A-SMGCS related Certification Aspects

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1 Scope of Document

In the preparation of the EMMA project it was recognized that with introducing A-SMGCS functions of higher levels the assurance of the safety an A-SMGCS system is an important issue which must be investigated.

The EMMA document D143 “A-SMGCS related Certification Aspects” is a document provided by the EMMA sub-project 1 ‘Concept’. It is not the purpose of this document to provide a guideline how to certify A-SMGCS systems but to look at various aspects which must be considered and to give an overview of certification procedures and rules used in related aerospace domains like aircraft certification.

In the first two chapters an overview of the certification process for aircraft Type Certification as applicable at project start (JAR 21) is given. As in the course of time EASA and its implementation rule (PART 21) were set into action at least some of the major differences are highlighted. This is followed by chapters dealing with certification of airports. Based on this material, especially for airborne equipment, suggestions, of how the task of certification may be approached in the ATM/ATC domain for an A-SMGCS system are laid down. Finally a feedback of the experience gained during daily operation use is suggested as means of maintaining and improving safety of A-SMGCS Systems continuously.
2 Introduction

In general ATM systems are not certified. This is in contrast with aviation and aircraft manufacturing where rigid certification is common practice including the management of the certification process. Licensing of ANSPs and Air Traffic Controllers may be regarded as ATM certification, as there is a method to classify airports. This EMMA report identifies existing certification rules and methods and it contributes to a further extension of the certification of ATM systems by making proposals how to certify A-SMGCS. The certification process should not be restricted to technical systems only. Also the working methods and procedures should be included. At last attention should be paid to the maintenance and periodic audit of all certification standards as applied to ATM and A-SMGCS.

The reader should be aware that some A-SMGCS parts will be installed in aircraft. Examples are the prototype Moving Map, Taxi Routing and Guidance and On-board Navigation, Communication and Surveillance functions. These on-board A-SMGCS components with associated procedures will automatically fall under the applicable existing certification rules and their necessary extensions for the new functionalities. For the ground parts new certification rules and rule making could be envisaged.

2.1 General Objectives and Definition of Certification

Generally the objectives of certification may be described by the following statement:

The aim of certification is, to provide a very high degree of assurance that a system operates according to a standard describing the at least expected characteristics of system and/or procedure commitments towards its clients.

The standard is usually developed by a group of the system stakeholders which may be comprised of:

- Service Providers,
- System Operators,
- System Users,
- System and Equipment Suppliers,
- Regulatory Authorities,
- International Bodies.

System in this context just refers to the hard- and software of technical equipment. It must be kept in mind that one of the major goals of certification is to assure safety and that certifying a technical system is not the full story but the starting point of safety. Operation and maintenance of a system and the appropriate qualification of system operators and users is another issue of safety to be considered.

The “Glossary of Terms used in the Management of Quality” [1] defines certification in a very general form as follows:

The procedure and action by a duly authorized body of determining, verifying and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with applicable requirements.

These definitions of certification and its general objectives are used as one of the basis to derive a guidance how certification may be performed for an A-SMGCS. The other basis is taken from the aviation domain, which looks back to a relatively long and successful experience of certifying aircraft development, production, operation and maintenance.

People nowadays have a very high confidence into aviation transport. A vital role to establish this plays the high degree of regulation introduced to assure aviation safety.
3 Aircraft Certification Requirements

The objective of this chapter is, to give an overview of certification rules, guidelines, requirements applied in the production and operation of aircraft. The procedures, rules and regulations in this area are used as a baseline to derive recommendations for an A-SMGCS certification guideline. The examples used are taken from JAR 21 of the JAA System of certification as at project begin the follow on, PART 21 of EASA, which eventually will supersede the JAR 21 were only just issued by commission regulation No 1702.

The certification process for aircraft and related products and parts thereof are defined in FAR21 (US), JAR-21 (JAA members states) or Part 21 (EC regulation) respectively. In this document administrative and procedural requirements to obtain for example Type Certificates are defined.

JAR-23, 25, 27, 29, and others (see 3.5) define technical requirements (now EASA uses the term certification specifications, abbreviated CS 23, 25, 27, 29 to obtain a Type Certificate (TC) for aeroplanes or helicopters.

3.1 The Joint Aviation Authorities (JAA)

The Joint Aviation Authorities (JAA) are a co-operative body for Aviation Safety of 33 Member Authorities, 13 of which being Candidate Members.

JAA are an associated body of the European Civil Aviation Conference (ECAC). ECAC membership is a prerequisite to JAA membership. All European Union Member States are also members of JAA.

The JAA remit relates to the following:
- Design and Manufacture, Operation and Maintenance of civil Aircraft and related products and parts,
- Licensing of flight crews,
- Noise and emissions of aircraft and engines.

The JAA operate under two fundamental documents:
- The JAA Arrangements of 1990 (or Cyprus Arrangements): These Arrangements, signed at the level of Member Authorities, envisage technical co-operation but does not envisage transfer of legal responsibilities, In particular, through the Arrangements, Member Authorities are committed to adopt, as soon as possible, the structure of JARs as their sole codes.
- EU Regulation 3922/91 relative to technical harmonisation in the field of Aviation: This Regulation strengthens the commitments of Member Authorities but for 15 of them only. In particular, when a JAR is adopted by the European Union, then this JAR becomes automatically the sole code for these 15 Authorities.

The JAA overall objective can be summed up as follows:
- Ensure a high consistent level of safety within its members,
- Set up a cost effective Aviation Safety System to avoid undue burden for the Aviation Industry,
- Contribute to free circulation of products, persons and services,
- Promote the JAA System world-wide.

More specifically the JAA has adopted an aim for safety which reads:

_The JAA aim at continuously improving its effective Aviation Safety System in order to reduce the number of accidents and the number of fatalities irrespective of the growth of Air Traffic._

1 These numbers are the state of about the year 2000
Under this objective and aim, the JAA have three main functions:

- Develop, Adopt and Maintain Joint Aviation Requirements (JARs),
- Jointly Implement these JARs and develop, adopt and maintain Joint Implementation Procedures (JIPs) to that effect.
- Standardise (i.e. ensure that JARs are implemented in a consistent manner) implementation of JARs within their Member Authorities.

The JAA have adopted 27 JARs; 60 aircraft and related products have been certified / validated in accordance with JIPs; 3000 Maintenance Organisations in Europe and World-wide have been approved/accepted in accordance with JAR-145 (Approval of Maintenance Organisations). These activities have led to significant co-operation with the European Commission, the US Federal Aviation Administration, EUROCONTROL, EUROCAE, SAE (Society of Automotive Engineers (USA)) and others.

### 3.2 The European Aviation Safety Agency (EASA)

However, the JAA has reached its limits. It is within the last years gradually superseded by the EASA (European Aviation Safety Authority/Agency) that is now (since 2003) the regulating body for type certification.

EASA is an independent European Community body with a legal personality and autonomy in legal, administrative and financial matters. The main tasks of EASA are:

- To assist the European Commission in preparing legislation, and support the Member States and industry in putting the legislation into effect;
- To adopt their own certification specifications and guidance material, conduct technical inspections and issue certificates where centralized action is more efficient;
- To assist the European Commission in monitoring the application of European Community legislation.

In more detail this means:

#### CERTIFICATION

On 28 September 2003, the Agency took over responsibility for the airworthiness and environmental certification of all aeronautical products, parts, and appliances designed, manufactured, maintained or used by persons under the regulatory oversight of EU Member States. This also includes all post-certification activities, such as the approval of changes to, and repairs of, aeronautical products and their components, as well as the issuing of airworthiness directives to correct any potentially unsafe situation. All type-certificates are therefore now issued by the European Aviation Safety Agency, and are valid throughout the European Union.

On the same date the Agency became the competent authority to approve and oversee the organisations involved in the design of aeronautical products, parts and appliances. It also carries out the same role for foreign organisations involved in the manufacture or maintenance of such products.

To execute its tasks within the present period of building up its resources, the Agency relies on national aviation authorities who have historically filled this role and concludes contractual arrangements to this effect.

#### RULEMAKING

The Agency contributes to the production of all EU legislation related to the regulation of civil aviation safety and environmental compatibility. It submits opinions to the European Commission and must be consulted by the Commission on all legislative proposals in this field. Its ex-
experts have direct contact with all relevant actors, and make use of the knowledge available within industry and national administrations across the European Union. The Agency, in consultation with its stakeholders, adopts also so-called 'soft rules'. These are non-binding standards, specifications and guidance material, to assist in the consistent application of EU legislation across the European Union.

QUALITY AND STANDARDISATION
Where Community law is implemented at Member State level, the Agency assists the Commission in overseeing its effective application and its uniform understanding.

The necessary standards are therefore being developed and maintained properly, uniformly and consistently across the European Union.

Accordingly, the Agency conducts inspections of undertakings as well as national authorities throughout the EU, both to monitor the application of EU rules on aviation safety, and to assess the effectiveness of these rules. The Agency also provides technical training, which is essential to achieve overall consistency and high level standards.

Although EASA is set into action and in the member states their rules according to the EC regulations are applied, the following chapters are still based on the JAA document JAR21, as the differences to the corresponding EASA document PART21 are not of great significance for the purpose of this document.

The differences between PART 21 and JAR 21 are of minor interest for a description of the general philosophy of the aircraft certification process, nevertheless, the general structure of PART 21 and some of the major differences shall be highlighted below. The picture below shows the general structure of regulations and standards and procedures related to certification issues of EASA such as IR, Part 21 and the Airworthiness Codes (in EASA terminology named certification specification (CS) and standards and procedures related to maintenance issues such as PART 145, 66 and 147 which have their counterparts in JAR 145, 66 and 147 and PART M.

![Figure 1: Structure of EASA regulations, implementation rules and accompanying material](image-url)
EASA has adopted JAR 21 as its "Certification Procedures for Aircraft and Related Products and Parts" to a great extend. Under EASA, JAR 21 was re-named to IR21 (Implementing Rule). Some of the differences/equalities are in brief:

- The JAR 21 numbering system is followed in PART 21 as closely as possible.
- Section A of PART 21 deals with Rights & obligations of applicants/holders and is basically similar to the JAR 21 with the following deviations:
  - Subparts A, C, D, E, F, G, H have their equivalences in both documents with some additions or clarifications in PART 21
  - Subpart I, Related to Noise Certificates has been added in PART 21.
  - Subparts JA and JB in JAR 21 where replaced by Subpart J related to Design Organisation Approvals only
  - Subparts K, M, O, Q of JAR 21 have their counterparts in Part 21, with Subpart M substantially extended
  - Subparts L, N, P of JAR 21 are left empty in PART 21
- Section B of PART 21 deals with ‘Competent Authority’ procedures.
- The JAR 21 appendices have been incorporated into the Subparts G and O of PART 21, while the PART 21 appendices’ contain applicable (mandatory) forms.

3.3 Certification procedures for aircraft and related products and parts (JAR-21)

3.3.1 Definitions

Airworthy:  
- An aircraft is airworthy when it conforms to an approved design and is in condition for safe operations.

Certification:  
The Authority performs two actions:
  - Technical findings: check compliance with regulations
  - Legal findings: issue of certificates, approval or licenses.

Products:
- JAR-21 defines as products only aircraft, engines and propellers

3.3.2 Purpose and applicability of JAR-21

JAR-21/ PART 21 prescribe procedural requirements for the issue of Type Certificates (TC), changes to a Type Certificate, the issue of standard Certificates of Airworthiness (C of A) and the issue of export airworthiness approvals.

The procedural requirements for the approval of certain parts and appliances are also described. Additionally it describes the rules applied to the holders of Certificates or Approvals mentioned above.

These procedural requirements and rules are applicable to products and parts designed in JAA countries and to products and parts designed in non-JAA countries. Non JAA products and parts are dealt with in Subpart N of the JAR 21 which has been deleted in the superseding PART 21.

JAR-21 defines procedural requirements for approval of organisation (Design and Production Approvals), however these are applicable only to organisation under the jurisdiction of JAA countries. This means, JAR-21 is applicable to the design and manufacture industry as a whole in these countries.

3.3.3 General Principles of JAR-21

JAR-21 recognizes the central role of the Type Certificate holder (i.e. Airbus Industries for Airbus products, Boeing Company for Boeing products). This role could be summed up as acting as a “good father” for the products.
JAR-21 introduces a concept of mandatory approvals for organisations under the jurisdiction of JAA states.

- Organisations approvals are consistently used within the JAA System.
- The rationale for organisation approvals is to ensure that such organisations have the expertise and competence to perform their job.
- Organisation approvals also reduce the risk of human errors as such errors may be induced by company culture.

To simplify an organisation approval addresses the following:
- Personnel requirements: they should be trained and qualified. Some specific post holders may be required.
- Requirements for procedures.
- Requirements for facilities and tools.

Requirements for a quality system: It should ensure that procedures are constantly reviewed and improved through audits.

The JAR-21 contains two organisation approvals:
- Design Organisation Approval (DOA).
- Production Organisation Approval (POA).

Both grant privileges to their holders.

JAR-21 brings a consistent approach to the activities under its scope. For example, it envisages links between design and production organisations. Another example is that production requirements are identical be it for products or parts. Finally JAR-21 is compatible with JAA single technical investigation procedures (see Chapter 4).

3.3.4 Design of aircraft and related products

3.3.4.1 Type Certificates

JAR-21 Subparts B defines the condition to obtain a Type Certificate.

The issue of a Type Certificate requires that the product complies with its applicable requirements and that, for JAA applicants only, a Design Organisation Approval has been obtained (acceptable alternatives must be found for non-JAA applicants) and the applicant will be able to discharge its responsibilities.

Therefore the TC is based both on technical and administrative conditions.

The applicable requirements can be summed up as follows:
- the applicable JAR at the date of application (i.e. JAR-25 for Large Aeroplanes, JAR-29 for Large Rotorcraft) and
- any necessary special conditions.

It should be noted that an applicant may always elect to comply with later requirements (i.e. later than the date of application).

Special Conditions are used when the design contains novel features or envisage unusual operations compared to those on which the JAR is based.

Special Conditions can also be notified when experience with comparable design shows that unsafe conditions can exist. The requirements contained in the Special Condition should ensure that an equivalent level of safety to the one of the applicable JAR is met. Compliance with applicable re-
quirements can be met literally or using equivalent safety finding procedures. In the latter case, re-
quirements are not met literally but compensating factors are found.

To sum-up, applicable requirements are the applicable JAR modified by any Special Condition or
elect to comply and compliance may be found either literally or through equivalent safety finding pro-
cedures.

As JARs are detailed requirements based on a certain state of the art, this allows for controlled flexi-
bility to accommodate new technologies. It should be noted that Design Organisation Approvals are
not required for simple design (e.g. Sailplanes, 4seater Touring Aeroplanes…)

Two responsibilities of the TC holder should be highlighted:
- The set up of a system to collect, analyse incidents and propose corrective actions.
- The development of manuals for continuing airworthiness.

3.3.4.2 Changes to Type Certificates

Today these are two categories of changes to TC in JAR-21 (minor and major changes). In a very near
future there will be four categories: minor, major non-significant, major significant and substantial.

Minor changes are changes which have no appreciable effect on weight, balance, structural strength,
reliability, operational characteristics or other characteristics affecting the airworthiness of the prod-
uct.
- Minor changes may be proposed by any person or organisation.
- The applicable requirements are the ones of the original TC.
- Minor changes are either approved directly by the Authority or by an approved Design Or-
organisation.
- JAR-21 Subparts D and ND address minor changes.

Major changes are all other changes not classified as minor. Major changes can be subdivided in:
- non-significant
- significant

A change that meets one of the following criteria is automatically considered significant:
- General configuration or principles of construction of the product to be changed do not remain
valid.
- Assumptions used for the certification of the product to be changed do not remain valid.

Major changes may be proposed by the TC holders using Subpart D or ND procedures or by Supple-
mental Type Certificate Holders using Subpart E or NE procedures. The applicable requirements for
major non-significant are the ones for the original TC. The applicable requirements for major signifi-
cant are the ones at the time of application of the change except for non affected parts and areas and
except for affected parts and areas, when the applicant can show that compliance with requirements
applicable at the date of application do not contribute materially to safety or is impractical.

Applicable requirements for major-significant changes are defined by a top down approach. Major
changes are approved by the Authority. Substantial changes are changes in design, configuration,
power, limitations, or weigh that are so extensive that a substantially complete investigation of com-
pliance with applicable requirements is required. This means a new Type Certificate and this is ad-
dressed by JAR-21 Subpart B and NB. Supplemental Type Certificates (STC) is addressed by Subpart
E and NE. JAA applicants must have a design organisation approval (except for simple design). Ac-
ceptable alternatives must be found for non-JAA applicants. A link may be required between the STC
holder and the TC holder. Responsibilities of STC holders are broadly comparable to those of TC holders.

### 3.3.4.3 Production of Aircraft and Related Products

A certificate of Airworthiness should be issued for aircraft by the Authority (see Subpart H and NH of JAR-21).

All other products and parts receive an Airworthiness Release document issued usually by an approved production organisation (see Subpart K and NK of JAR-21).

JAA organisations should receive a Production Organisation Approval (POA) in accordance to JAR-21 Subpart G. For non-JAA organisations, acceptable alternatives to POA should be found.

POA have the privilege to obtain a C of A from the Authority without further showing and to issue Airworthiness Release certificates without further showing.

A link is required between production organisations and design organisations. POA is the “normal” way to produce products and parts for JAA organisations. However, in some specific cases such as production of a limited number of aircraft, production may be done without a POA (see JAR-21 Subpart F). There are no privileges in Subpart F.

### 3.3.5 Design and Production of Parts

Subpart K and Subpart NK of JAR-21 envisage only four routes to approve parts:

- In conjunction with Type Certification or with change to Type Certificates procedures.
- Where applicable, under the JTSO authorisation procedures of Subparts O or NO of JAR-21.
- Where applicable under the Joint parts Approvals procedures of Subpart P of JAR-21. For non-JAA parts, acceptable alternatives must be found.
- In the case of standards parts (e.g. nuts, bolts…), in accordance with established industry (e.g. CEN, SAE…) or Government Specifications.

JTSOs are Joint Technical Standard Orders. Such authorizations can be issued for equipment such as radio transmitters, life-vests, altimeters, or airborne collision avoidance systems. There are no definitive criteria to define eligible equipment. JTSO is an approval of the design of equipment and a Production Approval (POA) for its manufacturers.

For some equipment for which the specification contains qualitative design requirements of significance to airworthiness, a DOA is required for its designer. Today only Auxiliary Power Units (APUs) are included in that category.

JTSO specification can be found in JAR-TSO. This JAR-TSO can be described as a catalogue of specifications.

Joint Part Approval (JPA) is also an approval of the design of the part and a Production Approval (POA) for its manufacturers. JPA is applicable to replacement parts and to modification parts. However, in the case of a modification part (i.e. the design of the part has been changed when for a replacement part there is no design change), the change must be a minor change.

The difference between JTSO and JPA is that a JTSO authorization is independent from the aircraft the equipment will be installed on whereas a JPA is linked to a specific product type.
3.3.6 Design and Production of repairs to Aircraft and Related Products and Parts

JAR-21 requirements (Subpart M) needs to be finalized, however the general principle should be:

- The design of a repair must be approved.
- The production of the material needed for a repair must be done in an approved manner.
- The installation of a repair must be done by an approved organisation.

PART 21 is going into more detail concerning this part of the document.

3.3.7 Import and Export of Aircraft and Related Products and Parts

JAR-21 Subpart L and Subpart N, dealing with Import and Export of Aircraft and Related Products are deleted in the EASA implementing rule Part 21.

3.4 Technical Airworthiness Codes

Technical Airworthiness Codes contain requirements in relation to performance, handling qualities, structural strength, design and construction, power plant installation, systems and equipment and limitations.

Such codes exist for Very Light Aeroplanes (JAR-VLA); for Sailplanes and powered Sailplanes (JAR-22); for Large Aeroplanes (JAR-25); for small Rotorcraft (JAR-27); for large Rotorcraft (JAR-29); for Engines (JAR-E); for Propellers (JAR-P); for Auxiliary Power Units (JAR-APU) and for Equipment (JAR-TSO). The structures of such codes are different between aircraft and engines/propellers/APUs/equipment.

The structure which is presented below is relevant to airworthiness codes for aircraft:

- Performances (e.g. climb gradients one engine inoperative) and handling qualities (e.g. static and dynamic stability, control forces…).
- Structure (gusts envelope, manoeuvres envelope, fatigue requirements)
- Design and Construction (e.g. emergency evacuation provisions; fire protection…)
- Power plant Installation (e.g. uncontained power plant failure, fuel and oil system requirements)
- Systems and Equipment (e.g. systems safety analyses; requirements for electrical, hydraulic and pneumatic systems; required equipment for flight and navigation)
- Manuals and limitations (e.g. speed limitations, flight manual, continued airworthiness manual…).

The requirements usually prevent unsafe conditions (e.g. performance requirements with one engine inoperative). However some have been written to limit the consequences of such unsafe conditions (e.g. emergency evacuation provisions to allow passengers escaping after a minor crash). Requirements may be performance oriented (e.g. there must be an inverse relationship between the probability of a failure and its consequences) or may impose design constraints (e.g. number and types of emergency exist versus number of passengers).

3.5 Relations with other requirements

Certification of the technical Equipment - the Aircraft - is only the starting point for safety.

Aircraft operation and maintenance (see chapter 2.1) are also regulated. Flight crews must obtain licenses. JARs only regulated Commercial Transportation (JAR-OPS 1 and 3). Commercial Air Transportation Operators receive an organisation approval (the AOC: Air Operator Certificate). JAR-OPS Subpart M describes the responsibilities of AOC holders in terms of maintenance. Maintenance for Commercial Air Transportation must be performed by approved maintenance organisations (JAR-145).
The AOC holders aeroplane maintenance programme is based on the one developed by the aircraft designer and must be approved by the Authority. AOC holders shall ensure the airworthiness of the aeroplane and the serviceability of both operational and emergency equipment. This includes:

- Accomplishment of pre-flight equipment.
- Rectifications of defects and damages.
- Accomplishments maintenance in accordance with the approved aeroplane maintenance programme.
- Analysis of the effectiveness of the above programme.
- Accomplishment of Airworthiness Directives.
- Accomplishment of modifications.

The AOC holder shall ensure that the Certificate of Airworthiness of each aeroplane it operates remains valid.
4 Type Certification Process

The purpose of this Chapter is to describe the Aircraft Type Certification Process. It concentrates on Type Certification for clarity purposes and also because the description of the process is valid for all States. It also provides a comparison with the EU global approach to conformity assessment.

4.1 The Aviation Type Certification Process

Aircraft Type Certification covers two distinct elements:

- Technical findings that the aircraft complies with the technical requirements. There are four phases in this process. Technical findings are done by Authority employees or by people or organisation nominated by the Authority.
- Legal findings which are the end of the Type Certification process and consist in the issue by the Authority of the appropriate Type Certificate

The four phases of the technical findings can be summed up as follows:

- The definition of an agreement on the Type Certification Basis (see section 2.2.4a: The applicable requirements).
- The definition and the agreement on the proposed means of compliance with the requirements (means of compliance can be flight or ground tests; analysis inspections, etc).
- The demonstration of compliance by the applicant (e.g. Airbus, Boeing, etc) and the acceptance of the demonstration by the Authority.
- The final phase (final report), issue of Type Certificate.

The JAA Joint Implementation Procedures ensures that technical findings are only done once to the satisfaction of its 33 member Authorities which in turn issue their legal findings (33 Type Certificates).

There are two JAA Joint Implementation Procedures:
- Joint Multinational Team Procedure
- Joint Local Team Procedures.

The first one is used for complex products (e.g. large aeroplanes; large rotorcraft). A multinational team is set up to do the technical findings. The second one is used for simpler products (e.g. sailplanes; small rotorcraft). A team made of employees of one JAA Authority do the technical findings. This Authority must be a-priori agreed by the JAA as a Primary Certificating Authority following an investigation of its resources, procedures, experience, etc. These two approaches have been agreed for pragmatic reasons taking into account the complexity of the product, technical competence and resources of Authorities and the burden put on Industry.

4.2 Comparison with the EU global approach to conformity assessment

4.2.1 The new approach to directives (Main Principles)

In this new approach, directives only notify essential requirements for safety (or other requirements in the general interest) with which products put on the market should conform and therefore benefit of free circulation.

The drawing up of technical specifications necessary to ensure conformity to the essential requirements is entrusted to organisations competent in the standardisation area (e.g. CEN, CENELEC, or ETSI).
These technical requirements are not mandatory. National Authorities are obliged to recognize that products conformity to these technical specifications is presumed to conform to the essential requirements.

Two conditions are needed for the operation of such system:

- The technical specification offer a guarantee of quality with regard to the “essential requirements”
- Public authorities keep intact their responsibilities for safety.

**4.2.2 Main elements to be included in a Directive**

These main elements are:
- Scope
- General clause for placing on the market
- Essential requirements
- Free movement clause
- Means of proof of conformity and effects
- Management of the list of standards
- Safeguard clause
- Means of attestation of conformity; although the general idea is that manufacturers be offered a wide range of means, the choice may be limited (even removed) according to the nature of products and hazards covered by the Directive
- Standing Committee
- Tasks and operation of the Committee

Note 4.2.1 and 4.2.2 are largely inspired by the text of the annex II to council resolution of 7 May 1989 on a new approach to technical harmonisation and standards.

**4.2.3 Conformity assessment procedures in the Technical Harmonisation Directives (general guidelines)**

The objective of conformity assessment procedures is to enable authorities to ensure, that products placed on the marked conform to the requirements expressed in Directives, in particular with regard to health and safety. Conformity assessment procedures can be divided into modules which relate to design and/or production. Both design and production should be assessed.

The range of choices open to manufacturers should be as wide as possible and at the same time remain compatible with the level of safety required for the product. Member states will notify bodies for the purpose of operating the modules (Notified bodies). Notified bodies must have the technical qualification required by the directives.

**4.2.4 Modules for conformity assessment**

These modules are:

1) Internal production control;
2) EC type examination;
3) Conformity to type;
4) Production quality assurance;
5) Product verification;
6) product quality assurance;
7) unit verification;
8) full quality assurance.
1, 7, and 8 cover both design and production. 3, 4, 5, and 6 are normally related to production and should be used in conjunction with 2, although for the product of very simple design and production can be used on their own. 4, 5, and 8 require quality systems from the manufacturer.

### 4.2.5 Comparison between Aircraft Type Certification and EU modules

#### 4.2.5.1 EC Type Examination

**EC Type Examination** is quite comparable to the Aircraft Type Certification for simple products. In the EC Type Examination the manufacturer submits to the notified body:

- Technical documentation
- Type, the notified body:
  - Ascertain conformity with essential requirements
  - Carries out tests if necessary
  - Issues EC Type-examination certificate

In the aviation system, the authority plays the role of the notified body. However it ascertains conformity with detailed airworthiness codes.

#### 4.2.5.2 Full Quality Assurance

In this module both design and production are covered.

Relative to design, the manufacturer operates an approved quality system for design; the notified body carries out the surveillance of the quality system and in specific directives verifies the conformity of design and issues EC design examination certificates. This is quite comparable to the issue of a Type Certificate to a manufacturer holding a Design Organisation Approval (DOA contain a quality system). The Authority plays the role of the notified body.

Relative to production, the manufacturer operates an approved quality system for production and testing, declares conformity, affixes the CE marking; the Notified body carries out the surveillance of the Quality System. This is quite comparable to the Aviation System (POA = Production Organisation Approval)\(^2\). The POA holder can obtain without further showing the certificate of airworthiness for aircraft and can issue directly the Airworthiness Release document for other products. The Authority plays the role of the notified body.\(^3\)

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\(^2\) The comparison made here is also valid for the module “production quality assurance”.

\(^3\) Paragraph 4.2.3 and 4.2.5 are largely inspired from the text of the annex to council decision of 13 Dec. 1990 concerning the modules for the various phases of the conformity assessments procedures which are intended to be used in the technical harmonisation directives.
5 Certification of Airports

Besides the regulations for certification of aircraft and related parts there are also rules for certification of airports in the US. These rules are defined by the FAA in 14 CFR (Code of Federal Regulations) Part 121 and Part 139 “Certification of Airports; Final Rule” [26]

The summary of the rules are as follows:

This rule revises the airport certification regulation and establishes certification requirements for airports serving scheduled air carrier operations in aircraft designed for more than 9 passenger seats but less than 31 passenger seats. In addition, this rule amends a section of an air carrier operation regulation to conform with changes to airport certification requirements. This rule is necessary to ensure safety in air transportation at all certificated airports.

Part 139 – Certification of airports consists of the following Subparts

Subpart A: General

The subpart is addressed to the applicability, the delegation of authority, definitions and methods and procedures for compliance.

Depending on the type of served air carrier operations, airports in the US are classified by the FAA for certification. Four classes are currently defined.

Class I airport:
certificated to serve scheduled operations of large air carrier aircraft that can also serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft.

Class II airport
certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.

Class III airport
certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.

Class IV airport
certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Subpart B: Certification

The subpart is addressed to the general requirements, the application for a certification, inspection authority, issuance and duration of a certificate, and exemptions and deviations.

The following paragraphs are included:

§ 139.101 General requirements.
(a) Except as otherwise authorized by the Administrator, no person may operate an airport specified under §139.1 of this part without an Airport Operating Certificate or in violation of that certificate, the applicable provisions, or the approved Airport Certification Manual. 
(b) Each certificate holder must adopt and comply with an Airport Certification Manual as required under § 139.203.
Subpart C: Airport Certification Manual

The subpart is addressed to the contents of an Airport Certification Manual and the amendments’.

§139.203
(a) Each certificate holder shall include in the Airport Certification Manual a description of operating procedures, facilities and equipment, responsibility assignments, and any other information needed by personnel concerned with operating the airport in order to comply with applicable provisions of subpart D of this part and paragraph (b) of this section.
(b) Except as otherwise authorized by the Administrator, the certificate holder shall include in the Airport Certification Manual the following elements, as appropriate for its class:

<table>
<thead>
<tr>
<th>Manual Elements</th>
<th>Airport Certificate Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lines of succession of airport operational responsibility</td>
<td>Class I Class II Class III Class IV</td>
</tr>
<tr>
<td>2. Each current exemption issued to the airport from the requirements of this part</td>
<td>X X X X</td>
</tr>
<tr>
<td>3. Any limitations imposed by the Administrator</td>
<td>X X X X</td>
</tr>
<tr>
<td>4. A grid map or other means of identifying locations and terrain features on and around the airport that are significant to emergency operations</td>
<td>X X X X</td>
</tr>
<tr>
<td>5. The location of each obstruction required to be lighted or marked within the airport’s area of authority</td>
<td>X X X X</td>
</tr>
<tr>
<td>6. A description of each movement area available for air carriers and its safety areas, and each road described in § 139.319(k) that serves it</td>
<td>X X X X</td>
</tr>
<tr>
<td>7. Procedures for avoidance of interruption or failure during construction work of utilities serving facilities or NAVAIDS that support air carrier operations</td>
<td>X X X</td>
</tr>
<tr>
<td>8. A description of the system for maintaining records, as required under § 139.301</td>
<td>X X X X</td>
</tr>
<tr>
<td>9. A description of personnel training, as required under § 139.303</td>
<td>X X X X</td>
</tr>
<tr>
<td>10. Procedures for maintaining the paved areas, as required under § 139.305</td>
<td>X X X X</td>
</tr>
<tr>
<td>11. Procedures for maintaining the unpaved areas, as required under § 139.307</td>
<td>X X X X</td>
</tr>
<tr>
<td>12. Procedures for maintaining the safety areas, as required under § 139.309</td>
<td>X X X X</td>
</tr>
<tr>
<td>13. A plan showing the runway and taxiway identification system, including the location and inscription of signs, runway markings, and holding position markings, as required under § 139.311</td>
<td>X X X X</td>
</tr>
<tr>
<td>14. A description of, and procedures for maintaining, the marking, signs, and lighting systems, as required under § 139.311</td>
<td>X X X X</td>
</tr>
<tr>
<td>15. A snow and ice control plan, as required under § 139.313</td>
<td>X X X</td>
</tr>
<tr>
<td>16. A description of the facilities, equipment, personnel, and procedures for meeting the aircraft rescue and fire fighting requirements, in accordance with §§ 139.315, 139.317 and 139.319</td>
<td>X X X X</td>
</tr>
<tr>
<td>17. A description of any approved exemption to aircraft rescue and fire-fighting requirements, as authorized under § 139.111</td>
<td>X X X X</td>
</tr>
<tr>
<td>18. Procedures for protecting persons and property during the storing, dispensing, and handling of fuel and other hazardous substances and materials, as required under § 139.321</td>
<td>X X X X</td>
</tr>
<tr>
<td>19. A description of, and procedures for maintaining, the traffic and wind direction indicators, as required under § 139.323</td>
<td>X X X X</td>
</tr>
<tr>
<td>20. An emergency plan as required under § 139.325</td>
<td>X X X X</td>
</tr>
<tr>
<td>21. Procedures for conducting the self-inspection program, as required under § 139.327</td>
<td>X X X X</td>
</tr>
<tr>
<td>22. Procedures for controlling pedestrians and ground vehicles in movement areas and safety areas, as required under § 139.329</td>
<td>X X X</td>
</tr>
<tr>
<td>23. Procedures for obstruction removal, marking, or lighting, as required under § 139.331</td>
<td>X X X</td>
</tr>
<tr>
<td>24. Procedures for protection of NAVAIDS, as required under § 139.333</td>
<td>X X X</td>
</tr>
<tr>
<td>25. A description of public protection, as required under § 139.335</td>
<td>X X X</td>
</tr>
<tr>
<td>26. Procedures for wildlife hazard management, as required under § 139.337</td>
<td>X X X</td>
</tr>
<tr>
<td>27. Procedures for airport condition reporting, as required under § 139.339</td>
<td>X X X</td>
</tr>
<tr>
<td>28. Procedures for identifying, marking, and lighting construction and other unserviceable areas, as required under § 139.341</td>
<td>X X X</td>
</tr>
<tr>
<td>29. Any other item that the Administrator finds is necessary to ensure safety in air transportation</td>
<td>X X X X</td>
</tr>
</tbody>
</table>

Table 1 Elements of Airport Certification Manual

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Subpart D: Operations

The subpart is addressed to the operation of a certificated airport. A detailed description of procedures for most of the elements of the Airport Certification Manual is given.

6 Considerations on A-SMGCS Certification Issues

6.1 General

ATM certification is not (yet) common practice. If a responsible body operates an ATM system it is mainly a one of a kind system with ICAO accepted operating procedures. In order to favour a harmonised, standard and safe way of ATM operations, certification of A-SMGCS should be promoted and institutionalised where necessary. ATM certification will not be a simple and easy job. But it needs appropriate attention. The recommended way to promote ATM certification is to start with the new systems to be added to the existing ones in operations. A-SMGCS is such a newer system on the horizon and this EMMA report tries to recommend how to certify A-SMGCS linking to existing procedures from aviation.

As a conclusion from the ARIBA WP3 Final Report [14] the certification of ground based ATM Systems could be an impossible task, caused by the variety and complexity of already existing systems. The approach, to consider all possible failures and the consequences, is characterised by an exponential growth of combinations and possibilities and is proven not suitable on its own. Another problem is the constant change of the overall ground system, in contrast to an airborne system which can be treated as closed. Another issue is the inclusion of already installed components, which were not certified when they were introduced. These components, as well as new elements and working procedures must be included in a certification process.

To cope with all these problems different approaches should be applied to ATM [14].

<table>
<thead>
<tr>
<th>Type</th>
<th>System</th>
<th>Characteristic Definition</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classical</td>
<td>Technical systems</td>
<td>Failure Mode and Effect Analysis</td>
<td>Comprehensive Straightforward</td>
<td>Analyses impossible in complex systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Easy to accept</td>
<td>Imagination limited</td>
</tr>
<tr>
<td>Manage hazards</td>
<td>Medium sized operations</td>
<td>Hazard Analyses Hazard Management Process</td>
<td>Linked to operational processes</td>
<td>Hazard assessment hard to perform Imagination</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Goal-setting</td>
<td>limited</td>
</tr>
<tr>
<td>Proactive</td>
<td>Management Systems and general organisations</td>
<td>Covers latent Hazardous condition</td>
<td>Managerial Goal-setting Attempts to cover the unexpected</td>
<td>Not directly linked to obvious problems</td>
</tr>
</tbody>
</table>

Table 2 Certification approaches applied to ATM

The overall certification process has to assess a system and procedures as they were designed and are currently operated. If a system plus procedures meets all requirements, then the system can be certified against these requirements. Therefore the system has to be certified as a whole, including the different components and the operational aspects. ([14])
6.2 Requirements Issues
The top level process in the requirements definition for an A-SMGCS development includes the identification of the operational procedures and the supporting functions and interfaces required for specific airport geometry, the environmental conditions and the organisational distribution (responsibilities) between stakeholders. A significant influence on an A-SMGCS architectural system design have the safety requirements allocated to procedures and functions at the various A-SMGCS levels and environmental conditions.

6.2.1 Types of Requirements

Customer Requirements
Customers requirements will vary with the airport type, the level of A-SMGCS targeted, the geometry of the runways, taxiways and parking positions which directly influences the functions required to be implemented.

Functional Requirements
Functional requirements are those needed to obtain the desired performance of a system to fulfil the operational procedures under the defined conditions.

Operational Requirements
A-SMGCS assist the pilots and controllers with automation. The proper intended operation should be defined in the Operational Concept and Operational Requirements specifications. It includes handling quality and quality assurance.

Some procedures have been identified already, like the identification procedures of labelled objects and the Mode S Transponder procedure on airports.

Safety Requirements
The safety requirements on A-SMGCS system and equipment level depend upon minimum performance constraints (e.g. accuracy, update rate, etc.), required integrity (correctness of behaviour) and availability (continuity of service).

• Availability Requirements
• Integrity Requirements
  o Failure Behaviour and Characteristics
• Performance Requirements

Licensing requirements
Existing controller and pilot licensing should be extended with the appropriate A-SMGCS operations.

6.2.2 Hardware
As there are no standards for certification of hardware used in ground systems in aviation, approaches for developing airborne electronic hardware could be used also for ground equipment. The EUROCAE document ED-80 (Design Assurance Guidance for Airborne Electronic Hardware) [8]

...provides guidance for design assurance of airborne electronic hardware from conception through initial certification and subsequent post certification product improvements to ensure continued airworthiness. It was developed based on showing compliance with certification requirements for transport category aircraft and equipment but parts of this document may be applicable to other equipment.

The document describes a Plan for Hardware Aspects of Certification (PHAC) (Chapter 10.1.1) to obtain an approval of systems containing hardware by the responsible authority. The PHAC includes...
processes, procedures, methods and standards that are agreed between the applicant and the authority to satisfy the hardware aspects of certification.

The main elements of the PHAC are given as follows [8]:

1. System Overview
2. Hardware Overview
3. Certification Considerations
4. Hardware Design Life Cycle
5. Hardware Design Life Cycle date
6. Additional Considerations
7. Alternative Methods
8. Certification Schedule

Chapter 9 of the document deals with a so called “Certification Liaison Process” which mainly implements a communication strategy between the applicant and the certification authority. The hardware planning process (chapter 4 of the ED-80) and the already mentioned PHAC should be used to accomplish the liaison process. The following means of compliance are identified by the document:

- The PHAC, hardware verification plan and other requested data should be submitted to the certification authority for review at a point in time when the effects of design changes on the program are minimal.
- Issues identified by the certification authority concerning the planning for the hardware aspects of certification should be resolved.
- Agreement on the PHAC should be obtained with the certification authority.
- Liaison with the certification authority during the design and certification cycle as outlined in the plan should be continued and issues raised by the certification authority resolved in a timely manner.

If the equipment also includes parts from other manufacturers, this should be clearly stated, and the necessary data has to be provided to the certification authority.

As an additional consideration the ED-80 also covers some aspects of the usage of Commercial Off The Shelf (COTS) components. These components are widespread used in hardware. In contrast, there are often no detailed specification data available for review. Therefore...

…the use of COTS components will be verified through the overall design process, including the supporting processes …The use of an electronic component management process, in conjunction with the design process, provides the basis for COTS components usage.

EUROCAE defines the electronic component management as a supporting process to the certification. The following principles are listed in [8]:

- The component manufacturer can demonstrate a track record for production of high quality components.
- Quality control procedures are established at the component manufacturer.
- There is service experience supporting the successful operation of the component.
- The component has been qualified by the manufacturer or by means of additional testing, which establish the component reliability.
- The component manufacturer has control of the component quality level or that this is assured by means of additional component testing.
- The components have been selected on the basis of technical suitability of the intended application, such as component temperature range, power or voltage rating, or that additional testing or other means has been used to establish these.
The component performance and reliability are monitored on a continuous basis, with feedback to component manufacturers concerning areas that need improvement.

6.2.3 Software

FAA defined DO-178B as a standard for certification for all kind of avionics software with their AC20-115B. While DO-178B is relevant to the US, EUROCAE produced an equivalent Document, ED-12B, valid for Europe.

As the documents are mainly relevant to the developing processes, there is a need for supporting documents. The amount of the documentation is dependent on the required development assurance level. The required level is determined from the safety assessment process and hazard analysis by examining the effects of a failure condition in the system. Table 3 gives an overview of the risk classification.

<table>
<thead>
<tr>
<th>Failure Condition Classification</th>
<th>Development Assurance Level</th>
<th>Probability of Occurrence</th>
<th>Qualitative definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>A</td>
<td>Extremely Improbable</td>
<td>Should virtually never occur, loss of functionality, multiple fatalities</td>
</tr>
<tr>
<td>Hazardous</td>
<td>B</td>
<td>Extremely Remote</td>
<td>Unlikely to occur, large reduction in functionality, excessive workload to operators, may impair capability to perform tasks</td>
</tr>
<tr>
<td>Major (Essential)</td>
<td>C</td>
<td>Remote</td>
<td>Unlikely to occur, significant reduction in operational capabilities, significant increase of workload</td>
</tr>
<tr>
<td>Minor (Non Essential)</td>
<td>D</td>
<td>Probable</td>
<td>Slight reduction in operational capabilities and/or safety margins, slight increase in workload</td>
</tr>
<tr>
<td>No Safety Effect</td>
<td>E</td>
<td>“Likely”</td>
<td>No effect on operational capabilities and/or safety margins</td>
</tr>
</tbody>
</table>

Table 3 Safety Assessment and Risk Classification

There is a relation of the above described classification to the software levels. The following Table 4 shows this relation and the definitions used by various documents.
### Table 4 Relationship between Functional Criticality Categories and Software Levels

As it is not only important how critical a failure is, but also the probability of occurrence the following table links these two parameters.

<table>
<thead>
<tr>
<th>Failure Effect Classification</th>
<th>System assurance level</th>
<th>Probability of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>A</td>
<td>Extremely Improbable</td>
</tr>
<tr>
<td>Hazardous</td>
<td>B</td>
<td>Extremely Remote</td>
</tr>
<tr>
<td>Major</td>
<td>C</td>
<td>Remote</td>
</tr>
<tr>
<td>Minor</td>
<td>D</td>
<td>Probable</td>
</tr>
<tr>
<td>Non essential (no safety issue)</td>
<td>E</td>
<td>Likely</td>
</tr>
</tbody>
</table>

### Table 5 Failure Effect Classification, system assurance level and probability of occurrence

In JAR, the terms probable, remote, extremely remote and extremely improbable are also expressed in terms of acceptable numerical frequency ranges for each flight hour.

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimate of frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Improbable</td>
<td>So unlikely that they are not anticipated to occur during the entire operational life of all aeroplanes of one type.</td>
</tr>
<tr>
<td>Extremely Remote</td>
<td>Unlikely to occur when considering the total operational life of all aeroplanes of the type, but nevertheless, has to be considered as being possible.</td>
</tr>
<tr>
<td>Remote</td>
<td>Unlikely to occur to each aeroplane during its total operational life but which may occur several times when considering the total operational life of a number of aeroplanes of the type.</td>
</tr>
<tr>
<td>Probable</td>
<td>Anticipated to occur one or more times during the entire operational life of each aeroplane.</td>
</tr>
</tbody>
</table>

### Table 6 Description of probability of occurrence related to aircraft

These numerical values are not directly applicable to A-SMGCS Systems, therefore it is recommended to associate the textual expression of these terms to a numerical numbers practicable for A-SMGCS.

### 6.3 Certification and Design and Development process issues

The certification process may be separated into two major parts.

- The first part of the certification process is related to the design, development, production and installation of a new system at an airport.
While the second part of the certification process is related to daily operational use of a system.

The effort required for certification depends upon the criticality of the system functions integrated into an A-SMGCS system to be certified.

The following diagram in Figure 2 shows a concept of an overall Certification Process from the design phase through to the operational phase.

Figure 2 Schematic of a proposed Concept of an overall certification process

As mentioned earlier, a kind of type certification is unfortunately most likely not the approach for the technical equipment used in an A-SMGCS System. Nevertheless the design and the requirements for technical equipment should fulfil necessary safety requirements which may be derived from some kind of build standards. Build standards for an A-SMGCS may be ICAO, EUROCAE and EUROCONTROL material; some of them are referenced as an example in the figure above.

Additionally advisory material from EUROCAE and/or other bodies and organisations based on experience gained during development, production, testing and operation of these systems and also some special conditions which may be required due to e.g. special runway configurations or geographic characteristics may also be defined as inputs to the requirements for system design.

There is a very close connection between system design of Hard- and Software where the required functions of an A-SMGCS are integrated and the operational procedures performed with the support of the A-SMGCS system, therefore documents which lay down the operational procedures requirements should also be part of the bases for the system requirements.

Certification of an A-SMGCS requires that the means of compliance how the build standards are met are agreed between two independent parties. Thus, those designing, developing the system and those responsible for certification should be independent of each other.
The definition of build standards are most likely driven by normative bodies and organisations, research institutes, and the operators. They all contribute with their knowledge and experience to set up a virtually comprehensive set of build standards. To control this process it is suggested to set up a procedure to collect in a controlled way the experiences of the design, production organisations and the operators. This may be by carried through by something like e.g. an incident reporting system which is controlled by an independent body/organisation like e.g. a certification authority, collecting and than distributing the experience and possibly derived consequences/changes to the build standards between all participants. The effort put into an incident reporting depends upon the criticality of the functions, operational procedures and systems involved.

Safety of the technical equipment is only part of an overall certification. In addition to the certification of an A-SMGCS System, the organisation(s) designing and producing a system have to prove, that they are capable of performing the job. This means they must have installed a well organized and controlled production and quality assurance process which is regularly monitored by an independent organisation and that the personal involved in design, development and production is sufficient in number and is well trained and skilled.

Something very similar applies to the service providers which operate and use these systems. Following the approach of the EASA / JAA this may be accomplished by procedures for licensing personal and approval procedures for companies / service providers involved.

The present situation is that well established processes are already set up and prove their efficiency in those domains and areas, where the criticality requires doing so.

New Systems with new higher functions to improve the airport efficiency by an A-SMGCS, especially in adverse weather situations, require a reviewing of those processes which assure that the currently very high safety levels are maintained. This may require that certification may not just look to certain areas but may have to incorporate all involved in the process. Safety issues where the driving idea t to design the above diagram which resembles a closed loop system involving all stakeholders of ASMGCS from normative organisations and bodies, researchers, design and production organisations and service providers. In The context of Safety it should be pointed out, that the term “incident reporting” used in Figure 2 should be looked at very carefully and most likely be defined more specifically. This should not only include incidents in the normal context but also other occurrences monitored and surveyed by the ANSPs e.g. in the context of safety management systems established within the last years.
7 Annex I

7.1 References

[2] Part21 / JAR 21 (EASA / JAA)
[5] WG 41 Papers
[6] Results of Emma Safety Group
[9] AIRBORNE ELECTRONIC HARDWARE
[18] EATMP, Advanced Surface Movement Guidance and Control System safety Policy, EUROCONTROL, Ed. 1.00, 2004-01
[20] EASA MB 02/04 , Decision of the Management Board Concerning the General Principles related to Certification Procedures to be Applied by the Agency for Issuing of Certificates for Products, Parts and Appliances (“Products Certification Procedures”), March 2004
[21] JAR 25.1309 Equipment, systems and installations, Change 15
[22] AC120-76A Guidelines for the certification, airworthiness and operational approval of electronic flight bag computing devices, FAA, July 2003

[26] Certification of Airports; Final Rule 14CFR Parts 121 and 139, Federal Register Vol. 69 No. 27, FAA, 2004-02-10

[27] JAR-1 Definitions and Abbreviations, JAA, NL, 1996

[28] ACJ 21, Annehmbare Nachweisverfahren (AMC) und Erläuterungen (IM) - Gemeinsame Richtlinien (ACJ) zu JAR-21, Januar 1997

[29] EASA Decision No. 2003/1/RM, On acceptable means of compliance and guidance material for he airworthyness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations. („AMC and Günter Mansfeld to Part 21“), 17.10.2003

7.2 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Long Name</th>
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<tbody>
<tr>
<td>AOC</td>
<td>Air Operator Certificate</td>
</tr>
<tr>
<td>APU</td>
<td>Auxiliary Power Unit</td>
</tr>
<tr>
<td>ARIBA</td>
<td>ATM system safety criticality Raises Issues in Balancing Actors responsibility</td>
</tr>
<tr>
<td>A-SMGCS</td>
<td>Advanced Surface Movement Guidance and Control (ICAO)</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Standardisation</td>
</tr>
<tr>
<td>CENELEC</td>
<td>European Committee for Electrotechnical Standardization</td>
</tr>
<tr>
<td>CofA</td>
<td>Certificates of Airworthiness</td>
</tr>
<tr>
<td>DLR</td>
<td>Deutsches Zentrum für Luft und Raumfahrt e.V., German Aerospace Center</td>
</tr>
<tr>
<td>DOA</td>
<td>Design Organisation Approval</td>
</tr>
<tr>
<td>EASA</td>
<td>European Aviation Safety Agency</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>ECAC</td>
<td>European Civil Aviation Conference</td>
</tr>
<tr>
<td>EMMA</td>
<td>European airport Movement Management by A-SMGCS</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EUROCAE</td>
<td>European Organisation for Civil Aviation Equipment</td>
</tr>
<tr>
<td>EUROCONTROL</td>
<td>European Organisation for the Safety of Air Navigation</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>IATA</td>
<td>International Air Transport Association</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organisation</td>
</tr>
<tr>
<td>JAA</td>
<td>Joint Aviation Authorities</td>
</tr>
<tr>
<td>JAR</td>
<td>Joint Aviation Requirements</td>
</tr>
<tr>
<td>JIP</td>
<td>Joint Implementation Procedures</td>
</tr>
<tr>
<td>JPA</td>
<td>Joint Part Approval</td>
</tr>
<tr>
<td>JTSO</td>
<td>Joint Technical Standard Orders</td>
</tr>
<tr>
<td>PHAC</td>
<td>Plan for Hardware Aspects of Certification</td>
</tr>
<tr>
<td>POA</td>
<td>Production Organisation Approval</td>
</tr>
<tr>
<td>RTCA</td>
<td>Radio Technical Commission for Aeronautics</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>STC</td>
<td>Supplemental Type Certificates</td>
</tr>
<tr>
<td>TC</td>
<td>Type Certificate</td>
</tr>
<tr>
<td>TSO</td>
<td>Technical Standard Orders</td>
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<tr>
<td>VLA</td>
<td>Very Light Aeroplanes</td>
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</tbody>
</table>
### 7.3 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable Require-ments</td>
<td>The comprehensive and detailed airworthiness codes established by an ICAO Contracting State for the class of aircraft under consideration (See ICAO Annex 8 Part II, 2.2) (Derived from ICAO)</td>
</tr>
<tr>
<td>Approval</td>
<td>The act of formal sanction of an implementation by a certification authority.</td>
</tr>
<tr>
<td>Approved</td>
<td>Accepted by the certification authority as suitable for a particular purpose. (ICAO)</td>
</tr>
<tr>
<td>Certification</td>
<td>The procedure and action by a duly authorized body of determining, verifying and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with applicable requirements.</td>
</tr>
<tr>
<td>Compliance</td>
<td>Conforming to a specification, standard or law that has been clearly defined.</td>
</tr>
</tbody>
</table>
8 Annex II

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