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**Lean Principles are the Smart Path to Lower Costs
and Greater Productivity**

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Leadership Perspective

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Lean Principles Are the Smart Path to Lower Costs and Greater Productivity

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The path toward Lean at Lockheed Martin

Lockheed Martin employs approximately 135,000 people worldwide and is engaged in the research, design, development, manufacture, and integration of advanced technology systems, products, and services. Nearly 80% of Lockheed Martin's business is with the U.S. Department of Defense and U.S. federal government agencies.

Lockheed Martin is a great company. We're proud of our heritage and we want to build on that. We ask ourselves, "If great things have happened in the past that have allowed us to be here today, how do we stay excellent in the twenty-first century?" Our answer to that question led us to utilize Lean principles and practices as an ongoing process.

We've created a path at Lockheed Martin that we call LM21, which stands for Lockheed Martin in the twenty-first century. From a management process viewpoint it is a "Lean" path. In doing this, and by calling it LM21, we customized Lean. Customizing, incidentally, is something I would strongly recommend that all leaders do if they intend to use Lean in their organizations. It is important to personalize the Lean path for one's own company to make it most effective.

Lean has enabled our growth

A few years ago Lockheed Martin was a \$24 billion company with 120,000 employees. We are now a \$31 billion company with 135,000 employees. So the idea that you can be the best *and* grow without downsizing is in fact true—not a given, but true if you work at it.

Since the year 2000 we have had a \$1.5 billion positive cash flow that has allowed us to reinvest in technology, acquire companies, pay down debts, and buy back shares. So one message we can share with everyone is that if Lean is a cornerstone of your business philosophy and growth strategies, then these things can come to be. Of course, it doesn't hurt that we make the neatest things on the planet!

Three paths to better performance and lower costs

As leaders and managers we face constant pressures from our customers. They say, "I want better performance from you in terms of quality, delivery, and things that I value; *and* at the same time I want you to lower your costs. You've got to do both." As leaders faced with that dilemma, what do we do? I think there are three

Three paths to better performance and lower costs, continued

options, three possible paths to increased performance and lower costs.

1. A “lazy” path, one that creates unintended consequences

The lazy path goes something like this: Your challenge is to reduce costs by 10%. As the leader, you call everyone into a special meeting and say, “Folks we’ve got to cut our costs 10%. So I’m cutting all your budgets 10%. Meeting over.”

I’m sure we’ve all been to meetings like that at some point in our careers. I call this the lazy path because it’s simplistic. You don’t spend a lot of sleepless nights figuring out where and how to make the right cuts.

Now your finance folks might love this path, because you’ve delivered instant gratification. The budget is cut 10%—it’s there on the balance sheet. The problem with this path is that it is one of unintended consequences. You settle for instant gratification, but bad things happen later. It’s carelessness and laziness, and not what we get paid for. We’re paid to bring our brain to the game. So we’ve blocked that exit to everybody at Lockheed Martin. We can’t use the lazy path anymore.

2. The “stupid” path, one that puts customers at risk

What else can you do to cut costs by 10%? Some choose the stupid path, which goes something like this: “I know what I’ll do. I’ll cut that maintenance program,” or “I’ll get rid of that field services office.” Here you’re cutting valued customer services. Now again, the finance folks may love it because it’s instant gratification, but it is another path of unintended consequences because you put your customer at risk. So we’ve also blocked that exit ramp at Lockheed Martin.

3. The path to excellence

With other options gone, what’s left? It’s the path to excellence: *Get rid of the waste in everything you do and in how you spend your day.* The reason people don’t jump to this path right away is because it’s the hardest. It makes you roll up your sleeves and put some skin in the game. It’s not instant gratification: It’s slow and steady. But it’s the only path that leads to quality, on-time delivery, and lower costs at the same time. And that is what Lean is all about.

Five requirements for Lean thinking

The questions for leaders at this point are, “How do I do it?” and “What will I have to do that I’m not doing today if I want to get on this path to excellence?” There are all kinds of answers and definitions. We’ve taken ours from Daniel Jones and James Womack, who wrote *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, because we think they’ve gotten it right.

Here are five principles of required behavior from every leader in Lockheed Martin. It’s easy to list principles like this, but to live and breathe them and do them every day is a challenge.

1. *We look at all the work we do and ask, “Is it value enhancement or is it waste?”*
And to answer that question, we take an external customer view of value.
2. *Do we know our “value streams” in detail?* Do we really know the painful reality

Five requirements for Lean thinking, continued

of how work *actually* gets done? Not how we hope it's getting done, or think it is, or feel it is. *We have to measure it.*

3. *Optimize all our systems for "flow."* That means optimizing the flow of molecules that become product and optimizing the flow of data that become a decision.

Unfortunately, most of the systems we've inherited at Lockheed Martin were not designed with flow in mind. Our assets were all in the wrong place. The way we'd organized our structure was probably not correct, and we had to do something about it. This is not to curse the past—people did what they had to do in their environment at the time. But what makes us think that the organizational constructs we've inherited, which were probably great thirty years ago, are still valid in the Internet age when we can move information around at the speed of light and put it anywhere? We challenge these constructs to see if we can optimize the flow of data a bit better.

4. *The fourth principle is the time element.* Wasting time is an enemy. We've got to measure cycle times and everything has to get shorter. In our businesses, for example, engineering changes that are driven by customers are a fact of life. I once heard it said that life would be easier if there was no such thing as a customer. But we're all in it because there *are* customers, and they do in fact change their minds. The only thing stopping us from delivering what the customer wants instantaneously, if they change their mind, is the time it takes to respond. So an inefficient use of time is the enemy. Everything has to shrink. And everything has to be measured against the element of time.
5. *The fifth principle is perfection.* No matter how good it is, you make it better. This requires two things of leaders: (a) you need to have management systems that tell you rapidly when you're not on the design intent anymore. (b) You understand the science of mistake-proofing and you permanently remove the cause of those errors from the system as you experience them. That's the perfection mandate. And it's important to establish a definition for perfection and tell everyone what has to be done to achieve it.

Understand how value is created in your process flow

A great way to get started with Lean is the value-stream method, a time-value analysis of a value-stream map. In the words of the great American philosopher Yogi Berra, sometimes you can see a lot just by looking. So you can "strap yourself to a purchase order," for example, ride through your system, and record the observable data. It's a good way to see where your value stream is aligned to your core principles and where it is not.

We used this technique at Kelly Air Force Base in San Antonio, Texas, where we handle the overhaul and repair of two types of jet engine that the Air Force uses. This used to be a government-owned, government-run facility, and we have reasigned all the employees to Lockheed Martin, and taken over the assets.

Understand how value is created in your process flow, continued

The first thing we did was map a macro view of how product actually goes through the base. Then we said, “We can do better.” And we have. When we started, 1.8 million square feet of space and twenty-nine buildings were being used. Today we use just under a million square feet of space and five buildings. Clearly it is less costly to operate in half the space and twenty-four fewer buildings. That’s the easy part. What’s difficult is taking that bold step and saying, “I’m going to change this reality *while* I’m overhauling engines,” because there’s no time-out in this game.

The bottom line is results. With the same assets and the same people, we’re now getting 80% more throughput and 45% less labor. The only thing that changed was the management philosophy. It’s the same people and the same asset base using a different management philosophy based on Lean principles.

Taking Lean to information management

We’ve applied these principles to information management as well. It used to be that when an aircraft was brought in for overhaul we’d climb through it to document its current condition and then document any additional items we might want to fix during the overhaul; this was all a paperwork process. Today, the mechanic documents the current condition of the aircraft when it arrives with a simple hand-held device. He can “tap” on a picture of the airplane, and then tap on the section he wants to look at—the wing, for example—then tap on the wing to get to the part number. He can document the current condition of the part—whether it needs to be fixed or requires work over and above normal maintenance, and this goes to the customer for approval. The result is that we reduced a five-day process to two days, using a simple hand-held device. These are the types of technologies that are available to us today that we can leverage and use, but only by conscious design from management. Otherwise, these changes are not going to fall out of the sky into your business processes.

Lean principles help the Hubble Space Telescope

These principles also work in areas other than manufacturing. For example, Lockheed Martin built, launched, and now services the Hubble Space Telescope. We took a look at how we do software uploads to the Hubble and asked ourselves whether we could do it more efficiently. We ran some kaizen events. We looked to optimize flow and the result is that we took operational deployment from eleven weeks down to five. Clearly these principles apply to all elements of work, not just the physical movement of molecules.

Product development kaizen

We have a tool that we call product development kaizen, because we’re in the invention business for our customers. One example of a new product we’ve just co-created is essentially an unmanned submarine that can be launched from the torpedo tube of a submarine. The sub can stay in deep water while the unmanned sub does surveillance in the shallows and can then be retrieved by the submarine.

Product development kaizen, continued

What's important here is to apply all this thinking toward looking forward, and not be trapped by the assets you currently have. For the submarine project we took a look at the entire system of work, all the way from the design to the systems that we were going to use to make it happen. The bottom line is that we ended up taking 53% out of the lead-time to create that product. We took \$200,000 out of the nonrecurring costs and \$150,000 out of the per-unit recurring cost. So applying this to the forward-looking product development process works also.

Workers are entitled to an environment designed for success

I want to emphasize the absolute criticality of mistake-proofing and visual controls. One of the fundamental premises of Lean is that all your employees want to do a good day's work. There's always that fringe personality we have to deal with, but for the most part, people show up wanting to do a good day's work. Your obligation as a leader is to create a work environment where they can succeed at that.

Commitment and training from the top on down is key

When it comes to training employees at Lockheed Martin, our management philosophy requires us to question whether all of us have learned what is being taught. In the beginning, very few people did, so we made a commitment that by 2004 at least half our population would be involved in a kaizen event or Green Belt project in Six Sigma, and that all of our leaders would participate in formal training classes. I'm happy to say that we're on the path to achieving those goals.

The CEO of Lockheed Martin, Vance Coffman, took the four-and-a-half day leadership training that we put together, and then he mandated that everybody below him and every leader in the corporation had to go through the same class. The groans were audible. People said, "I have no time for this!" But he shot back, "I cleared my calendar for four-and-a-half days to do this, and I'll compare my calendar to anybody else's in the corporation. Don't tell me you don't have time to do this."

So the training message is clear. It's for *all* of us. This is a leadership philosophy. If it is not shared from the top on down, it will not work, because it is going to challenge the leadership philosophies with which people come preprogrammed.

One-piece flow and a co- operative attitude

One-piece flow (the movement of products through the manufacturing process one unit at a time, in contrast to batch processing) is an easy thing to say, but a hard thing to do because it takes *everyone's cooperation* to make it happen.

We actually did one event that changed the flow in building F-16 aircraft, and at the end of the day somebody documented that twenty different functional organizations had to contribute to make that event work. Everybody from legal, to contracts, to subcontract management, to operations, to supply chains, to engineering, HR—you name it! They all had to contribute in a cooperative way to make things work. The point is that if you're trying to do Lean in your organization and everyone is not being pressured to participate, the changes will not work. So I would push very hard to get your leaders to do the training if you're serious about it. And start at the top.

Shingo is a resource

There is help out there, too. The Shingo Prize process is a good standard for measuring your company's progress. It makes you ask, "Are we really getting this done? Are we really making progress?" The Shingo examiners offer honest feedback on how well your company is doing, and they'll give you a score. I'm proud to say that our F-117 Nighthawk product was a Shingo Prize winner last year. The F-117, as you may know, is the first-strike aircraft in the U.S. Air Force. It is a stealth fighter that goes in unescorted to take out critical targets at the start of every engagement. It's been deployed in every one of the engagements that the U.S. has been involved in the last couple of years.

Lean takes ability, courage, and tenacity

If you want to achieve Lean operations in your business, it is essential to have three attributes, which can be consolidated into the acronym, *ACT*.

A - Ability. First, you must have the ability to see waste in all its forms. Ask, "Where is the waste?" We find it, and then make sure we're all seeing it the same way. After this, things get a little harder.

C - Courage. You must have the courage to act. Discovering and dealing with waste *is* going to challenge management philosophies that have been resident in the company for a while. And to declare things as waste in that environment takes an act of courage.

T - Tenacity. You need tenacity to get it done. There are going to be a lot of hurdles, and you'll encounter excuses such as, "We don't have time for this." You have to be the person with the tenacity to say, "This is the right thing for us to do. And we're going to make it happen."

About the author

Michael Joyce is Vice President of LM21 Operating Excellence at Lockheed Martin. He is responsible for the continuous improvement of all processes across the Lockheed Martin Corporation. Joyce was formerly the Vice President of Operations for the Aeronautical Systems Business Unit, where he was responsible for overall operations and supply chain management. He was also responsible for the continued implementation of processes to achieve maximum competitive advantage on critical programs such as the Joint Strike Fighter, F-22, C-130-J, F-16 and others. Before joining Lockheed Martin, Joyce was Vice President of Manufacturing for AlliedSignal Aerospace in Torrance, California. He implemented the company's Six Sigma program and introduced the Lean manufacturing methods of the Toyota Production System to the mechanical and electronic aerospace product lines.

About this article

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