contemporary issues

Enterprise Architecture: Origins, Tools, and Insights
Transforming Army Supply Chains: an Analytical Architecture for Management Innovation
Leaning the DoD Supply Chain: the DoD Activity Address Code

Contemporary Issues in this edition presents three articles: "Enterprise Architecture: Origins, Tools, and Insights," "Transforming Army Supply Chains: an Analytical Architecture for Management Innovation" and "Leaning the DoD Supply Chain: the DoD Activity Address Code."

In "Enterprise Architecture: Origins, Tools, and Insights" Captain Alice Marie Long, USAF, discusses enterprise architecture (EA), how it works, and most importantly, why it is needed. She also presents guidelines for implementation of EA, along with a synopsis of possible pitfalls in EA development.

Colonel Greg H. Parlier, PhD, USA, Retired, in "Transforming Army Supply Chains: an Analytical Architecture for Management Innovation" describes a practical approach for understanding the Army's extremely complex logistics system by introducing a systems framework which is guiding an ongoing project addressing major challenges confronting logistics transformation. The project focus is on inventory management policy prescriptions illuminated through the prism of an enterprise-wide supply chain analysis.

In the concluding article, Jay Barber, Global Logistics Support Center, USAF; Michael Werneke, Global Logistics Support Center, USAF; and Kevin P. Duffy, PhD, Wright State University, examine the efforts to introduce Lean to the Department of Defense (DoD) supply chain. A survey conducted by Manrodt, Vitasek and Thompson discovered that although Lean principles and concepts are being applied to the supply chain across numerous organizations, these principles are slow to be adopted in nonmanufacturing organizational settings. Importantly, the DoD is seen as an enormous organization, and an organization which is steeped in the traditional: the DoD encompasses ways of doing things which apply to supplier selection, organizational processes, and rigid hierarchical chains of command. Thus, the implementation of Lean principles into the DoD supply chain provides an extraordinary opportunity to examine a Lean implementation from two different perspectives. The first is that of applying Lean to a nonmanufacturing organization. The second perspective is to view attempts to implement Lean in a rigid organizational setting.

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Leaning the DoD Supply Chain: the DoD Activity Address Code

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Introduction

Information is the key to enabling supply chain design and performance. Accurate shipping and billing addresses are vital to the transportation segment within the supply chain; these addresses assure that products get to the right place, at the right time, and at the right cost. This is true for all supply chains, but even more so for the Department of Defense (DoD) distribution system. Not only does the DoD have fixed locations around the world to where supplies are shipped, but the DoD also ships to combat operations that continually change their locations.

Every DoD organization, including those in combat zones, has an address to receive mail and materiel. To manage this information, the DoD relies on a 6-digit code called a Department of Defense activity address code (DODAAC, pronounced "doe-dack") which represents an organization's physical address. Currently, the Air Force assigns and maintains over 9,000 DODAACs. This article documents the reengineering of an antiquated DODAAC maintenance process by applying Lean techniques.[1] Modern Web technology and the utilization of Lean concepts has enabled the development of a system that not only improves efficiency and reduces man-hours of processing time, but also provides tools for tracking information that have been impractical in the past. We discuss the history of DODAACs, their importance to DoD and Air Force activities, how the DODAAC system used to work, and what changes were required. We then discuss the redesign, development, testing and implementation of the new system. We conclude with a discussion of how the Air Force supply chain will benefit from using the new DODAAC Web Management System.

The warfighter must have visibility of all logistics processes to effectively engage in combat in the dangerous, resource constrained, and remote locations where they are deployed. Creating systems that are able to provide the instantaneous information required is essential for effective operation in war zones.

Lean Initiatives in the Supply Chain

The introduction of manufacturing systems had a profound impact upon workers, organizations, and life. These systems were set up to speed parts and raw materials through the manufacturing process. In turn, less expensive production methods resulted in the production of less expensive goods for consumers. As an added bonus, organizations realized huge profits. However, many of these manufacturing systems were laid out without giving thought to the process as a whole, or how the parts or pieces of the process interacted in order to produce a finished good. In an effort

to keep the manufacturing process moving, firms often would accumulate large amounts of parts and other inventory. The notion behind holding vast amounts of inventory was that of fully utilizing manufacturing tools and the firm's labor pool. Fully utilizing tools and labor would result in producing as much of a product as the firm was capable of producing. Unfortunately, this perspective did not consider the costs associated with inventory or its related carrying costs. The availability of excess labor and excess inventory, while enabling production to carry on within a manufacturing facility, translated into a cost to the firm which did not add value to the finished product (did not add value to the end customer).

In contrast, Lean initiatives, as applied to the manufacturing process, are intended to improve business by focusing on the elimination of waste. When Lean principles were adopted within manufacturing, more attention was given to factors such as how a chain of processes worked together, or how a process could be broken down into a rearranged series of tasks or steps.

Lean principles were originally adopted by organizations in an effort to remove waste and revitalize manufacturing processes, with hopes of achieving productivity gains seen in Japanese companies. Grant states that "Lean manufacturing was developed in Japan to eliminate waste in manufacturing processes."[2] An implementation of Lean principles strives to eliminate waste; both physical waste (excess inventory holdings) as well as process waste (removing excessive processing time and unnecessary processing steps from the firm's value chain). Underlying the application of Lean is the discovery that while processes may differ from manufacturing to service companies, and from one type of process to another, processes seem to suffer from the inclusion of unnecessary or wasteful steps. Taking an approach of standardizing process design aids in uncovering and eliminating many of these redundant or wasteful steps.[3]

Manrodt, Vitasek, and Thompson[4] note that their research has pointed them toward six attributes which are vital to building a Lean supply chain. These attributes are as follows:

Article Acronyms

AFB – Air Force Base
AFMC – Air Force Materiel Command
DAASC – Defense Automatic Addressing System Center
DoD – Department of Defense
DODAAC – Department of Defense Activity Address Code
DODAAD – Department of Defense Activity Address Directory
HQ - Headquarters
ICP – Inventory Control Point
LOT – Office Symbol for Distribution Office
LSO – Logistics Support Office
MAJCOM – Major Command
MILSTRIP – Military Standard Requisition and Issue Procedures
SME – Subject Matter Expert
SP – Service Point
TAC – Type Address Code

- Improved demand management
- Waste and cost reduction
- Process standardization
- Industry standards adoption
- Cultural change agent
- Cross enterprise collaboration

Improved demand management is an organizational focus on moving toward a *pull* supply system, rather than a *push* system. Briefly, a pull system revolves around customer demands (initiated when a customer places an order) rather than a manufacturer pushing goods into the system. Waste and cost reduction work hand-in-hand within a Lean system, rather than competing with one another. This is to say that cost reduction is not more important, as a system goal, than is reducing—or eliminating—waste. Waste can take the form of time, excess inventory, or can be found within organizational processes. Often, the authors note, when waste is reduced or eliminated, this reduction may be accompanied by cost reduction. Importantly, though, the authors note that the focus should remain one of reducing waste. They caution that focusing too sharply on cost reduction may "lead a firm down a suboptimal path, as not all waste can be easily tied to costs."[5]

Process standardization requires the firm to promote the standardizing of processes across the firm, with the intention of directing the process flow toward the chain's most efficient points. Further, they note that organizations wishing to differentiate themselves on the basis of proprietary workmanship may actually impede the smooth and efficient flow of work and processes, especially when materials and products cross country and organizational borders.

The notion of Lean being involved in cultural change stems from the age-old problem of resistance to change. The authors note[6] that one obstacle to implementing Lean principles is that these actions must be undertaken by people—people who often question why the tried-and-true methods of accomplishing tasks is no longer viewed as optimal. In these cases, actively promoting Lean through change management may be valuable for the firm. Kumar[7] states that organizations may wish to involve users and other employees in the project, as this will foster a sense of ownership. Finally, and importantly with respect to the supply chain, is to emphasize the notion of working with partners in bringing value to the customer, rather than suboptimally embracing a view which extends no further than the organization's boundaries.

While the practice of Lean manufacturing has been around for a while, the notion of applying Lean principles to the supply chain is a newer concept. Grant notes[8] that "most businesses have yet to apply Lean thinking to service and transaction processes."

This article examines the efforts to introduce Lean to the Department of Defense (DoD) supply chain. A survey conducted by Manrodt, Vitasek and Thompson[9] discovered that although Lean principles and concepts are being applied to the supply chain across numerous organizations, these principles are slow to be adopted in nonmanufacturing organizational settings. Additionally, the researchers note that the application of Lean can result in behavior or procedural changes within organizations. These necessary changes often present a barrier to the adoption and application of Lean. (The authors cite the

common anecdote of "we've always done it this way" as an example of resistance to change.) Importantly, the DoD is seen as an enormous organization, and an organization which is steeped in the traditional: the DoD encompasses ways of doing things which apply to supplier selection, organizational processes, and rigid hierarchical chains of command.

Thus, the implementation of Lean principles into the DoD supply chain grants an extraordinary opportunity to examine a Lean implementation from two different perspectives. The first is that of applying Lean to a nonmanufacturing organization. The second perspective is to view attempts to implement Lean in a rigid organizational setting. Our hope is to gather lessons learned from the implementation which, in turn, may assist other nonmanufacturing organizations, as well as other hierarchically structured organizations in their considerations of whether or not Lean initiatives are worth pursuing within their own organization.

The DODAAC within the DoD

For nearly 50 years, the DoD has relied on a standardized logistics system to manage the requisition and supply processes necessary to support worldwide armed forces operations. This program, known as Military Standard Requisition and Issue Procedures (MILSTRIP, DoD 4000.25-1-M) was designed in an era of mainframe computers and punch cards. Since data entry was restricted to 80 characters of data per card, the program relied heavily on coding of information. These codes are delineated in written manuals, regulations, or instructions. Although the DoD is working on modernizing this system, MILSTRIP is still in use today and still relies on *coded* information.[10]

One code is the DODAAC. The DODAAC is a six-digit code that represents shipping, mailing, and billing addresses for DoD locations throughout the world.

The Defense Automatic Addressing System Center (DAASC), located at Wright-Patterson Air Force Base (AFB) houses the data base that maintains the addresses for the DoD. This database is called the Department of Defense Activity Address Directory (DODAAD). Governed by DoD Manual 4000.25-6-M, this publication delineates responsibilities for each branch of the military and various other government agencies that supply material to the DoD and require DODAACs. Each of these organizations has an office called a *service point* to maintain their codes and addresses and input the information into the DODAAD.

The Air Force service point is located within the 401 SCMS/Distribution Flight at Wright-Patterson AFB. This service point maintains over 9,000 military and contractor DODAACs located throughout the Air Force. The office works with customers worldwide to establish new Air Force addresses. Prior to the reengineering effort, new addresses were accomplished through a series of complex and outdated methods including an Air Force Materiel Command (AFMC) legacy data system (D035T, developed in the 1980s), a Web site developed in 1995, and a network of military and civilian employees who approve new codes and address changes for their Air Force major command (MAJCOM). For example, Headquarters AFMC has four persons assigned the task of maintaining the DODAACs for all of the command—an organization with over 78,000 people.

Background

DODAAC Essential to the Air Force Supply Chain

Whenever an Air Force organization needs stock listed material (material that has been designated with a national stock number) to support their mission (for example an aircraft part) their supply system (Standard Base Supply System) generates a DoD requisition which is routed to the appropriate inventory control point (ICP). An item manager of the part determines from where to source the request and generates a material release order to have the item released from stock, or ordered from a vendor, and shipped to the customer. A DODAAC identifying the organization submitting the requisition is necessary before the requisition can be processed by the ICP. Once the material is released for shipment, the DODAAC is used to indicate where the material is to be shipped and is included in the transportation control number used to track the shipment through the transportation pipeline. Without a DODAAC included in the requisition, none of this could take place.[11, 12]

DODAAC Requirements

Although the DODAAC is a simple 6-digit code and the data behind the code is relatively straight forward (addresses), the information associated with a DODAAC's application within each Service and agency can be complex. The rules directing how addresses are developed and displayed in the data base are standard throughout the DoD. For example, each DODAAC will have a corresponding clear text address that will consist of a type address code (TAC) 1, 2 or 3. A TAC 1 address represents where a unit wants mail and mail-like material (US mail and possibly small parcel delivery) delivered. A TAC 2 address is where a unit wants freight delivered (normally larger than 150 pounds), and a TAC 3 is an invoicing address. Many times only a TAC 1 address is required as the unit may want both freight and mail delivered to the same location. Mail to overseas locations will usually go to an APO (military post office) and freight will go to a separate location with a street address requiring both a TAC 1 and TAC 2 address. International addresses have a variety of differences, so DAASC has developed a standard address format so all Services make their addresses look the same.

To keep each agency and military Service's DODAACs unique and separate from each other, the DoD has designated the first letter of the DODAAC to represent each Service and agency. The Air Force is restricted to codes that begin with E, F, and J. Although there are only three sets of codes available to the Air Force, there are thousands of combinations of numbers that can be created. All the other military Services and DoD agencies that require a DODAAC have been assigned their own unique codes. An "A," for example is for Army. The Air Force cannot assign any DODAAC that begins with an A. As long as the DODAACs begin with E, F, and J, the Air Force has been free to develop its own policy concerning format and use of the codes.

Air Force DODAAC Requirements

Over the years the Air Force DODAAC policy was developed to use the codes for purchasing and shipping various types of commodity (engines—FExxxx, munitions—FKxxxx, fuel—FPxxxx), types of product (computers—Fuxxxx, clothing—FSxxxx), types of service (base library—FLxxxx, dining halls—FTxxxx), and types of process (base supply—FBxxxx, ship to

only—Fyxxxx). In addition, F series DODAACs apply to military, E series DODAACs apply to Air Force contractors and J series DODAACs are used to supply a range of maps and flight publications to flying activities throughout the Air Force. To manage DODAACs for all these different purposes takes a large network of persons to provide the knowledge of how and why an Air Force DODAAC will be assigned (Air Force Manual 23-110, October 2005; Air Force Instruction 24-230, August 1996).[13, 14]

Air Force DODAAC Process Evolution

The DODAAC assignment process starts with an Air Force military unit or Air Force contractor identifying the need to have a new DODAAC assigned or to change or update an existing DODAAC. This could mean they relocated an office, formed a new organization, or in the case of contractors, have a new contract with a new manufacturing facility; all of which might require a new DODAAC to identify their new address. This has been especially critical in recent years since the country has been involved in Afghanistan and Iraq and has established many new addresses.

Past Practices

To get a DODAAC assigned, the initiator submitted a request (in the form of an e-mail, fax, or phone call) to the DODAAC monitor assigned to their parent MAJCOM for approval. When the MAJCOM DODAAC monitor determined they agreed with the request, they forwarded it to an Air Force control office (a subject matter expert [SME] for the type of equipment or material that would be purchased with the pending DODAAC) for their approval. Once the SME was satisfied with the request, it was forwarded to the Air Force service point. Once the service point agreed with the request, a code was assigned and forwarded to the DODAAD. Once established, the code was then available to be used for requisitioning and shipping material. This process could take as little as 2 to 3 days, but many times took much longer depending on the speed of the command monitors and the control offices. Sometimes it would take as much as 8 to 10 days (or longer) depending on availability of personnel within the approval process (vacations, sick days, business trips, and military deployments could delay request processing). Sometimes requests were lost altogether. In this case it was up to the originator to track down and locate his/her request. Although this process had issues, it was much better than processing computer *punch-cards* to the mainframe that the service point relied upon for many years. That process took as long as 30 days to complete.

Before reengineering, most steps in the DODAAC request and approval process were manual. After the requests from customers were processed and validated, personnel in supply chain management squadron would enter the data (two employees—full time) from the request into an Air Force legacy computer system (D035T) which sent the information to DAASC in a daily batch process which was then updated to the DODAAD. Once each day DAASC would then broadcast a data feed back to D035T to update the DODAAD information for use by the Air Force. D035T then became the Air Force's primary source for providing DODAAC data to other Air Force data systems.

A New Process Sought

As this process matured in the mid-1990s, a new DODAAC search process was desired. DAASC had a DODAAC program to display the addresses associated with a DODAAC, but one could not use any other information to create a search. For example, if one knew the zip code where the DODAAC was located, but didn't know the DODAAC, there was no way to find the DODAAC. A solution to this problem was to build a Web site that could take the information provided from DAASC each day to D035T, manipulate it, and create a search engine available to everyone in the Air Force. This was the beginning of the current process.

Several years after implementing the DODAAC Web site with its improved search capabilities, a cut in manpower (eliminating one of the full-time positions used to make all the additions and changes) LSO/LOT allowed the MAJCOM monitors the ability to use the Web site to make changes to addresses for DODAACS within their command. This was not well received since it pushed workload onto requesting offices. Additionally, there were many mistakes made in the data entry, and the service point office had no visibility as to what changes were being made. Calls from the field asking why shipments were not getting to them would generally uncover a mistake in their shipping addresses (because a MAJCOM monitor put in an incorrect address). The problem was corrected, but it took a lot of time to find the problems. Further, this created a bad situation for the customer, potentially causing the loss of valuable equipment intransit. To combat this problem, the service point office developed a feedback loop to provide visibility of any changes the MAJCOMs were making. Although it was after the change was made, it allowed for resubmission of another change if an entry was incorrect.

Small improvements were continually made to this part of the process but were still tied to D035T for DODAAC additions and deletions and the Web site for making changes. Figure 1 demonstrates how the system was working at the beginning of the project. All requests were supposed to be going to the MAJCOM monitor with new and delete transactions going to the Air Force Service point for entry into the DODAAD through D035T. In reality all of the add and delete requests, and many of the changes to existing DODAAC transactions were being sent to the Air Force service point. They had to be forwarded to the appropriate MAJCOM monitor for them to work. When the process was reviewed for this reengineering project investigators quickly found the existing process to be cumbersome, slow, somewhat disorganized, and labor intensive.

Air Force DODAAC Process Review

The DODAAC process review was initiated by several events; namely, the *War on Terror* and the increasing number of humanitarian relief operations. This elevated operation tempo identified a problem with being able to quickly add, change, and delete Air Force DODAACs as locations were established, closed, and relocated to support field troop movements. In working this process review, Lean principles were used as a guide.[15] Realizing the difficulties we had with the existing process we determined this would be a good project to reengineer.

Problem

When personnel working on the project began to brainstorm the limitations of the existing process flow, they identified many problems that affected the customer and the infrastructure in place to develop and maintain Air Force DODAACs. The following were the primary process problems identified:

- The customer did not have a consistent method to submit requests.

- The system in place was not customer oriented (user friendly).
- There was no customer feedback or tracking system.
- The system was labor intensive and somewhat unorganized.
- Air Force DODAAC data had to be updated manually.
- DODAAC paper files were cumbersome.
- D035T system changes were impractical.

Goals

Once the main problems with the DODAAC process were identified, the following goals were established as a guide through the reengineering process:

- Improved customer service
  - Ability for customer to figure out how to get a DODAAC assigned without added input from anyone—totally self-help
  - Faster and easier process for the customer
  - Process would be the only way to get a DODAAC—one-stop shopping
  - Customers would have visibility of the progress of their DODAAC requests
- Improved process control
  - Minimize workload for the MAJCOM monitors and the Air Force service point
  - Eliminate duplication in data entry
  - Delegate workload
  - Create a system that was less susceptible to *gaps* in the process (evaluators and approval authorities missing from the system)
  - Ensure more consistent information was passed through the system
- Administrative
  - Create metrics that would measure the process, locate bottlenecks, and help provide the basis for continual improvement
  - Eliminate paper files
  - Ensure traceability and accountability for all transactions
  - Improve training for those involved in the process

Limiting Factors

As with any new project there are constraints in trying to move from conception to implementation. No additional funding, personnel, or new equipment procurement could be devoted to this reengineering project (the project was started after the fiscal year and no funding requirements for this project had been included in the organization's budget request). Without funding, creative solutions and time management techniques had to be used to move this project from conception into reality.

Solution

DODAAC service point technical specialists were consulted, as well as a computer programmer to develop a flow chart of the process. Current Web technology, coupled with the programmer's knowledge of Web-based database management would permit the building of a process that would let the customer create the original record, and then send that record through an approval process without duplicating the data. The Web site should be simple to understand and display everything the customer would need to request a new DODAAC or change an existing one. Figure 2 demonstrates the basic process flow. The customer would access the Web site and select an operation. Once a form was displayed, the customer would complete the form and submit it. The computer would route the request to the MAJCOM monitor. Request approval required the monitor to press a button which sent it to the next person in the approval process, the control office. If the MAJCOM monitor disagreed with some part of the request, a rejected request could be returned to the customer for rework. This process would be repeated until the request made it to the Air Force DODAAC service point. There a new DODAAC request would have a DODAAC assigned and would be sent to DAASC for loading into the DODAAD. The process design was straightforward and was simple in concept. Building it was a lot harder.

A team of experts, including three internal DODAAC technical specialists, a computer programmer, and management was assembled; the team worked this project in addition to their normal workload. The team would meet for short brainstorming sessions (1 to 2 hours) two to three times per week. At first the meetings were used to develop the structure of the Web site. As the project progressed, the meetings were used to review previous work, demonstrate the work, and discuss what would be done after the meeting. In this manner all team members were kept on track. These meetings were also used to sort out technical problems, find alternatives, and redirect the programmer's activities. As the project progressed it went through the following steps:

- Mapped the new Web site and data management system
- Developed the Web site *framework*
- Developed the Web site structure—what the customer sees

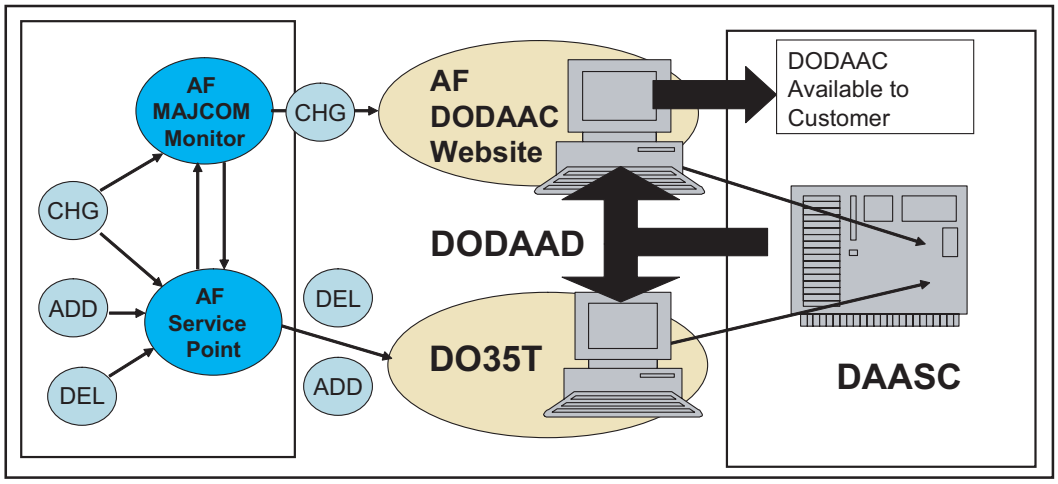

Figure 1. DODAAC Process Before Reengineering. Notes: the customer would submit his or her requests by phone, fax, or e-mail to either the Air Force service point or the MAJCOM monitor. The service point and the MAJCOM monitor would collaborate on the information and determine which office would submit the request. Most DODAAC changes were submitted by the MAJCOM monitor through the Web site and all the new and deleted DODAACs had to be submitted through D035T.

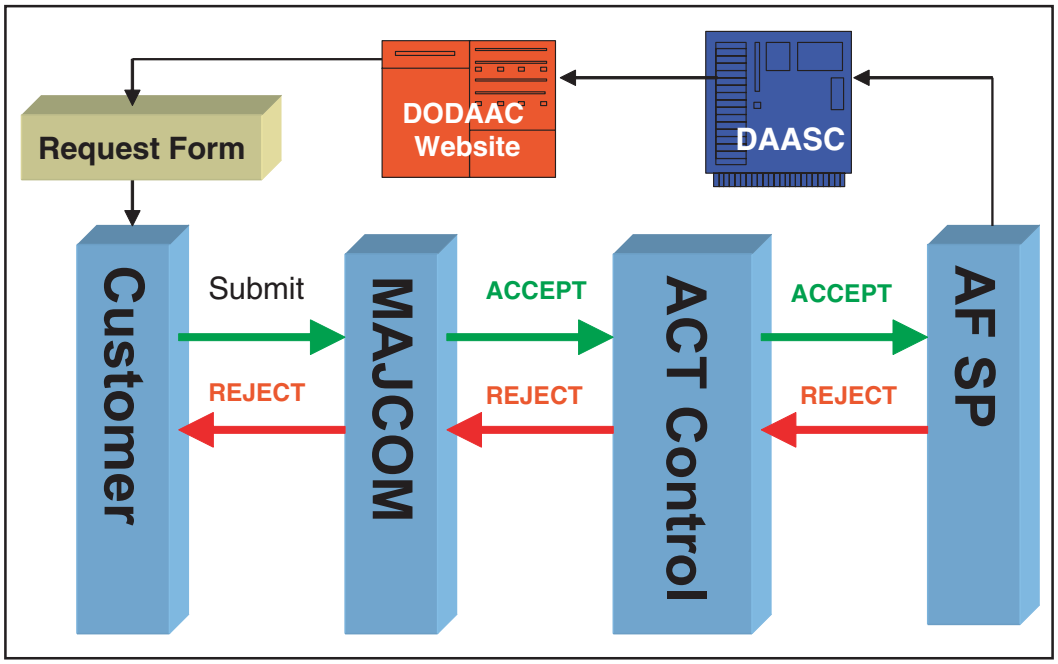

Figure 2. The DODAAC Web Management System

- Developed the supporting data tables and drop-down help data
- Developed the *flow* process
- Internal operability testing and review
- Data connection to other systems
- Acceptance and approval for using
- Prototype demonstration

The service point office hosted a DODAAC workshop at Wright-Patterson AFB when the new system was developed enough to demonstrate and validate the process. All MAJCOM monitors, control offices, and other SMEs were invited to attend. The agenda included introducing the system's capabilities, showing attendees how they would use the system, and most importantly, get feedback from the audience to allow for any last minute changes to the system before implementation.

The meeting provided valuable discussion and recommendations, specifically identifying ways to improve the system and make it more user friendly. This feedback was especially useful as it validated the system design and allowed for *buy-in* from the workforce. Some of the important items changed as a result of feedback from the meeting include the following:

- Add help note for deployed units under MAJCOM drop-down box on request form
- Develop *Reroute* system for requests that get submitted to the wrong MAJCOM monitor
- Add Headquarters Air Force on MAJCOM drop-down box
- Add link to MAJCOM monitor list in e-mail receipt back to requestor
- Add *No Special Characters* message to request form to alert requestor not to use (*, /, -) in address lines
- Add confirmation number to submission page for new requests
- On MAJCOM monitor, control office, and service point request view pages, add a link to requestor contact information in case they have questions about request
- Change canned responses to checkboxes on request view forms
- Add selection for City/State change to *Line 3, Line 4, No Change* on TAC 1 on DODAAC change form (like TAC 2 has now)
- Make rationale required field on change/delete form
- Put in *Are You Sure* page on closed/delete account form
- Make WPOD and APOD a drop-down box of selections to ensure they choose correct one; add help button.
- Set up dynamic validation report page and develop export to Excel feature
- Build requestor change/edit page for rejects from MAJCOM back to requestor
- Setup 24-hour tracking system
- Develop metrics of tracking information

Some very significant changes were developed during this validation trial run. Other important topics covered during the meeting were to brainstorm how to structure the annual validation process and how to do the live testing of the system. Following the meeting, two final steps included that of performing adjustments to the process, and the crucial step of live field testing and validation.

Testing the new system would be challenging because a complete test could not be run without turning off the existing system (the DODAAC Web Management System was hosted on an Air Force server that resided inside the Wright-Patterson AFB network firewall). Further, access was through one portal—there was no way to run the test while the old system was still functioning. MAJCOM monitors were informed of the shutdown to ensure they had all required work up to date, since only *emergency* DODAAC changes would be processed during the 10-day system shutdown. Manual updates in D035T were performed on an as-required basis.

The test was scripted by completing a DODAAC input for each MAJCOM monitor in our system. At a designated time each MAJCOM processed the information they were given. The flow of information was measured. After the first test, only 60 percent (approximate) of the information had been received. The system appeared to be working properly, but some of the MAJCOM monitors did not process their information correctly.

A second test was run to assure the system was working as intended and that the problem was not with the program. The second test was a great success. All of the information in the second test flowed properly and the Air Force DODAAC Web Management System was made available for Air Force use.

Implementation Results

The system is a major improvement. As soon as the DODAAC Web Management System was implemented one could tell it

would serve the Air Force as it was intended. Other than some minor glitches that were fixed quickly (usually within hours), the system has performed well.[16] The system has allowed DODAAC processing time to be reduced from an average of 4 to 5 days to its current average of 2 to 3 days.[17] The system has reduced administrative workload (waste) at least 75 percent system-wide (metrics are being developed to measure this accurately), provides accurate electronic records, and provides a single, precise method to manage DODAACs for the Air Force.

Supply Chain Improvements

The system was designed, developed, and implemented to follow the principals outlined by James Womack and Daniel Jones, in their book *Lean Thinking*.[18] More specifically, the goals included the need for the following:

- Create value from the customer's perspective
- Determine and improve the *value stream*
- Create *flow* through the system
- Create *pull* processes
- Strive for *perfection*

This *Lean thinking* allowed the process to be rebuilt from the customer's point of view. The existing system had not been set up to *guide* the customer; this was a main focus in designing the new system. Next, considering the process as one part of the value stream, the new system was built with the ability to replace the aging legacy system as the DODAAC data warehouse for the Air Force. This approach built in flexibility to store, manipulate, and use the DODAAC data in a manner beneficial to the entire Air Force.

To improve flow, the process to create or maintain a DODAAC is now streamlined. Instead of multiple ways to get the job done, the improved system has only one way to process a DODAAC. This eliminated many wasteful process steps, reduced redundant effort, and organized the data to come close to providing the customer same-day service.

The new DODAAC development and maintenance process is a true pull system. The customer is no longer responsible for figuring out what their request should consist of, what medium to use to communicate that request, and where to process their request. Instead, the system pulls the customer's request through once the customer places their order. The system triggers work at each approval point by an e-mail to tell the evaluator they have a request to review and the system measures each step of the process. Once the customer submits a request they can follow the approval process simply by visiting the Web site and using the Tracker system. From the Air Force supply chain perspective this helps the customer get their DODAAC assigned and updated faster than ever. It allows the customer to order material faster and reduce the stress in establishing a new address when speed may be critical.

Conclusions

The last Lean principle—perfection—is an ongoing process. This new system is not *finished* and may never be, since the Air Force is constantly changing. The old system was built around a legacy computer system which prohibited even small changes. The new system is very flexible to changes. Table 1 compares all DODAAC processes before and after Lean thinking was initiated and applied.

Discussion and Lessons Learned

From the start of the DODAAC system process improvement the team was focused on adding value for the warfighter. Nothing is more frustrating than being deployed in a remote and hostile location and not being able to accomplish a mission because of an inability to procure needed supplies. Under the old system it could take 3 or more days to get an Air Force DODAAC validated and loaded into the DODAAD. During this time the warfighter was waiting, unable to order the supplies required to accomplish or sustain the mission. The new system process will establish a new address in the DODAAD within 1 or 2 days. By working from the customer's perspective through the entire value stream, the team was able to provide better visibility of the process, establish metrics to control the process, improve overall data quality, and reduce total processing time using the same resources. Improving logistics support by 24 to 48 hours will continue to ensure our warfighter has a battlefield advantage.

There were a variety of lessons to be learned from the successful implementation of Lean principles. First and foremost of these is that the system is a success. This success is largely due to the formal aspects of the system itself. Committing the entire process to the system forced entry of data into the system—data did not get lost or otherwise go astray. The system aspects of the DODAAC system permitted rapid data entry, error detection, and error correction. Ultimately, the speed of the system facilitates the goals of the organization, individual units, and of those waiting for supplies.

Further, the system enabled streamlining of the entire process. In turn, this streamlining added tremendous visibility to the project, as potential users (DODAAC requestors) were following development and implementation efforts. Frequent meetings were held with users, both to provide progress reports and to seek their input into the system. These meetings had an unexpected benefit of strengthening user buy-in to the system.

One unexpected bonus only appeared following implementation of the system. In response to an Air Force Audit Agency finding, the system was modified to include a contractor validation page (and supporting process) to improve the ability to monitor DODAACs created for contractors. Before the modifications, it was not possible to monitor when to delete contractor DODAACs. Unless deletion had been requested by the contracting offices, there was no way to recognize an unneeded DODAAC and to act accordingly. In turn, this gap in information would permit contractors to order material from the defense supply system after a contract had expired. The modified process enables the contracting office to cross reference contracts to DODAACs and DODAACs to contractors. When fully implemented, this feature will allow for determination of when to delete a contractor DODAAC. In this fashion, the information is serving to ensure the integrity of the underlying process.

The Lean initiative described in this article not only ensures process integrity, but also provides a significant image boost to a process which before had been haphazard. The DODAAC assists in collecting all required information, collecting all required approvals, and by identifying bottlenecks in the process, assures that the process completes in a minimal timeframe. The goals and objectives of the organization, as well as those of its customers, are better met through the implementation of Lean principles underlying the DODAAC system.

System Function	Original Process	Lean Process
Creates Value for Customer	• Request process not clear • Various request methods • Customer always confused by request process • No customer feedback • Slow process (3-5 days)	• More visual process • One stop shopping • Totally self help • Visibility of DODAAC request • Faster process (2-3 days)
Improved Value Stream	• No single request process • No clear request guidance • Multiple approval process • Multiple data entry points • Data re-entered several times • Approval process not concise • Unclear workload delegation	• Created clear request process • Eliminated wasted time in processing DODAAC request • Single Data entry point • Improved data accuracy • Reduced processing time • Reduced workload • Workload clearly defined • Eliminated paper files • Reduced process gaps
Created Flow Through the System	• Inconsistent request process • Input not consistent • No customer feedback • Uneven workload in system • Duplicate workload • Inconsistent data into system	• Developed one method to request DODAAC • Standard request forms • Data entered once • System routes requests • All transactions accomplished on Web site—no phone of fax • Approval process done online—read request, push button • All approval actions and communication on one page
Created Pull System	• Customer had to push request • System was slow to react to request • No method to notify approval process of request in system • Many gaps in approval process • Customer had to provide legwork to find request	• System activates only with customer order • Customers request automatically routed through the system • Email sent to next approval point • If request rejected, system reroutes • Feedback loop keeps customer informed of progress
Perfection	• System patched together • Unable to change legacy system • No standard process • No quality control in system • Difficult to develop knowledgeable staff • No measure of system performance	• Continually reviewing process for improvement • System improves training for those involved in the process Provides metrics to measure and improve the process • Locates and eliminates bottlenecks in process • Platform for continual update

Table 1. DODAAC Process After Lean Thinking Applied

DODAAC Web Management System Updates

In the time since the DODAAC system began, many improvements have been made to the system. One of the most significant was the alignment of Air Force data with that in the DODAAD maintained by DAASC. This major development allowed for the elimination of the daily batch process. Instead, DODAAC input is pushed to DAASC in real time. Instead of taking 1 to 2 days, a DODAAC change or addition can be input in minutes, allowing a unit to order material much quicker.

A second major improvement provides a way for the Air Force contracting community to validate and maintain Air Force DODAACs assigned to their contractors. Previously, contracting offices had no way to determine if their contractors had a need to keep assigned DODAACs. Now contracting offices can use this system to validate the contactors continued need for a DODAAC and delete DODAACs when the contract expires.

Notes

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13. Air Force Manual 23-110, *United States Air Force Supply Manual*, Washington, DC: Government Printing Office, October 2005.
14. Air Force Instruction 24-230, *Maintaining the DoD Activity Address Directory (DODAAD)*, Washington, DC: Government Printing Office, August 1996.
15. Womack and Jones.
16. Once in the first month of operation we had to take the system down for one day to fix a minor issue.
17. We are working on replacing the daily *batch* process with *real time* delivery to DAASC, which should give the system same-day service.
18. Womack and Jones.

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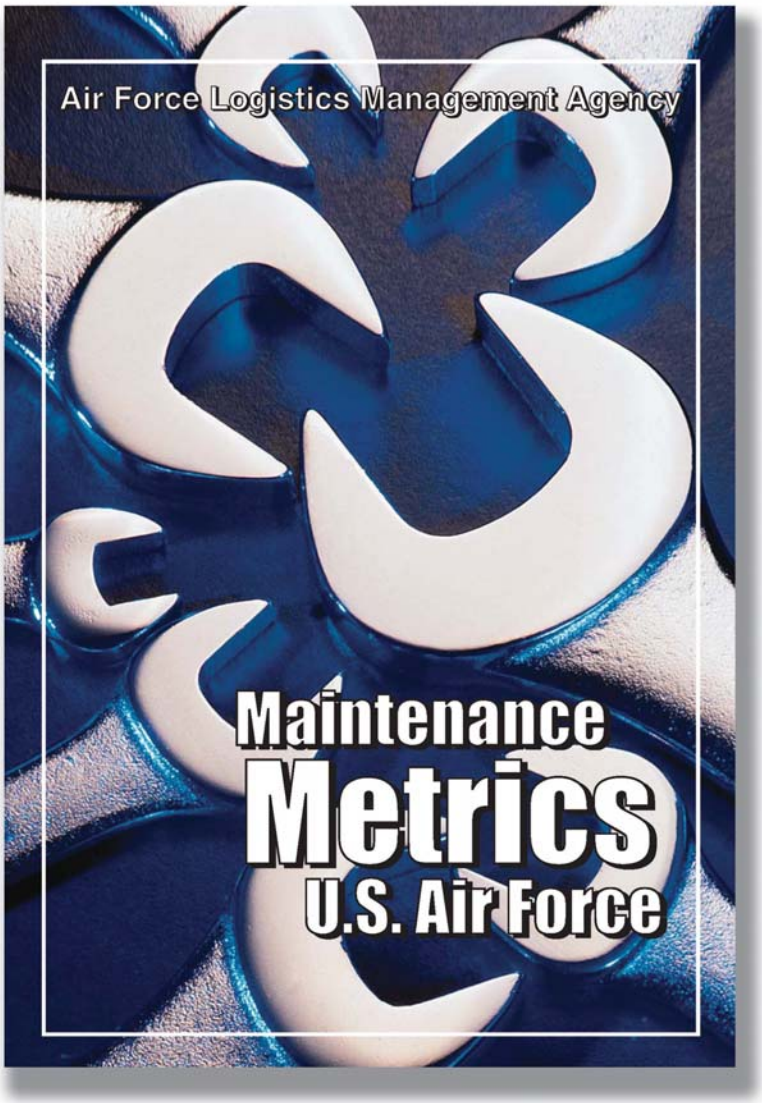

Aircraft maintenance metrics are important. Don't let anyone tell you differently! They are critical tools to be used by maintenance managers to gauge an organization's effectiveness and efficiency. In fact, they are roadmaps that let you determine where you've been, where you're going, and how (or if) you're going to get there. Use of metrics allows you to flick off your organizational autopilot and actually guide your unit. But they must be used correctly to be effective.

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