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The purpose of the study was to provide the Army with advice on maintaining its operational capabilities while facing a draw-down and ongoing budgetary pressures. The study team developed five force re-balancing strategies that demonstrably saved 21,172 positions, or the equivalent of approximately 4.7 Brigade Combat Teams. The study team also made several recommendations for the Army to modernize and restructure its maintenance functions, from developing a data analytics capability that would drive efficiencies, to contracting various maintenance functions within the brigade and at higher echelons.

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Army Science Board
Fiscal Year 2015 Study

Strategies to Optimize Army Operating and Generating Forces for 2025 and Beyond

Final Report
April 2016

Department of the Army
Office of the Deputy Under Secretary of the Army
Washington, D.C. 20310-0103

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DUSA-ASB April 15, 2016

MEMORANDUM FOR SECRETARY OF THE ARMY

SUBJECT: Final Report of the Army Science Board, “Strategies to OptimizeArmy Operating and Generating Forces for 2025 and Beyond.”

1. I am pleased to forward the final report of the Army Science Board study titled “Strategies to Optimize Army Operating and Generating Forces for 2025 and Beyond.” The study examined strategies for the Army to maintain or gain operational capabilities during its drawdown and the budgetary pressures being exerted across the DoD. The scope of the study included strategies that had the potential to produce efficiencies in combat service support and the generating force, where any savings could be re-invested into the operating force. Specific techniques reviewed by the study team included the appropriate use of contractors, disruptive technologies to enhance Army capabilities, and innovative concepts in supply chain management, e-procurement, logistics, personnel support, personnel services, and contracting.

2. For this effort, the study team brought subject matter experts in Physics, Engineering, Computer Science, ISR, Air Defense, Modeling & Simulation, Optics, Network Architecture, Analytics, Robotics, and a variety of military operations and technologies, as well as former Army leaders. During it’s seven months together, the study team conducted over thirty visits and interviews among Army and DoD agencies, FFRDCs, Academe, and commercial industry.

3. As a result of these efforts, the study team made a number of findings and recommendations aimed at saving force structure and rebalancing the force. In one example, the study team made a series of recommendations regarding maintenance operations. The Army could realize efficiencies in maintenance operations by creating an analytics capability to re-structure logistics and to synchronize bench stocks. This would go hand-in-hand with accelerating the implementation of condition-based maintenance (CBM) across all maintenance functions. In turn, these advances would support and enable the contracting-out of maintenance functions in CAB, BCT, and echelons above Brigade. The Army woould only have to maintain the necessary force structure in the Reserve and Guard Components to transition from peace to war, and to mitigate risk.These, and several other recommendations in the areas of S&T, deployed logistics, and installation support, created potential force structure savings of over 21,000 positions, or the equivalent of more than four BCTs.

4. The findings and recommendations in this study were adopted by the Army Science Board by unanimous vote on July 16, 2015. I hearby endorse the findings and recommendations in this report.

James A. Tegnelia
Chairman

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1.0 EXECUTIVE SUMMARY

> If we get small enough where some of these [world] leaders don't believe the Army can respond or deter them, if you can't ... deter them from believing they can accomplish something ... that increases the threats and danger to the United States.
>
> General Ray Odierno[1]

Prior to the release of the Pentagon's 2017 budget request, military leaders had used aggressive cuts to military pay and benefits and across-the-board force reductions to cut costs. The goal was to maintain adequate funding for training, new weapons and high-tech research. As applied to the Army, the cuts would have required the elimination and reorganization of Brigade Combat Teams (BCT), the core of the Army's combat force.[2] This raised concern over whether the proposed reductions might leave a hollow force; where the Army would lose its capacity to prevent, shape, and win against the future threats of an increasingly complex world. Army leaders stated publicly that force structure levels under the proposed cuts would diminish the Army's capability to meet ongoing deployment requirements and its capacity to respond to the contingency requirements of combatant commanders.[3]

While relief from this latest round of cuts appears to be forthcoming, the costs of manpower are rising and will continue to rise. Thus, as the most manpower-intensive branch of service, the Army will continue to face fiscal pressure to maintain its force structure. In order to address these foreseeable challenges, and to set the stage to make more effective decisions in shaping it force structure, the Army will need to develop longer-term strategies, rather than reacting to budgetary cycles.

Part of that strategy should be a continued emphasis on rebalancing the force. The Army has already examined various ways to preserve its combat capacity while shrinking its force structure, which General Odierno described as, "increasing our tooth-to-tail ratio."[4]

That same approach – the rebalancing of operating force (OF) or combat forces with generating force (GF) or support forces that sustain Army capabilities – should become routine. To provide some examples of how this strategy would work, our study sponsor, Commanding General (CG) U.S. Army Training and Doctrine Command (TRADOC), requested this study team develop rebalancing strategies that would, "retain or gain capabilities in the mid-term (2025) and beyond (2030-2040)." Specifically, the strategies should aim to preserve and invest in core operational capabilities, i.e., the BCTs.

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[1] Tan, Michelle. "Odierno: Army 'Dangerously Close' To Being Cut Too Deep." Army Times, 11 Aug 2015.
[2] DoD News, Defense Media Activity (www.Defense.gov). "Army Announces Force Structure, Stationing Decisions." 9 July 2015
[3] Ibid.
[4] Lopez, C. Todd. "Brigade Combat Teams Cut at 10 Posts Will Help Other BCTs Grow." Army Homepage (www.army.mil), 25 Jun 2013

The study team collected data over the course of more than 30 interviews to identify best practices, enabling concepts, and innovations that could be applied to rebalancing the force. The more promising rebalancing strategies were then analyzed and tested using data on the Army force structure derived from the Defense Manpower Data Center (including Active, Guard, Reserve and Civilian master files), and the Army Force Management Support Agency. The study team also conducted a literature review to learn more about Army force shaping and restructuring efforts over the last half century. Significantly, our review divulged the Army has failed to establish a single oversight organization to manage, monitor, and enforce its organizational redesigns during that period. As a result, there hasn't been a systematic approach to considering the Army's strategic goals, its mission(s), workload, manpower, and cost when restructuring the force.

To provide a broader, enterprise perspective in its recommendations, the study team adopted a systematic approach to consider those factors and, drawing upon its expertise in two dozen fields (from the sciences, engineering and military), it nominated five rebalancing strategies to preserve combat capacity.

The first strategy uses data analytics to identify maintenance efficiencies and comes from best practices observed in the Army and commercial industry. Typically, when systems are deployed, there's a scheduled interval of maintenance performed at the component level or at the system level to prevent critical failures. The intervals are determined by the manufacturer, largely based upon historical data that measure wear and tear in hours or cycles of use. The study team observed that when actual performance measures are used instead, i.e., measures taken on how the system is actually used, regularly scheduled maintenance intervals may be extended with greater confidence. The study team also observed that emphasis on condition-based maintenance (CBM), which optimizes maintenance events based on the actual condition of specific components/systems, could extend the scheduled maintenance intervals even further. This in turn would reduce both the personnel requirements to perform maintenance, as well as the supply requirements to support maintenance functions. The study team conducted an analysis to determine whether the savings on personnel requirements, measured in full time equivalents (FTE), were significant enough to impact force structure. Our initial results are promising in that we estimated the Army could reduce its vehicle maintenance personnel across all BCTs by about 2,800, the equivalent of about 60% of a BCT. The strategy and associated analysis is further explained in section 3.0 below.

The second strategy draws upon the recommendations of a previous ASB study[5] to leverage science and technology (S&T) in commercial industry. Starting with the assumption that all organizations, including the Army, have essential, core competencies that are unique to that organization (i.e., it's the best or the only one performing that competence), it follows that the organization should prioritize resources to preserve and develop those competencies. For those competencies that are non-core, (i.e., where other organizations perform as well or better), resources should be dedicated according to the amount of collaboration with others it takes to

[5] "Army Science and Technology Essential Core Competencies;" January, 2014.

maintain the competence. In some cases, other organizations will be so far ahead that the best course is simply to buy their product or service, rather than make investments to try to catch up. For example, the Army should never attempt to develop its own personal computers, because it can't make the investment to catch up with Dell, Apple, and other computer manufacturers. When the core-competence model was applied to Army S&T two years ago, the ASB study team found approximately 5.4% of the Army's S&T resources were being expended in these latter areas, where other organizations performed with far more resources and better expertise, such as in the fields of autonomy and power generation/conservation. Assuming the percentage is fairly consistent, approximately 740 or RDECOM's current personnel (both Military and Civilian) are dedicated in some capacity to S&T fields that could be fully leveraged. That equates to approximately 16% of a BCT, with a cumulative force structure savings (adding those from the previous strategy) of 3,529. While this particular strategy may yield relatively small results, it's important for the Army to make smart cuts to counter the otherwise blunt budgetary instruments, such as sequestration. The strategy and associated analysis is further explained in section 4.0 below.

The Third strategy makes use of Joint re-supply. The volume of materiel transported around the globe to support our Soldiers, approximately 145,000 twenty-foot equivalent units (TEU), requires a significant number of vehicles (surface and air) and people, as well a security to protect the materiel in transit. The study team observed that savings from any efficiencies found in this system could be passed on to combat efforts, and to that end, examined alternative methods for re-supplying Soldiers in the field. Specifically, we were interested in methods that would reduce time, cost, the number of personnel, and risk. One credible alternative involved using the Joint Precision Air Drop System (JPADS) to replace Army line haul or convoy functions delivering supplies to forward operating bases (FOB). Convoy operations are vehicle, personnel, and time-intensive, and when re-supplying FOBs in a combat zone, are particularly high risk. Alternately, the JPADS system can drop supplies with an accuracy of 50m and has already been tested and used extensively in Iraq and Afghanistan. To gauge potential savings, the study team performed a fairly conservative analysis. Assuming the use of JPADS could eliminate the need for approximately 30% of the personnel required to perform line haul or convoy functions, we found the Army could reduce associated personnel by approximately 2,772, or again, the equivalent of 60% of a BCT.[6] The cumulative force structure savings (adding those from the previous strategies) increases to 6,301. The strategy and associated analysis is further explained in section 5.0 below.

The final two strategies each utilize outsourcing: the first focuses on OF sustainment elements; the second focuses on base support functions in the GF.

The Study team found examples of outsourcing OF sustainment functions in the U.K. Ministry of Defence (MoD). MoD supported outsourcing efforts in supply chain and maintenance activities

[6] The ASB team did not perform a corollary analysis of the impact to the Air Force or other Services resulting from an increase in its JPADS mission, however, the reduction in risk to line haul/convoy personnel merits further study and modification.

by implementing a new contracting paradigm which is more attractive to commercial industry. The changes provide for long-term contracts renewable every five years, which foster stability and promote efficiencies. Similar opportunities exist for the Army to use outsourcing to free up force structure. Specifically, the study team analyzed the combat service support (CSS) elements of a BCT. Assuming there could be efficiencies found in the larger components of the CSS, the team looked specifically at maintenance functions, starting with a Combat Aviation Brigade (Medium) (CAB(M)), and extrapolating its finding to all BCT, and echelons above brigade. In this case, the study team found potential savings in both force structure (conservatively calculated at 12,007 personnel) and cost ($3.8m). To achieve these savings, the Army will have to adjust its approach to contracting by incenting the contractor with an adequate return on investment (ROI) (see Appendix F). The cumulative force structure savings (adding those from the previous strategies) increases to 18,308. The strategy and associated analysis is further explained in section 6.0 below.

The final strategy looks at outsourcing GF base support functions. The study team took inspiration for the strategy from examples from a number of commercial industry leaders, such as Amazon's logistics capability, McLane Systems' development of Walmart Grocery, and Delta Air Lines' reorganization. The team continued its analysis along the maintenance function, but recognizes it's not the only area of the GF where opportunities for savings and efficiencies exist. Using the same calculations and assumptions from the previous strategy, the study team found potential savings in force structure of 2,864 personnel, or 60% of a BCT. The cumulative force structure savings (adding those from the previous strategies) increases to 21, 172. The strategy and associated analysis is further explained in section 7.0 below.

Assuming an average BCT consists of approximately 4,500 personnel, if the Army were to adopt the five strategies outlined above and rebalance the force by applying the savings in force structure to OF combat functions, it would preserve approximately 4.7 BCTs.

While the datasets used in this study were collected from interviews and from official government databases, they represent a snapshot and may change over time. The study team also applied professional judgment to interpret the data and to develop the rebalancing strategies. Thus, prior to adopting the rebalancing strategies, it's incumbent upon the Army to verify workforce and workload, to validate the data and analyses of this study, and to investigate the long term effects associated with outsourcing.

During the course of its investigation, the study team identified eight major findings, and based upon those finding, made eight recommendations for actions to be taken by the Army (Fig. 1).

FINDING	OFFICE	RECOMMENDATION
1a. Traditionally, maintenance/replacement schedules were specified in terms of hours and/or cycles without regard to actual operational environment. 1b. Commercial best practices now allow for maintenance/ replacement based on operating environment and conditions of components/systems.	PEO EIS	Create Army-wide analytics capability for maintenance and use it to re-structure logistics and synchronize stocks
2. Potential for reduction in required number of maintenance personnel.	ASA (ALT)	Accelerate condition-based maintenance (CBM); implement CBM in all Milestone C documents and Engineering Change Packages
3. RDECOM's current civilian and military manpower is 13,700. Assuming the same rates of Army S&T effort as reported in 2013, potential savings in civilian and military GF may be realized by leveraging commercial development in non-core research.	ASA(ALT), ASA(M&RA), DCS G1	Ensure reductions in RDECOM align with research in Army Core competencies, such as the strategy in the 2013 ASB study
4. Reductions in the line haul functions and corresponding air and ground security force requirements can be achieved through alternate delivery means.	DCS G3	Embrace DODI 5158.06 and 5158.04 and assign HQDA LNO to TRANSCOM to coordinate Army equities, emphasizing the needs to (1) prioritize air drops of supplies directly to tactical locations, (e.g. utilize JPADS to the DODI), and (2) assign to TRANSCOM surface movements units in Elements above Brigade (-30% target reduction).
5. Outsourcing maintenance produces efficiencies and reduces Active personnel.	DCS G3/G4	Contract out maintenance functions in CAB, BCT, and echelons above Brigade, maintaining only the necessary structure in the Army Reserve and Army Guard Components to transition from peace to war and mitigate risk.
6. The Army may free up force structure by applying commercial outsourcing techniques to supporting functions.	DCS G4	Contract out installation support functions where the Army will (1) realize increased efficiency in support operations, and (2) experience little or no risk during transition to war.
7. Army does not have a demonstrated comprehensive approach to manage the relation between strategic goals, mission, workload, workforce, and cost.	Sec Army, CSA	Validate the data and analyses of this study and investigate the long term effects associated with outsourcing maintenance and establish the mandate to achieve greater than the 2011 OF/GF ratio (48:52), the best balance observed in the data.
8. Many organizations (DoD, Industry, other military) currently outsource multiple functions.	DCS G3	Apply the methodology to all components (Active, ANG, Army Reserve and Civilian force structure).

Figure 1. Study Findings and Recommendations

2.0 INTRODUCTION

As the United States continues to wind down from its longest period of sustained wartime operations, the challenge of making attendant reductions to the various Services from their wartime highs has been subject to increasing examination and debate. The ongoing mantra to do more with less may be a clarion for business to become more efficient, but there's more at risk and more at stake when looking at where and how to cut the military. The Army will take the brunt of pending cuts, given the extent to which it shouldered the burden of land operations in Afghanistan and Iraq. As such, it must be positioned to make the best decisions, i.e., those that preserve its it's combat capabilities.

2.1 TERMS OF REFERENCE

The Secretary of the Army requested the ASB to develop strategies for the Army to maintain or gain operational capabilities during its drawdown and the budgetary pressures being exerted across the DoD. As established in the study terms of reference (TOR) (see Appendix B), the timeframe for executing these strategies was 2025 and beyond.

The TOR tasked the ASB to focus on strategies that produced efficiencies in combat service support and the generating force. Savings would then be re-invested into the operating force to maintain or improve its capabilities, effectively rebalancing the operating and generating forces. Specific tasks included:

- Review and evaluate opportunities for improving the efficiency of generating force and operating force within combat arms, combat support, and combat service support units, including the appropriate use of contractors.

- Identify and evaluate enabling concepts, solutions, systems, and disruptive technologies for transforming operating force combat service support and generating force capabilities while strengthening Army capabilities.

- Examine Army, Joint, private sector, and academic organizations that are innovating supply chain management, e-procurement, logistics, personnel support, personnel services, and contracting.

The study accomplished these tasks and made findings and recommendations on five strategies to rebalance the force.

2.2 HISTORY OF PAST STUDIES

In a review of the literature on past Army reorganizations, the study team found a common theme: the Army faces long-standing challenges with effectively determining its manpower

requirement for the GF. It does not have an effective method, implementation, or enforcement that ensures that GF manpower is appropriately sized.

This issue has been identified by multiple studies, including General Accounting Office (GAO), RAND, Institute for Defense Analysis (IDA), and the Army Audit Agency. One GAO report criticized the GF manpower requirement as not being based on sound strategy and called for improved processes for determining the number and composition of noncombat positions.[7] The lack of a single, authoritative, oversight office was identified by another GAO report as a reason for why the Army's institutional redesign efforts have failed.[8] The Army has an ongoing practice of determining institutional or GF personnel requirements without an analysis of the workload. The Army Audit Agency went so far to say that the Army did not know its workload and thus could not justify personnel needs. As a result, Army redesign efforts have largely failed to produce efficiencies. IDA recently reported that one of the deficiencies of the Army's GF manpower determination was that the Army needed a better way to account for what the Army does (workload) and where the resources come from.[9] Finally, RAND recently reported on the need for improved alignment of GF with the OF.[10]

The aforementioned reports all discuss the same general gaps in the GF manpower requirement determination process. They also make similar recommendations about key elements needed to effectively determine GF manpower requirements, including:

1. Standardization of processes and metrics across the Army
2. Development of proper metrics
3. Integration of disparate processes and tools to link missions, workload, workforce, and cost (Fig. 2.1)
4. Enforcement authority at the Department level

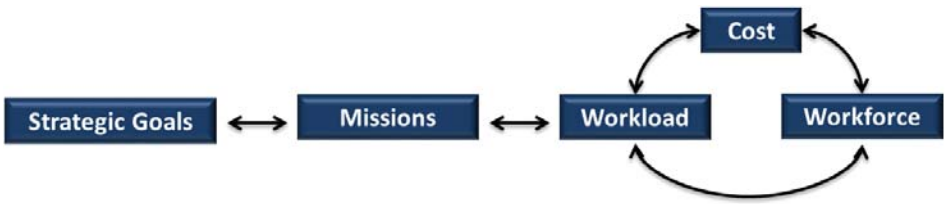

Figure 2.1 Elements of an Appropriate Determination of Force Structure

The reports also track the Army's history of restructuring, reorganizing and rebalancing the force.[11]

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[7] GAO, *Defense Budget: Observations on Infrastructure Activities*, 1997.
[8] GAO, *Force Structure: Army's Efforts to Improve Efficiency of Institutional Forces Have Produced Few Results,* 1998.
[9] Brinkerhoff, John R., *The Institutional Army*, *FY 1975-FY2002*, 2002.
[10] Camm, Frank, Cynthia R. Cook, Ralph Masi, and Anny Wong, *What the Army Needs to Know to Align Its Operational and Institutional Activities*, 2007.
[11] Cooke, James A., *Manpower Requirements Determination in the Institutional Army,* 2003.

Figure 2.2 Brief History of Army Restructuring Efforts

Before the 1970's, there was no integrated program at the Department level to determine the GF manpower requirement. In response to a pressure to downsize during the early 1970's, the Army assigned responsibility for determining GF manpower requirement to the Chief of Staff for Personnel. This new responsibility, however, was not adequately staffed or followed up on throughout the Army. Additionally, the major Army commands conducted manpower surveys of their own organizations, a practice that led to non-standardized surveys that are were not aligned to budget requirements. The results of these surveys were viewed as subjective efforts that failed to provide the necessary information for budgeting GF manpower. By the end of the decade, Congress questioned the MACOM survey program and recommended that the Army develop a new set of manpower standards across the Army that are based on the work function and workload. The expectation was that new standards would enable predictive determination of manpower requirements and alignment with budgeting activities.

In response to pressure from Congress, the U.S. Army Manpower Requirements Determination Agency (USAMRDA) was established to provide leadership and oversight role at the Department level. In the mid-1980's, the manpower staffing standard system (MS^3) built standards for over half of GF manpower requirements. The system was highly detailed and thorough. However, by 1994, the Army allowed the MS^3 effort to degrade and the Department-level responsibility was pushed downed to the MACOMs. This happened for three reasons:

1. The financial management function of the Army opposed the program. This faction supported determining manpower requirement based on funding available rather than on workload.

2. The MS^3 did not support the downsizing efforts. The standards program determined workload and manpower requirements to accomplish the workload. In some cases, the program determined an increase in staffing was required. Without a method to determine which missions or work functions should be reduced, the MS^3 could not be used to determine where to reduce manpower requirement.

3. The standard development process was labor intensive and appeared to be unproductive.

With efforts to determine GF manpower requirements failing again, the Secretary of the Army was forced to declare GF the effort a materiel weakness. As a result, the Army once again began a series of activities to best determine GF manpower requirements, and the U.S. Army

Manpower Analysis Agency (USAMAA) was given the implementation responsibility. A 12-step process was developed to determine manpower requirements based on workload. This process was to be implemented Army-wide, and USAMAA was to conduct a quality assurance review of the MACOM programs for compliance with the process. A new automated workload projection system, the Army Workload Performance System (AWPS), was also to be implemented. Finally, a database for linking the workforce to the budget, the Civilian Manpower Integrated Costing System (CMICS), was to be implemented. By the early 2000's, these initiatives had begun to be dismantled. The USAMAA certification program had been terminated and with that, the leadership required for GF manpower requirements determination had weakened. The MACOMs had not fully implemented the 12-step process. Also, the development of CMICS and AWPS missed deadlines.

At the start of the wars in Afghanistan and Iraq, focus shifted and little attention was given to the OF-GF balance. But as the history of the Army's efforts to rebalance the force has shown, the Army prioritizes GF manpower determinations when there is an external pressure such as budget reductions, political attention, or a major audit. The typical Army response to these pressures is to announce plans to address the issue and make preliminary moves in that direction, but when the external pressure dwindles, so too does the commitment and level of effort to execute the plans.

Thus, for the Army to effectively rebalance the force under current conditions, the study team believes sustained oversight by senior leadership will be required.

2.3 METHODOLOGY

The study team's investigation and data collection included over 30 visits, interviews, and teleconferences with various Army and Department of Defense (DoD) officials, Federally Funded Research and Development Centers (FFRDC), and over a dozen companies in commercial industry. During these interviews and visits, the study team's lines of inquiry aimed to:

1. Explore opportunities for improving the efficiency of both GF and OF, including the appropriate use of contractors

2. Evaluate enabling concepts, solutions, systems, and disruptive technologies for transforming OF and GF capabilities

3. Examine Army, Joint, private sector, and academic organizations for innovations in supply chain management, e-procurement, logistics, personnel services and support, and contracting

To analyze the efficacy of individual rebalancing strategies, the study team used data on the Army force structure derived from the Defense Manpower Data Center (Active, Guard, Reserve and Civilian master files), and the Army Force Management Support Agency (FMSWEB). Data

were presented to the team in a series of pivot tables constructed by Logistics Management Institute (LMI) via support contract. LMI also provided the following analytic support and interpretation:

1. Aggregated force structure data for the Army from FY 01-14

2. Analysis frameworks with refinements to focus on commands, MOS, types of employee (AD, permanent civilian, temporary civilian/overhires, Guard, Reserve, etc.), etc.

3. Reconstruction of the Army's command structures, which changed over the 14 years observed, to lend consistency throughout that period

Finally, the team conducted a review of the literature, focusing on previous studies by various organizations that analyzed the efficacy of earlier Army force shaping and force managing programs. Notably, the review revealed that over the last four decades, the Army has failed to establish a single oversight organization to manage, monitor, and enforce its organizational redesigns.

3.0 STRATEGY 1: DATA ANALYTICS IDENTIFIES MAINTENANCE EFFICIENCIES

Efficiencies may be exploited in the Army's maintenance program. Best practices observed in the Army and commercial industry demonstrate savings through the use of maintenance intervals that are determined based upon how equipment actually performs, versus manufacturers' set intervals for maintenance. To determine whether the savings on personnel requirements were significant enough to impact force structure, the study team researched the Army maintenance program.

3.1 ARMY MAINTENANCE PROGRAM

Combat, Combat Support and Combat Service Support systems are critical to the Army's warfighting capability. Maintenance of these systems is essential to retaining combat capability over time. Army Regulation (AR) 750-1, "Army Materiel Maintenance Policy" (12 Sep 2013) states the purpose of maintenance is to preserve the required performance capabilities of Army materiel, or to return those assets to their baseline performance capabilities. Maintenance is an enabling process to fulfilling Army Force Generation (ARFORGEN) requirements. AR 750-1 also establishes policies and assigns responsibilities for the maintenance of Army materiel. It establishes two levels of maintenance:

1. **Field maintenance** consists of maintenance functions formerly known as operator and/or crew (equipment operators and vehicle crews), unit, and direct support.

2. **Sustainment maintenance** consists of maintenance functions formerly known as general support and depot operations of the Army maintenance system and Army-wide programs for commodity-unique maintenance.

This study focuses on the first level of field maintenance associated with BCTs. Field maintenance includes both operator tasks and those tasks performed by unit field mechanics. Operator and/or crew maintenance is the most critical operation of the Army Maintenance System and requires continuous emphasis by all commanders and leaders. Operators and/or crews performing Preventative Maintenance Checks and Services (PMCS) from the applicable Army Technical Manuals (TM) Series 10 serve as the cornerstone of the Army Maintenance System because they detect faults during before- and after-operation checks. Additionally, operators and/or crews perform inspections by sight and touch; lubrication; cleaning; and replacement of unserviceable parts, modules, and assemblies as authorized. Field mechanics perform maintenance and supplement what's done by operator and crew.

3.1.1 MAINTENANCE RESOURCING

Army policy aims to ensure that maintenance organizations will be adequately equipped, staffed, and funded to repair and maintain equipment at operational levels. Modified table of organization and equipment (MTOE) and deployable modification table of distribution and allowance (MTDA) organizations are augmented in peacetime and garrison operations when

Soldier availability for maintenance man-hours falls below the MTOE and/or MTDA projected wartime maintenance man-hours. This ensures MTOE equipment will always be ready to meet Army mission requirements.

The Army uses two manpower standards for maintenance. MTOE is based on wartime operations and assigns one Soldier 3,230 Man Hours/Year for CSS units assigned to Division.[12] In peacetime, one Soldier is assigned 1,392 Man-hours/year for mechanical maintenance (Fig. 3.1).[13] The difference between the number of wartime and peacetime hours reflects additional duties and activities Soldiers must accomplish in peacetime. For example, a typical duty week for a Soldier with a maintenance MOS would include the following, non-maintenance related activities: physical training (8 hrs.), personal hygiene (4 hrs.), family time (2 hrs.), Sergeant time (5 hrs.), lunch (7.5 hrs.) formation (2 hrs.), etc.

Table 4–1
Peacetime Mission Availability Factors (PMAF)

Functional Areas	Available Hours*
Aircraft Maintenance	122
Engineer	113
Finance	127
Fixed Communications	121
Medical	94
Law Enforcement	121
Personnel	131
Tactical Signal	103
Supply	126
Transportation	120
Mechanical Maintenance	116

Notes:
[1] *Hours per month an MTOE Soldier is available to perform peacetime mission support. OCONUS commanders may assess the applicability of these figures. When appropriate, OCONUS commanders may reduce these figures by up to 2 hours.
[2] Availability factors are for manpower requirements determination only; actual utilization is the policy of the local commander.

Figure 3.1 Peacetime Mission Activity Factors

The discrepancy between peacetime and wartime hours could result in a shortage during peacetime, depending on the number of operational hours the systems require per year. The operational hours for each system varies based on actual usage. The system Operational Mode Summary/Mission Profile (OMS/MP) establishes the anticipated (usually considered worst case) operations for a system. For example, a system that has 1,338 hours of anticipated operation during wartime and 634 hours during peacetime will be short by ~10% the number of required maintainers during peacetime (Fig. 3.2).

	Sample System Example (1872 hours/year of maintenance)			
	Operational Hours	Manhours/Year	Required Man	MR
Peacetime	634	1392	0.64	1.00075
Wartime	1338	3230	0.58	1.00075

Figure 3.2 Peacetime/Wartime Maintenance Discrepancy

[12] AR71-32 Force Development and Documentation Consolidated Polices 3 Mar 1997 Appendix C
[13] AR570-4 Manpower Management 8 Feb 2006, Table 4-1

3.1.2 MANPOWER REQUIREMENTS CRITERIA DEVELOPMENT

The objective of a Manpower Allocation Requirements Criteria (MARC) study is to produce criteria which define quantitative and qualitative wartime manpower requirements needed for the performance of a defined function in a theater of operations at varying levels of work activity. The approved criterion becomes a standard upon which requirements decisions can be based.

MARC studies provide a complete explanation of the work function, skills involved, and the methodology employed to establish the proposed criterion. The final study output should produce the workload indicator, which the MARC proponent uses in conjunction with the annual MOS availability factors to develop an impact statement, which is an integral part of the study. During the development of the MARC study, the MARC proponent should review and validate the variables used to establish the annual MOS availability factors to ensure that their effect on the proposed standard is applied correctly. Substantive change, which alters the currently approved criteria, requires a new study. For example, changes in doctrine, mission, scope, workload driver, etc. MARC studies also address supervisory and staff function requirements, as well as worker position requirements.

Completed MARC studies are submitted to HQDA for staffing, and DCS, G–3/5/7 (DAMO–FMZ) for approval.

3.1.3 FORCE DEVELOPMENT DOCUMENTATION

The equipment Program Manager (PM), with support, must document system and associated support data that serve as input for preparing force development (FD) documentation. In turn, the FD documentation is used to identify Army warfighter personnel and equipment requirements, and to authorize force management and structuring activities.[14] It is important that the required system-related information be submitted to HQDA in a timely manner to effect successful fielding of the system, particularly with respect to ensuring adequate support facilities and equipment and properly trained operators and maintainers within the user/warfighter units.

The PM also develops basis of issue plan (BOIP) feeder data (BOIPFD) and submits it to the U.S. Army Force Management Support Agency (USAFMSA), a field operating agency of the DCS, G–3/5/7. These data establish the requirement for and distribution plan of new and improved equipment, associated support items of equipment (ASIOE), and personnel for Army warfighter units. The BOIPFD provides organizational, doctrinal, training, duty position, and personnel information for system operators and maintainers used to develop the BOIP and the tables of organization and equipment (TOE).

[14] See AR 71–32

The Army manpower requirements criteria program provides a means of establishing and justifying the right quantity and mix of maintenance personnel for sustainment of Army materiel. These criteria are HQDA-approved standards used to determine the mission-essential wartime position requirements for combat support and combat service support functions in TOE. The process includes the following:

1. The PM, with support from the Logistics Support Activity (LOGSA), is responsible for establishing and maintaining accurate reporting of maintenance man-hour requirements for Army systems throughout the life of the system.

2. For new systems the maintenance burden is derived from engineering estimates, supportability analyses, and test data.

3. Surrogate data cannot be used without analytical proof that it reflects the best estimate available.

4. After fielding, updates for system maintenance man-hours are derived from follow-on test data, actual field maintenance data, and the sample data collection.

The PM should invite the United States Army Force Management Support Agency to participate in the Supportability Integrated Process Team (SIPT) when developing BOIPFD to ensure the timely and accurate submission that result in a HQDA-approved BOIP.

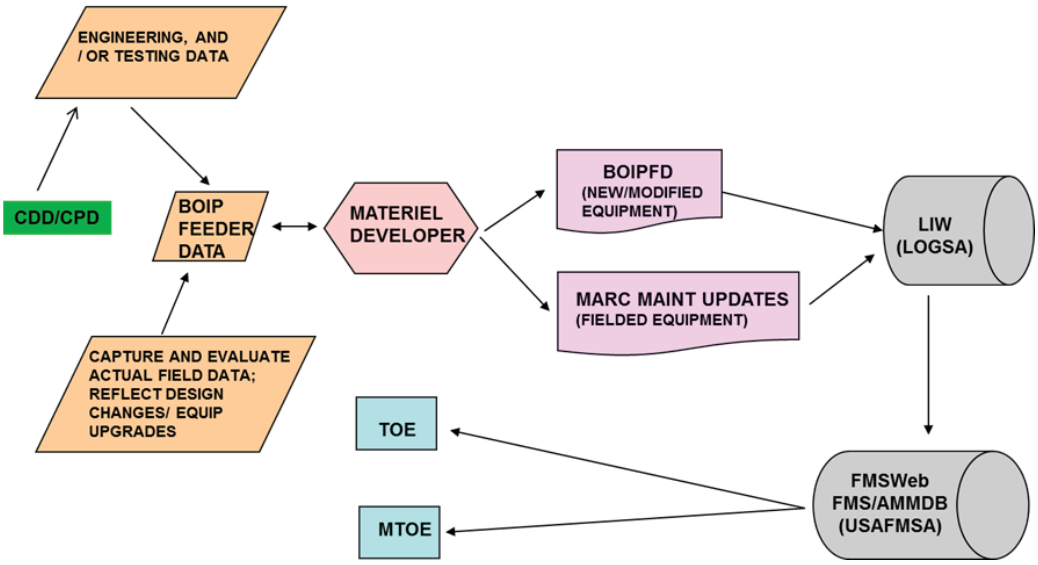

Figure 3.3 Force Development Documentation Process

The Direct Productive Annual Maintenance Man-Hours (DPAMMH) are the number of scheduled and unscheduled field level and sustainment level maintenance man hours above the operator level and below the depot level required for one year to keep the platform

operational. DPAMMH are based upon the wartime mission profile of the platform, including contributing factors such as:

1. Organizational level at which maintenance will be performed: Field / Sustainment / Aviation Maintenance Company / Aviation Support Company

2. MOS that will perform the maintenance

3. Equipment usage upon which the DPAMMH is based

4. Equipment operating parameter: Hours of operations, Kilometers traveled, rounds fired, etc.

Indirect productive time (IPT) is the time a mechanic spends performing other MOS-related tasks associated with a maintenance function, but does not involve actual repair of the equipment. IPT is normally 40% of the DPAMMH at field level and 22% of the DPAMMH at sustainment level. IPT activities include shop set maintenance, tool kit inventory, ground support equipment operator maintenance, etc.

The Annual Maintenance Man-Hours (AMMH) represents the total amount of maintenance hours required per system for one year in a wartime mission profile. It's calculated by adding the DPAMMH to the IPT factor, and that value displayed on the FMS MARC report determines maintainer requirements.

3.2 CASE STUDIES

The study team applied its research to maintenance operations in two types of BCT. In both cases, it appeared that the savings on personnel requirements were significant enough to impact force structure, and merit further study by the Army.

3.2.1 CASE STUDY 1: ARMORED BCT (ABCT)

To determine whether efficiencies could be found in the Army maintenance system, the study team looked at an Armored BCT (ABCT), arguably, one of the unit types most reliant on persistent maintenance operations to carry out its mission. Using the manpower requirements and force development processes described above, the study team determined the number of vehicle maintainers from the series 91 Military Occupational Specialty (MOS) required to fulfill the maintenance schedules. It then compared that number to the actual Army authorizations for 91 MOS positions in an ABCT.

Calculating the total number of maintenance man-hours required per ABCT, individual system AMMH numbers were multiplied by the number of systems in the ABCT, resulting in the 91 MOS hours per type of equipment required (see Appendix E). These were then tallied and

divided by the annual MOS availability factors (AMAF) (Fig. 3.4), resulting in 325 required 91 MOS positions (see Appendix E).

Annual MOS Availability Factors (AMAF)

UNIT TYPE

ECHELON		MAN	MAN SP	SUST	
Division HQ/ BCTs	MOBILE	11A 4161 (11.4)	21A 3176 (8.7)	31A 3230 [HRS/YR] (8.8) [HRS/DAY]	(Division)
Corps HQ/ Multifunctional Support BDEs	MOBILE	12A 4380 (12.0)	22A 3760 (10.3)	32A 3778 (10.4)	(Corps)
Army/Theater/ Functional Support BDEs	MOBILE	13A 4380 (12.0)	23A 4307 (11.8)	33A 4295 (11.8)	(EAC)
	FIXED	N/A	23B 4380 (12.0)	33B 4380 (12.0)	

AR 71-32 Force Development and Documentation (July 2013) Para 6-6 pg 26/27

Figure 3.4 Annual MOS Availability Factors

Actual Army authorizations for 91 MOS positions in the ABCT total 633 (Fig. 3.5).

MOS	MOS Title	Positions	E6	Supervisors	Recovery (56 Recovery vehicles)	Vehicle Mech
91A	Abrams Tank System Maintainer	91	16	8	20	63
91B	Wheeled Vehicle Repairer	180	16	8	40	132
91C	Utilities Equipment Repairer	23	2	1		22
91D	Power Generation Equipment Repairer	40	6	3		37
91E	Allied Trades Specialist	15				
91F	Small Arms/Artillery Repairer	30	1	0.5		30
91G	Fire Control Repairer	9	0	0		9
91H	Tracked Vehicle Repairer	60	5	2.5	30	28
91J	Quartermaster and Chemical Equipment Repairer	8	0	0		8
91L	Armament Repairer	6				
91M	Bradley Fighting Vehicle System Maintainer	116	20	10	18	88
91P	Artillery Mechanic	24	7	3.5	4	17
91S	Stryker Systems Maintainer	1	0	0		1
91X	Maintenance Supervisor	23		23		0
91Z	Senior Maintenance Supervisor	7		7		0
		633	73	67	112	434

Figure 3.5 Army Authorization for 91 MOS in ABCT

The highlighted MOS in Fig. 3.5 are those MOS 91 involved with vehicle system maintenance. The 91E and 91L are not included in vehicle systems. To determine the number of mechanics available for vehicle Field Maintenance, supervisors (E6 motor sergeants, and E7 & E8s "Supervisors") and recovery vehicle crewmen (2 per recovery vehicle) authorizations were subtracted from the total authorization, leaving 434 mechanics acting as direct vehicle system

maintainers. Compared to the number of maintainers required by calculating the individual system AMMH numbers, there are 109 extra or excess maintainers within the ABCT, which allows for a reduction of approximately 25% authorizations.

3.2.2 CASE STUDY 2: STRYKER BCT (SBCT)

A similar analysis as that done in Case Study 1 was conducted for a SBCT. The study team determined the number of required maintainers for a SBCT using the same MARC approach to determine the required maintenance hours (Fig. 3.6).

		SBCT Qty	MOS	AMFIELDMAINTENANCE	Maintenance hours/year	
Command Varient Vehicle	C41314	38	91S	419	15925.4	
Infrantry Carrier Vehicle	J22626	130	91S	1155	150114.9	
Engineer Squad Vehicle	J97621	24	91S	539	12931.7	
ATGM Vehicle	A83852	9	91S	294	2648.8	
Fire Support Vehicle	F86821	13	91S	291	3785.7	
Mortar Carrier Vehicle	M53369	36	91S	316	11368.8	
Recon Vehicle	R62673	51	91S	862	43943.1	
Mobile Gun System	M57720	27	91S	592	15992.4	
Medical Evacuation Vehicle	M30567	16	91S	275	4404.5	
					261115.3	Total

Figure 3.6 Required Maintenance Hours for SBCT

The requirement for 261,115.3 hours, divided by the MTOE standard of 3230 wartime man hours required per year (as described above) equals 81 maintainers, i.e., 91 series that are neither supervisors nor recovery operators. The study team noted that this estimate was higher than the 70 positions authorized in the TOE.

The total number of authorized maintainers (MOS 91 series) in SBCT is 344. When supervisors and recovery vehicle operators are removed, the total MOS 91 authorizations is 272 (Fig. 3.7).

MOS	MOS Title	Positions
91B	Wheeled Vehicle Repairer	114
91C	Utilities Equipment Repairer	20
91D	Power Generation Equipment Repairer	19
91E	Allied Trades Specialist	9
91F	Small Arms/Artillery Repairer	24
91G	Fire Control Repairer	2
91J	Quartermaster and Chemical Equipment Repairer	8
91L	Armament Repairer	6
91S	Stryker Systems Maintainer	70
		272

Figure 3.7 Adjusted Authorizations for 91 MOS in SBCT

Thus, the study team estimates there are 72 extra or excess maintainers within the ABCT, which allows for a reduction of approximately 20% of the current authorization.

3.3 CONDITION BASED MAINTENANCE

The gains made through leveraging efficiencies on the personnel side of maintenance operations could be supplemented with techniques aimed at streamlining the process itself. One such technique, observed by the study team in both Army and commercial industry applications, involves redefining the maintenance schedule from a prescribed timetable to a more preemptive and practical flow. To understand the difference between these approaches, it's helpful to consider the range of maintenance operations as falling within two main categories:

1. **Reactive maintenance** (also called corrective maintenance) is performed on items that are pre-selected to run to failure or those that fail prematurely. The purpose is to restore an item to a serviceable condition after the failure has occurred. Reactive maintenance of a reparable item is almost always unscheduled, in the sense that the occurrence of failure is unpredictable.

2. **Proactive maintenance** can range from an inspection, test, or servicing to an overhaul or complete replacement. There are two types of proactive maintenance:

    a. **Preventive**, also known as scheduled maintenance, may be based on standard time units (hours, days, etc.), equipment operating time, or a defined cycle such as number of starts, air vehicle landings, rounds fired, miles driven, etc. It may be scheduled or unscheduled, initiated based these predetermined intervals or after detection of a condition that may lead to failure or degradation of functionality.

    b. **Predictive** maintenance can be categorized as either diagnostic (identifying an impending failure) or prognostic (forecasting remaining equipment life), both of which enable optimum mission and maintenance planning.

The technique observed, Condition Based Maintenance Plus (CBM+), applies and integrates processes, technologies, and knowledge-based capabilities that improve the reliability and effectiveness of systems and their components. At its core, CBM+ manages maintenance so that it's performed as needed, based on evidence provided by Reliability Centered Maintenance (RCM) analysis and other enabling processes and technologies.

Its precursor, CBM, is a well-established approach to identifying and scheduling maintenance tasks. CBM employs continuous and/or periodic assessments on the condition of weapon systems by using sensors, external tests and measurements, first-hand observation, portable equipment, etc. The goal of CBM is to perform maintenance only when there is evidence of need.

CBM+ builds upon this process by adding a deliberate effort to shift equipment maintenance from an unscheduled, reactive approach at the time of failure to a more proactive, predictive approach driven by condition sensing and integrated, analysis-based decisions. CBM+ focuses on inserting technologies that improve maintenance capabilities and processes into both new and legacy weapon systems, and on integrating the support elements to enhance maintenance-centric logistics system responses. Using modern maintenance tools, technologies, and processes to detect the early indications of a fault or impending failure, CBM+ allows time for maintenance and supply channels to react and to minimize the impact on system operational readiness and life-cycle costs. Thus, it provides a means of optimizing the approach to maintenance, and is a vehicle to reduce scheduled maintenance requirements.

Because it generates more accurate predictions of impending failures (based on real-time condition data), and responds with timely and effective repairs, CBM+ produces dramatic savings in both time and money, as well as improvements in weapon system availability and performance. The flexibility and optimization of maintenance tasks with CBM+ also reduces requirements for maintenance manpower, facilities, equipment, and other maintenance resources. In short, companies and organizations that use CBM+ increase the operational availability and readiness of their machines and reduce life-cycle total ownership costs by performing only the required repairs at the optimum time, and by reducing stocks of spares and repair parts to support maintenance operations.

Both OSD and the Army are implementing CBM, but very slowly. The Army is focusing on some Aviation systems. Alternately, commercial industry has successfully implemented both CBM and CBM+. Boeing has incorporated CBM into most of their aircraft systems, resulting in significant savings in maintenance costs as well as increased aircraft availability. Boeing's cost per passenger seat has been reduced, which has increased company profits. Several other commercial industry leaders have also implemented CBM, including UPS, Caterpillar, John Deere, each realizing cost savings of 10+%. This number is consistent with the results of studies modeling CBM implementation, which consistently predict savings for maintenance costs >10%.

In a more promising example for DoD, an application of CBM has been applied in the Army Oil Analysis Program (AOAP) for decades. The program provides savings on oil use by only replacing

system oil when required, versus based on a set, predetermined time. The program has also successfully identified equipment status and signs of impeding failure based on material wear. This program has been saving the Army significant amounts of money for many years. The current program uses analysis equipment which is large and constrained to laboratories, which results in oil analysis being halted during deployments. Portable analysis equipment is now readily available and needs to be provided, so that oil analysis continues during deployments, when efficiency is just as critical.

3.4 SUMMARY

Initial results from applying analytics to the Army's maintenance program are promising. The study team estimates the Army could reduce its vehicle maintenance personnel across all BCTs by about 2,800. In terms of combat capability, the Army could rebalance the equivalent of about 60% of a BCT.

4.0 STRATEGY 2: LEVERAGE INDUSTRY S&T

In 2013, ASB was commissioned by the Secretary of the Army to conduct an assessment of the core competencies that must be performed by the Army's science and technology (S&T) community.[15] The ASB team provided a definition for core competence, established criteria for determining where the Army should focus its resources, and recommended twelve core competencies for the Army.

4.1 PREVIOUS ASB ANALYSES

A key principle driving the 2013 study's analyses focused on differentiating between what the Army does best in the world, that is, what sets of skills, processes and capabilities the Army uniquely possesses, versus what it could allow commercial industry and other, outside organizations to take lead on (Fig. 4.1). For example, the Army is best at developing, testing and fielding armor, but it should leave the manufacturing of personal computers to commercial industry.

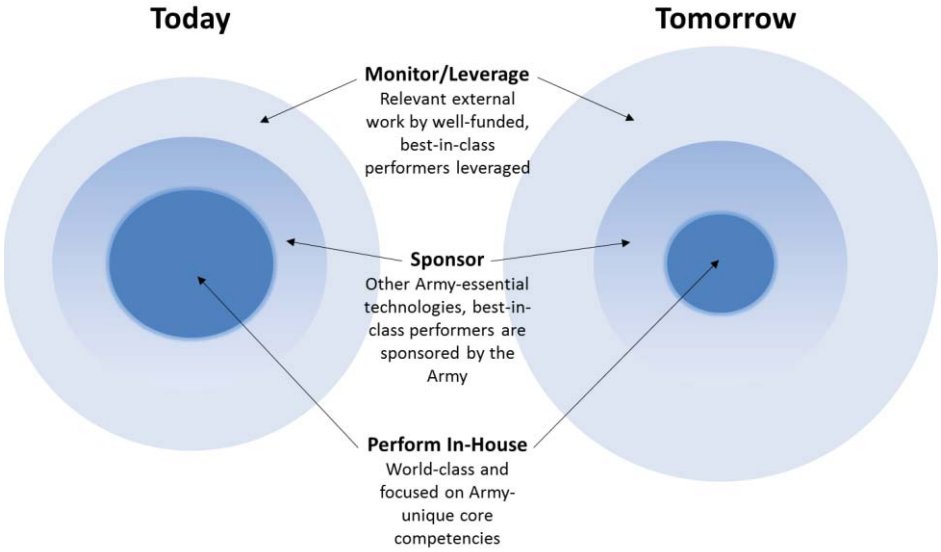

Figure 4.1 Classification of Army S&T Resources

Under the model adopted by the 2013 study team,[16] human capital was identified as an important resource to analyze because ultimately, core competencies reside in people. In any organization, core competencies are developed, maintained, and enhanced by the critically skilled S&T personnel resident in the organization. For the Army, the successful development and management of S&T personnel, residing mainly in Army Research, Development and

[15] Army Science Board, "Army Science and Technology (S&T) Essential Core Competencies," Final Report (Feb 2014)
[16] Adopted from C. K. Prahalad and Gary Hamel, "The Core Competence of the Corporation," Harvard Business Review, May-June 1990, available online at http://hbr.org/1990/05/the-core-competence-of-the-corporation/ar/1

Engineering Command (RDECOM), should sustain the Army's core competencies. However, ASB's analysis of the Army's S&T workforce yielded the following observations:

- A significant percentage of the Army's technical personnel were reaching retirement age, which would result in a steady loss of important, experienced talent.

- The Army had done well in accessions during the down economy and contingency operations over the last decade, but many of the newer accessions faced the risk of being cut due to severe budget reductions. Under the civil service reduction process, which uses last-hired-first-fired (a.k.a. FILO: first-in, last-out) criteria, many newly acquired individuals, who are cognizant of this process and wary of ongoing budget challenges, are leaving civil service.

To counter these pressures on its S&T workforce in 2013, ASB recommended RDECOM perform a gap analysis to guard against losing personnel with expertise in core competencies. The gap analysis method deliberately focuses on retaining skills necessary to support core competencies by filling shortfalls in key areas and targeting excesses and redundancy for elimination.

4.2 UPDATED ASB ANALYSIS

Two years later, the Army faced the same budgetary challenges, and planned to reduce its civilian workforce by 17,000, between FY 16 and FY 18. These constraints are likely to force reductions in the number of S&T personnel, and restrictive government/DoD regulations regarding hiring practices and reductions in force (RIF) present significant challenges to honing the most effective S&T force. Therefore, this year's study team recommends the Army perform the gap analysis and use that data to inform any future cuts of the S&T workforce. This approach is the best method for the Army to match the technical skills mix, levels of experience, and education of S&T personnel to organizational needs.

The study team recognizes the Army may face challenges associated with making precise personnel decisions. In the 2013 study, a review of available skills data suggested that there were a number of apparent mismatches in current and future S&T workforce needs within RDECOM. For example:

- The number of biologists in RDECOM appeared to be low given the needs for biological expertise in several of the Army core competencies.

- There was no skills identifier established for System Engineering, despite the fact that Systems Engineering had been recognized by many universities as a degreed competence for over a decade.

These and other mismatches in workforce needs resulted from two, more troubling shortfalls within the S&T community. First, The Army lacked an adequate S&T personnel database to

permit any deliberate assessment of the skills mix of its S&T personnel. In other words, it was impossible for the Army to make personnel decisions by matching skills, experience, and education to organizational needs. Second, the 2013 study group could find no strategic STEM personnel management activity addressing anticipated reductions (both civilian and military). The Army had no plan for maintaining an effective S&T workforce in the wake of impending budget cuts.

These challenges may be overcome if the Army and its laboratory managers make deliberate efforts to implement personnel decisions that are responsive to current conditions. To that end, a thorough assessment of expertise relevant to each core competence will identify critical shortfalls and excesses. Personnel decisions can then be made that support processes and capabilities for which the Army is uniquely qualified. The goal would be to leave a leaner, more efficient S&T workforce focused on identifying, developing and transitioning key technologies into end products for the operational Army.

4.3 SUMMARY

While it's outside the scope of this year's study to assess and/or nominate core competencies for the Army, the team did conduct an analysis of 2013 data to gauge whether the gap analysis approach would yield credible force structure savings (Fig. 4.2). Using the 2013 data, the study team found 5.4% of the Army's S&T resources were being expended in areas that other organizations were pursuing with more resources and better expertise (e.g. autonomy and power generation/conservation). The study team estimated approximately 788 personnel were working in areas where the Army should have been monitoring and leveraging technological advancements, but not supporting development with Army funds.

RDECOM Civ/ Mil Pers 2015	S&T Leverage %	Civ/Mil GF Reduction	Equiv BCT Saving
13,700	5%	740	0.16

Figure 4.2 Potential Force Structure Savings Using Gap Analysis in RDECOM

Assuming the same rate of RDECOM personnel, about 5.4%, continue to be misaligned with respect to Army core competencies, the gap analysis today would yield potential savings of about 740 personnel.

When aggregated with the previous force structure strategy, the study team estimates the Army could rebalance about 3,529 positions, or the equivalent of about 78% of a BCT.

5.0 STRATEGY 3: UTILIZE JOINT RE-SUPPLY

Since the creation of United States Transportation Command (USTRANSCOM) by OSD in the late 1980's, its mission has steadily expanded to develop a more encompassing approach to supporting the Joint Force. An important evolution came in September 2003, when USTRANSCOM became DOD's Distribution Process Owner, making it the single entity to direct and supervise execution of the strategic distribution system. The military's supply chain is a complex system that provides all consumable resources used by DoD forces worldwide. For example, a BCT will consume its own weight in supplies, 15,000 tons, over a 30-day period. Consequently, the volume of consumables dictates that the majority of the commodities move by surface modes as far forward as possible.

5.1 USTRANSCOM ROLE

Under DOD Instructions 5158.06 (Distribution Process Owner), and 5158.04 (United States Transportation Command), USTRANSCOM has been charged with delivering goods in accordance with the supported COCOM's operational plans in the most efficient manner, which means constantly looking to improve the distribution and deployment process for the COCOMs and Services. Thus, USTRANSCOM supports the COCOM concept of operations (CONOPS), but also has the mandate to shape and improve the delivery of units and goods to the COCOM's area or responsibility (AOR) in an optimal manner.

In most recent combat operations, USTRANSCOM has not been allowed to extend its operational touch in the COCOM's AOR beyond the boundaries of the Port of Embarkation (POE) and Aerial Point of Embarkation (APOE). The exception is commercial containers that are moved under commercial terms of service as far forward as tactically possible, normally to a major resupply point. COCOMs and their components might be resistant to relinquishing control of the entire movement to USTRANSCOM, but the status quo will continue to optimize segments of the logistics chain at the expense of the whole.

Despite this limitation, efficiencies have been realized in recent combat operations, mostly through the use of intermodal exchange points to move vehicles from ships to aircraft at forward ports within the AOR. Recent conflicts have also seen a rise in the use of tactical air assets to deliver consumables to forward bases via airdrop, which replaces the need for land based convoys and the attendant security required to move supplies to forward outposts. Limited demonstrations have been conducted using unmanned aircraft to deliver supplies to forward outposts. Where possible, COCOMs have also used the Army LOGCAP contract to provide Common User Land Transportation (CULT) trucks in lieu of deploying Army truck units.

5.2 LEVERAGING USTANSCOM CAPABILITIES

The Army can leverage initiatives such as these and collaborate with USTRANSCOM to improve the efficiency of the military supply chain while maximizing the use of supporting Army force structure. Collaboration could be improved by allocating Army line haul assets above the

division to USTRANSCOM for operational control and tasking. Doing so would cut the redundancies created by the Army maintaining assets to support the movement of goods form ports to forward areas while at the same time providing Logistics Civil Augmentation Program (LOGCAP) line haul assets *and* using the commercial container contracts to move goods.

The Army could also champion initiatives that foster efficiencies in its force structure. For example, since 2005 the Air Force has employed the Joint Precision Air Drop System (JPADS) and the JPADS delivery planning tool to accurately deliver 15 million pounds of fuel, food, and water in Iraq and Afghanistan. The 12,000 associated drops are equivalent to 12,000 convoy truck deliveries. The Air Force continues to develop this capability, employing 2K and 10K parafoils to make more than 350 deliveries within 50 meters of FOBs in Afghanistan. In addition, a 4K parafoil is also in operational testing.

By working with USTRANSCOM to optimize distribution all the way to the forward unit, the Army will ensure it doesn't lose the capability to deliver consumables to Soldiers in high risk areas.

5.3 SUMMARY

Based upon its findings, the study team recommends the Army embrace DODIs 5158.06 and 5158.04 and assign a liaison officer to USTRANSCOM with the authority to coordinate Army equities. Specifically, the following initiatives should be championed: (1) prioritize air drops of supplies directly to tactical locations, (e.g. utilize JPADS to the DODI); and (2) assign to USTRANSCOM surface movements units in Elements above Brigade. This would allow the Army to right size the line haul force structure, and if initiatives are fully leveraged, the Army may realize as much as a 30% reduction currently allocated to the EAD line haul mission, or the equivalent of approximately 2,772 positions.

When aggregated with the previous force structure strategies, the study team estimates the Army could rebalance about 6,301 positions, or the equivalent of about 1.4 BCTs.

6.0 STRATEGY 4: OUTSOURCE OF CSS & SUSTAINMENT FUNCTIONS

The United Kingdom's Ministry of Defence (MoD) has taken steps to reform its business practices by enlisting commercial industry to introduce technology, analytics, and industry standard operating processes to MoD activities.[17] One major result has been MoD's adoption of government-owned, contractor-operated (GoCo) organizations, which effectively privatize aviation maintenance, supply chain, etc. To attract commercial industry, UK MoD has adopted longer term contract vehicles with incentives and renegotiation points built in to reward good performance. Another innovation involved transferring government staff to the winning bidders and giving the organization five years to right size that staff by taking advantage of commercial techniques and technologies. These innovations were designed to reduce cost and to free up infrastructure that would be re-applied to core MoD functions.

6.1 CASE STUDY: CAB(M) MAINTENANCE FUNCTION

There are precedents for adopting a GoCo model within DoD, such as the Defense Logistics Agency (DLA) contracting out strategic fuel management and distribution. For the Army to adopt such an approach on its own, it would require a detailed analysis of core Army functions to determine which could be outsourced with minimum risk. Further analysis would need to be conducted to determine proper risk mitigation steps and processes to enact.

Following this method, and building upon its previous analysis of the maintenance field, the study team identified an opportunity to contract out some of an aviation brigade's maintenance function. The CAB(M) CSS has approximately 257 Solders with a maintenance MOS (Fig. 6.1).

[17] MoD originally planned to outsource both the acquisition and sustainment processes, but as of the date of this writing, has only outsourced the latter.

CSS Structure in CAB (M)

SKILL_GP	CAB (M)	
CA	1,459	55%
CS	200	7%
CSS	871	33%
MISC	19	1%
SP BR	108	4%
FUNC AREA	18	1%
Grand Total	**2,675**	

SKILL	HQ	AHB	GSAB	ARB	ARS	ASB	UAS CO	Grand Total
Quartermaster	9	65	83	61	61	143	16	438
Ordnance/Maintenance	1	28	48	49	52	138	16	332
Adjutant General	13	7	7	7	7	9	2	52
Transportation	2	6	6	4	5	12		35
Logistics	1	1	1	1	1	9		14
Grand Total	**26**	**107**	**145**	**122**	**126**	**311**	**34**	**871**

Of the 332 Ordnance /Maintenance skill sets,
257 Soldiers have Maintenance MOS (77%)

Figure 6.1 CAB (M) CSS Highlighting Maintenance

Applying the process across all 13 CABs, the force structure savings would be approximately 3,500 positions. Further expanding the process to all BCTs would yield significant additional force structure savings. To account for the variability associated with risk analyses and mitigation measures, the study team produced calculations for both "low-end" (40%) reductions and deeper, "high-end" (70%) reductions (Fig. 6.2).

LOCATION	Total Strength	Low End Reduction (%)	High End Reduction (%)	Low End Total Active CSS Savings	Higher End Total Active CSS Savings	Ave Potential Equiv BCT Saving
Ord/Maint - CAB	**3,559**	**40%**	**70%**	**1,424**	**2,491**	**0.87**
Ord/Maint - BCT	**11,827**	**40%**	**70%**	**4,731**	**8,279**	**2.88**
Ord/Maint - Echelon above BDE	**14,631**	**40%**	**70%**	**5,852**	**10,242**	**3.57**

Figure 6.2 Extrapolating Maintenance Force Structure Savings

6.2 OUTSOURCING COST SAVINGS

Given the current (and foreseeable) budgetary climate, any outsourcing efforts will have to produce cost savings, or at least be budget-neutral. Any force structure savings that cost more to enact, regardless of how promising they appear, make the associated rebalancing efforts counterproductive. Thus, to gauge the cost effectiveness of outsourcing maintenance functions, the study team analyzed how maintenance was accomplished in the 160th CAB, where a mix of

contractors and active duty personnel perform the maintenance function. Flight hour data provided by the unit indicated that contractors were more productive than active duty maintainers. The unit estimated that 2.3 active duty maintainers were required to perform the work of one contractor (Fig. 6.3).

LABOR TYPE	FLIGHT HR./WORKER	STRENGTH	FLIGHT HRS.
Active Duty	56	250	14,000
Contractor	130	150	19,500
2.32X performance using CTR			

Figure 6.3 Active Duty Maintainer vs. Contractor Flight Hour Comparison

Unit data on workloads corroborated this finding. Assuming an Active Duty maintainer only spends about 60% of his or her time performing maintenance functions due to having to accomplish other, "Soldier" duties, contractors, who don't have those ancillary duties, work more efficiently (Fig. 6.4). The full time equivalent (FTE) in personnel for 250 Active Duty maintainers is 108 contractors.

Active Duty Strength	Assume % of time spent on Maintenance	Equiv. FTE	Efficenciency of Contractor based on Active Duty FTE	Equiv. CONT to replace Active Duty
250	60%	150	1.4	108

Figure 6.4 Active Duty Maintainer vs. Contractor Workload Comparison

The savings in dollars associated with flight hour and workload efficiencies were calculated using annual costs reported by the Office of the Deputy Chief of Staff for Programs (HQDA G8), multiplied by the FTE, which indicated a potential savings of $3.8m (Fig. 6.5).

	Annual Cost (K) per G8	FTE	Cost	Cost savings (K)
Active Duty	100	150	$15,000	
Contractor	103	108	$11,124	$3,876

Figure 6.5 Active Duty Maintainer vs. Contractor Cost Comparison

Two factors appear to drive the efficiency and cost savings associated with outsourcing the maintenance function. First, better utilization of the workforce's available hours, where there are no diversions to non-maintenance tasks. Second, higher skill levels occurring in the contractor workforce, which may also be a factor related to an exclusive focus on the maintenance function.

6.3 SUMMARY

With modest improvements in Operational Contract Support (OCS) vehicles, the study team believes a significant portion of maintenance functions in the CABs, BCTs, and echelons above brigade can be outsourced. Taking into account the savings proposed in Strategy 1 (2,789 positions) and using conservative calculations (the average between 'High End,' 70% and 'Low End,' 40% reduction rates explained above) to mitigate greater risk, the study team estimates a reduction of 12,007 positions, or approximately 2.5 BCTs

When aggregated with the previous force structure strategies, the study team estimates the Army could rebalance about 18,303 positions, or the equivalent of about 3.8 BCTs.

Furthermore, based upon the Army's current use of OCS, such as the LOGCAP, the study team believes similar outsourcing processes might be applied to supply chain and life support functions. In recent engagements, the Army has used vehicles such as LOGCAP to provide support functions in the AOR, while at the same time retaining the force structure in garrison to perform those functions. Thus, there should be significant force structure savings available in those areas for rebalancing back to the OF. To mitigate risk, the Army could retain the capability required to perform these functions in the Reserve Component (RC), allowing non-core activities to be outsourced both in garrison and in the AOR, while a portion of the RC would be dedicated to cover the time it takes to either (a) deploy contractors from garrison to the AOR, or (b) establish new vehicles to hire contractors to support the contingency.

Current OCS vehicles would have to be modified to include garrison activities with deployment features for all contractor personnel. IN other words, the current EAGLE base support vehicle will need to be linked to LOGCAP so that the same contracted support team would operate in both environments. The Army will have work with the contractor to determine a means of assuring an adequate return on the contractor's investment to incent the level of support required for surging into contingency operations. More broadly, the study team believes the Army's contract management process needs to be improved to support the recommendations in this study (see Appendix E: Operational Contract Support Improvements). One doctrinal improvement that would support outsourcing would see the Army add its contracting function to the warfighters operating concept. This would recognize contract support as a warfighter enabler and align the procurement process with the concept of operations.

7.0 STRATEGY 5: OUTSOURCE GF BASE SUPPORT

If the Army can realize force structure savings through outsourcing certain functions in the OF, it follows that a similar process might be employed in the GF. To that end, the study team observed several processes in commercial industry that had promising applications to the Army's support functions:

- Amazon.com - Amazon made use of advanced technology, robotics, and data analytics in its distribution process. They also changed their basic approach to distribution by applying principles of fluid dynamics to deal with turbulence and chaos as an integral part of inventory management. The flexibility gained by this approach enables better use of the company's information and tracking system, as well as its reliance on robotics at the distribution centers. Overall, Amazon has decreased the required storage space for a given volume of goods by 50%, and it has developed the capability to set up temporary locations for specific events, like NASCAR races, that exist virtually for the duration of the event. In short, data analytics drives the process yields real bottom line impacts in reduced labor and improved inventory turnover.

- McLane Systems, the company that assisted Walmart in developing its grocery operations, collaborated with the company and its suppliers to use sales data to drive the production cycle. The goal was to enable the suppliers to drop ship to a store or distribution center so that a store shelf would never be empty or overstocked. The process required the Walmart manager to rely on a third party to obtain those results, but that risk was accepted, and the resulting processes drove down levels of idle inventory at the factory, distribution, centers, and stores.

- Delta Airlines has a unifying metric that all employees focus upon: flying revenue miles. If any function in the company doesn't contribute to flying revenue miles, it's either cut or outsourced as a no-core function.

The common theme among these activities is the focus on core tasks and the elimination or outsourcing of those tasks that aren't central to the corporation's defining function. Applied to the Army, a similar exercise would free up force structure and resources in the GF and other support areas to be reapplied to core tasks and operational missions.

7.1. PROTOTYPING THE OUTSOURCING

Precedent for outsourcing support functions in DoD can be found in numerous examples. One successful case involves USTRANSCOM right sizing the DOD infrastructure to optimize the commercial movement of goods via ocean carriers and air carriers in support of the COCOMs. The result has been an overall reduction in the government staffs previously required to manage the movement of goods into a COCOM's AO.

To make changes of this magnitude, the study team recommends the Army establish a test bed and prototyping process. Prototyping the concept in a geographic area of CONUS will be key to getting it right for the Army and industry. The primary goal for the Army will be to realize increased efficiency in support operations, and to experience little or no risk during transition to war. The geographic area selected needs to provide a full range of Army units for inclusion in the base contract and sufficient structure to manage the effort. It should take the Army's LOGCAP vehicle as the starting point with Army Sustainment Command supporting Army Forces Command. The day-to-day operation will need to be at the Division level so that when a BCT deploys, it and its support can transition to an OCONUS model and maintain its habitual support relationships to the contractor base. Eventually, the project will require a more robust vehicle than LOGCAP. Analysis in the prototype should focus on identifying those functions that yield the highest payoffs in releasing GF structure while reducing cost with the least risk of mission impact. The study team believes the maintenance, supply, transportation, and information management functions hold the most promise for outsourcing.

In creating the contracting construct and providing contracting oversight (see Appendix E), the guiding principle should be to create a warfighter enabler. The required Return on Investment (ROI) should be clear and understood by all sides to assure performance, with punitive options for failure to perform that both government and industry agree to. As is the case in the UK approach, a long term approach (5-10 years) should be taken. The Amazon model for managing supply chain velocity and the commercial industry approach to maintenance and repair operations (MRO) should be adopted to fit the unique needs of the Army.

7.2. SUMMARY

The study team believes a significant portion of base support functions can be outsourced. Continuing with our theme of looking at the maintenance field, the team identified 5,728 positions in maintenance and ordinance MOS that serve base support functions. Assuming a conservative reduction of 50% of those positions, the Army could rebalance 2,864 positions, or two-thirds of a BCT.

When aggregated with the previous force structure strategies, the study team estimates the Army could rebalance about 21, 172 positions, or the equivalent of about 4.7 BCTs.

Finally, the Army should look at the potential second- and third-order right-sizing in the GF (TDA training, support, schoolhouses, and enterprise level depots) to align with the reduced demand for uniformed skills. This will take time to emerge but the approach should allow the Army to release additional structure for rebalancing.

8.0 CONCLUSION

Using the five force structure strategies outlined in this report, the study team was able to identify a potential savings of over 21,000 positions, or the equivalent of nearly 5 BCTs. This shows tremendous potential for the Army to maintain its combat capability amid future budget uncertainty.

Further analysis should be completed before the Army adopts any of these strategies. Specifically, the study team recommends the Secretary of the Army and the Chief of Staff validate the data and analyses of this study and investigate the long term effects associated with outsourcing maintenance. The validation should be done now, as the Army faces a relatively stable budgetary environment going into FY 17. Failure to prepare now for the next budget "crisis" will leave the Army in a poorer position to make smart reductions that maintain combat capability.

Our review of past efforts to restructure, reorganize and rebalance the force indicate the Army needs to adopt a more strategic approach to managing its force structure. As part of that process, the study team recommends the Secretary of the Army and the Chief of Staff establish a mandate to achieve greater than the 2011 OF/GF ratio (48:52), which was the best balance observed in our data analysis. This should become a matter of doctrine for the Army moving forward.

Finally, once the Army validates force structure strategies and makes rebalancing a matter of doctrine, the study team recommends the Army G3 apply this methodology to all components (Active, ANG, Army Reserve and Civilian force structure), to maximize efficiencies across the force.

APPENDIX A. ABBREVIATIONS AND ACRONYMS

ABCT	Armored Brigade Combat Team
AD	Active Duty
ALT	Acquisition, Logistics and Technology
AMAF	Annual MOS Availability Factors
AMMH	Annual Maintenance Man-Hours
AO	Area of Operations
AOAP	Army Oil Analysis Program
AOR	Area of Responsibility
APOE	Aerial Point of Embarkation
AR	Army Regulation
ARFORGEN	Army Force Generation
ASA	Assistant Secretary of the Army
ASB	Army Science Board
ASIOE	Associated Support Items of Equipment
AWPS	Army Workload Performance System
BCT	Brigade Combat Team
BOIP	Basis of Issue Plan
BOIPFD	Basis of Issue Plan Feeder Data
CAB	Combat Aviation Brigade
CAB (M)	Combat Aviation Brigade (Medium)
CBM	Condition Based Maintenance
CBM+	Condition Based Maintenance Plus
CG	Commanding General
CMICS	Civilian Manpower Integrated Costing System
COCOM	Component Commander
CONOP	Concept of Operations
CSA	Chief of Staff of the Army
CSS	Combat Service Support
CULT	Common User Land Transportation
DCS	Deputy Chief of Staff
DoD	Department of Defense
DPAMMH	Direct Productive Annual Maintenance Man-Hours
EIS	Enterprise Information Systems
FFRDC	Funded Research and Development Centers
FILO	First in, Last Out
FMSWEB	Army Force Management Support Agency
FOB	Forward Operating Base
FTE	Full-Time Equivalent
FY	Fiscal Year
G1	Personnel
G3	Operations
G4	Logistics
GAO	General Accounting Office
GF	Generating Force
GoCo	Government-owned, Contractor-operated
HQDA	Headquarters, Department of the Army
IDA	Institute for Defense Analysis
IPT	Indirect Productive Time
JPADS	Joint Precision Air Drop System
LMI	Logistics Management Institute
LOGCAP	Logistics Civil Augmentation Program
LOGSA	Logistics Support Activity
M&RA	Manpower and Reserve Affairs
MACOM	Major Army Command (obsolete)
MARC	Manpower Allocation Requirements Criteria
MOD	Ministry of Defence (UK)
MOS	Military Occupational Specialty
MS^3	Manpower Staffing Standard System
MTDA	Modification Table of Distribution and Allowance
MTOE	Modified Table of Organization and Equipment
OCS	Operational Contract Support
OF	Operating Force
OMS/MP	Operational Mode Summary/Mission Profile
OSD	Office of the Secretary of Defense
PEO	Program Executive Officer
PM	Program Manager
PMCS	Preventative Maintenance Checks and Services
POE	Port of Embarkation
RC	Reserve Component
RDECOM	Research, Development and Engineering Command
RIF	Reduction in Force
ROI	Return on Investment
S&T	Science and Technology
SBCT	Stryker Brigade Combat Team
Sec Army	Secretary of the Army
SIPT	Supportability Integrated Process Team
STEM	Science, Technology, Engineering and Math
TEU	Twenty-Foot Equivalent Units
TOE	Table of Organization and Equipment
TOR	Terms of Reference
TRADOC	Training and Doctrine Command
USAFMSA	U.S. Army Force Management Support Agency
USAMAA	U.S. Army Manpower Analysis Agency
USTRANSCOM	U. S. Transportation Command

APPENDIX B. TERMS OF REFERENCE

SECRETARY OF THE ARMY
WASHINGTON
JAN 06 2015

Dr. James Tegnelia
Chairman, Army Science Board
101 Army Pentagon
Washington, DC 20310

Dear Dr. Tegnelia:

I request that the Army Science Board (ASB) conduct a study entitled "Strategies to Optimize Army Operating and Generating Forces for 2025 and Beyond." As the Army draws down due to budgetary pressures, the Army must seek means to retain and gain needed operational capabilities.

The purpose of the study is to develop strategies for rebalancing the Army operating and generating force to retain or gain capabilities in the mid-term (2025) and beyond (2030-2040). This study will identify opportunities to improve the efficiency of operating force combat service support and generating force capabilities to help provide the means to invest in core operational capabilities. Recommendations and findings must be supported by sound systems analysis.

The study tasks should include, but not necessarily be limited by, the Terms of Reference (TOR) described below:

a. Review and evaluate opportunities for improving the efficiency of generating force and operating force within combat arms, combat support and combat service support units, including the appropriate use of contractors.

b. Identify and evaluate enabling concepts, solutions, systems and disruptive technologies for transforming operating force combat service support and generating force capabilities while strengthening Army capabilities.

c. Examine Army, Joint, private sector and academic organizations that are innovating supply chain management, e-procurement, logistics, personnel support, personnel services and contracting.

The sponsor of this study is the Commanding General (CG), U.S. Army Training and Doctrine Command (TRADOC). The ASB must present a comprehensive briefing to the CG, TRADOC and me by September 30, 2015. The final written report must be provided by October 31, 2015. The supporting data for findings and recommendations need to be available to Army senior leaders upon request.

2

The study will operate in accordance with the Federal Advisory Committee Act and Department of Defense (DoD) Directive 5104.4, "DoD Federal Advisory Committee Management Program." It is not anticipated that this study will need to go into any "particular matters" within the meaning of Title 18, United States Code Section 208, nor will it cause any member to be placed in the position of acting as a procurement official.

Sincerely,

John M. McHugh

APPENDIX C. STUDY TEAM MEMBERS

Chair – Dr. Gisele Bennett

Vice-Chair – Dr. Leonard Braverman

Panel Members

Dr. Joe Beaman
COL (Ret). William Crowder
Dr. John-Paul Clarke
Dr. Endy Daehner
MG(Ret) Charles Henry
Dr. Mal O'Neill (LTG Ret)
Dr. Buck Tanner (LTC Ret)
Dr. John Matsumura

Senior Advisor – GEN(Ret) David Maddox

Study Manager – LTC Patrick Marshall

Dr. Norm O'Meara – Study Analyst (LMI)

Tech Writer/Editor – Mark Swiatek

APPENDIX D. LINES OF INQUIRY AND VISITATIONS

D.1 LINES OF INQUIRY

The following Lines of Inquiry were used for all study group visitations and teleconferences:

1. Develop strategies for rebalancing the Army operating and generating force to retain or gain capabilities in the mid-term (2025) and beyond (2030-2040). This study will identify opportunities to improve the efficiency of operating force combat service support (CSS) and generating force capabilities to help provide the means to invest in core operational capabilities.
    a. Generation of combat capability as needed vice continuously / COMPO 1, 2, 3 rebalance - Capabilities documented in/across MTOEs to have mission fits and exact match of TPFDD for lift and sustainment cost reduction – deployment (equipment package) stage and ship locations optimization
    b. Tailoring / Novel version of round-out concept
    c. Host nation support & SOFA / military vs civilian economies / contractors vs DOD
    d. Move to DoD roles and mission (and EA responsibilities) from services' process seams / seek out economies of scale – rebalance operating and generating force responsibilities from seams
    e. Means to make "just-in-time" work (sustain or improve operational capability) with LRU data / PBM / Failure rate as KPP and diagnostic / prognostic sensors
    f. Major elements of combat power relationship to generating constraints for those elements
    g. Generating force need to continuously evolve with US and global industries
    h. Risk incurred by operating force from varying elements of CSS and generating force – Sister services' cost (great disparity scaled to individual service's size)

2. Review and evaluate opportunities for improving the efficiency of generating force and operating force within combat arms, combat support, and combat service support units, including the appropriate use of contractors.
    a. Per generating force organization what is output product (what is product line)
    b. How will study define efficiency – between generating force and operating force
    c. How do you produce output (maximally efficient) with reduced generating force?
    d. SOF force generation
    e. Focus on robust requirements to drive efficient force generation
    f. Impact of Executive Agency
    g. For those functions that will be contracted – what is the generating force?

3. Identify and evaluate enabling concepts, solutions, systems, and disruptive technologies for transforming operating force combat service support and generating force capabilities while strengthening Army capabilities.
    a. Positive and negative effects of big data
    b. What makes data relevant / data must be efficient. How to combine divergent elements of data to provide information in a timely manner accessible to key decision makers
    c. How do we handle cybersecurity in the log environment to flow data efficiently?
    d. Host nation enablement of processes
    e. Next Generation soldiers and what they expect from data
    f. What can be divested

4. Examine Army, Joint, private sector, and academic organizations that are innovating supply chain management, e-procurement, logistics, personnel support, personnel services, and contracting.
    a. Amazon process – can it be applied to Army culture
    b. Technologies innovation of commercial aviation industry supplies and maintenance
    c. Continuous disciplined execution of process
    d. Success is executing fundamentals – What is in supply chain management that yields efficiency FEDEX / UPS / USPS (these are long term predictable businesses)
    e. Contracting at the speed of maneuver
    f. Role of contractors in the battle space

5. Discussion Points.
    a. Alternative approaches
    b. Balancing techniques
    c. Transformations that did not yield desired outcomes
    d. “Big Data”
    e. How to define efficiency
    f. Stake holder validation
    g. Variance across industry and how these apply
    h. Lean
    i. How to handle cybersecurity in the log environment to flow data efficiently
    j. Corporations that have executed major (20%+) personnel reductions and rationale
    k. Value added vs. compliance (Army metrics for staffing these two types of organizations)
    l. Recent process actions to gain efficiency & lessons
    m. Public relations & perception matching

D.2 VISITATIONS AND INTERVIEWS

The following visitations and teleconferences are chronologically ordered and grouped by category: Defense Department and Agency, Private Industry, and Research Institutions.

1. Defense Department and Agency OSD, Agencies, Combatant Commands (USPACOM and USTRANSCOM), Army Service Component Commands (USARPAC), Army Material Command, Army Contracting Command-Expeditionary Contracting Command, and TRADOC

TRADOC ARCIC (LTG McMaster, 17 March 2015, Pentagon, VA)

Army Contracting Command, Expeditionary Contracting Command (ECC) (BG Hoskin, 31 March 2015, Huntsville, AL)

Army Material Command, G8 (Mr. Trousdale, SES, DCSG8; Ms Goodyear, SES, ADSCG8, 31 March 2015, Huntsville, AL)

Defense Logistics Agency DLA (Mr. Ted Case, SES, 21 April, Fort Belvoir) Mr. John Hall, SES; Ms Yvette Burke, SES

Logistics Innovation Agency (Mr. Mike Williams, SES, 21 April, Fort Belvoir)

DARPA (Dr Pratt, 22 April, Arlington VA)

TRADOC ARCIC (LTG McMaster, Follow-up, 23 April 2015, Crystal City, VA)

TRANSCOM (Mr. , 4 May 2015, Atlanta, GA)

USPACOM Deputy CG (LTG Crutchfield, 9 June 2015, Camp Smith, HI)

USPACOM J8, J81 (9 June 2015, Camp Smith, HI)

USARPAC Staff Round Table, G37 (USARPAC Staff, 9 June 2015, Fort Shafter, HI)

USARPAC CG (GEN Brooks, 10 June 2015, Fort Shafter, HI)

USARPAC G3, TJFLCC (9 June 2015, Fort Shafter, HI)

USARPAC, 94th AAMDC (10 June 2015, Hickam AFB, HI)

USARPAC G4 Trans, LSV (10 June 2015, Pearl Harbor, HI)

USARPAC, MCTC (BG Patrick Mattlock, ADCS 25ID 11 June 2015, Fort Shafter, HI)

USARPAC, JPMR.C (BG Patrick Mattlock, ADCS 25ID, 11 June 2015, Fort Shafter, HI)
USARPAC, G4, CASCOM, ECC (11 June 2015, Fort Shafter, HI)

USPACOM, TAMC, 18th MEDCOM (11 June 2015, Tripler, HI)

2. Private Industry

WWE (Mr. Sean Sellman, Dir. Production Logistics, February 2015, Teleconference)

Boeing WebEx (7 April 2015, Teleconference)

AeroEnvironment (9 April, Teleconference)

AeroEnvironment (14 April, Semi Valley)

Tapestry (April 2015, La Jolla, CA)

Andromeda Systems (21 April, Arlington, VA)

Microsoft (Ms. Nadia Matthews, Ms. Carla VonBernewitz, April 2015,Teleconference)

Boeing (Mr. Jamie Moran, May 2015, Seattle, WA)

Delta (Mr. John Laughter, 11 May 2015, Atlanta, GA) Mr. Bob Currey, Mr. Jon Tovani, Mr. Bill
Smith

Coca Cola (Mr. Eric Welsh, 13 May 2015, Atlanta, GA)

McLean (Mr. Drayton McLane, July 2015, Teleconference)

3. Research Institutions

RAND (Dr Frank Camm, 2 February, Arlington, VA)

GTRI (Dr Gary Oneill, May 2015, Atlanta, GA)

APPENDIX E. ABCT MAINTENANCE BREAKOUT

The following tables provide background for the methodology used in section 3.0 Strategy 1: Data Analytics Identifies Maintenance Efficiencies.

System AMMH numbers:

LIN	NOMEN	ABCT (	MOS	ASI	AMFIELDMAINTENANC	MOSTITLE	total
A05001	ASSAULT BREACHER VEHICLE: (ABV)	6	91A	D8	1447	M1 ABRAMS TANK SYSTEM MAINTAINER	8680.56
A05001	ASSAULT BREACHER VEHICLE: (ABV)	6	91J	00	7	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	42
C10908	CARRIER AMMUNITION: TRACKED VEHICLE (CATV)	18	91H	00	0	TRACK VEHICLE REPAIRER	0
C10908	CARRIER AMMUNITION: TRACKED VEHICLE (CATV)	18	91P	00	1528	ARTILLERY MECHANIC	27510.84
C10990	CARRIER 120 MILLIMETER MORTAR: SELF PROPELLED ARMORED	18	91H	00	847	TRACK VEHICLE REPAIRER	15246
C10990	CARRIER 120 MILLIMETER MORTAR: SELF PROPELLED ARMORED	18	91J	00	28	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	511.56
C11158	CARRIER ARMORED COMMAND POST: FULL TRACKED	44	91D	00	870	POWER-GENERATION EQUIPMENT REPAIRER	38290.56
C11158	CARRIER ARMORED COMMAND POST: FULL TRACKED	44	91G	00	7	FIRE CONTROL REPAIRER	308
C11158	CARRIER ARMORED COMMAND POST: FULL TRACKED	44	91H	00	850	TRACK VEHICLE REPAIRER	37391.2
C11158	CARRIER ARMORED COMMAND POST: FULL TRACKED	44	91J	00	29	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	1275.12
C18234	CARRIER PERSONNEL FULL TRACKED: ARMORED (RISE)	61	91H	00	847	TRACK VEHICLE REPAIRER	51667
C18234	CARRIER PERSONNEL FULL TRACKED: ARMORED (RISE)	61	91J	00	41	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	2476.6
D11538	CARRIER COMMAND POST: LIGHT TRACKED	14	91D	00	488	POWER-GENERATION EQUIPMENT REPAIRER	6832.56
D11538	CARRIER COMMAND POST: LIGHT TRACKED	14	91G	00	7	FIRE CONTROL REPAIRER	98
D11538	CARRIER COMMAND POST: LIGHT TRACKED	14	91H	00	850	TRACK VEHICLE REPAIRER	11901.12
D11538	CARRIER COMMAND POST: LIGHT TRACKED	14	91J	00	29	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	405.72
F60564	FIGHTING VEHICLE: FULL TRACKED INFANTRY (IFV) M2A3	103	91C	00	3	UTILITIES EQUIPMENT REPAIRER	346.08
F60564	FIGHTING VEHICLE: FULL TRACKED INFANTRY (IFV) M2A3	103	91F	00	160	SMALL ARMS/TOWED ARTILLERY REPAIRER	16452.19
F60564	FIGHTING VEHICLE: FULL TRACKED INFANTRY (IFV) M2A3	103	91G	00	35	FIRE CONTROL REPAIRER	3573.07
F60564	FIGHTING VEHICLE: FULL TRACKED INFANTRY (IFV) M2A3	103	91M	B9	1503	BRADLEY FIGHTING VEHICLE SYSTEM MAINTAINER	154845.1
F90796	FIGHTING VEHICLE: FULL TRACKED CAVALRY (CFV) M3A3	32	91C	00	3	UTILITIES EQUIPMENT REPAIRER	107.52
F90796	FIGHTING VEHICLE: FULL TRACKED CAVALRY (CFV) M3A3	32	91F	00	160	SMALL ARMS/TOWED ARTILLERY REPAIRER	5109.76
F90796	FIGHTING VEHICLE: FULL TRACKED CAVALRY (CFV) M3A3	32	91G	00	35	FIRE CONTROL REPAIRER	1110.08
F90796	FIGHTING VEHICLE: FULL TRACKED CAVALRY (CFV) M3A3	32	91H	00	0	TRACK VEHICLE REPAIRER	0
F90796	FIGHTING VEHICLE: FULL TRACKED CAVALRY (CFV) M3A3	32	91M	B9	1503	BRADLEY FIGHTING VEHICLE SYSTEM MAINTAINER	48107.2
H57642	HOWITZER MEDIUM SELF PROPELLED:	18	91H	00	0	TRACK VEHICLE REPAIRER	0
H57642	HOWITZER MEDIUM SELF PROPELLED:	18	91J	00	21	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	370.44
H57642	HOWITZER MEDIUM SELF PROPELLED:	18	91P	00	828	ARTILLERY MECHANIC	14908.32
M05004	MINE PROTECTED CLEARANCE VEHICLE:	2	91B	00	1022	WHEELED VEHICLE MECHANIC	2044
M05004	MINE PROTECTED CLEARANCE VEHICLE:	2	91C	00	26	UTILITIES EQUIPMENT REPAIRER	51.24
N96543	NUCLEAR BIO CHEM RECON VEH: (NBC RV)	3	91C	00	5	UTILITIES EQUIPMENT REPAIRER	14.37
N96543	NUCLEAR BIO CHEM RECON VEH: (NBC RV)	3	91S	00	435	STRYKER SYSTEM MAINTAINER	1305.99
R50681	RECOVERY VEHICLE FULL TRACKED: MEDIUM	14	91G	00	11	FIRE CONTROL REPAIRER	147
R50681	RECOVERY VEHICLE FULL TRACKED: MEDIUM	14	91H	00	1392	TRACK VEHICLE REPAIRER	19488.28
R50681	RECOVERY VEHICLE FULL TRACKED: MEDIUM	14	91J	00	29	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	405.72
R50885	RECOVERY VEHICLE FULL TRACKED: HEAVY M88A2	22	91H	00	1391	TRACK VEHICLE REPAIRER	30602.88
R50885	RECOVERY VEHICLE FULL TRACKED: HEAVY M88A2	22	91J	00	29	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	637.56
T13305	TANK COMBAT FULL TRACKED: 120MM GUN M1A2	87	91A	K4	1811	M1 ABRAMS TANK SYSTEM MAINTAINER	157530
T13305	TANK COMBAT FULL TRACKED: 120MM GUN M1A2	87	91C	00	55	UTILITIES EQUIPMENT REPAIRER	4750.2
T13305	TANK COMBAT FULL TRACKED: 120MM GUN M1A2	87	91G	00	233	FIRE CONTROL REPAIRER	20304.06
T13305	TANK COMBAT FULL TRACKED: 120MM GUN M1A2	87	91H	00	0	TRACK VEHICLE REPAIRER	0
T13305	TANK COMBAT FULL TRACKED: 120MM GUN M1A2	87	91J	00	7	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	609
T34704	TRUCK UTILITY: ECV ARMAMENT CARRIER W/IAP ARMOR READY M1151A1	46	91B	00	396	WHEELED VEHICLE MECHANIC	18225.2
T34704	TRUCK UTILITY: ECV ARMAMENT CARRIER W/IAP ARMOR READY M1151A1	46	91C	00	18	UTILITIES EQUIPMENT REPAIRER	850.08
T37588	TRUCK UTILITY EXPANDED CAPACITY ENHANCED: M1152A1	179	91B	00	337	WHEELED VEHICLE MECHANIC	60258.56
T37588	TRUCK UTILITY EXPANDED CAPACITY ENHANCED: M1152A1	179	91C	00	18	UTILITIES EQUIPMENT REPAIRER	3307.92
T38844	TRUCK AMBULANCE: 4 LITTER ARMD 4X4 W/E (HMMWV)	11	91B	00	306	WHEELED VEHICLE MECHANIC	3366.44
T38844	TRUCK AMBULANCE: 4 LITTER ARMD 4X4 W/E (HMMWV)	11	91C	00	2	UTILITIES EQUIPMENT REPAIRER	23.1
T41515	TRUCK CARGO: 5 TON WO/WINCH	71	91B	00	522	WHEELED VEHICLE MECHANIC	37050.64
T41515	TRUCK CARGO: 5 TON WO/WINCH	71	91C	00	111	UTILITIES EQUIPMENT REPAIRER	7910.11
T55054	TRUCK PALLETIZED (LHS): M1120A4	59	91B	00	494	WHEELED VEHICLE MECHANIC	29157.8
T55054	TRUCK PALLETIZED (LHS): M1120A4	59	91C	00	54	UTILITIES EQUIPMENT REPAIRER	3204.88
T55236	TRUCK PALLETIZED LOADING: M1074A1	18	91B	00	647	WHEELED VEHICLE MECHANIC	11642.4
T56383	TRUCK UTILITY EXPANDED CAPACITY ENHANCED 4X4: M1165A1	155	91B	00	337	WHEELED VEHICLE MECHANIC	52179.2
T56383	TRUCK UTILITY EXPANDED CAPACITY ENHANCED 4X4: M1165A1	155	91C	00	18	UTILITIES EQUIPMENT REPAIRER	2864.4
T58318	TRUCK TANK: WO/WINCH	45	91B	00	536	WHEELED VEHICLE MECHANIC	24129
T58318	TRUCK TANK: WO/WINCH	45	91C	00	54	UTILITIES EQUIPMENT REPAIRER	2444.4
T60946	TRUCK TRACTOR: (LET)	12	91B	00	481	WHEELED VEHICLE MECHANIC	5770.32
T60946	TRUCK TRACTOR: (LET)	12	91C	00	54	UTILITIES EQUIPMENT REPAIRER	651.84
T62359	TRUCK VAN: M1079A1P2 WO/WINCH	14	91B	00	529	WHEELED VEHICLE MECHANIC	7406
T62359	TRUCK VAN: M1079A1P2 WO/WINCH	14	91C	00	111	UTILITIES EQUIPMENT REPAIRER	1559.74
T63161	TRUCK WRECKER: M984A4	11	91B	00	506	WHEELED VEHICLE MECHANIC	5564.02
T63161	TRUCK WRECKER: M984A4	11	91C	00	54	UTILITIES EQUIPMENT REPAIRER	597.52
T67136	TRUCK: EXPANDABLE VAN WO/WINCH	8	91B	00	543	WHEELED VEHICLE MECHANIC	4345.6
T67136	TRUCK: EXPANDABLE VAN WO/WINCH	8	91C	00	127	UTILITIES EQUIPMENT REPAIRER	1014.16
T81874	TRUCK: PALLETIZED LOADING	64	91B	00	647	WHEELED VEHICLE MECHANIC	41395.2
T88983	TRUCK TRACTOR: WO/WINCH	20	91B	00	367	WHEELED VEHICLE MECHANIC	7338.8
T88983	TRUCK TRACTOR: WO/WINCH	20	91C	00	111	UTILITIES EQUIPMENT REPAIRER	2228.2
T93271	TRUCK CARGO: LWB WO/WINCH	22	91B	00	521	WHEELED VEHICLE MECHANIC	11456.94
T93271	TRUCK CARGO: LWB WO/WINCH	22	91C	00	111	UTILITIES EQUIPMENT REPAIRER	2451.02
T94671	TRUCK WRECKER:	9	91B	00	602	WHEELED VEHICLE MECHANIC	5418
T94671	TRUCK WRECKER:	9	91C	00	120	UTILITIES EQUIPMENT REPAIRER	1077.93
X44403	TRUCK DUMP: 20 TON DSL DRVN 12 CU YD CAP (CCE)	4	91B	00	741	WHEELED VEHICLE MECHANIC	2964.08
X44403	TRUCK DUMP: 20 TON DSL DRVN 12 CU YD CAP (CCE)	4	91C	00	2	UTILITIES EQUIPMENT REPAIRER	8.4
Z00963	CARRIER BRIDGE LAUNCHING: JOINT ASSAULT XM1074	4	91A	D8	1199	M1 ABRAMS TANK SYSTEM MAINTAINER	4795.28
Z00963	CARRIER BRIDGE LAUNCHING: JOINT ASSAULT XM1074	4	91C	00	26	UTILITIES EQUIPMENT REPAIRER	102.48
Z00963	CARRIER BRIDGE LAUNCHING: JOINT ASSAULT XM1074	4	91H	00	0	TRACK VEHICLE REPAIRER	0
Z00963	CARRIER BRIDGE LAUNCHING: JOINT ASSAULT XM1074	4	91J	00	7	QUARTERMASTER AND CHEMICAL EQUIPMENT REPAIRER	28

Annual required 91 MOS hours:

MOS	Total hours
91A	171005.9
91B	329712.2
91C	35565.59
91D	45123.12
91F	21561.95
91G	25540.21
91H	166296.5
91J	6761.72
91M	202952.3
91P	42419.16
91S	1305.99

Annual required 91 MOS positions:

		MY
		3,230
MOS	Total hours	
91A	171,006	53
91B	329,712	102
91C	35,566	11
91D	45,123	14
91F	21,562	7
91G	25,540	8
91H	166,296	51
91J	6,762	2
91M	202,952	63
91P	42,419	13
91S	1,306	0
	total	325

APPENDIX F. OPERATIONAL CONTRACT SUPPORT (OCS) IMPROVEMENTS

While the investigation of Army contracting practices falls outside of the study team's tasks as described in the TOR, contracting is foundational to the recommendations of this study. As such, it became clear to the team that the Army's current contracting system might impede the adoption of some recommendations. The following observations are made to provide a comparative analysis between Army contracting and commercial industry best practices, with an eye towards making the Army contracting system more efficient, more economical, and better at integrating with partners in industry.

Under existing laws and regulations, the Army's contracting function can be improved to generate greater efficiency in Army operations and higher yield in monetary savings. The study team observed a number of best practices from commercial industry, which can be implemented by the Army in the short term, including:

- Providing the authority to make contracting decisions at lower levels, which would reduce the overhead and indirect costs associated with superfluous layers of supervision.

- Adopting the common industry standard of Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) to measure success. This point of friction can best be understood by recognizing that investment decisions are made based on the ability to get a rate of return on the investment that is greater than the cost of money and acceptable risk.

- Increasing competitiveness by using real time data and a less time (e.g., 90 days) to measure progress and to be on par with the speed of business and technology.

Improvements that are achievable in the mid-term could focus on how the Army manages the contracting function, from how it competes a task to how it trains its personnel to act as smart buyers. For example, the Army could:

- Compete all new "starts," and employ learning curve (LC) techniques to foster proper relationships with contractors. The LC approach will identify contractors who stay true to commitments and yield savings, which reduces the need to re-compete, and proves them eligible for longer contract terms.

- Require all prime contractors to manage subcontractors, producing savings for the Army

- Train all Army officers in contract formation principles to the extent that all officers acquire a working knowledge to make basic contract management decisions

The aggregated effects of these improvements include a reduction in uncertainty and confusion for both the Army customer and the contractor, which results in better management, administration, and performance of the contract, more efficient delivery in goods and services, and therefore, lower administrative costs (to include reduced effort by the Army in re-bidding contracts).

Finally, longer term improvements should be geared toward addressing negative impacts the current Army contracting system produces on industrial base business partners. For example, current Army procedures preclude contractors from planning, budgeting for, or investing in independent research and development (IRAD). In addition, the Army's reliance on short term contracts creates indecision at the corporate level regarding the future of particular programs. These and other adverse effects could be remedied by adopting more flexibility in long term contracting. The Army would likely need to work with Congress to obtain authority for some aspects of a long term approach, but the changes would produce efficiency, economy and better product delivery to the soldier.

APPENDIX G. APPROVED BRIEFING WITH FINDINGS AND RECOMMENDATIONS, 16 JULY 2015

Army Science Board

16 July 2015

Strategies to Optimize Army Operating and Generating Forces for 2025 and Beyond

Army Science Board 1

Introduction

Rebalancing Concepts

1. Data Analytics Identifies Maintenance Efficiencies
2. Leverage Industry S&T
3. Utilize Joint Re-Supply
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5. Outsource GF Base Support

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Army Science Board 2

Introduction: Study Team

Chair – Dr. Gisele Bennett
Vice-Chair – Dr. Leonard Braverman

Panel Members

Dr. Joe Beaman	**MG(Ret) Charles Henry**
COL (Ret). William Crowder	**Dr. Mal O'Neill (LTG Ret)**
Dr. John-Paul Clarke	**Dr. Buck Tanner (LTC Ret)**
Dr. Endy Daehner	**Dr. John Matsumura**

Senior Advisor – GEN(Ret) David Maddox
Study Manager – LTC Patrick Marshall
Dr. Norm O'Meara – Study Analyst (LMI)
Tech Writer/Editor – Mark Swiatek

Areas of Expertise

Physics, Engineering, Computer Science, ISR, Air Defense, Modeling & Simulation, Rapid Manufacturing, Optics, Network Architecture, National Security, Analytics, Robotics, Autonomy, Program Management, SE&I, Military Space, Munitions, Sensors, Aerospace Technology, Logistics, Materials, Acquisition, Sustainment

Army Science Board 3

Introduction: Data Collection

The Study Team conducted over 30 visits and interviews:

- **Army:** G3/5/7, G8, AMC, ACC/ECC CASCOM, TRADOC, ARCIC, CAC, MCCoE, 4th ID, Logistics Innovation Agency, ARSOAC
- **DoD:** OSD/Joint: DARPA, USPACOM, USARPAC, USSOCOM, USTRANSCOM, DLA
- **FFRDCs/Academe:** RAND, GTRI, MITRE, Georgia Tech
- **Industry:** Aeroenvironment, AUSA, Boeing, Coca Cola, Delta, Maersk, NDIA, Tapestry, Andromeda Systems, Cypherworks, Maersk, Microsoft, Leidos, Walmart, Tapastry, WWE

Data used in the study analyses were derived from the Defense Manpower Data Center (Active, Guard, Reserve and Civilian master files), and the Army Force Management Support Agency (FMSWEB)

Army Science Board 4

Introduction: Terms of Reference

CG Training and Doctrine Command (TRADOC) sponsored this study to develop strategies for rebalancing the Army's operating force (OF) and generating force (GF) with the aim of retaining or gaining capabilities in the mid-term (2025) and beyond (2030-2040).

Specific tasks include:

1. Review and evaluate opportunities for improving the efficiency of GF and OF within CA, CS, and CSS units, including the appropriate use of contractors
2. Identify and evaluate enabling concepts, solutions, systems, and disruptive technologies for transforming OF CSS and GF capabilities while strengthening Army capabilities
3. Examine Army, Joint, private sector, and academic organizations that are innovating supply chain management, e-procurement, logistics, personnel support, personnel services, and contracting

Army Science Board 5

Introduction: Background

Challenge:

How to retain Army combat capacity (BCTs & CABs) despite force reductions

Objective:

Focus force reduction on OF sustainment and GF structure by changing process, technology, and increasing efficiencies

Assumptions and Facts Bearing on the Problem:

- National Commission on Future Army will address the size of operating force and balance between the active, AR, and National Guard
- Active duty (Uniform) FY16 Pres budget personnel 470k and TOA $126.5B will continue to be reduced
- Current mission to Prevent, Shape, And Win the fight of major wars remains
- Military operations continues to exert pressure for operating forces
- For those areas in which we are proposing reductions, we are applying a process flow for determining strength reductions
- Professional judgments were used to derive parameters that bear on manpower savings

Army Science Board 6

Introduction: Methodology

History and Context

No single, oversight organization managed or monitored organizational redesigns

1970's	1980's	1990's	2000's
• Oversight authority • Non-standardized process • Congress scrutinizes process	• Oversight & enforcement authority • Standardized process	• Standardized process dismantled • Sec Army declares material weakness • New process, authority & tools	• Enforcement authority dismantled

An appropriate determination of force structure requires:

- Standardization of correct metrics across the Army
- Integration of processes & tools to link missions, workload, workforce, & cost
- Enforcement authority at the Department level

Target: 20,000-troop force reduction from FY 16-17; save BCTs

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Rebalancing Concepts

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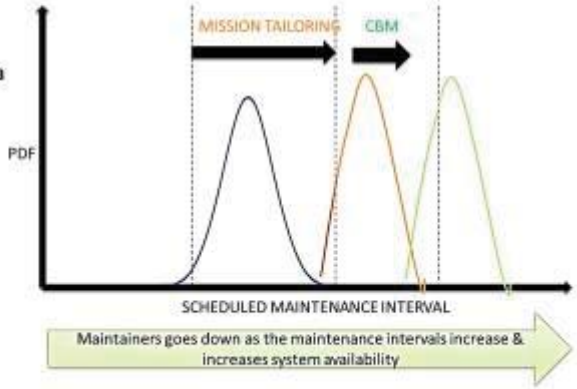
Data Analytics: Maintenance

- Traditionally, maintenance/replacement schedules were specified in terms of hours and/or cycles without regard to actual operational environment.
- Commercial best practices now allow for maintenance/replacement based on operating environment and conditions of components/systems.
  - Mission Tailoring examples include Boeing and ARSOAC, which analyze operational data to increase maintenance intervals and pre-emptive maintenance
  - Condition-based maintenance (CBM) is increasingly being used to optimize maintenance events based on the actual condition of specific components/systems



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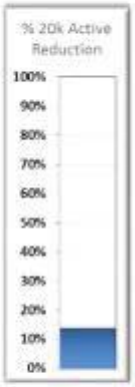
Data Analytics: Maintenance

Required Annual FTE Maintainer	Assume % of time spent on Maintenance	Equiv. FTE	Est. Total ABCT Mech.	% Utilization of ABCT Mech.	Est. Total BCT Mech.	Proposed Reduction due Workload	Total Potential OF Reduction	Ave Potential Equiv BCT Saving
65	60%	108	243	45%	10,066	28%	2,789	0.62



Required FTE Calculation Accounts for:

- Qty and type of vehicles
- Designed maintenance specs (ABCT)
- Combat operating hrs (worst case)
- Assume 2000/person year

Assumes:

- All soldiers have other Soldier duties
- Maintainers have the required skills and experience

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Data Analytics: Recommendations

R1: PEO EIS create Army-wide analytics capability for maintenance and use it to re-structure logistics and synchronize stocks

- Develop maintenance data analytics competence
- Leverage ARSOAC tool for other Army aviation and ground units
- Incorporate best practices in statistical analyses of mission performance to optimize scheduled maintenance intervals

R2: ASA (ALT) accelerate condition-based maintenance (CBM); implement CBM in all Milestone C documents and Engineering Change Packages

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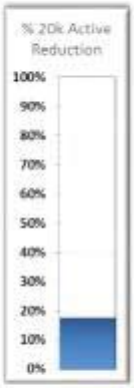
Leverage Industry S&T

- ASB assessed 2013 resources expended by the Army laboratory system and established criteria to determine where the Army should focus S&T efforts
- ASB found 5.4% of the Army's S&T resources were being expended in areas that other organizations were pursuing with more resources and better expertise (e.g. autonomy and power generation/conservation)
- The study team estimated approximately 788 personnel were working in areas where the Army should monitor and leverage, but not support with Army funds
- RDECOM's current civilian and military manpower is 13,700. Assuming the same rates of Army S&T effort as reported in 2013, potential savings in civilian and military GF may be realized by leveraging commercial development in non-core research



RDECOM Civ/ Mil Pers 2015	S&T Leverage %	Civ/Mil GF Reduction	Equiv BCT Saving
13,700	5%	740	0.16

RECOMMENDATION

R3: ASA(ALT), ASA(M&RA), DCS G1 ensure reductions in RDECOM align with research in Army Core competencies, such as the strategy in the 2013 ASB study.

Sources: ASB FY 2013 Army Essential Core Competencies Final Report Jan 2014; RDECOM Workforce Factsheet (2014)

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Joint Re-Supply

- Resupply of combat units is through surface and air transportation involving air, trucks, drivers, and security. Due to the volume required to support the forces, the majority is delivered by surface (145k TEU)
- There are alternative means of resupplying combat units that require less time, cost, personnel and risk
- Under DODI 5158.06 and 5158.04 USTRANSCOM has the mission to improve the distribution and deployment process for the COCOMs and Services.
- TRANSCOM supports the COCOM concept of operation and advises optimal means of execution
- Unlike other Services, the Army has not assigned movement assets to TRANSCOM, therefore TRANSCOM does not have mission tasking authority over Army surface movements assets

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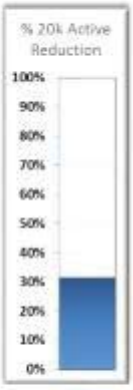
Joint Re-Supply

- USAF employs Joint Precision Air Drop System (JPADS) to enable accurate delivery of cargo
- The JPADS delivery planning tool has enabled the accurate delivery of 15 million pounds of fuel, food, and water in Iraq and Afghanistan (2,000 drops ≈ 6,000 convoy trucks)
- USAF employed 2K and 10K parafoils to make over 350 drops w/in 50m of FOBs in Afghanistan; 4K parafoil in operational testing



Joint Personnel in all Line Haul	Target Reduction %	Total Potential Reduction	Ave Potential Equiv BCT Saving
9,240	30%	2,772	0.61

Alternate delivery means reductions in linehaul functions and corresponding convoy support requirements can be achieved through

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Joint Re-Supply: Recommendation

R4: Embrace DODI 5158.06 and 5158.04 and assign HQDA LNO to TRANSCOM to coordinate Army equities, emphasizing the needs to (1) prioritize air drops of supplies directly to tactical locations, (e.g. utilize JPADS to the DODI), and (2) assign to TRANSCOM surface movements units in Elements above Brigade (-30% target reduction)

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Outsourcing OF

- UK is currently outsourcing many functions – maintenance and supply chain activities (warehouse /consumables management)
- UK has had a long term support agreement for multiple aircraft in execution for over 20 years renewable every 5 years that has allowed an efficient shift from government operated to contractor provided support (Boeing team)
- UK MOD moves government staff to industry team with 5 years to right size with the objective of overall major cost savings
- DoD outsources strategic fuel (DLA)

Application to the Army: outsource supporting functions to free up force structure

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Outsourcing OF: Analysis (CAB (M))

CSS Structure in CAB (M)

SKILL_GP	CAB (M)	
CA	1,459	55%
CS	200	7%
CSS	871	33%
MISC	19	1%
SP BR	108	4%
FUNC AREA	18	1%
Grand Total	**2,675**	

Of the 332 Ordnance /Maintenance only 257 soldiers have Maintenance MOS skills (77%)

SKILL	HQ	AHB	GSAB	ARB	ARS	ASB	UAS CO	Grand Total
Quartermaster	9	65	83	61	61	143	16	438
Ordnance/Maintenance	1	28	48	49	52	138	16	332
Adjutant General	13	7	7	7	7	9	2	52
Transportation	2	6	6	4	5	12		35
Logistics	1	1	1	1	1	9		14
Grand Total	**26**	**107**	**145**	**122**	**126**	**311**	**34**	**871**

Outsourcing maintenance produces efficiencies and reduces Active personnel.

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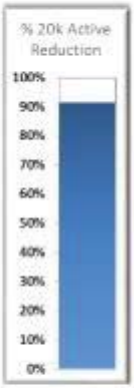
Outsourcing OF: Analysis (BCT & Echelons above BDE)

SKILL	Maintenance

Sum of STRENGTH	FORCE_TYPE		
PARENT_TYP	**Operating**	**Generating**	**Grand Total**
BCT	14,616		14,616
CAB	3,559		3,559
ENABLERS	14,631		14,631
TDA		5,902	5,902
TDA AUG		132	132
Grand Total	**32,806**	**6,034**	**38,840**



LOCATION	Total Strength	Low End Reduction (%)	High End Reduction (%)	Low End Total Active CSS Savings	Higher End Total Active CSS Savings	Ave Potential Equiv BCT Saving
Ord/Maint - CAB	3,559	40%	70%	1,424	2,491	0.87
Ord/Maint - BCT	11,827	40%	70%	4,731	8,279	2.88
Ord/Maint - Echelon above BDE	14,631	40%	70%	5,852	10,242	3.57

BCT Strength takes into account efficiencies from 1st concept implemented (14,616-2,789)
Low end numbers derived for reductions used in estimated goal

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Outsourcing OF: Analysis

160th CAB experience with Military Labor vs Contract Production

ARSOAC	Flight hour / person	Strength	Flight Hours
Active Duty	56	250	14,000
Contractor	130	150	19,500
2.32X performance using CTR			

Active Duty Strength	Assume % of time spent on Maintenance	Equiv. FTE	Efficenciency of Contractor based on Active Duty FTE	Equiv. CONT to replace Active Duty
250	60%	150	1.4	108

Contractors don't have other jobs

	Annual Cost (K) per G8	FTE	Cost	Cost savings (K)
Active Duty	100	150	$15,000	
Contractor	103	108	$11,124	$3,876

Outsourcing is not necessarily 1:1, Active to Contractor

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Outsourcing OF: Recommendation

R5: Contract out maintenance functions in CAB, BCT, and echelons above Brigade, maintaining only the necessary structure in the Army Reserve and Army Guard Components to transition from peace to war and mitigate risk

- Align Guard & Reserve capacity for surge/deployment for risk mitigation
- Determine OF CSS candidate functions with the least risk of mission impact, e.g. maintenance, supply chain, and life support
- Verify workforce, workload, the numbers and execute
- Create the correct contracting construct and contracting oversight to reinforce that this is a warfighter enabler

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Introduction

Rebalancing Concepts

1. Data Analytics Identifies Maintenance Efficiencies
2. Leverage Industry S&T
3. Utilize Joint Re-Supply
4. Outsource OF CSS & Sustainment Functions
5. Outsource GF Base Support

Conclusion

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Outsourcing GF

- Amazon demonstrated more efficient warehousing and an ability to stand up temporary locations
- McLane Systems (developed Walmart Grocery) advocates outsourcing as the only way to break paradigms and realize efficiencies from innovative companies
- TRANSCOM is the process of right sizing DoD distribution functions up to the COCOM boundary
- Delta's re-organization made each employee align to producing flying revenue miles

Application to the Army: outsource supporting functions to free up force structure

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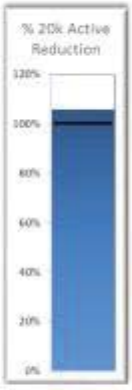
Outsourcing GF: Analysis

MOS Maintenance Example

Sum of STRENGTH SKILL_TTL	FORCE_TYPE Generating
913A - Armament Systems Maintenance Warrant Officer	19
914A - Allied Trades Warrant Officer	13
915A - Automotive Maintenance Warrant Officer	102
915E - Senior Automotive Maintenance Warrant Officer/Senior Ordnance Logistics	152
919A - Engineer Equipment Maintenance Warrant Officer	22
91A - M1 Abrams Tank System Maintainer	232
91A - Maintenance and Munitions Materiel Officer	514
91B - Wheeled Vehicle Repairer	2071
91C - Utilities Equipment Repairer	321
91D - Power Generation Equipment Repairer	284
91E - Allied Trades Specialist	182
91F - Small Arms/Artillery Repairer	250
91G - Fire Control Repairer	50
91H - Tracked Vehicle Repairer	196
91J - Quartermaster and Chemical Equipment Repairer	110
91L - Construction Equipment Repairer	143
91M - BRADLEY Fighting Vehicle System Maintainer	219
91P - Artillery Mechanic	52
91S - STRYKER Systems Maintainer	138
91X - Maintenance Supervisor	491
91Z - Senior Maintenance Supervisor	168
Grand Total	5728



Total Ord/Maint for GF	Target Reduction %	Total Potential Reduction	Ave Potential Equiv BCT Saving
5,728	50%	2,864	0.6

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Outsourcing GF: Recommendations

R6: Contract out installation support functions where the Army will (1) realize increased efficiency in support operations, and (2) experience little or no risk during transition to war

- Prototype the outsourcing concept
- Select a geographic region (TXLA) with adequate operating forces to prove out concept.
  - Establish as a FORSCOM activity
  - Have an installation on line by start of FY17
- Determine GF candidate functions with highest payoff and reduced cost with the least risk of mission impact, e.g. maintenance, supply, transportation, and information management
- Create the correct contracting construct and contracting oversight to reinforce that this is a warfighter enabler
  - Build in a ROI that guarantees performance with punitive options that both government and industry agree to
  - Use UK approach on contracting for long term (5 -10 years)
  - Use Amazon as model for managing supply chain
  - Use MRO approach to maintenance

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Conclusion

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Conclusion: Senior Leader Business

Concept Savings: 21,172 Total Active Component / ~ 4.7 Brigades

R7: Sec Army/CSA validate the data and analyses of this study and investigate the long term effects associated with outsourcing maintenance and establish the mandate to achieve greater than the 2011 OF/GF ratio (48:52), the best balance observed in the data

R8: G3 apply the methodology to all components (Active, ANG, Army Reserve and Civilian force structure)

We have identified potential manpower reductions that will enable the Army to meet budgetary cuts without taking it from combat units

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BACKUP SLIDES

Summary Findings & Recommendations (1-3)

F1a: Traditionally, maintenance/replacement schedules were specified in terms of hours and/or cycles without regard to actual operational environment.

F1b: Commercial best practices now allow for maintenance/replacement based on operating environment and conditions of components/systems.

R1: PEO EIS create Army-wide analytics capability for maintenance and use it to re-structure logistics and synchronize stocks

F2: Potential for reduction in required number of maintenance personnel

R2: ASA (ALT) accelerate condition-based maintenance (CBM); implement CBM in all Milestone C documents and Engineering Change Packages

F3: RDECOM's current civilian and military manpower is 13,700. Assuming the same rates of Army S&T effort as reported in 2013, potential savings in civilian and military GF may be realized by leveraging commercial development in non-core research

R3: ASA(ALT), ASA(M&RA), DCS G1 ensure reductions in RDECOM align with research in Army Core competencies, such as the strategy in the 2013 ASB study

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Summary Findings & Recommendations (4-6)

F4: Reductions in the linehaul functions and corresponding air and ground security force requirements can be achieved through alternate delivery means

R4: DCS G3 Embrace DODI 5158.06 and 5158.04 and assign HQDA LNO to TRANSCOM to coordinate Army equities, emphasizing the needs to (1) prioritize air drops of supplies directly to tactical locations, (e.g. utilize JPADS to the DODI), and (2) assign to TRANSCOM surface movements units in Elements above Brigade (-30% target reduction)

F5: Outsourcing maintenance produces efficiencies and reduces Active personnel.

R5: DCS G3/G4 Contract out maintenance functions in CAB, BCT, and echelons above Brigade, maintaining only the necessary structure in the Army Reserve and Army Guard Components to transition from peace to war and mitigate risk

F6: The Army may free up force structure by applying commercial outsourcing techniques to supporting functions

R6: DCS G4 Contract out installation support functions where the Army will (1) realize increased efficiency in support operations, and (2) experience little or no risk during transition to war

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Summary Findings & Recommendations (7-8)

F7: Army does not have a demonstrated comprehensive approach to manage the relation between strategic goals, mission, workload, workforce, and cost

R7: Sec Army/CSA validate the data and analyses of this study and investigate the long term effects associated with outsourcing maintenance and establish the mandate to achieve greater than the 2011 OF/GF ratio (48:52), the best balance observed in the data

F8: Many organizations (DoD, Industry, other military) currently outsource multiple functions

R8: DCS G3 apply the methodology may be applied all components (Active, ANG, Army Reserve and Civilian force structure)

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