

Highlights on the Effect of Lean Concept in Aero Industry

Priyanka Garg*

University of Madras, Tamil Nadu, India

E-mail: priyanka.spr116@gmail.com

INTRODUCTION

Of all the domains, aerospace industry carries a wide range of scope for research and development from diversified engineering fields. Every aspect of technology can be equally important to materialize different aerospace projects. Also, the industry expertise holds a great responsibility to coordinate the demands of delivery, cost, quality and the flexibility of every aerospace operation to achieve client's satisfaction. In all the processes, the resources as well as the services are utilized in plenty without compromising on the quality and efficiency of the technology developed. In the meanwhile, a huge amount of waste is realized in various sectors of the aerospace industry. Due to increasing rate of wastage of manpower, resources and time, experts are putting efforts towards dealing with the problem of waste management. Lean concept is one of the most favored methodologies encouraged for process improvement and waste reduction. Mechanism based on Lean principles carries a systematic approach to eliminate wastage of resources, services and thereby reducing the time consumption in aerospace industry.

LEAN CONCEPT

Lean principles are the mechanism for process improvement developed by Womack and Jones based on the original work done by Ohno of the Toyota Motor Corporation to optimize production by eliminating waste. Toyota settled on an effective strategy based on: Kanban-based pull production, eliminate waste, faith in the value and importance of quality,

continuous improvement, belief in the value and utilization of human resources, reducing setup time for machines, integration of suppliers and material acquisition and efficient, cellular layouts with balanced material flow. It has four defining characteristics: waste awareness, continuous quality assurance, just in time and level production.

LEAN CYCLE

The concept of lean production is continuous improvement. It is a long-term journey and efforts. The lean cycle combine and link the Plan-Do-Check-Action (PDCA) cycle

Plan Aspect

1) Mindset change the company awareness and mindset change are the most important for the lean implement. There are many different functional groups in aerospace manufacturing suppliers, including design engineering, production engineering, production control, parts fabrication and component assembly, etc. Those functional groups should change their mindset and stereotype to remove interface barrier within the organization. All departments align the same goal and target to achieve the overall benefit of enterprise.

The key issues of mindset change describe as follow:

Top management commitment is the key successful factor for improvement activities. All improvement ideas need the support from management to become activities and obtain benefits.

- Leader Lead Lean (3L) is the current concept for lean improvement. Due to the management level has more resources, authorization, information, and judgment ability, the management level lead the lean improve can get quick and more results.
- 7 wastes include defects, overproduction, transportation, waiting, inventory, motion, and processing.
- 7 ways are the methodologies to inspire and encourage creativity to generate multiple solutions to meet a customer needs.

2) 5S/TPM

Manpower and machine/facility are the key elements for the shop floor of aerospace manufacturing suppliers. The 5S can ensure the employee disciplines and accountability. The TPM can secure the machine availability and utility. Those two factors can support the steady and smooth production in the shop floor.

Do Aspect

1) Stream flow line/takt assembly line: The main products of aerospace manufacturing suppliers are detail parts and component assembly. The machine/facility of parts fabrication line should follow the process sequence to construct the stream flow line. The rhythm and assembly progress should base on the requirement of production rate and takt time to arrange the number of manpower and assembly jig. The concept of paced production line shows as Figure 3. The warehouse setup the supermarket to release the raw material (plate, metal sheet, tube and composites preprag) to part fabrication, include machine, sheet metal, tubing and composite shop uniformly and sequentially. These flow line of parts fabrication shop pull and produce the raw material into required dimension, contour and function, and then flow to surface treatment for coating and painting. These

parts go to kitting center and ready to supply the kitting board to assembly line follow the production rate and takt time. The assembly activities include drill, rivet, and seal. Design a moving line to combine and link those operations together.

Check Aspect

1) Aligning the IT system the production cost control is critical to evaluation the gain or loose of different program. The working-hour collection of each shipset aircraft number will be monitored and compared with the value come from learning curve. Once the working-hour of process or machine was improved by lean activities, the improve results (standard working-hour, lead time, transportation, space, downtime, etc.) should revise in IT system. Also the lean implement office will monitor the long-term implement trends to ensure the lean activities have been follow-up and flow down.

Action Aspect

1) Strategic/system transformation After the team work of lean activities, the work definition, process, interface of each functional group will be changed. The process flow/layout may change after value stream mapping and shop floor simulation. The management philosophy may change after the team brain storming and several times simulation. So after the lean cycle, management should consider the Strategic/System Transformation: The key issues of Strategic/System Transformation describe as follow:

- Organization and functional group integration to reduce the interface and barrier.
- Personnel training: include on-job-training and multiple skill training.

LEAN GOALS AND STRATEGY

The role of the leaders within the organization is the fundamental element of sustaining the progress of lean thinking. Experienced kaizen members at Toyota,

for example, often bring up the concepts of Senpai, Kohai, and Sensei, because they strongly feel that transferring of Toyota culture down and across Toyota can only happen when more experienced Toyota Sensei continuously coach and guide the less experienced lean champions. One of the dislocative effects of lean is in the area of key performance indicators (KPI). The KPIs by which a plant/facility are judged will often be driving behaviour, because the KPIs themselves assume a particular approach to the work being done. This can be an issue where, for example a truly lean, Fixed Repeating Schedule (FRS) and JIT approach is adopted, because these KPIs will no longer reflect performance, as the assumptions on which they are based become invalid. It is a key leadership challenge to manage the impact of this KPI chaos within the organization. Similarly, commonly used accounting systems developed to support mass production are no longer appropriate for companies pursuing lean. Lean accounting provides truly lean approaches to business management and financial reporting. After formulating the guiding principles of its lean manufacturing approach in the Toyota Production System (TPS), Toyota formalized in 2001 the basis of its lean management: the key managerial values and attitudes needed to sustain continuous improvement in the long run. These core management principles are articulated around the twin pillars of Continuous Improvement (relentless elimination of waste) and Respect for People (engagement in long term relationships based on continuous improvement and mutual trust). This formalization stems from problem solving.

CONCLUSION

The lean concept not only can apply in the production process of aerospace industry, but also in the business process. Especially for aerospace manufacturing suppliers,

they have to reduce their cost to increase their competitiveness. The concept of lean production is continuous improvement. It is a long-term journey and efforts. The lean cycle combine and link the Plan-Do-Check-Action cycle. The Lean Implement Model includes four categories (human resources, machine, method, and process). Through the continuous lean cycle, the scope/level of lean topics and environment will become wider/higher than before. The Lean activity is a step-by-step and spiral upgrade process. The goal of Lean activity implement is to strength the management performance of enterprise. Through the top management commitment and companywide involvement, the resources can be aligned and focused. The ultimate goal of lean production implement is construct the learning organization and achieve the continuous improvement. Thus, the aerospace manufacturing suppliers can increase their competence in the competitive market.

REFERENCE

1. Hsien-Ming Chang, Chikong Huang, and Chau-Chen Torng, Lean Production Implement Model for Aerospace Manufacturing Suppliers, *International Journal of Innovation, Management and Technology*, April 2013; Vol. 4, No. 2.
2. V. V. S. Nikhil Bharadwaj , P. Shiva Shashank , Munigala Harish, Parthasarathy Garre, A Review On Lean Manufacturing to Aerospace Industry, *International Journal of Engineering Research and General Science*, July-August, 2015; Volume 3, Issue 4, ISSN 2091-2730.
3. <https://deepspaceindustries.com/advanced-space-resource-utilization-technology-projects-supported-by-new-nasa-awards-to-deep-space-industries/>
4. https://en.wikipedia.org/wiki/Lean_manufacturing.