

PMA Supplier Selection Using the Mahalanobis Taguchi System

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INTRODUCTION

Most hi-tech industries owe at least some of their success to being in the right place at the right time. This is especially true for the aircraft parts manufacturer approval (PMA) industry. A PMA is both a design approval and a production approval. It is issued for the production of modification or replacement parts for aircraft, which includes materials, parts, processes, and appliances. In the current economic climate, airlines throughout the world are looking for partners with financial stability. The reason is simple, they want partners that will continue to support them with extra savings opportunities in the short and long-term future. As more and more PMA companies are advertising through the Internet, a supplier performance measurement model applying to each of these networked organizations will facilitate the airline selection of long-term PMA partners. In this chapter, the Mahalanobis Taguchi System (MTS) approach, a multivariate data based selection system, will be used to identify the promising PMA suppliers. Suppliers who are known to be promising are called promising groups and their performance data sets are used to create a reference metric for the promising PMA supplier population. In view of the synergetic performance of neural network and data mining technologies, it is expected that this MTS-based PMA partner selection method, implementing through a neural data mining system (NDMS) will provide a practical solution in the identification of the promising PMA suppliers.

AIRCRAFT PARTS MANUFACTURER APPROVAL (PMA) EVOLUTION

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proval and a production approval. It is issued for the production of modification or replacement parts for aircraft, which includes materials, parts, processes, and appliances. The history of PMA parts dates back to 1986, when there was an unplanned surge in world demand for the combustion chambers of Pratt & Whitney JT8D aircraft engine. At the time, the original equipment manufacturer (OEM) was unable to meet production requirements to keep the world fleet flying. The solution came largely in the form of PMA parts rather than original sourced or issued (OEM) parts. Since then many airlines that were unfamiliar with or had not used PMA parts found themselves customers of PMA suppliers.

In the current economic climate, airlines are looking for partners with financial stability. The reason is simple, they want partners that will continue to support them with additional savings opportunities in the near and long-term future. New product development is being driven by customer commitments that are then subject to routine engineering approval. The large commercial aircraft manufacturers such as Boeing have a mutual relationship with PMA manufacturers in that they subcontract their parts out for license fees. Therefore, they have a high degree of control of not only the design and development of the part or assembly, but also who they select to manufacture the item. Nowadays, more and more airline organizations are challenging PMA companies to go into aircraft systems and engine applications.

During the 1980s the FAA started to review and overhaul its PMA procedures and regulations. In 1995 the PMA requirements were clearly outlined. FAR 8110.42 is attributed with clarifying the PMA process where the manufacturers could understand the direction and documents required in order to obtain the relevant approval for parts manufacture and sales.

As many PMA companies are advertising through the Internet, a supplier performance evaluation model applying to each of these networked organizations

will greatly facilitate the airline selection of long-term PMA partners. For instance, The PMA parts finder (a relational database implementation of all known FAA PMA, Canadian PDA, and Australian APMA parts) gives access to about 331,500 FAA PMA approval entries and their 2,100 current, unique PMA holders representing 2,500 company listings (Aviation Data Research, 2006). Also, one may find the list of PMA parts approved by the Federal Aviation Administration from the official site: http://www.faa.gov/aircraft/air_cert/design_approvals/pma/pma_parts/.

It is therefore a major aim of this chapter of developing a practical approach in the evaluation of PMA part suppliers. In the following sections, first the definition and reasons for using PMA are explained. Besides industrial exhibitions and media coverage, most PMA suppliers would promote their products through the Internet. From the literature it can be found that the Mahalanobis Taguchi System (Taguchi, Chowdhury, & Wu, 2001) have been successfully applied in various industries and also an integration of neural network and data mining have demonstrated satisfactory applications in the evaluation of trust in virtual enterprises (Wong & Lau, 2003). Hence a method of selecting PMA suppliers based on an implementation of the Mahalanobis Taguchi System (MTS) through a neural data mining system (Wong, 2006) is suggested.

WHAT IS AN AIRCRAFT PMA PART?

In the aviation industry, parts manufacturer approval (PMA) is both a design approval and a production approval. It is issued for the production of modification or replacement parts, which includes materials, parts, processes, and appliances.

A PMA part is a replacement or modification part for an aircraft that has been produced in accordance with the United States of America's Federal Aviation Administration's Parts Manufacturer Approval process. This process insures that the PMA part is safe and eligible for installation on an aircraft.

All PMA parts must be permanently identified "FAA-PMA" per Federal Aviation Regulations (FAR, 2006). A PMA part must also be permanently identified with the PMA part number, the name or trademark of the manufacturer, and the brand and model of the aircraft it is eligible to be installed upon.

When one sees an aircraft replacement part that is identified "FAA-PMA" he can be assured that part:

- Was produced by a company whose facilities are regularly audited by the FAA and has an FAA approved Fabrication Inspection System (FIS) per FAR 21.303,h;
- Is fully interchangeable with the original equipment manufacturer's (OEM) part as outlined on the PMA supplement per FAR 21.303,f;
- Has been manufactured to the FAA approved blueprint and passed both in-process and final inspections before identification and shipment to you per FAR 21.303,h;
- Is completely traceable: including raw material, processing, treatments, additive finishes, plating, non-destructive testing, and inspection—each step is documented and filed with the dated work order per FAR 21.303,h,9;
- Is eligible to be accompanied by an 8130-3 FAA Airworthiness Approval Tag for TRUE FAA recognized traceability per FAA Order 8130.2.

Typical PMA parts in demand include:

- **Power Generation Systems:** Constant speed drives (CSD), integrated drive generators (IDG), and AC generators.
- **Pneumatics and Environmental Control Systems:** Air cycle machines (ACM), pneumatic valves, and air turbine starters (ATS).
- **Airframes:** Flight control cables, panel seals, gaskets and wiper blades.
- **Fuel Systems:** Engine driven fuel pumps and fuel boost pumps.
- **Turbine Engines and Gearbox:** Pratt & Whitney and GE engines, rivets, seals, bearings, gears, and so forth, including fan reverser parts.
- **Auxiliary Power Units:** Auxiliary power units, including starters.
- **Hydraulic Systems:** Hydraulic power packs and pumps.

REASONS FOR USING PMA PARTS

Every second source replacement part must meet or exceed original part specifications in order to gain

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