAW, APW, runway incursion alerts* *ATC Tools: MTCD, AMAN, DMAN, A-SMGCS*

4. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objectives should be included in the **Flight Data Processing (FDP)** course:

1.4.1	State ATC requirements	1	QoS, unambiguous, accurate, error free, timely
1.4.2	Explain the functions of FDP	2	Flight strip production, flight plan data updates, code/call sign correlation, flight progress monitoring, coordination and transfer *Optional content: CIV/MIL coordination*
1.4.3	Define inputs and outputs	1	Flow control (CFMU/IFPS/FMP, ETFMS), flight strips/data displays, MRT, environmental data, static data, airspace adaptation
1.4.4	Describe the basic software functions/applications	2	FDP (IFPS, route processing, code/call sign correlation, code allocation, strip distribution, track labelling)
1.4.5	Describe the FPL data update process	2	Automatic and manual update

5. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objectives should be included in the **Human Machine Interface Systems** course:

1.5.1	Describe the different display technologies	2	Raster scan, common graphic display interface, LCD, plasma, TFT, Touch Input Device
1.5.2	Recognise what information is normally displayed on the ATCO and ATSEP HMI	1	—

6. SUBJECT 8: DATA PROCESSING — TOPIC 1: BASDAT

The following objective should be included in the **Miscellaneous Information** course:

1.6.1	State the additional data used by ATM system	1	e.g. MET, airlines

AMC9 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objectives should be included in the **Overview of SMC Function** course:

1.1.1	Describe the principles and purpose of the operational management of the technical services	2	Service requirements, interfaces, boundaries of tactical responsibility *Optional content: hierarchy of authority for the technical and ATC structures*
1.1.2	Describe the technical system architecture of the SMC function and its subordinate systems	2	Main monitoring and control architecture *Optional content* *Surveillance: Radar stations, communications, processing, display* *Communications: TX/RX, circuit management, networks, HMI, standby facilities, recording* *Navigation: NDB, VOR, ILS, DF* *DP: FDPS, data communications* *Facilities: Power, generators, UPS, battery, environmental (heating, cooling), fire and security*
1.1.3	Describe the transfer of responsibility for a service	2	Operational and technical responsibility Configuration and monitoring access and responsibility

2. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objectives should be included in the **System Configuration** course:

1.2.1	Describe the range of	1	*Equipment or channel switching, parameter*

	configurations that can be used		*settings*
1.2.2	Describe the general techniques that are employed to make configuration changes	1	e.g. physical switching
1.2.3	State procedures required to implement a planned major system change	2	e.g. safety requirement, authorisation, coordination, implementation plan, fallback strategies, major system change, activation of new version of software in a subordinate system, transfer of a service to a new system, change of a database

3. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objectives should be included in the **Monitoring and Control Functions** course:

1.3.1	State the monitoring functions that are available	1	*Optional content: BITE, status, parameters, software and hardware watchdogs*
1.3.2	State the control functions that are available	1	*Optional content: switching, parameters, set configurations*
1.3.3	Explain the importance of SMC management and coordination of maintenance activities	2	—
1.3.4	State analysis tools associated with SMC	1	*Optional content: possible malfunctions (SASS-C, SASS-S, RAPS, track and noise monitoring tools)*

4. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objective should be included in the **Coordination and Reporting** course:

1.4.1	State why coordination and reporting is required and how it is achieved	1	Facility interrupts, deconflict multiple outages, legal requirements *Optional content* *Causes: service failure, planned outage, loss of backup, software upgrade* *Relevant parties: external service providers, ATC, other centres* *Relevant information: NOTAM, logbook*

5. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objectives should be included in the **Emergency Coordination** course:

1.5.1	Describe situations where coordination and reporting will be necessary	2	*Optional content: hijack, mayday, R/T fail, loss of aircraft, MIL action, fire, flood, security, terrorist threat or action, medical*
1.5.2	State which parties may be involved in the coordination and	1	*Optional content: ATC supervisors (local and remote), ATSEP supervisors (local and*

	reporting of emergency situations		*remote), management, police, MIL, medical, accident investigation branch*
1.5.3	Explain the responsibilities and/or duties of SMC members during an emergency situation by using an example scenario	2	—
1.5.4	State the succession of authorities and responsibilities in the event that the nominated person or function is not available	1	Hierarchy of responsibility

6. SUBJECT 9: SYSTEM MONITORING AND CONTROL — TOPIC 1: BASSMC

The following objectives should be included in the **Equipment Operating** course:

1.6.1	Define the principles and ergonomics of the HMI of the SMC central system and its subordinate systems	1	Permissions, control tokens, ergonomic conventions (e.g. green is good or safe, red is fail or unsafe)
1.6.2	State the routine tasks required and the criticality of their completion and any legal requirements	1	*Optional content: audio circuit voice checking, audio recording checking, archive media changing and storage, VOLMET*

AMC10 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 10: MAINTENANCE PROCEDURES — TOPIC 1: BASMP

The following objectives should be included in the **Maintenance Procedures** course:

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

AMC11 ATSEP.OR.105(a)(2) Basic training

1. SUBJECT 11: FACILITIES — TOPIC 1: BASMP

The following objectives should be included in the **Power Supplies** course:

1.1.1	Define the performance for power supply systems in the operational environment	1	Availability, quality, continuity of service
1.1.2	Define the main features of current power supply systems	1	*Optional content: UPS systems, batteries and emergency generators, high voltage, earthing techniques, power provider(s)*
1.1.3	Describe the power distribution system at an example operational site	2	*Optional content: power distribution redundancy, input, output, protections, measurements and monitoring, block schematic*

2. SUBJECT 11: FACILITIES — TOPIC 1: BASMP

The following objectives should be included in the **Air Conditioning** course:

1.2.1	State the function, appropriate terminology and performance of current air conditioning systems in use	1	*Optional content: air conditioning, water cooling, humidity control, air filtering system, visit to stations*
1.2.2	State the importance and criticality of maintaining a controlled environment	1	Short-term and long-term effect on people and equipment

APPENDIX 3a to Annex XII

SUBPART A — TECHNICAL AND ENGINEERING ELECTRONIC PERSONNEL

Section 1 — Air traffic safety electronics personnel

AMC to ATSEP.OR.110

Qualification training — Shared

AMC1 ATSEP.OR.110 Qualification training

1. SUBJECT 1: SAFETY — TOPIC 1: SAFETY MANAGEMENT

The following objectives should be included in the **Policy and Principles** course:

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

2. SUBJECT 1: SAFETY — TOPIC 1: SAFETY MANAGEMENT

The following objectives should be included in the **Concept of Risk and Principles of Risk Assessment** course:

1.2.1	Describe the concept of risk	2	Types of risk, components of risk, risk contributors (people, procedure,

			organisations and equipment)
1.2.2	State ways of assessing risk	1	Risk comparisons, risk analysis
1.2.3	Describe the concept of risk tolerability	2	Risk assessment and mitigation, ALARP Principle *Optional content: risk perception, risk management*

3. SUBJECT 1: SAFETY — TOPIC 1: SAFETY MANAGEMENT

The following objectives should be included in the **Safety Assessment Process** course:

1.3.1	Explain the methods for the assessment of hazards and possible failures	2	*Optional content: failure and hazard brainstorm session, fault tree analysis*
1.3.2	Appreciate the importance of adopting a total system approach covering human, procedure, organisation and equipment elements	3	ATM system description (including scope definition and limitation), end to end integrity of safety assessment *Optional content: Concept of TRM*
1.3.3	Describe the overall safety assessment process and its relationships with risk assessment during the total life cycle of ANS system	2	Collection and presentation of results, contingency arrangements, back-up procedures *Optional content: risk-based process, FHA, (safety objectives), preliminary system safety assessment PSSA (safety requirements), system safety assessment SSA (safety monitoring and evidence)*

4. SUBJECT 1: SAFETY — TOPIC 1: SAFETY MANAGEMENT

The following objective should be included in the **Air Navigation System Risk Classification Scheme** course:

1.4.1	Describe the ATM system risk classification scheme	2	Commission Implementing Regulation (EU) No 1035/2011 *Optional content: scenario of failure of air navigation system (incident chain), component of a risk classification scheme, severity classes, probability classes (qualitative and quantitative)*

5. SUBJECT 1: SAFETY — TOPIC 1: SAFETY MANAGEMENT

The following objectives should be included in the **Safety Regulation** course:

1.5.1	Describe the role of safety regulation	2	The purpose of regulation, objectives of the Safety Regulation Commission, objective of the national regulator
1.5.2	Explain the relationship between the safety regulation documents	2	ICAO documentation (SARPS), AMCs, GM, national regulation

1.5.3	Explain how the safety regulation documents affect ATM service provision	2	ICAO documentation (SARPS), AMCs, GM, national regulation
1.5.4	Explain the interface between the safety regulator and the ANSP	2	Information to be provided to regulator by ANSP and vice versa, importance of incident reporting

AMC2 ATSEP.OR.110 Qualification training

1. SUBJECT 2: HEALTH AND SAFETY — TOPIC 1: HAZARD AWARENESS AND LEGAL RULES

The following objective should be included in the **Hazard Awareness** course:

1.1.1	State potential hazards to health and safety generated by equipment used in CNS/ATM	1	*Optional content* *COM/SUR/SMC: mechanical hazards, electrical hazards (LV, HV, EMI), chemical hazards* *NAV: includes RF energy* *DP: none*

2. SUBJECT 2: HEALTH AND SAFETY — TOPIC 1: HAZARD AWARENESS AND LEGAL RULES

The following objectives should be included in the **Regulations and Procedures** course:

1.2.1	State applicable international requirements	1	*Optional content: European norms, CENELEC, DIN*
1.2.2	State any applicable national requirements	1	—
1.2.3	State safety procedure for the persons working on or near relevant equipment	1	*Optional content* *COM/NAV/SUR/SMC: isolation (clothing, tools), fire extinction types, safety man presence, safety interlocks, isolating switches, security of the site, climbing procedures, earthing, direct or indirect contact with HV*

3. SUBJECT 2: HEALTH AND SAFETY — TOPIC 1: HAZARD AWARENESS AND LEGAL RULES

The following objective should be included in the **Handling of Hazardous Material** course:

1.3.1	State European and local regulations for electronic device disposal	1	Protection of environment *Optional content: recycling*

AMC3 ATSEP.OR.110 Qualification training

1. SUBJECT 3: HUMAN FACTORS — TOPIC 1: INTRODUCTION TO HUMAN FACTORS

The following objectives should be included in the **Introduction** course:

1.1.1	Explain why human factors are particularly important in the ATM environment	2	Historical background, safety impact on ATM, incidents

1.1.2	Define human factors	1	*Optional content: ICAO Human Factors Training Manual*
1.1.3	Explain the concept of systems and its relevance in the ATM environment	2	People, procedures, equipment
1.1.4	Explain the use of the SHELL model	2	*Optional content: ICAO Human Factors Training Manual, visits to OPS and technical rooms*
1.1.5	State the factors which can affect personal and team performance	1	*Optional content: psychological, medical, physiological, social, organisational, communication, stress, human error, working knowledge and skills*

2. SUBJECT 3: HUMAN FACTORS — TOPIC 2: WORKING KNOWLEDGE AND SKILLS

The following objectives should be included in the **ATSEP Knowledge, Skills and Competence** course:

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

3. SUBJECT 3: HUMAN FACTORS — TOPIC 3: PSYCHOLOGICAL FACTORS

The following objectives should be included in the **Cognition** course:

3.1.1	Describe major aspects of human information processing	2	Perception, attention, memory, judgement, decision making, response execution, control of execution
3.1.2	Describe the factors which influence information processing	2	*Optional content: stress and strain, experience, knowledge, distraction, interpersonal relations, working environment, risk perception, attitude, workload, fatigue, confidence, job security*
3.1.3	Appreciate factors which influence information processing	3	*Optional content: case study, simulation, role playing*

4. SUBJECT 3: HUMAN FACTORS — TOPIC 4: MEDICAL

The following objectives should be included in the **Fatigue** course:

4.1.1	Describe the effect of fatigue on human performance	2	Physiological, cognitive and relational effects *Optional content: lack of concentration,*

			irritability, frustration
4.1.2	Recognise the signs of fatigue in oneself and in others	1	*Optional content: making frequent mistakes, unable to concentrate, lack of normal humour, sleeping and/or eating disorders*
4.1.3	Explain how to respond to indications of fatigue in an appropriate manner	2	Take time off, rest for short periods of time, seek professional help

5. SUBJECT 3: HUMAN FACTORS — TOPIC 4: MEDICAL

The following objectives should be included in the **Fitness** course:

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

6. SUBJECT 3: HUMAN FACTORS — TOPIC 4: MEDICAL

The following objective should be included in the **Work Environment** course:

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

7. SUBJECT 3: HUMAN FACTORS — TOPIC 5: ORGANISATIONAL AND SOCIAL FACTORS

The following objectives should be included in the **Basic Needs of People at Work** course:

5.1.1	Explain basic needs of people at work	2	*Optional content: balance between individual ability and workload, working time and rest periods; adequate working conditions, positive working environment*
5.1.2	Characterise the factors of work satisfaction	2	*Optional content: money, achievement, recognition, advancement, challenge*

8. SUBJECT 3: HUMAN FACTORS — TOPIC 5: ORGANISATIONAL AND SOCIAL FACTORS

The following objective should be included in the **Team Resource Management** course:

5.2.1	State the objectives of TRM	1	Experience sharing, feedback, improved interpersonal relations, indirect increase in safety

9. SUBJECT 3: HUMAN FACTORS — TOPIC 5: ORGANISATIONAL AND SOCIAL FACTORS

The following objectives should be included in the **Teamwork and Team Roles** course:

5.3.1	Describe the differences between social human relations and professional interactions	2	—
5.3.2	Identify reasons for loss of team effectiveness and actions to prevent it and prevent repetition	3	*Optional content: roles poorly defined, goals poorly identified, bad planning, too many leaders or not enough, respect for others, divergence in values, misunderstandings*
5.3.3	Describe the principles of teamwork	2	*Optional content: team membership, group dynamics, advantages/disadvantages of teamwork*
5.3.4	Identify reasons for conflict	3	—
5.3.5	Describe actions to prevent human conflicts	2	—
5.3.6	Describe strategies to cope with human conflicts	2	*Optional content: in your team*

10. SUBJECT 3: HUMAN FACTORS — TOPIC 6: COMMUNICATION

The following objectives should be included in the **Written Report** course:

6.1.1	Appreciate the importance of recording information by writing effectively	3	ATSEP technical report, logs, system degradation reports, specification, system manager report
6.1.2	Use appropriate terminology to communicate effectively in writing	3	Be concise, clear; common technical terms; convey key points

11. SUBJECT 3: HUMAN FACTORS — TOPIC 6: COMMUNICATION

The following objectives should be included in the **Verbal and Non-Verbal Communication** course:

6.2.1	Describe the human communication process	2	—
6.2.2	Characterise the factors which affect verbal communication	2	*Optional content* *Cognitive: lack of knowledge of the procedures, of technical terms, workload, poor receiver references* *Affective: being shy, feelings of not being listened to, not being part of the group, not being assertive, poor eye contact while talking, stress* *Physiological: stuttering, low voice level*

6.2.3	Describe factors which affect non-verbal communication	2	*Optional content: touch, noise, interruption, body language*
6.2.4	Use appropriate vocabulary to communicate effectively on technical matters	3	Technical 'jargon', language differences, standard words/phrases
6.2.5	Use appropriate language for professional communication with non-ATSEP	3	Term sharing, translation, being concise, simple words, selection of information and detail level according to the receiver

12. SUBJECT 3: HUMAN FACTORS — TOPIC 7: STRESS

The following objectives should be included in the **Stress** course:

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

12. SUBJECT 3: HUMAN FACTORS — TOPIC 7: STRESS

The following objectives should be included in the **Stress Management** course:

7.2.1	Act to relieve or minimise stress in self and/or others	3	The effect of personality in coping with stress, benefits of active stress management
7.2.2	Appreciate how assistance is obtained in stressful situations	3	Benefits of asking, offering and accepting help in stressful situations *Optional content: CISM*
7.2.3	Recognise the effects of shocking and stressful situations	1	For oneself and for others, abnormal situations
7.2.4	Consider the benefits of critical incident stress management	2	—

13. SUBJECT 3: HUMAN FACTORS — TOPIC 8: HUMAN ERROR

The following objectives should be included in the **Human Error** course:

8.1.1	Describe human error	2	—
8.1.2	Explain the relationship between human error and safety	2	Mechanism, error-prone conditions, consequences *Optional content: reason model, feedback*

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

APPENDIX 4a to Annex XII

SUBPART A — TECHNICAL AND ENGINEERING ELECTRONIC PERSONNEL

Section 1 — Air traffic safety electronics personnel

AMC to ATSEP.OR.110(a)

Qualification training

AMC1 ATSEP.OR.110(a) Qualification training — Stream COM-VOICE

1. SUBJECT 1: VOICE — TOPIC 1: AIR-GROUND

A. The following objectives should be included in the **Transmission/Reception** course:

1.1.1	Perform typical measurements on a transmitter	3	Frequency (single carrier, offset carrier), modulation, channel spacing, output power, SWR
1.1.2	Adjust a generic radio transmitter	4	Noise, intermodulation, harmonics, power, bandwidth
1.1.3	Analyse the block diagram of a generic radio transmitter	4	Characteristics (modulation, single carrier, channel spacing) functionalities
1.1.4	Perform typical measurements on a receiver	3	Frequency, modulation, channel spacing, sensitivity, selectivity
1.1.5	Adjust a generic radio receiver	4	Signal to noise ratio, harmonics
1.1.6	Analyse the block diagram of a generic radio receiver	4	Characteristics (single carrier, channel spacing, sensitivity, selectivity)

B. The following objectives should be included in the **Radio Antenna Systems** course:

1.2.1	Explain antenna parameters	2	Impedance, polar diagram, bandwidth, polarisation, types of antennas
1.2.2	Characterise the coverage of the radio system	2	Polar diagram, types of antennas, frequency bands, propagation mode
1.2.3	Characterise budget link according to various conditions	2	Output power, antennae, propagation, geographic, meteorological, day and night
1.2.4	Characterise the elements of a generic antenna system	2	Filters, combiners, multicavity system
1.2.5	Check the conformity of a system to ITU and national regulation	3	Ref.: ICAO Annex 10 (VHF, UHF)
1.2.6	Perform measurements with generic radio test equipment	3	Spectrum analyser *Optional content: scanner*

C. The following objectives should be included in the **Voice Switch** course:

1.3.1	Analyse switching functionalities	4	General architecture, digital, analogue, multiplex types, PCM *Optional content: cross-coupling, split headset (radio both ears, telephone single ear)*
1.3.2	Explain the principles of non-blocking switches	2	Advantages, disadvantages, delays (digital)
1.3.3	Describe the signal processing all along the chain	2	Signal tracing treatment, protocols (a few), data flow

D. The following objective should be included in the **Controller Working Position** course:

1.4.1	Describe the most common features of a controller working position	2	Frequency selection, emergency, station selection, coupling, headset, loudspeaker, footswitch, Push to Talk *Optional content: microphone (noise cancelling), short time recording*

E. The following objective should be included in the **Radio Interfaces** course:

1.5.1	Describe the different types of interface	2	Internal, external, phantom keying, inband signal

2. SUBJECT 1: VOICE — TOPIC 2: GROUND-GROUND

A. The following objectives should be included in the **Interfaces** course:

2.1.1	Describe the different types of interfaces	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	*Optional content: dB meters, level meters, generators, sniffer*

B. The following objectives should be included in the **Protocols** course:

2.2.1	Operate standard protocol analysers	3	*Optional content: MFC R2 and/or ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN*
2.2.2	Analyse communication protocol with appropriate tools and documentation	4	*Optional content: MFC R2 , ATS QSIG (rerouting), impulse dialling and DTMF dialling, ISDN, national protocols*

C. The following objectives should be included in the **Switch** course:

2.3.1	State the similarities between ground-ground and air-ground switches	1	Switching techniques
2.3.2	Describe the most commonly used functionality of PABX	2	General architecture, digital, analog, multiplex types, PCM30
2.3.3	Analyse conversion analog-digital, digital-analog	4	General architecture, analog-digital-analog

D. The following objective should be included in the **Communication Chain** course:

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

E. The following objective should be included in the **Controller Working Position** course:

2.5.1	Describe the most common 2 features of a controller working position and the HMI	2	—

3. SUBJECT 2: TRANSMISSION PATH — TOPIC 1: TRANSMISSION PATH — TOPIC 2: SPECIFIC LINKS

A. The following objective should be included in the **Microwave Link** course:

2.1.1	Describe a microwave link	2	*Optional content: carrier frequency, type of modulation, Fresnel Theory, loss, atmospheric influences*

B. The following objective should be included in the **Satellite** course:

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

5. SUBJECT 3: RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain the international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how ATM/ANS providers comply with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information.*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

6. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objectives should be included in the **Safety Attitude** course:

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. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

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

AMC2 ATSEP.OR.110(a) Qualification training — Stream COM-DATA

1. SUBJECT 1: DATA — TOPIC 1: INTRODUCTION TO NETWORKS

A. The following objectives should be included in the **Types** course:

1.1.1	State the evolution of network topologies	1	LAN, WAN *Optional content: architectures, size of the segments, length of the systems, quality of service*
1.1.2	Explain how networks meet requirements	2	Redundancy, bandwidth, BER, time delay, network security

B. The following objectives should be included in the **Networks** course:

1.2.1	Analyse the features of a network	4	Routing scheme, rate, internal networking, routers, bridges, gateways, modems, switches, firewalls *Optional content: wireless networks*
1.2.2	Describe network standards and devices	2	Ethernet, fibre optic, wireless
1.2.3	Appreciate the replacement of components in a network in a safe way	3	Continuity of service, network integrity Additional: for achievement of competence, this objective shall be applied practically, at the latest, by the end of S/E Rating training

C. The following objective should be included in the **External Network Services** course:

1.3.1	Define aspects of external network services	1	Provided QoS *Optional content: SLAs*

D. The following objectives should be included in the **Measuring Tools** course:

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) *Optional content: net scout*
1.4.2	Perform analysis to support fault-finding for correction	2	Data analyser (sniffer) *Optional content: net scout*

E. The following objective should be included in the **Troubleshooting** course:

1.5.1	Appreciate how to troubleshoot a network		Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: broken lines, unusable network components, overload, integrity problems*

2. SUBJECT 1: DATA — TOPIC 2: INTRODUCTION TO PROTOCOLS

A. The following objectives should be included in the **Fundamental Theory** course:

2.1.1	Apply the principles of layers	3	Differences between layers *Optional content: layer(s) of sniffer information*
2.1.2	Apply the principles of addressing strategy	3	Masks, subnets IP addressing, MAC addressing *Optional content: same logical network computers and systems*
2.1.3	Apply the principles of routing strategy	3	Routing tables, priorities, fault tolerance, management of routing strategy, static and dynamic routing *Optional content: unicast, multicast, broadcast*

B. The following objectives should be included in the **General Protocols** course:

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

C. The following objective should be included in the **Specific Protocols** course:

2.3.1	Describe the specific protocols	2	*Optional content: BATAP — ARINC 620, FMTP*

3. SUBJECT 1: DATA — TOPIC 3: INTRODUCTION TO NATIONAL NETWORKS

A. The following objectives should be included in the **National Networks** course:

3.1.1	Name the national networks to which the organisation is connected	1	*Optional content: ANSP, MET, military, PTT, airlines, national network(s)*
3.1.2	Describe the interfaces between national and global networks	2	—

4. SUBJECT 1: DATA — TOPIC 3: INTRODUCTION TO EUROPEAN NETWORKS

A. The following objectives should be included in the **Network Technologies** course:

4.1.1	State emerging network technologies	1	*Optional content: as used in EAN, NEAN, AMHS, PENS*
4.1.2	Describe the characteristics of current networks	2	Surveillance data, flight plan data and AIS networks *Optional content: CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP, AMHS*

5. SUBJECT 1: DATA — TOPIC 5: INTRODUCTION TO GLOBAL NETWORKS

A. The following objective should be included in the **Networks and Standards** course:

5.1.1	List the global networks and the standards on which they are based	1	*Optional content: ICAO for FTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)*

B. The following objective should be included in the **Description** course:

5.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service

C. The following objective should be included in the **Global Architecture** course:

5.3.1	Describe the architecture of the ATN	2	Air-ground subnetworks, ground-ground subnetworks, airborne networks

D. The following objective should be included in the **Air-Ground Subnetworks** course:

5.4.1	Describe the air-ground subnetworks	2	VDL (mode 2), HFDL, AMSS, SATCOM

E. The following objective should be included in the **Ground-Ground Subnetworks** course:

5.5.1	Describe the composition of ground-ground subnetworks	2	PTT, commercial telecom providers, ARINC, SITA

F. The following objective should be included in the **Networks on Board of the Aircraft** course:

5.6.1	State the existence of subnetworks inside the aircraft relevant for ATM communications	1	*Optional content: AFDX — ARINC 429*

G. The following objective should be included in the **Air-Ground Applications** course:

5.7.1	State the main communication applications using data link systems	1	*Optional content: CPDLC, DLIC/AFN, ATIS, DCL*

6. SUBJECT 2: TRANSMISSION PATH — TOPIC 1: LINES

A. The following objective should be included in the **Lines Theory** course:

1.1.1	Calculate parameters of a line	3	*Optional content: equation, attenuation, impedance, S-parameters, Smith chart, bandwidth, HF specifics (dipoles, multipoles), SWR*

B. The following objective should be included in the **Digital Transmission** course:

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

C. The following objectives should be included in the **Types of Lines** course:

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

7. SUBJECT 2: TRANSMISSION PATH — TOPIC 1: SPECIFIC LINKS

A. The following objective should be included in the **Microwave Link** course:

2.1.1	Describe a microwave link	2	*Optional content: carrier frequency, type of modulation, Fresnel Theory, loss, atmospheric influences*

B. The following objective should be included in the **Satellite** course:

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

8. SUBJECT 3: RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain the international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how ATM/ANS providers comply with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

9. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

10. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe the implications of functional failures in terms of exposure time, environment, effect on controller and effect on pilot		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

AMC3 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — NON-DIRECTIONAL BEACON (NDB)

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness

			Optional content: Time To First Fix
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and an RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2 GROUND-BASED SYSEMS — NDB — TOPIC 1: NDB/LOCATOR

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Appreciate the principles of NDB	3	Relative bearing, measuring method
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.3	Explain the technical limitations of NDB	2	Lack of accuracy, lack of integrity, sensitivity to interference
1.1.4	Describe the current situation	2	*Optional content: number, type, users, user groups, European context*

B. The following objectives should be included in the **Ground Station Architecture** course:

1.2.1	Describe the main components of an NDB ground station	2	Electronic cabinet, antennas, power supply, remote controls and monitoring *Optional content: auto tune antenna units*
1.2.2	Relate NDB station design to	4	Coverage, ID code, VOR backup, double beacon

	operational requirements		approach, siting

C. The following objectives should be included in the **Transmitter Subsystem** course:

1.3.1	Characterise the main NDB signal parameters	2	Carrier and ident frequency, output power, depth of modulation
1.3.2	Perform typical measurements on the main NDB signal parameters	3	*Optional content: carrier and ident frequency, power measurements, depth of modulation, audio distortion, antenna current, spectrum measurements, ID code*

D. The following objectives should be included in the **Antenna Subsystem** course:

1.4.1	Explain NDB antenna characteristics	2	Impedance, polar diagram, polarisation, ground reflections
1.4.2	Appreciate the interface between power stage and the antenna	3	SWR, radiated power

E. The following objectives should be included in the **Monitoring and Control Subsystems** course:

1.5.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.5.2	Describe which parameters are used for the monitoring	2	Antenna current, ID code, depth of modulation
1.5.3	Appreciate how the operational status of the NDB monitoring system is checked	3	System status Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training
1.5.4	Describe the issues associated with NDB obstacle limitations and obstacle removal	2	Siting

F. The following objectives should be included in the **On-Board Equipment** course:

1.6.1	Describe the on-board equipment (ADF)	2	Receiver, antenna, displays
1.6.2	Describe how NDB information is used on-board	2	ADF indicator, RMI, HSI, ND

G. The following objectives should be included in the **System Check and Maintenance** course:

1.7.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *Optional content: European regulations*
1.7.2	Appreciate calibration tasks and	3	Additional: for achievement of competence, this objective shall be applied practically, at

	flight inspection results		the latest by the end of S/E Rating training *Optional content: maintenance and flight inspection manuals, procedures and reports*
1.7.3	Appreciate troubleshooting of an NDB	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: maintenance and flight inspection manuals, procedures and reports*
1.7.4	Appreciate the origins of NDB errors	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: multipath, EMC, interference with radio broadcast transmissions*

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

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

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database

1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: AUTONOMOUS NAVIGATION

A. The following objective should be included in the **Inertial Navigation** course:

2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating

6. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, radio altimetry, geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC4 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — DFI

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *Optional content: Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2: GROUND-BASED SYSTEMS — DFI — TOPIC 1: DF

A. The following objectives should be included in the **Use of the System** course:

1.1.1	State the different types of DF	1	VDF, DDF, IDF
1.1.2	Describe the user HMI	2	Indication on radar picture, DF indicator
1.1.3	Appreciate the principles of DF	3	Bearing, measuring method (standard, Doppler, interferometry)
1.1.4	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.5	Explain the technical limitations of DF	2	Sensitivity to interference
1.1.6	Describe the current situation	2	*Optional content: number, type, users, national context*

B. The following objective should be included in the **VDF/DDF Equipment Architecture** course:

1.2.1	Describe the main components of DF equipment	2	Electronic cabinet, antennas, power supply, remote controls and monitoring

C. The following objective should be included in the **Receiver Subsystem** course:

1.3.1	Explain the main signal parameters	2	Frequency band (UHF, VHF)

D. The following objectives should be included in the **Antenna Subsystem** course:

1.4.1	Explain DF antenna characteristics	2	Impedance, polar diagram, polarisation, types of antennas
1.4.2	Appreciate protection areas	3	Obstacles, ICAO Annex 10 *Optional content: manufacturers manuals*

E. The following objectives should be included in the **Monitoring and Control Subsystems** course:

1.5.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.5.2	Describe which parameters are used for the monitoring	2	Noise figure, stability of measurement
1.5.3	Appreciate how the operational status of the DF monitoring system is checked	3	System status Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training
1.5.4	Describe the issues associated with DF obstacle limitations and obstacle removal	2	Surrounding environment, protection of bearing accuracy

F. The following objectives should be included in the **System Check and Maintenance** course:

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

			Optional content: multipath, EMC, interference with radio broadcast transmissions

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

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

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database
1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: AUTONOMOUS NAVIGATION

A. The following objective should be included in the **Inertial Navigation** course:

2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating

6. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC5 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — OMNIDIRECTIONAL RADIO RANGE (VOR)

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *Optional content: Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2: GROUND-BASED SYSTEMS — VOR — TOPIC 1: VOR

A. The following objectives should be included in the **Use of the System** course:

1.1.1	State the types of VOR Systems	1	Conventional, Doppler
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.3	Explain the technical limitations of CVOR	2	Type of information (azimuth), accuracy, integrity, suitable for a network of fixed routes
1.1.4	Appreciate the differences between CVOR and DVOR	3	Signal broadcast differences, bearing information robustness
1.1.5	Describe the current situation	2	*Optional content: number, type, users, user groups, national context, European context*

B. The following objectives should be included in the **Fundamentals of CVOR and/or DVOR** course:

1.2.1	Appreciate the mathematical signal description	3	Declination, equations of CVOR and/or DVOR, reference and variable signals
1.2.2	Appreciate the principles for generating the variable signal	3	<u>CVOR</u> Rotating antenna principle Generating a rotating radiation pattern with static antennas and/or <u>DVOR</u> Frequency modulation through switching antenna

C. The following objectives should be included in the **Ground Station Architecture** course:

1.3.1	Describe the main components of a CVOR and/or DVOR ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring
1.3.2	Relate VOR station design to operational requirements	4	Siting, coverage, ID code, NDB backup

D. The following objectives should be included in the **Transmitter Subsystem** course:

1.4.1	Characterise main signal parameters for a CVOR and/or DVOR	2	Carrier frequency stability, output power, signals generated
1.4.2	Perform typical transmitter measurements on VOR signals	3	Radiation pattern accuracy, power and modulation measurements, spectrum measurements, ID Coding

E. The following objectives should be included in the **Antenna Subsystem** course:

1.5.1	Explain VOR antenna characteristics	2	Impedance, polar diagram, polarisation, types of antennas
1.5.2	Appreciate the interface between power stage and the antennae	3	SWR, radiated power
1.5.3	Appreciate protection areas	3	Obstacles, ICAO Annex 10 *Optional content: manufacturers manuals*

F. The following objectives should be included in the **Monitoring and Control Subsystem** course:

1.6.1	Describe the purpose of monitoring	2	Integrity, continuity of service, availability
1.6.2	Describe which VOR parameters are monitored	2	ICAO and RTCA/EUROCAE requirements *Optional content: NSA requirements*
1.6.3	Describe the principles of the CVOR and/or DVOR monitoring systems	2	Near field sensors, far field sensors, recombination Local and remote monitoring
1.6.4	Appreciate how the operational status of the CVOR and/or DVOR monitoring systems are checked	3	Near field sensors, far field sensors, recombination Local and remote monitoring Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: BITE, Watchdog*
1.6.5	Describe the issues associated with VOR obstacle limitations and obstacle removal	2	Surrounding environment, multipath prevention
1.6.6	Explain the optional ILS interface	2	—

G. The following objectives should be included in the **On-Board Equipment** course:

1.7.1	Describe the on-board equipment	2	Antenna, receiver HMI *Optional content: CDI, RMI, HSI, ND, PFD*
1.7.2	Describe how the VOR information is used on board	2	*Optional content: single VOR, VOR-VOR, approach procedures, manual mode, automatic mode*

H. The following objectives should be included in the **System Check and Maintenance** course:

1.8.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10
1.8.2	Perform typical system measurements	3	In space modulation, phase sideband/carrier, ground check for bearing errors
1.8.3	Appreciate calibration tasks and flight inspection results	3	Flight inspection (coverage, flight check for bearing errors and modulation) Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: maintenance manuals, procedures and reports*
1.8.4	Appreciate troubleshooting of a CVOR and/or DVOR	3	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: maintenance and flight inspection manuals, procedures and reports*
1.8.5	Analyse the origins of CVOR and/or DVOR errors	4	CVOR System dependent, adjustments, drifts, multipath, on-board errors and/or DVOR North Adjustment *Optional content* *DVOR: antenna feeding* *DVOR and CVOR: multipath, EMC, interference with radio broadcast transmissions*

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

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

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database
1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: AUTONOMOUS NAVIGATION

A. The following objective should be included in the **Inertial Navigation** course:

2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating

6. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC6 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — DISTANCE MEASURING EQUIPMENT (DME)

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *Optional content: Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area	2	Fixed route vs flexible route structure

	navigation		

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2: GROUND-BASED SYSTEMS — DME — TOPIC 1: DME

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Describe the overall performances for DME	2	Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the limitations of DME	2	Accuracy, integrity, capacity
1.1.3	Describe the current situation	2	*Optional content: number, types, users, user groups, national context, European context*
1.1.4	State the role of the DME infrastructure in the future navigation applications	1	PBN
1.1.5	Explain the differences between DME and TACAN for civilian use	2	*Optional content: azimuth and range*

B. The following objectives should be included in the **Fundamentals of DME** course:

1.2.1	Describe the key elements of DME system operation	2	Two-way ranging technique, slant range, time measurement A/c interrogation, pulse pairs, ground reply, fixed time delay, interrogation stagger, 'X' and 'Y' channels
1.2.2	Explain the frequency spectrum and the channel spacing allocated	2	ICAO Annex 10, L-band

C. The following objectives should be included in the **Ground Station Architecture** course:

1.3.1	Describe the main components of a DME ground station	2	Electronic cabinet, antenna system, power supply, remote controls and monitoring
1.3.2	Relate DME station design to operational requirements	4	Coverage, ID code, siting

D. The following objectives should be included in the **Receiver Subsystem** course:

1.4.1	Explain the main receiver parameters for a DME	2	Sensitivity, selectivity, dynamic range, jamming immunity
1.4.2	Perform the typical measurements on the	3	Sensitivity, selectivity, dynamic range, jamming immunity

	interrogation signals		

E. The following objectives should be included in the **Signal Processing** course:

1.5.1	Explain the functions performed by a DME/N signal processor	2	Decode, Reply Delay, Automatic Reply Rate Control, Encode, priority (Ident, DME signal, Squitter)
1.5.2	Perform the typical measurement on the DME/N transponder signals	3	Reply Delay, Reply Delay offset, decode parameters, rate of replies

F. The following objectives should be included in the **Transmitter Subsystem** course:

1.6.1	Characterise the main signal 2 parameters from the ground station	2	Carrier frequency, output power, pulse shape, pulse spacing, pulse repetition frequency, main delay, ID code
1.6.2	Perform the typical measurements on a DME	3	Power and pulse measurements, spectrum measurements, modulation measurements

G. The following objectives should be included in the **Antenna Subsystem** course:

1.7.1	Explain DME antenna characteristics	2	Patterns, antennas
1.7.2	Appreciate the interface between power stage and the antenna	3	SWR, radiated power, propagation delay, distribution circuit (e.g. duplexer, circulator)
1.7.3	Appreciate protection areas	3	ICAO Annex 10, protection area criteria and enforcement *Optional content: manufacturers manuals*

H. The following objectives should be included in the **Monitoring and Control Subsystem** course:

1.8.1	Describe the purpose of monitoring	2	Integrity, continuity of service
1.8.2	Describe which DME parameters are monitored	2	ICAO and RTCA/EUROCAE requirements *Optional content: NSA requirements*
1.8.3	Appreciate how the operational status of the DME monitoring system is checked	3	Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training
1.8.4	Describe the issues associated with DME obstacle limitations and obstacle removal	2	Multipath, blanking

I. The following objectives should be included in the **On-Board Equipment** course:

1.9.1	Describe the on-board equipment	2	Transmitter, antenna, receiver, HMI *Optional content: HSI, DME range indication, ND*
1.9.2	Describe how the DME information is used on board	2	*Optional content: single DME, multi-DME navigation (rho rho), approach procedures, manual mode, automatic mode*

J. The following objectives should be included in the **System Check and Maintenance** course:

1.10.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *Optional content: European regulations*
1.10.2	Appreciate calibration tasks and flight inspection results	3	Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: maintenance and flight inspection manuals, procedures and reports*
1.10.3	Appreciate troubleshooting of a DME	3	Carrier frequency deviation, depth of modulation, lack of power, harmonics ratio Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: main delay and monitor shutdown errors, interference* *Maintenance and flight inspection manuals, procedures and reports*
1.10.4	Appreciate the origin of DME errors	3	Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: Multipath, EMC, interference with radio broadcast transmissions (harmonics)*

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

1.1.1	Explain the importance and continuing development of GNSS	2	FANS CNS/ATM concept, ICAO Doc 9849, Navigation Application & NAVAID Infrastructure Strategy for the ECAC Area up to 2020, EUROCONTROL GNSS Policy, SESAR ATM Master Plan
1.1.2	Describe the elements of GNSS within Europe	2	Core constellations, ABAS, SBAS (EGNOS) *Optional content: GBAS, SCAT 1, APV, ICAO Annex 10*

1.1.3	Appreciate the sources of interference to GNSS signals	3	Intentional, unintentional, ionospheric interference, solar activity
1.1.4	Explain who has responsibility for GNSS oversight in your State and how it is carried out	2	*Optional content: EASA, GSA, NSA, ANSP*
1.1.5	Appreciate the impact of the modernisation of GNSS on the ARNS bands	3	Introduction of L5, E5A, E5B *Optional content: COMPASS*
1.1.6	Explain the need for a minimum number of visible satellites needed to provide integrity monitoring	2	*Optional content: AUGUR*
1.1.7	Describe the purpose of the GNSS NOTAM	2	ICAO Annex 10, Vol. 1

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database
1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: AUTONOMOUS NAVIGATION

A. The following objective should be included in the **Inertial Navigation** course:

2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating

6. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC7 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — INSTRUMENT LANDING SYSTEM (ILS)

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *Optional content: Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation applications support the different phases of flight	1	PBN Manual ICAO Doc 9613

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2: GROUND-BASED SYSTEMS — ILS — TOPIC 1: ILS

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Describe the overall performances for ILS	2	ICAO Annexes 10 and 14 Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the limitations of DME	2	ICAO Annexes 10 and 14 Only 40 channels, no segmented paths of approach, beam corruption due to multipath
1.1.3	Interpret ILS Facility Performance Categories	5	ICAO Annexes 10 and 14 Cat I, Cat II, Cat III Different operational category depending on operational minima, equipment and airport facilities
1.1.4	Define obstacle free zones for ILS components	1	ICAO Annexes 10 and 14 Dimensions *Optional content: national regulations*
1.1.5	Explain the importance and need for ILS obstacle free zones	2	ILS beam protection, increased significance during LVP conditions
1.1.6	Explain the current situation	2	*Optional content: number, type, users, national context*
1.1.7	Consider the need for ATC ILS status indications	2	No continuous monitoring by ATSEP

B. The following objectives should be included in the **Fundamentals of ILS** course:

1.2.1	Explain how to obtain a change in depth of modulation of an amplitude-modulated signal as a function of angular position	2	Addition of a carrier signal and a side band signal in space
1.2.2	Characterise the signals to be radiated	2	Amplitude and phase relationship, antenna systems
1.2.3	Relate the adjustment of signals generated to the resulting beam patterns and standards	4	Phases and amplitudes in antenna array, modulations on carrier signal, phase and amplitude of sideband
1.2.4	Describe the required performance of an antenna array	2	Beam bend potential, coverage, impact on location of critical and sensitive area

C. The following objectives should be included in the **2F-Systems** course:

1.3.1	Explain the limitations of a 1F system	2	Multipath in adverse environment and terrain
1.3.2	Describe the capture effect	2	Capture effect in receiver circuits

1.3.3	Describe radiation parameters for 2F-LOC and 2F-GP	2	Types of antenna arrays, patterns, coverage, signal distribution, radiated power

D. The following objectives should be included in the **Ground Station Architecture** course:

1.4.1	Describe the layout of an ILS	2	—
1.4.2	Describe the main components of the LOC (1F and 2F), GP (1F and 2F), markers and field monitors	2	Electronic cabinet, antennas, power supply, remote controls and monitoring, tower indication *Optional content: DME*
1.4.3	Relate ILS station design to operational requirements	4	Coverage, ID code, siting

E. The following objectives should be included in the **Transmitter Subsystem** course:

1.5.1	Appreciate main signal parameters for LOC (1F and 2F), GP (1F and 2F) and markers	3	Carrier frequency, output power, signals generated
1.5.2	Explain the block diagram of the ILS transmitters	2	LOC, GP, Marker beacons Synthesiser, modulator, power amplifier, control coupler, RF changeover

F. The following objective should be included in the **Antenna Subsystem** course:

1.6.1	Explain ILS antenna characteristics: LOC, GP and Marker Beacons	2	Types, position, polarisation, patterns, coverage, antenna matching, distribution circuits, radiated power, ground reflection

G. The following objectives should be included in the **Monitoring and Control Subsystem** course:

1.7.1	Describe the purpose of monitoring	2	Integrity, continuity of service
1.7.2	Describe the parameters for the monitoring according to ICAO Annex 10: LOC, GP and Marker Beacons	2	RF level, DDM, SDM on position and width
1.7.3	Explain the key additional required monitoring: LOC and GP	2	External, internal and integral monitoring
1.7.4	Explain the purpose, advantages and disadvantages of the FFM system	2	*Optional content: content position, width, requirement for Cat III operations (some States)*
1.7.5	Draw a diagram of the monitoring system: LOC, GP, FFM and Marker Beacons	1	Near-field, integral network, internal network, monitor signal processor *Optional content: DME*

1.7.6	Explain the optional DME interface	2	Identity coding ratio

H. The following objectives should be included in the **On-Board Equipment** course:

1.8.1	Describe the on-board equipment associated with LOC, GP and Marker Beacon	2	Antennas, receiver, pilot interface (cross pointer) *Optional content: FMS*
1.8.2	Describe how ILS information is used on board	2	*Optional content: approach procedures, landing, roll-out, manual, automatic mode (auto-pilot)*

I. The following objectives should be included in the **System Check and Maintenance** course:

1.9.1	Appreciate the conformity of LOC, GP and Marker Beacons to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *Optional content: European regulations*
1.9.2	Justify the occasions when it is necessary to downgrade an ILS Facility Performance Category	4	*Optional content: system failures, environmental changes/disturbance*
1.9.3	Explain the implications of ILS Facility Performance Categories to the pilot	3	Link with prevailing Instrument RVR, weather dictating Decision Height
1.9.4	Perform some typical measurements	3	Output power, spectrum analysis, modulation, ID code
1.9.5	Appreciate calibration tasks and flight inspection results	3	LOC, GP and Marker Beacons Flight inspection and ground calibration results LOC Centreline measurement, width and centreline field measurements Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: RF interference monitoring Maintenance and flight inspection manuals, procedures and reports*
1.9.6	Appreciate troubleshooting of ILS LOC, GP and Marker Beacons	3	DDM and SDM misalignment, coverage pilot reported errors, field checks, monitor checks Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: lack of power, carrier frequency deviation, harmonic ratio, depth of modulation maintenance and flight inspection manuals, procedures and reports*

1.9.7	Appreciate the origin of ILS errors	3	Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: Multipath, EMC, interference with radio broadcast transmissions (harmonics)*

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

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

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database
1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: AUTONOMOUS NAVIGATION

A. The following objective should be included in the **Inertial Navigation** course:

2.1.1	Describe the principles and key features of INS/IRS navigation	2	Gyros, accelerometer, accuracy, drift, updating

6. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC8 ATSEP.OR.110(a) Qualification training — Stream NAVIGATION — MICROWAVE LANDING SYSTEM (MLS)

1. SUBJECT 1: PERFORMANCE-BASED NAVIGATION — TOPIC 1: NAV CONCEPTS

A. The following objectives should be included in the **Operational Requirements** course:

1.1.1	Explain the main performance characteristics of a navigation system	2	Accuracy, precision, stability, integrity, availability, continuity of service, coverage, robustness *Optional content: Time To First Fix*
1.1.2	Explain the relationship between performance measures and the phases of flight	2	PBN Manual ICAO Doc 9613

B. The following objectives should be included in the **Performance-Based Navigation** course:

1.2.1	Describe the PBN concept	2	ICAO and EUROCONTROL documents, airspace concept, application supported by navigation infrastructure and navigation specifications, functionality of the avionics
1.2.2	Differentiate between an RNAV and RNP navigation specification	2	On-Board Performance Monitoring and Alerting
1.2.3	State which navigation	1	PBN Manual ICAO Doc 9613

	applications support the different phases of flight		

C. The following objective should be included in the **Area Navigation Concept (RNAV)** course:

1.3.1	Differentiate between conventional navigation and area navigation	2	Fixed route vs flexible route structure

D. The following objective should be included in the **NOTAM** course:

1.4.1	Explain the need for NOTAMs	2	—

2. SUBJECT 2: GROUND-BASED SYSTEMS — MLS — TOPIC 1: MLS

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Describe approach and landing path	2	Azimuth station, elevation station, back azimuth station, approach DME, equipment layout, ICAO defined benchmarks
1.1.2	Describe the overall performances for MLS	2	Coverage, accuracy, availability of the system, integrity, continuity, category and level
1.1.3	Explain the technical limitations of MLS	2	Sensitivity to weather conditions, complexity, sensitively to multipath, criticality of signal at edge of coverage
1.1.4	Explain the advantages of MLS	2	Type of information, accuracy, small critical and sensitive areas, number of channels, complex approach paths, less prone to interference, reduced sensitivity to multipath, size of antennae array
1.1.5	Interpret MLS Facility Performance 5 Categories	5	Cat 1, 2, 3 Different operational category depending on operational minima, equipment and airport facilities
1.1.6	Define MLS critical and sensitive areas	1	Critical and sensitive area dimensions
1.1.7	Explain the importance and need for MLS critical and sensitive areas	2	MLS beam protection, increased significance during LVP conditions
1.1.8	Describe the current situation	2	Multi-mode receivers, ground and aircraft equipment *Optional content: low equipage, users, number of manufacturers*
1.1.9	Consider the need for ATC MLS status indications	2	No continuous monitoring by ATSEP

B. The following objectives should be included in the **Fundamentals of MLS** course:

1.2.1	Explain the principle for generating a scanning beam	2	Phase changes, phase relations
1.2.2	Describe the relationship between beam pattern and accuracy	2	Beam width, side lobe level reduction
1.2.3	Explain why data transmission is necessary	2	Station coordinates, ident, function synchronisation, time reference
1.2.4	Describe the data transmission structure	2	ICAO specification

C. The following objectives should be included in the **Ground Station Architecture** course:

1.3.1	Describe the layout of an MLS	2	—
1.3.2	Describe the main components of the azimuth, elevation, back azimuth and DME stations	2	Electronic cabinet, antennas, power supply, remote controls and monitoring, tower indication
1.3.3	Relate MLS station design to operational requirements	4	Coverage, ID code, siting

D. The following objectives should be included in the **Transmitter Subsystem** course:

1.4.1	Characterise main signal parameters for azimuth, elevation and back azimuth station	2	Carrier frequency, output power, signals generated
1.4.2	Explain the main components of the transmitters	2	Azimuth, elevation, back azimuth station Synthesiser, modulator, power amplifier, control coupler, RF changeover

E. The following objective should be included in the **Antenna Subsystem** course:

1.5.1	Explain MLS antenna characteristics: azimuth, elevation and back azimuth stations	2	Types, location, polarisation, pattern, coverage, distribution circuits, radiated power

F. The following objectives should be included in the **Monitoring and Control Subsystem** course:

1.6.1	Describe the purpose of monitoring	2	Integrity, continuity of service
1.6.2	Describe the parameters for the monitoring according to ICAO Annex 10: azimuth, elevation and back azimuth stations	2	RF level, beam width, scan speed
1.6.3	Explain how the parameters are monitored: azimuth, elevation and back azimuth station	2	External and internal monitoring

1.6.4	Explain the FFM system	2	Requirements for CAT 3 operations
1.6.5	Draw a diagram of the monitoring system	1	—

G. The following objectives should be included in the **On-Board Equipment** course:

1.7.1	Describe the on-board equipment	2	Antennas, receiver, pilot interface, HMI *Optional content: FMS*
1.7.2	Describe how the MLS information is used on board	2	Approach procedures, ILS-like display

H. The following objectives should be included in the **System Check and Maintenance** course:

1.8.1	Appreciate the conformity to international and national regulations	3	ITU regulations (EMC + SAR), ICAO Annex 10 *Optional content: European regulations*
1.8.2	Justify the occasions when it is necessary to downgrade an MLS Facility Performance Category	4	—
1.8.3	Explain the implications of MLS Facility Performance Categories to the pilot	2	Link with prevailing Instrument RVR, weather dictating Decision Height
1.8.4	Consider the need for ATSEP MLS remote maintenance and monitoring systems	3	Control, status, performance monitoring including alarm logging
1.8.5	Perform the typical system measurements	3	Output power, spectrum analysis, datalink modulation, ID code, Ground field checks
1.8.6	Appreciate calibration tasks and flight inspection results	3	Azimuth, back azimuth, azimuth centreline measurement, width and centreline measurements, elevation Flight inspection and ground calibration results Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: maintenance manuals, procedures and reports*

1.8.7	Appreciate troubleshooting of an MLS	3	Lack of power, carrier frequency deviation, harmonic ratio, beam pattern Additional: for achievement of competence, this objective shall be applied practically,at the latest by the end of S/E Rating training *Optional content: maintenance and flight inspection manuals, procedures and reports*
1.8.8	Appreciate the origin of MLS errors	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: Multipath, EMC, weather influence*

3. SUBJECT 3: GNSS — TOPIC 1: GNSS

A. The following objectives should be included in the **General View** course:

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

4. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 1: ON-BOARD SYSTEMS

A. The following objectives should be included in the **On-Board Systems** course:

1.1.1	Explain the purpose and use of a navigation computer	2	Sensors, navigation database

1.1.2	Explain the purpose and use of an FMS	2	Sensors, navigation database, path steering, displays

5. SUBJECT 4: ON-BOARD EQUIPMENT — TOPIC 2: ON-BOARD EQUIPMENT — TOPIC 3: VERTICAL NAVIGATION

A. The following objective should be included in the **Vertical Navigation** course:

3.1.1	Describe the different types of vertical sensors and their limitations	2	Barometric, Radio Altimetry, Geodetic *Optional content: air data computers, manual intervention, dynamic information (AGL), undulation (WGS84)*

7. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 1: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

8. SUBJECT 5: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

2.1.1	Describe 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

AMC9 ATSEP.OR.110(a) Qualification training — Stream SURVEILLANCE — PRIMARY SURVEILLANCE RADAR

1. SUBJECT 1: PRIMARY SURVEILLANCE RADAR — TOPIC 1: ATC SURVEILLANCE

A. The following objectives should be included in the **Use of PSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach PSR	2	Range, resolution, coverage, availability
1.1.2	Relate key parameters of PSR to system performance	4	Key parameters: PRF, Signal energy, frequency diversity, antenna gain, update rate, polarisation, receiver MDS, beamwidth Performance: range, accuracy, resolution, extractor minimum target threshold, weather influence, PD, blind speed, ambiguities, capacity *Optional content: weather channel*

B. The following objective should be included in the **Antenna (PSR)** course:

1.2.1	Describe antenna types, accuracy and problems	2	Antenna beam(s), side lobes, reflector antenna, active (phased array) antenna, rotating joints, waveguide interface, pressurisation, dehumidification, polarisation, azimuth encoding, drive systems

C. The following objectives should be included in the **Transmitters** course:

1.3.1	Describe the basic characteristics of a transmitter	2	Supply, EHT, RF source (appropriate to type chosen), modulation, interlocks
1.3.2	Describe the signals at all key points	2	Supply, EHT, RF source (appropriate to type chosen), modulation, interlocks
1.3.3	Describe a generic transmitter block diagram for both compressed and non-compressed system	2	*Optional content: solid state, klystron, magnetron, travelling wave tube*
1.3.4	State possible failures and where they can occur in the transmitter system	1	*Optional content: solid state modules, arcing, corona discharge, component stress, control loops, isolation*
1.3.5	State constraints and problems on the high voltage circuitry	1	*Optional content: corona discharge, dielectric stress, isolation, arcing, ageing, interlocks, stability (including control loop)*

D. The following objective should be included in the **Characteristics of Primary Targets** course:

1.4.1	Appreciate the characteristics of targets detected by PSR	3	Backscatter, radar cross section (such as reflectivity, stealth technologies, aspect), Doppler shift, Ground Speed, Wind Turbines *Optional content: Swerling Case*

E. The following objectives should be included in the **Receivers** course:

1.5.1	Describe the basic characteristics of a receiver	2	Low noise, high dynamic range, bandwidth, detection, frequency, sensitivity, selectivity
1.5.2	Describe the basic elements of a generic receiver	2	LNA, local oscillator, coherent oscillator, down-converter, filtering, rejection, IF, PSD, AGC, STC, beam switching
1.5.3	Appreciate the importance of STC	3	Saturation, RF-IF dynamic range

F. The following objectives should be included in the **Signal Processing and Plot Extraction** course:

1.6.1	Describe the basic function of data processing	2	Plot extraction (range bin reports, range correlation, azimuth correlation), target reports, sliding window, weighted centre, local tracking

1.6.2	Appreciate the basic functions of a current radar signal processor	3	A/D conversion, I/Q matching, target detection, detection criteria (fixed, adaptive), MTD and clutter maps
1.6.3	Describe the processing techniques to improve the quality of target reports using scan to scan information	2	Tracking, environment mapping, adaptive feedback to extraction parameters

G. The following objectives should be included in the **Plot Combining** course:

1.7.1	Describe the basic function of plot combining	2	Secondary/primary combining, secondary/primary assigning, prime target, range and azimuth collimation
1.7.2	Describe the basic functions of a current radar plot combiner	2	Scan to scan correlation, angel filtering, vehicle filtering, output format

H. The following objective should be included in the **Characteristics of Primary Radar** course:

1.8.1	Explain the basic principles of electromagnetism, propagation, signal detection, RF power generation and distribution	2	Frequency and phase, electromagnetic radiation, spectrum and bandwidth, noise, HPA, waveguide problems

2. SUBJECT 1: PRIMARY SURVEILLANCE RADAR — TOPIC 2: SMR

A. The following objectives should be included in the **Use of SMR for Air Traffic Services** course:

2.1.1	Describe the operational requirements of SMR	2	Range, resolution, coverage, MTBF, availability
2.1.2	Relate key parameters and necessity to achieve performances	4	Specific equations for ranging and power budget, PRF, frequency with respect to range and accuracy, PD, frequency diversity, range with respect to TX power, antenna gain, receiver MDS, update rate, beamwidth, extractor minimum target threshold, polarisation, influence to meteorology

B. The following objectives should be included in the **Radar Sensor** course:

2.2.1	Explain the layout of the SMR	2	Dual system, service display
2.2.2	Describe the basic functions of the receiver/transmitter unit	2	Hardware/function overview
2.2.3	Describe how to operate a sensor	2	*Optional content: block diagram, timing relations, video path, frequency diversity, polarisation, controller structure*
2.2.4	Describe the basic functions of the antenna unit	2	*Optional content: hardware function overview, control/switch unit, external interface, azimuth*

			encoding, monopulse techniques

3. SUBJECT 1: PRIMARY SURVEILLANCE RADAR — TOPIC 3: TEST AND MEASUREMENT

A. The following objective should be included in the **Test and Measurement** course:

3.1.1	Appreciate how measurements can be made on PSR and SMR	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: spectrum analyser, vector voltmeter, oscilloscope, SWR meter, sensor analysis tools*

3. SUBJECT 2: HUMAN MACHINE INTERFACE (HMI) — TOPIC 1: HMI

A. The following objectives should be included in the **ATCO HMI** course:

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

B. The following objectives should be included in the **ATSEP HMI** course:

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 subsystem

C. The following objectives should be included in the **Pilot HMI** course:

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	—

D. The following objective should be included in the **Displays** course:

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)

4. SUBJECT 3: SURVEILLANCE DATA TRANSMISSION — TOPIC 1: SURVEILLANCE DATA TRANSMISSION

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks *Optional content: RADNET, messages CAT 1+*
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

B. The following objective should be included in the **Verification Methods** course:

1.2.1	Identify the causes for a fault, based on test tool measurements	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: data analyser, line analyser*

5. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 1: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

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

7. SUBJECT 5: DATA PROCESSING SYSTEMS — TOPIC 2: SYSTEM COMPONENTS

A. The following objectives should be included in the **Surveillance Data Processing Systems** course:

1.1.1	Identify all functions of a SDP system	3	Plot processing, tracking, single-sensor and multisensor tracker *Optional content: radar, ADS, MLAT, estimating limits and accuracy of multisensor tracker, recording* *Optional content: ARTAS tracker*
1.1.2	Describe all major components of a SDP	2	Functional architecture, technical architecture

1.1.3	Differentiate SDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
1.1.4	Appreciate how to operate the system	3	*Optional content: configuration, adjust parameters, start up and shut down, monitoring*
1.1.5	Explain the principles of emergency switching	2	—

AMC10 ATSEP.OR.110(a) Qualification training — Stream SURVEILLANCE — SECONDARY SURVEILLANCE RADAR

1. SUBJECT 1: SECONDARY SURVEILLANCE RADAR (SSR) — TOPIC 1: SSR AND MSSR

A. The following objectives should be included in the **Use of SSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach SSR	2	Range, coverage, resolution, performance, update rate ICAO Doc 9684
1.1.2	Relate key parameters of SSR to system performance	4	Key parameters: rotation rate, PRF, interlaced modes, capacity, frequencies, power budget (uplink, downlink), monopulse techniques Consequences: FRUIT, garbling, side lobes reception and transmission, transponder availability, PD, 2nd recurrence replies

B. The following objective should be included in the **Antenna (SSR)** course:

1.2.1	Describe the principles of SSR/MSSR antenna	2	Monopulse antenna techniques, coaxial connection, sum, difference and control pattern, error angle measurement, azimuth encoding, beam sharpening, side lobes

C. The following objectives should be included in the **Interrogator** course:

1.3.1	Describe the characteristics of an interrogator	2	Frequency, spectrum, interrogation modes, duty cycle, ISLS, IISLS, staggering
1.3.2	Explain a generic Interrogator	2	Timing, interface, modulator, BITE
1.3.3	Explain the need for integrity monitoring	2	Safeguards against erroneous transmission, BITE

D. The following objectives should be included in the **Transponder** course:

1.4.1	Explain the operational use of the transponder	2	Diagram of interaction between transponder and aeroplane
1.4.2	Define the global performances	1	Range, accuracy, fixed delay to respond

1.4.3	Describe the basic characteristics of a transponder	2	Transceiver, aerial location, switching and polar diagram, size ACAS Mode S and ADS compatibility, maximum reply rate, ISLS compatibility
1.4.4	Explain the advantages of the transponder	2	Longer range, more information
1.4.5	Explain the limitations of the transponder	2	Hundreds of feet precision, 3A limited codes
1.4.6	Describe the conformity to regulations	2	Equipage obligations, ICAO Annex 10
1.4.7	Describe the data format of the received transponder messages	2	P1, P2, P3, P4, P5, P6 signals and DPSK modulation (P6)
1.4.8	Describe the data format of the transmitted transponder messages	2	Field lengths, data bits, gray code, unused bits, Mode S reply (preamble and data)
1.4.9	Describe the basic characteristics of a transmitter	2	Timing, modulation, pulse width, power output
1.4.10	Describe the use of the transponder as a field monitor	2	—

E. The following objective should be included in the **Receivers** course:

1.5.1	Describe the basic characteristics of an SSR receiver	2	Standard/MSSR receiver, sensibility, bandwidth, dynamic range, GTC (normal, sectorised), monopulse processor, RSLS, multi-path and interferences

F. The following objectives should be included in the **Signal Processing and Plot Extraction** course:

1.6.1	Describe monopulse extraction	2	Phase and amplitude modulation, off boresight angle calculation, azimuth encoding
1.6.2	Describe sliding window SSR extraction	2	Leading edge, trailing edge, azimuth accuracy, azimuth encoding
1.6.3	Describe the signal processing	2	Video digitiser, pulse processor, reply decoder (bracket pair detector), synchronous reply correlator
1.6.4	Decode a transponder message	3	Standard message with SPI set *Optional content: Mode S*
1.6.5	Describe the SSR processing techniques	2	Discrete code correlation, general association, zones, categories, code swapping, general correlation Mode A code data, Mode C data, target position report

1.6.6	Explain the reasons for surveillance processing and the key options	2	False target identification and elimination, data validation, data correction, reflection identification and processing, enhanced resolution performance

G. The following objectives should be included in the **Plot Combining** course:

1.7.1	Describe the basic function of plot combining	2	Secondary/primary combining, secondary/primary assigning, prime target, range and azimuth collimation
1.7.2	Describe the basic functions of a current radar plot combiner	2	Describe the basic functions of a current radar plot combiner

H. The following objective should be included in the **Test and Measurement** course:

1.8.1	Appreciate how measurements can be made on SSR	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: spectrum analyser, vector voltmeter, oscilloscope, SWR meter, sensor analysis tools*

2. SUBJECT 1: SECONDARY SURVEILLANCE RADAR (SSR) — TOPIC 2: MODE S

A. The following objectives should be included in the **Introduction to Mode S** course:

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

B. The following objectives should be included in the **Mode S System** course:

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

3. SUBJECT 1: SECONDARY SURVEILLANCE RADAR (SSR) — TOPIC 3: MULTILATERATION

A. The following objectives should be included in the **MLAT in Use** course:

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

B. The following objectives should be included in the **MLAT Principles** course:

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

4. SUBJECT 1: SECONDARY SURVEILLANCE RADAR (SSR) — TOPIC 2: SSR ENVIRONMENT

A. The following objectives should be included in the **SSR Environment** course:

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

5. SUBJECT 2: HUMAN MACHINE INTERFACE (HMI) — TOPIC 1: HMI

A. The following objectives should be included in the **ATCO HMI** course:

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

6. SUBJECT 1: SURVEILLANCE DATA TRANSMISSION — TOPIC 1: SURVEILLANCE DATA TRANSMISSION

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks *Optional content: RADNET, messages CAT 1+*
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

B. The following objective should be included in the **Verification Methods** course:

1.2.1	Identify the causes for a fault, based on test tool measurements	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: data analyser, line analyser*

7. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 1: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

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,

9. SUBJECT 5: DATA PROCESSING SYSTEMS — TOPIC 2: SYSTEM COMPONENTS

A. The following objectives should be included in the **Surveillance Data Processing Systems** course:

1.1.1	Identify all functions of a SDP system	3	Plot processing, tracking, single-sensor and multisensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multisensor tracker, recording *Optional content: ARTAS tracker*
1.1.2	Describe all major components of a SDP	2	Functional architecture, technical architecture

1.1.3	Differentiate SDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
1.1.4	Appreciate how to operate the system	3	*Optional content: configuration, adjust parameters, start up and shut down, monitoring*
1.1.5	Explain the principles of emergency switching	2	—

AMC11 ATSEP.OR.110(a) Qualification training — Stream SURVEILLANCE — AUTOMATIC DEPENDENT SURVEILLANCE

1. SUBJECT 1: AUTOMATIC DEPENDENT SURVEILLANCE (ADS) — TOPIC 1: GENERAL VIEW ON ADS

A. The following objectives should be included in the **Definition of ADS** course:

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

2. SUBJECT 1: AUTOMATIC DEPENDENT SURVEILLANCE (ADS) — TOPIC 2 ADS-B

A. The following objectives should be included in the **Introduction to ADS-B** course:

2.1.1	Explain the basic principles of ADS-B	2	Autonomous operation, navigation solutions, link options, aircraft situation awareness
2.1.2	Identify the major elements of ADS-B	3	*Optional content: ADS-B global chain (from the aircraft to the controller HMI), GNSS, FMS, encoding, scheduling, link*

B. The following objectives should be included in the **Techniques of ADS-B** course:

2.2.1	Explain the characteristics of the data links used in ADS B	2	VDL Mode 4, Mode S extended squitter, UAT
2.2.2	Describe the major ADS-B applications	2	*Optional content: ADS-B-NRA, ADS-B-RAD, ASAS*

C. The following objective should be included in the **VDL Mode 4 (STDMA)** course:

2.3.1	Describe the use of VDL Mode 4	2	High-level description

D. The following objectives should be included in the **Mode S Extended Squitter** course:

2.4.1	Describe the use of the Mode S extended squitter	2	High-level description
2.4.2	Explain the principles related to signals in space	2	Modulation scheme, signal structure, key data and frequency
2.4.3	Explain the principles related to random access technology	2	Consequences on the RF environment (1090 MHz)
2.4.4	Explain the relevant messages	2	Information in each field, information encoding and decoding
2.4.5	Recognise the structure of a Mode S extended squitter signal	1	Signal timing and sequencing, data encoding
2.4.6	Explain the interface between the BDS and the extended squitter message	2	—

E. The following objective should be included in the **UAT** course:

2.5.1	State the use of the UAT	1	High-level description

F. The following objective should be included in the **ASTERIX** course:

2.6.1	Decode and analyse a signal coded according to the ASTERIX category 21 standard	3	Reference to ASTERIX standard Decode position, call sign, Mode S address, etc.

3. SUBJECT 1: AUTOMATIC DEPENDENT SURVEILLANCE (ADS) — TOPIC 3: ADS-C

A. The following objectives should be included in the **Introduction to ADS-C** course:

3.1.1	Explain the basic principles of ADS-C	2	Contract, multicontract, time, event triggering
3.1.2	Identify the major elements of the ADS-C system	3	ADS-C global chain (from the aircraft to the controller HMI), GNSS, processor, link, ground station

B. The following objective should be included in the **Techniques in ADS-C** course:

3.2.1	Explain the characteristics of the data links used in ADS-C	2	*Optional content: subnetworks (VDLs, AMSS, HFDL)*

4. SUBJECT 2: HUMAN MACHINE INTERFACE (HMI) — TOPIC 1: HMI

A. The following objectives should be included in the **ATCO HMI** course:

1.1.1	Describe the display types available	2	Video, synthetic, mixed
1.1.2	State the type of selections	1	Source, range, maps, filters

	available		
1.1.3	Describe the advantages of different display types	2	Clarity, configurability, fallback, data integration

B. The following objectives should be included in the **ATSEP HMI** course:

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 subsystem

C. The following objectives should be included in the **Pilot HMI** course:

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	—

D. The following objective should be included in the **Displays** course:

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)

5. SUBJECT 3: SURVEILLANCE DATA TRANSMISSION — TOPIC 1: SURVEILLANCE DATA TRANSMISSION

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks *Optional content: RADNET, messages CAT 1+*
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

B. The following objective should be included in the **Verification Methods** course:

1.2.1	Identify the causes for a fault, based on test tool measurements	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: data analyser, line analyser*

6. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 1 SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

7. SUBJECT 4: FUNCTIONAL SAFETY — TOPIC 2: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

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

8. SUBJECT 5: DATA PROCESSING SYSTEMS — TOPIC 2: SYSTEM COMPONENTS

A. The following objectives should be included in the **Surveillance Data Processing Systems** course:

1.1.1	Identify all functions of a SDP system	3	Plot processing, tracking, single-sensor and multisensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multisensor tracker, recording *Optional content: ARTAS tracker*
1.1.2	Describe all major components of a SDP	2	Functional architecture, technical architecture
1.1.3	Differentiate SDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
1.1.4	Appreciate how to operate the system	3	*Optional content: configuration, adjust parameters, start up and shut down, monitoring*
1.1.5	Explain the principles of emergency switching	2	—

AMC12 ATSEP.OR.110(a) Qualification training — Stream DATA — DATA PROCESSING

1. SUBJECT 1: COMMUNICATION DATA — TOPIC 1: INTRODUCTION TO NETWORKS

A. The following objectives should be included in the **Types** course:

1.1.1	State the evolution of network topologies	1	LAN, WAN *Optional content: architectures, size of the segments, length of the systems, quality of service*
1.1.2	Explain how networks meet requirements	2	Redundancy, bandwidth, BER, time delay, network security

B. The following objectives should be included in the **Networks** course:

1.2.1	Analyse the features of a network	4	Routing scheme, rate, internal networking, routers, bridges, gateways, modems, switches, firewalls *Optional content: wireless networks*
1.2.2	Describe network standards and devices	2	Ethernet, fibre optic, wireless
1.2.3	Appreciate the replacement of components in a network in a safe way	3	Continuity of service, network integrity Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training

C. The following objective should be included in the **External Network Services** course:

1.3.1	Define aspects of external network services	1	Provided QoS *Optional content: SLAs*

D. The following objectives should be included in the **Measuring Tools** course:

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) *Optional content: net scout*
1.4.2	Perform analysis to support fault-finding for correction	2	Data analyser (sniffer) *Optional content: net scout*

E. The following objective should be included in the **Troubleshooting** course:

1.5.1	Appreciate how to troubleshoot a network	3	Additional: for achievement of competence, this objective shall be applied practically, at the latest by the end of S/E Rating training *Optional content: broken lines, unusable network components, overload, integrity problems*

2. SUBJECT 1: COMMUNICATION DATA — TOPIC 2: INTRODUCTION TO PROTOCOLS

A. The following objectives should be included in the **Fundamental Theory** course:

2.1.1	Apply the principles of layers	3	Differences between layers *Optional content: layer(s) of sniffer information*
2.1.2	Apply the principles of the addressing strategy	3	Masks, subnets IP addressing, MAC addressing *Optional content: same logical network computers and systems*
2.1.3	Apply the principles of the routing strategy	3	Routing tables, priorities, fault tolerance, management of routing strategy, static and dynamic routing *Optional content: unicast, multicast, broadcast*

3. SUBJECT 2: FUNCTIONAL SAFETY — TOPIC 1: FUNCTIONAL SAFETY

A. The following objective should be included in the **Functional Safety** course:

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

B. The following objectives should be included in the **Software Integrity and Security** course:

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

4. SUBJECT 2: FUNCTIONAL SAFETY — TOPIC 2: SAFETY ATTITUDE

A. The following objective should be included in the **Safety Attitude** course:

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

5. SUBJECT 3: DATA PROCESSING SYSTEMS — TOPIC 1: USER REQUIREMENTS

A. The following objectives should be included in the **Controller Requirements** course:

1.1.1	Explain ATCO missions and services needed in an Area Control Centre	2	Operational requirements *Optional content: separation, flight progress monitoring and coordination, trajectory prediction, coordination with adjacent centres*
1.1.2	Explain ATCO missions and services needed in an Approach Control Unit	2	Operational requirements *Optional content: vectoring, sequencing, AMAN, CDM*
1.1.3	Explain ATCO missions and services needed in an Aerodrome Control Tower	2	Operational requirements *Optional content: runway management, DMAN*

B. The following objectives should be included in the **Trajectories, Prediction and Calculation** course:

1.2.1	State different types of trajectories	1	*Optional content: FPL-based, surveillance data-based, FMS-based*
1.2.2	Explain the main processes for trajectory prediction	2	SDP trajectory, FPL trajectory, merged trajectory, predicted trajectory

C. The following objective should be included in the **Ground Safety Nets** course:

1.3.1	Describe the function of safety nets 2 and their legal status	2	STCA, APW, MSAW, ASMGCS-based safety nets

D. The following objectives should be included in the **Decision Support** course:

1.4.1	Explain the major steps in the air traffic planning process	2	ATFCM with strategic, pre-tactical and tactical, ATC sector planning, tactical control
1.4.2	Explain the principles of trajectory prediction, conformance monitoring and medium term conflict detection processes	2	Route adherence monitoring *Optional content: CORA, MTCD, CLAM, Level adherence monitoring*
1.4.3	Explain the benefit of these tools for safety and efficiency	2	—

6. SUBJECT 3: DATA PROCESSING SYSTEMS — TOPIC 2: SYSTEM COMPONENTS

A. The following objective should be included in the **Processing Systems** course:

2.1.1	Describe all major components of a data processing system	2	Functional architecture, technical architecture, supervision

B. The following objectives should be included in the **Flight Data Processing Systems** course:

2.2.1	Identify all functions of a FDP system	3	FDPS Reference Model, Message Handling, Initial Flight Data Handling, Relationship with Other Functions, Air Ground Datalink Processing, Trajectory Prediction, Flight Data Management and Distribution, SSR Mode A Code Assignment and Management, Correlation, Co-ordination and Transfer
2.2.2	Describe all major components of a FDP	2	Functional architecture, technical architecture *Optional content: HMI, ATC Tools, support tools (technical supervision, QoS monitors and logging)*
2.2.3	Differentiate FDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
2.2.4	Appreciate how to operate the system	3	*Optional content: configuration, adjust parameters, start up and shut down, monitoring*
2.2.5	Explain the principles of emergency switching	2	—

C. The following objectives should be included in the **Surveillance Data Processing Systems** course:

2.3.1	Identify all functions of a SDP system	3	Plot processing, tracking, single sensor and multisensor tracker (e.g. radar, ADS, MLAT), estimating limits and accuracy of multisensor tracker, recording *Optional content: ARTAS tracker*
2.3.2	Describe all major components of a SDP	2	Functional architecture, technical architecture
2.3.3	Differentiate SDP features in the ATS units	2	Area Control Centres Approach Control Units Aerodrome Control Towers
2.3.4	Appreciate how to operate the system	3	*Optional content: configuration, adjust parameters, start up and shut down, monitoring*
2.3.5	Explain the principles of emergency switching	2	—

7. SUBJECT 4: DATA PROCESS — TOPIC 1: SOFTWARE PROCESS

A. The following objectives should be included in the **Middleware** course:

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	*Optional content: CORBA, UBSS, OTM, EJB*
1.1.3	Demonstrate the use of a middleware in an ATM environment	2	Duel processing system

B. The following objectives should be included in the **Operating Systems** course:

1.2.1	Describe the major aspects of a relevant operating system	2	*Optional content: design, start-up, configuration, back-up and restore*
1.2.2	Perform relevant operating system commands	3	—
1.2.3	Characterise typical consequences of an OS upgrade	2	Some possible implications on HW (performance, memory), middleware (compatibility) and SW components
1.2.4	Explain downward compatibility	2	Checks on embedded SW modules ability to run under new OS version
1.2.5	Take account of hardware/software compatibility	2	Examples of HW requirements of specific SW implementations
1.2.6	Describe interactions between application and OS	2	Examples of OS calls by the application software if no middleware is in use
1.2.7	Describe the life cycle management of an operating system	2	*Optional content: versions, releases, patches, migration*

C. The following objective should be included in the **Configuration Control** course:

1.3.1	Describe the principles of configuration control	2	Clear identifcation of all versions, proof of testing and 'build state', tool and mechanisms to aid control, authorisation, audit trail, appropriate quality standard requirements of the administration

D. The following objectives should be included in the **Software Development Process** course:

1.4.1	State the main software development processes	1	SWALs *Optional content: life cycle, waterfall model, RUP*

1.4.2	List the main steps of two of the main software development processes	1	—
1.4.3	Explain the main differences between two software development processes	2	*Optional content: advantages/disadvantages*

8. SUBJECT 4: DATA PROCESS — TOPIC 2: HARDWARE PLATFORM

A. The following objective should be included in the **Equipment Upgrade** course:

2.1.1	Explain the key factors that have to be considered when data processing equipment is upgraded or changed	2	Specification, compatibility, 'proven' or 'state-of-the-art' technology, maintenance and operating consequence (e.g. personnel, training, spares, procedures), environmental requirements (e.g. size, power requirements, temperature, interfaces), testing

B. The following objective should be included in the **COTS** course:

2.2.1	Explain the advantages and disadvantages of commercial off-the-shelf equipment	2	Cost, multiplicity of suppliers, quality, maintainability, life cycle, liability

C. The following objective should be included in the **Interdependence** course:

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

D. The following objective should be included in the **Maintainability** course:

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

9. SUBJECT 4: DATA PROCESS — TOPIC 3: TESTING

A. The following objectives should be included in the **Testing** course:

3.1.1	Appreciate the techniques available for system and performance requirements testing	3	*Optional content: code walkthrough, modelling, simulation real time and fast time, black box testing, formal methods, use of independent test personnel, data corruption simulation, hardware failure simulation*
3.1.2	Appreciate the techniques available for system testing and integration	3	*Optional content: system integration testing, load testing, regression testing*

10. SUBJECT 5: — TOPIC 1: DATA ESSENTIALS FEATURES

A. The following objective should be included in the **Data Significance** course:

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

B. The following objective should be included in the **Data Configuration Control** course:

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

C. The following objectives should be included in the **Data Standards** course:

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

11. SUBJECT 5: DATA — TOPIC 2: ATM DATA DETAILED STRUCTURE

A. The following objectives should be included in the **System Area** course:

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

B. The following objectives should be included in the **Characteristic Points** course:

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

C. The following objectives should be included in the **Aircraft Performances** course:

2.3.1	List the performance data used in FDPS	1	Example of data from in-house system
2.3.2	Describe the structure of aircraft performance data	2	—
2.3.3	*Define* speeds, rates and levels	1	—
2.3.4	Explain the consequences of the use of the wrong type of aircraft	2	—

D. The following objective should be included in the **Screen Manager** course:

2.4.1	Describe how the screen manager is used to set up the ATC HMI	2	—

E. The following objectives should be included in the **Auto-Coordination Messages** course:

2.5.1	Describe the meaning of coordination messages in the control process	2	Coordination parameters, conditions groups, OLDI conditions groups, characteristics of remote centres
2.5.2	Describe the characteristics of the remote centres relevant to OLDI	2	Civil and military

F. The following objective should be included in the **Configuration Control Data** course:

2.6.1	Explain the structure of the configuration data	2	Sector CSU link, sectorisation plan, control parameters

G. The following objective should be included in the **Physical Configuration Data** course:

2.7.1	Explain the structure of the physical configuration data	2	External configuration, device configuration

H. The following objective should be included in the **Relevant Meteorology Data** course:

2.8.1	Explain the organisation of the data related to meteorology	2	Meteorology, QNH TL areas, CB activity

I. The following objectives should be included in the **Alert and Error Messages to ATSEP** course:

2.9.1	Explain the importance of alert and error messages	2	—
2.9.2	Describe different categories of two alert and error messages	2	—

J. The following objectives should be included in the **Alert and Error Messages to ATCO** course:

2.10.1	Describe the structure of the data used in these types of message	2	MSAW, conflict alert parameters
2.10.2	Explaine alerts and error messages, and their importance from an ATCO point of view	2	*Optional content: MSAW, conflict alert, MTCD*

12. SUBJECT 6: SURVEILLANCE PRIMARY — TOPIC 1: ATC SURVEILLANCE

A. The following objective should be included in the **Use of PSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach PSR	2	Range, resolution, coverage, availability

13. SUBJECT 7: SURVEILLANCE SECONDARY — TOPIC 1: SSR AND MSSR

A. The following objectives should be included in the **Use of SSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach SSR	2	Range, coverage, resolution, performance, update rate ICAO Doc 9684
1.1.2	Relate key parameters of SSR to system performance	4	Key parameters: rotation rate, PRF, interlaced modes, capacity, frequencies, power budget (uplink, downlink), monopulse techniques Consequences: FRUIT, garbling, side lobes reception and transmission, transponder availability, PD, 2nd recurrence replies

14. SUBJECT 7: SURVEILLANCE SECONDARY — TOPIC 2: MODE S

A. The following objectives should be included in the **Introduction to Mode S** course:

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

15. SUBJECT 7: SURVEILLANCE SECONDARY — TOPIC 3: MULTILATERATION

A. The following objectives should be included in the **MLAT Principles** course:

3.1.1	Explain the MLAT system architecture	2	Standards, transmitters and receivers, data processing/fusion, redundancy, performance, costs, timing solutions, etc.
3.1.2	Appreciate the principles of MLAT system	3	Triangulation, coverage, position calculation *Optional content: SCAS*
3.1.3	Describe how to operate the system	2	Tracking, map creation and blanking
3.1.4	Describe testing possibilities for MLAT	2	*Optional content: SASS-C*

16. SUBJECT 8: SURVEILLANCE — HMI — TOPIC 3: HMI

A. The following objectives should be included in the **ATCO HMI** course:

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

16. SUBJECT 9: SURVEILLANCE DATA TRANSMISSION — HMI — TOPIC 1: SURVEILLANCE DATA TRANSMISSION HMI

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks (e.g. RADNET), messages CAT 1+
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

AMC13 ATSEP.OR.110(a) Qualification training — SYSTEM MONITORING AND CONTROL — COMMUNICATION

1. SUBJECT 1: COMMUNICATION VOICE — TOPIC 1: AIR-GROUND

A. The following objective should be included in the **Controller Working Position** course:

1.1.1	Describe the most common features of a controller working position	2	Frequency selection, emergency, station selection, coupling, headset, loudspeaker, footswitch, Push to Talk *Optional content: microphone (noise cancelling), short time recording*

2. SUBJECT 1: COMMUNICATION VOICE — TOPIC 2: GROUND-GROUND

A. The following objective should be included in the **Interfaces** course:

2.1.1	Describe the different types of interfaces	2	Analog (2, 4, 6 and 8 wires), digital ISDN (64 Kb, 2 Mb)

B. The following objectives should be included in the **Switch** course:

2.2.1	State the similarities between ground-ground and air-ground switches	1	Switching techniques
2.2.2	Describe the most commonly used functionality of PABX	2	General architecture, digital, analog, multiplex types, PCM30
2.2.3	Analyse conversion analog-digital, digital-analog	4	General architecture, analog-digital-analog

C. The following objective should be included in the **Controller Working Position** course:

2.3.1	Describe the two most common features of a controller working position and the HMI	2	—

3. SUBJECT 2: COMMUNICATION DATA — TOPIC 1: EUROPEAN NETWORKS

A. The following objectives should be included in the **Network Technologies** course:

1.1.1	State emerging network technologies	1	*Optional content: as used in EAN, NEAN, AMHS, PENS*
1.1.2	Describe the characteristics of the current networks	2	Surveillance data, flight plan data and AIS networks *Optional content: CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP, AMHS*

4. SUBJECT 2: COMMUNICATION DATA — TOPIC 2: GLOBAL NETWORKS

A. The following objective should be included in the **Networks and Standards** course:

2.1.1	List the global networks and the standards on which they are based	1	*Optional content: ICAO for AFTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)*

B. The following objective should be included in the **Description** course:

2.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service

C. The following objective should be included in the **Global Architecture** course:

2.3.1	Describe the architecture of the ATN	2	Air-ground subnetworks, ground-ground subnetworks, airborne networks

D. The following objective should be included in the **Air-Ground Subnetworks** course:

2.4.1	Describe air-ground subnetworks	2	VDL (mode 2), HFDL, AMSS, SATCOM

E. The following objective should be included in the **Ground-Ground Subnetworks** course:

2.5.1	Describe the composition of ground-ground subnetworks	2	PTT, commercial telecom providers, ARINC, SITA

F. The following objective should be included in the **Air-Ground Applications** course:

2.6.1	State the main communication applications using data link systems	1	*Optional content: CPDLC, DLIC/AFN, ATIS, DCL*

5. SUBJECT 3: COMMUNICATION RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how the ATM/ANS provider complies with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

6. SUBJECT 4: NAVIGATION — PBN NDB — TOPIC 1: NAV CONCEPTS

A. The following objective should be included in the **NOTAM** course:

1.1.1	Explain the need for NOTAMs	2	—

7. SUBJECT 5: SMC — ANS STRUCTURE — TOPIC 1: ANSP ORGANISATION AND OPERATION

A. The following objectives should be included in the **ANSP Organisation and Operation** course:

1.1.1	Describe the SMC function within the organisation	2	What the SMC does, interfaces with other functions, similarities and major differences between SMC function at different sites
1.1.2	Describe the structure, roles and responsibilities of the SMC team and any direct interfaces	2	—
1.1.3	Explaine the duties of the ATC supervisor	2	—

8. SUBJECT 5: SMC — ANS STRUCTURE — TOPIC 2: ANSP MAINTENANCE PROGRAM

A. The following objectives should be included in the **Policy** course:

2.1.1	Describe, in general terms, the ANSP maintenance policy	2	—
2.1.2	Describe the aspects of the maintenance policy that apply specifically to SMC	2	—

9. SUBJECT 5: SMC — ANS STRUCTURE — TOPIC 3: ATM CONTEXT

A. The following objective should be included in the **ATM Context** course:

3.1.1	Describe the ATM requirements and the related services provided by the SMC	2	Service level agreements, working arrangements *Optional content: ASM, AFTCM*

10. SUBJECT 5: SMC — ANS STRUCTURE — TOPIC 4: ANSP ADMINISTRATIVE PRACTICES

A. The following objective should be included in the **Administration** course:

4.1.1	Describe any ANSP administrative procedures, specifically applicable to SMC	2	Any non-technical practices *Optional content: security, access control (building and platform), safety, fire*

11. SUBJECT 6: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 1: OPERATIONAL IMPACTS

A. The following objectives should be included in the **Degradation or Loss of System/Equipment Services** course:

1.1.1	Describe the importance of monitoring system performance	2	—

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

12. SUBJECT 6: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 2: USER POSITION FUNCTIONALITY AND OPERATION

A. The following objective should be included in the **User Working Position** course:

2.1.1	Appreciate working position performance to agreed parameters	3	*Optional content: ATCO, Met, ATSEP, airport positions*

B. The following objective should be included in the **SMC Working Position** course:

2.2.1	Appreciate SMC working position performance to agreed parameters	3	—

13. SUBJECT 7: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 1: REQUIREMENTS

A. The following objective should be included in the **SMS** course:

1.1.1	Describe the ICAO and European requirements and the national and ANSP SMS plans	2	Commission Implementing Regulation (EU) No 1035/2011, ICAO Annex 10 *Optional content: national regulations*

A. The following objective should be included in the **QMS** course:

1.2.1	Describe the quality management system requirements	2	*Optional content: ISO, EFQM*

C. The following objectives should be included in the **SMS Application in the Working Environment** course:

1.3.1	Describe the relationship between the SMS and the application of SMC	2	Reporting procedures
1.3.2	Explain which occurrences require incident reporting and follow-up	2	*Optional content: national categories for reporting, Safety Event Processing*

	action(s)		
1.3.3	Apply incident reporting procedures to example occurrence(s)	3	*Optional content: Safety Event Procedure*

14. SUBJECT 7: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 2: MAINTENANCE AGREEMENTS WITH OUTSIDE AGENCIES REQUIREMENTS

A. The following objectives should be included in the **Principles of Agreements** course:

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

15. SUBJECT 7: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 3: SMC GENERAL PROCESSES

A. The following objectives should be included in the **Roles and Responsibilities** course:

3.1.1	Describe the role and general method of operations of the SMC	2	—
3.1.2	Describe the need to monitor service conditions and the way to take appropriate action to ensure service performance	2	*Optional content: process to interrupt services for planned maintenance purposes, management of service provision during corrective maintenance, continuity of service, availability*
3.1.3	Describe the coordination role of the SMC	2	*Optional content: ATSEPs, ATCOs, external* ATM/ANS providers, ATM stakeholders
3.1.4	Describe how risk analysis can contribute toward decision-making	2	*Optional content: assessing risk, handling of service interventions*

16. SUBJECT 7: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 4: MAINTENANCE MANAGEMENT SYSTEMS

A. The following objectives should be included in the **Reporting** course:

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

17. SUBJECT 8: SMC — TECHNOLOGY — TOPIC 1: TECHNOLOGIES AND PRINCIPLES

A. The following objective should be included in the **General** course:

1.1.1	Describe the principles of control and monitoring systems used	2	*Optional content: national basis, color codes, ergonomics*

B. The following objectives should be included in the **Communication** course:

1.2.1	Describe the key aspects of control and monitoring system capability	2	*Optional content: parameters presented to the SMC and types of actions that can be taken*
1.2.2	Appreciate the impact of the replacement of components in a communication chain	3	Continuity of service, communication chain integrity

C. The following objectives should be included in the **Facilities** course:

1.3.1	Describe the key aspects of system management capability	2	*Optional content: parameters presented to the SMC and types of actions that can be taken*
1.3.2	Appreciate the impact of the loss of supply and/or replacement of components in facility equipment	3	Continuity of service, integrity

AMC14 ATSEP.OR.110(a) Qualification training — SYSTEM MONITORING AND CONTROL — NAVIGATION

1. SUBJECT 1: NAVIGATION DATA — TOPIC 1: EUROPEAN NETWORKS

A. The following objectives should be included in the **Network Technologies** course:

1.1.1	State emerging network technologies	1	*Optional content: as used in EAN, NEAN, AMHS, PENS*
1.1.2	Describe the characteristics of the current networks	2	Surveillance data, flight plan data and AIS networks *Optional content: CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP, AMHS*

2. SUBJECT 1: NAVIGATION DATA — TOPIC 2: GLOBAL NETWORKS

A. The following objective should be included in the **Networks and Standards** course:

2.1.1	List the global networks and the standards on which they are based	1	Optional content: ICAO for AFTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)

B. The following objective should be included in the **Description** course:

2.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service

C. The following objective should be included in the **Global Architecture** course:

2.3.1	Describe the architecture of the ATN	2	Air-ground subnetworks, ground-ground subnetworks, airborne networks

D. The following objective should be included in the **Air-Ground Subnetworks** course:

2.4.1	Describe the air-ground subnetworks	2	VDL (mode 2), HFDL, AMSS, SATCOM

E. The following objective should be included in the **Ground-Ground Subnetworks** course:

2.5.1	Describe the composition of ground-ground subnetworks	2	PTT, commercial telecom providers, ARINC, SITA

F. The following objective should be included in the **Air-Ground Applications** course:

2.6.1	State the main communication applications using data link systems	1	*Optional content: CPDLC, DLIC/AFN, ATIS, DCL*

3. SUBJECT 2: COMMUNICATION RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how ATM/ANS providers comply with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information.*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

4. SUBJECT 3: NAVIGATION — PBN NDB — TOPIC 1: NAV CONCEPTS

A. The following objective should be included in the **NOTAM** course:

1.1.1	Explain the need for NOTAMs	2	—

5. SUBJECT 4: NAVIGATION — GROUND-BASED SYSTEMS-NDB — TOPIC 1: NDB LOCATOR

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Appreciate the principles of NDB	3	Relative bearing, measuring method
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system,

			integrity, continuity
1.1.3	Explain the technical limitations of NDB	2	Lack of accuracy, lack of integrity, sensitivity to interference
1.1.4	Describe the current situation	2	*Optional content: number, type, users, user groups, European context*

6. SUBJECT 5: NAVIGATION — GROUND-BASED SYSTEMS-DFI — TOPIC 1: DF

A. The following objectives should be included in the **Use of the System** course:

1.1.1	State the different types of DF	1	VDF, DDF, IDF
1.1.2	Describe the user HMI	2	Indication on radar picture, DF indicator
1.1.3	Appreciate the principles of DF	3	Bearing, measuring method (standard, Doppler, interferometry)
1.1.4	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.5	Explain the technical limitations of DF	2	Sensitivity to interference
1.1.6	Describe the current situation	2	*Optional content: number, type, users, national context*

7. SUBJECT 6: NAVIGATION — GROUND-BASED SYSTEMS-VOR — TOPIC 1 VOR

A. The following objectives should be included in the **Use of the System** course:

1.1.1	State the types of VOR Systems	1	Conventional, Doppler
1.1.2	Describe the overall performance	2	Coverage, accuracy, availability of the system, integrity, continuity
1.1.3	Explaine the technical limitations of CVOR	2	Type of information (azimuth), accuracy, integrity, suitable for a network of fixed routes
1.1.4	Appreciate the differences between CVOR and DVOR	3	Signal broadcast differences, bearing information robustness
1.1.5	Describe the current situation	2	*Optional content: number, type, users, user groups, national context, European context*

8. SUBJECT 7: NAVIGATION — GROUND-BASED SYSTEMS-DME — TOPIC 1: DME

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Describe the overall performances for DME	2	Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the limitations of DME	2	Accuracy, integrity, capacity

1.1.3	Describe the current situation	2	*Optional content: number, types, users, user groups, national context, European context*
1.1.4	State the role of the DME infrastructure in the future navigation applications	1	PBN
1.1.5	Explain the differences between DME and TACAN for civilian use	2	*Optional content: azimuth and range*

9. SUBJECT 8: NAVIGATION — GROUND-BASED SYSTEMS-ILS — TOPIC 1: ILS

A. The following objectives should be included in the **Use of the System** course:

1.1.1	Describe the overall performances for ILS	2	ICAO Annexes 10 and 14 Coverage, accuracy, availability of the system, integrity, continuity, number of users
1.1.2	Explain the technical limitations of ILS	2	ICAO Annexes 10 and 14 Only 40 channels, no segmented paths of approach, beam corruption due to multi-path
1.1.3	Interpret ILS Facility Performance Categories	5	ICAO Annexes 10 and 14 Cat I, Cat II, Cat III Different operational category depending on operational minima, equipment and airport facilities
1.1.4	Define obstacle free zones for ILS components	1	ICAO Annexes 10 and 14 Dimensions *Optional content: national regulations*
1.1.5	Explain the importance and need for ILS obstacle free zones	2	ILS beam protection, increased significance during LVP conditions
1.1.6	Explain the current situation	2	*Optional content: number, type, users, national context*
1.1.7	Consider the need for ATC ILS status indications	2	No continuous monitoring by ATSEP

10. SUBJECT 9: SMC — ANS STRUCTURE — TOPIC 1: ANSP ORGANISATION AND OPERATION

A. The following objectives should be included in the **ANSP Organisation and Operation** course:

1.1.1	Describe the SMC function within the organisation	2	What the SMC does, interfaces with other functions, similarities and major differences between SMC function at different sites
1.1.2	Describe the structure, roles and responsibilities of the SMC team	2	—

	and any direct interfaces		
1.1.3	Explain the duties of the ATC supervisor	2	—

11. SUBJECT 9: SMC — ANS STRUCTURE — TOPIC 2: ANSP MAINTENANCE PROGRAM

A. The following objectives should be included in the **Policy** course:

2.1.1	Describe, in general terms, the ANSP maintenance policy	2	—
2.1.2	Describe the aspects of the maintenance policy that apply specifically to SMC	2	—

12. SUBJECT 9: SMC — ANS STRUCTURE — TOPIC 3: ATM CONTEXT

A. The following objective should be included in the **ATM Context** course:

3.1.1	Describe the ATM requirements and the related services provided by the SMC	2	Service level agreements, working arrangements *Optional content: ASM, AFTCM*

13. SUBJECT 9: SMC — ANS STRUCTURE — TOPIC 4: ANSP ADMINISTRATIVE PRACTICES

A. The following objective should be included in the **Administration** course:

4.1.1	Describe any ANSP administrative procedures, specifically applicable to SMC	2	Any non-technical practices *Optional content: security, access control (building and platform), safety, fire*

14. SUBJECT 10: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 1: OPERATIONAL IMPACTS

A. The following objectives should be included in the **Degradation or Loss of System/Equipment Services** course:

1.1.1	Describe the importance of monitoring system performance	2	—
1.1.2	Describe possible ways in which the SMC may become aware of degradation of services and/or systems	2	*Optional content: monitoring systems, telephone calls, aural alerts, user complaint*
1.1.3	Take account of the end users/customers affected	2	*Optional content: ATC units, airports, airlines*
1.1.4	Appreciate the implications for end users/customers	3	—
1.1.5	Appreciate the appropriate actions to restore service	3	*Optional content: switching, replacing, reconfiguration, calling external service provider*
1.1.6	Appreciate the need for appropriate communication	3	*Optional content: users, customers, external and internal providers*

	before and after restoring service		

15. SUBJECT 10: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 2: USER POSITION FUNCTIONALITY AND OPERATION

A. The following objective should be included in the **User Working Position** course:

2.1.1	Appreciate working position performance to agreed parameters	3	*Optional content: ATCO, MET, ATSEP, airport positions*

B. The following objective should be included in the **SMC Working Position** course:

2.2.1	Appreciate SMC working position performance to agreed parameters	3	—

16. SUBJECT 11: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 1: REQUIREMENTS

A. The following objective should be included in the **SMS** course:

1.1.1	Describe the ICAO and European requirements and the national and ANSP SMS plans	2	Commission Implementing Regulation (EU) No 1035/2011, ICAO Annex 10 *Optional content: national regulations*

A. The following objective should be included in the **QMS** course:

1.2.1	Describe the quality management system requirements	2	*Optional content: ISO, EFQM*

C. The following objectives should be included in the **SMS Application in the Working Environment** course:

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

17. SUBJECT 11: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 2: MAINTENANCE AGREEMENTS WITH OUTSIDE AGENCIES REQUIREMENTS

A. The following objectives should be included in the **Principles of Agreements** course:

2.1.1	Describe the principles and need for maintenance agreements	2	*Optional content: types of service level provided*
2.1.2	Describe within which functional areas maintenance agreements	2	*Optional content: network providers, facilities management, communications*

	will occur		
2.1.3	Describe where in the SMS Manual these agreements are included or referenced	2	—

18. SUBJECT 11: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 3: SMC GENERAL PROCESSES

A. The following objectives should be included in the **Roles and Responsibilities** course:

3.1.1	Describe the role and general method of operations of the SMC	2	—
3.1.2	Describe the need to monitor service conditions and the way to take appropriate action to ensure service performance	2	*Optional content: process to interrupt services for planned maintenance purposes, management of service provision during corrective maintenance, continuity of service, availability*
3.1.3	Describe the coordination role of the SMC	2	*Optional content: ATSEPs, ATCOs, external ATM/ANS providers, ATM stakeholders*
3.1.4	Describe how risk analysis can contribute toward decision-making	2	*Optional content: assessing risk, handling of service interventions*

19. SUBJECT 11: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 4: MAINTENANCE MANAGEMENT SYSTEMS

A. The following objectives should be included in the **Reporting** course:

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

17. SUBJECT 12: SMC — TECHNOLOGY — TOPIC 1: TECHNOLOGIES AND PRINCIPLES

A. The following objective should be included in the **General** course:

1.1.1	Describe the principles of control and monitoring systems used	2	*Optional content: national basis, colour codes, ergonomics*

B. The following objectives should be included in the **Navigation** course:

1.3.1	Describe the key aspects of control and monitoring system capability	2	e.g. parameters presented to the SMC and types of actions that can be taken
1.3.2	Appreciate the impact of the replacement of components in	3	Continuity of service, navigation aid integrity

	navigation equipment		

C. The following objectives should be included in the **Facilities** course:

1.6.1	Describe the key aspects of system management capability	2	*Optional content: parameters presented to the SMC and types of actions that can be taken*
1.6.2	Appreciate the impact of the loss of supply and/or replacement of components in facility equipment	3	Continuity of service, integrity

AMC15 ATSEP.OR.110(a) Qualification training — SYSTEM MONITORING AND CONTROL — SURVEILLANCE

1. SUBJECT 1: SURVEILLANCE DATA — TOPIC 1: EUROPEAN NETWORKS

A. The following objectives should be included in the **Network Technologies** course:

1.1.1	State emerging network technologies	1	*Optional content: as used in EAN, NEAN, AMHS, PENS*
1.1.2	Describe the characteristics of the current networks	2	Surveillance data, flight plan data and AIS networks *Optional content: CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP, AMHS*

2. SUBJECT 1: SURVEILLANCE DATA — TOPIC 2: GLOBAL NETWORKS

A. The following objective should be included in the **Networks and Standards** course:

2.1.1	List the global networks and the standards on which they are based	1	*Optional content: ICAO for AFTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)*

B. The following objective should be included in the **Description** course:

2.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service

C. The following objective should be included in the **Global Architecture** course:

2.3.1	Describe the architecture of the ATN	2	Air-ground subnetworks, ground-ground subnetworks, airborne networks

D. The following objective should be included in the **Air-Ground Subnetworks** course:

2.4.1	Describe the air-ground subnetworks	2	VDL (mode 2), HFDL, AMSS, SATCOM

E. The following objective should be included in the **Ground-Ground Subnetworks** course:

2.5.1	Describe the composition of ground-ground subnetworks	2	PTT, commercial telecom providers, ARINC, SITA

F. The following objective should be included in the **Air-Ground Applications** course:

2.6.1	State the main communication applications using data link systems	1	*Optional content: CPDLC, DLIC/AFN, ATIS, DCL*

3. SUBJECT 2: COMMUNICATION RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain the international regulations	2	ICAO regulations (recording and reproducing)
1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how ATM/ANS providers comply with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

4. SUBJECT 3: NAVIGATION — PBN — TOPIC 1: NAV CONCEPTS

A. The following objective should be included in the **NOTAM** course:

1.1.1	Explaining the need for NOTAMs	2	—

5. SUBJECT 4: SURVEILLANCE — PRIMARY — TOPIC 1: ATC SURVEILLANCE

A. The following objective should be included in the **Use of PSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach PSR	2	Range, resolution, coverage, availability

6. SUBJECT 5: SURVEILLANCE — SECONDARY — TOPIC 1: SSR AND MSSR

A. The following objective should be included in the **Use of SSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or	2	Range, coverage, resolution, performance, update rate

	an approach SSR		ICAO Doc 9684

7. SUBJECT 5: SURVEILLANCE — SECONDARY — TOPIC 2: MODE S

A. The following objectives should be included in the **Introduction to Mode S** course:

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

8. SUBJECT 5: SURVEILLANCE — SECONDARY — TOPIC 3: MULTILATERATION

A. The following objectives should be included in the **MLAT Principles** course:

3.1.1	Explain the MLAT system architecture	2	Standards, transmitters and receivers, data processing/fusion, redundancy, performance, costs, timing solutions, etc.
3.1.2	Appreciate the principles of MLAT system	3	Triangulation, coverage, position calculation *Optional content: SCAS*
3.1.3	Describe how to operate the system	2	Tracking, map creation and blanking
3.1.4	Describe testing possibilities for MLAT	2	*Optional content: SASS-C*

9. SUBJECT 6: SURVEILLANCE — HMI — TOPIC 1: HMI

A. The following objectives should be included in the **ATCO HMI** course:

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

10. SUBJECT 7: SURVEILLANCE — DATA TRANSMISSION — TOPIC 1: SURVEILLANCE DATA TRANSMISSION

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks *Optional content: RADNET, messages CAT 1+*
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

11. SUBJECT 8: SMC — ANS STRUCTURE — TOPIC 1: ANSP ORGANISATION AND OPERATION

A. The following objectives should be included in the **ANSP Organisation and Operation** course:

1.1.1	Describe the SMC function within the organisation	2	What the SMC does, interfaces with other functions, similarities and major differences between SMC function at different sites
1.1.2	Describe the structure, roles and responsibilities of the SMC team and any direct interfaces	2	—
1.1.3	Explain the duties of the ATC supervisor	2	—

12. SUBJECT 8: SMC — ANS STRUCTURE — TOPIC 2 ANSP MAINTENANCE PROGRAM

A. The following objectives should be included in the **Policy** course:

2.1.1	Describe, in general terms, the ANSP maintenance policy	2	—
2.1.2	Describe the aspects of the maintenance policy that apply specifically to SMC	2	—

13. SUBJECT 8: SMC — ANS STRUCTURE — TOPIC 3: ATM CONTEXT

A. The following objective should be included in the **ATM Context** course:

3.1.1	Describe the ATM requirements and the related services provided by the SMC	2	Service level agreements, working arrangements *Optional content: ASM, AFTCM*

14. SUBJECT 8: SMC — ANS STRUCTURE — TOPIC 4: ANSP ADMINISTRATIVE PRACTICES

A. The following objective should be included in the **Administration** course:

4.1.1	Describe any ANSP administrative procedures, specifically applicable to SMC	2	Any non-technical practices *Optional content: security, access control (building and platform), safety, fire*

15. SUBJECT 9: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 1: OPERATIONAL IMPACTS

A. The following objectives should be included in the **Degradation or Loss of System/Equipment Services** course:

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

16. SUBJECT 9: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 2: USER POSITION FUNCTIONALITY AND OPERATION

A. The following objective should be included in the **User Working Position** course:

2.1.1	Appreciate working position performance to agreed parameters	3	*Optional content: ATCO, MET, ATSEP, airport positions*

B. The following objective should be included in the **SMC Working Position** course:

2.2.1	Appreciate SMC working position performance to agreed parameters	3	—

17. SUBJECT 10: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 1: REQUIREMENTS

A. The following objective should be included in the **SMS** course:

1.1.1	Describe the ICAO and European requirements and the national and ANSP SMS plans	2	Commission Implementing Regulation (EU) No 1035/2011, ICAO Annex 10 *Optional content: national regulations*

A. The following objective should be included in the **QMS** course:

1.2.1	Describe the quality management system requirements	2	*Optional content: ISO, EFQM*

C. The following objectives should be included in the **SMS Application in the Working Environment** course:

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

18. SUBJECT 10: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 2: MAINTENANCE AGREEMENTS WITH OUTSIDE AGENCIES REQUIREMENTS

A. The following objectives should be included in the **Principles of Agreements** course:

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

19. SUBJECT 10: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 3: SMC GENERAL PROCESSES

A. The following objectives should be included in the **Roles and Responsibilities** course:

3.1.1	Describe the role and general method of operations of the SMC	2	—

3.1.2	Describe the need to monitor service conditions and the way to take appropriate action to ensure service performance	2	*Optional content: process to interrupt services for planned maintenance purposes, management of service provision during corrective maintenance, continuity of service, availability*
3.1.3	Describe the coordination role of the SMC	2	*Optional content: ATSEPs, ATCOs, external ATM/ANS providers, ATM stakeholders*
3.1.4	Describe how risk analysis can contribute toward decision-making	2	*Optional content: assessing risk, handling of service interventions*

20. SUBJECT 10: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 4: MAINTENANCE MANAGEMENT SYSTEMS

A. The following objectives should be included in the **Reporting** course:

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

21. SUBJECT 11: SMC — TECHNOLOGY — TOPIC 1: TECHNOLOGIES AND PRINCIPLES

A. The following objective should be included in the **General** course:

1.1.1	Describe the principles of control and monitoring systems used	2	*Optional content: national basis, color codes, ergonomics*

B. The following objectives should be included in the **Surveillance** course:

1.4.1	Describe the key aspects of control and monitoring system capability	2	e.g. parameters presented to the SMC and types of actions that can be taken
1.4.2	Appreciate the impact of the replacement of components in a surveillance chain	3	Continuity of service, surveillance chain integrity

C. The following objectives should be included in the **Facilities** course:

1.6.1	Describe the key aspects of system management capability	2	*Optional content: parameters presented to the SMC and types of actions that can be taken*
1.6.2	Appreciate the impact of the loss of supply and/or replacement of components in facility equipment	3	Continuity of service, integrity

AMC16 ATSEP.OR.110(a) Qualification training — SYSTEM MONITORING AND CONTROL — DATA

1. SUBJECT 1: COMMUNICATION DATA — TOPIC 1: EUROPEAN NETWORKS

A. The following objectives should be included in the **Network Technologies** course:

1.1.1	State emerging network technologies	1	*Optional content: as used in EAN, NEAN, AMHS, PENS*
1.1.2	Describe the characteristics of the current networks	2	Surveillance data, flight plan data and AIS networks *Optional content: CIDIN, OLDI, CFMU-RCA, quality of service, architecture, FMTP, AMHS*

2. SUBJECT 1: COMMUNICATION DATA — TOPIC 2: GLOBAL NETWORKS

A. The following objective should be included in the **Networks and Standards** course:

2.1.1	List the global networks and the standards on which they are based	1	*Optional content: ICAO for AFTN/CIDIN/AMHS, ICAO for ATN, FANS 1 and FANS A for ACARS applications (SITA and ARINC)*

B. The following objective should be included in the **Description** course:

2.2.1	Describe the characteristics of the AFTN networks	2	Users and data, architectures, quality of service

C. The following objective should be included in the **Global Architecture** course:

2.3.1	Describe the architecture of the ATN	2	Air-ground subnetworks, ground-ground subnetworks, airborne networks

D. The following objective should be included in the **Air-Ground Subnetworks** course:

2.4.1	Describe the air-ground subnetworks	2	VDL (mode 2), HFDL, AMSS, SATCOM

E. The following objective should be included in the **Ground-Ground Subnetworks** course:

2.5.1	Describe the composition of ground-ground subnetworks	2	PTT, commercial telecom providers, ARINC, SITA

F. The following objective should be included in the **Air-Ground Applications** course:

2.6.1	State the main communication applications using data link systems	1	*Optional content: CPDLC, DLIC/AFN, ATIS, DCL*

3. SUBJECT 2: COMMUNICATION RECORDERS — TOPIC 1: LEGAL RECORDERS

A. The following objectives should be included in the **Regulations** course:

1.1.1	Explain the international regulations	2	ICAO regulations (recording and reproducing)

1.1.2	Explain national regulations	2	Appropriate national regulations
1.1.3	Explain how the ATM/ANS provider complies with the regulations	2	*Optional content: storage media, access to recording and reproducing room, time to store information (overwrite/erase voice or data), procedure to reproduce information*

B. The following objective should be included in the **Principles** course:

1.2.1	Explain the principles of recording and reproducing	2	*Optional content: storage media (tape, optical and magnetic disc), A/D-D/A converters, frequency range (300 to 3400 Hz), channel capacity, time synchronisation, connection to a network, synchronisation of radar and voice recording, replay limitations*

4. SUBJECT 3: NAVIGATION — PBN — TOPIC 1: NAV CONCEPTS

A. The following objective should be included in the **NOTAM** course:

1.1.1	Explain the need for NOTAMs	2	—

5. SUBJECT 4: SURVEILLANCE — PRIMARY — TOPIC 1: ATC SURVEILLANCE

A. The following objective should be included in the **Use of PSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach PSR	2	Range, resolution, coverage, availability

6. SUBJECT 4: SURVEILLANCE — SECONDARY — TOPIC 1: SSR AND MSSR

A. The following objective should be included in the **Use of SSR for Air Traffic Services** course:

1.1.1	Describe the operational requirements of an en-route or an approach SSR	2	Range, coverage, resolution, performance, update rate ICAO Doc 9684

7. SUBJECT 4: SURVEILLANCE — SECONDARY — TOPIC 2: MODE S

A. The following objectives should be included in the **Introduction to Mode S** course:

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

2.1.4	Explain Mode S implementation	2	Elementary and enhanced surveillance, II and SI codes, use of BDS

8. SUBJECT 4: SURVEILLANCE — SECONDARY — TOPIC 3: MULTILATERATION

A. The following objectives should be included in the **MLAT Principles** course:

3.1.1	Explain the MLAT system architecture	2	Standards, transmitters and receivers, data processing/fusion, redundancy, performance, costs, timing solutions, etc.
3.1.2	Appreciate the principles of MLAT system	3	Triangulation, coverage, position calculation *Optional content: SCAS*
3.1.3	Describe how to operate the system	2	Tracking, map creation and blanking
3.1.4	Describe testing possibilities for MLAT	2	*Optional content: SASS-C*

9. SUBJECT 5: SURVEILLANCE — HMI — TOPIC 1: HMI

A. The following objectives should be included in the **ATCO HMI** course:

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

10. SUBJECT 6: SURVEILLANCE — DATA TRANSMISSION — TOPIC 1: SURVEILLANCE DATA TRANSMISSION

A. The following objectives should be included in the **Technology and Protocols** course:

1.1.1	Describe the implementation of formats and protocols	2	Network protocols, Surveillance Data Networks *Optional content: RADNET, messages CAT 1+*
1.1.2	Decode ASTERIX messages	3	*Optional content: categories 1, 2, 20, 21, 34, 48, and 62*
1.1.3	Identify the data transmission architecture in a multisensor environment	3	Fault tolerance, redundancy of line equipment *Optional content: software fallback capability, contingency of service, RADNET*
1.1.4	Characterise the degradations of the surveillance transmission network	2	*Optional content: saturation, excess latency*

11. SUBJECT 7: DATA PROCESSING — DSP SYSTEMS — TOPIC 1: USER REQUIREMENTS

A. The following objectives should be included in the **Controller Requirements** course:

1.1.1	Explain ATCO missions and services needed in an Area Control Centre	2	Operational requirements *Optional content: separation, flight progress monitoring and coordination, trajectory prediction, coordination with adjacent centres*
1.1.2	Explain ATCO missions and services needed in an Approach Control Unit	2	Operational requirements *Optional content: vectoring, sequencing, AMAN, CDM*
1.1.3	Explain ATCO missions and services needed in an Aerodrome Control Tower	2	Operational requirements *Optional content: runway management, DMAN*

B. The following objectives should be included in the **Trajectories, Prediction and Calculation** course:

1.2.1	State different types of trajectories	1	*Optional content: FPL-based, surveillance data-based, FMS-based*
1.2.2	Explain the main processes for trajectory prediction	2	SDP trajectory, FPL trajectory, merged trajectory, predicted trajectory

C. The following objective should be included in the **Ground Safety Nets** course:

1.3.1	Describe the function of safety nets 2 and their legal status	2	STCA, APW, MSAW, ASMGCS-based safety nets

D. The following objectives should be included in the **Decision Support** course:

1.4.1	Explain the major steps in the air traffic planning process	2	ATFCM with strategic, pre-tactical and tactical, ATC sector planning, tactical control
1.4.2	Explain the principles of trajectory prediction, conformance monitoring and medium term conflict detection processes	2	Route adherence monitoring *Optional content: CORA, MTCD, CLAM, Level adherence monitoring*
1.4.3	Explain the benefit of these tools for safety and efficiency	2	—

12. SUBJECT 8: DATA PROCESSING — DATA PROCESS — TOPIC 1: HARDWARE PLATFORM

A. The following objective should be included in the **Equipment Upgrade** course:

1.1.1	Explain the key factors that have to be considered when data processing equipment is upgraded or changed	2	Specification, compatibility, 'proven' or 'state-of-the-art' technology, maintenance and operating consequence (e.g. personnel, training, spares, procedures), environmental requirements (e.g. size, power requirements, temperature, interfaces), testing

B. The following objective should be included in the **COTS** course:

2.2.1	Explain the advantages and disadvantages of commercial off-the-shelf equipment	2	Cost, multiplicity of suppliers, quality, maintainability, life cycle, liability

C. The following objective should be included in the **Interdependence** course:

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

13. SUBJECT 9: DATA PROCESSING — DATA — TOPIC 1: DATA ESSENTIALS FEATURES

A. The following objective should be included in the **Data Significance** course:

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

B. The following objective should be included in the **Data Configuration Control** course:

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

C. The following objectives should be included in the **Data Standards** course:

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

14. SUBJECT 10: SMC — ANS STRUCTURE — TOPIC 1: ANSP ORGANISATION AND OPERATION

A. The following objectives should be included in the **ANSP Organisation and Operation** course:

1.1.1	Describe the SMC function within the organisation	2	What the SMC does, interfaces with other functions, similarities and major differences between SMC function at different sites
1.1.2	Describe the structure, roles and responsibilities of the SMC team and any direct interfaces	2	—
1.1.3	Explain the duties of the ATC Supervisor	2	—

15. SUBJECT 10: SMC — ANS STRUCTURE — TOPIC 2: ANSP MAINTENANCE PROGRAM

A. The following objectives should be included in the **Policy** course:

2.1.1	Describe, in general terms, the ANSP Maintenance Policy	2	—
2.1.2	Describe the aspects of the Maintenance Policy that apply specifically to SMC	2	—

16. SUBJECT 10: SMC — ANS STRUCTURE — TOPIC 3: ATM CONTEXT

A. The following objective should be included in the **ATM Context** course:

3.1.1	Describe the ATM requirements and the related services provided by the SMC	2	Service level agreements, working arrangements *Optional content: ASM, AFTCM*

17. SUBJECT 10: SMC — ANS STRUCTURE — TOPIC 4: ANSP ADMINISTRATIVE PRACTICES

A. The following objective should be included in the **Administration** course:

4.1.1	Describe any ANSP administrative procedures, specifically applicable to SMC	2	Any non-technical practices *Optional content: security, access control (building and platform), safety, fire*

18. SUBJECT 11: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 1: OPERATIONAL IMPACTS

A. The following objectives should be included in the **Degradation or Loss of System/Equipment Services** course:

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

19. SUBJECT 11: SMC — ANS SYSTEM/EQUIPMENT — TOPIC 2: USER POSITION FUNCTIONALITY AND OPERATION

A. The following objective should be included in the **User Working Position** course:

2.1.1	Appreciate working position performance to agreed parameters	3	*Optional content: ATCO, MET, ATSEP, airport positions*

B. The following objective should be included in the **SMC Working Position** course:

2.2.1	Appreciate SMC working position performance to agreed parameters	3	—

20. SUBJECT 12: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 1: REQUIREMENTS

A. The following objective should be included in the **SMS** course:

1.1.1	Describe the ICAO and European requirements and the national and ANSP SMS plans	2	Commission Implementing Regulation (EU) No 1035/2011, ICAO Annex 10 *Optional content: national regulations*

B. The following objective should be included in the **QMS** course:

1.2.1	Describe the quality management system requirements	2	*Optional content: ISO, EFQM*

C. The following objectives should be included in the **SMS Application in the Working Environment** course:

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

21. SUBJECT 12: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 2: MAINTENANCE AGREEMENTS WITH OUTSIDE AGENCIES REQUIREMENTS

A. The following objectives should be included in the **Principles of Agreements** course:

2.1.1	Describe the principles and need for maintenance agreements	2	*Optional content: types of service level provided*
2.1.2	Describe within which functional areas maintenance agreements will occur	2	*Optional content: network providers, facilities management, communications*

2.1.3	Describe where in the SMS Manual these agreements are included or referenced	2	—

22. SUBJECT 12: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 3: SMC GENERAL PROCESSES

A. The following objectives should be included in the **Roles and Responsibilities** course:

3.1.1	Describe the role and general method of operations of the SMC	2	—
3.1.2	Describe the need to monitor service conditions and the way to take appropriate action to ensure service performance	2	*Optional content: process to interrupt services for planned maintenance purposes, management of service provision during corrective maintenance, continuity of service, availability*
3.1.3	Describe the coordination role of the SMC	2	*Optional content: ATSEPs, ATCOs, external ATM/ANS providers, ATM stakeholders*
3.1.4	Describe how risk analysis can contribute toward decision-making	2	*Optional content: assessing risk, handling of service interventions*

23. SUBJECT 12: SMC — TOOLS, PROCESSES AND PROCEDURES — TOPIC 4: MAINTENANCE MANAGEMENT SYSTEMS

A. The following objectives should be included in the **Reporting** course:

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

24. SUBJECT 12: SMC — TECHNOLOGY — TOPIC 1: TECHNOLOGIES AND PRINCIPLES

A. The following objective should be included in the **General** course:

1.1.1	Describe the principles of control and monitoring systems used	2	*Optional content: national basis, color codes, ergonomics*

B. The following objectives should be included in the **Data Processing** course:

1.3.1	Describe the key aspects of control and monitoring system capability	2	e.g. parameters presented to the SMC and types of actions that can be taken
1.3.2	Appreciate the impact of the replacement of components in data processing chain	3	Continuity of service, data processing, chain integrity

C. The following objectives should be included in the **Facilities** course:

1.3.1	Describe the key aspects of system management capability	2	*Optional content: parameters presented to the SMC and types of actions that can be taken*
1.3.2	Appreciate the impact of the loss of supply and/or replacement of components in facility equipment	3	Continuity of service, integrity

GM1 to Appendix 1a, 2a, 3a and 4a to ANNEX XII
SYLLABI STRUCTURE

This guidance material provides explanatory material on how to read the tables in the appendices contained in this ANNEX XII.

(a) Structure of the syllabi

Each table represents a syllabus which has been structured according to the following:

(1) for ease of reading, each table repeats the titles of all subjects that are listed in the implementing rule; and

(2) these subjects are further divided into the topics that are listed in the implementing rule; then

(3) topics are divided into one or more subtopics; and

(4) subtopics contain one or more training objectives.

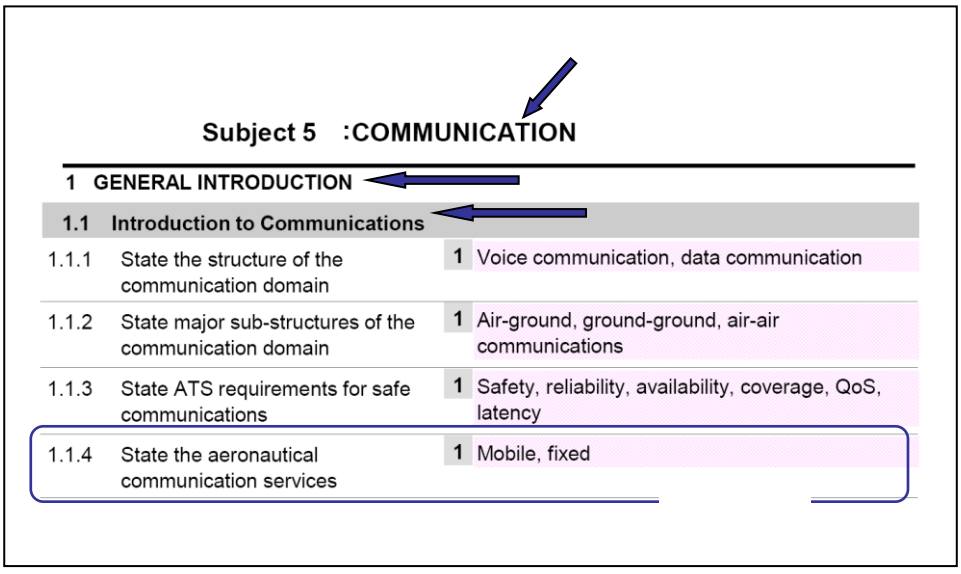


Figure 1: Structure of tables.

(b) Training objectives

Each training objective should be understood to contain three mandatory elements:

(1) Corpus, which is a description of the required performance. It always contains an action verb at the beginning of the sentence to ensure that the outcome is observable. The action verb is always associated with a defined taxonomy.

(2) Taxonomy Level, which is the numerical representation of the classification of the action verb.

(3) Content.

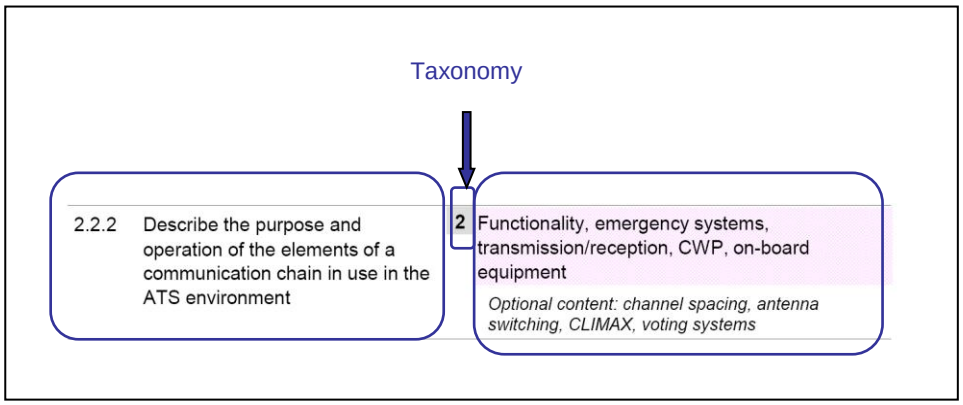


Figure 2: A training objective consists of corpus, taxonomy level and content.

(c) Corpus

Objectives relate to single activities, where possible.

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

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

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

Figure 3: Example of an objective with generic equipment.

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

(d) Taxonomy levels

The five taxonomy levels should be understood to have the following levels of complexity:

(1) Level 1 — Basic knowledge of the subject. It is the ability to remember essential points, to memorise data, and retrieve it.

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

(3) Level 3 — Thorough knowledge of the subject and the ability to apply it with accuracy. The ability to make use of the repertoire of knowledge to develop plans and activate them.

(4) Level 4 — The ability to establish a line of action 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.

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

(e) Content

The content illustrates and details performance.

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

When the items are in a list, each of them is to be addressed as a minimum.

Optional content items are italicised and clearly preceded with the words 'Optional content'. They help to illustrate the type of content that may be used to achieve given objectives.

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

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

(f) Additional note in content

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

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

Figure C: Example of an objective with 'Appreciate + additional note'.

When the verb 'appreciate' is used with the additional note, the objective may, as a minimum, be taught as a theoretical objective during qualification training. This is permitted when using 'appreciate', i.e. learners shall be able to understand a situation and know what is involved in a problem-solving situation, to state a plan without applying it. However, it is acknowledged that these objectives, without any practical application, are of extremely limited operational competence value. Therefore, these objectives shall, at the latest, be achieved practically during system/equipment rating training.

(g) Common training objectives

An objective should be considered common to two or more qualification streams if the objective recurs verbatim and the context within which the objective is applied does not change.

Common objectives should be taught at least once when:

(1) training for two or more qualification streams are combined to form one course; or

(2) a course is provided for the purpose of an ATSEP acquiring an additional qualification stream.

(h) Action verbs

The tables below list action verbs and their associated taxonomy levels that are used in training objectives.

Definition of verbs — Level 1

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

Definition of verbs — Level 2

Verb	Definition	Example
Characterise	Describe the quality of features in something.	Characterise navigation methods.
Consider	Think carefully about it.	Consider the benefits of Critical Incident Stress Management (CISM).
Demonstrate	Describe and explain. Logically or mathematically, prove the truth of the a statement.	Demonstrate the use of middleware in an ATM environment.
Describe	Say what it is like or what happened.	Describe the elements of Global Navigation Satellite System (GNSS) in Europe.
Differentiate	Show the difference between things.	Differentiate conventional navigation from area navigation.
Explain	Give details about something or describe so that it can be understood.	Explain the function of FDP.

Take account of	Take into consideration before deciding.	Take account of hardware/software compatibility.

Definition of verbs — Level 3

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

Definition of verbs — Level 4

Verb	Definition	Example
Adjust	Change to a new position, value or setting.	Adjust a generic radio receiver.
Analyse	Examine minutely the constitution of.	Analyse the block diagram of a generic radio receiver.
Justify	Show the rightness of a choice or of an option.	Justify the occasions when it is necessary to downgrade an ILS Facility Performance Category.
Relate	Establish link with.	Relate VOR station design to operational requirement.

Definition of verbs — Level 5

Verb	Definition	Example
Interpret	Decide on meaning or significance of something when there is a choice.	Interpret ILS facility Performance Categories.

(i) Acronyms

The following abbreviations are applied within the tables:

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

ASMGCS	Advanced SMGCS
ASTERIX	All purpose Structured EUROCONTROL Radar Information exchange
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSEP	Air Traffic Safety Electronics Personnel
AUGUR	EUROCONTROL RAIM Prediction Tool
BATAP	'Type-B' Application-to-application Protocol
BDS	Binary Data Store
BER	Bit Error Rate
BITE	Built In Test Equipment
B-RNAV	Basic-RNAV
CAA	Civil Aviation Authority
CB	Cumulonimbus
CBT	Computer-Based Training
CDM	Collaborative Decision Making
CDTI	Cockpit Display of Traffic Information
CFMU	Central Flow Management Unit
CIDIN	Common ICAO Data Interchange Network
CISM	Critical Incident Stress Management
CIV	Civil
CLAM	Cleared Flight Level Adherence Monitoring
CLIMAX	Multi-station carrier offset mode, with voting override
CMS	Control and Monitoring System
CNS/ATM	Communication Navigation and Surveillance/Air Traffic Management
CORA	Conflict Resolution Advisory
CORBA	Common Object Request Broker Architecture
COTS	Commercial off-the-Shelf
CPDLC	Controller-Pilot Datalink Communications
CRT	Cathode Ray Tube
CSU	Control Sector Unit
CTR	Control Zone
CVOR	Conventional VOR
CWP	Controller Work Position
DCL	Departure Clearance

DDF	Doppler DF
DDM	Difference of Depth of Modulation
DF	Direction Finding
DLIC	Datalink Initiation Capability
DMAN	Departure Manager
DME	Distance Measuring Equipment
DME/N	DME/Normal
DME/P	DME/Precision
DPSK	Differential Phase Shift Keying
DTMF	Dual Tone Modulation-Frequency
DVOR	Doppler VOR
EAD	European Aeronautical Database
EAN	European ANSP Network
EASA	European Aviation Safety Agency
ECAC	European Civil Aviation Conference
EFQM	European Foundation for Quality Management
EGNOS	European Geostationary Navigation Overlay Service
EGPWS	Enhanced Ground Proximity Warning System
EHS	Enhanced Mode S
EHT	Extremely High Tension
EJB	Enterprise Java Bean
ELS	Elementary Mode S
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ETFMS	Enhanced Tactical FMS
EU	European Union
EUROCAE	European Civil Aviation Electronics
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration (US)
FANS	Future Air Navigation Systems
FDP	Flight Data Processing
FDPS	FDP System
FFM	Far Field Monitor
FHA	Functional Hazard Assessment
FIR	Flight Information Region
FMS	Flight Management System
FMTP	Flight Plan Messaging Transport Protocol
FoM	Figures of Merit

FPL	(Filed) Flight Plan
FRUIT	False Reply Unsynchronised in Time
FUA	Flexible Use of Airspace
GALILEO	Satellite radio navigation system
GBAS	Ground-Based Augmentation System
GLONASS	GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Global Navigation Satellite System)
GNSS	Global Navigation Satellite System
GP	Glide Path
GPS	Global Positioning System
GRAS	Ground-based Regional Augmentation System
GSA	GNSS Supervisory Authority
GTC	Gain/Time Control
HF	High Frequency
HFDL	High Frequency Datalink
HMI	Human-Machine Interface
HPA	High Power Amplifier
HSI	Horizontal Situation Indication
HV	High Voltage
HW	Hardware
Hz	Hertz
ICAO	International Civil Aviation Organization
IDF	Interferrometric DF
IF	Intermediate Frequency
IFF	Identification Friend/Foe
IFPS	(Integrated) Initial Flight Plan Processing System
ILS	Instrument Landing System
INS	Inertial Navigation System
I/O	Input/Output
IP	Internet Protocol
IRS	Inertial Reference System
IRVR	Instrument Runway Visual Range
I/Q	In phase and Quadrature
ISDN	Integrated Services Digital Network
ISLS	Interrogator Side Lobe Suppression
IISLS	Improved Interrogator Side Lobe Suppression
iTEC	Interoperability Through European Collaboration
ITU	International Telecommunication Union

ISO	International Standards Organisation
LAM	Local Area Multilateration
LAN	Local Area Network
LAPB	Link Access Protocol, Balanced
LCD	Liquid-Crystal Display
LLZ	Localiser
LNA	Low Noise Amplifier
LVP	Low Visibility Procedures
MDS	Minimum Detectable Signal
MET	Meteorology
METAR	Meteorological Actual Report
MFC	Multi-Frequency Coding
MHz	Megahertz
MIL	Military
MLAT	Multilateration
MLS	Microwave Landing System
MOTNE	Meteorological Operational Telecommunications Network Europe
MRP	Multi-radar Processing
MRT	Multi-radar Tracker
MSAW	Minimum Safe Altitude Warning
MSSR	Mono-pulse SSR
MTBF	Mean Time Between Failure
MTCD	Medium-Term Conflict Detection
MTD	Moving Target Detection
NAVAID	Navigation(al) Aid
ND	Navigation Display
NEAN	North European ADS-B Network
NDB	Non-Directional Beacon
NOP	Network Operations Plan
NOTAM	Notice to Airmen
NPA	Non-Precision Approach
NRA	Non-Radar Area
NSA	National Supervisory Authority
OJTI	On-The-Job Training Instructor
OLDI	On-Line Data Interchange
OS	Operating System
OSI	Open System Interconnection
OST	On-site Training

OTM	Object Transaction Monitor
PA	Precision Approach
PABX	Private Automatic Branch Exchange
PBN	Performance Based Navigation
PCM	Pulse Code Modulation
PD	Probability of Detection
PENS	Pan-European Fixed Network Services
PFD	Primary Flight Display
PPI	Plan Position Indicator
PRF	Pulse Repetition Frequency
P-RNAV	Precision RNAV
PSD	Phase Sensitive Detector
PSSA	Preliminary System Safety Assessment
PSR	Primary Surveillance Radar
PTT	Post, Telephone and Telegraph (generic term to identify the provider)
QoS	Quality of Service
QNH	Q-code for atmospheric pressure at sea level
Qsig	Quality of signal
RAIM	Receiver Autonomous Integrity Monitoring
RAPNET	(European) Regional Aeronautical Packet switched Network (CBN + DAKOS)
RAPS	Recording, Analysis, Playback and Simulation system for radar data (COMSOFT)
RDP	Radar Data Processing
RCA	Remote Client Application
RF	Radio Frequency
RMI	Relative Magnetic Indicator
RNAV	Area Navigation
RNP	Required Navigation Performance
RPL	Repetitive Flight Plan
RSLS	Receiver Sidelobe Suppression
R/T	Radiotelephony
RTCA	Radio Technical Commission for Aeronautics
RUP	Rational Unified Process
RVR	Runway Visual Range
RX	Receiver
SAR	Specific Energy Absorption Rate
SARPS	Standards And Recommended Practices
SASS	Surveillance Analysis Support System

SASS-C	SASS-Centre
SASS-S	SASS-Sensor
SATCOM	Satellite Communications
SBAS	Space/Satellite-Based Augmentation System
SCAS	Surveillance Coverage Analysis Suite
SCAT-1	Special Category 1
SDM	Sum of Depth of Modulation
SDP	Surveillance Data Processing
S/E	System/Equipment
SELCAL	Selective Calling
SESAR	Single European Sky AM Research
SID	Standard Instrument Departure
SITA	Société Internationale de Télécommunications Aéronautiques (France)
SMC	System Monitoring and Control
SMR	Surface Movement Radar
SMS	Safety Management System
S/N	Signal/Noise
SNOWTAM	NOTAM on Snow conditions
SNMP	Simple Network Management Protocol
SPI	Special Pulse Identification *or* Special Position Identification Pulse (SSR)
SRC	Safety Regulation Commission *(*EUROCONTROL*)*
SSA	System Safety Assessment
SSR	Secondary Surveillance Radar
STC	Sensitivity Time Control
STCA	Short-Term Conflict Alert
SV	Supervisor
SW	Software
SWALs	Software Assurance Levels
SWIM	System Wide Information Management
SWR	Standing Wave Ratio
TACAN	UHF Tactical Air Navigation aid
TAF	Terminal Area Forecast
TCAS	Transponder Collision Avoidance System
TCP	Transmission Control Protocol
TDOA	Time Difference on Arrival
TFT	Thin Film Transistor
TIS	Traffic Information Service
TMA	Terminal Area

TRM	Team Resource Management
TX	Transmitter
UAT	Universal Access Transceiver
UBSS	UNIX Basic System Software
UHF	Ultra High Frequency
UPS	Uninterruptible Power Supply
UTA	Upper (Traffic) Control Area
VCS	Voice Communications System
VDF	VHF DF Station
VDL	VHF Digital/DataLink
VESDA	Very Early Smoke Detection Alarm
VHF	Very High Frequency
VOLMET	Routine Voice broadcasts for Meteorological Information
VOR	VHF Omnidirectional Radio Range
VORTAC	VOR and TACAN combination
WAAS	Wide Area Augmentation System (US)
WAM	Wide Area Multilateration
WAN	Wide Area Network
WGS84	World Global System 84
X25	Packet Switched Data Network Protocol