System Engineering and Analysis (SEA): System/System Life-Cicle - II

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Like we human beings, every System has a life cycle, i.e. they are designed, developed, produced, operated and, in the end, are discarded. The similarity to the life cycle of humans is remarkable. The most striking difference is that the human being is a System much more perfect than any physical System made by them.

We try to always remember that the IYK are flashes, i.e. they give an idea about the subject. The deepening of the matter shall be made by means of works that deal with the subject, such as those listed in our references.

But before discussing the the Systems life-cycle (SLC), we must to re-examine the concept of SEA and System. We said at IYK 29 that SEA is the set of all engineering activities that occur throughout the life cycle of the systems.

This is true, but we must go a little deeper, making it clear that SEA is an interdisciplinary methodology that addresses the typical processes to conduct engineering activities throughout the SLC.

As it is interdisciplinary, it should be taught in all engineering courses Universities[1], especially in the last school year of these courses and/or be offered in these universities as postgraduate course.

SEA can be divided into two parts: one dedicated to the architectural design and procedures of the System (technical domain) and another part that deals with the management of all processes of SEA, in its various phases (domain management).

Returning to the System, we can say that in general, the System has two major subsystems: Operational Subsystem (OS) and Logistic Subsystem (LS). Nothing special about it, since no System can operate without a logistic support.

The OS contains the item or component called "principal", ie, that one that ultimately performs the function or mission of the System.

Thus, in a simple layout, we present the System as shown in Figure 1, typically an Aeronautical System.

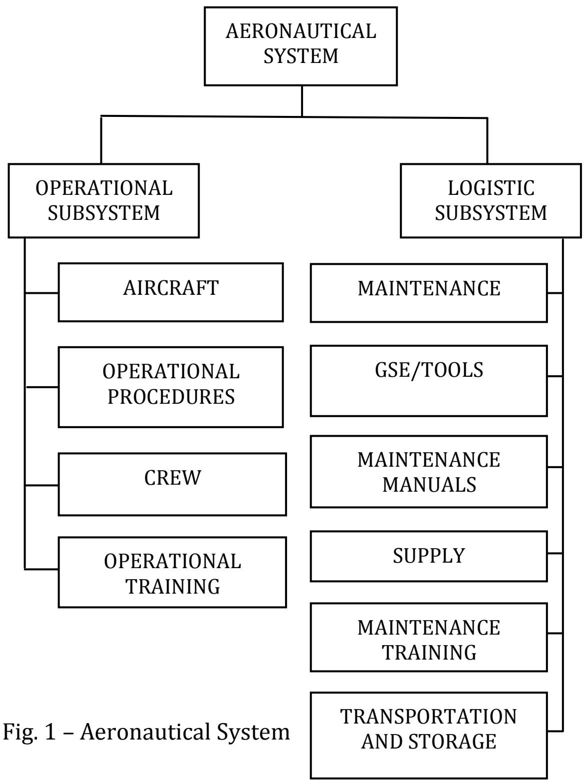

Fig. 1 – Aeronautical System

GSE is the acronym of Ground Support Equipment.

The operational procedures include those focused on the safe driving of the principal component and those worried with operational safety ashore.

The logistic subsystem is structured with the six logistic factors or elements presented, but the maintenance is the focus of the other five

[1] Strictly, the SEA should be taught in all undergraduate courses (Engineering, Medicine, Business Administration, etc.), because everything is System.

factors, ie their outputs are directed to maintenance.

Of course, the above configuration may differ for certain types of systems. For example, space systems for satellite launch. In this case, it does not makes sense to speak of "crew". But there is an emphasis on operational procedures and operational training.

In the Spacial System, we also have to consider the logistics activity of assembly and disassembly which, in Figure 1, would be in the maintenance factor.

That said, let us go to the concept of SLC. Incidentally, this SLC structure is the main part of the methodological aspect of the SEA.

The stages through which a System goes in its SLC may receive slightly different names, depending on the author, but in the end, the essence is the same.

We present in Figure 1 the diagram of the System Life-Cycle (SLC).

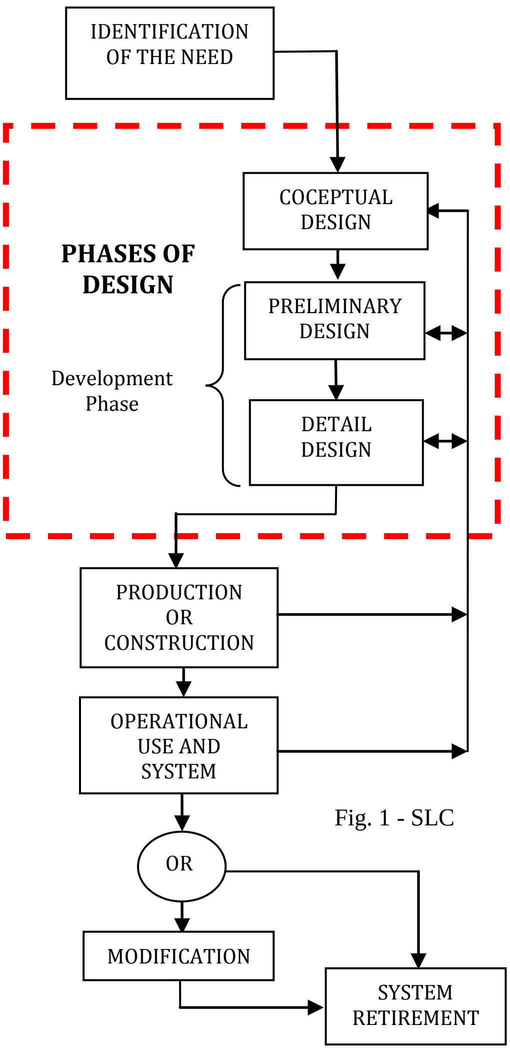

Fig. 1 - SLC

Some authors include the identification of the need in the conceptual design.

Let us begin by identification of the need.

Nobody acquires or develops a System without the need to do it and, in general, is the commercial aspect of the gain that is in play. The World moves this manner.

But this Phase of Identification of the Need, we would say, is the stage of "courtship", making a comparison with the System "Marriage."

In this phase, we identify the need, ie the System that the market or a particular customer wants and the general requirements (top level) for the System.

There are at least three possible situations to consider:

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 the first case, we can mention the Department of Aerospace Science and Technology (Departamento de Ciência e Tecnologia Aeroespacial - DCTA), of the Air Force Command (Comando da Aeronáutica), in São José dos Campos - SP, and links of the National System for the Development of Spatial Activities (Sistema Nacional de Desenvolvimento das Atividades Espaciais – SINDAE), which includes the DCTA and the National Institute for Space Research (Instituto Nacional de Pesquisas Aeroespaciais - INPE). In general, the governmental entity identifies its need through general requirements for the System he wish to purchase.

In the second case, can be cited the airline companies. The identification of the need for a given system and its requirements is made by company that wants to provide the system. This process requires that the supplier to check out potential companies that use similar Systems, setting up a face-to-face communication, to understand exactly what the customer wants. There are several techniques for accomplishing this. One of the most widespread is called “Quality Function Deployment (QFD)”.

In the latter case, that is, direct use of users, a good example is the car users. The process of identifying the needs of users is similar to the second case, but here we go straight to the user to identify what he wants. The techniques used are also similar to those of the second case.

The identification of the need is made in customer language, commonly called the Voice of the Customer. Their demands are vague sometimes, as in the case of car users, sometimes are detailed, as in the case of Systems ordered by governmental entities.

Whatever the type of customer, he may be interested in a new System to perform a function or mission for which there is no System in its collection capable of accomplishing it.

It may also be that he is interested in replacing a System because the operational costs are prohibitive, due to the high failure rate, requiring many parts for repairs, or due to the scarcity and/ or the high price of these parts.

Another factor that may decide on a new acquisition is obsolescence. The System operates according to requirements without major problems in logistical factors, but its operational requirements are obsolete for the environment in which it must operate. For example, fighters operating in environments where enemy aircraft have more maneuverability, speed and/or firepower.

We stop here. We will be back to this matter in the next IYK.

See you.

References

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