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Comparison on the Ways of Airworthiness Management of Civil Aircraft Design Organization

YANG Kun^a, LIU Cunxi^b, a*

^aAirworthiness Certification Technologies Research Center, Civil Aviation University of China, Tianjin 300300, P.R.China

^bAVIC The First Aircraft Institute, Xi'an 710089, P.R.China

Abstract

The characteristics and functions of EASA DOA and FAA ODA are explored in this paper. The essential structure of EASA DOA and the basic model of FAA TC ODA are established primarily. Furthermore, the similarities and differences between these two airworthiness management modes are discussed. This research will do good contribution to the DOA, ODA applicants and our design organization to establish the proper design assurance system or the parallel under the airworthiness requirements.

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1. Introduction

Airworthiness management is a technical management and engineering approach to ensure the civil aircraft safety level as the ultimate goal. It is the scientific and standardized certification, identification, surveillance and management according to the airworthiness standards made by the government to civil aircraft design, production, operation and maintenance [1]. Airworthiness management of the civil aircraft design organization is to enable the organization to ensure the design of the products, parts and appliances or the design change thereof, comply with the applicable airworthiness requirements.

* Corresponding author. Tel.: +0086-022-24092312; fax: +0086-022-24092311.

E-mail address: yangkun.cauc@hotmail.com.

EASA and FAA have already established the particular provisions to certify and oversee the civil aircraft design organization.

Considering the airworthiness management status and evolution of the civil aircraft design organization in China, it is necessary to explore and identify the international advanced airworthiness management modes and the practice experience to make the reference and support to our airworthiness work and research.

2. Airworthiness Management Status of Civil Aircraft Design Organization

2.1. Airworthiness Management Status of Civil Aircraft Design Organization in Europe

Before EIS(Entry to Service), the European civil aircraft need be with four certificates which are DOA (Design Organization Approval), TC (Type Certificate), POA (Product Organization Approval) and C of A (Certificate of Airworthiness). At present, the approval of design organization is implemented within EU Member States and their Allies and certified by EASA. DOA is a way to qualify and oversee the civil aircraft design organization in Europe.

DOA is based on certification of organization and certification of the design of products to make the authority confidence that the design of product complies with the applicable requirements.

According to Commission Regulation (EC) No 1702/2003[2], the applicant of Type Certificate (TC) shall hold DOA under EASA Part 21 subpart J, that is to say, the applicant within the scope of the government under EASA must hold DOA before he gets TC. If the design organization is the DOA holder, the workload and task load which are performed by EASA are reduced and effective much. Some privileges are authorized to DOA holder by EASA. DOA holder can approve minor changes and minor repairs and even the design of major repairs, for which it holds TC or supplemental type certificate (STC) without further certification of EASA. DOA holder can implement three functions: design function, airworthiness function and independent monitoring function.

2.2. Airworthiness Management Status of Civil Aircraft Design Organization in the U.S.

Comparing with Europe, the aircraft manufactured in the United States need be with three certificates which are TC, PC (Product Certification) and AC (Airworthiness Certificate). During type certification, the applicant is the first responsible person in charge of all airworthiness responsibilities. During the aircraft certification, FAA initially authorizes some privileges to individuals (not an organization) as the designated representatives including DER (Designated Engineering Representative), DMIR (Designated Manufacturing Inspection Representative) and DAR (Designated Airworthiness Representative), etc. However, the disadvantages of this kind of designation compared with the authorization to a design organization are revealed because the airworthiness risks will be increased. To improve it, FAA established the ODA (Organization Designation Authorization) program in FAR 183 which addresses all FAA delegations to organizations and will replace the DOA (Delegation Option Authorization), DAS (Designated Alteration Station), ODAR (Organizational Designated Airworthiness Representative), and SFAR 36 delegation programs. This ODA program does not affect on the individual designees. However, the number of the individual designees will be significantly reduced in the ODA holder organization because managing organizations is more efficient for the FAA than managing the activity of many individual designees [3,4,5].

2.3. Airworthiness Management Status of Civil Aircraft Design Organization in China

The Chinese Civil Aviation Regulations use the Federal Aviation Regulations for reference. In CCAR21 there is not direct requirement on the design assurance system, but the requirements to certify design assurance system and design assurance handbook are prescribed in AP 21-03 R3. For the delegation policy, there is CCAR 183 which stipulates the rules for designation of civil aircraft airworthiness individuals and organizations. For example, during the ARJ21 type certification, CAAC has used CDER (Candidate Designated Engineering Representative) to approval some engineering papers.

However, those requirements look like not enough to type certification and the certification team burdened very large work. From the trend on the evolution of airworthiness management, the current policy to design assurance system and designation of civil aircraft airworthiness individuals and organizations should be innovated.

3. Analysis on EASA DOA and FAA ODA

In this paper the airworthiness management modes of EASA DOA and FAA ODA are explored and the similarities and their respective characteristics are discussed.

3.1. Analysis on EASA DOA

3.1.1. Characteristics of DOA

Design Organization Approval (DOA) means the recognition by EASA that a Design Organization has the demonstrated capacity and capability to design, to validate the design to show compliance with applicable requirements and to perform airworthiness and certification activities on behalf of EASA under granted privileges.

The scope of the DOA holder is involved in TC holder, STC holder and ETSOA holder. There are two significant characteristics of DOA:

- Independent monitoring function which is implemented by Design Assurance System (DAS) to monitor all the airworthiness activities of the organization related to design.
- Some privileges are authorized to the DOA holder by EASA.

In order to hold DOA, the design organization shall establish a design organization handbook refer to all design and corresponding airworthiness activities and set up an effective structure to independent monitor each work under DOA. Once the applicant becomes the DOA holder, it will be with the privileges granted by EASA and monitor and entitled to approve all the corresponding authorized matters. Those privileges are the followings:

- Issuance of certification documents in the frame of type certification and approval of major changes without further EASA verification.
- Classification of changes to type design and repairs as ‘major’ or ‘minor’.
- Approval of minor changes to type design and minor repairs.
- Issuance of information or instructions containing the following statement: ‘The technical content of this document is approved under the authority of DOA.’
- Approval of design of major repairs to products for which it holds the type-certificate or the supplemental type-certificate.
- Approval of documentary changes to the aircraft flight manual with the corresponding statements.

3.1.2. Essential Structure of DAS

DAS is the core of DOA and is the organizational structure, responsibility, procedures and resources to ensure the proper function of the design organization.

DAS is to ensure the design and design change of products, parts and appliances continuing compliance with the applicable certification specification and environmental protection requirements, to ensure the responsibilities are properly discharged according to DOA provisions and terms of approval and to ensure the establishment of independent monitoring function to independent monitor any change of the organizational structure, people's responsibilities, procedures and resources.

Actually DAS is a big system in aircraft manufacture organization, perhaps at least involving engineering department, airworthiness department and correlating with quality department, procurement department, programme department and customer services.

Particularly, DAS does not only monitor the internal resources, but also control the external resources. DAS shall require the parts or appliances designed by suppliers according to the applicable requirements and procedures to ensure those parts or appliances airworthiness.

In Europe if the applicant wants to get TC, he must prior to hold DOA. To become DOA holder, he must prior to establish DAS. Here an essential structure of DAS is established and showed in Fig.1 which is based on the EASA DOA requirements and practical cases. In this structure, the main functions and tasks of DAS are clarified and presented.

Generally, DAS has six functions indispensably as followings:

- Control and supervision of the design
- Continuing compliance with the applicable requirements
- Proper discharge of responsibilities
- Independent monitoring
- Independent checking of showing of compliance
- Control partners or subcontractor

DAS has an organizational structure to control and supervise the design and show continuing compliance with the applicable requirements and independent checking of showing of compliance.

Systematic actions are carried out for type investigation. Those actions are to issue and update the handbook required in 21A.243, proper discharge of responsibilities of nominated personnel which are certification verification engineer (CVE), people under office of airworthiness, head of DOA, to perform the liaison with Agency as well as prepare, update and manage the maintenance and operating instructions.

A satisfactory DAS is the integration of the applicant and their suppliers' DAS. That is to say, DOA applicant must assure the parts or appliances supplied by its suppliers continuing compliance with the applicable airworthiness requirements. Thus, it is very important to control suppliers for the DOA applicant and if the applicant becomes the DOA holder and then the TC holder, he must be with responsibilities for all type design in the end. How to control the suppliers and tier suppliers is a big challenge to TC holder.

Independent monitoring function is the specialties of DOA. The department which performs independent monitoring function is in charge of monitoring any change of produces, organizations and people's responsibilities related to airworthiness. The internal and external assessments are the way to ensure the good running of DAS. The surveillance is to make sure the continuing compliance with the certified handbook and correlated instructions.

3.1.3. Supplier Management

Supplier management is an important aspect in the airworthiness management of the civil aircraft design organization.

As EASA 21A.239(c) mentioned, the design organization shall ensure the airworthiness of the parts or appliances designed by suppliers. To comply with this requirement, firstly, the applicant should specify different requirements to different types of suppliers and clarify the correlated responsibilities in the handbook. Secondly, the executed procedures should be set up according to the above requirements in the handbook. Finally, all the above actions should be monitored by the design assurance department which is performing the independent monitoring function and be reported to the agency.

EASA 21A.243(b) requires that when any design or any design change to the products are performed by suppliers, the handbook shall include a statement to show how the design organization could give the assurance of those actions. To comply with this requirement, the applicant should establish an interface document with suppliers to specify the external monitor activities and nominate some people in supplier side to maintain this interface document and in charge of the liaison with DOA applicant.

The above two clauses are the special requirements to the suppliers in EASA Part 21. How to manage those suppliers under the airworthiness requirements is a challenge not only to the DOA applicant but also to the agency. It is quite new issue and is different from the traditional supplier quality manage or supplier control.

3.2. Analysis on FAA ODA Type Certification

3.2.1. Basic Model of FAA ODA

There are six types of ODA programs that are Type Certification ODA, Production Certification ODA, Supplemental Type Certification ODA, Technical Standard Order Authorization Holder ODA, Major Repair, Alteration, and Airworthiness ODA and Parts Manufacturer Approval ODA. To perform functions available to a certain ODA type, organizations must meet certain eligibility requirements. But for each type ODA, it must comply with the general ODA eligibility and qualification requirements.

(1) Qualifications

Each applicant must have experience and a thorough working knowledge of FAA requirements and must have a recent and successful history performing certification work.

Each applicant must have sufficient administrative and technical resources to satisfy all the requirements of requested authorization. It must employ the ODA administrator who should have technical and management experience with the functions performed under the ODA and must have the ODA unit to perform the authorized functions. For example, an engineering ODA unit member must meet the qualifications for a DER.

(2) Responsibilities

The ODA holder is responsible for the activity of the ODA administrator and ODA unit. The ODA administrator manages the ODA unit activities and liaises with the authority to ensure the organization follows the FAA-approved procedures manual. Each ODA unit number must comply with the approved procedures manual and fully support the FAA oversee.

(3) Procedures manual

Each ODA holder must perform the authorized functions in terms of its FAA-approved procedures manual. For the establishment of this procedures manual, the following aspects should be highlighted:

- Procedure for revising manual and method of documenting any change of ODA holder.
- Authorized functions and limitations and procedures for performing those authorized functions.
- Description of the ODA holder and ODA unit organizational structure and responsibilities involving in the ODA administrator and unit member responsibilities.
- Self-audit procedures and maintenance of eligibility.
- Procedures for performing continued airworthiness functions.

(4) Self-audit

The self-audit must be performed annually. It must include the evaluation of the ODA unit members and review of their work for accuracy whether they located at the ODA holder’s facility or at suppliers.

The self-audit must include the evaluation of the procedures and requirements used to perform the authorized functions and it will not be punished for regulatory violation if the ODA holder notifies it to the authority in time.

3.2.2. FAA ODA Type Certification Function

In the TC ODA holder’s procedures manual the specific authorized functions must be identified which are:

- Approve type design data and substantiation data.
- Approve operational or repair information.
- Approve airworthiness limitations information.
- Issue airworthiness certificates and approvals.
- Perform conformity inspection work.
- Approve the major repairs and major alterations.
- Perform approvals in support of TC ODA holder projects.

Here the basic model of FAA TC ODA is established and showed in Fig. 2.

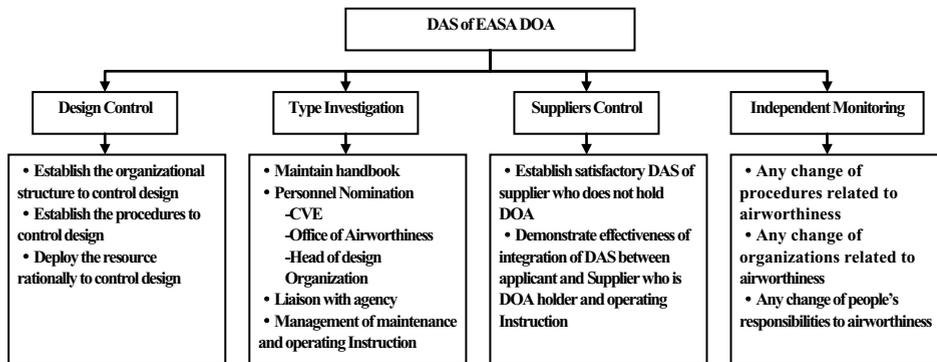


Fig.1.The essential structure of DAS of EASA DOA

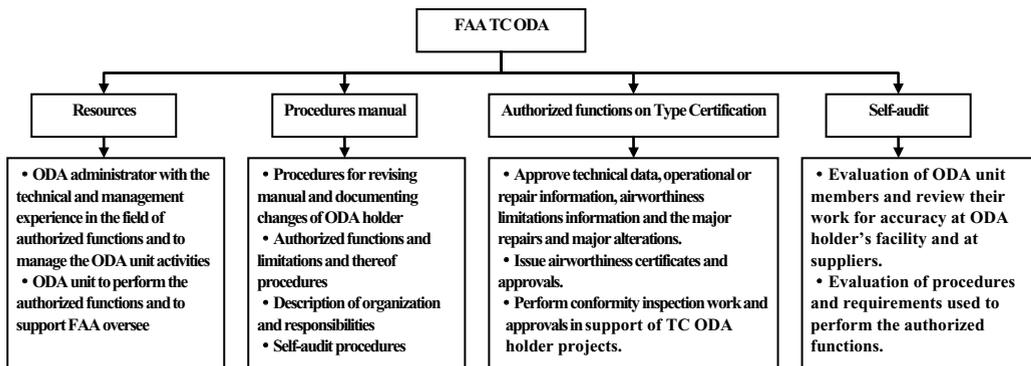


Fig.2.The basic model of FAA ODA

3.3. Discussion

From Fig.1 and Fig.2 the following similarities between EASA DOA and FAA TC ODA could be identified:

- (1) Arranged to present on the four aspects: organization, procedures, responsibilities and resources.
- (2) Setting up the particular unit where people are qualified and designated to perform the authorized functions.
- (3) Establishing the authority-approved procedures and manual to enable the corresponding people to perform.
- (4) The self-audit and monitoring function to ensure the right people at the right place with the right means.
- (5) The range of the airworthiness management covering the whole life cycle of the civil aircraft.
- (6) Being the outside resource, the Suppliers monitored and managed as a part of the design organization.

Furthermore, they also have their own characteristics. For example, the systematic and specific organizational structure is required by EASA which does fully focus on the design organization. Comparing with it, the general ODA requirements which do fit on six types of ODA programs are stipulated by FAA and the particular functions for each ODA type are prescribed respectively.

4. Conclusion

The aim of this research is to find the ways and methods to enable the civil aircraft design organization to ensure the design of the products, parts and appliances or the design change thereof, comply with the applicable airworthiness requirements.

After the exploration on the characteristics and functions of EASA DOA and FAA ODA, the essential structure of EASA DOA and the basic model of FAA TC ODA were established primarily. Furthermore, the similarities and differences between these two airworthiness management modes were discovered. Those are very useful to the DOA, ODA applicants and our design organization to establish the proper design assurance system or the parallel under the airworthiness requirements.

Particularly, according to the airworthiness management status and evolution of the civil aircraft design organization in China, several aspects should be regarded:

- (1) It is more effective to manage the designation organization rather than the designation individuals by the authority because the designation organization could perform the self-audit or independent monitoring function which could not only arrange the available resource reasonably but also reduce the workload of the authority.
- (2) A satisfactory design assurance system is the integration of the applicant and their suppliers, that is to say, the suppliers should be monitored and managed as a part of the civil aircraft design organization.
- (3) The range of the airworthiness management should cover the whole life cycle of the civil aircraft which could be arranged to present in the approved procedures and manual.

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