



Joint Strike Fighter

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# THE LEAN ENTERPRISE— A MANAGEMENT PHILOSOPHY AT LOCKHEED MARTIN

*MICHAEL JOYCE AND BETTINA SCHECHTER*

In 1999, Lockheed Martin developed an approach called LM21, for Lockheed Martin in the 21st century, to identify best practices for increasing efficiency and improving financial and operating performance. Leaders soon realized that best practice sharing was just one means to a higher end. The ultimate goal is to create a system that consistently achieves excellence for our customers, shareholders, and employees. We selected and implemented the management philosophies called Lean and Six Sigma. This article describes the Lean Enterprise at Lockheed Martin and the steps taken to make it a reality.

**L**ockheed Martin is the world's largest defense contractor, a company built by a strategic vision of merger and acquisition that characterized the mid- to late-1990s. Rooted in the heritage of 18 different companies, Lockheed Martin set out in 1999 to identify and share best practices to increase efficiency and improve financial and operating performance. While this approach, called LM21 for Lockheed Martin in the 21st century, did identify many best practices, leaders and employees alike soon began questioning the real end objective of the exercise. The realization is that best practice sharing is just one means to a higher end. The ultimate goal is to create a system of work, or operating system, that consistently achieves excellence for our customers, shareholders, and employees.

In early 2000, the title of the effort was changed from LM21 Best Practices to LM21 Operating Excellence. We then looked at the challenge of defining and achieving Operating Excellence and found that, in addition to transferring good ideas, we needed a consistent set of principles and behaviors that would drive

us to continuously improve and continuously learn. When we looked both internally and externally for a set of proven concepts, we selected the management philosophies called Lean and Six Sigma. Many of the Lockheed Martin businesses were familiar with Lean and/or Six Sigma and had been using these tools to eliminate waste and variation in their isolated processes. LM21 quickly became the common corporate drive for application of the Lean and Six Sigma philosophy and methodology throughout the Lockheed Martin enterprise, with coordinated efforts in training and standard application of the tools.

Almost four years later, LM21 has become a workplace standard and a mindset. The Lean/Six Sigma principles of process improvement have migrated to every business function: Finance, Business Development, Procurement, Operations, Human Resources, Cash Management, Contracting, and Engineering, to name a few.

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More than anything, LM21, the pursuit of Operating Excellence, is a management mandate with active participation of every employee. Leading this charge to Excellence are the corporation’s top managers. More than 8,000 of them—ranging in level from the chief executive officer to corporate executive and program managers—have participated in a 4-1/2 day Lean Leadership training program. The program requires leaders to complete a real-time transfer of learning into action by conducting an improvement event in their business area. These actions, coupled with the work of more than 6,000 employees trained as experts in the principles of Lean/Six Sigma, have generated thousands of improvements that have touched virtually every one of our 125,000 employees. Significant in this approach is the engagement of our customers who are also trained and participate in improvement activities with us. It is most evident that Lockheed Martin has transformed its operating system in continual pursuit of a Lean Enterprise.

In the remainder of this article we will describe the Lean Enterprise at Lockheed Martin Corporation and the approach we have taken to make this a reality in our business. We believe the reader can use the methodology and path we have taken to drive Operating Excellence in their own domain.

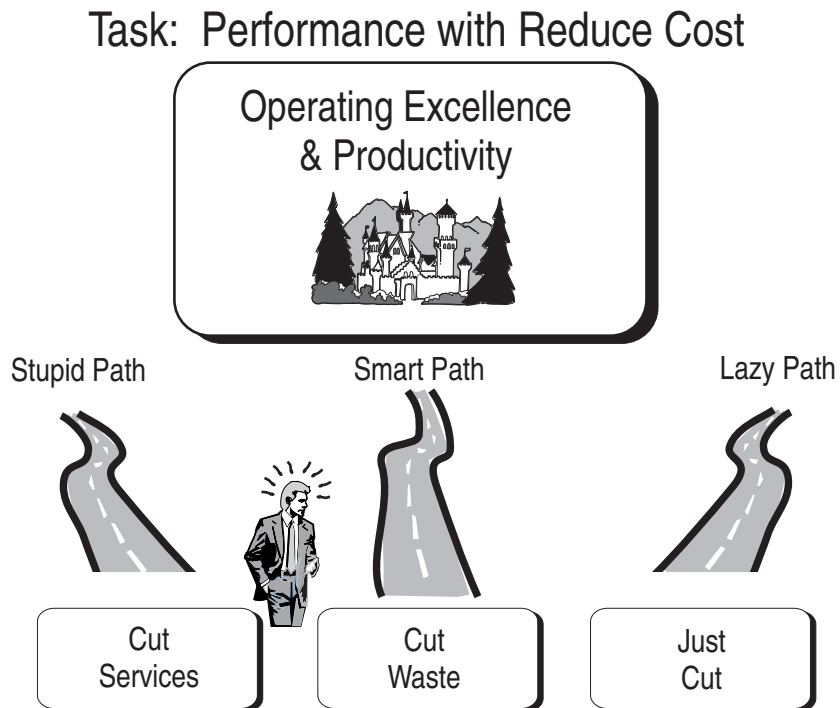
## LEAN ENTERPRISE—A MANTRA OF CONTINUOUS IMPROVEMENT

At the core of the Lean Enterprise is a philosophy of continuous improvement of the work that we do. Regardless of the task—compile data for management reports, assemble a wiring harness, or schedule air combat training—“make it better” is the mantra.

We drive this engine by insisting on a year over year reduction in cost in every program and department. Faced with this challenge, leaders can choose from a short list of scenarios. (See Figure 1.)

**Scenario One: Cut budgets.** How many times does management edict an across-the-board percent-reduction in budgets? Shave 10 percent or 20 percent. Just cut. Lazy managers do this by taking the easiest path of asking everyone equally to cut back. It is a lazy approach because it requires little skills or knowledge of the work; unfortunately, it also leads to unintended consequences as cut to value added work would result in poor program performance. This is the lazy path.

**Scenario Two: Cut service.** How often are costs trimmed by eliminating a particular service or feature? Certainly an immediate reduction arises. But what if the curtailed service is something the customer wants and is willing to pay for? What if the service is something your competitors can also supply? So the



LM21: Lean Processes that Operate at Six Sigma Capability

**FIGURE 1. COST REDUCTION SCENARIOS**

unintended consequence is a loss of or dissatisfaction by your customer base. This is the stupid path to change.

**Scenario Three: Cut waste.** The path of Operating Excellence and the key to a Lean Enterprise is attacking waste. When given the goal to take cost out, managers need to carefully examine an entire value chain to identify wasted activity and sources of variation and then work with their entire organization to eliminate them. This is the smart path.

So, how do you cut cost smartly and provide an environment of continuous improvement? Lockheed Martin's answer is a unique blending of Lean Thinking and Six Sigma methodology. The resulting formula, called LM21, has made a tremendous impact to the Corporation.

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LM21 is the *how to* guide for cutting cost and improving quality and customer satisfaction. It builds on the five principles of Lean as a set of leadership and decision making mandates that define excellence:

1. Customer Value – define it from the customer's perspective.
2. Value Stream – identify all activities used to make a product or provide a service.
3. Flow – create a system where value is continuously added. Clear away obstacles that don't add value or clog the value stream.
4. Pull – initiate work only at the demand and to the specific specifications of the customer.
5. Perfection – continuously refine the process to improve efficiency, cycle time, costs and quality.

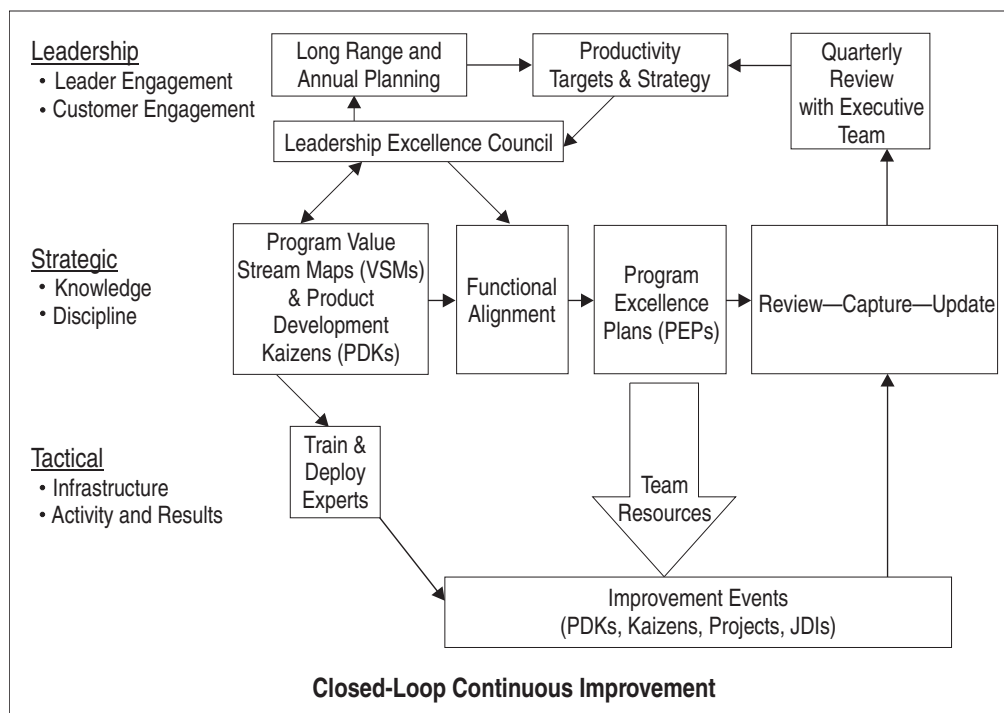
Principles of Six Sigma—which embody the fifth principle of Lean, *Perfection*—complement this methodology, honing processes to make them more reliable, repeatable, and predictable. Six Sigma is a data driven methodology that focuses on driving to perfection all business, technical, and operational processes and results—encompassing defect prevention, eliminating variability and mistake proofing through the use of data driven tools. The merging of these two methodologies provides a powerful and proven approach that engages the entire workforce in continuous improvement.

This is the philosophy and toolset driving Operating Excellence at Lockheed Martin.

## INFRASTRUCTURE: A FOUNDATION FOR THE LEAN ENTERPRISE

To institutionalize LM21, Lockheed Martin has developed an infrastructure and management strategy and approach to introduce principles; demonstrate a clear need to continuously improve; set management expectations for improvement; provide the tools, talent, and other resources necessary; and ensure follow-up and that the savings opportunities are realized. This infrastructure links **Leadership** with a **Strategic** focus to a **Tactical** deployment—with all three needing to be present and working together in a closed-loop environment (where there is continuous feedback of expectations and results) to be effective. (See Figure 2.)

A question to be answered in promoting a Lean Enterprise is how and where do you get started? Early in the LM21 maturity path, emphasis was placed on training and holding events (events are activities in varying duration of length that engage the experts and people who do the work, to change their process based on the principles of Operating Excellence) to get as many employees and leaders as possible to experience the Lean and Six Sigma tools (e.g., process mapping, statistical analysis, time analysis, defect analysis). This reinforces the belief that *to see is good, to do is better*. Once people have experienced success with the tools, they become believers and they are champions for change. Selection of processes and opportunities to attack, however, were often tactically driven, and while results were achieved (in terms of dollars saved or cycle time reduced), there was little integration of efforts with each other or with the business’s strategic plan.



**FIGURE 2. LM21 OPERATING EXCELLENCE DEPLOYMENT**

As the capability of the Corporation grew to hold productive events and sustain results, the LM21 toolset grew with the addition of the **Value Stream Map (VMS)**. This tool gives leadership a strategic look at its value streams (Lean principle number two) and the ability to see waste in the operating system at a macro level. As part of the process, leaders identify and prioritize the improvement events necessary to eliminate the waste, such as Kaizen events (an activity where a team is chartered for a period of 3–5 days, to identify waste for a given process and implement immediate, sustainable solutions for waste elimination/reduction), other VSMs, projects (an activity that can occur over several months focusing on a process improvement requiring extensive work and change) and **Just Do Its** (short term projects that require few resources and limited amounts of time and resources to complete). The result: a plan is in place to strategically identify and eliminate the waste that most interferes with the ability to deliver value to the customer. (See Figure 3.)

As VSMs became widely used across Lockheed Martin and events were more clearly linked to operating plans and business objectives, each business set up another important facet of its infrastructure—**Leadership Excellence Councils**. Comprised of senior leaders within each business, these councils meet regularly to discuss LM21 progress and determine where resources should be allocated to have the biggest impact in the business. The councils also assign the talent (in this case, Green Belts and Black Belts) to lead and facilitate successful events and commit resource allocation when new opportunities are uncovered.



**FIGURE 3. LEAN PROCESSES WITH SIX SIGMA CAPABILITY**



Within Lockheed Martin, the great majority of our customer value comes via a customer program and program office. Therefore, the key ingredient in the strategic application of this process and resource is the **Program Excellence Plan**. The plan looks strategically at the program, its value stream, and its performance compared to what the principles of excellence demands and identifies gaps and plan improvement activities.

While much of this effort is aimed at programs that are already engaged in producing products and services, Lockheed Martin sees tremendous opportunity to work on the front end of the product lifecycle, in the proposal and design phases. LM21 has created a tool called Product Development Kaizen (PDK) for this critically important part of the program. PDK is a generic term for three related tools: Pre-Proposal Kaizen, Pre-Design Kaizen, and Pre-Production Kaizen, which help define the enablers needed to deliver a product or service in the time, cost, and performance the customer wants. These tools, as their names suggest, are applied at different stages of the development process of a product or service.

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The new objective achieved in using this tool is to apply the same system engineering disciplines we use on our products to design the systems of work we will deploy on new programs. These tools have had a tremendous impact on Lockheed Martin’s success in winning new business with competitive pricing and improved profit margins.

Lockheed Martin emphasizes the continuous nature of LM21 improvement by setting annual savings targets that equate to a percentage of sales. Each year, Lockheed Martin businesses are required to look for ways to improve their processes by eliminating additional waste. This pursuit of Excellence will never end, and looking for and eliminating waste becomes a way of doing business—a management philosophy.

Lockheed Martin has also worked closely with hundreds of suppliers in the pursuit of Excellence by engaging them in events, training, and planning that improves the entire supply chain. As much as 60 percent of program costs can come from the supply chain. The company has taken strategic looks at its supply chains and identifies key suppliers that have a track record of success and provide valuable services. Lockheed Martin then partners with them to identify opportunity to eliminate waste so that cycle times and costs can be reduced.

## PEOPLE ENGAGEMENT

Central to the LM21 approach is measuring reality; and who better to know it than those closest to the products and services. Lockheed Martin is about people—from corporate executives to front-line workers. Embracing the philosophy of Just Do It is one of the ways people are engaged in LM21 and the pursuit of Excellence.

The concept of *Kaizen Management* is a major element in which leadership provides direction and then allows those who do the work to change their process in a formal event. All employees have accountability to act and behave following the five principles of LM21. In this model, leaders stay engaged and connected throughout, and front-line workers are encouraged and supported to make changes to continually improve their work environment.

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In this way, Lockheed Martin’s strategy is characterized by a top down and bottoms up approach, which reinforces that LM21, at its core, is a management philosophy. A knowledgeable and engaged leadership sets improvement strategies linked to business goals, sets targets and objectives, and provides resources. Managers and employees use the LM21 tools with the help of trained experts to improve their work areas. All 125,000 Lockheed Martin employee, managers and leaders are marching in the same direction, in pursuit of Excellence.

## ACHIEVING OPERATING EXCELLENCE

While definitions for Operating Excellence are plentiful, a common thread is delivering on customer expectations—providing results. LM21 has helped Lockheed Martin excel in this capacity. Not only has the company saved itself and its customers billions of dollars, but LM21 actually helps improve customer relationships. This has been measured in improved customer ratings and satisfaction with current programs and services, the capture of repeat business, and the winning of new business. We have seen this work in major acquisitions, such as the Joint Strike Fighter (JSF) or F-35 Fighter, where customer timing and acquisition costs required new ways of doing business. By continually applying these concepts, even when our customer is highly satisfied, we have seen tremendous opportunities open. The

first principle of LM21 mandates understanding value from the customer’s perspective—to do this, you have to know your customers and their needs. Our company slogan, “At Lockheed Martin, we never forget who we work for,” reflects this passion for customers.

And, in today’s world, customer needs change rapidly. Lockheed Martin uses LM21 to develop an operating system that has the *discipline* to deliver results reliably and the *flexibility* to change and grow in step with the customer.

Operating Excellence at Lockheed Martin is not an option; it is a business imperative. Customers expect it in the products and services they receive. Shareholders expect it in their investments. Employees expect it in their on-the-job challenges and workplace environment. LM21 enables the success of Operations Excellence and requires all Lockheed Martin people to be fully engaged and connected.



**Michael Joyce** is Vice President of Lockheed Martin in the 21st century (LM21) Operating Excellence. He was formerly the Vice President of Operations for the Aeronautical Systems Business Unit responsible for overall operations and supply chain management across the business unit. He joined Lockheed Martin in August 1997. Joyce has over 25 years experience in a broad variety of aerospace systems. He holds bachelor’s degrees in mechanical engineering and mathematics from Columbia University in New York City and a master’s degree in mechanical engineering from Rensselaer Polytechnic Institute in Troy, New York.

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