System: Logistic Subsystem - I

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In reality, the subject which we will deal with here is also about Engineering and Systems Analysis, but we have had a pause in the IYK 34 to "take a breath". We now return to finish it, presenting the Logistic Subsystem (LS), in the Operational Phase. The design of the aircraft can be perfect, but if the LS was not developed effectively and efficiently, in close relation with the development of the aircraft, the system will not have a good presage in its continued airworthiness, in its Operational Phase.

This is our theme, in this IYK. We hope you enjoy it.

It is difficult to provide a reasonable range of references for our discussion, because much of what we will write here is based on our rich experience, not wanting to confuse it with professional competence.

So, this time we present just one reference, which is attributed to three authors, among which we highlight the magisterial teacher Blanchard, who, alone or co-authored, has kept his books in the state of the art.

As we have said somewhere, every system has a n Operational Subsystem (OS) and a Logistics Subsystem (LS). The latter is developed along with the OS. They march together in the Operational Phase.

Without the LS, the main component of the system (the aircraft, in the case of an Aeronautical System), would not go far away, remaining on the ground paralyzed, unavailable and therefore useless.

Thus, the LS is not important, but extremely important.

Our focus here at IYK, is to treat the LS, in relation to their activities in the Operational Phase, but for this we will have to appreciate a little its origin in the Development Phase.

Remember that both the OS as LS, in civil environment and military environment, are not developed according with the desire of each company. There is a pile of requirements, logically linked, from civil airworthiness authorities and from the military authorities, dedicated to each type of aircraft, to which these companies have to obey.

But the main design guideline for the LS is the allocation of the various requirements focused on the three following characteristics: Reliability (R), availability (A) and Maintainability, known by the acronym RAM.

This allocation sets, with good probability, the future of the airworthiness of the aircraft.

These characteristics are interrelated, that is, when we allocate a requirement for one, the other two have to be adjusted to the rhythm of the first, with the designer looking for the best balance (trade-off) for them (see Ref.).

Figure 1 shows the elements or factors of the LS.



Fig. 1 Factors of the Logistics Subsystem (LS)

But why the maintenance is a rectangle with yellow background? Just to show that this is the logistic factor around which revolve all the other factors of the LS. The final goal is to optimize the maintenance factor.

However, we will address the Maintenance and all the other factors at the same time.

The critical items for airworthiness (communications, hydraulics, fuel, etc.) can be in one of three possible States: operating normally, with defect or in fault.

In the first State, the aircraft is airworthy. In the second, the aircraft may or may not be airworthy. At last, the aircraft is not airworthy and therefore unavailable for the flight.

Maintenance is a set of activities that seeks to maintain the aircraft available (airworthy) or restore it to the airworthy condition, in the case of it becomes unavailable by ineffectiveness of a critical item.

It can be Preventive or Corrective

Preventive maintenance is the type of maintenance that seeks to keep the aircraft airworthy. It is also said that it is the type of maintenance Before-the-Fact, ie occurs before the failure occurs. The process of this type of maintenance is inserted in handbook issued by the aircraft manufacturer, drawn generally based maintenance methodology focused on reliability (Reliability Centered Maintenance - RCM). Currently, the process followed by most aerospace companies, based on RCM, is the MSG-3 (Maintenance Steering Guide - 3). (see Ref).

The corrective maintenance is the type of maintenance After-the-fact (which occurs after the failure occurs, i.e. when the aircraft enters into the state of fault). For this type of maintenance, aircraft manufacturers issue certain manuals, such as the manual for structural repairs and the parts catalog (Parts Catalog) manual, this latter allows the maintainer quickly identify the fault items, for replacement.

A type of manual that can greatly ease the life of maintenance personnel is the exquisite collection of guides issued by manufacturers called Job Guides, showing the process of disassembly and assembly of the aircraft items. The military area uses quite such manuals.

Equipment manufacturers, mainly electrical and electronic, also emit a collection of maintenance manuals for their items, besides the so called installation manual. In general, they prepare the operating manuals, intermediate maintenance, overhaul manual and parts catalog.

Although the manufacturer's installation manual is not exactly a maintenance manual, we

would like to suggest to anyone that intends to install any equipment on an aircraft, try always to follow, as much as possible, the installation manual. If the installation design is different from that which is in the manual, that is, if there is some deviation regarding the manual, the modified design must be carefully studied and the reason of the deviation clearly registered. Such a procedure can prevent headaches, in the future, in case of accidents investigations.

We know well that the nature of operation of commercial aircraft is quite different from the military. Let us remember that military aviation is intended for combat, and the spirit that prevails in this area, as we have already said in the IYK 20, is to have all available resources to combat.

Therefore, the maintenance of military aircraft has its own rules for the maintenance process. Normally, the military have a very consistent network of logistics resources, in typical three levels of maintenance: Organizational (On Aircraft), Intermediate (On and Off Aircraft) and Depot (On and Off Aircraft).

In Brazil's case, usually the first two modalities are performed in air bases, where the aircraft operates, and the third in the *Parques de Material Aeronáutico*. Eventually, especially in the case of military aircraft designed exclusively for passenger transport, maintenance can be done in specialized workshops of the maintenance civil network.

The commercial civil aviation, on the other hand, as its name implies, develops a commercial activity. The aircraft have to be available, not only from the point of view of safety, but also with a view to not lose revenue. The aircraft are maintained by individual companies that operate the aircraft or by others private workshops, or even by aircraft manufacturers. The workshops are rigidly controlled by the airworthiness authority of the respective country. These workshops must follow the requirements set out in regulations.

We will continue in the next IYK, with the concatenated analysis of the other logistic factors.

Thank you for your attention.

Reference:

Blanchard, B. S.; Vewrm, Dinesh; Peterson, Elmer L. Maintainability: A Key to Effective Serviceability and Maintenance Management. John Wiley & Sons, Inc., USA. 1995.