

Product lifecycle management in aviation maintenance



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A study on the article entitled “ Product Lifecycle Management in Aviation Maintenance, Repair and Overhaul”. This paper analyses the journal based on inputs which is covered in the course “ Product Design and Development. Further, it explains briefly about Product Lifecycle Management (PLM) and the different phases of PLM over new product development process and also the benefits of PLM over Aviation Maintenance, Repair and Overhaul (MRO) industry. Product Data Management (PDM) application in PLM are also discussed in this paper.

Summary of the article

The journal has three phases of discussion, first phase is introduction, second phase is the about the activity of PLM and the final phase is about PLM benefits in aviation MRO industry.

Phase 1: The competition among the world in new product development leads to data sharing among the enterprise and end users i. e. from ideas, design, manufacturing, customer/installation, service etc. to overcome this PLM is proposed to have proper integration of customer, process, management and data to have control throughout the life cycle period of the product. Nowadays most of the industries have adopted PLM in their design process to the maximum extent when compared to the other process in their product life time.

Similarly in Aviation MRO industry, PLM has not yet adapted to the extreme end compare to the design process in the aviation industry. The PLM in aviation MRO industry can be more worthy as the total life period for an aircraft is approximately more over than 30 years.

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Phase 2: PLM has been divided into two management phases as shown in figure 1. One is related to enterprise and other is related to product data (virtual enterprise). This article focuses on the second phase which integrates computer-aided design and manufacturing through PDM. Product Data Management (PDM) system is the division of PLM, which communicates and gathers the data from the initial process of concept development to the end life of the product. PDM system organizes the computer-aided design tools. PDM archives the customer feedback, engineering data and management data to incorporate the information between the enterprise, customer, service industry and other end user of the product throughout its life time.

Second phase of PLM is further divided into four phases. First phase is concept development in which the ideas from customer are organized and designed. Second phase is design. This concentrates on describing, defining, developing the product design based on first phase and finally analyzing and simulation is carried out in design phase. The third phase is manufacturing and marketing where the production, sales and installation process are carried on to produce a new product. The final phase is servicing where maintain and support, removal or disposal i. e. customer support by means of MRO.

Figure 1: Different Phases of PLM

In general PLM reduces marketing time, improves the product quality in new product as well as in service, centralizes product records, cost and waste reduction. Many industries have applied PLM as an initiative and are mostly used in design process. According to a survey detailed in the article, it shows

that the usage of PLM and PDM in MRO are very inadequate when compared with design.

Phase 3: The adoption of PLM is in very high percentage in automotive and aircraft industry due to life period and the impossibility in prototype; but in aviation service industry the percentage of PLM application implemented is deficient. PLM reduce the normal design and assemble period of aircraft in many aircraft industry. This result in higher percentage of reduction in manufacturing process, but the percentage of reduction in life cycle period is very less.

In aviation industry the profit amount of the aircraft is calculated only based on the total life period. It can be obtained only by proper maintenance and repair. From the article it pronounces that over 17000 commercial aircrafts are active at present. The analysis of budget in aviation MRO industry from the year 2005 to 2010 shows a massive increase. This increase in expense is due to inventories in the aviation MRO industry. The profitability of the aviation industry depends on the life span of the aircraft. To have maximum profit in aircraft industry, they need safe operation, adequate maintenance for the parts. PLM in MRO will minimize the time of maintenance, cost and also increase the total life period of the aircraft.

Maintenance is the process to achieve reliability, safety and overall performance of the product. There are two types: one scheduled maintenance in which the repair process is scheduled according to the time intervals and second one is unscheduled maintenance and it implies when there is sudden breakdown. Earlier the scheduled and unscheduled

maintenance are known as preventive maintenance. In addition to this, maintenance is further classified into “ On or OFF” aircraft maintenance. On maintenance represents repaired within the craft without cancelling the transit. Off maintenance represents the change of parts i. e. overhaul of parts. Here, the temporary part is replaced till the repair process is carried out in the part.

The aim of PLM in aviation MRO industry is to have adequate reliability, safety, proper data from OEM for overhaul and this will result in cost reduction. To acquire product reliability and safety in aircraft, both the maintenance processes are to be carried. For proper maintenance the major thing in consideration is product and part manual from Original Equipment Manufacturer (OEM). In order to minimize the difficulty of MRO the OEM has to provide the sufficient data's like methods of detailed data of the part, maintenance process, fault identification method, tools required to overhaul and also 3D modeling drawing view of the part. These are accomplished by the PDM which make use computer for safe data transfer from OEM to MRO and also by feedback from customer to OEM and MRO industry.

Case studies on different methods of how maintenance, repair and overhaul are carried out in different aviation MRO industry located in Singapore. They described the percentage of inaccuracy in their method of repair. They point out the repair work flow procedure and the different methods of process they carried on for the repair of aviation part. The reason for this inadequate quality of repair is analyzed below in this paper.

Journal relation with “ Product Design and Development”

The journal related to one of the main area “ Product Lifecycle Management (PLM)” which was covered under the lecture “ PLM and Product Planning”.

In addition to PLM “ Product Data Management (PDM)” are also discussed in this article which is a part of PLM.

The information from the lecture about the tools PLM and PDM, gave the input how to develop a new product with an efficient lifecycle time i. e. from the process of concept creation to end life of the product or till recycling of the product and also effective data management system. These concepts are related to the service industry which is at the end phase of lifecycle of a product. This helps to identify the benefits and characteristic of PLM in aviation MRO industry.

Journal Analysis

The impact of Product Lifecycle Management (PLM) in aviation maintenance repair and overhaul (MRO) industry is analyzed in this article. They address the PLM benefits and necessity in MRO industry for effective and accurate quality in repair process. They also analyze the different maintenance process carried on in the aviation industry.

Figure 2: Current Scenario Of Data Flow Without Adoption PLM in aviation MRO industry.

In this article they analyzed how they repaired the high pressure blade and outer cover panel. Also it describes the demerits in their method without PLM. It shows the data flow from the OEM to MRO industry is inadequate as

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shown in the figure 2. Thus it leads to improper Maintenance, repair and overhaul of the part in aircraft. Product Data Management (PDM) system should be applied with PLM for proper flow of information between the OEM to customer, customer to MRO and also MRO to OEM and vice versa. Such feedback from customer end will improve the process in MRO in addition to design of aircraft. Thus the figure 3 represents the flow of data between various processes in aviation industry. It shows the characteristic and benefits on adoption of PLM in service industry. In addition to service process PLM has to be implemented in management activities like Enterprise Resource Planning (ERP) and supply chain management (SCM) in aviation industry to increase the total lifecycle time of the new product.

Figure 3: Implementaion of PLM with Product Data Management (PDM) in aviaton Industry.

The case study done on the aviation MRO industry in Singapore represents the work flow of the repair process carried out on different parts of aircraft. In this, the original part definition data was measured and calculated by coordinate measurement system with the help of a reverse engineer. The measured data was not too accurate when compared to OEM data. This improper method is mainly because of insufficient product data information. This method will lead to poor reliability and safety, life period of the product is thus reduced and also overall life span of the aircraft deteriorates. Further, it leads to poor customer satisfaction and very less profitability to the aviation industry.

The influencing factors that affect the MRO industry are insufficient data sharing between the OEM and MRO. To rectify the problem in aviation MRO industry, it is required to adopt PLM system incorporated with PDM. The author suggests adopting the PLM process in MRO industry as the process implemented in design process shows remarkable result in that sector. In addition to design and service, PLM can also be implemented on various processes in the aviation industry which will clearly show a valuable increase in the reliability and safety of the aircraft. It also increases the overall profitability of the product. In addition to this, PLM provides consistent and precise feedback between the OEM, MRO and customers and also between the partners in the enterprise resulting in optimization of the inventory and further improves the efficiency of maintenance by reducing the non-value added tasks.

Conclusion

PLM activities in the aviation industry have to be analyzed more precisely and research must be carried in various process of aircraft and MRO industry to increase the industries' profit and service. In addition to PDM, Collaborative Product Development (CPD), Concurrent Engineering (CE) tools can also be used in future to increase the total life span of the aircraft and MRO industry.