PLAN OF ACTION TO GAIN OPERATIONAL AND AIRWORTHINESS APPROVAL FOR MA-AFAS PRE-OPERATIONAL VALIDATION FLIGHT TRIALS

ISSUE 1

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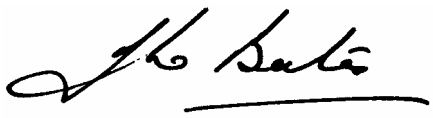

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REFERENCES

1. The More Autonomous – Aircraft in the Future Air Traffic Management System.
Annex I – Description of Work
European Commission Document Number MA-AFAS/0/1.0
Version 1.0 Dated: 4/11/99

2. The More Autonomous – Aircraft in the Future Air Traffic Management System.
Airworthiness Operational Approval Requirements and Methods
STASYS Limited Document Number STA/R/151/1/2/1
Issue 1 Dated: 14/08/00

3. Certification Procedures for Aircraft and Related Products and Parts.
JAR-21
Joint Aviation Authorities

4. Administrative and Guidance Material, Section 3 – Certification, Part 2 – Procedures.

Joint Aviation Authorities

GLOSSARY

ADS-B	Automatic Dependent Surveillance - Broadcast
AOC	Airline Operational Centres
ASAS	Airborne Separation Assurance System
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Service
CAA	Civil Aviation Authority
CDTI	Cockpit Display of Traffic Information
CMU	Communication Management Unit
CNS	Communications, Navigation and Surveillance
CPDLC	Controller Pilot Data Link Communications
DOA	Design Organisation Approval
ECAC	European Civil Aviation Conference
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	Federal Aviation Authority (USA)
FMS	Flight Management System
GACS	Generic ATN Communication Service
GNSS	Global Navigation Satellite Systems
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
JAA	Joint Aviation Authorities

JAR	Joint Aviation Requirements
JLP	Joint Local Procedure
JMP	Joint Multi-national Procedure
JPA	Joint Part Approval
JTSO	Joint Technical Standard Order
MA-AFAS	More Autonomous Aircraft in the Future ATM System
MASPS	Minimum Aviation System Performance Standards
MOPS	Minimum Operational Performance Standards
NAA	National Aviation Authority
PCA-STC	Primary Certification Authority for Supplemental Type Certification
RTCA	Radio Technical Commission for Aeronautics
SARPS	Standards and Recommended Practices (ICAO)
STC	Supplemental Type Certificate.
URCO	Urgent Communication Service
WP	Work Package

DEFINITIONS

a) "Joint Aviation Authorities" means all the Authorities that have signed the JAA Arrangements Document of 11 September 1990, each of them acting in accordance with joint procedures.

b) "National Authority" means that one of the Joint Aviation Authorities, having legal jurisdiction over the applicant for, or holder of, the Certificate, Approval or Authorisation.

c) "The Authority" means the National Authority applying in the particular case, the regulations contained in this JAR–21. However, in any case where the Joint Aviation Authorities have established procedures to jointly conduct the certification or approval process, The Authority means the Joint Aviation Authorities.

d) For the purposes of this document, "Product" means an aircraft, aircraft engine, or propeller.

e) "Parts and Appliances" means any instrument mechanism, equipment, part, apparatus, appurtenance, or accessory, including communications equipment, that is used or intended to be used in operating or controlling an aircraft in flight and is installed in or attached to the aircraft. It includes parts of an airframe, engine or propeller. *Note, in JAR-21 the term "appliance" is not used alone; the term "part" when used alone carries its normal dictionary meaning*.

f) "Import", "Export" mean the transfer of products, parts and appliances between a JAA country and a non -JAA country.

g) "Comply"; "compliance" are used in connection with meeting a rule, regulation or requirement.

h) "Conform"; "conformity" are used in connection with showing or finding a product, part or appliance is in accordance with an approved design.

i) "Demonstrate", unless otherwise stated, means demonstrate to the Authority.

j) Mandatory Clauses:

- use "shall", and are referred to as a "regulation", where they are an imperative (i.e. non-compliance could involve penalties).

- use "must", and are referred to as a "requirement", where they are a condition precedent (i.e. non-compliance leads to failure to obtain a certificate or approval .)

k) "Person" is a legal entity which is subject to the jurisdiction of a JAA country; it can include an Organisation or Company.

l) "Applicant" means a person or organisation applying for a Supplemental Type Certificate.

m) "National Aviation Authority" means any of those Aviation Authorities which have signed the Arrangements document concerning the development, acceptance and implementation of JAR.

n) "Primary Certification Authority" means the National Aviation Authority accepted by the other National Aviation Authorities to conduct a Type Certification process under the JAA Local Procedure.

o) "Primary Certification Authority for Supplemental Type Certification" means the National Aviation Authority accepted by the other National Aviation Authorities to conduct a Category 2 STC process or the validation of a Category 2 STC from a non-JAA country under the JAA Local Procedure.

p) "JAA Product" means a Product which has been certificated or validated in accordance with agreed JAA Procedures, including Caught-Up products (see JAR-21 Appendix D).

q) "Lead Authority", in the context of the JAA Catch-up programme, means the NAA accepted by the other NAAs to conduct, for a specific type, the activities under the Implementation and Post Catch-up Procedures.

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1 INTRODUCTION

1.1 GENERAL

1.1.1 The civil avionics market is in the early stages of major revolution, which is being driven by the growth of civil air traffic (5% in time of recession, 8% in 1998). This growth is pushing present Air Traffic Management (ATM) systems to breaking point. Within Europe the situation can be characterised by long delays for passengers, inefficient routing for operators and unacceptable stress for controllers.

1.1.2 The More Autonomous Aircraft in the Future ATM System (MA-AFAS) programme aims to transform European research results into practical operational ATM procedures with the potential to radically improve the European ATM scenario in the near term (from 2005). By selecting and validating key airborne elements of Communications, Navigation and Surveillance (CNS) and defining their economic benefits and certification requirements, the research will enable more autonomous aircraft operation in the European ATM system.

1.1.3 The improvements must be capable of being applied to existing aircraft, so the project focuses on the ATM solution required for aircraft retrofit. The project is divided into four main Work Packages (WPs). WP1 defines the future ATM and ground requirements, ground infrastructure and operational scenarios, which will be used as a baseline. WP2 designs and develops the retrofit avionics solution to meet this baseline, which will be validated in WP3 within representative future ATM environments. Finally, WP4 identifies the steps required to transition from the trials demonstration of the avionics package to in-service pre-operational validation, by providing cost benefit analysis, operational procedures, new and modified standards and implementation and certification plans.

1.2 SCOPE

1.2.1 This document has been produced as Deliverable D45 to satisfy the requirements of Work Package 4.2.1. The objective of WP 4.2.1 is to generate a plan of action to gain operational and airworthiness approval for pre-operational validation trials, including any necessary certification activities, from the Joint Aviation Authority (JAA). Airworthiness approval is required in order to be able to install the MA-AFAS experimental package on commercial aircraft.

1.3 PURPOSE

1.3.1 The purpose of this document is to provide a plan of action to gain operational and airworthiness approval for pre-operational validation trials. As such, this document will define the relevant certification standards that are applicable to the MA-AFAS system, describe the procedure for gaining certification from the appropriate organisations and provide reference to documentation relevant to the certification of the MA-AFAS system.

1.3.2 A certification process checklist and a sample compliance table that could be used to show how compliance with the relevant certification standards is demonstrated are described in Deliverable D15 paragraph 8.

1.3.3 It is the responsibility of the Applicant, when applying for approval, to demonstrate compliance with the certification standards. The purpose of this document is to provide a plan to explain and facilitate certification process.

2 MA-AFAS SYSTEM DESCRIPTION

2.1 SYSTEM DESCRIPTION

2.1.1 The MA-AFAS programme is focused on the ATM solution required for aircraft retrofit with the system design being based on a core ARINC 702A standard Flight Management System (FMS). The capabilities that will be added to the core FMS and validated within this programme include the following:

- Evaluation of airborne 4D trajectory generation and guidance, including negotiation of the flight path with the Air Traffic Control (ATC) via data link.

- The use of Global Navigation Satellite Systems (GNSS) with ground and space based augmentation for enhancing approach procedures under 4D flight-path control.

- Automatic Dependent Surveillance – Broadcast (ADS-B) (using VDL Mode 4) with Cockpit Display of Traffic Information (CDTI) and Airborne Separation Assurance System (ASAS).

- Integration of an on-board taxiway map and data linked clearances.

- Support for the Airline Operational Centres (AOC) in respect of aircraft maintenance, and the control and management of their aircraft fleet.

- Evaluation of the flight deck Human Machine Interface (HMI) improvements to support the increased capabilities of the FMS with particular emphasis on the 4D trajectory generation and monitoring in a more autonomous environment.

- Integration of the full Aeronautical Telecommunications Network (ATN) stack (using VDL mode 2 and VDL mode 4 sub networks) in the airborne environment to support AOC and ATC communications using ODIAC defined standards.

2.1.2 In order to meet these enhanced capabilities, it is expected that the following aircraft equipment will be affected:

- Flight Management System (FMS).

- Communication Management Unit (CMU).

2.1.3 The MA-AFAS Ground System (here also referred to as MA-AFAS Ground Platform) is the ATM ground counterpart of the airborne system designed and implemented by MA-AFAS. It should enable the testing and validation of the new avionic functions providing the peer functions on the ground.

2.1.4 The analysis of the requirements has led to the inclusion of the following high-level functions (or functional areas according to the FARADEX terminology) in the MA-AFAS Ground Platform:

a) Capacity and Flow Management.

On the basis of airspace demand and capacity planning, this functional area develops the Daily Operational Plan (DOP). It is updated for any event that can change the demand or capacity and is presented to the ATS providers and other users the day before operations. In part, this corresponds to the function presently performed by the CFMU for the ECAC airspace.

b) Air Traffic Services (ATS).

This includes ATC services in all phases of flight (en-route, approach, departure, landing, surface movement), Flight Information Services (FIS) and Traffic Information Service (TIS). In the MA-AFAS scope, these services are provided without interacting with the operational ATS (shadow mode).

c) CNS infrastructure.

This function includes the Communication, Navigation and Surveillance capabilities that transport information throughout the whole system. The MA-AFAS CNS infrastructure is widely based on the use of digital communications, satellite-based navigation and ADS-B based surveillance. Nevertheless, traditional infrastructures (radar, voice communications) are also exploited.

d) Data Management.

The main aspect of this functional area is the process of retrieving and combining data in order to produce, in real-time, the current and the future Air Traffic Situation (Surveillance Data Processing and Flight Data Processing). Archiving capabilities also support off-line data analysis.

e) Airline Operations Centre.

This refers to the aircraft operator participation in co-ordinating the initial flight planning and in-flight re-planning with the ATS. In the MA-AFAS scope, AOC functions are closely linked to ATS due to the involvement of the airline in the 4-D flight plan negotiation.

f) Support Functions.

This area includes the functions that are required to enable the whole platform to be used as a validation platform for the objectives

of the project (simulation functions, playback functions, platform management functions, evaluation functions, and so on).

2.1.5 Although the following functional areas exchange information with the system, they fall outside the scope of the MA-AFAS ground platform:

a) Airspace Management.

ATM is concerned with the definition of the Airspace and the Route Network structure (including areas of Free Routing / Free Flight).

b) Weather Service Provider.

This is the source of aviation weather information for all parties dealing with flight planning and flight operations. The Weather Service Provider will provide various weather forecasts, but may also use weather data down linked from a/c to produce ‘nowcasts’ which can then be provided to the ground platform.

2.2 INTERFACE DESCRIPTIONS

2.2.1 The external interfaces are assumed to include interfaces between aircraft equipment and ground equipment and also aircraft to aircraft communications links.

2.2.2 ATN Communications

2.2.2.1 The ATN communications interface shall be compliant with ATN SARPS ICAO 9705/2.

2.2.3 VDL Mode 2

2.2.3.1 The aircraft equipment shall support the reception and transmission of ATN messages through VDL Mode 2 link.

2.2.3.2 At airfields selected for VDLM2-specific trials, the ground stations shall support the reception and the transmission of ATN messages through a VDL Mode 2 link.

2.2.4 VDL mode 4

2.2.4.1 The aircraft equipment shall support the reception and transmission of ATN messages through VDL Mode 4 link.

2.2.4.2 At airfields selected for VDLM4-specific trials, the ground stations shall support the reception and the transmission of ATN messages through a VDL Mode 4 link.

2.2.5 SATCOM

2.2.5.1 The aircraft equipment shall support the reception and transmission of ATN messages through a satellite communications link.

2.2.5.2 The ground equipment shall support the reception and transmission of ATN messages through a satellite communications link.

2.2.6 ATN Services

2.2.6.1 The Generic ATN Communication Service (GACS) allows a user of this service to transfer data transparently across the ATN to one or more other users.

2.2.6.2 It is assumed that the AOC will interface with the ATN upper layer (GACS API) in order to communicate information to the aircraft equipment or receive information from the aircraft.

2.2.7 CPDLC

2.2.7.1 Controller Pilot Data Link Communications (CPDLC) is a means of communication between Controller and pilot using data link for ATC communication.

2.2.7.2 The CPDLC capabilities of the ground and aircraft equipment shall be compliant with ODIAC AGC-ORD-01.

2.2.7.3 CPDLC shall implement extensions of ATN SARPS ICAO 9705/2 CPDLC services where required to support FLIPCY, DYNAV and Taxi management operational functions.

2.2.7.4 The CPDLC capability shall implement a subset of ATN SARPS ICAO 9705/2 CPDLC services sufficient to meet the MA-AFAS trials requirements.

2.2.8 FIS

2.2.8.1 The Flight Information Service (FIS) provides a means of supplying advice and flight information (e.g. ATIS and meteorological information) to the pilot.

2.2.8.2 The Data Link Flight Information Services (FIS) shall be compliant with ODIAC AGD-ORD-01

2.2.8.3 FIS shall implement a subset of ATN SARPS ICAO 9705/2 FIS services sufficient to perform the scenarios defined for MA-AFAS.

2.2.9 ADS-C

2.2.9.1 ADS-C supports a surveillance technique for use by air traffic services in which aircraft automatically transmit information derived from the on-board aircraft systems about he aircraft position, speed and heading to the ATC.

2.2.9.2 The aircraft equipment shall implement all ATN SARPS ICAO 9705/2 ADS-C services.

2.2.9.3 The ground equipment shall implement all ATN SARPS ICAO 9705/2 ADS-C services.

2.2.10 URCO

2.2.10.1 The Urgent Communication Service (URCO) provides a mechanism for exchanging urgent messages with aircraft that are not yet under ATSU control.

2.2.10.2 The aircraft equipment aircraft shall be capable of receiving urgent communications from ATC through a VLD mode 4 link.

2.2.10.3 The ground equipment aircraft shall be capable of transmitting urgent communications from ATC through a VLD mode 4 link to the aircraft.

3 CERTIFICATION

3.1 BACKGROUND

3.1.1 All changes to an approved aircraft type need to be approved by the Joint Aviation Authorities (JAA). The JAA are an associated body of the European Civil Aviation Conference (ECAC). They represent the civil aviation regulatory authorities of a number of European states that have agreed to co-operate in developing and implementing common safety regulatory standards and procedures. This co-operation is intended to provide high and consistent standards of safety and a level playing field for Europe. Much emphasis is also placed on harmonising the JAA regulations with those of the USA (FAA).

3.1.2 One of the functions of the JAA is to develop and adopt Joint Aviation Requirements (JARs) in the fields of aircraft design and manufacture, aircraft operations and maintenance, and the licensing of aviation personnel. The JARs have been produced to provide common comprehensive and detailed airworthiness requirements, agreed by the Civil Aviation Authorities (CAAs) of JAA member States, with a view to minimising Type Certification problems on joint ventures and to facilitate the export and import of aviation products. The JARs are recognised by the Civil Aviation Administrations of participating countries as an acceptable basis for showing compliance with their national airworthiness codes.

3.1.3 Any avionics package developed under the MA-AFAS programme that will be installed on a commercial aircraft, for either pre-operational trials or in operational use, is required to have appropriate certification.

3.2 REQUIREMENTS

3.2.1 The JAR-21 (Certification Procedures for Aircraft and Related Products and Parts) [3] is the JAA document which prescribes:

a) Procedural requirements for the issue of Type Certificates and changes to those certificates; the issue of standard certificates of airworthiness; the issue of export airworthiness approvals.

b) Procedural requirements for the approval of certain parts and appliances.

c) Procedural requirements for the approval of organisations for the purposes of a) and b) above.

d) Rules governing the holders of any certificate or approval specified in a), b) and c) above.

3.2.2 The procedural requirements related to the approval of Parts and Appliances are prescribed in JAR-21 Subpart K. Subpart K states that the showing of compliance with applicable requirements for Parts and Appliances to be installed in a type certificated Product may only be made:

a) In conjunction with the type certification procedures of Subpart B (Type Certificates), Subpart D (Changes to the Type Certificates) or Subpart E (Supplemental Type Certificates) for the product in which it is to be installed; or

b) Where applicable, under the Joint Technical Standard Order (JTSO) Authorisation procedures of Subpart O; or

c) Where applicable, under the Joint Part Approval (JPA) procedures of Subpart P; or

d) In the case of standard parts, in accordance with established Industry or Government specifications.

3.2.3 In May 2002, the JAA was consulted in order to clarify the certification process and requirements applicable to the avionics package to be developed under the MA-AFAS programme. Based upon the information available, the JAA advised that the Supplemental Type Certification (STC) procedure is the most appropriate.

3.2.4 The procedural requirements for the approval of major changes to the type design under the Supplemental Type Certificate procedures are prescribed in JAR-21 Subpart E. In addition, guidance material on the STC certification procedure is given in the JAA Administrative and Guidance Material Section 3 Part 2 [4]. Together, those two documents define the STC certification procedure in detail. A high level description of the procedure, taken from the guidance material [4], is provided below.

4 DESCRIPTION OF STC CERTIFICATION PROCEDURE

4.1 ORGANISATION

4.1.1 JAA Central Structure.

4.1.1.1 JAA Headquarters activities relating to STC are performed within the JAA Certification Division, by the various Certification Co-ordinators. The Certification Co-ordinators report to the Certification Director.

4.1.2 National Aviation Authorities.

4.1.2.1 When the Joint Local Procedure (JLP) applies, the relevant National Aviation Authority (NAA) has the responsibility to conduct the STC investigations on behalf of all other NAAs. Such an NAA must be accepted as a Primary Certification Authority for Supplemental Type Certification (PCA-STC).

4.2 PRINCIPLES OF THE JAA STC PROCEDURE

4.2.1 Impact of STC on Type Certificate.

4.2.1.1 An STC does not require any amendment to the Type Certificate issued by the country of origin or by any NAA approving or validating an STC.

4.2.2 Eligibility.

4.2.2.1 This procedure applies to the STC approval process of major changes for JAA Products but may be applied voluntarily to NAA Products.

4.2.3 STC Category.

4.2.3.1 From a procedural point of view, STCs are divided into Category 1 and Category 2.

a) A “Category 1 STC” is a major design change which necessitates a change to the Type Certification Basis referenced in the Type Certificate Data Sheet (TCDS) for the Product.

b) A “Category 2 STC” is any other STC.

4.2.4 Category 1 STC.

4.2.4.1 For a Category 1 STC, JAA standardisation is ensured through the use of the Joint Multi-national Procedure (JMP) or Joint Local Procedure (JLP).

4.2.5 Category 2 STC.

4.2.5.1 For a Category 2 STC, JAA standardisation is ensured through the use of JLP procedures, especially by the acceptance of an NAA as a PCA for STC activities. Guidance on the acceptance of an NAA as PCA-STC is given in Chapter 8 of Ref [4].

4.3 PROCEDURE FOR THE APPROVAL OF AN STC

4.3.1 Application

4.3.1.1 Application for approval of an STC under JAR-21 Subpart E shall in all cases be made to the NAA of the STC applicant (see JAR-21.113).

4.3.1.2 In the case of an STC under JAR-21 Subpart N-E, application for approval shall be made to any NAA at the discretion of the applicant (see JAR-21.N113), and must include a declaration by the applicant that he has filed an application with this NAA only.

4.3.1.3 An application for JAA validation of an STC will only be accepted if the STC applicant is subject to the jurisdiction of an Authority which has entered or is prepared to enter into an Arrangement in accordance with JAR 21N5. That includes specific provisions for this purpose (see also JAR 21N112), in particular to address the case of an STC applicant who is subject to the jurisdiction of an Authority that has not issued the original Type Certificate for the product.

4.3.1.4 The applicant should propose with appropriate justification the classification of the STC, as either Category 1 or Category 2, for the agreement of the NAA to which the application is made.

4.3.2 Category 1 STC

4.3.2.1 For all Category 1 STCs, the JAA procedure used for the certification / validation of the JAA Product, i.e. JMP or JLP (in principle the post -TC procedures for Major Design Changes), will be applied.

4.3.2.2 If the NAA, having received an application, decides the STC is Category 1, the NAA will send the application to the JAA Certification Division, who will:

a) Review the NAA decision on Design Organisation Approval (DOA) determination,

b) For an STC to a JAA Product having been subject to the JMP, task the PCM of the JAA Product, or,

c) For an STC to a JAA Product having been subject to the JLP, task the PCA of the JAA Product, or,

d) For an STC to a JAA Product having been subject to Catch-up, task the nominated Lead Authority for the Product, in accordance with Implementation and Post Catch-up Procedures (see Table 1).

Category 1 STCs	STC Applicant	STC Investigation by
JAA certification of STC to a JAA certificated product.	Located in JAA country.	PCM, PCA or Lead Authority for the JAA Product.
JAA certification of STC to a JAA validated product.	Located in JAA country.	PCM or Lead Authority for the JAA Product.
JAA validation of STC to a JAA certificated product.	Located in non-JAA country.	PCM, PCA or Lead Authority for the JAA Product.
JAA validation of STC to a JAA validated product.	Located in non-JAA country.	PCM or Lead Authority for the JAA Product.

Table 1

4.3.2.3 The PCM in consultation with the Team, the PCA or the Lead Authority, respectively, will then decide which disciplines and how many specialists are necessary for carrying out the investigation and approval process. For an STC under JAR-21 Subpart E, the NAA of the applicant will notify its involvement as State of Design to the PCM, PCA or Lead Authority.

4.3.2.4 After the specialist team involved in the STC investigation process has been satisfied by the compliance demonstration, the PCM, PCA or Lead Authority will issue a Statement of Compliance to the NAA of the STC applicant.

4.3.2.5 The NAA of the STC applicant will issue the STC.

4.3.2.6 Where the design change involved in the STC is “Significant”, the JAA Certification Director will issue a JAA recommendation letter to all NAAs.

4.3.2.7 For JAA Validation of an STC, the NAA being the First Customer Authority will issue the STC.

4.3.3 Category 2 STC

4.3.3.1 For all Category 2 STCs, the STC approval process will be carried out following the principles of the JLP by one NAA (in most cases the local Authority of the STC applicant or the First Customer Authority, see Table 2), on behalf of all the other NAAs.

Category 2 STCs	STC Applicant	Application to responsible PCA-STC
JAA certification of STC to a JAA certificated product.	Located in JAA country.	PCA-STC who is Local Authority of STC-Applicant.
JAA certification of STC to a JAA validated product.	Located in JAA country.	PCA-STC who is Local Authority of STC-Applicant.
JAA validation of STC to a JAA certificated product.	Located in non-JAA country.	Any PCA-STC (e.g. First Customer Authority).
JAA validation of STC to a JAA validated product.	Located in non-JAA country.	Any PCA-STC (e.g. First Customer Authority).

Table 2

4.3.3.2 If the NAA is not a PCA for the category of products, or the State of Design of the Product certificated in accordance with JMP, or the Lead Authority for the Caught-Up Product, to which the STC application is made, the NAA will either:

a) make an application to the JAA Certification Director to be accepted as a PCA-STC in accordance with the procedures, or

b) request the JAA Certification Division to find an existing relevant PCA -STC to volunteer to perform the JAA STC process. The NAA that has received the STC application will transfer it to the NAA that has volunteered.

4.3.3.3 The NAA in charge of the STC investigation will then decide which disciplines and how many Specialists need to be involved in the STC investigation and approval process. For an STC under JAR-21 Subpart E, the NAA of the applicant will notify its involvement as State of Design to the responsible NAA.

4.3.3.4 Where the PCA-STC is not the PCA for the JAA Product, it must establish appropriate information exchange links with either the PCM, PCA or the Lead Authority for the JAA Product. This information exchange should include, but not be limited to, details of the application, classification (Category 1 or 2), DOA determination and involvement of the TC Holder.

4.3.3.5 After the specialist team involved in the STC investigation process has been satisfied by the compliance demonstration, the PCA-STC, if the NAA of the STC applicant, will issue a Statement of Compliance and the STC.

4.3.3.6 If not the NAA of the STC applicant, the PCA-STC will issue a Statement of Compliance to the NAA of the STC applicant that will act immediately and issue the STC.

4.3.3.7 For JAA Validation of an STC, the NAA to which the application is made (normally the First Customer Authority) will issue the STC.

4.3.3.8 The PCM, PCA or Lead Authority of the JAA Product will be informed by the NAA who has issued the STC.

4.3.4 Mutual Recognition

4.3.4.1 Mutual recognition will be achieved by publishing in JAA Administrative and Guidance Material information on the STCs approved by the NAAs in accordance with these STC procedures.

4.3.4.2 Some NAAs may have to issue their own STCs in order to comply with National laws.

4.3.5 STC on NAA Products

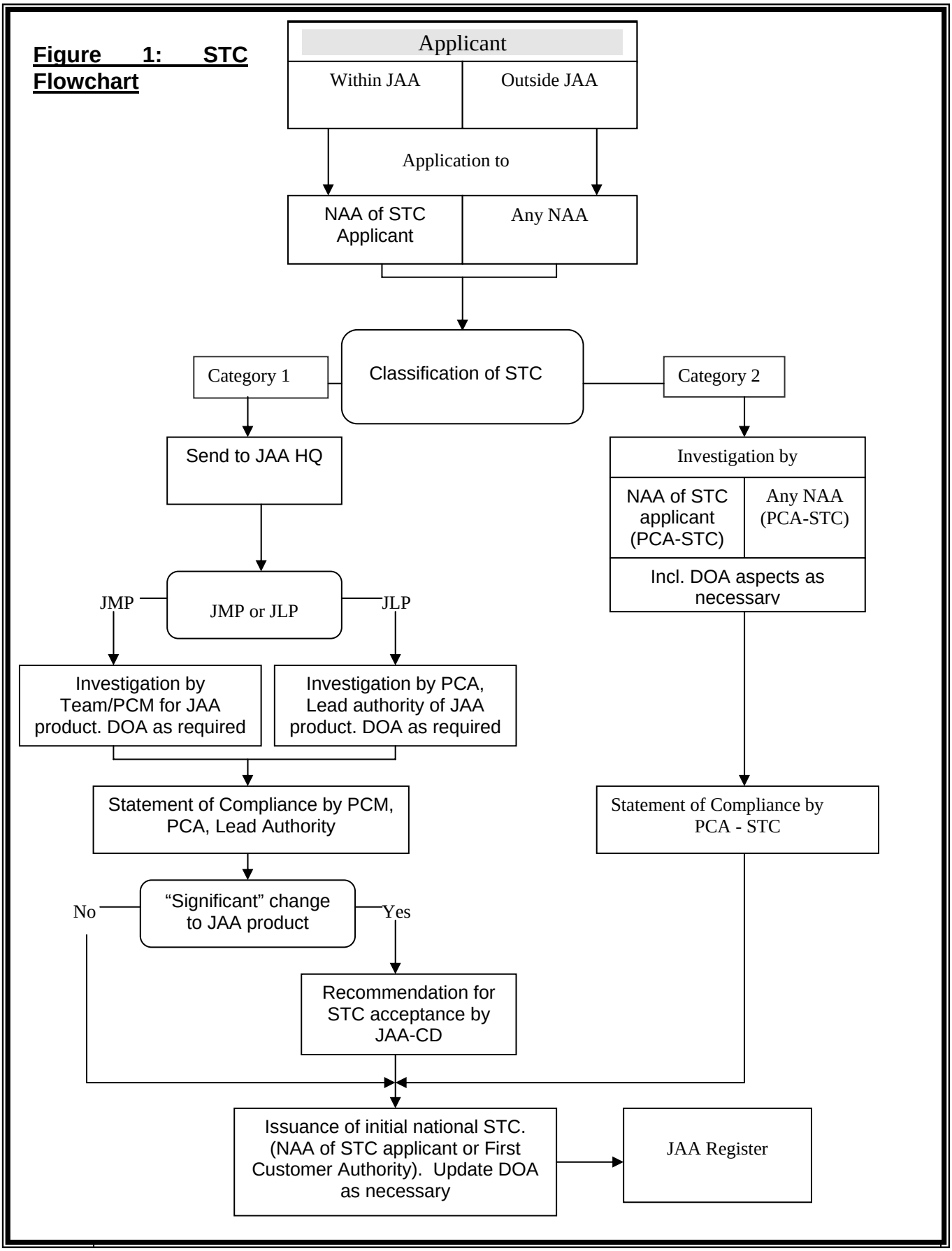
4.3.5.1 When these procedures are used on a voluntary basis for the issue of an STC to NAA Products, JLP principles apply in all cases.

4.3.5.2 For the issue of STCs to Products of Type Certificate (TC) holders located in JAA countries, the PCA-STC must, if it is not the NAA of the TC holder, establish appropriate information exchange links with this NAA. This information exchange should include, but not be limited to, details of application, classification (Category 1 or 2), DOA determination and involvement of the TC holder.

4.3.6 STC Approval Flowchart

4.3.6.1 A flowchart showing the STC approval process is given in Figure 1.

Figure 1: STC Flowchart



III. Inspection and testing of components and sub-assemblies.
- NAA issues individual conformity inspection requests.
- Applicant makes arrangements for inspections and tests.
- Applicant/NAA conduct inspections and tests.
- Applicant submits test reports and substantiating data.
- NAA evaluates test reports and substantiating data.
IV. Inspection and testing of complete assembly and installation.
- Applicant submits proposed Flight Manual Supplement and flight-test proposal.
- NAA evaluates proposed Flight Manual Supplement and flight test proposal.
- Applicant makes arrangements for final inspections and tests.
- NAA prepares TIA.
- Applicant makes arrangements for installation conformity inspection.
- NAA/applicant conduct installation conformity inspection.
- Applicant completes company development flight tests.
- Applicant submits flight test report.
- NAA evaluates flight test report.
- NAA/applicant conduct final inspections and tests, per TIA.
- Applicant submits all final data.
- NAA evaluates final data.
- NAA initiates TIR.

V. Issuance of the STC.
- NAA prepares STC. - STC sent to applicant. - NAA finalises TIR and registers FCA. - Data files sent to NAA archives. - Project closed.

Table 3 – Certification Plan of Action

5 CERTIFICATION DOCUMENTATION

5.1 INTRODUCTION

5.1.1 The documents listed in this section will be used to a greater or lesser extent in the process of gaining certification for the pre-operational MA-AFAS system.

5.1.2 The JAA documents set the regulations and requirements with which the Products, Parts and Appliances must comply.

5.1.3 ICAO is the only organisation that produces globally accepted standards. The contents however do not have a direct involvement in the certification process. The ICAO documents listed give general and technical guidelines. The RTCA and EUROCAE organisations use the ICAO documents as a basis for their standards.

5.1.4 The EUROCAE and RTCA documents address the detailed requirements that are needed to obtain a certifiable product.

5.2 ICAO DOCUMENTS

a) SARPS ANNEX 6 - Operational requirements - 5th Edition Dated Nov 2001

b) SARPS ANNEX 8 - Certification of aircraft systems - 9th Edition Dated Nov 2001

c) SARPS ANNEX 10 Volume III - Aeronautical Telecommunications - 1st Edition Dated Nov 2000

5.3 JAA DOCUMENTS

a) JAR-21 (March 2001) - Certification procedures for aircraft and related products and parts.

b) JAR-25 (Re-issued by Change 15) reflects many requirements for the avionics equipment for large aeroplanes and was recommended by the JAA for the approval process outlined in this document.

i) **JAR 25.581** Lightning protection

ii) **JAR 25X899** Electrical bonding and protection against lightning and static electricity

iii) **JAR 25.1301** Function and installation

iv) **JAR 25.1307** Miscellaneous equipment

v) **JAR 25.1309** Equipment, systems and installations

vi) **JAR 25.1321** Arrangement and visibility

vii) **JAR 25.1331** Instruments using a power supply

viii) **JAR 25.1333** Instrument systems

ix) **JAR 25.1351** Electrical systems and equipment

x) **JAR 25.1353** Electrical equipment and installations

xi) **JAR 25.1355** Distribution system

xii) **JAR 25.1357** Circuit protective devices

xiii) **JAR 25X1360** Precautions against injury

xiv) **JAR 25X1362** Electrical supplies for emergency conditions

xv) **JAR 25X1363** Electrical system tests

xvi) **JAR 25.1431** Electronic equipment

xvii) **JAR 25.1457** Cockpit voice recorders

xviii) **JAR 25.1459** Flight recorders

5.3.1 Joint Technical Standard Orders (JTSOs) contain minimum performance and quality control standards for specified materials, parts, or appliances used on civil aircraft. There are two types of JTSOs; those that are identical to the FAA TSOs and those that are different from FAA TSOs. The numbering of the latter start with JTSO 2 C followed by a reference number. The JTSOs used for this document are of this kind.

a) **JTSO-2C37E** - VHF radio communications transmitting equipment operating within the radio frequency 117.975 – 137 MHz.

b) **JTSO-2C38E** - VHF radio communication receiving equipment operating within the radio frequency 117.975 – 137 MHz.

c) **JTSO-2C122** - Devices that prevent blocked channels used in Two-Way Radio communications due to simultaneous transmissions.

d) **JTSO-2C128** - Devices that prevent blocked channels used in Two-Way Radio communications due to unintentional transmissions.

5.4 RTCA DOCUMENTS

a) **DO-127** - Standard Procedure for the measurement of the Radio-Frequency radiation from aviation radio receivers

b) **DO-160D** - Environmental Conditions and Test Procedures for Airborne Equipment

c) **DO-178B** - Software Considerations in Airborne Systems and Equipment

d) **DO-186A change 1** - MOPS for Airborne Radio Communications Equipment operating within the radio frequency range 117.975 – 137.000 MHz

e) **DO-187** - MOPS for Airborne Area Navigation Equipment Using Multi-Sensor Inputs

f) **DO-207** - MOPS for devices that prevent blocked channel usage for two-way radio communications due to unintentional transmissions

g) **DO-208 change 1** - MOPS for Airborne Supplemental Navigation Equipment using GPS

h) **DO-209** - MOPS for devices that prevent blocked channels usage for two-way radio communications due to simultaneous transmissions

i) **DO-212** - MOPS for Airborne ADS Equipment

j) **DO-214** - Audio systems characteristics and MOPS for aircraft Audio systems and Equipment

k) **DO-215A change 1** - Guidance on AMSS End-to-End System Performance

l) **DO-216** - Minimum general specification for ground-based electronic equipment

m) **DO-217 change 2** - MASPS DGNSS Instrument Approach System (cat1)

n) **DO-218B** - MOPS for Mode-S Airborne Data Link Processor

o) **DO-219** - MOPS for TWDL Communications

p) **DO-222** - Guidelines on AMSRS

q) **DO-224A change 1** - Signal in space MASPS advanced VHF Digital Data communications including Capability with digital voice techniques

r) **DO-225** - VHF Air-ground communications system improvements alternatives study and selection of proposals for future action

s) **DO-226** - Guidance Material for Evolving Airborne Precision Area navigation Equipment with the Emphasis on MLS

t) **DO-229C** - MOPS for GPS Wide Area Augmentation System Airborne Equipment

u) **DO-231** - Design guidelines and recommended Standards for the Implementation and Use of AMSS in a Data Link Environment

v) **DO-232** - Operations concept for datalink Applications of Flight Information Services

w) **DO-238** - Human Engineering guidance for Data Link System

x) **DO-239** - MOPS for TIS Data Link Communications

y) **DO-240** - MOPS for Avionics

z) **DO-242** - MASPS for ADS-B

aa) **DO-243** - Guidance for Initial Implementation of CDTI

bb) **DO-245** - MASPS for Local Area Augmentation System (LAAS)

cc) **DO-246B** - GNSS Based Precision Approach local Area Augmentation System (LAAS) - Signal in Space Interface Control Document

dd) **DO-248B** - First annual report for clarification of DO-178, software considerations in airborne systems and equipment certification

ee) **DO–252** - Minimum Interoperability Standards for Automated Meteorological Transmission (AUTOMET)

ff) **DO-253A** - MOPS for GPS Local Area Augmentation System Airborne Equipment

gg) **DO-254** - Design Assurance Guidance for Airborne Electronic Hardware

hh) **DO-255** - Requirements Specification for Avionics Computer Resource (ACR)

ii) **DO-258** - Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications

jj) **DO-260** - Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B)

kk) **DO-261** - NAVSTAR GPS L5 Signal Specification

ll) **DO-262 change 1** - Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)

mm) **DO-270** - Minimum Aviation System Performance Standards (MASPS) for the Aeronautical Mobile-Satellite (R) Service (AMS(R)S) as Used in Aeronautical Data Links

5.5 EUROCAE DOCUMENTS

a) **ED-12B** - Software considerations in Airborne Systems and Equipment certification

b) **ED-14D change 1** - Environmental Conditions and test Procedures for airborne equipment

c) **ED-23B** - MOPS for Airborne Receiver-Transmitter operating between 117.975 and 135.975 MHz

d) **ED-58** - MOPS for RNAV system using multisensor input

e) **ED-67** - MOPS for devices that prevent unintentional simultaneous transmissions

f) **ED-68** - MOPS for Devices that prevent simultaneous transmissions

g) **ED-72A** - MOPS for Airborne GPS Receiving Equipment used for Supplemental Means of Navigation

h) **ED-73A** - MOPS for Secondary Surveillance Radar Mode-S Transponders

i) **ED-78A** - Guidance Material for the Establishment of Data-Link Supported ATS Services

j) **ED-79/ARP 4754** - Certification Considerations for Highly Integrated or Complex Aircraft Systems

k) **ED-81** - Certification of Electronic Systems for the Indirect effect of Lightning

l) **ED- 82A** - MOPS for Mode-S Aircraft Data Link Processors

m) **ED-84** - Aircraft Lighting Environment and related test Waveforms standard

n) **ED-85** - Data-Link Application System Document for the departure Clearance Data-Link service

o) **ED-86** - Equipment Characteristics for Mode-S Transponders with Extended Interface Functions

p) **ED-88** - MOPS for Multi Mode Airborne Receiver Including ILS, MLS and GPS used for Supplemental Means of Navigation

q) **ED-90** - Radio Frequency Susceptibility Test procedures Ref. ED-14D)

r) **ED-92** - MOPS for VDL-2 Transceiver for Airborne Equipment

s) **ED-93** - MASPS for CNS/ATM message recording systems

t) **ED-94B** - First annual report for clarification of ED-12B (software)

u) **ED-95** - MASPS for GPS Ground Based Augmentation System to support cat 1 Operations

v) **ED-97** - Interim Technical Performance Statement for EGNOS/WAAS Airborne Equipment

w) **ED-100** - Interoperability Requirements for ATS Applications using ARINC 622 Data Communications

x) **ED-101** - Minimum Operational Performance Specification for Mode S Specific Service Applications

y) **ED-102** - Minimum Operational Performance Standards for 1090MHz Automatic Dependent Surveillance - Broadcast (ADS-B)

z) **ED-107** - Guide for the certification of Aircraft in a High Intensity Radiated Field (HIRF)

aa) **ED-108** - Interim MOPS for VDL Mode 4 Aircraft Transceiver for ADS-B

bb) **ED-109** - Guidelines for CNS/ATM Systems Software Integrity Assurance

6 ADVICE FROM THE JAA

6.1 CERTIFICATION AND OPERATIONAL APPROVAL

6.1.1 The JAA's first impression of this requirement is that the most appropriate route to airworthiness certification would be via the STC process initiated through the first customer's National Aviation Authority (NAA) (see 3.2.3 above). This procedure is discussed above. At the time of writing it is intended that the trials will be undertaken on an Airbus of the Spanish airline Iberia and it therefore seems likely that the Spanish CAA will be the NAA involved. However, despite lengthy negotiations the Spanish CAA have declined to take part in the development of this plan and certification activities until the first customer is confirmed and a pre-operational FMS is available.

6.1.2 The operational approval under which these trials will take place in Spanish airspace will also need to be negotiated with the Spanish CAA in parallel with certification.

6.2 PRE-OPERATIONAL FLIGHT TRIALS

6.2.1 The JAA were approached with a view to gaining advice on the best way to proceed with certification and approval for the Pre-Operational Flight Trials. They advise that:

6.2.1.1 The matter (MA-AFAS trials) is most simple if the equipment to be tested can be accepted on the basis of non-interference, i.e. there must be **no influence at all** on the tasks of the flight crew or cabin crew. Connections to aircraft systems must be proven to not interfere with the functioning of this equipment even if the experimental equipment fails, and the experimental equipment must itself be proven to be safe both in normal operation and in failure conditions. Analyses according to JAR 25.1309 and equipment qualifications under DO-160D would normally support such non-interference claims.

6.2.1.2 When there is impact on the duties of the flight and/or cabin crew, in addition to non-interference with other equipment, a more extensive assessment should be made, to ensure that crew workload and airplane safety are not significantly effected.

6.2.1.3 When it concerns an FMS like system, the crew interface and associated workload will be considerable, and the only way to experiment is on dedicated flights with only test crew and no paying passengers/cargo. Such tests are normally limited to aircraft with experimental status.

6.2.1.4 Depending on the state of registry, most countries have processes in place to allow temporary installation of, and operation with, uncertified equipment on the basis of non-interference. These processes would include establishing limitations such as flight envelope, airspace, no carrying of passengers, etc. There is no formal JAA process for this, so the best advice is to contact the state of registry.

6.2.1.5 The current intention is for the first batch of Pre-operational flight trials to be observation only i.e. the crew will only observe the MA-AFAS FMS operating in a shadow mode. Therefore, as this will not interfere with the aircraft's operational systems, and is unlikely to cause any significant increase in crew workload, it may be possible to undertake this phase of the trials under the non-interference procedures above.

6.2.1.6 The JAA advice indicates that subsequent phases of the trials may need to be operated under a more formal experimental regime (see 6.1.1.3 and 6.1.1.4). However, until the first customer is confirmed and their national certification authority is identified, and consulted, it will not be possible to define how these trials can proceed.