

The Real Power of Lean Military Transformation

Aligning today's lean initiatives for long-term, collaborative improvements.

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Readiness for challenge and change. Doing more with less. Focus on quality and the customer. All familiar territory for manufacturers, these challenges are shared by leadership in the military and their suppliers, as they learn to create and strengthen a lean culture. This article offers an overview of “military lean” in several contexts.

Leadership for Enterprise-wide Transformation

Military senior leadership support and buy-in — “walking the talk” — is needed for lasting, enterprise-wide cultural change, as in private industry. The U.S. Air Force, for example, is adopting the fundamental concepts of lean across the organization, according to Lt. General Don Wetekam,

Deputy Chief of Staff for Logistics Installations and Mission Support, U.S. Air Force.¹ He noted that lean had broadened its reach from three Air Logistics Centers (Robins, Tinker, and Hill Air Force Bases [AFB]), where lean initiatives brought dramatic improvements in cycle time and other key measurables. Successful MRO (Maintenance, Repair, and Overhaul) operations share characteristics such as single-piece cellular flow, visual controls, a flexible workforce, resources at the point of use when needed, right-sized facilities and equipment, and proactive scheduling of workload to meet customer requirements.

For example, a number of Rapid Improvement Events (RIEs) during the past five years at Robins AFB enabled personnel to trim the average overhaul cycle time for C-5 aircraft from 339 days to less than 180 “and heading for 120,” said Wetekam. It used to take more than ten percent of this time or 39 days to do the inspection of the aircraft before repair work started. Inspection time now averages 21 days. While recounting similar improvements at all of the logistics centers, Wetekam acknowledged, “The bulk of the work is still in front of us.”

In Brief

Lean transformation in the military is much more than building muscle and might. It is about learning to see processes more clearly and consistent leadership for cultural change.

The call for leadership's direct involvement in lean transformation was seconded by George Falldine, director, Plans and Programs, Warner Robins Air Logistics Center at Robins AFB in Georgia. Robins AFB is part of the Air Force Materiel Command, with responsibility to develop, acquire, and sustain AF weapons systems. For example, they are working on airborne lasers in the development stage. Their 6000-7000 workers overhaul everything from a huge C-5 to wings on F-15s, black boxes on planes, even small radios. Many employees at the logistics center are civilians, although all leadership is military and there is a new commander every two-three years. As of late September 2006, there were 12,547 civilians and 2022 military in the Air Logistics Center. The overall base population is more than 27,000.

"You need leadership to stay the course, to maintain constancy of purpose," Falldine said. "Lean has to be top-down driven. Otherwise, it may be perceived as the 'flavor of the month.' People are not born with Toyota DNA; you need to inject it, for leadership and in turn for all your employees."

Fundamental Cultural Change

"We started lean back in 1999 here at Warner Robins in our repair facilities," Falldine said. "We are learning to adapt and use the Toyota Production System (TPS) and the real power behind it. Looking at processes is not new; we had been involved in (W. Edwards) Deming's concepts since the 1970s. The real power of TPS is really the thought process behind it, the idea of being able to see work so that you can identify and eliminate waste."

"We are talking about cultural change," Falldine continued. "Everyone talks about culture, but nobody tells how to change it. Human inertia is a powerful thing. A huge, deep paradigm shift that lean has brought is how to identify waste — asking whether an activity is valued by your customer." Resistance to such an attitude change also can be powerful, he noted. Reasons range from fear about losing jobs

to the uncertainties when an engineer or other knowledge worker feels threatened by the use of standard work practices.

"Cultural change is not easy. It is the collective attitudes, beliefs, and assumptions that drive our behavior," he continued. "All organizations tend to have cultures. The challenge of inertia — reluctance to change — affects acceptance of new ways. Another problem can be the attitude, 'I don't have time to do this because I have to get my work done.' We are asking for a fundamental change in the ways people work."

Potential in Knowledge Work

Lean concepts have extended to two other Air Force centers doing depot-level maintenance. Reducing turnaround time for overhauling an airplane is critical when the goals include returning it quickly to the field and meeting budget targets. For example, every five to seven years, C-5s are brought in for depot maintenance. Workers tear them apart and put them back together, replacing and repairing parts as needed. Each overhaul takes thousands of hours. "We have shaved well over 100 flow days from our average cycle time, cutting the number of days here by a third from 2000 to 2006," Falldine said. "For fiscal year 2006, we have been 100 percent on time with C-5 overhauls with zero schedule changes. (See Figure 1.)

"Now we are expanding lean into transactional (such as purchasing) and knowledge work," said Falldine. "For example, program managers are responsible for keeping C-5 planes (built in the 1960s) flying and meeting their missions. Analyzing the related data is knowledge work. Knowledge work is where lean has the greatest potential. It is value-added work, where information is packaged in a way that makes sense to leaders in the organization of information."

The need to do value stream mapping (VSM) in knowledge work initially may not seem logical to some knowledge workers. Again emphasizing that lean is a way of looking at the way work gets done and what offers value to the customer, he added,



Figure 1. C-5 programmed depot maintenance is performed at the Warner Robins Air Logistics Center.

“Knowledge work is about asking and answering questions. You need standard questions, in the right order, to complete an assignment and make it more efficient. For example, when you are acquiring a new weapons system, you can use an acquisition strategy panel for each one — a standard list of questions — that walks you through. That applies for the full spectrum of a system, such as an airborne laser. The faster we can design a workable technology and deliver it and make it affordable, the better.”

Another lean administrative application cited by Falldine is reducing the time to fill vacant positions. “We just went through a series of programs where we looked at different jobs with different skill requirements,” he said. “We found that we literally had hundreds of job descriptions. We have standardized and reduced the number of job descriptions, decreasing the amount of time needed to fill and track jobs.

“We’ve also evaluated some of the work done in my own organization,” said Falldine, who reports to the Robins AFB commander. The relentless search for and elimination of non-value-added (NVA) activities has reached the strategic planning and five-year budgeting processes as well as the lean and transformation activities. “We have looked at how people do ad hoc assign-

ments, eliminating weeks of wasted time when we were getting clarity on tasks, and asking where we’d find the greatest value-added (VA) benefit,” Falldine noted.

Leadership gets its share of being in the lean spotlight. For example, a leadership root cause analysis team defined a problem: “Our leadership culture allows the center to operate in a manner preventing optimum performance in safety, quality, compliance, and workforce development, creating excessive risk and jeopardizing long-term performance.” They defined root causes contributing to leadership culture as accountability, discipline “courage” and “rigor,” aligned metrics, management of priorities, roles/responsibilities, and communications. They asked, “What does it mean to hold someone to account, and to walk the talk?” Their leadership culture solutions and charter are shown in Figure 2. Falldine is encouraged by such initiatives. While he is hopeful for “profound change” in administrative areas, he described industrial lean activities as more mature (at the walking stage) versus administrative lean in the crawling stage.

Flexibility and Responsiveness

Such profound change is needed as military objectives are becoming more complex. Falldine said missions such as wiping out an enemy battalion specify a target and a way to destroy it. “Now we are thinking in terms of the effect you want to create and what do you need to do to create that,” he said. “Lean brings to the table not only eliminating waste but also thinking about value, and about providing value that is needed (for example, unmanned vehicles used for reconnaissance can be modified to allow missiles on board).”

Falldine commented that lean is not the only change initiative affecting military organizations — AS9100, Aerospace Quality Management System registration, for example, sparks improvement activities and related changes in metrics. “We don’t want separate programs for improvement,” he said. “We are looking for more of the definition of what it means to be flexible and

Robins AFB Leadership Solutions Team Charter and Solutions

Charter

“Develop effective, deployable, and sustainable action plans that, when implemented, will correct the problems identified during the root cause phase and eliminate the possibility of their recurrence.”

Solutions:

- Create a two-way communication process
- Develop a continual self-inspection program
- Emphasize compliance with the written word
- Educate/train on good order and discipline
- Ensure policies are complete, current, and consistent
- Standardize articulation of the commander’s weekly priorities
- Align center metrics.

The team also noted that solutions are codified in the written word, integrated into processes, and executed by organizations, and that solutions implementation is a chain-of-command responsibility.

Figure 2.

responsive. We are mixing our capabilities to achieve the needed effect. My favorite example of transformation is the photo taken in Afghanistan of a special ops sergeant riding a horse, doing forward air control, carrying a laptop with GPS (global positioning system) capability, and sighting where bombs were to be dropped by B-52s.” (See Figure 3).

“Transformation has forced the military branches to work more effectively, and that means working together to develop new capabilities,” he continued. “The Department of Defense (DoD) is encouraging a dramatic shift in how we do conflict and how we adapt to it, with previous competitor organizations working together and sharing resources.”

Moving to More Horizontal Organizations

Today’s military environment demands more collective and collaborative efforts than ever before, asserted Michael Hardee, USN, Commander, Fleet Readiness Centers, Patuxent River, MD. “We are moving from stovepipe organizations to more horizontal types of organizations — a work in progress,” he said. “We are seeing more networking types of coalitions, to be more effec-



Figure 3. Photo taken in Afghanistan of a special ops sergeant riding a horse, doing forward air control, carrying a laptop with GPS (global positioning system) capability, and sighting where bombs were to be dropped by B-52s, as noted by George Faldine of Warner Robins Air Logistics Center.

tive in what we do, using lean and six sigma.

"Our lean initiatives and the transformation associated with them allow the military to design more effective and efficient systems," the admiral said. "In our case, it means repairing aircraft and returning them to service more quickly as we reduce our process cycle times. The challenges of transformation are fairly typical of any change leadership. Leadership needs to firmly grasp and communicate what changes are needed, down to the deck plate level. People need to hear and understand the importance of the quality of their work. Workers embracing this are immediately rewarded as the quality of their work improves and they are seeing improvements in their own work spaces."

Transparency is one of the keys to cultural change and process improvement, regardless of the tools being used, Hardee said. He counseled, "There are always discoveries — what I called 'templateable' — across other activities in lean and somewhat in six sigma. You look for templates that can replicate improvements across the enterprise. I don't believe in best practices; I believe in better practices," he said. He noted the value of benchmarking outside the military to find better practices. Whether leaders are looking for improved aircraft readiness or non-military performance gains, key metrics are universal, he noted; cycle time, variability, productivity, and total cost flow from basics and fundamentals. "You can't improve your process or change the organizational culture unless you understand the process first, and how it can be measured," Hardee said.

Hardee added, "For Fleet Readiness Centers (FRC), organizational and operational change is necessary to grow into the more efficient, agile, and high-velocity maintenance team our warfighter needs today, tomorrow, and in the future. We designed the six FRC area commands to encourage and enhance collaboration and partnership between all stakeholders. This allows us to smartly manage and reduce costly variability in FRC operations and identify, solve, or prevent problems more effectively and efficiently. Across the NAE (Naval

Aviation Enterprise), we have saved millions of dollars using disciplines like lean, six sigma, and Theory of Constraints to make measurable, lasting improvements in the way we do business. Fleet Readiness Centers is just one way we're continually striving to improve how we deliver products to the warfighter to ensure we meet the NAE's vision of delivering the right force, with the right readiness, at the right cost, at the right time — today and in the future."

U.S. Navy: Implementing Lean in a Budget-Constrained Environment

A sense of urgency to transform and deliver more readiness also prevails in the U.S. Navy as personnel embark on the challenge of implementing lean and Six Sigma and a cultural change of continuous improvement, according to Jim Brice, director of Task Force Lean in the Naval Sea Systems Command (NAVSEA) at the Washington Navy Yard, DC. "Our role as NAVSEA partnered with our Program Executive Offices (PEOs) is acquisition and life cycle sustainment of the Navy's ships and associated weapons systems," Brice said. "We develop, design, acquire, deliver, overhaul, maintain, modernize, and ultimately dispose of ships, platforms, and associated weapons systems. We own the fundamental processes and contracts to do the work along with a core government workforce to sustain key capabilities. This is a cradle to grave responsibility. We have about 50,000 government folks across our Command — about 27,000 people in four Naval shipyards, about 19,000 people in 11 Warfare Center Divisions, about 1000 people at four SUPSHIPS, and about 2400 people at headquarters."

Their contracts engage and involve thousands of people in industry as well. NAVSEA/PEO's business volume is about \$26 billion annually; a little over \$20 billion of that flows to industry and the rest to government workforce. Shipyard budgets and the number of ships declined after the end of the Cold War. The current fleet is 283

ships. The build rate is about four ships a year. ADM Mike Mullen, the Navy's Chief of Naval Operations, aims to expand the nation's fleet of Navy ships to 313 by 2025. This charter challenges all involved (government and industry), and demands a "transformation" that delivers more readiness and assets for the existing budgets.

"We gain a little here, a little there, all stemming from Toyota concepts," Brice said. "We need to get all 50,000 NAVSEA/PEO people, plus hundreds of thousands of others in the rest of the Navy, plus our contractors, to realign their thinking. This is cultural change, and it's big. We've worked for years improving processes in the Navy. The biggest change is that lean and six sigma means that we look to our employees for sources of inspiration to make the changes that are needed, as we reprioritize our budgets and learn how to be more efficient. That is not our traditional culture, which is chain of command-oriented, telling people what to do. We need people to come to the table with a new attitude, starting at the top and at the bottom. The middle is the hardest to reach. Together, we need to find better and easier ways to do things that eliminate waste, improve quality, reduce variation, and overcome bottlenecks and constraints.

"Recapitalization is a key word," said Brice. "This is a learning journey. In 2004, through executive planning sessions, we picked key value streams such as torpedo work and submarine overhauls where we are spending the most money. We are applying lean and six sigma tools in those value streams, learning to see all the work and then to drive improvements. Some tools, such as value stream mapping, are better than others. We now have active lean and six sigma efforts in all our shipyards, warfare centers, at headquarters, and other areas, with some significant results."

Brice continued, "We are following the basic lean principles: Provide customer value, map and analyze value streams end-to-end across organizational boundaries, make the value streams flow, enable the customer to 'pull' from the value stream,

and seek perfection. We are transforming value streams by developing and implementing Rapid Improvement Plans which consist of Rapid Improvement Events (RIEs) that typically operate on a seven-week cycle. More complex projects take three to six months; other projects fall into the 'just do it' category.

Continuing to Mature

"We want to continue to mature," Brice said. "We need to encourage more participation in lean events by leaders in particular across the enterprise — so they can actually experience it first-hand. We need to reach critical mass. We are also putting more emphasis on what we call Navy Enterprises. These are five Naval Warfare Enterprises: Aviation, Surface, Undersea, Network, and Expeditionary. We are trying to get the best utilization of our assets and readiness in each of those five areas. For example, at the Norfolk Naval Shipyard, we have done lean work in the dry-docks, in the ships, in the machine shop, etc. What the customer wants is for us to translate all this improvement across the shipyard into a simple result — getting his work done — preferably more value-added work — on time and within the budget. That translates into savings of millions of dollars.

"We are developing value stream reporting," Brice continued. "Instead of reporting on 1000 lean events, for example, we are grouping our reports by the type of work involved. The Naval Aviation Enterprise is already doing that. We are seeking to get to the same level of maturity in NAVSEA and other Enterprises. We need to get results that we can leverage and build on." Collaborative efforts and benchmarking with Raytheon, Lockheed Martin, Naval Air Systems Command depots, Northrop Grumman, and others accelerates the learning cycles.

"We are also working with the American Society for Quality (ASQ) to develop Department of Navy standards for training and certifying lean and six sigma black belts and green belts," said Brice.

"This brought added change momentum and added credibility to our training efforts. We now have about 92 black belts across the Department of Navy who have attained this ASQ certification. In addition, all military Engineering Duty Officers are now being trained as green belts and all future Command Development personnel will receive black belt training."

NAVSEA's Lean Six Sigma College (L6SC) offers regional training for black belts, green belts, and champions at Port Hueneme and at the Norfolk Naval Shipyard. They promote an integrated approach of the predominant process improvement methodologies: lean, six sigma, and theory of constraints (TOC).

Doug Smith, dean of the L6SC, emphasized their focus on applying improvement concepts, not simply learning about them. RIEs and DMAIC projects give black belts and green belts on-the-job experience in using lean, six sigma, and TOC. This field work serves them well as they gain certification and then bring standardized continuous process improvement principles and tools throughout the Navy enterprises. "We need to put results on the table, in terms of savings for our customers, whether we're talking about wrench-turners or transactional and support processes," Smith said. "We've incorporated these concepts in apprenticeship training. Also, our new engineers brought into the shipyard get lean training early in their careers."

Deployment through Depot-Level Ship Maintenance, Overhaul, and Modernization

Continuous process improvement is being accelerated throughout NAVSEA field activities using lean and six sigma methodologies. For example, at Norfolk Naval Shipyard (NNSY) in Portsmouth, VA, lean teams are applying the concepts to three distinctly different work models, said Mike Zydron, NNSY process improvement director.

First are the back shops which include traditional machining and component overhaul, as well as services/coatings. This

model is more of the traditional application of lean techniques; the work flows through the workforce in cellular fashion.

Second, above the shop floor are "transactional"-type processes where key support functions are performed to support the yard's key mission. For example, thousands of technical work instructions and drawings, and hundreds of thousands of parts and pieces, are (annually) required to support the mechanic at the right place and the right time. Many other similar support processes also take advantage of lean methodologies.

Third, shipboard and waterfront work execution processes represent the core mission of the shipyard, and a significantly different model in that hundreds of resources each day must efficiently flow through widely-varying work requirements across five major ship classes. "The complexity resulting from the key and support processes delivering the right product at the right time and place with requisite quality makes this segment of our work rich with opportunity," said Zydron. "Our workforce understands we are here to support the fleet and deliver this complex work on schedule, with first-time quality and within budget, and we are using the lean toolbox to improve results in all three areas."

For example, on the *USS Harry S. Truman* (CVN-75; see Figure 4), recently completing a major availability at NNSY, the project team including the ship's force teammates with assistance from NNSY black belts and green belts, got together and developed a plan to improve cost, quality, and safety using lean and six sigma before the ship's arrival. Through RIEs, they reengineered the process for main shaft removal and installation, allowing them to give back a total of 1000 man-days during the estimating process. "That didn't decrease the bottom-line cost of the availability, but instead allowed the customer to increase the amount of total maintenance performed during the availability," Zydron said. The RIE teams are collaborating with the other Naval Shipyards, such as Puget Sound in this case, to ensure two-directional flow of best practices and innovation.

"We use intranet posting of RIE results (report-outs for each event) for continuous knowledge sharing, but we also periodically implement collections of best practices corporately through our four-yard National Value Stream (NVS) management strategy," Zydron said. "Carriers and submarines are our tier one NVSs. Additionally, we identified key support processes required to execute availabilities, such as industrial processes, supply chain management, training, resource management, and lifting and handling. Champions for these processes meet regularly and execute corporate RIEs — looking at processes that apply to two or more shipyards."

The product of these efforts, which started in 2005, are periodic Lean Releases that are implemented across all Naval shipyards. The beneficiaries are the Chief of Naval Operations (CNO)-scheduled depot availabilities. The Naval shipyards have implemented two such Lean Releases, affecting more than 30 different CNO-scheduled availabilities; Lean Release 3.0 is due to release early this year. This increasingly standardized approach to improvement dovetails with the Navy's Enterprise alignment strategy which is targeting more productive capacity for the dollar. Zydron added that collaboration with industry partners at Northrop Grumman Newport News and other operations speeds the lean learning cycles.

Despite early progress, more work is needed in leveraging "shared learning." "We discovered that we weren't doing a good job of sharing our lessons learned, with internal databases," said Doug Wright, Team Submarine lean program manager. Remedies included the development of a common database and a standard tracking metrics for RIEs and related events. "We're working toward the enterprise concept, to share as much information as possible," Wright said.

"We've realized that the old way of doing business — planning a job and following up — doesn't work any more. We need to look at our overall goals for future and current readiness and the safety of our force — operating in a safe and efficient



Figure 4. The Nimitz-class *USS Harry S. Truman* (CVN-75) at the Lambert's Point Deperming Station in Norfolk, VA. While at the station, the ship was wrapped with electrical cables which are charged with a current that removes the magnetic field from the ship. Demagnetizing ships counters magnetic mines and stops interference with communication and navigation equipment.

manner. We need a different form of applied systems reengineering designing processes for lean and six sigma," said Wright "We are using lean and six sigma in a structured approach, at PEO Subs and NAVSEA headquarters to help us define our business strategy and deliver value to the customer."

Virginia Class submarine cost is expensive, and Wright said the Navy has begun to reduce that cost. "We are conducting a joint initiative with industry to build two Virginia Class submarines per year at a cost of \$2 billion each, as measured in FY05 dollars," he said. "That compares to the current \$2.4-\$2.5 billion cost per submarine. This is a huge undertaking — we need to get the biggest value we can from the value stream, by 2012, through right-cost saving, lean, and six sigma initiatives.

"Better planning and scheduling, among other improvements, can better our performance in servicing existing submarines," said Wright. Shaving times in

dry-dock, when the cost runs about \$100,000 a day per ship, offers dramatic savings potential. During a recent dry-docking period, an evaluation of repairs to the fore, mid, and aft sections of the ship indicated that the biggest cost driver was the aft section. These “lessons learned” were presented at a five-day lean value stream analysis (VSA) led by Wright. At this session, the project team developed a future state that trimmed five days from time in dry-dock, after the VSA spotlighted common dry-dock issues and interfering work packages as the main schedule and cost drivers. Improvement initiatives included better coordination and sharing of common dry-docking issues and problems associated with overhauls and refit periods (hull surveys and hull cleaning), as well as the development of standardized tracking metrics for use with all future installs.

Time, training, and resistance to change are continuing challenges cited by Wright. “Communication is key,” he said. “Focus on results in the value streams and encourage training,” he said of keys to lean success. Wright also noted the need for sustained and involved leadership as well as a formal implementation plan and an enterprise-wide focus on cultural change.

Royal Navy: Front Line, Senior Leadership Involvement

People on the front line are motivated and focused on improvement. After all, when they are not involved in combat they are working on it every day, reported Commander Alan Martyn, recently Commander (Air Engineering) aboard the Strike Carrier HMS *ILLUSTRIOUS*. He described “Leaning the UK Strike Carrier” during his 2006 AME annual conference presentation in Dallas, TX and in a recent interview. Internal processes as well as physical aspects of the carrier were revamped, resulting from a review of the total delivery of strike warfare from sea and implementation of lean concepts. Cdr. Martyn has been a key leader in the lean transformation aboard the *ILLUSTRIOUS* and in extending this approach to broader

application across the whole of the Royal Navy (RN).

Value stream mapping, spaghetti diagrams, and other lean tools had uncovered wasted steps and time in various areas on the carrier. Among the dramatic results achieved by *ILLUSTRIOUS* personnel were: £ 20 million, and more importantly, a significant improvement in the “output of the business” — Sortie Generation. For example, they determined that no more than nine Harrier aircraft should be on deck at a time to allow each jet to move independently. Previously, up to 16 jets would be crowded on the deck under the assumption that from more you would get more. Lean proved that this was not the case. Everything from air stores delivery to hangar design and the air weapons workshop (cutting the time to prepare a 1000 lb. bomb by more than 80 percent) was evaluated for the elimination of waste. In aviation depth support, such low-tech solutions as a simple painted shelf location helped to improve flow. Standardized work became the goal and then the reality in many areas. In aircraft lifts and deck services, for instance, personnel learned how to reduce operator error by 84 percent and cut lift repair times by 37 percent. The Air Management Organisation (AMO) developed a mission planning cell and Squadron Operations area; their standardized work practices and optimized working spaces helped reduce the non-value-added planning activity (four hours to two hours) to generate much more of the value-added flying activity. Even the dining hall flow drew lean analysis, leading to shorter wait times.

Despite this success there was still a perception that “lean was a geeky engineering tool for engineers,” said Cdr. Martyn when he was asked to investigate the potential to lean the Royal Navy. “Very importantly, it was believed that all ROI was in spares and supply chain management, and we needed to justify that a similar ROI could be achieved away from logistics. So we looked at Flag Officer Sea Training (FOST). This is the organization in the RN that prepares units for operations. We started with FOST and got some improvements

for 11:1 ROI — in planning, reporting, transportation of trainers, etc. From there, we took these results and applied lean to our manpower processes across the RN. Now we are starting to build a picture of success — reducing the waiting for training and other areas.”

Culture change and sustaining change require a broader strategy, however. Martyn reported that as of June 2006, the Royal Navy committed to fleet-wide lean operations — with an enterprise-wide value stream analysis involving all the admirals conducted in September 2006.

Effective communications support lean success, the commander said. One lesson learned about communications, for example: Don’t do road shows until you have something to talk about; let people learn about successful change for themselves. “Otherwise, you’ve got a busted flush as you fire people up to lean and then it is months before they themselves are involved,” Martyn said.


“You also need personal involvement by senior leaders,” he added. “Some leaders get lean quickly or not at all, and some pretend that they do. They won’t really understand it until they do it themselves, by participating in at least two lean events. They might like the results from the first one and pay more attention after the second one. The other big problem when you talk about the ‘leadership challenge’ of lean to a military audience is that they tend to ignore the warning. You can see them thinking, ‘Leadership — not a problem; we do leadership in the military!’” Cdr. Martyn’s experience is that lean program management requires new levels of leadership tenacity that can challenge the best military officer as he cuts through the waste of government bureaucracy to deliver change. Despite the challenges and the journey that lie ahead for the military, Cdr. Martyn’s RN work demonstrated two important things: Lean can be used to significantly improve the output at the front line; and an enterprise approach to strategic transformation can be facilitated using lean tools. These cutting-edge programs were aided by the Simpler Company, he added.

Red River Army Depot


Cultural change can be a tough road when you have many years’ experience doing things the same way. “The hardest thing about lean manufacturing and lean operations is asking people not to concentrate on making the value-added (VA) stuff better, but to find the non-value-added (NVA) activities and remove them,” said Mike Lockard, head of the Enterprise Excellence Office at the U.S. Army’s TACOM-LCMC, Red River Army Depot (RRAD), Texarkana, TX. As a member of the Tank-automotive and Armaments Command, Red River has major depot-level support missions in the areas of vehicle/fleet maintenance and missile recertification, supported by a variety of base operations functions.

“Another challenge is converting from a batch-push to a flow-pull mentality; it generates so much waste to process many parts at once in a batch methodology,” Lockard said. “Overproduction, poor space utilization, quality concerns, and large cash investments in parts to support batch processing are just a few reasons to switch to flow. In addition, teaching people how to see waste is difficult, when the processes we’ve used for 15 to 25 years had been identified as the best way. You cannot see the waste at first, especially in administrative areas, without a change in your thought process. This new thought process, ‘lean thinking,’ is often 180 degrees from our current thoughts on the best way to overhaul or repair a broken-down vehicle. Red River employees are learning more effective ways to do their work every day. Instead of the traditional path (specialists figuring out how to fix a problem), the workers are involved in the process of analyzing their process flow, or lack of, using lean and six sigma tools. This employee empowerment — people making changes themselves — builds buy-in for continuing improvements.”

Red River’s approximately 3400 civilian workers now are being trained to look at what the customer wants, and in turn how to meet those requirements using a flow process. “If we had concentrated on



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just making the VA steps more effective, that would have covered only about ten percent of a typical process,” Lockard said. “Attacking NVA processes allows you to attack more of the process leadtime, which will greatly increase the extent of your improvements. We remind our co-workers as well as ourselves daily that it’s not just about turning a wrench faster.”

For example, mechanics working along with engineers, technicians, and management increased output from five vehicles (SEEs, or small emplacement excavators) a month to 16 vehicles a month through the use of lean tools. Labor costs decreased by half, as they trimmed the previous lengthy (13 miles) of process travel by more than 70 percent. Lockard said of the previous process, “Replacement parts from various suppliers and work activities in dispersed areas of the depot added to process complexity. Using spaghetti diagrams,

identifying excess travel, and converting bay operations to flow resulted in a consolidated operation.” A lean team visiting a work site to discuss possible solutions to space challenges is shown in Figure 5.

Another example of Red River putting lean concepts to work is the heavy expanded mobility tactical truck (HEMTT). Repair cycle time on this cousin to an 18-wheeler (in five configurations) used to take an average 120 days, from disassembly to final assembly. Over a 15-month period, several Rapid Improvement Events (RIEs — week-long events focused on eliminating waste from processes) were held to consolidate operations, create standardized and balanced flow cells, and create visual controls. These changes enabled better communication between customers and suppliers throughout the operation, which resulted in repair cycle time dropping to an average of 30 days. “The biggest impact was made by converting to flow from batch operations,” Lockard said. “The basics of workplace organization also reduce cycle times here — putting tools next to the workers, sorting, straightening, setting in order, scrub and shine, standardize, and finally focusing on safety, our top priority during FY07.”

HMMWV recap operations are the third value stream at Red River, in addition to SEEs and HEMTTs engaged with lean tools. Workers complete repairs on 32 vehicles a day, instead of the previous rate of one every two days. Lean tools such as takt time, standard work, and 6S help workers keep up this pace (“an awesome program,” according to Lockard), but they face a continuing challenge to improve even more by converting this operation into a mixed model line. RRAD is working to rebuild HMMWV ambulances on this line in addition to current models, greatly increasing the complexity associated with delivering the right parts to the line in the right quantities. As they seek to create new lean successes, Lockard added, there is a need to widen the circle of lean practitioners to encompass more than revenue generators. Everyone from mechanics and millwrights to parts managers, maintenance groups, etc. needs the same training. “We can be



Figure 5. A lean team visiting a work site to discuss possible solutions to space challenges at Red River Army Depot (RRAD), Texarkana, TX.

ten times better than we are today," Lockard said. "As we learn to see waste and pull it from more areas, there will never be an end to improvements."

Lean Information Processes: U.S. Coast Guard

Another lean application in the military was offered by CAPT. Larry White, Commanding Officer, U.S. Coast Guard Finance Center in Chesapeake, VA. "We produce millions of payments a year. Queues, backlogs, and defects can occur just as readily in an accounting operation as in a factory. We are beginning the journey of learning and implementing lean and six sigma techniques for accounting and financial transaction processes," said White, formerly chairman of the board for the Institute of Management Accountants.

"About a year ago, shortly after I took command, I started talking about lean and six sigma, and engaged the support and interest of the senior managers at the Finance Center," White said. "All managers and supervisors were trained as project sponsors in June and July 2006. So far, two staff members are trained as black belts and 30 are trained green belts." Before the George Group was engaged as primary consultants, the entire finance center work force, about 525 people, was provided introductory training on lean and six sigma. Also, first-line supervisors in accounting operations had another eight-hour session, a plant tour, and a session of manufacturing simulation games, and other exercises.

"We are currently doing our first suite of black belt projects and green belt projects," White added. "One of the black belt projects is to improve our accounts payable processes — to consolidate our accounts payable processes into a more uniform one."

Another improvement area is "suspense accounts." White explained, "A factory analogy is that the factory may have defective products to analyze and fix; you are looking at the source of problems and why transactions go into the defect holding bin." The process used for paying government bills of lading, which has high variation in terms of

the type of documentation received, is being evaluated for potential improvement, along with an IT (information technology) help desk for external customers.

"Like most factories, the biggest group of people here works on transactions which are pretty direct customer-facing operations," White said. He noted that in addition to accounting operations, the finance center has a division that does financial reporting and control and a systems division that is equivalent to plant maintenance in that it keeps the accounting information system (an accounting factory's primary tool) running. "I've made a decision we will apply lean six sigma to accounting operations first since it is the area closest to the customer and defines the requirements of the system," White said.

Although White is pleased that early improvement efforts are trimming waste in what he describes as "low-hanging fruit" areas such as reducing purchase order backlogs, he is mindful that the reason for failure in many change initiatives is first-line supervisor acceptance and buy-in. "I still pay a lot of attention to first-line supervisors," he said. "They can facilitate or impede change directly for the greatest number of people."

Barriers to cultural change have various sources, White has learned. "When you talk about efficiency, everybody thinks about job reductions," he said. "We have emphasized we've got plenty of work to do and financial accounting and reporting requirements are growing rapidly." But another concern for workers was that, as a result of successful improvement efforts, they may create a situation where they would be shifted to another work group with a different supervisor. To address these concerns, White has focused on communications including personal discussions (Lunch with Larry), sitting at technicians' desks and learning their job, "all-hands" speeches with Q&A sessions, and personally-crafted monthly newsletter articles on lean and six sigma activities that relate to the issues of the finance center workforce.

Continuous Process Improvement and Analysis

Focusing on government processes is one part of the military lean transformation story. As noted by CAPT. Steve Huber, commander of the Naval Surface Warfare Center, Port Hueneme, CA during his presentation at the AME 2006 annual conference, organizational assessment should increasingly encompass industry partners. Better material at lower cost and reduced labor cost are among the benefits from this collaborative approach. He also cited the need to identify financial or other incentives for contractors to seek cost efficiencies, recommending language in the RFP (request for proposal) requiring contractors to deliver more services or products for the same amount of resources as a result of increased efficiencies.

Darrell Gooden, lean transformation champion at the Naval Surface Warfare Center Port Hueneme Division, Port Hueneme, added that effective Activity-Based Costing (ABC) analysis is a tool that can help the military and contractors partner more effectively. "Transformation is a tough business," he said. "People have to make decisions for themselves, in a cultural change. ABC helps people to know if changes are actually being made, what changes to focus on, and how they are making a difference." Related evaluations introduce a system approach to establish clear cost metrics and ensure optimal use of resources, provide "proof" needed to eliminate unnecessary activities, re-deploy activities to meet objectives, and ensure that activities continue to support the organization's mission," Gooden said.

Contractors, Industry Partners

Lean and other continuous improvement efforts are escalating throughout the military and among defense contractors/sub-contractors.² Among recent presenters at AME's recent annual conference in Dallas, TX was Mike Jones, SCI (Supply Chain Integration) project manager and information systems analyst with Lockheed Martin

Aeronautics Company, Fort Worth, TX. He also presented a white paper on SCI efforts to lean the order-to-delivery process at a Supply-Chain Council conference. Among the challenges he noted: Requirements and specs can change as ERP (Enterprise Requirements Planning) or MRP (Material Requirements Planning) systems generate need dates for parts to build an aircraft. In turn, a huge volume of information traditionally flowed between buyers and suppliers as they struggled to manage daily changes and meet assembly/production needs. As the MRP wheels continued to spin, buyers cranked out faxes and emails to suppliers with the latest information on shortages, pushing need dates forward or back. "Collaboration between suppliers and buyers could take weeks," Jones said. "What SCI did was create a web-based front end, allowing suppliers to see information on what is needed for themselves, with information updated near real-time. We can quickly set new need dates and update with our supplier base around the world, speeding up and streamlining these activities."

Such visibility offers new collaborative opportunities for buyers and suppliers, Jones continued. Armed with shared information, they are developing lower-cost, innovative design and manufacturing strategies from planning and sourcing activities through production, delivery, and return of materials. Metrics for the SCI initiative, launched in 2002, range from a material management focus (such as buyerless transactions processed, potential/projected inventory savings, actual inventory savings, past due schedules, and program shortages) to information systems-focused metrics (including users accessing the system, response times, user usage duration, web page usage, etc.). Automatic, real-time information now is available on buys for some 230,000 purchase order line items (\$500 million annual inventory value). The LM Aeronautics Company and its supplier resources devoted to managing this data are shared more effectively, trimming cost and time from order-to-ship cycles. Traditional purchase order management labor has been reduced dramatically, thus allowing the procurement workforce to

focus on exception items — improving part delivery accuracy and efficiency to fighter programs.

Moving into the arena of vendor-managed inventories, with a min/max approach, also brings new savings in time and other resources, Jones said. "As parts stabilize in their design life cycle, the opportunity exists to shift procurement methodologies from traditional schedule-managed practices to vendor-managed inventory," he said. "SCI provides suppliers with a build schedule forecast summarizing the need for parts over time. When the data are combined with SCI's visibility into current inventory positions and status on deliveries and rework, the supplier has all the information needed to coordinate the delivery of parts to LM Aeronautics Company themselves. Basically, all we have to do is determine the maximum and minimum bin levels required to support our manufacturing flow and then let the suppliers manage the inventory. The companies involved begin to understand the value of increased data collaboration and the adoption of lean principles. LM Aeronautics Company has an effective supplier lean program to help members of the supply chain continually improve the way they produce and deliver parts. Through these ongoing exchanges, continuous improvement ideas are captured and considered for implementation throughout the supply chain."

Editor's notes: The assistance of Bill Donohue of the Virginia Philpott Manufacturing Extension Service in the development of this article is appreciated.

A Community of Practice (CoP) for Lean Accounting and the Defense Industry is being formed. The CoP goal is to identify opportunities for participants in the Department of Defense (DoD) supply chain, including the DoD, defense contractors and their suppliers, academia, accounting professionals, and other interested parties to apply lean accounting principles in the defense sector. A related meeting was held during the recent AME annual conference held in Dallas, TX. More information is available from Glenn Marshall at Glenn.Marshall@ngc.com or Bill Waddell at bill@bestmanufacturingpractices.com.

Lea A.P. Tonkin, editor of Target Magazine, lives in Woodstock, IL.

Footnote

1. Lt. General Don Wetekam, Deputy Chief of Staff for Logistics Installations and Mission Support, U.S. Air Force as well as George Falldine, Warner Robins Air Logistics Center were among the presenters at AME's 2006 annual conference held in Dallas, TX.

2. Lean shipyard supply chain improvements were noted in the article, "Northrop Grumman Newport News: Reaching Out to Suppliers," by Lea A.P. Tonkin, *Target*, First Issue 2006, pp. 51-56.

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