System Engineering and Analysis (SEA): System/System Life Cycle (SLC) - III

Berquó, Jolan Eduardo – Electronic Eng. (ITA)
Aerospace Product Certifier (DCTA/IFI)
Government Representative for Quality Assurance – RGQ (DCTA/IFI)
jberquo@dcabr.org.br

IYK 31 – FEB 16, 2013

On IYK 30, we discussed the Need Identification Phase of the System Life Cycle (SLC). Now, the sequence is the Conceptual Design Phase.

We remember that the SEA is applicable to any system. If the system is complex, certainly will exist all phases of SLC. Being a simple system, for example a bicycle, some phases may not exist or are very simple.

Very well, when we decide to go ahead with this new phase, the Conceptual Design, it means that a program is established. Why the term "Program"? Simply because, thereafter, several projects will be developed by the end of the SLC, and as we know, a number of projects connected to the same goal is a program.

Right now, the company responsible for implementing the Program, prepares, within their sphere, a Program Management Plan (PMP), relative to the entire SLC. This is the management facet of SEA that we have treated on the IYK 30.

When referring to an acquisition of governmental agency, the plan is properly discussed and agreed with the program manager of the mentioned organ.

Of course, the PMP has a very general character, but serves as a basis for the development of more refined other planes along the SLC.

As mentioned above, in the IYK 30, the methodology of the SEA has a functional approach. No physical architecture can be selected, until all level system functions, subsystems and equipment (components) have been identified and the requirements (attributes or characteristics)[1] have been allocated for each function.

This approach functional SEA is also quite good in all directions, especially, for example, when we have to do an analysis of the system or its other hierarchical levels, as in the case of an accident or an improvement design. We have already had the opportunity to go through it a few times.

The fact is that the allocation of functional requirements and the related allocation requirements are an important landmark of the program and defines a Functional Baseline for the System.

An example of requirements allocation for a system function in relation to safety requirement (safety), was presented in the IYK 10, considering the function of attitude indication of an aircraft in roll and pitch.

But let's talk a bit about these requirements that will be allocated to each function of the System, Subsystem, and finally to equipment or components. Beforehand, we should say that, in our opinion, based on experience, the process of identification of requirements is perhaps the hardest part of the methodology of the SEA.

As we saw in the IYK 30, in general the system has two main subsystems, under the technical point of view: Operational Subsystem (OS) and Logistics Subsystem (LS).

The activity of gathering requirements must cover both subsystems. Briefly, we cite some operational requirements: Lifecycle intended (lifetime); Autonomy; Operating Environments (where the System will operate?); Mission or Missions Profiles (altitudes along the segments of the mission; temperature variation in each segment, etc.); efficacy parameters (availability, reliability, maintainability, etc.). And so on.

With respect to the LS, we can mention: Maintenance Levels (in the operational Base of the aircraft and/or in the Factory); Repair

[1] Criteria or attributes are measurable features that serve to evaluate the various alternatives, whose value or range of values obey certain standard: : temperature; Standard: less than 90° c.

Policy (repairable items, partially repairable or not repairable), and so on.

As we saw in the IYK 30, there are at least three possible situations to be considered in developing a system:

a) the System is developed by or for a governmental entity (military or civilian);
b) the System is developed for private companies; and
c) the System is designed for direct use of users.

In case (a), the customer goes to companies that have a system that meets his needs. The acquisition of existing systems already on the market some time ago, in general is less expensive than to develop a new system, due to high development costs.

When there is only one system available on the market that meets the customer's requirements is relatively easier to go on. But if the market supports several providers for the system that meeting the requirements, then the customer will have to make a comparative study between the options, weighing quite the cost operational and the logistical cost.

When we have the special case of government procurement, there are two important factors to be considered: cost and political factors. The latter is perhaps the most decisive in choosing either option. We have recent evidence in Brazil of the importance of this factor.

In cases (b) and (c), as we have said, the company goes to the market to hear the "voice" of potential customers.

Both to the government area, or to the private area, the company that will develop the system should make a feasibility study, ie, identify alternatives and determine which configuration more feasible from the economic and technologic point of view. Then the company has to make the called feasibility analysis considering various alternatives.

This analysis seeks to obtain the most balanced solution (trade-off).

The conceptual phase ends with the called System Design Review - SDR. It is an interdisciplinary meeting, or a meeting of company experts from all areas involved in the design, with the objective of determining if these areas are working in an integrated manner and in accordance with the provisions of PMP.

Although it is an internal meeting of the company, in the case of a government customer, he will surely be invited to participate and can provide valuable help when there is a doubt about compliance or not of a particular requirement.

In fact, in governmental projects in general the customer does not waive his participation in the SDR with their experts.

Finished the SDR, the company issues the Technical Specification for the System, called "A" SPEC (note the alphabetical order, ie, it is the first technical specification), which will serve as the basis for the next phase. It is the result of the transfer of the customer's voice for the language engineering[2].

With the completion of the issuance of SDR and the ESPEC A, we have the Conceptual Design Phase closed.
Até lá.

See you.

References:

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(5) Blanchard, B. S.; Fabrick, W. J. **Systems Engineering and Analysis,** 5th. Ed. Prentice Hall. Upper Saddle River, NJ, USA. 2006.

(6) SAE: ARP 4761, **Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment**, SAE. USA, 1996.

[2] The reader is invited to see an ESPEC A, in Reference (5).