# System: Logistic Subsystem – II

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*Continuing the theme, we'll analyze here, in a quick job, others logistical factors of the Logistic Subsystem. At MSC 35, we talked about maintenance and maintenance manuals. Now let's explore a little the training, GSE & Tools, Storage, Transportation and Spare Parts.*

*We start by training*

*It may seem simple the training of maintenance personnel, but it is not quite. Such personnel has to be able to perform what is in the manuals. So, basically, these manuals are the source for the training.*

*Instructors must have some experience in other similar aircraft. This experience is important for various reasons. They can, for example, present, during the instruction, the several problems by which have passed on maintenance. This is precious.*

*In training it is important to use the original manuals, which, in general, are in English. If this is not possible because of difficulties with the English language, and the manuals are then translated, it is important to stamp on every page of this material the phrases: "This material can only be used in training. It is expressly forbidden its use in maintenance".*

*We call attention to this because our experience shows what can happen during maintenance when using translations. It may seem incredible, but sometimes the foreign translator changes the meaning of terms like "bellow" for "above" and "above" for "below." These errors can stop an entire fleet of aircraft, as we saw in Brazil some time ago. It took a long time until we could find that was a mistranslation of a manual used in the laboratories of a company for the calibration of instruments that would be installed in aircraft.*

*Another thing that always happens is the issue of the learning curve. The training may have been efficient and effective, however, when the technician goes to the practice of maintenance, will still take place some time for him to acquire a reasonable ability to detect breakdowns (troubleshooting).*

*This is exactly why, at the beginning of the operation of the aircraft, there are many improper removals equipment. Usually, they are forwarded to the maintenance performed at distant sites from the site of operation. As they passed by a test bench test, they may not present any problems, and so are returned to the operator. But until this time, the aircraft may have been unavailable during a long time, if there is no equipment for replacement.*

*This fact makes the MTBUR[1] be very high at the beginning of the operational phase. Later, with the learning of maintenance technicians, the MTBUR decreases and approaches its limit, i.e. The MTBF.*

*Regarding to these removals of equipment in perfect condition, we have an experience which showed to us that 55% of equipment removed from an aircraft that had entered recently into operation had no any problem.*

*The GSE (Ground Support Equipment) is another element that must have their development carried out with great care. The GSE can be a simple item, like a simple protective cover of some aircraft surfaces (for example, those used in very sharp edges, as we have seen in the F-104 aircraft), or a complex electronic equipment for making some test on one aircraft or in a workshop.*

*We remind everybody that the GSE can produce accidents if used carelessly or if it was badly designed or badly produced. The practical part of the training must provide such care to technicians.*

*Once we were performing a compatibility test of a GSE for installation and removal of an electric generator on an aircraft and it broke, almost reaching our feet. The GSE had been poorly designed.*

*Packaging is another major factor. It has to be appropriate to each case, as occurs, for example, with instruments that use tiny bearings (micro-*

[1] MTBUR – *Mean Time Between Unscheduled Removals*

*bearings) and electrical wires with diameters of a human being hair.*

*When the package is not adequate, it may be the cause of new problems for the item, ie, it can be generator of other faults, beside those which caused his removal. In our maintenance activities, it was not unusual to receive an item with problems which were not been reported by the Operator.*

*Often, these breakdowns arose in transporting the item for the maintenance or from the maintenance for the operator. With the time, these problems were solved by adopting appropriate and dedicated packages.*

*The storage and handling are facilitated by the instructions of the manufacturers of the items, but applying them may be a work of engineering because is necessary to harmonize the environment requirements of each manufacturer. It's hard to build an environment of storage for each item. Therefore, we have to have an environment that can contain various items with different storage requirements. What is done is to create an environment with characteristics that satisfy as far as possible, the environmental requirements of the various items that will be stored there.*

*The civil and military areas usually have adequate storage systems to store their items.*

*We leave the spare parts as the last factor. Spare parts always were a torment for the maintenance workshops.*

*The quantification of spare parts is a complicated work. The basis of quantification is the MTBF of each item. But the experience of the technicians is very important for this quantification. The reference presents an excellent chapter on this factor.*

*By the way, the use of MTBF has been contested today as a suitable parameter to quantify spare parts and for various other purposes. Some experts are seeking to convince the quantifiers of parts to use directly the reliability. But this is another speech. May be that we will discuss it in another oportunity.*

*Some time ago the Brazilian Ministry of Aeronautics made an acquisition of spare parts at EMBRAER for one of its aircraft. It was inserted on the contract the clause called Buy-Back. Basically, that clause said that if the piece was purchased in excess, in relation to the indication made by the company, it would have to receive the excess back. Something like that.*

*Well, with this MSC we ended our discussion about SL. But there is much more to explore. We suggest a reading of the book of reference. It is complete. You will like.*

*Thanks for your attention.*

*Reference:*

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