



TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering
Vol. 64, Issue Special IV, December, 2021

SPECIFIC ASPECTS OF QUALITY ASSURANCE AND MANAGEMENT IN THE AEROSPACE FIELD

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Abstract: *The aerospace industry produces and brings continuous improvements through safe and reliable products that satisfy the requirements of customers and regulatory authorities. All this must respecting the rewards of using the product buying from manufacturers around the world, while providing item for more buyers, depending on their expectations and quality specifications. A quality assurance system and management are of particular importance for the good development of all activities. Aerospace quality assurance is essential for companies in the aerospace, defense and defense industries. In order to survive in the competitive global business market, organizations are rapidly implementing considerable quality management practices to improve competitiveness and gain tactical benefits and gains in their environment. Fundamentals of quality approach are described in international and regional standards, which form the basis for international conformity certification systems. International standards recommend and involve the introduction in companies of specific functions that will be presented in this paper. The field of interest being represented by the specific requirements of quality assurance in the aerospace field through the aircraft maintenance program, quality audit, monitoring of maintenance programs but also the quality of maintenance. This paper presents the standards in the aerospace field but also the importance of their use because it is essential that the rules of the quality system in the aerospace field are observed for the proper functioning of the entire industry.*

Key words: *aerospace, management, quality assurance, aerospace standards.*

1. INTRODUCTION

There is a need for changes in the approach to quality assurance issues, in our country we are witnessing, in recent years, the intensification of concerns in this area, at the level of economic agents, but also of some governmental and non-governmental bodies, associations, companies consulting.

Many companies show a special interest in the quality assurance models proposed by the international standards in the ISO 9000:2015 family, being in different phases of implementing such a model. About 200 organizations have a certified quantity system based on these standards. They consider that the

certification of the quality system has a favorable impact on business performance, recognizing, at the same time, the importance of continuous improvement of this system and the implementation, in perspective, of the principles of total quality management, to ensure success in competition. [1]

This process will be facilitated by progress in defining the legal and institutional framework for conformity assessment and accreditation of certification and inspection bodies, as well as laboratories, in accordance with European and international accreditation rules.

On the other hand, in the current economic field, which is marked by the globalization of phenomena and a growing recognition of the

interdependence between environment and development, there is an increase in society's demands on environmental protection, requirements embodied in increasingly drastic regulations. [10]

The pressure of these new regulations but also the increasing importance of ecological criteria in separating products on the market, in conditions of a diversified and dynamic offer, more and more organizations, including Romania, are concerned to implement an environmental management system to meet the requirements environmental management and audit models, such as the model promoted by the international standards ISO 14000:2015. Concerns regarding the certification of conformity with the mentioned models are added to those related to the improvement of the quality system based on ISO 9000:2015 standards, standards whose edition in 2000 will formulate new requirements aimed at increasing the efficiency of processes in achieving objectives. Also, an increased compatibility with the ISO 14000:2015 standards will be ensured, which will favor the approach of the enterprises considering the achievement of an cover quality-environment management system. [10]

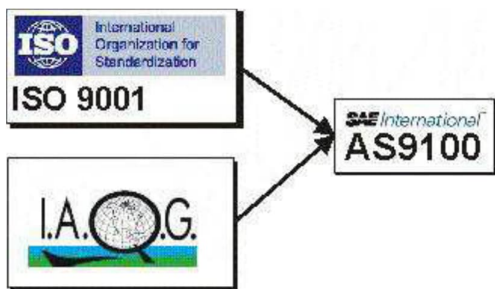


Fig. 1. AS9100 composed of ISO 9001:2015 and the requirements of the International Quality Assurance Group

The dynamic evolution of the aviation has become a purpose for the creation of standards for this industry of the economy, which has resulted in the construction of AS 9100:2018 quality management systems. The aim of this work was to achieve a significant betterment in quality, safety and cost reduction by analyzing values in the aerospace field.[2] Until now, the

standard was two renaissance for the AS 9100B1 version and the new AS 9100C.

The AS 9100C aerospace quality standard assign to the quality management system and requirements for aerospace organization. This standard indicate the requirements for a quality system for organizations to demonstrate their ability to deliver the aviation product that meets customer requirements, Figure 1. Suppose that the organization in which this standard is implemented look for improve customer satisfaction by applying efficient system of systematic improvement and assurance compliance with legal requirements and regulations. [1]

AS 9100C includes ISO 9001:2008 and AS 9100B inputs, topical aviation additions required for aeronautical products. This standard sets out requirements for quality management system for to improve quality and safety and reduce costs owed to the elimination or reduction of exceptional requirements of the organization as well as their combination. AS 9100C, built on ISO certification of the quality management system ISO 9001: 2008 is the basis of airlines, without which no organization can function properly.

Technical SAE International Standards will notify that the AS 9100C report is freewill and used by organizations to increase the level of technical and engineering sciences. (Dale, 2010)

2. TOTAL QUALITY AND ZERO DEFECTS STRATEGY-WAY TO EFFICIENCY AND EFFECTIVENESS

Continuous process improvement can lead to fewer and fewer errors. "Zero Defects" defines the strategy for increasing the quality of products and services as a result of improving the development of the processes through which they are obtained. For a "zero defect" strategy, the direct responsibility of each employee for quality must be highlighted. A special contribution in the application of this strategy belongs to the managers who must be aware of each employee. [3]

Because success in preventing defects is not the sanctioning of errors, it is obtained as a result of concrete measures in order for each operation to be executed correctly. [3]

"Zero Defects" is a realistic goal that is achieved consistently in:

- prevention of defects (non-conformities);
- establishing the causes of defects (non-conformities) and eliminating them, which is equivalent to a continuous orientation towards quality in all activities. [3]

Improving quality in all areas must be:

- continuous improvement and not sporadic actions;
- a prevention of defects (non-conformities) and not their remedy;
- a systematic, professional approach. [3]

The European aerospace industry is one of the state-of-the-art industries for increasing production in Europe. The development of products and processes in airplane, device tools and other high-tech manufacture are dependend to a large extent on efficient and adaptive manufacturing processes. Improving items and processes can therefore represent a big cost savings for those fields that will profit customers as well as producers. Therefore, control systems and strategies that include the decision of zero defect strategies are more likely to have morerealistic results to quality and cost objectives and to improve decision-making. [2]

In this industry, there is the possibility to reduce product and process defects, organizational flexibility and energy consumption. Human action, change management and relationships have a potential for development, which can have a major impact on the aerospace industry. [2].

The specialists introduced the importance of total quality management as a management system and insert this to the requirements by meeting the internal needs. Quality methods come from a research framework, in which it uses a compact approach and a connection of worldviews. Mixed approaches between qualitative and quantitative methods are often used to specify the type of processes.

3. QUALITY MANAGEMENT SYSTEMS APPLIED IN THE FIELD OF INTEREST

Quality is the set of characteristics of an entity that gives it the ability to meet expressed and implicit needs. Quality means continuous satisfaction of customer requirements. If a product achieves everything expected of it, or the service meets the requirements, then the quality has been achieved. The expressed needs refer to the obtaining of the performances or qualities of the product included in the presentation reference that can be measured or that can be verified in its operation (ex: maximum speed of an airplane).[8] The implicit needs depend, among other things, on the specific "culture" of the consumer, on his abilities to use the product and even on some more particular aspects such as the illustration of his standard of living (by using branded products). Quality control is techniques and activities of an operational nature, used to meet quality requirements. Quality control refers to the introduction and control of the technological process applied to the production of the product. Technological processes include quantity issues related to resource provision (material, energy, human, financial), manufacturing preparation, actual manufacturing, quality inspection on the manufacturing and final flow, packaging, storage, delivery and service.

The ISO 9000:2015 standards is part of to the group of international standards connected to the implementation of the quality management system in organizations from different field.

Most organizations recognize the importance of continuous quality improvement. Following this trend, space chain organizations have continuously invested in resources as a way to provide survival in the global market, but these organizations have difficulty assessing the effect of the quality improvement programs they have adopted and identifying the key factors for their success. program failure. In fact, organizations recognize the need to promote a high level of quality at lower costs in order to achieve better efficiency and maintain business competitiveness. The best way to achieve these

improvements was to implement quality improvement practices, especially in the aerospace field.[11] Total quality management being a well-established practice through the quality of management systems based on ISO 9001:2015, AS 9100 and TS 16949 standards, these being applied in the aerospace field. Prior to the development of AS9100 standards for aerospace quality management systems, the US military applied two specifications for supplier quality and inspection programs, namely:

- MIL-Q-9858A, Quality program requirements;
- MIL-I-45208A, Military Specifications: Inspection System Requirements.

For years, these specifications have been the basic principles of the aerospace industry. However, when the US government adopted ISO: 9001, it withdrew these two quality standards. Large aerospace companies then began requiring suppliers to develop quality programs based on ISO 9001:2015. As aerospace provider discovered that ISO 9001 did not consign to the specific requirements of their clients, FAA, NASA and aerospace companies, have expand AS9000 establish on ISO 9001 : 2015, to supply a quality management standard. Overhead to the symbol of a specific quality standard. With the release of the AS9000, manufacturers have suspend the use of previous quality additions, preferring to use the AS9000. AS9100 includes the all of ISO 9001: 2015. Furthermore, to line the defense requirements, the structure of aviation area requirements and with the recent ISO 9001 : 2015, the result have been apply:

- Prevention of false parts has been added in a new clause in other areas;
- The risk clause has been merged with the new risk requirements ISO 9001:2015, with an increased emphasis on risks in operational processes;
- The awareness clause with enhanced requirements of the contribution to the quality and safety of products and services, as well as ethical behavior has been added;
- Human factors are included in non-compliance management actions;

- Configuration management has been clarified and improved to meet the needs of stakeholders The latest version of the AS9100 standard was launched on September 20, 2016 under the name AS9100D.

4. QUALITY ASSURANCE IN THE AEROSPACE FIELD-SPECIFIC REQUIREMENTS AND PROPOSED POINTS OF VIEW

Commercial aviation is the fastest form of transport and is a catalyst for the largest transport industry in the world. So, standardization is necessary for a good and developing air transport field.

Organizations that provide and help the standardization system in civil aviation are:

- World Leader - International Civil Aviation Organization
- World Trade Association - International Air Transport Association (IATA): represents an association for all airlines and plays a major role in supporting aviation standards in terms of safety, security, and efficiency;
- Safety Agency - European Aviation Safety Agency (EASA): is an agency of the European Union and is responsible for the safety and standardization of civil aviation in terms of regulations and investigations.

The ICAO Council adopts standards and recommends practices regarding air navigation, the prevention of illegal interference and the facilitation of border procedures for civil aviation. Thus, ICAO delimit the protocols for the investigation of international accidents pursued by the authorities for safe transport in the signatory countries of the International Convention on Civil Aviation, better known as the Chicago Convention. ICAO has developed a universally accepted standard known as Standards and Recommended Practices. SARPs cover all technical and operational aspects of international civil aviation, such as safety personnel licensing, aircraft operation, aerodromes, air traffic services, accident investigation and incidents and environmental protection. All structure operating in the

aerospace field must register with the specific standards AS 9100, AS 9110 or AS 9120. Thus, these standards of agreement cover a large scope of zones, through configuration management, product assurance, gross material testing, assistance after delivery. Reaching the objectives in this field can have a lot of advantages for manufacturers and providers in the aerospace industry. (Barker, 2002)

Standards play an important role in the aviation field. So the standards are:

- AS9100: This streamlined policy set assistance improve work rate and performance and cost-effectiveness for worldwide organizations.
- AS9110: includes a lot of the same thing as the AS9100, and offers a lot of individual standards for maintenance and aircraft repair. In the final stage, companies that ensure aerospace equipment for preventive maintenance and failure of the addressing system typically require standard AS9110 certification of compliance.
- AS9120: The scope of AS9120 is to devise a easy, more productive experience for organizations and customers.
- AS6081: Businesses can reveal and take action to resolve problems related to unfair procurement before causing big financial or productivity damages.

Aircraft maintenance program

The technical maintenance of aircraft has an essential influence on the quality of products and services offered for sale, especially on its components: flight safety, reliability and passenger comfort.

This activity must first and foremost ensure the maximum safety of passengers, personnel and aircraft in flight and on the ground, in accordance with current airworthiness requirements, and, secondly, make it possible to perform these services regularly, in accordance with the established schedule and at a level of quality that satisfies the consumer.[11]

Aircraft maintenance is any work or combination of overhaul, repair, inspection, replacement, modification or repair of an aircraft / aircraft component.

A certificate of commissioning before flight shall be required at the closure of any

maintenance package planned by the approved aircraft maintenance schedule, if such maintenance has been performed as basic or scheduled maintenance, at the closure of any defect repair, during the period when the aircraft performs flight operations between the planned maintenance works.

Reliability means operational safety and stability. Aviation reliability refers to the operational safety or stability of an aircraft system or component thereof and can be assessed by static means.

Quality audit applied to aircraft

The purpose of the aircraft audit is to verify the compliance of each operational aircraft with the applicable airworthiness requirements, the frequency of which shall be determined by the Director for Flight Quality and Safety.

If a deficiency is found to affect the safety of the aircraft, the audit officer shall immediately inform: the head of the department involved, the head of the Quality Assurance department, the head of the Quality Control department and the chief engineer. A certificate of entry into service will not be issued until the deficiencies have been rectified as required. The following forms are used to record and report deficiencies and to initiate corrective and follow-up actions: Audit report, Deficiency report, Audit criteria. Quality assurance should be used as a tool to continuously assess the efficiency of management and to improve and refine the procedures governing maintenance, as well as the methods of management and coordination. The maintenance program is controlled by decisions and managerial actions that are based on the continuous analysis of the data collected from the field. This is an effective tool for maintaining reliability within acceptable limits.

The qualitative characteristics of a product or service can be grouped into process characteristics, basic characteristics and operating characteristics.[6] The process characteristics represent some behaviors of the product during use are not only explained by the basic or operating characteristics, but also by the way it was manufactured. But not all the characteristics of the technological process

constitute process characteristics for the product. For example, the cost of manufacture, labor productivity are not characteristic of the product, but the technical level of the equipment used, the degree of organization of manufacture is directly reflected in the quality of the product. The basic characteristics are those that have a direct role in the functionality of the product and that can be determined by the analysis of each product, they being of several types:

- functional characteristics, which include technical parameters (speed, efficiency, precision, resistance), physico-chemical properties, geometric dimensions, speed, traction force, etc. ;

- economic characteristics, which describe the effort made for the operation of the product and include the expenses necessary for the operation, maintenance, assembly, cost of spare parts, warranty period, etc. They present difficulties of appreciation only in the case of absolutely new products, for which there is no experience;

- aesthetic characteristics refer to shape, contour, proportions, color, degree of finish, simplicity;

- social characteristics, which describe the effect of the product on people. They refer to the degree of pollution, ergonomics, comfort, operational safety, vibration, lighting level and psychological. Ergonomic features refer to the human-product relationship, the ease of operation, the physical and mental stresses it creates. [13] The operating characteristics are those that describe the behavior of the product over time. This class includes: availability, reliability, maintainability, preservability, durability, accessibility. By similarity with other products, these values can be appreciated at the time of delivery. Also, through statistical studies, accelerated tests, some of the characteristics are predictable at the time of delivery, but their real values result only from the processing of operational data. All these types of characteristics must be notified both by the manufacturer and the beneficiary, as well as by the representatives of the company, including the general public, which, in general, emphasizes only noticeable characteristics without special means. It is appreciated that

these features should be independent of each other as they describe aspects of the product's functions that are independent, and the choice of a large number of features can lead to weighting.

[9] Manufacturing characteristics include: process capability, quality of purchased subassemblies, operator qualification, technological discipline; Operating characteristics include: operating conditions, quality of operators, maintenance and repairs. The characteristics required by the user refer to the global technical level, global interests and those resulting from market research.

5. CONCLUSIONS

This scientific paper aims to help clarify the concept of quality in aerospace. The basic reason for this scientific paper is the significant importance of the quality management system in today's products and services. Many organizations have concluded that successful quality management can improve their capacity and provide strategic rewards in the marketplace.

It is believed that in order to ensure customer satisfaction, aerospace organizations need to continually make improvements so that products are safe and confident and exceed client requirements and regulations.

Suppliers in the aerospace industry face the challenge of delivering the product to several customers who have varied expectations and quality requirements. This AS9100 standardizes the quality of the management system requirements for the aerospace industry.

Standards in civil aviation are needed to ensure safe air transport. State civil aviation authorities always carry out audits of the organization of concerns to maintain these standards.

Increased aviation needs and requirements are considered to have led to the development of quality systems standards and guidelines that complement the relevant product or service requirements in the technical documentation.

Aviation is an area of increasing importance for businesses, for the economy in general, but

also for the defense of the country in the current geopolitical context. Civil aviation has become a part of the economy, being a key catalyst for economic growth with a profound influence on the quality of life of the world's populations. It integrates the world economy and promotes the international exchange of people, products, investments and ideas. Basically, civil aviation touches almost every aspect of our lives, and its success has taken a global form of safety, efficiency and prosperity.

The main objective of aerospace organizations is to ensure and support the standardization system, aiming at aviation safety. Aviation safety means the state of an aviation system or organization in which the risks associated with aviation activities, in direct support of the operation of aircraft, are reduced and controlled to an acceptable level. It encompasses the theory, practice, investigation and classification of flight failures and the prevention of such failures through regulation, education and training.

Consequently, it is extremely important that the rules of the aerospace quality system are followed for the proper functioning of the whole industry.

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ASPECTE SPECIFICE ALE ASIGURĂRII ȘI MANAGEMENTULUI CALITĂȚII ÎN DOMENIUL AEROSPAȚIAL

Rezumat: Industria aeronautică și aerospațială produce și aduce îmbunătățiri continue prin produse sigure și fiabile care îndeplinesc cerințele clienților și autorităților de reglementare. Toate acestea trebuie făcute, respectând provocările de utilizare și integrare a produsului achiziționat de la furnizori din întreaga lume, oferind în același timp produs pentru mai mulți clienți, în funcție de așteptările și specificațiile lor de calitate. Un sistem de asigurare a calității și managementul sunt de o importanță deosebită pentru o bună desfășurare a tuturor activităților. Asigurarea calității în domeniul aerospațial este esențială pentru companiile din industria aeronautică, spațială și de apărare. Pentru a supraviețui pe piața de afaceri globală competitivă, organizațiile implementează rapid practici considerabile de management al calității pentru îmbunătățirea competitivității și pentru a obține beneficii și câștiguri tactice în mediul lor înconjurător. Aspectele fundamentale privind abordarea calității sunt descrise în standarde internaționale și regionale, care creează baza pentru sistemele internaționale de certificare a conformității. Standardele internaționale recomandă și presupun introducerea în întreprinderi a unor funcții specifice ce vor fi prezentate în această lucrare. Domeniul de interes fiind reprezentat de cerințele specifice ale asigurării calității în domeniul aerospațial prin programul de întreținere al avioanelor, auditul calității, monitorizarea programelor de întreținere dar și calitatea întreținerii. În această lucrare sunt prezentate standardele din domeniul aerospațial dar și importanța utilizării acestora deoarece este esențial ca regulile sistemului de calitate din domeniul aerospațial să fie respectate pentru o bună funcționare a întregii industrii.

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