Also, rocks of organogenic construction of Turov and Drozdov age are characterized by a decrease in lithological variability in the section. There is an increase in the proportion of breccia-like rocks due to inclusions of intraclasts of denser differences of different dimensions. Deposits of organogenic construction of the Drozdov age are characterized mainly by a complex type of reservoir – pore-cavern-crack, whereas in the Zadonsk age the main type of reservoir space is pore – cavern and cavern-pore.

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## SYSTEM ENGINEERING AS A TOOL FOR THE IMPLEMENTATION OF ENGINEERING PROJECTS


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Several definitions of system engineering were found, some of them are listed below:

1. System engineering is a management technology that includes the organization, application and provision of scientific and other forms of knowledge that ensure customer satisfaction. [4]
2. System engineering is a creative process through which products, services or systems that are supposed to meet the needs of a client are conceptualized, agreed or defined, and ultimately developed. [1]
3. System engineering is a discipline with high potential, requiring multidisciplinary knowledge and allowing to aggregate a variety of system elements. [3]
4. System engineering - an interdisciplinary approach that ensures the implementation of successful systems. Successful systems must meet the needs of customers, users, and other stakeholders. [2]

Definition No. 4 is the most suitable of all of the above, since in systems engineering - an interdisciplinary approach, it combines knowledge in several areas simultaneously; international experience shows that the product obtained using SI is successful in the market.

In order to implement a successful system, a system engineer supports a number of life cycle processes that begin at the early stages of conceptual design and continue throughout the entire life cycle of the system through its production, development and deployment.

**System life cycle.** System engineering is a creative process through which products, services or systems satisfy the needs and requirements of customers; These requirements and needs are conceptualized or detailed, or defined, and ultimately developed and created. [1]

Life cycle is a representation of the sequence of states of existence of a product and the processes of transition between them from the emergence of an idea to realization in life. Each process has its own life cycle; a process is a combination of one or more actions whose goal is to achieve a goal. In systems engineering, this goal contributes to the implementation of the strategic plan. To be interesting, a process must have at least one “input” and one “output”, and each activity in the process contains more than one action, and depends on some other action in the same process. The process is an element of the enterprise, and the enterprise itself is the process itself. Each enterprise can be considered as a system, then it has a life cycle. [1]

Life cycles model organizational behavior; behavior is characterized by products that can be stacked into manageability stages. Each stage is usually characterized by one or more main products that appear in the process. [3]

There is no single life cycle model that is accepted around the world and is suitable for any situation. However, there are a number of stages in creating the life cycle of a system.

**Requirements engineering.** A requirement is an approval with a specific structure and corresponding to certain rules. Requirements for a product or service form a need, expressed by a person or a group of persons, on which it will have a positive or negative impact. [2]

Requirements are ambiguous and inaccurate, but nevertheless they are the most accurate representations of actual needs, and should be considered as the standard by which the finished product or service will be evaluated or measured. Specifications - an engineering product, and is the criterion for the end, and not the beginning of the life cycle. This is a valid life cycle; it sets four steps in the process of identifying requirements and only then converts them into a specification.

1. Identification of requirements;
2. Classification;
3. Analysis;
4. Prototyping;
5. Documentation and specification requirements.

An initial list of requirements can be created using a team approach or by interviewing stakeholders and discussing their needs. In this case, the starting point of the requirements of the engineering process is the process of collecting information, which includes a number of people in order to provide consideration of a wide range of potential ideas and problems. When identifying requirements, it is necessary to answer the following questions:

- Who is the potential consumer? What are they doing?

- What is currently available? What's new? What's up?
- What are the boundary conditions? (determined by the customer and determines the range of information collection)
- What kind of work should the developer do?

The second stage is an organization to identify requirements. At this stage, there is no change in requirements, but just a simple classification and categorization.

The third stage - the analysis of requirements - refers to their change: the transformation takes place if the engineer makes a number of changes to the requirements that were not received from the stakeholders. For example, adding parts is a change in requirements.

The fourth stage is the development of the prototype, the synthesis stage, in which some part of the problem is developed to a certain level of completion. Thus, poorly understood requirements can be verified and possibly strengthened, corrected or refined. Such activity is usually carried out to prove the concept and serves to obtain feedback from both stakeholders and engineers.

The fifth stage is the presentation of requirements as a finished product to stakeholders. A list of requirements or some equivalent document format is compiled, these collected requirements are then converted into a specification. [1]

**SI application.** A new generation air transport system. Air Traffic Management ATO is responsible for ensuring aircraft navigation in the US National Airspace system; The organization uses a five-tier architecture. Each plane passes through different stages, and possibly through different zones of this architecture, from takeoff to landing at another airport. However, this architecture is fragmented and in connection with this a large number of questions arise: Is the flight path of the aircraft optimized? Can the flight path change from one zone to another? Etc.

The organization's goal is to provide the safest and most efficient aerospace system in the world. To this end, the NextGen project aims to strengthen US leadership in the field of air transportation.

In terms of the implementation of the NextGen project, the following issues were discussed:

- Performance;
- Company policy;
- Staffing;
- Security;
- Environmental planning.

It is possible to solve problems in the following way: in order to ensure security, develop company policy and technical progress, it is necessary to achieve inter-agency cooperation. However, the main part of the problem is the integration of new technologies into outdated systems: airplanes, airports.

To fulfill this goal, a number of requirements were defined: network access to information; services and operations arising from the needs of practical activities; taking weather into account when making a decision; multi-level adaptive protection; location, navigation and synchronization services; actions based on the trajectory of the aircraft; equivalent visual operations and ultra-high density of arrival and departure.

Verification and validation of project results is the main problem, since traditional methods of validation and verification are designed to test an isolated system, and NextGen is not one of them, therefore, changes in human and technical resources are necessary to effectively solve this problem.

As mentioned above, the current practice of validation validation in system engineering is focused on individual isolated systems, and not on many interconnected ones.

**Conclusion.** All the above examples show how much more efficient the system becomes when using system engineering in the development process.

All models and systems engineering processes are organized around the life cycle concept. Although the detailed representations, implementation, and terminology used to formulate the SI life cycle differ among different stakeholders and customers, they all have common elements, for example, the stages of system development: analysis, development, production, deployment, operation and support.

A properly designed life cycle of the system increases the efficiency of work, because at the stage of developing the concept of the life cycle, work is carried out to determine the strategic goals of the system and interact with stakeholders to identify their needs. Needs - this is an expectation expressed from a certain point of view. One need can meet several requirements. Requirements are obtained as a result of working with needs, such work, depending on the point of view, is called requirements analysis or business analysis. A requirement is a statement with a certain structure and corresponding to certain rules, the rules for formulating requirements are given in the above chapter. In the context of verification and validation, this means the following:

If the requirement is presented to the system and affects the design and implementation of the system, then there must be the ability to establish the compliance of the system with the requirement (that is, there must be the ability to verify the system);

The requirement for the system should be such that it is possible to check whether the system satisfies the need on the basis of which the requirement is created (that is, it must be possible to validate the system).

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