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Aviation Technology Life Cycle Stages

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Abstract
The core of product lifecycle management is creating, preserving and storing information relating to the business activities of the product, to ensure fast, easy and hassle free screening, refining, distribution and use of the data required for its daily operations. That article deals with the management of the product life cycle, namely aviation technology. Aviation technology has unique characteristics which distinguish it from standard products, and therefore the aviation technology life cycle is different from the life cycle of the standard product. The article discusses the specific stages of the life cycle of aviation technology from the stage of conception to disposal of the product.

Key words Life cycle, Product, Aviation Technology

1. INTRODUCTION

Achieving the required capabilities, their maintenance and development is the most important objective in all areas of activities, including aircrafts. Today's time and the current market environment puts heavy demands on the need to be flexible in the means for the future of aeronautical technology, especially in the area of material. We can say that through the implementation of rules and principles of lifecycle management systems can be achieved in particular more integrated, efficient and customer-driven acquisition of aircraft. Other advantages of the implementation life cycle management are systematic and coordinated preparation and implementation of processes and activities within the various stages of aviation technology - from development, through production, use, ensuring its safe and reliable operation to decommissioning.

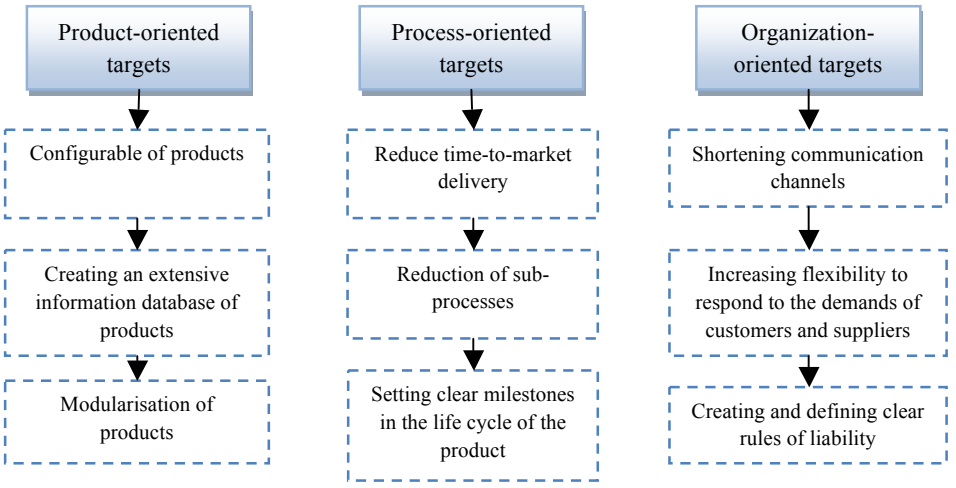
Basic international document that covers the lifecycle management standard is ***ISO / IEC 15288: 2008 "Systems and software engineering - System life cycle processes."***, which describes the implementation of hardware and human resources to process life-cycle systems. It is complemented by ***ISO / IEC 12207: 2008 "Systems and software engineering - software life cycle processes."***, which deals with the implementation of software solutions in the systems life cycle processes. Other standards dealing with documentation during the life cycle of systems is ***ISO / IEC 15289: 2006 "Content of the information results (documentation) process life cycle systems and software."***

These standards have a general character and discusses the processes of the life cycle of systems created by people, which can be configured with one or more of the following items: hardware (HW), software (SW), people, processes (e.g. the review process), procedures (e.g. instructions for the operator) and equipment. They define a set of processes and the subsequent terminology.

2. LIFECYCLE MANAGEMENT

Management lifecycle is called a systematic and controlled concept for management, product development and information concerning the product from initial idea of creating a product until its ultimate disposal and recycling. The basic objective of this approach is to deliver quality systems in the required quantity, quality, price, and using identifiable, measurable and repeatable process.

The objectives in implementing the principles of product lifecycle management in organizations can be broken down into three main groups:



At the end of the process of creating objectives and in implementing the principles of management life cycle must be set concrete measures to determine the degree of implementation in a particular individual and the organization.

Each system has a life cycle. Life cycle can vary according to the nature, purposes, and the use of the prevailing circumstances of the system. The life cycle can be divided into the group of stages. Life cycle stages consist of processes and activities. The described system progresses from stage to stage through the results of the various activities that are carried out and organized by people in the organization.

Every stage of the life cycle is determined by its unequivocal purpose and contribution to the entire life cycle. It is assessed in planning and conducting the system lifecycle. International Standard ISO / IEC 15288 defines six basic stages of life-cycle systems (Fig. 1):

- Stage of design,
- Stage of development,
- Stage of production
- Stage of use,
- Stage of support
- Stage of disposal.

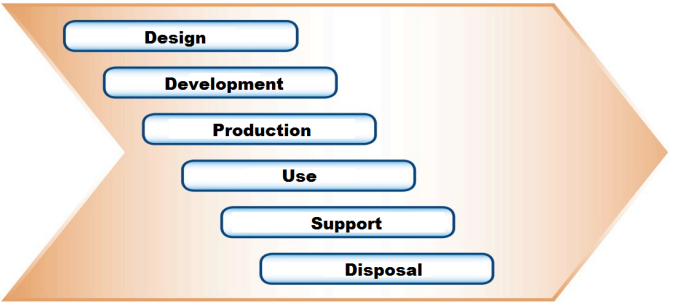


Figure 1 Life cycle stages of system

Among life cycle stages are decision gates, which control entry to and exit from stages and provide the control mechanisms. Decisions taken at each stage must be documented and concerning the following operations (fig. 2):

- The implementation of the next stage,
- Continuation of the current stage,
- Return to the previous stage,
- Completion of the project (during the life cycle)
- Preservation of the activity in Project (during the life cycle).

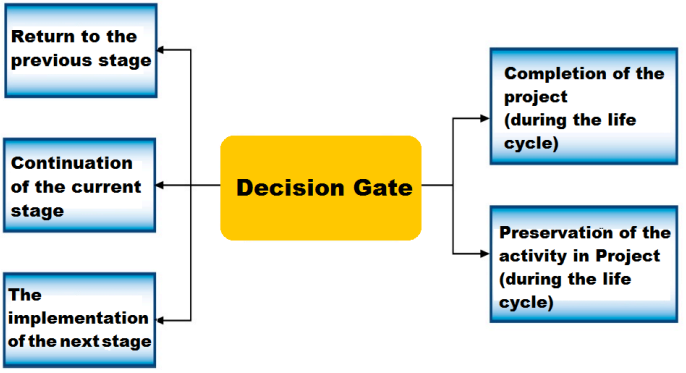


Figure 2 Taking decisions in Decision gates

Each stage represents a necessary period of time the system lifecycle. Dividing the life cycle of the stage it is based on the effectiveness of the implementation work in small, clear and time-bound steps.

3. AVIATION TECHNOLOGY LIFE CYCLE STAGES

As mentioned, the international standard ISO / IEC 15288 has a general character and applies to the field of aviation technology, which has its own specifics. Mentioned specifics need to be considered already in breakdown and targeting different stages in the aircraft life cycle. The specifics of aviation technology include in particular the requirements for flight safety and high reliability requirements of aviation technology, which is reflected mainly in the specific test requirements of flight techniques (especially flight test), airworthiness of aircraft, certification of aeronautical products and operation.
Generally it can be life cycle stages of aviation technology break down as follows:

- Stage of design,
- Stage of definition
- Stage of development
  - Development stages / steps from conceptual design to project
  - Design of the aircraft (aviation technology)
  - Prototype
  - Prototype testing (factory tests - FAT tests (Factory Acceptance Test / Testing), ground test, flight test, certification tests and further testing according to customer requirements)
  - Approval of a type of aircraft and aviation technology (issue of a type certificate for an aircraft and its components and consent to the use of products in civil aviation)
- Stage of production (or buildings),
  - In this stage are performed tests to verify the quality of production and can be carried out tests of test series and other types of tests
- Stage of tests (testing)
  - Verify the airworthiness of the aircraft (certificate of airworthiness),
  - SAT Test (Site Acceptance Tests / Testing) - acceptance tests at the installation / placement of air Product / System
  - Further testing according to the requirements and specifics of the customer
- Stage of operation (use),
  - Operate the aircraft in accordance with its Certificate of Airworthiness
- Stage of support,
- Stage of modernization (or upgrading),
- Stage of decommissioning,
- if necessary, stage of extension of technical life (may be associated with modernization)

An overview of the various stages in the aviation technology life cycle is shown in Figure 3.

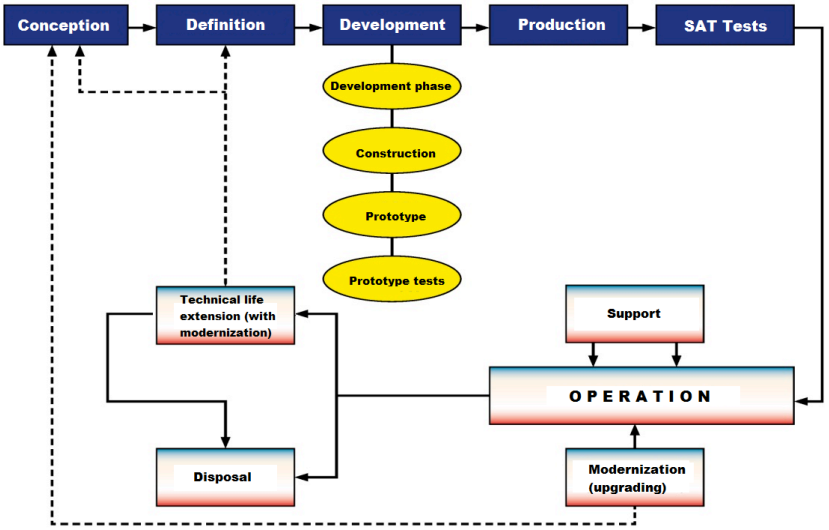


Figure 3 Aviation Technology Life cycle Stages

3.1 Stage of conception

The basic objective of stage of conception is to consider all available options and create the preliminaries for the product. In that stage, it is all about understanding customer needs and incorporate these needs into a conceptual model. Need to develop new types of passenger aircraft is conditioned mainly by a change in the global demand for air transport and travel habits arising from the requirements of commercial and private clients.

During the stage of conception, it is necessary to carry out these activities, mainly:

- baseline research, which monitors and evaluates all used, but also new technologies and concepts, new trends, opportunities, research;
- applied research, which focuses on research into new technologies and techniques that can be used for the construction of new types of aircraft, powerplants and components;
- determination and understanding of the primary tasks and functions necessary for the system;
- determination and understanding of the performance and economic needs, demands and characteristics placed on the different categories of aircraft.

3.2 Stage of defining

In stage of defining are determining the systemic solutions that meet customer requirements have to be set while allowing for development and production. A customer typically consolidates all information obtained during the stages of design or specify its request. For key requirements - System targets, in terms of overall security solutions can be considered:

- the safety of aircraft,
- ripeness of systems and their readiness for use / operation,
- fulfillment customer expectations,
- 100% usability of aviation technology / systems for attaining the main tasks / missions,
- ability to operate in all conditions,
- the lowest possible price / life cycle cost of aviation technology / system.

The main objective of this stage can be formulated as follows:

- development of the concept and definition of the final solution;
- development of system architecture and system configurations;
- mapping the supply base in order to determine what equipment, components and materials are available or may be required to support emerging design;
- ensure that the materials were selected with knowledge of the laws and to determine their use in accordance with health, safety and environmental protection;
- defines the physical characteristics and assembly and the interface requirements;
- Development of operational and computer models of individual systems;
- quantification of key performance of systems.

3.3 Stage of development

Any new developed aircraft must by technical parameters and operating characteristics to replace morally, technically and economically obsolete aircraft, it must also ensure that the requirements of customers and the operators' obligations under existing aviation legislation and demanding operating conditions, which by transport aircraft are primarily the need for greater seating capacity , increased comfort during transportation, reducing the specific fuel consumption, reduced noise levels and emissions produced. Finally, it must take into account the current and future development in term of at least 30 years.

Currently, the main focus in the development of aviation technology given to the following areas:

- increasing flight safety
- reduction in specific fuel consumption,
- increasing the range,
- reducing emissions,
- improve passenger comfort.
- increasing transport capacity of the aircraft.

3.4 Stage of production

At this stage materialized conceptual designs and data obtained in previous stages. During the initial stages of phase schedule will be developed for the supply of components needed for the manufacturing process. The main objective is to produce a product, test it and, if necessary, to create related supporting and auxiliary systems and equipment.

During this phase are also carried out the following activities:

- production of individual parts and final assembly of the aircraft;
- delivery of equipment and installations needed for the manufacturing process;
- testing of installed systems.

3.5 Stage of testing

Aviation equipment and its components are subject to a rigorous assay program to verify that aviation technology under specified conditions, unable to meet the purpose. At this stage, has the following duties:

- planning of ground and flight tests;
- ground and flight testing of aviation technology;
- analysis of data obtained during the tests;

- comparison of the data obtained to support operational capability.

The stage of testing is not only the testing of aeronautical technology, but also the testing and integration of devices, components, assemblies and ultimately the entire aircraft. During the verification process capability can be used modelling, various types of analysis, comparison with existing schemes or similar, and ultimately functional testing.

3.6 Stage of operation

The operating stage begins after installing a transitional system in use. The objective of this stage is to operate the product to the specified environment fulfils the required parameters supplied services provided, and to ensure the maximum uptime. In the case of aviation technology is given particular emphasis on safety. This stage ends in the moment when reduces the ability of the product to meet the required parameters and service. In this case, about half of the operating stage is time to think over any modernization or extension of technical life.

3.7 Stage of support

The purpose of this stage is to provide logistics, maintenance and support services that enable continuous system operation and maintenance of services. This is to ensure a high level of reliability of the system perform optimally during the technical life. In the air transport system it is one of the priority tasks of ensuring a high level of reliability of aviation technology. During this stage is carried out also support performance monitoring of the system and its services and the identification, classification and reporting of anomalies, deviations and failures of the system and support services.

3.8 Stage of disposal or technical life extension

Aviation equipment in the course of its life cycle at some point gets to the stage when it is morally or physically obsolete. At this point, the life cycle has to come a decision based on the assessment of the cost of operation, reliability and loss of value. Alternatives in decision-making is upgrading, careful maintenance, the sale of surplus aviation technology to other users or scrapping. End of technical life can be caused by factors such as moral obsolescence increasing operating costs, disproportionate burden on the environment (noise, emissions) compared to more modern aviation engineering.

4. CONCLUSION

Product life cycle determines its position in the market. Lifecycle management is one of the key tasks of marketing and sales. The need for effective management of the product life cycle is determined by competitive pressure and ever increasing demands of customer requirements. From this perspective, it is the management strategy of product life cycle, offering manufacturers an environment of cooperation with business partners to accelerate product launch, reduce production costs, increase quality and ultimately improve customer satisfaction. Product life cycle management to control the whole area of product life and information associated with him. Effective lifecycle management enables companies to successfully compete in the international and global markets.

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