

# **Lean at the C-5 Galaxy Depot: Essential Elements of Success**

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### *Lean Enterprise Change Research Case Study Series*

This case study provides an example of managerial and organizational changes that have accumulated into significant performance improvements. It is one of a series of case studies undertaken by researchers at the Lean Aerospace Initiative (LAI) at the Massachusetts Institute of Technology. LAI focuses on developing, testing and studying the application of lean and other management principles in the aerospace industry. LAI's sponsors, and their improvement initiatives, have created a natural laboratory for studying lean enterprise efforts. The case studies in this series report on interesting and novel applications of lean methodologies at enterprise levels in LAI-sponsoring and other companies.

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## **Lean at the C-5 Galaxy Depot: Essential Elements of Success**

Donning white t-shirts with the slogan “We did it!,” the C-5 mechanics and support staff at Warner Robins Air Logistics Center in Georgia gathered at the flight line last September for a ceremony to celebrate the record 23 aircraft delivered in FY03. “I’m proud of you,” said General Wetekam, the ALC commander, as the last aircraft to complete depot maintenance that fiscal year taxied down the runway.

They had come a long way. Some came, in fact, all the way from San Antonio, when the program was transferred in 1998 from Kelly Air Force Base, which was closing down under the Base Realignment and Closure process (BRAC). Warner Robins won a 7-year contract for maintaining the C-5 in a public/private competition against three companies, including Boeing and Lockheed Martin that had pledged to keep the work at Kelly. The workforce shrank with the move to Georgia from 1,200 to 715 employees; about 1/5 of which transferred from San Antonio. For the first four years, the program struggled. Then, lean repair practices, first introduced in June 2001, led to remarkable improvements in productivity and on-time delivery. Flow days have been reduced by one third and all 13 aircraft deliveries so far in FY04 have been ahead of schedule. Furthermore, the C-5 has used freed up capacity to bring additional work back to the base from private contractors. These achievements have helped secure the recent Air Force decision to forgo competition for the upcoming renewal of the contract and keep the C-5 work at Warner Robins as an organic, in-house program.<sup>1</sup>

At a time of war one might expect that workers at an Air Force facility would have no fear of losing their jobs. Yet, we found that workers at Warner Robins ALC are subjected to instability-creating pressures similar to those felt by workers in the private sector. These pressures include BRAC, with another round of elimination or realignment approaching; privatization, which involves competition with private companies for workload and contractors working side by side with civil service workers; and a new, National Security Personnel System (NSPS) that may radically change their rights and work conditions. This instability can be a motivator, but it can also affect workforce morale and cause employees to hold back their knowledge and creativity, which are essential for the continued success of lean.<sup>2</sup> Examining instability, its sources, and consequences can help understand future issues in the improvement and competitiveness of C-5 at Warner Robins.

### **Background and methodology**

Robins Air Force Base is the largest industrial complex in Georgia, employing some 25,000 civilian, contractor and military workers on its premises. The Air Logistics Center has over 13,000 employees: about 2,000 of these are military and 11,000 civil servants. The ALC maintains and repairs the C-5 Galaxy, F-15 Eagle, C-130 Hercules and C-17 Globemaster, as well as special operations aircraft, avionics and electronic warfare. It is

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<sup>1</sup> Other factors may have weighted in this decision. In particular, federal law mandates that at least half of Air Force maintenance dollars be spent in-house.

<sup>2</sup> Instability as defined by the Labor Aerospace Research Agenda (LARA) is substantive change in organizational structure, economic factors, technological elements, and supply chain elements.

also responsible for program management and supply chain management for these and other weapon systems. The main union at the facility is the American Federation of Government Employees (AFGE) Local 987. The local represents some 9,000 workers at Warner Robins and has 2,600 members.

This case study centers on lean change in the C-5 program. The C-5 Galaxy is a four engine cargo and troop transport aircraft, the largest and one of the oldest in the Air Force inventory. The aircraft has a wingspan of 223 feet, is 247 feet long and 65 feet high. It has a seven-person crew and can carry up to 270,000 pounds of cargo. Today, there are 126 C-5s in use: 74 'A' models (built 1969-1986), 50 'B' models(1986-1989), and 2 'C' models(a late 1980's modification). The Air Force is retiring 14 'A' models in FY05. No decision has been reached about whether the remaining C-5s will be upgraded or retired and replaced with C-17s..

The two LARA researchers conducting this study joined forces with another three researchers from LAI who were focused on lean efforts at various programs as well as a more comprehensive base-wide view. We made two 2-3 days trips in January and February 2004. During these visits, we took guided tours of the facility, attended briefings on the scope of operations and lean initiatives at the base, and conducted group and individual interviews with 26 people. In the C-5 program, this included four members of the lean change management team at various levels, as well as five mechanics and the union steward for the program. In order to understand the context of lean transformation for the workforce at Warner Robins, we also interviewed base-level managers responsible for training, personnel, and labor relations, and had two group meetings at the union hall: one with union leaders and the other with stewards acting as lean points-of-contact. In some cases, follow-up interviews took place over the phone. We also relied on documentation provided by management and the union, as well as newspaper articles from the Robins Rev Up and the local press in Macon and San Antonio.

### **Lean change at the C-5**

Lean efforts began in June 2001 for at the C-5 maintenance program. The program had had a rough start at Warner Robins and production lagged behind schedule. Most aircraft, 12 out of a total of 17, were delivered late in FY01; the average delay was 80 days. Flow days per aircraft were 340, far from the 180 days set in the contract. Depot leadership decided that implementing a lean work system was important to the improvement of base performance. Lean theories derive out of the Toyota production system that is designed to respond to a customer pull, eliminate waste in all areas such as inventory or flow, integrate the supply chain, and rely on employee participation to drive continuous improvement. Establishment of this system depends on factors such as clear goal setting, the development of trust, and stable relationships across the supply chain. Many of these factors are in the lean plan at Warner Robins and base leadership is supporting the lean initiative.

The first lean event involved drawing a top-level value stream map of the entire C-5 Programmed Depot Maintenance (PDM) process, from start to end. The map covered three walls, featuring more than 52 major processes. Event participants also drew an ideal state map and an action plan of how to get there. The ideal state map pictured a streamlined process with eight work cells, visual production controls and a parts pull system that would bring flow time down to the target 180 days. This map and the action plan provided a blueprint for lean efforts at the C-5 over the next two years.

Implementation began with the back shops. These were smaller, self-contained units where success could be shown early on. The first lean events took place in the Engine Pylon Shop (Aug 2001), the Landing Gear and Tire Shop (Sept 2001) and the Production Support Center (Oct 2001). Flow time dropped from 23 to 14 days in the pylon shop and from 14 to 11 days in the landing gear and tire shop, and the staffing level of the landing gear shop was now reduced. The workers were transferred to other parts of the C-5 program.

Next, lean started in evaluation and inspection (Nov 2001), which was not a back shop but a core maintenance task. Here the C-5 leadership's reluctance to shift from the traditional system of assigning a crew to work on an aircraft from head to tail, to having the aircraft move through a series of specialized work cells had to be overcome. This reluctance was not unreasonable in that depot maintenance differs in some key ways from the high-volume manufacturing operations in which lean practices originated. Depot maintenance involves small-batch production and high variation in the actual work package performed on each aircraft, which depends on "wear and tear." Furthermore, some problems (e.g., corrosion), only become apparent once the aircraft has been taken apart. This variability makes harder to keep a smooth flow across work cells.

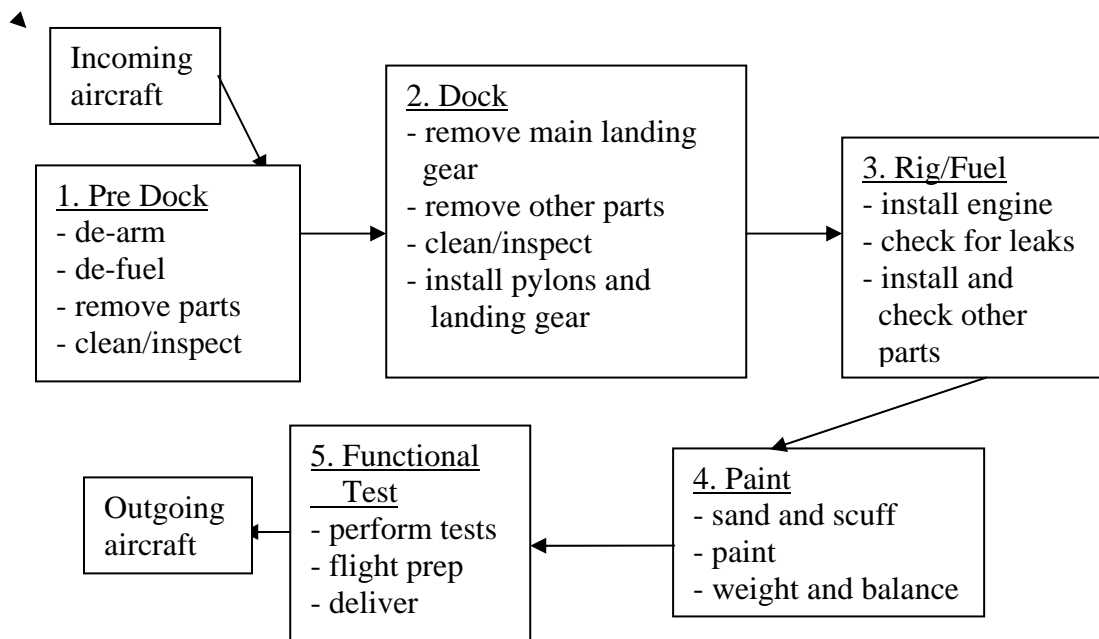
The decision was finally made and the first cell, the "pre-dock cell" was created (Jan 2002) (See cell flow chart below). The cell consists of a dedicated team of mechanics and support staff that is responsible for de-fueling, de-arming, stripping and inspecting the aircraft, which is also taken to the paint shop for de-painting. About half the team are inspectors that conduct a thorough examination of the aircraft and input all identified problems into a database. This database is then used to generate work cards for the next cell, "dock cell." The "pre-dock cell" is located in an uncovered area of the flight line; a building was added to store equipment and shelter workers from inclement weather. The team quickly bonded, organizing cookouts and other events. They reduced flow days from 37 to 22, bettering the 24 they had set as their target. (See cell flow chart below)

Lean then moved on to the dock area (Feb 2002), where the bulk of the repair and maintenance work is performed. For almost a year, events were held to plan and prepare for the transition to the "dock cell" (Feb 2003). The cell is located in the C-5's only hangar dedicated to aircraft repair and includes four workstations. Each station has a dedicated team of mechanics and support staff. The cell holds four aircraft at a time for 60 days each. Any unfinished tasks become "traveled work" that needs to be performed outside. Initially, there was a separate team assigned to complete this work that was later

eliminated as the need diminished. In late 2002, lean events also began to take place in the “post-dock cells”: rigging, fuel, paint, and functional tests, in that order.

In the C-5, lean was thus introduced sequentially, from start to end of the production process. In each cell, this involved value-stream mapping, cleaning, sorting and rearranging the work area, standardizing work, making parts kits and having them, together with tools and supplies, ready at the point of use, as well as using production control boards and other visual displays. The philosophy was to make the mechanic “the center of the universe:” mobilizing the workers’ knowledge and ideas about how to make their daily work more efficient and acting on their proposals. This, however, is easier said than done. It was found, for instance, that the training initially provided for lean event participants was not sufficient; it was expanded and a basic introduction to lean was also given to the whole C-5 workforce. Improving communication with workers and with middle-level managers that need to follow up with changes has remained a key goal for the lean team.

C-5 Cell Flow Diagram\*



\*Adapted from C-5 program materials

A second-round value-stream mapping of the entire C5 PDM process took place in April 2003 to identify further improvement opportunities. By that time, nearly all the actions outlined in the first round had been completed and all cells were in place. Since then, lean has reached out to the support office. The first supply support event dealt with parts issues (March 2004). It identified flight controls as the #1 item in need of improvement. More recently, the cell support teams (e.g., schedulers, planners, parts procurers) have moved physically to the cell area and are now in the process of standardizing their work.

Adoption of lean is finding more resistance in the administrative environment. The planners, for instance, have resisted standardization, and quality control workers have resisted becoming part of the cell support team on the shop floor. The quality control workers have very specialized skills, and integration into cells would likely require them to become more multi-skilled and change their function to quality assurance.

Another task ahead is developing pull systems with suppliers. Back in April 2002, a lean event on floorboards, which are produced internally at Warner Robins by the Commodities and Industrial Products Division, established such a system. Creating pull systems with external suppliers might involve other ALCs as well. For example, the landing gear, which is a major constraint, is repaired at Ogden ALC.

In all, there have been 54 lean events (3-5 days) and half as many short (1 day) events in the C-5 program as of March 2004. There has also been an effort to build in-house expertise, rather than rely exclusively on consultants. The lean team consisted of 1 person in June 2001 and grew to 5 by the end of 2001. It then reached 9 in July 2003 and 10 in March 2004 (4 of them trainees).

### **Key results and goals ahead**

The C-5 program has made substantial gains in productivity and schedule. Flow days, i.e., the time it takes, on average, to complete depot maintenance and repair on an aircraft have steadily declined from 340 days in FY01 to 229 days as of May 2004. This is so even after customer demand surged with the war and 23 aircraft had to be handled in FY03—a 35% increase over previous years. Demand for this year is 18 aircraft.

The goal of 100% on-time delivery was reached in FY04, a vast improvement over FY01, when it was less than 30%. All 13 aircraft processed thus far in FY04 have been delivered ahead of schedule.

Output per man/day has also increased by nearly 35% over the last two years. This metric is calculated by dividing direct produced standard hours by total paid hours (including indirect and military labor) and multiplying the result by 8, in order to turn hours into days. The number of direct labor personnel has remained fairly stable over this period. It went from 563 in Sept 2001 to 520 in Sept 2002, then up to 550 in Sept 2003 and back to 520 in June 2004. This means that the gains we see at the C-5 are not simply the result of employing more mechanics to do the job.

There are other signs of increased efficiency. The number of times the aircraft is towed, for instance, has halved: from 22 in FY01 to 11 in FY04. “Traveled work,” which is work not completed during the time the aircraft is at the dock that has to be done later, outside the hangar, has also decreased. As of March, traveled work for FY04 was 1,984 hours, 60% less than in FY01.



## C-5 PDM (Programmed Depot Maintenance) Results

	FY01	FY02	FY03	FY04*
Flow days (per aircraft)	340	280	268	229
Deliveries	17	17	23	12
Early	2	2	9	12
On-time	3	4	2	0
Late	12	11	12	0
Output per man/day	--	2.70	3.25	3.64

\*The fiscal year starts in October of the previous year and ends in September. Data for FY04 is up to the end of May.

The C-5 program used the capacity freed up by lean improvements to attract additional workload. Unscheduled Depot Level Maintenance (UDLM) has been performed on 13 aircraft so far in FY04. In half of these cases, the work entailed replacing damaged torque decks, something that was previously contracted out. The rest involved modifications or repair of combat-damaged aircraft. Together with lean, the new work is part of a drive to gain more control over the future; a future that looks now more secure since the Air Force has decided to turn C-5 maintenance into an in-house program.

Lean efforts will continue. The goal is to further reduce flow time to 180 days, to maintain 100% on-time delivery, and to continue improving quality. Large gains are likely to be made by leaning the parts supply process, but this is a complex task that involves more than reducing inventory but also, organizational practices, rules, and regulations that span beyond the C-5 and Warner Robins.

### **The view from the workforce**

The C-5 mechanics we interviewed said that lean had made their jobs easier, because everything they need, i.e., tools, supplies, and parts, is now “at their fingertips.” Several reported that they had become more efficient, mentioning standard work and daily briefings as some of the ways in which efficiency had been gained. One worker said: “We are more and more efficient this year because we have learned a lot in my shop.” Another stated: “I see a lot of good things happening here; we have made these changes and have made us more efficient -- people, for the most part, show more pride.” Lean has improved the work environment by promoting clean hangars, better facilities and the appropriate tools/equipment. A union steward summarized the workers’ sentiment as follows: “A lot of them like it, some don’t...People feel things have changed for the better.”

When asked about the challenges they still face, mechanics pointed to the parts procurement process as a big issue in need of improvement. Several also asserted that

supervisors and other managers needed to do more follow up after lean events. “There is no action a lot of times; things don’t always get implemented.” “You can have all the people you want buying into it, but then shovel it into the corner.” These mechanics also wanted to have more input throughout the process. One worker said: “I had my lean event 2 1/2 years ago...I haven’t had any activity to take stock, see if it needs any adjustment.” Another stated: “They come to us, we tell them how to fix it... but then they stop; they do not come back to us for further improvement.”

Union officials echoed some of these themes. They identified, for instance, middle-managers as a weak link in a complex management structure that includes military and civilian counterparts. The union president remarked: “The only reason lean is working is because management is allowing workers to buy in and the union to be involved.” The process has not yet been expanded to shifts in managerial roles at mid-levels. Just as shopfloor workers find their roles changed, further implementation of lean will need to include changes at all levels.

The union has secured participation in lean: the local vice-president works in the lean office and each program has a designated steward that acts as point-of-contact (POC). The POCs attend lean events and troubleshoot any concerns the union may have over the impact of proposed changes on work conditions. We found, however, that POC level of involvement varied greatly across the base. Some had participated in many events, while others had hardly any involvement; some saw themselves as a watchdog, while others had made many suggestions for improvements. Both union and management agreed that more training was needed for POCs and some momentum seemed to be building for it. At our meeting at the union hall, the POCs were excited by the chance to compare notes and asked for regular meetings to coordinate their efforts.

The issues that have come up with lean include changes to job descriptions or work hours. An important issue is that the cell-based work system is leading some mechanics to lose certification as the range of work they perform has narrowed. This is less of a problem in the C-5 than in the F-15 and C-130, where cells are more specialized. Certification is time rather than capability-based. Every year, workers need to perform required duties for a certain amount of time in order to qualify. If they lose certification, their employability on other programs or outside Warner Robins will be jeopardized. Workers try to get around this by working overtime in other cells, but managers are preventing people from doing so. This has led to a number of grievances. Plans to devise a rotation scheme have not yet been put into effect. Maintenance of individual skills and certification and its long-term implications are issues that require attention.

Lean has also brought about worker concerns over promotions. Managers initially assigned the individuals they thought would perform best to work as lean change agents. These assignments were temporary and did not follow the normal competitive promotion process. Some workers saw them as favoritism. When the situation was corrected and the new positions posted, many of those originally assigned did not get the job. One of the reasons for this is that the promotion process handicaps mechanics due to their classification as wage grade rather than general staff. Management is trying to lessen this

handicap, but the whole episode raised doubts over the fairness of the process in workers' minds. The new DoD's "modern personnel data system" has further confounded the issue. The system was procured from a private contractor and reportedly has many bugs that must still be worked out. Until recently, Warner Robins had an automatic skills locator that identified candidates for promotion consideration. Now, the new system relies on self-nomination, which places the burden on the employee to keep track of new openings and apply on line. Union officials and personnel staff are concerned that this might tend to keep more mechanics from being promoted.

The base commander promised at the onset of lean that it would not result in any lay offs. This proclamation was important because it diminished the workforce's fear that their jobs could be eliminated as efficiency increased. When asked about the future, one of the mechanics we interviewed replied: "I hope we'll get more work here; we have done well, 23 aircraft last year." Others had BRAC on their minds, like the worker who mused: "From the record last year, we feel pretty secure; but then, the same was true in San Antonio." Base closings and other external forces are making workers feel insecure about the future. This can, in turn, lead them to hold back knowledge and ideas in a protective impulse that hinders lean efforts. Uncertainty must be tempered by trust that believes that contributions to the base's success will be rewarded fairly and equitably. With this in mind, labor and management are working to build a stronger relationship.

### **The wider labor relations context**

Consensus is growing at Warner Robins on the improvement in the labor relations climate. Table 2 below illustrates the fluctuations in numbers of different types of disputes for a ten-year period. While the past has been somewhat contentious and dispute numbers were high, recent efforts such as an alternative dispute resolution plan, are having a positive effect. General Wetekam used his 2002 State of the Center Report to highlight a serious problem with labor and human relations and then, in 2003, he used the same platform to report on the improvements accomplished on this front. Labor and employee relations are important components to the environment at Warner Robins because they aid in the implementation of the new work system initiatives such as lean.

Labor relations had deteriorated over time and union leadership felt that the only avenue through which communication could be channeled were the various dispute resolution processes available. The result was a dramatic increase in disputes in 1999, 2000 and 2002. According to labor relations staff, the main grievance disputes arose over performance appraisals, improperly scheduled overtime, and work classification issues. There was no direct reference of any impact from lean on these disputes. Complaints were filed over the permanent award of jobs that had been temporarily filled at the introduction of lean efforts.

In 2003, union and management signed three agreements to attempt to improve the employment relations climate. The first is a partnership agreement that fosters better relations between the union and leadership at the base. The agreements also mandate mediation efforts at an early stage and pursuing a fast track for unfair labor practice

charges internally with the intent to resolve them before they go to an external agency. The parties thought that improving relations and reducing dispute levels would increase overall ALC effectiveness. General Wetekam said, “I am pleased with this agreement. It’s good for the workers at Robins, it’s good for the Air Force and it’s good for the community.”<sup>3</sup> Local Congressman Jim Marshall, whose involvement in the effort indicates the importance of the base for the local economy, said “Increasing the ability to communicate at the base level and resolve these matters before they reach Air Force level is very helpful to the base in accomplishment of its mission and to this community.”<sup>4</sup>

**Table 2: Dispute Types and Numbers at Warner Robins ALC 1993 – 2003**

Type of Complaint	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<b>Labor Grievances</b>	194	210	212	306	250	139	399	1044	211	506	223
<b>Unfair labor Practices</b>	42	34	85	101	72	117	136	57	9	111	57
<b>Informal and Formal EEO Complaints</b>	349	362	257	329	370	345	426	445	441	318	292
	21	27	32	27	52	31	73	80	80	104	62
<b>Totals</b>	<b>606</b>	<b>633</b>	<b>586</b>	<b>763</b>	<b>744</b>	<b>632</b>	<b>1034</b>	<b>1626</b>	<b>741</b>	<b>1039</b>	<b>634</b>

Current efforts to reduce dispute levels appear to be successful. The number of grievances fell almost 60% from 506 in 2002 to 223 in 2003. Mediation is now credited in resolution of more than 2/3 of the grievances filed. Unfair labor practice allegations were also cut in half from 111 to 57. Nearly all of these allegations are now solved internally. After the establishment of a diversity council and a supervisory training program, Equal Employment Opportunity (EEO) complaints are also down 40%, from 104 to 62. Given past oscillations in the number of disputes, it will be important to see whether this downward trend continues in the next years.

Collective bargaining is largely done at the national level between Air Force Materiel Command and the American Federation of Government Employees (AFGE) Council 214. The council represents 10 union locals around the country with a bargaining unit of approximately 36,000 workers in both blue and white-collar occupations.<sup>5</sup> Council 214 leadership helped develop and endorsed the alternative dispute resolution plans that have been introduced at Warner Robins as well as other bases.

While Council 214 bargains the master labor agreement at the national level, locally there has been little formal contract negotiation activity for many years. The local agreement language, which covers issues of specific local application such as shift times, appears unchanged since 1982. Labor and management have been very cautious about opening

<sup>3</sup> Lanorris Askew, Labor agreement called a step forward, Rev-Up, May 23, 2003, 2A

<sup>4</sup> Ibid

<sup>5</sup> Federal workers have the right to be represented by their unions without becoming members.

negotiations, although recently, tentative preliminary discussions were reported. Evolving avenues for communication and increased acknowledgement of shared interests will improve labor-management relations, but tensions and factors external to the base will also insure that this is a delicate process. Changes already underway will increase the challenges facing union and management leadership.

### **Instability from the Larger Perspective**

Even as their efforts support warfighters in Iraq, Afghanistan, and other global hotspots, workers at Warner Robins worry about how forces beyond their control will affect their work lives and paychecks. Local leaders have introduced innovative work practices, dispute resolution and cost-cutting measures to enhance the stability and future of the base. But there is also BRAC, the new employment relations laws handed down by Congress, and privatization, all of which are less controllable, external threats to stability. Examination of these factors will shed light on the pressures that base leaders face as they work to improve performance.

The impetus to assess and close unnecessary military bases first arose in the sixties as the military shifted from WWII readiness to Cold War readiness. Closures are endorsed as cost-saving measures for U.S. taxpayers. The next round of BRAC-mandated closures will be announced in 2005. These closures affect more than just the workers at the base. If Warner Robins Air Logistics Center is closed in the next round of BRAC, the state of Georgia will lose its largest industrial employer. Data for 2003 credits the base with a \$4.1 billion impact on Georgia's economy.<sup>6</sup> With stakes this high, each related action takes on great importance. Local, state, and federal government officials work with private citizen groups to influence the decision-making. Every aspect of the process is scrutinized and every statistic of base operations analyzed to see if any detail that could make a difference has been overlooked. For example, grievance levels or costs such as worker compensation payments can take on deeper significance because they might reflect poorly on base performance.

Beyond BRAC, civil service workers are now learning the ramifications of the National Security Personnel System (NSPS) that was created as part of the 2004 National Defense Authorization Act.<sup>7</sup> DoD officials now have greater authority to develop and implement new rules for human resources, labor-management relations, and employee appeals systems. Warner Robins chief personnel officer, Michael O'Hara, has said that the impact of this law will be fundamental "and will be the largest change I've been involved in during the 31 years or so that I've worked for the government."<sup>8</sup> According to the DoD NSPS website;

"NSPS will create a new framework of rules, regulations, and processes — rooted in the principles of flexibility and fairness — that govern the

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<sup>6</sup> "Economic Impact Statement 2003", Warner Robins ALC Public Affairs Office .

<sup>7</sup> The website for the National Security Personnel System is <http://www.cpms.osd.mil/nsps/>

<sup>8</sup> Holly J. Logan, "Pay, grade changes on the way for civilians", Robins Rev-Up, V49, 9 March 5, 2004, 1A.

way civilians are hired, compensated, promoted, and disciplined in DoD. This law was necessary to replace outdated and rigid civil service rules that hindered the Department's ability to carry out its national security mission, and to recognize the critical role that the hardworking, dedicated DoD civilian workforce plays in that mission.”

DoD officials are currently meeting at a national level with union leaders and others to plan a transition to the new regulations. AFGE union officials have warily watched the actions of the Bush Administration since 2003 when, what they dubbed “the Rumsfeld Plan,” was unveiled. The plan exempted selected federal workers from the provisions of the National Labor Relations Act.<sup>9</sup> At the time of our visit, local leaders were not certain of what the full impact of these legal changes would be. The full spectrum of employment relations will be reviewed and reconstituted with the stated goal of making the DoD “a more competitive and progressive employer at a time when the country's national security demands a highly responsive system of civilian personnel management.” DoD now has the “latitude to assign occupations and positions to broad occupational groups and broad pay levels and to establish qualifications for positions.”<sup>10</sup> The unions fear that these new regulations will erode collective bargaining rights and reduce worker protections. This could, in turn, affect their support for cooperative endeavors such as lean that are taking place in different ALCs.

Incentives and trust are essential components of any positive workplace change like lean. Therefore new employment regulations will play a critical role. For example, wages will be among the areas affected by the law. Pay bands will be established that group current compensation grades together. The bands have open pay ranges, with no fixed step rates. The DoD has run several demonstration projects and in each case “a key factor was the elimination of the many limiting grades and steps within the current general schedule system. NSPS will eliminate the grades and steps pay architecture and will simplify job classification.” Care must be taken to ensure that the implementation of these changes is perceived by workers as procedurally just and equitable, in order to preserve morale.

Contracting out is a widespread practice in every aspect of government work. Such privatization of government services is a goal that the U.S. government is seriously and deliberately pursuing. Cutting costs and improving services through competition are two of the most frequent arguments heard in the privatization debate. Others, however, counter that federal employees often perform the services more effectively due to their expertise and a lack of appropriate oversight mechanisms for the private contractors who take over the work. In any event, privatization affects lean efforts because it makes federal employees feel insecure in their jobs, undermining the trust and commitment necessary for continuous improvement processes. In interviews, several people reported

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<sup>9</sup> NCFLC Courier, Volume 19 Issue 1, 1<sup>st</sup> Quarter 2004, p 6. reports that the “Rumsfeld personnel Plan” transferred 170,000 federal workers to the Department of Homeland Security and took away their rights to representation. As a result of this reduction in the federal workforce, federal appeals agencies are reducing their staffing levels and closing offices. The Merit System Protection Board, the Federal Labor Relations Authority and the Equal Employment Opportunity Commission have all cut back on their coverage.

<sup>10</sup> From the NSPS website cited above.

uneasiness with the contractors' practice of hiring retirees at Warner Robins. They complained that a person could retire and come back the next day to the same job but working for a private company.

The C5 program provides other examples of how privatization can play out. When Kelly Air Force Base was closed in 2001 as a result of the last round of BRAC, redevelopment efforts attracted private companies like Boeing, Lockheed Martin and Pratt & Whitney to the vacated military installation. Many of these companies are aerospace parts or service providers and can tap into the local pool of skills among former Kelly employees. One company is indeed repairing C-5 engines at San Antonio. So while some jobs have been regained and competition appears to have increased as a result of community redevelopment, this case raises concerns about long-term skills provision. As both government and private sector try to reduce costs, new training initiatives look less attractive than alternatives such as offshoring or hiring laid-off and retired workers with pre-existing skills. Over time, these avenues do not replenish the skills base and it is not clear who is training the U.S. aerospace workforce of the future.

### **Conclusions**

The C-5 program has succeeded in their initial lean efforts. As workforce understanding of lean principles grows, performance can continue to improve. Lean depends on a deep and ongoing integration of the process principles with the knowledge of the workers to create continuous incremental improvements. Lean implementation frequently begins as a series of one-time events rather than an ongoing engagement of workforce knowledge and creativity. This has been the pattern at Warner Robins as well.

As management evaluates the outcomes of these activities, they are beginning to recognize that they were paying more attention to the number of lean events than to the amount of continuous improvement produced. This initial focus on rapid deployment also meant reliance on external consultants, rather than developing endogenous capacity for lean. More recently, base management is taking a more strategic approach that pays greater attention to sustainment. Further progress will be constrained by three factors: organizational complexity, lack of decision-making autonomy, and the impact of instability.

**Organizational Complexity:** Successful lean operations are generally characterized by flatter structures where organizational layers have been reduced and more authority decentralized to front-line workers. We did not find this process underway at Warner Robins. There appear to be increasing layers of middle management within the organization while workers have not yet begun to take on significant autonomy. In addition, the dual military and civilian leadership structures are complex hierarchies that add layers of relationships and chains of command to operations at Warner Robins. These structures may pose a serious constraint on lean improvements because they reduce flexibility and information sharing.

**Lack of Decision-Making Autonomy:** Warner Robins ALC is embedded in a web of regulation and regulatory structure. This web often takes the decision-making authority

out of the hands of the base leadership and limits the scope of lean changes that can be pursued locally, without involvement of higher-level structures such as the Air Force Materiel Command (AFMC). This constraint is becoming more apparent as lean efforts move up from the maintenance floor to the support administrative areas. For example, those involved in leaning the purchase request process at Warner Robins found their options limited by decisions made outside the base.<sup>11</sup>

**Impact of Wider Instability:** For workers at Warner Robins, the link between their performance and employment security is blurred by wider forces, such as BRAC and privatization. In both these situations, the livelihood of the worker is at risk and seems to be subject to political decisions. The new NSPS adds to this uncertainty, as it may result in reduced rights and protections. Job security is a key aspect of the employment bargain when lean is introduced.<sup>12</sup> Without a sense of security, workers are less likely to freely share the knowledge and creativity necessary for continuous improvement. In this context, the current efforts at building a stronger partnership with the union at Warner Robins are important because they might help alleviate the fears of the workforce. Developing trust and a mutual sense of responsibility for one another is a difficult but essential element of success.

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<sup>11</sup> Jessica Cohen, 2004, WR-ALC – Lean and the PR Process, p 12-13.

<sup>12</sup> Cletcher-Gershenfeld and others, 1999, Knowledge-Driven Work