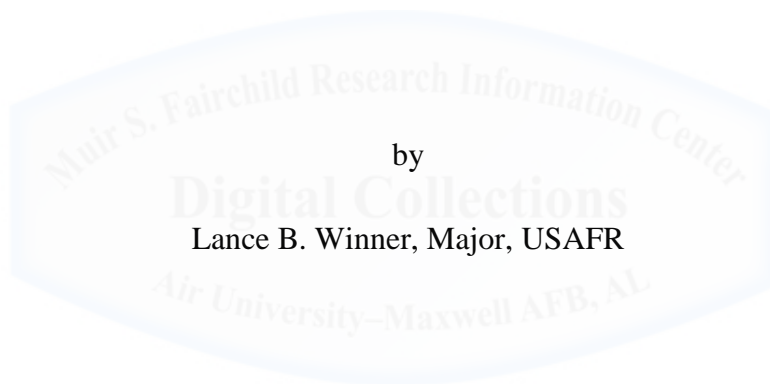


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**SUPPLIER DEVELOPMENT: A LONG-TERM
SUPPORTABILITY OPTION FOR USAF ENGINES**



by

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A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

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PREFACE

This research is designed to understand what regulations, if any, restrict the United States Air Force (USAF) from developing suppliers and demonstrate the benefits from creating an effective supplier development program. My experience at successful private sector companies has demonstrated that robust supplier development programs can be beneficial. The companies I worked with had implemented strong supplier development programs designed to strengthen the supply chain's ability to better meet performance objectives. My experience in the Air Force, particularly in the engine supportability arena, indicates a supplier development program is frail or non-existent. I have seen the benefits of supplier development programs and believe the USAF could benefit from one as well. My desire to improve this supply chain shortfall is what interested me to further investigate this research topic.

I would like to thank Dr. Richard Smith and Dr. Paul Moscarelli for answering countless trivial questions of this novice researcher and helped steer me toward the finish line. Their combined help was instrumental in getting my thoughts on paper in an organized, logical fashion. In addition, I would like to thank Lt. Col. Kevin Nalette and countless other colleagues for humoring me and providing me information and sound advice, helping me focus on a topic that was both interesting and supportive of the engine supportability business. Lastly, I want to thank my wonderful wife and my daughters. They had to cope with my numerous hours locked in the office struggling through a demanding curriculum and bailing on dish and bathtub duties. I appreciate your patience through this endeavor; you are the best family in the world, I love you very much.

ABSTRACT

The USAF engine supply chain community has struggled to meet the warfighter's need for engine production and management of items subject to repair (MISTR) production requirements. USAF engine suppliers currently account for 50% of the USAF total engine production requirement, while the USAF organic depots provide the other half. USAF engine suppliers have been an important part of the integrated supply chain management (SCM) process providing engines and parts, aiding in the ability of the depots to meet the warfighter's needs. The hypothesis is that the USAF can improve supplier's performance by strengthening its supplier development program. Commercial industry supplier development programs have produced successful partnerships, leading to improved on-time deliveries, reduced costs, streamlined operations, and the reduction of quality defects.

This research uses an evaluation framework to determine whether the USAF engine supply chain community is effectively developing their suppliers. The research investigates the current supplier development programs that exist in the USAF engine supply chain community today and compares them to successful programs in the private sector.

SECTION 1: INTRODUCTION

The United States Air Force (USAF) engine supply chain has struggled in the past to support the warfighter with enough engines to accomplish the mission. The engine supply chain management (SCM) community supports the warfighter by providing serviceable engines via management of items subject to repair (MISTR). Supply chain management is defined by the Department of Defense (DoD) Supply Chain Management Implementation Guide as "...an integrated process that begins with planning the acquisition of customer driven requirements for material and services and ends with the delivery of material to the operational customer."¹ The USAF SCM team manages the supply chains for both organic and contract methods of providing engines and MISTR items. The organic method refers to the repair or maintenance of engine and MISTR items performed by USAF members, whether Active Duty, National Guard, Reserve military members, or civilian employees. Contract workload is work performed by contractors or suppliers. For this research, contractor and supplier are used interchangeably. The USAF uses contractors for both procurement of new parts and the overhaul repair of engines and MISTR items. In FY2010, the USAF propulsion enterprise spent \$500M supporting the warfighter with safe and reliable MISTR items.² The USAF spent 30% of this budget on organic maintenance repair and 70% on contract repair. The primary focus of this research is on the opportunity to develop suppliers who account for 70% of the engine MISTR repair dollars for FY2010.

Supplier development is a relatively new concept, but has made significant progress in the private sector. For the purpose of this research, supplier development is defined as "Any effort of a firm to increase performance and/or capabilities to meet the firm's short and/or long-

term goals” as articulated by Daniel Krause, Professor of Operations and Supply Chain Management at Colorado State University.³ The philosophy behind supplier development is that stronger, more capable suppliers can improve the enterprise’s competitive ability, lower costs, and be more responsive to customer demands.⁴ Companies like Caterpillar Inc., PACCAR Inc., General Motors and Honda have supplier development programs that focus on improving supplier relations while improving quality, delivery performance, reducing costs and have reported substantial successes. Honda claimed to have reduced suppliers’ cost by \$200,000 in one year on one project alone.⁵ General Motors conducted supplier development projects with over 2,000 suppliers, reportedly increasing productivity by 50%, reducing lead-time by 70%, and reducing inventory by 75%.⁶ There have been many explanations provided as to why the USAF supply chain process neglects the supplier development element of SCM. Experience with USAF professionals indicates they believe it is because the return on the investment is not immediately recognized, while others say it cannot be accomplished due to the Federal Acquisitions Regulations (FAR). The FAR governs the acquisition process. It provides policies and procedures to ensure fair and equitable business rules are followed during the acquisition process. Many believe supplier development programs cannot exist in the government for the appearance of unfairness toward other competing suppliers. It is the intent of this research to understand what regulations, if any, restrict the AF from developing suppliers and demonstrate if the AF could benefit from creating a robust supplier development program.

Framework

This research will use an evaluation framework to compare supplier development programs implemented by Company A and Company B to the USAF supplier development

program. Company's names are masked to protect sensitive information related to private sector data. Both companies represent significant markets in the manufacturing industry. The goal is to determine whether the USAF engine supply chain community is effectively developing their suppliers and receiving the benefits and results the private sector supplier development programs are experiencing. The research will investigate the current supplier development programs that exist in the USAF engine supply chain community today. It will review and highlight any USAF or Department of Defense (DoD) regulations limiting or restricting the supply chain community from implementing robust supplier development programs. Any USAF programs that do exist will be evaluated by using predetermined criteria. The criteria used to measure supplier's effectiveness will be their ability to affect key SCM metrics: quality, cost, and delivery. The effectiveness of the USAF supplier development programs will be compared to successful supplier development programs in the private sector. These programs will also be evaluated using the same criteria. This research will highlight inefficiencies in the USAF's current supplier development programs and educate key USAF propulsion personnel on the long-term benefits of strong supplier development programs. Ultimately the goal is to provide the USAF propulsion supply chain leaders a proposal and implementation plan for a supplier development program that will provide long term support for engine production. The scope for this research will be limited to mature repair services and established purchase items for engine supportability requirements and not research and development services and repairs. The research and development acquisition process is much different than the mature acquisition process. In a research and development type acquisition, the government pays dollar-for-dollar for services rendered and provides incentives only for early milestone completion. This research will focus on the items and services rendered where the processes are established and the government uses

a firm fixed price (FFP) contract. These types of acquisitions, typically, do not offer incentives for quality improvements, cost reductions, or improved delivery performance other than the exercising of option years on the contract.



SECTION 2: BACKGROUND AND DISCUSSION OF PROBLEM

Importance of Suppliers in Sustaining an Engine Fleet for the Warfighter

USAF suppliers have long been an important part of the integrated supply chain management process. Their role is to provide quality engine parts on time at a competitive price. A supplier's ability to accomplish their role directly contributes to the depot's ability to meet the warfighter's needs. This task becomes more difficult with every passing year. Many of the engines used to power USAF aircraft are considerably past their original life expectancy. The F110-GE-100, which powers the F-16, was originally scheduled to retire in 2012.⁷ However with the implementation of the F110 Service Life Extension Program (SLEP), Aging Engine Upgrade (AEU), and the Augmentor Exhaust Nozzle Refurbishment programs, the service life was extended to 2025.⁸ Most original equipment manufacturers (OEMs) are no longer willing to manufacture parts to support older engines. These OEMs appear to prefer to focus on future USAF engine requirements, as opposed to manufacturing old engine parts to meet the current USAF engine requirements. This fact makes it very difficult and costly for the USAF to find quality suppliers who are willing and able to manufacture parts for an aging engine fleet. Furthermore, when the USAF does find suppliers willing to produce engine parts, there is little evidence of an effective program to successfully develop the suppliers to improve their overall performance and ensure future supplier supportability. In Jan 2004, the F100-PW-220 engine was having issues receiving quality blades from one of their suppliers. It took over a year for the supplier to analyze the repair process and rectify the quality issue.⁹ The supplier and USAF did have numerous meetings to discuss the issue; however, no action was taken by the USAF engine supply chain community to help the supplier fix the problems. The USAF informed the supplier

of the quality issue on the blade and then monitored the progress of the supplier until the quality issue was resolved. It is important for the USAF to have a more engaged supplier development program to ensure engine parts supportability now and in the future. There are many instances where suppliers fail to provide quality parts or cannot deliver them on time, which can negatively affect the depot's mission to produce engines and consequently degrade the warfighter's ability to accomplish their mission. The F100 blade issue mentioned earlier is a substantive example. The USAF did not receive quality blades for over a year while the supplier worked on fixing the repair process which led to a substantial supportability issue for the F100 engine.¹⁰

Unfortunately, the current USAF method to deal with a failing supplier is to not exercise optional years on the contract and then possibly replace the underperforming supplier. This forces the supply chain to start the acquisition process over from the beginning. The acquisition process creates significant costs to the USAF in terms of money, time, and resources. In addition, the search for a new supplier may be unrewarding because the new supplier may be plagued with the same issues as the previous supplier therefore forcing the process to start over yet again.

Currently, the USAF does not choose to work with and develop failing suppliers; instead they choose to replace them. This task can be very daunting and one that will be examined in this research.

Suppliers perform approximately 50% of current repair actions supporting the USAF propulsion enterprise supply chain mission to provide safe and reliable engines to the warfighter. Current law, Title 10 U.S.C. § 2466, sets a limit for funds that can be made available in a Fiscal Year for contract depot workload.¹¹ It states no more than 50% percent of a military department or a defense agency's budget can be outsourced to a contractor unless approved by waiver from the Secretary of Defense.¹² This law benefits both the government and the private sector. It

ensures the military depots retain some critical depot maintenance capability, while providing workload opportunities for the private sector, which also generates competition. Providing there are no significant future changes to this law, there is ample opportunity for the USAF to benefit from creating a supplier development program for engagement with current suppliers.

The current fiscal challenge facing the country demands all members of the government be fiscally responsible. DoD spending will be reduced to a level that coincides with the debt ceiling agreement reached by Congress and the President.¹³ It is clear the Secretary of Defense does not want cuts that will result in a weakened military and jeopardize national security.¹⁴ The USAF propulsion SCM organization spent 70% of its FY10 budget on contracted workload and MISTR item buys.¹⁵ There is a significant opportunity for the USAF to focus attention on suppliers who receive 75% of the engine MISTR and repair budget. The USAF does make significant strides in reducing costs pre-contract award through source selection competition, however there could be more savings post-contract award through supplier development programs. Often, suppliers have increased costs due to government contract administration requirements or to simply make up for operational inefficiencies. These inefficiencies are passed on to the government. A robust supplier development program would develop cost reduction goals and help the contractor identify operational inefficiencies to reduce costs. If the USAF could implement a supplier development program similar to private sector programs, a significant cost reduction opportunity exists. This kind of program falls right in line with President Obama's Executive Order *Promoting Efficient Spending*.¹⁶ His direction for agencies to establish plans for reducing costs within their respective organizations could be accomplished in the contract supply chain arena through supplier development.¹⁷

Overview of Current AF Engine Supply Chain Management Practices

The USAF does not currently have a robust supplier development program. It does have ways to manage suppliers; however, the current methods lack the ability to make significant, quick changes to affect supplier performance. Three very common measures of supply chain management effectiveness are cost, quality, and delivery. The USAF controls and monitors cost through the source selection process and the contract type. They monitor quality and delivery after contract award through the Contractor Performance Assessment Report (CPAR). All the methods the USAF has in place to effectively manage contractor's costs, quality, and delivery do not appear to capitalize on the benefit a focused supplier development program could provide.

The USAF current acquisition process is designed to get the best price and the best quality needed through a rigorous source selection process. According to the FAR, the purpose of source selection is to provide the best value.¹⁸ Conceptually, the source selection process creates competition, thereby lowering costs. The government relies heavily on this concept because after government award there is very little government influence on supplier performance. Cost can be controlled prior to contract award, by the type of contract the government uses. The source selection team can choose to use a firm-fixed price arrangement, whether it is a sole source or competitive acquisition strategy. The firm-fixed price contract ensures the contractor maintains the price for the duration of the contract, unless an economic adjustment has been negotiated into the contract. This type of contract places a cost risk on the supplier. It also places the burden on the supplier to price the service or product appropriately, taking into account learning curves, proposed quantities, and any other assumptions. Typically these unknowns will give the supplier no choice but to quote at a higher price to cover unanticipated or hidden costs and assumptions. Once the contract is awarded, the government is

obligated to pay the negotiated contract price whether it was high or low. In a firm-fixed price contract, the supplier is motivated to reduce inefficiency and reduce operational costs only to increase profit. The government cannot affect cost reductions until contract expiration. At that time, the USAF could re-compete the workload in an effort to obtain a lower price quote. The current USAF source selection process does affect cost through the creation of competition; however, the process does not allow for cost adjustments after award. Government contracts do have a tendency to move from one supplier to another after contract expiration to create competition and maintain a qualified industrial base to accomplish a specific repair or the manufacturing of a specific part. The government may receive a cost reduction over the span of several contracts by creating competition; however, it does not happen quickly.

The two USAF processes currently used to manage supplier's quality and delivery performance are the CPAR and the Corrective Action Request (CAR). The CPAR process is initiated by the Program Office. The CPAR is an annual requirement to provide the supplier feedback on their performance. The CPAR includes categories such as quality of product, schedule, cost control, business relations, management of key personnel, and other areas.¹⁹ The CPAR has very little short-term impact on a supplier to make improvements; it is merely a feedback mechanism. The government depends on the supplier to take negative comments or negative performance measures provided by the CPAR and make adjustments accordingly. The CPAR does not mandate any immediate action on the part of the supplier. For this reason, the CPAR process does have a short-term ability to affect supplier performance. It can, however, affect future source selection. Source selection teams use CPARs to evaluate contractors' past performance. If a contractor has a poor CPAR on file, it could affect their opportunity of winning the next contract. The CPAR does have some ability to affect poor supplier

performance, but it is not immediate. Changes made by a supplier as a result of a negative CPAR is merely a supplier decision motivated by the possibility of future business. A CAR is a notification from the government to a supplier that a contractual nonconformity exists requiring the supplier to initiate corrective action in accordance with contractual requirements²⁰. The CAR process is initiated by the Defense Contract Management Agency (DCMA). DCMA is a DoD component responsible for ensuring the integrity of the government contracting process.²¹ In general, DCMA provides contract administration services to all military services worldwide.²² DCMA manages what is contractually agreed on by the Government and the supplier.

AF and DoD Regulations “Limitation or Hoax:” Can USAF Develop Suppliers?

Many USAF supply chain managers believe the FAR does not allow for a supplier development program. Some challenge the fact that a supplier development program can get a reasonable return on investment. Most supplier development programs consist of quality and development engineers and purchasing and supply chain professionals. Consequently, to create an organization to develop suppliers would possibly increase qualified personnel, and in a fiscally constrained environment adding people might be difficult, if not impossible. Many others claim a supplier development program cannot exist in the USAF because of the FAR. They believe the FAR would not allow a program that is designed to help the supplier do better or that might create an unfair advantage for some suppliers.²³ However, the FAR does not govern the relationship between the supplier and government after contract award. The FAR governs the acquisition process leading up to contract award. It also provides policies and procedures to ensure fair and equitable business rules are followed during the acquisition process.²⁴ “The FAR is the primary regulation for use by all Federal Executive agencies in the

acquisition of supplies and services with appropriated funds.”²⁵ The Federal Acquisition System uses the FAR to satisfy the customer in terms of cost, quality, and timeliness of product or service delivery.²⁶ The FAR accomplishes this by helping the acquisition community maximize the use of commercial products and services, use only reputable and superior suppliers, and promote competition.²⁷ Use of the FAR also minimizes administrative operating costs, demands business be conducted with integrity and fairness and ensures public policy objectives are fulfilled.²⁸ The FAR is divided into three sections: requirement and acquisition planning, contract preparation, and contract administration. The contract administration section is the only section that discusses the government’s functions after contract award. This section lists all the functions given to the contracting officer and those functions delegated to the contract administration office (CAO), after contract award. There are seventy-one functions identified in this section. Most of the functions are administrative in nature, allowing the contracting officer to perform reviews of the contractors compensation structure, evaluate contractors price proposals, and even negotiate and execute price adjustments.²⁹ In the contract administration section of the FAR, the government is granted the power to perform an oversight function of the contract. It provides the authority to review and evaluate contractor’s compliance with the contract but doesn’t authorize, or deny the government the ability to take action for poor performance.³⁰ Nowhere in the FAR does it state that a supplier development program is illegal. It also does not govern what a supplier development program if created would look like. It appears the reason the USAF does not have a supplier development program is based on cultural barriers. The idea the FAR exists to provide policies and procedures to ensure fair and equitable business rules are followed tends to make people believe supplier development creates an unfair advantage for the supplier being developed. Culturally, it is believed that supplier development

programs cannot exist in the Government for the appearance of unfairness toward other suppliers.³¹ This is not true. Once contract is awarded, the government could be able to develop suppliers as long as the contract states it is acceptable.



SECTION 3: UNITS OF MEASUREMENT

Key Supply Chain Performance Measurements

The SCM community uses many different metrics to measure supplier's performance. Some of the leading commercial industry measures are cost, quality, delivery, willingness to share data, customer response time, communication, financial analysis, use of electronic data interchange (EDI), and certification levels. The most common amongst all supply chain management organizations are quality, cost, and delivery (QCD). This research focuses on a supply chain management team's ability to affect a supplier's performance through their development program.

The quality measurement captures the supplier's ability to provide a quality product based upon the specified drawing. This is normally measured in defects per million opportunities (DPMO) and then converted to a percentage. The quality of a part or service is measured when that product or service is received. Quality is an important metric to review because defective part can slow down the supply chain process and cost money, for both the contractor and the USAF. Quality should be measured at both the USAF and the contractor's facility. A supplier may have an internal quality issue but mitigate it with a robust inspection program. This extra level of inspection costs the supplier money, which in turn, can be passed on to the government. A good metric to review in this instance is the 'first time pass rate'. This metric measures how many times it takes a supplier to manufacture a quality part. The longer it takes to create a part, the more it costs the supplier. The cost of poor quality is normally passed on to the customer. Quality is typically the most important metric used to measure a supplier's performance.

The second measurement is cost. Cost is not just the purchase price of a product or service. Cost can be dissected into many different elements such as labor, transportation, inventory, facilities, and many others. To measure true cost, the purchasing entity must have access to the supplier's cost structure. The FAR provides provisions for the contracting officer to access a contractor's cost data, unless competition exists to drive the price down.³² Cost is a measurement that is very important to monitor. Every company is in the business to make a profit. They will charge the maximum of what one is willing to spend. It is important to track pricing because the market for material does change, resulting in fluctuating prices. The purchasing entity must track these changes to ensure they are paying for material or labor cost increases and not for supplier inefficiencies. Cost is measured by the increase or decrease of price in a part or service over a specified period of time.

The last metric used is on-time delivery. On-time delivery is measured to access the supplier's ability to deliver goods or services when needed or when required by the contract. Manufacturing centers and defense depots run on manufacturing schedules. In a Lean manufacturing environment, parts should arrive when needed not earlier or later (the Just-In-Time inventory concept). Late parts or service delivery can severely limit a manufacturer's ability to produce products in a timely manner. When parts are unavailable due to late delivery, manufacturing lines must reschedule to maintain operations flow. Once the parts arrive, another schedule revision must take place slowing down the manufacturing process again. The exercise of rescheduling costs significant amounts of time, money and resources. Early delivery presents its own set of issues as well. Parts delivered early increase inventory costs and place a substantial footprint in the warehouse facility. This increases internal transportation and

warehouse costs. On-time delivery is measured by tracking the percentage of parts or services delivered by the previously specified need date.



SECTION 4: DISCUSSION OF ALTERNATIVES

Company A and Company B Supplier Development Programs

Companies A and B have both realized the benefits from having a strong supplier development program. They, like the USAF engine community, outsource a portion of their workloads to focus more attention on their core competencies. Their programs seek to establish partnerships with suppliers based on mutual trust and integrity. Their goal is to develop world class suppliers capable of providing quality parts and services on-time, at a reasonable price. Because both companies have thousands of suppliers, they use a key supplier approach to narrow down their development focus. They manage the top twenty percent of their suppliers based on the amount spent with those suppliers in a given year. 'Spend' is the amount of money allocated to supplier for goods or services. The philosophy is there is more to gain on improving a supplier who provides the majority of the company's total outsource budget. Companies A and B both measure their suppliers using quality, cost, and delivery as metrics.

Company A has a supply chain management team that accomplishes the supplier development task. Each team consists of supply chain professionals dedicated to a particular commodity. Commodity groups consist of similar parts in an industry that requires the same material or require similar manufacturing processes. Examples of commodity groups are purchased finish products such as, steel (flat steel, rolled steel, tube steel, etc), heavy manufactured material (frames and chassis), and electronics and wiring. Each team consists of a purchasing manager, a buyer, a supplier development engineer (SDE), and a supplier quality engineer (SQE). Every team member has different roles they perform everyday within the supply chain management process while sharing a common goal to develop suppliers. The team

develops goals for their suppliers and communicates the goals to suppliers at the beginning of each year. The main metrics used are quality, cost, and delivery (QCD). Typically the goals are to reduce defects, reduce costs, and improve on-time delivery. The supplier development team and the supplier collaborate to create an initial plan to meet the agreed upon goals. This plan is formally documented and signed by both company's management. Once per quarter, the Company A team will meet with the key suppliers to discuss their quarterly performance and compare their performance to the goals. If the performance goals are met, or are in within reach, conversations typically center on new business opportunities and potentially new goals. However, if goals are not met, the team will review the failing metrics and develop a new plan to achieve the goals. A new plan could consist of: Company A-assisted or led 6 Sigma event, monthly meetings as opposed to quarterly meetings, a get-well plan, or in extreme cases, an exit strategy to find a new supplier. An exit strategy is the worst possible route to take because it costs a significant amount of time and resources to find another capable supplier. This strategy sometimes results in a break in the supply chain, causing production to slow down or completely stop during transition to a new supplier. In any case, when a supplier is failing, they will almost always get increased attention and focus from the Company A supply chain management team.

Company B has a very similar supplier development program. Their QCD goals are provided by the corporate purchasing department. Each commodity has goals to improve QCD tailored for their commodity. The divisions within Company B develop their own plans to accomplish the goals set forth by corporate purchasing. Company B's supplier development team is not as defined as Company A's. They accomplish the same development tasks; however, they have less people. Their team consists of the purchasing manager, a buyer, and the supplier quality engineer. The buyer is the only team member who is designated to a specific commodity.

The supplier quality improvement plans are developed by the SQE. Part of the SQEs plan is to conduct four High Impact Kaizen Events (HIKE), and two 6 Sigma events with the suppliers that have the lowest quality ratings. A HIKE is a 6 Sigma tool Company B uses that combines lean initiatives and 6 Sigma methodologies to make improvements in processes. Company B defines a HIKE as a “6 Sigma event on steroids”³³. HIKEs are generally accomplished in four weeks. Company B’s 6 Sigma projects are normally two months in duration and use statistical methods designed to reduce variability within a process. Cost reduction and on-time delivery improvement plans are developed by the commodity buyer with assistance from the purchasing manager. Together, they develop plans to reduce supplier costs through several methods such as supplier manufacturing process reviews and strategic sourcing initiatives. Several HIKEs have been accomplished by the buyers and purchasing manager, resulting in waste removal at the supplier’s facility, leading to reductions in purchase price. On-time delivery improvement plans are managed in the same manner; however, on-time delivery plans are focused on suppliers who habitually fail to reach the 80% on-time delivery goal established by the purchasing team. The supplier development team meets with their key suppliers quarterly to review goals and objectives to ensure supplier success. After the initial meeting where the annual QCD goals are agreed on, the quarterly meetings review the supplier’s progress towards set goals and discuss any other issues experienced by either company.

SECTION 5: MAJOR DIFFERENCES – PRIVATE SECTOR VS. USAF

There are many differences between private sector and the USAF supply chain management processes for developing suppliers. This section highlights examples in the private sector and the government, where QCD metrics were failing and actions were taken to remedy the situation. The most significant differences were the amount of time it took for the issues to be resolved, the desired results achieved and the effect the actions taken will have on long term supportability for the future. The private sector's focus almost always achieves the desired results more quickly through supplier engagement and collaborated improvement plans in addition to increased future supportability opportunities.

Quality Comparison

In Sept 2008, Company B received three shipments of cable drums from a casting supplier that were rejected by the quality department for excessive 'runout' in the flange area (Figure 1). These drums are used to manufacture the winch found primarily on industrial pipelayers. 'Runout' is a term for measuring the tolerance of a machined part's out-of-roundness. Many different operations in a manufacturing process can contribute to 'runout'. In this instance, a Company B Sigma team was deployed to the supplier's facility to review the manufacturing process. After three days of process reviews, several issues were discovered that resulted in the quality problem. The program on the machine used to manufacture the part was incorrect, the material provided by the supplier's vendor was out of specifications, and the operator was not properly trained, all contributing to the problem³⁴. The Company B team quickly corrected the machine program and identified additional training for the operator. The

supplier's vendor was also notified of the issue spawning a future 6 Sigma event at that supplier's facility. In addition, it was discovered the supplier had an internal scrap rate of 38%. The efforts of the Company B team resulted in reduction of their internal scrap rate to less than 10%. The internal scrap reduction consequently led to a cost reduction saving Company B \$250,000 annually³⁵.



Figure 1. Identification of the flange area on a cable drum.³⁶

In January 2004, the USAF experienced a quality issue with compressor blades for the F100-PW-220. Several consecutive shipments of blades from the supplier were not within specifications. The USAF identified the quality issue and notified the supplier with a CAR issued by DCMA. After issuing the CAR, the USAF monitored the supplier's progress through recurring telephone conferences. It took over a year for the supplier to analyze the repair process and rectify the quality issue.³⁷ No action was taken by the USAF engine supply chain community to help the supplier fix the quality issue other than providing serviceable blade

specifications. The USAF supply chain community was forced to get waivers from engineering to continue re-using existing blades to support engine production. The quality event was annotated in the CPAR; however, the overall CPAR was still rated satisfactory.

The private sector and the USAF both manage supplier quality; however, it is done differently. The private sector encourages engagement by both companies to achieve quality goals. The government relies on the contractor to abide by the quality requirements in the contract. Government involvement with helping the contractor fix quality issues is almost non-existent. The government does incentivize good performance by exercising option years on the contract and by issuing acceptable CPAR scores.

Cost Comparison

Cost is the most difficult supply chain metric to compare between the private sector and the USAF. This is primarily due to the differences in missions. The private sector is motivated to reduce costs to attain higher profit margins. The government's mission is to provide the customer the required part or service at the best price available. The private sector establishes cost reduction goals with suppliers, and engages their management and operation teams to develop plans to achieve them. The government sets a firm fixed price for a product or service through its contractual arrangement and relies on the competitive source selection process to achieve the best price possible. As mentioned earlier, the government relies on industry to create competition to reduce the market cost of a specific good or service. Once a contract is awarded, the government does not affect price. The only time a price change would be adjusted, post-contract award, is if the supplier requested an economic price adjustment due to increased material costs or labor costs (only if the economic price adjustment clause is in the contract).³⁸

The private sector and the USAF both manage costs; however, the private sector has the ability to affect immediate price adjustments based on mutual agreements to reduce cost. The government manages cost by creating a competitive environment, therefore lowering the market value of a good or service. Cost reductions in the government are normally seen after the expiration of a contract and in the competitive source selection process of the follow-on contract. Cost reductions are limited to the length of the current contract.

On-Time Delivery Comparison

In 2001, Company A was experiencing late deliveries on several manufactured parts from a supplier. Their supplier was averaging approximately a 40% on-time delivery metric.³⁹ Company A's buyer was told that requirements received through the electronic data interchange (EDI) were being added within established lead time. The supplier was unable to manufacture the part as quickly as needed. The lead time for the parts was negotiated at twelve weeks. Orders were being taken by Company A and being scheduled within the twelve week window. It was a valid issue for investigation by Company A's buyer. The buyer called a meeting with all the appropriate players from both companies. Together they discovered that Company A's sales department was taking any order they could, without regard to lead time. Both companies understood the issue; however, neither wanted to lose sales. Together they wanted to determine a way to meet the increased demand. The supplier agreed to manufacture extra parts each week for one month, providing a 'cushion' for increased demand. During that month, Company A's buyer and SDE worked with the supplier to accomplish a process review with the goal of reducing manufacturing lead time. During their process review several inefficiencies were discovered. Among them was excess material handling time, lengthy machine setup time, and

poor welding techniques. The buyer and the supplier were able to negotiate a plan to remove these inefficiencies in effort to improve their on-time delivery. From the initial notification of the problem to the time adjustments were made was about two and a half weeks. The supplier's delivery performance started to improve immediately after the adjustments and both companies were able to increase sales due to a more efficient process.⁴⁰

In the spring of 2007, the USAF was not receiving fuel nozzles for the F108-GE-100 in time to meet the engine production schedule at the depot. Unlike the private sector, the USAF did not help the supplier improve their delivery performance. The contracting officer notified the contractor that their delivery performance was violating the requirements of the contract. After months of being behind schedule, the USAF SCM team was forced to seek fuel nozzles elsewhere. The F108 team released an urgent purchase request for six months worth of fuel nozzles to a new contractor. The USAF paid a higher price for the new fuel nozzles because of the short notice requirement. The contracting officer sought to receive damages from the original contractor under the Liquidated Damages clause in the FAR⁴¹. The specific FAR clause used stated that the government could seek just compensation for damages caused by late deliveries⁴². The USAF, however, was unable to prove damage as a result of the contractor's late delivery. The USAF lost several months of production on the F108 engine, spent over \$300,000 creating an urgent purchase request for new parts, and paid \$800,000 more for the new parts⁴³. The supplier did receive a substandard CPAR rating and the follow-on options of the contract were not exercised.

The USAF and private sector measure on-time delivery very closely; however, both have very different methods of correcting on-time delivery problems. Company A's example demonstrates that their supplier engagement method works by fostering relationships and

teamwork. The end result benefits both parties simultaneously. Although the USAF example does not represent how every on-time delivery infraction is handled, it does provide an example that the current supplier development program needs work.



SECTION 6: RECOMMENDATION

“Supply chain management is one of the key practices developed in the private sector over the past two decades. This concept, which involves significant process changes, holds great promise for improving military logistics support. Making successful use of this concept requires the proper mix of commercial practices, modern technologies, and consideration of DoD’s unique logistics characteristics.”⁴⁴

- James T. Eccleston, Assistant Deputy Under-Secretary of Defense, Supply Chain Integration

Supplier development should be a key aspect of the USAF supply chain management roles and responsibilities. Today’s engine suppliers perform approximately 50% of the current repair requirements supporting the USAF supply chain propulsion enterprise mission. This provides an excellent opportunity for USAF supply chain managers to seek improvement in all supplier supply chain metrics. Many major corporations are using a more “hands-on” approach to managing their suppliers.⁴⁵ Many private sector companies have identified a need to focus on improving their supplier’s manufacturing processes and administrative systems which improves their overall ability to support the customer.⁴⁶ The USAF SCM team can adopt elements of existing supplier development programs from the private sector and use them to improve the defense supply chain’s ability to meet the warfighter’s engine needs. The USAF would have to make adjustments to implement a robust supplier development program. The contract used in the acquisition process would have to allow for a more ‘hands-on’ approach by the Government, DCMA would have to expand its responsibilities, and the acquisition community would have to overcome the culturally-biased belief that supplier development cannot work in the defense industry.

The contract used to bind a supplier to the USAF for a specific good or service would have to incorporate a supplier development element. Current firm-fixed price contracts would

need to change to include cost reductions goals over the life of the contract. A firm-fixed price contract might be acceptable for a two year basic period, but contract extensions must incorporate some type of cost reduction goal. This would allow the supplier to establish a firm price for the first two years covering all unknown costs, and then establish a cost reduction plan for the future in an attempt to entice the Government to exercise the contract extension years. In addition to cost reduction goals, there must be quality improvement and on time delivery goals. Although these are common metrics measured in current contracts, they could be given more impact by contractually mandating suppliers to perform 6 Sigma projects once a year focusing on quality and on-time delivery improvements. Realizing these projects would cost money and resources, the supplier would have to incorporate the costs into the two year basic pricing; however, they would be contractually obligated to give back to the government any efficiency gained through cost reductions or split it with the government. The efficiencies gained through 6 Sigma projects should strengthen the company's ability to support USAF engine supply chain and allow for them to grow and develop the rest of their business.

DCMA is the most appropriate DoD agency to manage supplier development. Their current mission to provide contract administration services to the DoD acquisition community should be expanded to include supplier development. DCMA should have supplier development groups specialized by specific commodities. The commodity distinction will allow for personnel to specialize within each individual field of expertise. DCMA should provide the acquisition community the appropriate QCD goals to be included in the government request for proposal and eventually incorporation into the contract. Then, DCMA could hold their suppliers accountable for reaching those goals. Using the "hands-on" approach adopted by many private sector companies, they could help suppliers develop. In the beginning stages, DCMA should focus on

the suppliers that make up 10% of the commodities purchases. The supplier base could be expanded to include more suppliers as the team becomes more knowledgeable and experienced. DCMA personnel would serve as the liaison between the engine supply chain management community and the supplier for all QCD issues. DCMA would be able to accomplish their current contract administrative service, along with the supplier development if the acquisition community added supplier development language to future contracts.

The USAF supply chain management and acquisition communities must overcome the culturally-based belief that supplier development cannot exist in the defense department. The FAR does not govern the relationship between the supplier and government after contract award. The FAR regulates the acquisition process leading up to contract award. It ensures fair and equitable business rules are followed during the acquisition process. It has policies and procedures that guarantee suppliers have equal opportunity to bid on government requirements.⁴⁷ “The FAR is the primary regulation for use by all Federal Executive agencies in the acquisition of supplies and services with appropriated funds.”⁴⁸ The only section of the FAR that pertains to supplier relationships after award is the contract administration section, and even it does not reject the ability for the DoD to develop suppliers. The FAR helps the acquisition community maximize the use of commercial products and services and promote competition.⁴⁹ It does not hinder the ability of government to engage in supplier development. The government’s culturally-biased belief parity across the entire supply base, established by the FAR, must be overcome after contract award. Helping a supplier develop once on contract, only ensures the viability of that supplier to support the government’s requirement for the remainder of the contract.

SECTION 7: CONCLUSION

The USAF engine supply chain has struggled in the past to support the warfighter with enough engines to accomplish the mission. In FY2010, the USAF propulsion enterprise spent 70% of their annual budget on contract repair, either through parts purchases or MISTR item repair. With the shrinking fiscal budget, and the increase demand on aging engine equipment, this trend is not likely to be reversed. The USAF SCM will continue to rely on suppliers to support the aging engine fleet to meet the warfighter's needs now and into the future. It is more apparent than ever that the USAF should begin to develop the supply base to ensure parts availability. Supplier development is quickly gaining private sector awareness. It has garnered the private sector enormous gains in building a strong viable supply chain capable of saving money and providing quality parts on time. A supplier development program is needed for the government to be a more efficient steward of taxpayer money in the future. If the private sector can develop stronger and more capable suppliers capable of improving the enterprise's ability to be competitive, in addition to reducing costs, and being more responsive to customer, than so can the Government. It is time for the Government to become more engaged in their supply base and create the positive changes needed to improve the defense supply chain management performance.

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography.)

- ¹ DoD Supply Chain Management Implementation Guide 2000, 14.
- ² 848 SCMG/OM office at Tinker AFB, OK. This number only includes the MISTR repair dollars spent in FY2010. It does not include whole up engine repair.
- ³ Krause, 1997, 1.
- ⁴ Boden, 2010, 2.
- ⁵ Hartley and Thomas 1996, 1.
- ⁶ Hartley and Thomas 1996, 1.
- ⁷ F110 Engine Life Management Plan (ELMP) dated 1 July 2008. Online, available at: <https://cews.tinker.af.mil/gkg/ELMP/#F100>.
- ⁸ F110 Engine Life Management Plan (ELMP) dated 1 July 2008. Online, available at: <https://cews.tinker.af.mil/gkg/ELMP/#F100>.
- ⁹ Interview with F100 Item Manager (IM), 23 Jan 2012.
- ¹⁰ Interview with F100 Item Manager (IM), 23 Jan 2012.
- ¹¹ Title 10 U.S.C. § 2466.
- ¹² Title 10 U.S.C. § 2466.
- ¹³ E-mail message from Secretary of Defense Leon E. Panetta to all DoD personnel, *Meeting our Fiscal and National Security Responsibility*, 4 Aug 2011.
- ¹⁴ SecDef Panetta e-mail message, 4 Aug 2011.
- ¹⁵ 848 SCMG/OM office at Tinker AFB, OK.
- ¹⁶ Executive Order, President Barack Obama, *Promoting Efficient Spending*, 9 Nov 2011.
- ¹⁷ Executive Order, President Barack Obama, *Promoting Efficient Spending*, 9 Nov 2011.
- ¹⁸ Federal Acquisition Regulation, Subpart 15.3, 3 Jan 2012.
- ¹⁹ Taken directly from blank Contractor Performance Assessment Report (CPAR) form at Tinker AFB, OK.
- ²⁰ Defense Contract Management Agency (DCMA) website. Online, available at: <http://guidebook.dcma.mil/226/226-1/index.cfm>.
- ²¹ Defense Contract Management Agency (DCMA) website. Online, available at: <http://guidebook.dcma.mil/226/226-1/index.cfm>.
- ²² Defense Contract Management Agency (DCMA) website. Online, available at: https://home.dcma.mil/Command/strategic_plan/introduction.cfm#role.
- ²³ Interview with Contracting Officer, 2 Dec 2011.
- ²⁴ Federal Acquisition Regulation, Subpart 1.1.102, March 2005.
- ²⁵ Federal Acquisition Regulation, Volume 1, page 4, March 2005.
- ²⁶ Federal Acquisition Regulation, Subpart 1.1.102, March 2005.
- ²⁷ Federal Acquisition Regulation, Subpart 1.1.102, March 2005.
- ²⁸ Federal Acquisition Regulation, Subpart 1.1.102, March 2005.
- ²⁹ Federal Acquisition Regulation, Subpart 1.1.102, March 2005.
- ³⁰ Federal Acquisition Regulation, Subpart 42.2, 2 March 2005.
- ³¹ Interview with Contracting Officer, 2 Dec 2011.
- ³² Federal Acquisition Regulation, Subpart 15.403-4, March 2005.
- ³³ Company B 6 Sigma Quality Department Instructions, 2005.

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- ³⁴ Company B 6 Sigma Presentation, 2008.
- ³⁵ Company B 6 Sigma Presentation, 2008.
- ³⁶ Company B 6 Sigma Presentation provided by casting buyer, 2008.
- ³⁷ Interview with F100 Item Manager (IM), 23 Jan 2012.
- ³⁸ Federal Acquisition Regulation, Subpart 14.408.4, March 2005.
- ³⁹ Interview with Company A Buyer, 2011.
- ⁴⁰ Interview with Company A Buyer, 2011
- ⁴¹ Interview with Contracting Officer, 2 Dec 2011.
- ⁴² Federal Acquisition Regulation, Subpart 11.501, page 11.4-1, March 2005.
- ⁴³ Interview with Contracting Officer, 2 Dec 2011.
- ⁴⁴ *DoD Supply Chain Management Implementation Guide* 2000, vii.
- ⁴⁵ Hartley and Thomas 1996, 1.
- ⁴⁶ Hartley and Thomas 1996, 1.
- ⁴⁷ Federal Acquisition Regulation, Subpart 14.104, March 2005.
- ⁴⁸ Federal Acquisition Regulation, Volume 1, page 4, Mar 2005.
- ⁴⁹ Federal Acquisition Regulation, Subpart 1.1.102, Mar 2005.



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