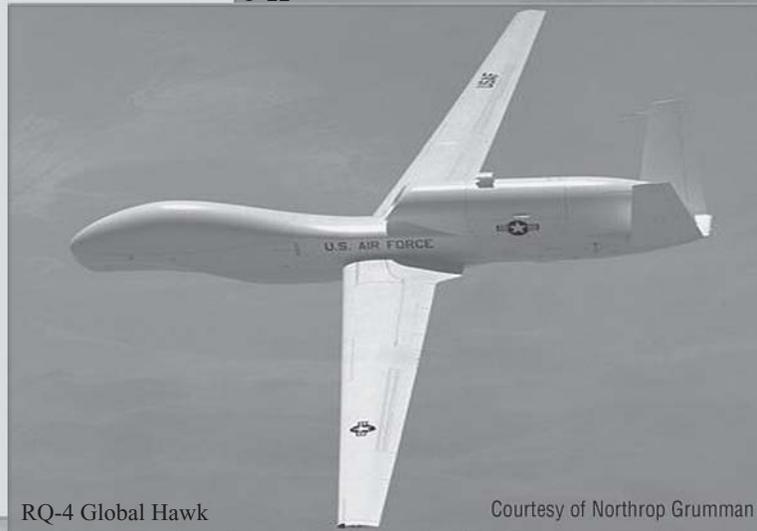


F-22

Courtesy of Lockheed Martin



RQ-4 Global Hawk

Courtesy of Northrop Grumman



F-16

Courtesy of Lockheed Martin

LEAN NOW—USING A RESEARCH COMMUNITY TO UNDERSTAND CHANGE IN THE ACQUISITION ENTERPRISE

ERIC REBENTISCH, PH.D. AND MAJ RONALD JOBO, USAF

Members of the Lean Aerospace Initiative (LAI) consortium have joined to pool experience and expertise to accelerate the adoption of Lean practices in military acquisition through an initiative called *Lean Now*. Lean Now has demonstrated that the concept of industry and government teaming for focused interventions can produce savings and accelerate change in the acquisition process. It also represents a systematic change method that lends itself to data collection and theory development. This paper outlines some of the findings to date, as well as implications for using such a model for research on the military acquisition system.

Acquisition system improvement (the term *acquisition reform* is also used) has been an imperative since the earliest days of the U.S. military. In the 20th century, several movements, often involving expert commissions or panels, sought to improve the performance, relevance, and adaptability of an increasingly large, complex, and bureaucratic system (McKinney, Gholz, & Sapolsky, 1994). Most of these efforts used a top-down approach to change. Many other, less visible attempts to improve the acquisition system have used a bottom-up approach, focusing at the level of practitioner in an attempt to foster systemic change through the diffusion of best practice. This paper is about one such initiative, and how it is lending itself to research and insights about improvement processes in the complex government acquisition system.

In August 2002, the Lean Aerospace Initiative (LAI) Executive Board committed to help the government apply lessons learned from Lean implementation within its own operations. The industry partners of LAI had already started on the path to Lean in the mid-1990s and were making significant improvements, mostly in production and manufacturing operations. The purpose of the Lean Now initiative was to accelerate transformation of the total government/industry enterprise by:

- Eliminating barriers that impede progress.
- Focusing on the interface processes between government and industry.
- Using the LAI venue to facilitate government/industry collaboration and teamwork.
- Leveraging the collective knowledge and efforts of government and industry.

In October 2002, candidate government/industry processes and programs that exemplified them were selected. They were the F/A-22 Test and Evaluation process, the F-16 Contract Closeout process, and the Global Hawk Evolutionary Acquisition processes. The prototypes were to prove if the Lean Now concept of focusing on government/industry interfaces was feasible. It was hoped that the results and lessons learned from the prototype programs could be applied to other Air Force programs and possibly throughout the Department of Defense (DoD).

***“Action research is focused on understanding
and creating knowledge about
social interventions and change.”***

Lean Now fully availed itself of the resources of the LAI consortium. It was truly a partnership between government, industry, and academia. Through the LAI venue, Massachusetts Institute of Technology (MIT) provided the knowledge and research-based tools; the industry partners provided the practical experiences of its best Lean Subject Matter Experts (SMEs) to kick-start and accelerate the government's transformation. Industry agreed to provide SMEs for the first year of Lean Now to train and mentor the prototype programs. This would give the Air Force a chance to learn from industry experts, while building its own infrastructure of Air Force Lean SMEs. To help the Air Force become self-sufficient in Lean, MIT and the LAI industry partners are also developing an Air Force SME training course.

In addition to being a vehicle for accelerating the adoption of Lean in government acquisition processes, Lean Now represents an ideal opportunity to pursue research in the style of action research (Argyris, Putnam, & Smith, 1985). Action research is

focused on understanding and creating knowledge about social interventions and change. If successful, the knowledge it produces can be used to aid future implementation activities, to advance theory about change, and to better understand the nature of systems being changed to more thoughtfully construct models of alternative future states. This approach is especially cogent to complex systems such as the military acquisition process, with its multiple interdependent stakeholders.

While Lean Now began with a push to jump-start the adoption of Lean principles and practices in the U.S. Air Force, it is beginning to yield new insights not only into change processes in the acquisition system, but also the structure and behavior of the system itself. Moreover, because it is proceeding using a relatively structured process, it lends itself well to systematic study. This paper will discuss early findings from Lean Now (this report documents only the beginning of what could eventually be a multi-year experiment). It will finish by discussing its implications for future acquisition research activities.

INTERVENTION METHOD

A common method for intervening in a Lean Now engagement is emerging based on the combined experience of the LAI SMEs and its application to date. This method has three distinct phases: (1) Set-up Phase, (2) Planning Phase, and (3) Execution and Follow-through. Within each phase are distinct steps that must occur in order for the Lean initiative to be successful. Figure 1 presents the three phases and their respective steps.

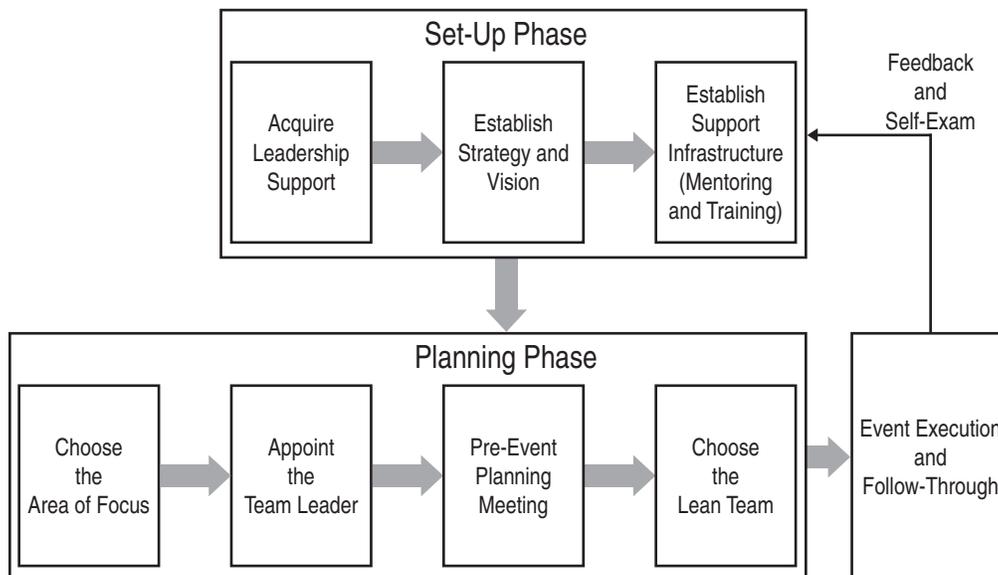


FIGURE 1. THE LEAN NOW ENGAGEMENT PROCESS

The first step in the Set-up Phase involves acquiring leadership support, setting the vision, strategy, and goals of the initiative, and ensuring the organization has the infrastructure to support the initiatives. This infrastructure includes having a Lean SME and a Lean training curriculum. The Lean Now projects relied on LAI's industry partners for their support infrastructure.

The Planning Phase comes next. The first step is to choose the area of focus. Several methods were used: (1) pick the program with the greatest sense of urgency, (2) use a decision matrix, (3) use the value stream map (VSM), or (4) have someone else choose it for you. The next step is to choose the initiative's team leader. The team leader must be knowledgeable and experienced in the processes to be examined, a good communicator, open to new ideas, and possess the ability to juggle many things at once. Once the team leader is chosen, he or she meets with the Lean Subject Matter Expert to discuss the project, its goals, resource availability and constraints, and any possible barriers to implementation. They also plan the Lean event, including the team training requirements and the Lean methods and tools to be used during the event. They then choose the Lean team. All stakeholders must have a representative on the team. In order to make the team effective, each team member must have a practical experience in the process to be examined and have the backing of his or her leadership.

“As the results from the Lean initiative begin to materialize, it is important to apply any feedback or lessons to continuously improve the process.”

After these steps are complete, it is possible to hold a Lean event. Depending on the event, the Lean SME will facilitate the team's use of the appropriate Lean tools and methodologies. After the Lean event, the team leader must ensure each member of the team follows through on his or her assigned action items. The team leader is also responsible for communicating the status of the initiative to the organization or enterprise leadership. As the results from the Lean initiative begin to materialize, it is important to apply any feedback or lessons to continuously improve the process. These lessons are also continuously collected, documented, and shared throughout the organization and enterprise.

Because the process for intervention is becoming standardized, the findings of the Lean Now events lend themselves well to systematic empirical study. With the foundation of a standard intervention method, variables can be manipulated to produce research designs that create knowledge and advance theory about system change.

FINDINGS

Summaries of each of the three prototype projects presented below provide a context for Lean Now and its activities. A set of general observations describes some of the key lessons learned and concludes this section.

F/A-22

Lean Now was proposed as a way to help the F-22 program in meeting its cost, schedule, and performance expectations, specifically involving the test and evaluation process. The Operational Flight Program (OFP) Preparation and Load process at the F/A-22 Combined Test Force (CTF) at Edwards Air Force Base (AFB) was selected by the F-22 Enterprise Lean Team. The OFP is the software that runs the systems on the F/A-22 and is highly dependent on the hardware configuration of the aircraft. The test aircraft are configured according to the test they have to perform. As testing progresses, new OFPs and new hardware configurations are generated, with a resulting challenge of keeping track of the many OFP versions/aircraft configurations and quickly reconfiguring test aircraft as changes arise. This challenge prevented the F/A-22 test program from generating test sorties in a timely fashion.

“The F/A-22 CTF was so compelled by the results of the OFP Prep and Load Lean project that they held another VSM event that identified 20 projects for the F/A-22 enterprise.”

A team assembled at the F/A-22's Combined Test Force at Edwards AFB and first did a VSM of the existing OFP Prep and Load process and identified many issues that caused delays and rework. By the end of the week, the team articulated the desired end state of their OFP process and generated 144 improvement suggestions to help get to this future state. The team returned to their respective jobs to start implementing the changes identified during the VSM exercise. Prior to Lean Now, the OFP Prep and Load process took between 60 and 90 days. The results of the initial suggestions lowered the time to 3 to 4 weeks. Through continuous improvement, the OFP Prep and Load time is now approximately 7 hours.

The F/A-22 CTF was so compelled by the results of the OFP Prep and Load Lean project that they held another VSM event that identified 20 projects for the F/A-22 enterprise. These projects included eliminating multiple identification numbers for the same part, better managing test asset and pilot availability to ensure fewer deviations from the test plan, reducing finishes rework after flightline activities, and aligning budgets with requirements. Each project was assigned to the stakeholder process owner,

with an accompanying target completion date, and all are underway. As they work on these initiatives and identify waste, they find that they are identifying further areas requiring improvement, with some of the original initiatives generating three or four additional initiatives.

GLOBAL HAWK

The Global Hawk is the U.S. Air Force's long range, unmanned, intelligence, surveillance, and reconnaissance (ISR) platform. The program has a very aggressive *spiral acquisition* approach that challenged its development schedule because of the time it took to put a new spiral on contract. One of the Lean Now project's foci was to reduce the cost and lead time of the platform's subsystems, while another was decreasing the time to put a new capability spiral on contract.

The Global Hawk System Program/Project Office (SPO), Northrop Grumman, and Raytheon chose to tackle the Integrated Sensor Suite (ISS) in the first event. The ISS costs as much as the airframe and engines and has an 18-month lead time. The ISS Lean team completed a value stream map of the current ISS production process from request for proposal to first flight. Through the use of the VSM, the team established a plan that increased the production capacity from 3 per year to 6 per year, with a savings of \$2 million per ISS. Other potential opportunities for further decreasing cost and production time were found, which the team is currently exploring.

“The Global Hawk is the U.S. Air Force’s long range, unmanned, intelligence, surveillance, and reconnaissance (ISR) platform.”

A value stream map of the Integrated Communications Suite (ICS) helped identify opportunities to eliminate \$3.6 million of specialized test equipment and reduce lead time between 2 to 3 months. This was done by eliminating unnecessary specialized test equipment and identifying the need for other test equipment to accelerate the transition to production. It also identified possible lifecycle cost savings from using common modules and open systems architecture. Finally, value stream mapping of the Alpha Contracting process identified means to reduce the average time to produce a formal proposal from 265 man-days to 166 man-days.

The Global Hawk team continues its work on the ISS, ICS, and Alpha Contracting projects to further reduce cost and cycle time. It is finding that in order to make further headway, stakeholders such as Air Force Materiel Command, the Defense Finance Accounting Service, and the Defense Contract Management Agency must also be involved in the process.

F-16

The F-16 Lean Now team chose to focus on the Contract Closeout process, and specifically, inactive contracts. Contract closeout is the activities associated with reconciling the terms of the contract with the products and services delivered. The process is long (on the order of 8 to 10 years) and is very resource intensive. There is currently a backlog of approximately 1,200 Lockheed Martin inactive contracts for the F-16, with some dating back to the late 1970s. The goal of the F-16 Lean Now initiative was to reduce the cycle time to close a contract, increase the efficiency and reduce the resources required, and to eliminate the backlog of contracts that are currently inactive yet remain open.

“Contract closeout is the activities associated with reconciling the terms of the contract with the products and services delivered.”

Even before the Lean Now initiative, the F-16 program had been working to close the backlog of inactive contracts and made significant gains in the Contract Closeout process. By the end of the four-day value-stream mapping event, the team realized that their proposed changes did little to reduce the time to closeout contracts. Process stakeholders at a higher level would have to become engaged.

Based on the first event, the Lean Now SMEs held another Contract Closeout event involving higher-level stakeholders that identified 12 viable initiatives, including establishing one Defense Finance and Accounting Service (DFAS) point of contact for the contract, expand Defense Contract Management Agency (DCMA) Q Final authority to cover fixed-price contracts, automation of work order generation process for contracts entering an annual audit phase, and aligning subcontractor contracts actions with contractor contract actions. If all 12 initiatives can be implemented successfully, the projected minimum cost avoidance to the F-16 program is \$2.4 million and an estimated cycle time reduction between 3 to 7 years. Several of them have been completed or are underway with some dovetailing work by senior leadership at the U.S. Air Force Aeronautical System Center, the DoD, or Congress.

GENERAL OBSERVATIONS

Lean Now’s first spiral of programs proved the feasibility of a government-industry focus on process interfaces to create useful change. Each of the projects was success-

oriented; they were not likely to fail to produce positive results. Consequently, it is challenging to identify clear *success factors* leading to superior outcomes. Nevertheless, there was sufficient variation in how each of the projects proceeded compared with the standard process and in the outcomes to note a few key differences. A more detailed exploration of those observations can be found in the report by Jobo (2003). Of distinction among the many observations that emerged from the experience with the prototype projects were characteristics of both leadership and of the teams (shown in Table 1).

The first three Lean Now prototypes had support from very senior Air Force leaders. This allowed the enterprise leaders and Lean teams the opportunity to take risks and try options never before considered—they knew it was okay to make mistakes. At more tactical levels, it was important that local leaders provided clear direction for how the Lean project fit into strategic plans and would help the organization achieve its strategic objectives. Lacking that, teams were more likely to *have Lean events* without the necessary follow-through to achieve compelling changes to enterprise processes. As such, leadership played a key role in follow-up to ensure the team stayed motivated and completed action items resulting from the Lean activities. While part of this involved the specific actions of the leaders of the initiative, it also played out in the degree to which the team was able and had the resources to manage or change the processes within their collective control.

The importance of team composition was demonstrated on multiple occasions. It was important that stakeholders in the process be represented, and their values defined so that they could articulate clear objectives to focus their efforts. The VSM exercises were important to not only identify underlying process flows, but also to identify the interdependencies among stakeholders that when dysfunctional could lead to ineffective communication, hand-offs, or other sources of waste in the system. The act of value stream mapping was in many cases a key communication process for uniting these groups that otherwise had not previously met.

TABLE 1. BEHAVIOR FOR LEADERSHIP AND TEAM MEMBERS FOR SUCCESSFUL LEAN INTERVENTIONS

<p>Leadership Involvement for Successful Lean Implementation</p>	<ul style="list-style-type: none"> • Long-term thinking and strategic vision. • Provides strategic direction and objectives. • Provides momentum for change. • Provides resources for implementation. • Provides the credibility and consistency of method for change. • Empowers project teams.
<p>Team Involvement for Successful Lean Implementation</p>	<ul style="list-style-type: none"> • Members must possess the correct level of authority for the given event. • Members must possess the correct level of expertise for the given event. • Members must be open to new possibilities.

Whatever the final outcome of these first three Lean Now prototypes, it is safe to say Lean has made an impact on the F/A-22, Global Hawk, and F-16 programs. The real value of Lean Now to date may not be the discrete results achieved as much as it represents the first steps in the building of an infrastructure for change and transformation. This effect is seen in the number of additional improvement events that were spawned by the initial interventions, and by the skeptical participants who through the process became dedicated advocates.

RESEARCH IMPLICATIONS

To date, the primary efforts associated with Lean Now have involved creating and standardizing the intervention method, deploying the SMEs and conducting the actual events, and documenting the outcomes. In a sense, Lean Now might represent the earliest phases of an action research program. More complete documentation of results and presentation to academic and peer research audiences lies ahead, as well as more active involvement in defining the subjects and content of the interventions. Even though it is in its early days, Lean Now already represents a significant investment of time and resources on the part of several individuals and organizations. From a research standpoint, this implies a significant *up-front* investment in creating the research context prior to doing the research. In this regard, undertaking a project such as Lean Now may not be appropriate or feasible for all researchers. Nevertheless, because of the unique nature of this activity, it represents a compelling venture for study that has already begun to produce results consistent with the aims of traditional action research.

“To date, the primary efforts associated with Lean Now have involved creating and standardizing the intervention method, deploying the SMEs and conducting the actual events, and documenting the outcomes.”

Lean Now has captured knowledge from a variety of sources on how to have successful organizational change intervention, and demonstrated its successful diffusion in a variety of contexts. Additional facilitators have been trained using these materials, and the number of active Lean Now projects has increased dramatically, most importantly in the form of initiatives spawned from the initial events and based on local demand.

From a theory development perspective, the preliminary nature of Lean Now means that there are still many more questions than answers. Lean Now events have grappled directly with the challenge of scalability—whether a technique with origins in

group-level interventions can work successfully in enterprises spanning multiple organizational boundaries. An important next step might be, for instance, to manipulate the organizational scope of the intervention as a research design variable to help leaders understand the level of resource commitment required for a given intervention. There is much yet to be learned about how these organizations, especially those with distributed functions (as is often the case with defense acquisition) learn, adapt, and share new knowledge. Perhaps the most interesting challenge is to understand ultimately how effective this form of organizational intervention can be as a bottom-up attempt to transform a complex system that has seen so many top-down change imperatives come and go.



Eric Rebentisch, Ph.D., is a research associate at the Massachusetts Institute of Technology working in the Lean Aerospace Initiative. His core research interest focuses on developing and managing core capabilities in complex organizations. This has translated into research activities in knowledge management, international technology and knowledge transfer, intellectual capital management, the management of long-term institutional change, the fuzzy front end of product development, subsystem commonality, and strategies for managing in an unstable environment.

(E-mail address: erebenti@mit.edu)



Major Ronald S. Jobo, USAF, was the 2002 Air Force Fellow at the Massachusetts Institute of Technology's Lean Aerospace Initiative. He is currently serving as the Affordability and Lean Integrated Product Team (IPT) lead at the Global Hawk System Program Office at Wright-Patterson AFB Ohio. He holds a bachelor's degree in aeronautical engineering from the U.S. Air Force Academy and a master of business administration from Wright State University.

(E-mail address: ronald.jobo@wpafb.af.mil)

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