

Quality planning in the aviation industry

Planowanie jakości w branży lotniczej

W artykule przedstawiono istotę planowania jakości w branży lotniczej. Scharakteryzowano korzyści, jakie może mieć przedsiębiorstwo lotnicze planując jakość swoich wyrobów. Omówiono stosowane formy planów jakości (tablica, schemat blokowy, formularz, tekst). Uwagę zwrócono na międzynarodowe dokumenty normalizacyjne, które mają zastosowanie przy planowaniu jakości w branży lotniczej. Podano przykład sporządzenia planu jakości podczas remontu silników lotniczych w przedsiębiorstwie remontowym.

Słowa kluczowe:

jakość, planowanie jakości, zarządzanie jakością.

The article presents the essence of quality planning in the airline industry. There were characterized benefits, which airline industry can have during planning the quality of the products. There were discussed used forms of quality plans (board, flowchart, form, text). The attention turned on international normalizing documents, which, have use in quality planning in the airline industry. There was an example of creating quality plan during the repairs of aircraft engines in repair company.

Key words:

quality, quality planning, quality management.

Introduction

The aviation industry attracts considerable attention in terms of materials and technology, which are a measure of novelty, quality and safety. The aviation technology is used by many other industries. The aviation companies that compete with each other must meet the stringent requirements of both customers and aviation supervision authorities. The most important issues related to aviation are regulated by the Act of 3 July 2002 Aviation Law (Journal of Laws of 2002 No. 130, item. 1112, with later amendments). In terms of safety and efficiency of civil aviation this law refers to the international requirements for aviation safety, construction and operation of aircraft and ground infrastructure equipment. This includes requirements set up by:

- European Organisation for the Safety of Air Navigation (EUROCONTROL),
- European Civil Aviation Conference (ECAC), including the Joint Aviation Authorities (JAA),
- European Aviation Safety Agency (EASA).

The standards outlined in the requirements of the said organizations relate to safety in aviation as a whole and quality planning is an essential element of quality management in manufacturing and service companies.

The essence of quality planning

Quality plan is a document specifying, which processes, procedures and related resources ought to be used, who and when is to implement them for a specific project, product, process or contract (PN-ISO, 2007, p. 15).

Quality planning is focused on setting goals for the quality (or „object of the effort or intent with respect to quality”; PN-EN, 2009a, p. 29). It is very important to give to the objectives concerning quality the same priority as organizational objectives or financial ones. Quality planning can be seen as an active participation in the whole process of quality management. Proper planning activities serve to reduce the need to improve the system at a later date, due to the correct implementation of the plan in the first place. The benefits from establishing a quality plan are as follows: increased confidence that the requirements will be met, better assurance that the processes are supervised, motivation and opportunities for improvement.

There are many situations where quality plans may be useful or even necessary — for example (PN-ISO, 2007, p. 15):

- to show how the organization's quality management system is applied to a specific area,
- to meet the requirements of legislation, regulations or the client's ones,

- to develop and validate new products or processes,
- to demonstrate inside and / or outside the organization, how the quality requirements will be met,
- to organize efforts to meet the quality requirements and achieving quality objectives and manage these activities,
- to optimize the use of resources to achieve the quality objectives,
- to minimize the risk of not complying with the requirements,
- to be used as a basis for monitoring and assessing compliance with the quality requirements,
- to be used in the absence of a documented quality management system.

Quality plans apply to the entire supply chain, starting from the customer's requirements, through the manufacturing of the product, to the customer satisfaction.

Quality plans may take many forms. For example: a table, block diagram, form, text. The text presentation of quality plan may, in certain circumstances, be more appropriate than presenting a table, block diagram, or form. Besides, the shape of the scheme or a form can be supplemented with text. Quality plans may be prepared electronically, and cited documents — available through hyperlinks. There may be other forms of preparing quality plans, depending on the needs of the organization itself and the requirements of the customers, who can even dictate what the quality plan should look like.

Quality plan should be integrated with other quality management system documents and identify all undertakings for compliance with the customers' requirements. Quality plans should highlight the requirements for the product and processes of its manufacturing and the links to system procedures (Tkaczyk, Widomska-Idczak, 2001, p. 678).

During the development of a quality plan it is necessary to decide whether it relates to quality issues on a micro scale (e.g. separate product), or on the macro scale concerning functioning of the entire quality management system (e.g. an organizational entity, or mass production). A plan created can be compared to a prototype, thus it requires further improvement and adapting to the executive reality (Stęplewski, 2009, p. 397).

Quality plan is an evidence that requirements specified by the customer, contained in the agreement are properly planned, implemented and monitored. It is not only an important part of contract, but also associated with the development of the company and its improvement.

Quality planning in practice leads to (Miller, 2011, p. 19):

- the formulation of quality objectives,
- identifying processes covered by the quality management system,

- defining and documenting policies, practices applied with regard to the processes,
- identifying responsibilities for individual activities, approvals, competences and range of duties,
- identifying relationships and interconnections between processes,
- establishing the rules of communication and communication means,
- ensuring the necessary resources to perform the tasks. It is possible to list a few features that are essential in the quality planning:
 - coherence — the quality plan is coherent, it is able to react as a whole, in different ways, to the stimuli coming from the outside,
 - effectiveness — the extent to which planned activities are realized and the planned results achieved,
 - efficiency — the relationship between the results achieved and the resources used,
 - synergy — the quality plan as a whole, is more than a collection of individual, creating it actions,
 - preventive nature — the system action should primarily be aimed to prevent the emergence of problems, not just to deal with their consequences.

The objective of creating a quality plan is formalizing and documenting:

- organization's quality policy,
- risks associated with the implementation of the agreement,
- the objectives to be achieved,
- products envisaged to be produced with the required quality,
- plans to carry out the quality tasks,
- techniques planned to implement the said tasks,
- responsibility for the implementation of the quality tasks,
- general issues and assumptions concerning the product quality control,
- mutual relationships between the participants of the process.

Normalization concerning quality planning in the aviation industry

Quality planning principles at the aviation industry companies are described by the following standards and other international standardization documents:

- PN-ISO 10005:2007 Quality management systems. Guidelines for quality plans,
- AS 9100 edition B, Quality Management System — Aviation — Requirements,
- PART and JAR requirements,
- AQAP 2105:2005, NATO requirements concerning quality plans for the product which is the subject of the contract,

- AQAP 2110:2009, NATO requirements for quality assurance in design, development work and production,
- AQAP 2120:2009, NATO requirements for quality assurance in production.

There are also standards established complementing the AS 9100 standard. The most important of them are:

- EN 9101 Aerospace series — Quality management systems — Assessment (based on ISO 9001:2000),
- EN 9102 Aerospace series — Quality systems — First article inspection,
- EN 9103 Aerospace series — Quality management systems — Variation management of key characteristics,
- EN 9104 Aerospace series — Quality management systems — Requirements for Aerospace Quality Management System Certification/Registrations Programs,
- EN 9107 Aerospace series — Quality systems — Direct Delivery Authorization — Guidance for Aerospace Companies,
- EN 9110 Aerospace series — Quality systems — Model for quality assurance applicable,
- EN 9111 Aerospace series — Quality management systems — Assessment applicable to maintenance organizations (based on ISO 9001:2000),
- EN 9114 Aerospace series — Quality systems — Direct Ship — Guidance for Aerospace Companies,
- EN 9120 Aerospace series — Quality management systems — Requirements for stockist distributors (based on ISO 9001:2000),
- EN 9121 Aerospace series — Quality management systems — Assessment applicable to stockist distributors (based on ISO 9001:2000),
- EN 9130 Quality systems — Record retention,
- EN 9131 Quality management systems — Non-conformance documentation,
- EN9132 Aerospace series — Quality management systems — Data Matrix Quality Requirements for Parts Marking,
- EN 9133 Aerospace series — Quality management systems — Qualification Procedure for Aerospace Standard Parts,
- EN 9134 Aerospace series — Quality systems — Supply chain risk management guideline.

EASA agency conducts inspections and audits of the organizations, which have been issued certificates. It issues and renews certificates for the designing, manufacturing, maintenance and training providing organizations. The most important EASA requirements are contained in the PART documents. These include:

- PART 21 — designing and production organizations,
- PART 145 — maintenance organizations,
- PART M — ensuring continuous airworthiness,
- PART 147 — aviation training centres,
- PART 66 — certifying personnel qualifications.

Based on the experience gained from the work of the Concorde and Airbus programs, Joint Aviation Authorities was established. Major shareholders of these programs, namely France, Germany and the United Kingdom laid the foundations for the emergence of JAA association (Joint Aviation Authorities). JAA has issued a number of requirements called JAR, in short (Łunarski, 2008, p. 212–213).

AQAP Publications (NATO's Allied Quality Assurance — Publications on quality assurance) apply for contracts within NATO member states. Since the establishment of the North Atlantic Treaty, NATO countries monitor the quality of products delivered. Based on the quality plan provider is able to demonstrate the mechanism by which it intends to manage the quality of the implementation of a specific contract. Quality plan should fulfil two complementary functions (Kosiński, Wójcik, 2008, p. 54):

- describe and document the requirements for a quality management system,
- describe and document planning of the product implementation in terms of product requirements, required resources, required inspection activities (verification, validation, monitoring, inspection, testing), and the acceptance criteria.

Planning within the quality management system

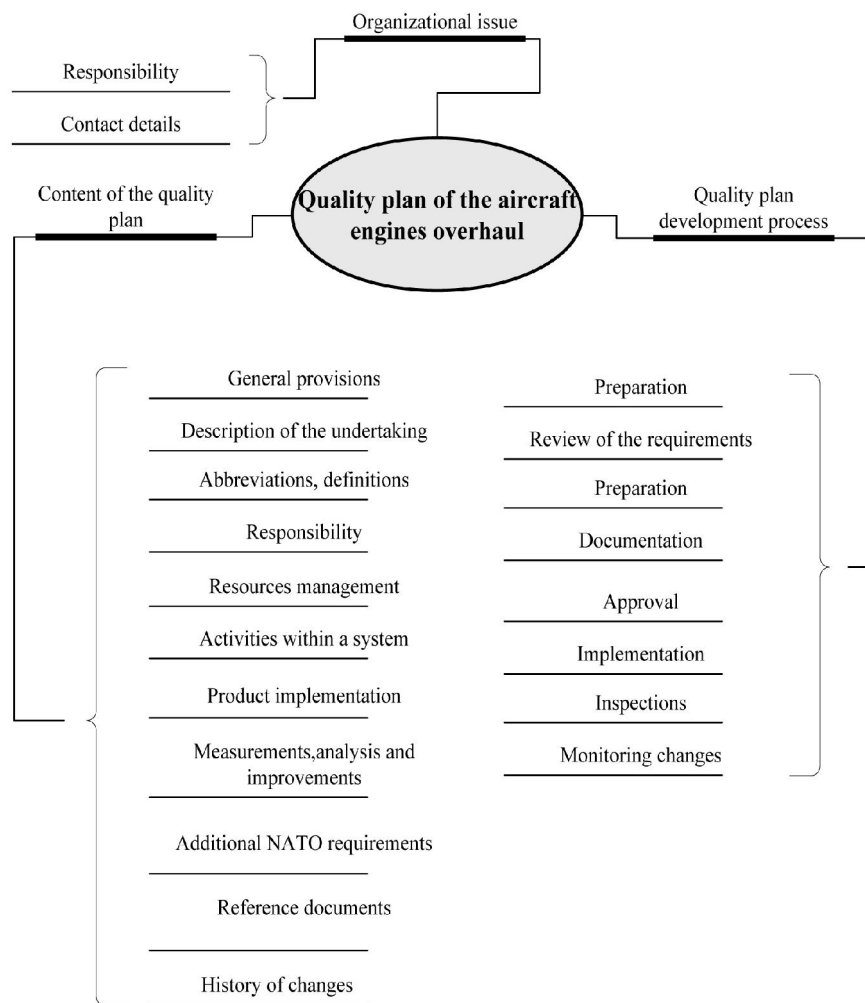
Planning processes should relate to those quality management system processes that decide about running the production under controlled conditions. Production should be carried out in these supervised conditions. There are three areas in which the planning activities should concentrate. The area associated with the availability of information defining the properties of the product should include issues related to ensuring adequate access of the personnel to this information and the relevant instructions describing how to perform the work. Criteria for evaluation of the product should be presented in an appropriate manner, adapted to the product and competences of the personnel.

Planning is a process necessary to maintain the quality management system and product implementation. The scope of the planning depends mainly on the type of tasks planned to be implemented and the tasks arising from contracts with customers.

Planning, takes into account:

- quality objectives,
- requirements for the product,
- type, scope and timing of product implementation,
- necessary resources including infrastructure,
- needs and resources for processes and documentation,
- measures concerning verification, validation, monitoring, inspection and product/service-specific testing,

Figure 1
Structure of the quality plan for the aircraft engines overhaul



Source: authors' own elaboration.

- actions required for the verification, validation, monitoring, measurements and product acceptance criteria,
- records confirming compliance of the process/product with the requirements.

Quality planning is an important and necessary part of a quality management system functioning at the aviation industry enterprise. The next chapter describes method of quality planning in the process of overhauling aircraft engines.

Quality plan for the aircraft engine overhaul — case study

Quality planning in the aviation industry is exemplified by the process of overhauling aircraft engines.

The planning process begins with the identification of hazards and risk evaluation while reviewing the contract before signing it. Approved quality plan

is part of an agreement with the customer. Document structure is shown on the Figure 1.

Supplying the engine of the right quality and reliability and a high degree of safety is crucial. It is installed on airplanes operated by the Polish army and abroad. Its reliability directly affects the safety of pilots and technical staff (servicing) and the whole environment in which aircraft operate.

Quality plan envisages a detailed review of the contract with the client, before signing it, for the contract contains important elements for the process of aircraft engines overhaul, such as:

- object of the contract (clarification of the number and type of engines overhauled),
- duration of the overhaul,
- delivery conditions for the engines overhaul,
- technical conditions of conducting an overhaul,
- conditions of the customer's acceptance of the engines following an overhaul,
- warranty conditions,

- terms of payment and the method of payment,
- arrangements for cooperation.

The quality plan also established which documents, that are in force in the company quality management system, should be used in the overhaul process.

Quality plan is subject to an update review in the course of an overhaul as the reaction to the need for changes must be reflected:

It may concern:

- possible annexes to the contract signed with the client,
- technology of the overhaul,
- the cooperation,
- necessary purchases,
- the use of the machinery,
- the use of employees.

The structure and content of the quality plan was adapted to the requirements of AQAP 2105. The reference was made, therefore, to all the requirements described in this document using the guidelines of the PN-EN ISO 10005:2007 standard and the necessary legal requirements and internal arrangements of the company.

The main attention in this paper focuses on the issues such as:

- responsibilities and authorisations of employees at various levels of the organizational structure (not just in terms of developing quality plan, but mainly the implementation of its provisions),
- management of resources (human, company infrastructure used in the process of overhaul, work environment and the parts and materials used in the overhaul),
- activities conducted as part of the quality management system,
- implementation and continuous monitoring of the identified processes affecting the quality and reliability of the engines being overhauled,

- requirements for the system, as well as, technological documentation used,
- planning the realization of the overhaul process,
- review of the contract with the client,
- purchases, including supervision of suppliers and purchasing products needed in the overhaul process,
- carrying out and monitoring the overhaul of engines and aggregates,
- monitoring the inspection, measurement and testing equipment,
- configuration management,
- activities concerning analyses, measurements and improvements,
- cooperation with the customer.

These are just a few issues, but the most important, in the aircraft engines overhaul process, whose taking into account in the quality plan is essential.

Summary

The quality planning at the aerospace company is a multi-faceted problem that requires a systemic approach and application of certain standards or other international standardization documents. Among them:

- PN-ISO 10005:2007 Quality management systems. Guidelines for the quality plans,
- AS 9100 ed. B, Quality Management System — Aviation — Requirements,
- AQAP 2105:2005 NATO requirements concerning quality plans for the product which is the subject of the contract.

The article only highlights the problem of quality planning in the aviation industry. Due to the wide range of issues, the example was limited only to quality planning during the overhaul of aircraft engines.

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