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Industry Study

Final Report
Land Combat Systems

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LAND COMBAT SYSTEMS 2013

ABSTRACT: The United States remains the top producer and user of leading edge technology of Land Combat Systems. The U.S. Government, in conjunction with private industry, is significantly involved in the development, production and sustainment of all U.S. military vehicles. Due to decreased demand by the Department of Defense for combat and tactical wheeled vehicles, and a marked reduction in defense procurement spending, the Land Combat Systems industry is in decline and faced with excess production capacity. A decade of increased defense expenditures resulted in an expanded and recapitalized land combat systems fleet. The Department of Defense is now facing a military drawdown leading to reduced ground forces. Future defense acquisition programs must focus on affordability. Accordingly, the Department of Defense must develop a strategy to effectively manage current industry conditions, while establishing new, favorable conditions towards achieving its interests of maintaining a viable defense industrial base, maintaining the primacy of U.S. weapons systems, and optimizing economic efficiencies within its acquisition programs.

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LOCATIONS VISITED

Domestic:
Aberdeen Test Center (Aberdeen Proving Grounds, MD)
Allison Transmission (Indianapolis, IN)
AM General (Mishawaka, IN)
Anniston Army Depot (Anniston, AL)
BAE Systems Land and Armaments Headquarters (Arlington, VA)
BAE Systems Land and Armaments, York Operations (York, PA)
General Dynamics Land Systems Headquarters (Sterling Heights, MI)
General Dynamics Land Systems, Anniston Operations (Anniston, AL)
Joint Systems Manufacturing Center – Lima Tank Plant (Lima, OH)
Lockheed Martin Aeronautics (Fort Worth, TX)
Lockheed Martin Missiles and Fire Control (Grand Prairie, TX)
Oshkosh Corporation (Oshkosh, WI)
Textron Marine and Land Systems (Slidell, LA)
Tognum/MTU (Detroit, MI)
U.S. Army Program Executive Officer, Ground Combat Systems (Warren, MI)
USMC Program Manager, Advanced Amphibious Assault (Stafford, VA)
USMC Joint Light Tactical Vehicle Program Office (Stafford, VA)
USMC Mine Resistant Ambush Protected Program Office (Stafford, VA)

International:
None

INTRODUCTION

The Land Combat Systems (LCS) industry is in transition. This report examines the industry's current state, challenges, and ability to respond to the United States' future LCS requirements. Building upon the 2012 LCS Industry Study Report, this analysis uses the Ascher-Overholt strategy development model to determine the objectives needed to support the Department of Defense's (DoD) interests considering the current and potential conditions of the industry (See Appendix A). Overall, the industry is an oligopoly comprised of firms that develop and produce military vehicles purchased by the U.S. Government (USG) in support of defense requirements. These vehicles fall into the categories of combat vehicles (CV), tactical wheeled vehicles (TWV), and protected vehicles (PV).[1] The industry competitors are commercial firms, defense firms, Government-Owned Commercial-Operated (GOCO) facilities, and Government-Owned, Government-Operated (GOGO) facilities that develop, produce, and supply a broad spectrum of vehicles for defense roles and missions.[2] The industry is in a downturn due to reductions in DoD funding and an associated revision of the U.S. military force structure. Accordingly, as vehicle purchases decrease, unit costs increase.

Compromises and conflicting interests within the USG greatly influence decisions made within the LCS industry. Although industry leaders, Congress, DoD, and the individual services share interests in delivering capable, reliable equipment to the warfighter, they also have other prioritized interests. Industry leaders must earn sufficient profits to justify participation in the market to their shareholders, while Congressional leaders must protect the interests of their constituents simultaneously with their own concerns for the national interests. DoD must prioritize the competing demands of the services, while the individual services must make hard choices between programs to ensure they not only acquire needed equipment, but also receive the best value possible.

Competitors within the LCS industry must adapt to decreased DoD demand to remain solvent. The industry faces the challenge of retaining both key manufacturing skills and production capabilities. Foreign Military Sales (FMS) and sustainment of currently fielded platforms continue to serve as a major driver for key firms in this industry, but are insufficient to sustain the industry in its current form. DoD must monitor the industry and its suppliers in the coming years to ensure the industry can respond to national security needs.

Despite declining resources, DoD has numerous new platforms in early acquisition phases. U.S. Army and Joint programs include the Ground Combat Vehicle (GCV) to replace the M2/M3 Bradley, the Armored Multi-Purpose Vehicle (AMPV) to replace the M113 Armored Personnel Carrier (APC), and the Joint Light Tactical Vehicle (JLTV) to replace the High Mobility Multipurpose Wheeled Vehicle (HMMWV) fleet. U.S. Marine Corps programs include upgrading its Assault Amphibious Vehicle (AAV) to bridge the forced entry capabilities gap until fielding a new Amphibious Combat Vehicle (ACV) and complementary Marine Personnel Carrier (MPC). These programs compete for limited research and development (R&D) funding, and are collectively unaffordable given the likely trend of reduced defense spending.

Because of this decreased demand, DoD must determine which market sectors within the LCS industrial base require preservation or workload distribution, while shaping the market to achieve its strategic interests rather than responding to budget constraints or political influence. Overall, DoD must make informed decisions to maximize its limited resources, recognizing that these decisions will determine whether the LCS industry remains capable of producing the ground vehicles needed to meet U.S. national security requirements.

INTERESTS

Maintaining a healthy LCS industry requires the DoD to manage a range of shared and competing interests. In the context of Land Combat Systems, the DoD has three essential interests. First, the DoD must maintain a Defense Industrial Base (DIB) capable of supporting both the National Security Strategy (NSS) and National Military Strategy (NMS). Second, the DoD must ensure primacy of its defense systems and capabilities. Finally, the DoD must optimize economic efficiency within the DIB.

Surge capacity, readiness, and modernization drive the DIB's capability to support both the NSS and NMS. Accordingly, the United States must ensure the DIB can support emergency requirements to increase production and throughput in times of crisis. Doing so involves the readiness of the major defense corporations and their suppliers to meet surge demand requirements. Leveraging innovation and technological advances are essential to the modernization of production capabilities, for both the products and the manufacturing bases that produce them. Ensuring primacy of U.S. defense systems means harnessing cutting edge research and technology to deliver vehicles with overmatch capabilities needed to defeat any potential aggressor. These capabilities provide both operational and tactical comparative advantages, as well as a competitive edge in overseas markets by promoting sales to U.S. Allies and partners. This enhances interoperability with multinational partners, supports U.S. industry, and reduces platform unit costs for all stakeholders. Recognizing that defense spending is finite and competes with other priorities, economic efficiency within the DIB is essential to meeting DoD needs while preserving the trust and confidence of U.S. citizens that their tax dollars are being spent wisely, and that the warfighter can accomplish his/her mission with quality equipment.

All U.S. participants in the LCS market share these three interests in some measure. However, the Executive branch, Congress, and the private sector interpret and prioritize these interests in different and potentially conflicting ways.

Executive Branch. The Executive branch is the primary proponent for LCS policy and includes the President, senior administration officials, and senior civilians and uniformed military leaders within DoD. The NSS, NMS, and associated DoD policies define Executive Branch policies. These documents highlight the branch interpretations of U.S. interests. Notably, executive policy documents promote a minimalist approach to the DIB, and prioritize economy efficiency over primacy, provided the range of U.S. capabilities still meet defense requirements. The U.S. 2010 NSS, as part of the U.S. strategic approach under the subject of defense, states, " we are strengthening our military to ensure that it can prevail in today's wars…We will continue to rebalance our military capabilities…while ensuring our force is ready to address the full range of military operations."[3]

The call for rebalancing highlights a shift in priority from wartime to peacetime posture, while preserving readiness for a full range of military operations. Further, the NSS promotes development of deterrent strategies and a range of necessary capabilities, implying a more austere resourcing strategy, particularly regarding ground platforms. Specifically, it states that "this means credibly underwriting U.S. defense commitments with tailored approaches to deterrence and ensuring the U.S. military continues to have the necessary capabilities across all domains—land, air, sea, space, and cyber."[4]

The NSS addresses strongly the need for economic efficiencies stating, "cost-effective and efficient processes are particularly important for the Department of Defense, which accounts for

approximately 70 percent of all Federal procurement spending. We will scrutinize our programs and terminate or restructure those that are outdated, duplicative, ineffective, or wasteful."[5] This exemplifies the goal of the U.S. military to be capable across the full spectrum of operations while being equipped in the most efficient, effective means possible. Similarly, the 2012 U.S. Defense Strategic Guidance, signed by both President Obama and former Secretary of Defense Leon Panetta, promotes acquisition decisions that accept a degree of risk in prioritizing cost over capability given an era of austerity and constrained resources:

> …we have sought to differentiate between those investments that should be made today and those that can be deferred. This includes an accounting of our ability to make a course change that could be driven by many factors…Accordingly, the concept of "reversibility" – including the vectors on which we place our industrial base…is a key part of our decision calculus.[6]

The Defense Strategic Guidance attempts to manage the risk by promoting reversibility of these decisions, noting that: "In adjusting our strategy and attendant force size, the Department will make every effort to maintain an adequate industrial base and our investment in science and technology."[7] These statements reflect the challenges the DoD faces in prioritizing resources to balance security requirements with investments in technology and innovation.

Services. The two military services with the most vested interests in the LCS DIB are the U.S. Army and U.S. Marine Corps. From the Army's perspective, the completion of two major conflicts affects prioritization of LCS DIB interests. The associated force structure and budget reductions result in economic efficiency being the Army's top interest for the LCS DIB.

> [U.S. Army Chief of Staff, General Raymond] Odierno, who has said that the Army does not need to spend any additional money on tanks or Bradleys, said the service already had 3,100 excess tank hulls and could afford to spend less in such areas. The general also mentioned the upcoming force structure cuts, which will take the Army from 560,000 active-duty soldiers to 490,000 or lower if the automatic cuts triggered by sequestration are allowed to remain in place.[8]

The next priority for the Army is to maintain primacy of defense systems. The M1 Abrams and Bradley fleets are combat proven and retain overmatch capability against known threats. The Army's final priority is maintaining an LCS DIB capable of supporting the current combat and tactical wheeled vehicle modernization efforts.

The USMC priority interest for the LCS DIB is maintaining primacy of defense systems as reflected in their investment priorities for amphibious combat operations. Optimizing economic efficiencies is the next priority, per the USMC 2011 Ground Combat Tactical Vehicle Strategy (GCTVS) objective to field an affordable and balanced ground combat and tactical vehicle portfolio.[9] Finally, the USMC is also dependent on the LCS DIB to support planned modernization initiatives as reflected in the GCTVS.

Congress. While Congress expresses support for the LCS DIB key interests, the economic conditions within their states and districts significantly influence decision-making. They struggle to balance the competing interests of maintaining a LCS DIB that supports the NSS and NMS,

while preserving jobs and stimulating local economies. "A government vehicle facility managed by General Dynamics Land Systems (GDLS) in Lima, OH, and a BAE Systems Land and Armaments (BAE) facility in York, PA, have become issues for House and Senate lawmakers worried about potential job losses should the Army redirect spending to other priorities."[10] These competing interests affect the resourcing and modernization processes for the DoD and each of the Services, exacerbating the known issues with the acquisition process and prioritization of modernization initiatives.

Industry. Through the course of this LCS industry study, all of the visited companies defined their role within the LCS DIB. In each of their vision and mission statements they clearly identified maximizing shareholder value as their top priority. Supporting the three LCS DIB interests, which in turn supports the NSS and NMS, effectively maximizes shareholder value. They ensure their LCS capabilities maintain primacy for the U.S. and its allies, while striving to optimize economic efficiencies that maximize profit margins.

CORE ENVIRONMENT

Enduring U.S. philosophies on the appropriate relationship between government and private industry shapes the current environment for defense resourcing. This core environment is generally constant, and defines the nature of LCS industry and market. As such, it informs U.S. strategic options for defense acquisition. The LCS market is highly concentrated as shown through an analysis of 2000-2012 government contract data.[11] It consists of relatively few firms that provide CVs, TWVs, and PVs. The size of the U.S. defense budget relative to the rest of the world, coupled with laws and regulations for exportation of military goods and technology, makes the DoD a monopsony buyer of domestic defense products, and provides the DoD strong buyer power when programs are competitive. Commercial/foreign buyers weaken DoD's buying power by increasing the number of customers for competitors to market their product to within the industry. Threats of substitutes include unmanned vehicles and contracted commercial transportation services.

CVs are military unique and built specifically for a defense function. Examples are the M1 series of main battle tanks, self-propelled artillery vehicles, and the Multiple Launch Rocket System (MLRS). TWVs are light, medium, and heavy-duty trucks designed to support military functions, specifically combat support and combat service support. They are primarily modified commercial vehicles. Examples are the Medium Tactical Vehicle Replacement (MTVR), the Heavy Equipment Transport (HET), the Family of Medium Tactical Vehicles (FMTV), and the HMMWV. PVs emerged in response to the need to protect personnel engaged in counterinsurgency operations. As these vehicles are similar to TWVs but used in combat mission roles, they are hybrid platforms. The primary example of a PV is the Mine Resistant Ambush Protected vehicle (MRAP).[12]

The CV market is oligopolistic with the USG a monopsony consumer. Over the past five years, market revenue was $8.2 billion with an annual decline of 4.8%. The five-year outlook reflects a continued decline of 3.5%.[13] The Herfindahl-Hirschman Index (HHI) for this market is 0.47, reflecting a balance between GDLS and BAE as the main competitors.[14] Key economic drivers are defense spending, price of steel, and the price of plastic/resin materials[15].

The TWV market shares many features with, and relates directly to, the commercial truck market. It is relatively competitive overall, but oligopolistic for military vehicles. For the

commercial market, there are a wide number of buyers such as local governments, cargo shipping firms, and construction companies. Over the past five years, the market's revenue was $23.9 billion with an annual growth of 2.6%. The five-year outlook for the commercial truck market reflects a continued growth of 1.4%.[16] For the military vehicles specifically, the USG is a monopsony buyer. The HHI index for this portion of the market is 0.16 reflecting a balance between firms competing for defense contracts.[17] Key economic drivers within this market are commercial and military demands for truck transportation and the average age of the respective vehicle fleets.[18] Appendix B reflects the relationship between the CV and TWV markets.

Competitors. Four categories of competitors exist within the LCS industry. They are commercial firms, defense firms, Government-Owned Commercially-Operated (GOCO) facilities, and Government-Owned Government-Operated (GOGO) facilities. The analysis of competitors results from using Porter's Five Forces Analysis[19], examining common business strategies, and identifying relevant acquisition programs within each category.

1. Commercial Firms. Commercial firms primarily compete in private sector markets, providing modified commercial-based products for military use. Two prime companies within this category are Oshkosh[20] and Navistar[21]. Several other companies provide subsystems, such as Allison Transmissions,[22] Cummins,[23] Caterpillar,[24] and Tognum/MTU.[25] Although commercial firms are diversified across multiple markets, they compete narrowly within the broader defense market. Differentiated products often result in partnerships and joint ventures, offsetting the strong competition for new programs. Stranded capital slows, but does not prevent, exit from the market. There are minimal entry barriers resulting from product design and capital requirements. Switching costs are high. Supplier power is weak for common commercial truck parts. Sole source suppliers have greater power, which commercial firms overcome through maintaining beneficial partnerships.

The majority of commercial firms are healthy, with Oshkosh the strongest and Navistar the weakest. Business strategies focus primarily on domestic and international commercial markets. They mitigate short-term losses within the defense sector through the gains in other sectors, allowing them to remain in a market vice exiting. These firms augment U.S. sales by pursuing entry into international markets such as Asia and South America[26]. Additionally, many of these firms focus on providing Commercial-off-the-Shelf (COTS) subsystems to defense firms vice competing as a prime contractor. Regarding current contract competition, Oshkosh is competing for the JLTV, and for the continuation of life cycle support for the FMTV. Navistar was eliminated from the JLTV competition, and is focusing on developing the Ground Mobility Vehicle (GMV) for the U.S. Special Operations Command (USSOCOM). Allison Transmission is the sole provider of transmissions for all JLTV competitors, and expects to be the sole provider for both the GCV and the ACV. Cummins and Caterpillar are expected to compete to be the engine provider for MPC and the AMPV, while Tognum/MTU is the sole provider of the engines for all GCV and ACV bids.

2. Defense Firms. Defense firms are businesses that develop military unique products, and have limited presence in commercial markets. Their business models focus almost exclusively on U.S. and foreign defense sales, and their corporate structures allow for adaptation to U.S. acquisition regulations and to leverage the political nature of U.S. defense budgeting. The prime companies within this category are GDLS[27], BAE[28], Textron Marine & Land Systems[29], Lockheed Martin

Missiles and Fire Control[30], and AM General.[31] Defense firms have less flexibility than commercial firms to enter and exit the market, but can use extensive political influence to access federal funds to support their businesses. This category has mixed competitive rivalry, with competition primarily between BAE and GDLS, and product differentiation leading to partnerships with other firms. Ownership of technical data packages (TDP) by these firms presents a high barrier to competition for life cycle support of existing platforms. The threat of new entrants for CVs is high due to Research and Development (R&D) costs, manufacturing capital, and congressional support of existing factories; the threat for TWVs and PV is medium. Similar to the commercial firms, supplier power is weak for common, commercial parts yet high for sole source or military unique items. DoD is a monopsony buyer with significant power during competitive prototype development, but weakens if a contract results in sole source product development, or if the firm retains the TDP. The Weapons Systems Acquisition Reform Act Organizational Conflicts of Interest (WSARA OCI) requirements and reforms to compete sub-work enhance the DoD's power. Threats of substitutes include unmanned ground vehicles and air alternatives.

Due to reduced demand for military unique products, defense firms are facing difficulty. Accordingly, their business strategies focus on offsetting reduced DoD demand with international sales through FMS, Foreign Military Funding (FMF), and Direct Commercial Sales (DCS) programs. In an effort to protect their capital investments and production capacity, the major firms within this sector leverage Congressional support and political influence to subsidize production in excess of DoD requirements. Additionally, they seek partnerships with firms who win defense contracts in order to maintain revenue. Currently, GDLS is competing for GCV, ACV, AMPV, and MPC while continuing Stryker recapitalization/double-V hull modification and M1 Abrams life cycle maintenance. BAE is competing for the same programs while continuing the Paladin Integrated Management (PIM), Amphibious Assault Vehicle Upgrades (AAV-U), M88A2 Hercules life cycle maintenance, and Bradley Engineering Change Proposal (ECP) implementation. Textron is not competing for any U.S. LCS programs, and is focusing solely on U.S. maritime and international opportunities. Finally, Lockheed Martin is competing for the JLTV and MPC while AM General focuses on JLTV and HMMWV life cycle support.

3. GOCO facilities. There is one GOCO facility and one GOCO-like facility within the LCS industry. GDLS operates the GOCO called the Joint Services Manufacturing Center (JSMC) in Lima, Ohio that provides heavy fabrication such as tank manufacturing[32]. Allison Transmission operates the GOCO-like facility called Plant 14 in Indianapolis, Indiana that provides transmissions for tracked vehicles[33]. The difference between the two facilities is that JSMC is entirely government-owned, while the majority of the equipment in Plant 14 is government-owned, but not the facility itself. These facilities have low competitive rivalry for existing programs, and moderate competition with other commercial and defense firms for new programs. Threat of new entrants is low due to the high capital costs of facilities and tooling and limited expectation of future sales. Supplier power is mixed. It is weak for common parts and high for unique parts due to TDP ownership and high switching costs. Buyer power is low as DoD depends upon the GOCO operators' knowledge and experience to operate these facilities successfully. FMS customers further weaken DoD's buyer power. Threat of substitutes is low, occurring only from changes in global demand or creative destruction.

The GOCO facilities within the LCS industry are not operating efficiently. As competition is limited for these facilities, their business strategies do not consider other firms. Instead, they base their plans upon their unique status via government ownership. Accordingly, they regularly

seek DoD funding and foreign defense sales to remain operational. GDLS in particular has successfully lobbied Congress for such support. Currently, JSMC maintains the M1 Abrams recapitalization program and an Israeli contract for the Namer personnel carrier. Additionally, JSMC seeks future contracts for Stryker refurbishment and "double-V" hull integration.[34] Plant 14 continues refurbishment of the X1100 cross-drive transmission for the M1 Abrams, seeks to produce the transmission for GCV, and is examining expanded production of the X200 transmission for direct commercial sale.[35]

4. GOGO facilities. GOGOs are limited in number and do not work for profit. The U.S. Army maintains two major GOGOs, Anniston Army Depot (ANAD) in Anniston, Alabama and Red River Army Depot in Texarkana, Texas.[36] The U.S. Marine Corps maintains GOGOs with its depots in Albany, Georgia and Barstow, California.[37] Competitive rivalry is low as legal statutes and DoD policy mandates work sharing with GOGOs, but competition exists where permitted. This competition centers on pricing, scheduling, and past performance. Additionally, GOGOs compete against each other for DoD budget support. The threat of new entrants is low due to legal statutes and congressional interest. Potential entrants mitigate capital investment requirements through public private partnerships. Supplier power is mixed with Defense Logistics Agency (DLA) as DoD's mandated supplier of consumable parts. Original Equipment Manufacturers (OEM) and their vendors have limited power for unique parts, and compete with DLA to provide supply chain management for recapitalization contracts. GOGOs mitigate supplier power through parts reclamation. Buyer power is low resulting from political influence and legalities such as the "50/50" work share statute. Threats of substitutes include new production and OEM modernization vice depot level reset.

These facilities do not operate for profit and are protected by legal statute. However, these entities are periodically assessed for efficiency though the Base Realignment and Closure (BRAC) process. Accordingly, their business strategies focus on maintaining a steady flow of work in order to maintain sufficient labor hours to demonstrate their value and prevent their closure. To do this, the GOGO leverage their legal status through the "50/50" statute and Public Private Partnerships (P3) while maintaining strong support from their Congressional representatives. ANAD currently conducts "double-V" hull integration with GDLS for Stryker, refurbishes M1 tanks, and rebuilds military engines and transmissions within the LCS industry. The Red River depot performs work with BAE on M2/M3 Bradley Fighting Vehicles, and on HMMWVs. The U.S. Marine Corps depots refurbish all of the U.S. Marine Corps' vehicles except for the M1A1 Abrams.

Near-Term Outlook. The two essential factors of declining demand and excess production capacity dominate the near-term outlook of the LCS industry over the next five years. The effects of the wars in Iraq and Afghanistan strongly influence the current and future LCS demand by DoD. War-related spending on new production and recapitalization has left the U.S. with a historically new vehicle fleet resulting from recapitalization and refurbishment, but that fleet remains dominated by legacy platforms such as M1 Abrams tanks, M2/M3 Bradley Fighting Vehicles, AAV and HMMWVs, and the family of MRAP vehicles that have uncertain roles in future combat formations. While prioritizing near term combat readiness and immediate operational needs, DoD canceled or deferred the acquisition of new platforms such as the Future Combat System (FCS), Expeditionary Fighting Vehicle (EFV), GCV, and JLTV intended to replace the legacy vehicles from the 1970s and 1980s. Although relatively new in terms of miles and hours since recapitalization, legacy systems are approaching design obsolescence, and have largely reached

the limits of their potential to integrate new technology. Power generation is inadequate for modern accessory equipment suites, and degraded performance occurs resulting from the bolt-on armor needed to mitigate emerging threats. The need for newer designs is clear, but budgetary constraints stemming from the post-war drawdown and the 2008 global economic crisis has resulted in reduced demand. Future modernization spending is threatened by not only austerity measures in the United States and Europe, but also by growth in non-discretionary spending such as Social Security, Medicare, and rapidly expanding defense-related personnel costs including pay, benefits, and escalating healthcare costs for wounded and retired veterans.

Wartime spending for recapitalization, modernization, and MRAP acquisition yielded a significant expansion of production capacity within the DIB, including expanded market share for commercial firms such as Oshkosh and Navistar. This capacity now exceeds demand across all supply categories: defense firms, commercial firms, GOCOs, and GOGO. The combination of a young but technologically dated LCS fleet, budgetary pressure, and overcapacity represent the conditions that will shape the LCS industry environment over the next five years. The clearest effect will be a demand trough, or "bathtub," as recapitalization ends and production for new programs such as JLTV and GCV does not begin until 2017 at the earliest. This four year trough may extend as uncertainty over future force structure requirements forces DoD to further delay acquisition decisions. Both the Army and Marine Corps continue to draw down combat forces, resulting in an associated reevaluation of vehicle requirements in an uncertain security environment, including an increased emphasis on the Asia-Pacific region. DoD will lack the fiscal resources to begin acquisition of all its major program needs within the next three to five years, forcing difficult choices that will shape the core LCS environment toward consolidation of production capacity and fewer competitors in the market.

This will affect competition. Absent major program awards such as JLTV, some commercial firms, or undiversified defense firms such as AM General, may choose to exit the market, spinning-off their defense segments to commercial competitors or established defense firms. Those choosing to remain will continue to rely on FMS, FMF, DCS, and lifecycle support for legacy systems to weather the acquisition trough. Further consolidation of defense firms is unlikely, as the USG will remain committed to preserving competition, and will employ anti-trust measures to prevent mergers that threaten to create near-monopolistic conditions. GOCO and GOGO facilities will face significant pressure to reduce workforces and consolidate, but will retain political influence and statutory protection. GOGO and GOCO closures will be limited, and most resourcing will occur through P3 and mandatory work-share arrangements in conjunction with the minimal sustaining rate funding that defense firms will exploit to weather the acquisition trough.

Long-term Outlook. Existing trends will continue over the next 15 years. External budget pressure and rising internal human capital costs will lead to smaller military forces, particularly in non-mobilization periods. The future military will see fewer platforms fielded, but will enjoy greater lethality, survivability, and integration of vehicles and weapons systems. Technology-intensive systems, purchased in comparatively low volumes, will have high unit costs, and yield an LCS industry featuring a high degree of horizontal integration to exploit comparative advantage of different production capabilities and competitive strategies.

The likely result is that GDLS and BAE will remain the dominant players in the market, serving as the prime contractors due to corporate structures designed to exploit the defense acquisition laws and regulations, advantages in military-specific research and development, and experience with integrating "systems of systems" developed by different divisions within the

major defense firms. Manufacturing trends, however, will promote divestiture of some internal production and assembly capacity by defense firms in favor of joint ventures that leverage commercial, GOCO, and GOGO production facilities. Advanced manufacturing techniques such as 3-D printing and flexible, adaptive assembly lines will reduce capital start-up costs and allow commercial firms fluid access to defense markets in concert with the business cycle and changes in defense expenditures. GOCO facilities will preserve low demand, defense specific production capabilities to augment COTS manufacturing and commercially contracted assembly and integration. GOGOs will continue to provide higher-level maintenance and reserve capacity for battle damage/repair and surge recapitalization during wartime and periods of mobilization.

PREFERRED ENVIRONMENT

Four primary characteristics define the preferred environment of the LCS Industry. These are maximization of private industry production through workload distribution, maintenance of capital and surge capacity necessary to meet requirements, capacity for viable sustainment and refurbishment capability, and sustainment of U.S. technological superiority through continual innovation.

The preferred characteristic of the LCS industry is that it is self-sustaining, requires minimal USG intervention and minimal dedicated federal funding to maintain market health. Similarly, the preferred LCS market would contain multiple OEMs under private ownership, which are completely responsive to any government requirement for new combat vehicles or vehicle refurbishment. Unfortunately, the current LCS market exists along a spectrum of government control. This spectrum contains the three categories of contractor-owned, contractor-operated facilities (COCO), GOCO, and GOGO.

Economically, DoD would prefer the LCS market to operate solely within the COCO category. This would allow multiple firms to provide cutting-edge products at competitive prices. These firms would bid on, win contracts for and deliver new vehicles or provide service in a timely manner at best value. However, the unique nature of LCS industry makes pursuit of the COCO-only environment nearly impossible. The federal government purchases combat vehicles in a "lumpy" or sporadic manner, which has the tendency to drive out competition or precludes new firms from entering the market. The lack of demand prompts either government funding to maintain a firm's participation or outright government ownership of key aspects of production. The nature of the market also forces the government to maintain its own capital equipment and skilled workers at GOGOs to ensure the health of the LCS market and to guarantee the availability of a surge capacity in time of war. The U.S. military must maintain a domestic capacity to allow industry to reset combat vehicles used or damaged in combat. In wartime, this capability must prioritize schedule over cost in order to quickly refurbish and return combat vehicles to the conflict. The uncertain timing of when a surge capacity will be required runs counter to the predictability preferred by private industry. Firms will not maintain skilled workers, supplies and unused capital equipment should it be required for a national emergency. As such, some government ownership of manufacturing capability is required to produce, recapitalize, and maintain the LCS inventory needed during times of conflict.

The fiscal environment expected over the next five years makes increased subsidies likely as demand decreases, forcing firms to depart the LCS market. The predicted fiscal and procurement environment will work directly counter to the preferred LCS market environment. The true danger of the current fiscal environment is the possibility of multiple defense contractors

departing the LCS market. The United States does not want to follow the European model, where most nations possess limited ability to produce new LCS equipment in the short-term in response to a national emergency. The United States must maintain the flexibility to design, build, and field rapid solutions to emerging challenges encountered in combat. The MRAP vehicle production example is a testament to the flexibility of the LCS DIB, and represents a critical capability that must be maintained. The LCS DIB produced 27,740 vehicles in 48 months for $47.7B in direct response to an emerging threat.[38] However, the MRAP was a niche vehicle with significant commonality with commercial vehicles. A MRAP-like production surge of military-specific CVs would be a much more difficult problem, particularly if the CV manufacturing base erodes further.

The preferred environment described above directly supports the interests of a DIB capable of supporting the nation's strategy, it maintains the superiority of U.S. systems, and seeks to maximize economic efficiency. The optimal LCS market is predominantly within private sector and retains the capability to adjust rapidly to DoD demand signals while providing cutting-edge equipment. However, alternate scenarios are possible, shaped in large measure by how LCS competitors react to U.S. strategic choices in the next five years.

ALTERNATE ENVIRONMENT 1 – GLOBALIZATION OF THE DEFENSE INDUSTRY

The first alternative environment reflects a different reality within the defense industry than experienced in recent U.S. history. Since World War II, the United States developed complex defense interdependences with its allies to support the technology development required for advanced weaponry. In 1940, President Roosevelt delivered a message about victory in the Pacific, stating, "We must have more ships, more guns, more planes – more of everything…*We must be the great arsenal of democracy*."[39] From the 1940s through the 1970s, the United States was self sufficient in the acquisition of it major weapons systems. U.S. global defense interaction existed primarily in the form of FMS. In the 21st century, this paradigm dramatically shifted. The Untied States operates in a complex web of global interdependencies. Globalization is defined by the International Monetary Fund as "the growing economic interdependence of countries world-wide through the increasing volume and variety of cross-border transactions in goods and services and of international capital flows, and also through the more rapid and widespread diffusion of technology."[40] The most significant example of this paradigm shift is the F-35 Lightning Joint Strike Fighter program. This 5th generation fighter aircraft is being developed, produced, and financed with foreign content in collaboration with eight partner nations. Similarly, the LCS industry is globalizing with firms like GDLS and BAE operating foreign subsidiaries, and most systems having some degree of foreign content.

The primary international market for LCS technology, and the potential for globalization in this industry, is within the European Union (EU). While the EU competes with the U.S. comparatively based on their gross domestic product, €12 trillion to $11 trillion in currency terms of 2010 Euros, they do not match up comparatively based on defense spending, €194 billion to $520 billion, and defense investment spending €44 billion to $159 billion.[41] This is the primary reason for the mergers and acquisitions that allow access to U.S. defense articles. As demand decreases, as reflected in the current constrained budget environment, there will be less incentive to operate in the United States and to sustain any products already developed. Further, U.S. laws such as International Traffic in Arms Regulations (ITAR) complicate foreign sales of LCS systems and technologies designed in the United States. This creates incentives for multi-national corporations to isolate technology from U.S. control.

Globalization and cross-border mergers are extensive in the defense industry, particularly trans-Atlantic. Companies like BAE and Finmeccanica have merged or procured U.S. defense companies in order to compete in varied defense sectors domestically and internationally. The Defense Security Services (DSS) maintain Special Security Agreements (SSA) with these companies. These SSAs govern the control and compliance of these companies with USG security and export regulations. In 2012, the DSS had 111 special security agreements at 346 facilities.[42] Advocates of this arrangement assert significant advantages. For example, companies can consolidate fixed costs, expand market access, diversify program political risk, rationalize R&D planning, and create enhanced access to innovative technology. Additionally, trans-Atlantic, as opposed to intra-European mergers can offer additional advantages by improving North Atlantic Treaty Organization (NATO) interoperability while shoring up political support.

The primary impact of globalization is the potential for a diffusion of critical technologies leading to a possible loss of technological superiority. ITAR impacts U.S. policies on the sale, export, and retransfer of defense articles and defense services as an integral part of safeguarding national security. However, it does not manage the diffusion of technology from the globalization of defense. As a cost saving measure, DoD policy already encourages companies competing for new U.S. programs to employ Industry Research and Development (IR&D) funds to finance technology development. If industry reaches a degree of globalization where R&D no longer occurs within the United States, DoD could potentially promote technology development unregulated by ITAR and thus not controlled as closely as if developed domestically. Globalization encourages technology diffusion, and even Allied foreign governments have differing views on export controls. Just within the EU, multiple examples of foreign export exist that are counter to U.S. interests. Examples include Thales collaborating with Russian firms, sales of armor vehicles and amphibious warfare ships to Russia, EU policies on sales of dual use technology to China, and the EU debate over lifting the arms embargo to China.[43] Additionally, difficulties could arise with allies who develop critical components for U.S. defense systems, but do not support U.S. foreign policy actions. This ultimately could result in the lack access to a critical system component should a country choose to boycott U.S. defense manufacturing because of these actions.

Other significant concerns over the globalization of the LCS industry are the potential loss of capital investment, the ability to manage a supply chain for a system in a global environment with a thirty to forty year life expectancy, and the capacity to surge in support of wartime needs. Based on recent studies, the United States has a concentrated combat vehicle manufacturing capability. Combining the limited capital resources with limited demand and scarce funding puts this limited capital at significant risk. With the current strategy to sustain land combat systems for 30 years or more, access to the industrial base for the supply chain and access to the manufacturer for modernization is critical. Globalization creates risk in achieving this, as it limits to access to TDP and intellectual property of systems.

One of the key lessons learned from the Iraq and Afghanistan wars was our ability to surge when needed. The Defense Priorities and Allocations System (DPAS) assures DoD can provide the industrial resources to meet current national defense and emergency preparedness program requirements. All prime or sub-contractors in support of an authorized program receive a priority rating. A DX rating provides those programs the highest national priority, and only the Secretary of Defense can override this rating for the fulfillment of non-DoD purchases. This DX rating allows for a defense contractor and sub-contractor to prioritize orders above other domestic or

international orders.[44] This proved vital over the past ten years as reflected in the development and fielding of the MRAP.

An example of this paradigm shift is the Congressional Budget Office's (CBO) recently published *The Army's Ground Combat Vehicle Program and Alternatives, April 2013*. This report provided numerous recommendations for the industry including significant globalization. It recommended cancelling the GCV in favor of procuring the Israeli Namer armored personnel carrier, or purchasing the German-made Puma Infantry Fighting Vehicle. Their report specifically stated, "on the basis of CBO's primary metric, the Puma would be the most capable of the vehicles, and both it and the upgraded Bradley Infantry Fighting Vehicle (IFV) would be significantly more capable than the GCV. In addition, fielding Pumas or upgraded Bradleys would cost $14 billion and $9 billion less, respectively, than the Army's GCV program and would pose less risk of cost overruns and schedule delay.[45] Although this report does not translate into a procurement of these foreign platforms, as the full support of Congress would be unlikely, it does represent a paradigm shift and a potential new way of thinking by our appropriators.

This shift could send significant resources outside the United States causing the diffusion of technology and loss of capital investment. Additionally, this shift could create obstacles in the U.S. defense supply chain that would significantly hamper the capability to sustain LCS platforms. Overall, this environment significantly affects the DoD's ability to achieve its interests of maintaining a DIB capable of supporting the national security strategy and ensuring primacy of defense systems.

ALTERNATE ENVIRONMENT 2 – PARTIAL MARKET FAILURE

The second alternate environment represents a partial failure of the LCS market, with the attendant loss of private sector capacity to produce CVs and the key subsystems associated with tracked vehicles. The FY 12 budget request for DoD Research, Development, Test and Evaluation (RDT&E) and procurement was $113 billion, a slight decrease in RDT&E and slight increase in procurement over the FY 11 Budget.[46] However, the DIB is also very fragile. The USG is the only customer with sufficient financial resources to cover R&D and capital overhead costs for tracked combat vehicles, and if DoD pursues a long-term procurement holiday, competitors will likely elect to leave the market. Reduced DoD acquisition budgets, along with the additional automatic budget cuts due to sequestration, create the conditions for significant cuts in defense acquisition programs, resulting in the large commercial firms departing the LCS segment of the defense market so they can concentrate on the more profitable air, sea, space, and cyber programs. The lack of current and projected volume is the principle factor that is driving commercial designers, producers, and suppliers out of the entire LCS market. In this environment, defense specific firms such as GDLS, BAE, and Lockheed-Martin would close or sell off their LCS production facilities, and their design engineers would move to other programs or enter the civilian markets. Commercial firms such as Oshkosh, Allison, and Navistar focus their design and production efforts on commercial enterprises, and on the residual TWV segments.

In the near term, each of these firms would maintain a small production capability as well as supply-chain activities to complete production of existing United States and foreign military contracts. However, noticeable divestiture efforts and downsizing are planned, publicized, and initiated in LCS production and sustainment. Additionally, the small to medium sized suppliers of both common and specialized parts begin movement to other customers, segments, markets, or curtail operations as requisitions for parts decline and lack of volume prevents long-term

sustainment. What remains in the CV segment are USG owned and operated facilities that will sustain the design, test, and production capabilities of LCS for at least the next 5-10 years.

At risk in this environment are the unique design, test, and production engineering capabilities, as well as the technical and specialized skills of the labor force, that distinguish the highly specialized military equipment sector from the commercial sector. On the production side, the specialized welding and armoring skills are unique to the defense industry, and are perishable if certifications and skills are not maintained. Although the industrial capability could regenerate over time, the loss of standing capacity would leave a significant production gap in the event of crisis, and significantly increase startup costs and unit costs if DoD seeks to acquire a replacement CV in the future.

Absent a commercial base, DoD would rely on GOGOs for reset and recapitalization of existing platforms, using P3 with residual OEMs for managing legacy supply chains and technical data packages similar to the partnership between ANAD and Honeywell to maintain and build AGT1500 tank engines. The DoD could retain a limited R&D capability with a smaller and more concentrated cadre of scientists, engineers, and designers in government labs, but CV research and development would be minimal and focused more on budget friendly modernization programs as opposed to innovation, modern designs, or new technology.

Fiscal pressure is the essential driver of this alternative environment. Former Secretary of Defense Panetta calculated that sequestration represents a reduction of nearly 20 percent in DOD funding over the next ten years and that sequestration would effectively eradicate an entire generation of military modernization, to include those initiatives focused on LCS systems.[47] Personnel and healthcare costs continue to consume more and more of the baseline defense budget accounting for, 34 percent in 2012 and projected to reach 46 percent by 2021.[48] These mandatory personnel and healthcare costs parallel the larger federal budget, and have become a requirement in defense budget planning despite the broad acknowledgement within DoD that cost trends are unsustainable. DoD can reduce long-term personnel costs by cutting force structure, but the only large budget lines available to source are Operations and Maintenance (O&M) and acquisition investment accounts. Reducing O&M funding is tantamount to advocating for a less trained and capable military, so DoD regards cutting acquisition funding as politically easier and safer. Congressional interests have contributed to the fragility of the CV segment by funding minimum sustaining rates at multiple facilities, including depot work share. Intended to protect domestic constituencies and preserve competition, the policy has a second order effect of diluting CV market share by maintaining excess capacity at redundant facilities, and undermining the financial prospects of both competitors in the CV segment.

Across the board, changing policy guidance accompanies fiscal pressure. The rebalance towards the Asia-Pacific region places a premium on acquiring the most advanced air, sea, space, and newly critical cyber capabilities to support the U.S. National Security and National Military Strategies, and risks DoD adopting a "good enough" philosophy regarding the nation's land combat forces. Existing CV and TWV fleets are either complete or nearing completion of production, are currently extremely capable and survivable due to upgrades, and following extensive re-set programs, are very young in relative terms. In the LCS market, both commercial firms and USG facilities recognize that volume for both new vehicles and re-set work on existing vehicles is quickly falling to financially unsustainable levels. The most optimistic forecasts for future high volume production of new vehicles such as the JLTV are in the 2017 to 2020 timeframe, and the survival of the GCV and ACV programs are in question. Cancellation or delay of all major CV programs beyond 2020, coupled with the elimination of minimum sustaining rate

funding, is likely sufficient to trigger this environment. Over the next three to five years, the major commercial firms, followed closely by many of the small to medium suppliers, would stop production, release employees, close facilities, and no longer submit proposals or designs for new programs or compete for sustainment contracts of existing programs. As firms depart, the USG would need to assume control of existing GOCOs, and either close or consolidate those facilities with existing GOGOs.

Loss of this segment within the LCS industry would significantly undermine previously identified DoD interests. The US national security strategy requires a robust and agile industrial base to mass produce the highest quality military equipment in both steady-state and surge situations, a capability that would be reduced with a partial market failure. Similarly, the primacy of U.S. weapons systems stems from the diverse commercial R&D facilities and large IR&D budgets of defense firms that participate in the CV segment. Without commercial firms to employ, train, educate, and push the next generation of thinkers and innovators the United States risks losing the technological edge in weaponry that has sustained its global reputation for the past seven decades.

ALTERNATIVE ENVIRONMENT 3 – INDUSTRY CONSOLIDATION AND CONTRACTION OF LCS PROCUREMENT PROGRAMS

The third alternative environment reflects consolidation and contraction of the LCS industry, leaving DoD with a single major defense contractor for CVs and a limited number of OEMs for TWVs. As with partial market failure, this environment would stem from the continued low demand signal for the development, procurement, and manufacturing of LCS vehicles. This results from declining procurement funds in the U.S. defense budget as the U.S. economy continues slow growth and entitlement programs grow. Additionally, the DoD LCS vehicle fleet is excessive for the requirements of a smaller force, and is well maintained resulting from reset, refurbishment, and upgrading in support of recent Overseas Contingency Operations. The key differentiation between this environment and the partial market failure environment is the selective procurement of the highest priority vehicles, with at least one CV platform achieving limited rate production around 2017. With only a single "winner take all" CV program of either the GCV or ACV, and the shift of the TWV market toward commercial firms, the losing defense firms would have strong financial incentives to leave the LCS market, thus creating a monopoly for the surviving firm in the CV segment.

The most adverse impact of this consolidation and contraction of LCS programs would be the loss of competition in the industry, resulting in severe limitations on the DoD's ability to pursue its interests. Primarily, a consolidation of the industry prevents economic efficiency. With the DIB consolidating to a single major defense contractor for armored combat vehicles and limited smaller OEMs remaining for the TWV market, DoD's buyer power decreases as the industry moves from an oligopoly to monopoly environment. The loss of competition will reduce contractor incentives to bid and deliver lower cost vehicles, control costs, and adhere to production schedules. A consolidated LCS Industry would be less likely to invest IR&D dollars for technology improvements as the single remaining major defense contractor and limited OEMs would have less competitive incentive to make such investments.

Industry consolidation and contraction will also adversely affect the key core interest of maintaining a self-sustaining and capable domestic DIB**.** The impact is with the associated risk for the loss of key domestic DIB capabilities. These capabilities include performance of heavy

manufacturing and associated use of special tooling to perform this heavy manufacturing service, loss of critical welding skills for ballistic armor and aluminum, and the deterioration and loss of the domestic supply chain for key components.

EXOGENOUS CONTINGENCIES

In addition to visualizing a future consistent with current trends influenced by U.S. decisions, the United States must also consider unpredictable contingencies when developing strategies. One such contingency would be a second global economic crisis that further restricts DoD funding. As current acquisition programs and life cycle sustainment depend on reliable and realistic budgeting, an unforeseen economic crisis that significantly affects resourcing would result in not only the cancellation of new programs, but also affect the life cycle sustainment of existing programs. The DoD would need to make difficult choices and assume significant risk on what systems would take priority, what would go into production, what capability gaps would be acceptable based on limited funding. In some instances, this would determine whether increased USG intervention would be required not only to meet defense requirements, but also to preserve the industry.[49]

A second unpredictable contingency is the development of an unforeseen threat to national security. Recent world events such as the ongoing tensions with North Korea, acts of domestic terrorism such as the Boston Marathon Bombing, and the continuing operations within Afghanistan reflect that the LCS industry must be flexible enough to meet DoD requirements across the full range of military operations. As the industry initially unprepared to meet the increased survivability requirements to counter Improvised Explosive Devices, it will more than likely be initially unprepared to meet a significant, unforeseen threat. As the DoD cannot shape the environment to prevent these two exogenous contingencies, strategy objectives that focus on maintaining an industrial base capable of meeting DoD needs during fiscal austerity, while preserving a strong military advantage across the full range of military operations, is vital. Failure to achieve this would result in the inability of the DoD to achieve its three primary interests within the LCS industry.

CORE STRATEGY

The DoD core strategy is defined by sequestration driven budget reductions and the changing force requirements tied to the U.S. rebalancing to the Asia-Pacific region. The U.S. Army and U.S. Marine Corps will undergo force reductions of a minimum of 80,000 and 20,000 respectively over the 2014-2017 timeframe[50]. Additionally, the current CV, TWV, and PV fleets greatly exceed current or projected force requirements due to the aggressive use of Overseas Contingency Operations (OCO) funds to reset and recapitalize the fleet to a historically low age. Recognizing the potential impact of these changes within the DIB, DoD initiated several programs to determine their severity. Within DoD, the Undersecretary of Defense for Acquisition, Logistics, & Technology (USD(ATL)) has the lead responsibility for managing defense industrial base policy, and this office has issued policy guidance to implement Administration priorities. In October 2011, then (Acting) Under Secretary Frank Kendall issued the guidance that "a healthy industrial base means a profitable industrial base, but it also means a lean and efficient base that provides good value for the taxpayers' defense investments…We will ensure critical skills and capabilities in the industrial base are identified and preserved."[51]

The 2011 National Defense Authorization Act (NDAA) established the Deputy Assistant Secretary of Defense (DASD) for Manufacturing & Industrial Base Policy (MIBP), and merged several functions of DOD industrial base policy under this office.[52] Also in 2011, the Deputy Secretary of Defense, Dr. Ashton Carter, directed a Sector-by-Sector, Tier-by-Tier (S2T2) evaluation of the DIB. This effort is led by the USD(ATL), and delegated to the DASD (MIBP). S2T2 is designed to be a comprehensive collection and assortment of data designed to facilitate analysis across the spectrum of the DIB, and assist in future research & development as well as procurement decisions.[53]

Additionally, Dr. Carter directed the DASD(MIBP) to "serve as the Department's repository for industrial base data to encourage reuse, make it easier to see connections, reduce the cost of collection, and enhance inter-service cooperation."[54] Within the U.S. Army, the Program Executive Office for Ground Combat Systems (PEO GCS) is conducting a corollary but mutually supporting effort of S2T2. Contracted by PEO GCS, the company A.T. Kearney is conducting an in-depth assessment of the specific industries that support the development, procurement, and sustainment of CVs. The methodology focuses on the gathering of data and conducting analysis of four work streams, assessing 275 suppliers within this industry.[55] The expected report in June 2013 will inform resourcing efforts for future defense budgets, and should serve as the base for implementing the three primary core strategy objectives highlighted below.

When enacting a strategy, the DoD should first invest in R&D vice procurement in the near-term. DoD and senior leadership of the services have, through press releases and Congressional testimony, reinforced the need to prioritize R&D for future modernization over the production or continued recapitalization of existing platforms in the CV, PV, and TWV fleets.[56] Their collective assessment of the near-term operational risk resulted in a strategy calling for the retention of current production capabilities in a warm status using contracts for the Technology Development (TD) and Engineering Manufacturing Development (EMD) prototyping and FMS of existing systems through 2017.[57] This prioritization strategy met with resistance from within the defense industry and members of Congress, as it will result in workloads below what industry partners have defined as their minimum operational sustainment rate, which could result in a loss of manufacturing capability for the future and threaten employment in influential political districts. Congress has overridden DoD's stated position by directing hundreds of millions of dollars to

support the continued production/recapitalization of the M1 Abrams and M2/M3 Bradley Fighting Vehicle in Fiscal Years 2013 and 2014.[58]

Second, DoD should champion acquisition reform focusing on the requirements process in both the near and long-term. Better processes for defining program requirements would shorten procurement timelines and improve performance. A major complaint from across the LCS industry is the lack of clearly defined and stable requirements in request for proposals (RFP) and other contract documents. The relatively rapid turnover of senior leaders in key positions within the Pentagon, service staffs, and the U.S. Army Training and Doctrine Command amplifies this problem. Although the 2007 National Defense Authorization Act provided specific guidance to the DoD to develop a training and certification program for military and civilian requirements developers[59], requirements for new acquisition and recapitalization programs are undisciplined. The strategy to professionalize the requirements managers, as part of acquisition reform, will take on greater importance as the cost of programs increase and the availability of resources continue to decline. Emphasis on clear requirements definition and stability in basic requirements will reinforce the goals and objectives of the Better Buying Power initiative.[60]

Finally, DoD should balance the available workload between commercial, defense, and GOGO entities. The DoD strategy to balance workload within the LCS industry partners must leverage the strengths of each sector. The overall strategy is to maintain a viable industrial base capability while setting the conditions for future modernization and sustainment of systems throughout their lifecycle by distributing the workload in order to encourage competition, balance risk, and seek efficiencies in an inherently inefficient industry. Each industry competitor is vital, and has a niche to fill and is able to compete for LCS work based upon best value to the government. USG owned facilities would generally take precedence over commercial or defense specific industry partners for reset and limited recapitalization efforts and remanufacturing, while new production and prototyping efforts would require prioritization to commercial and defense-specific industry partners vice government organizations.

BASIC STRATEGY

Several basic strategy objectives help foster the preferred LCS environment possessing maximized private industry production, capital and surge capacity necessary to meet requirements, capacity for viable sustainment and refurbishment capability, and sustainment of U.S. technological superiority. First, the DoD should consolidate its maintenance and repair capabilities. Public law requires DoD to identify and maintain a core logistics capability encompassing "those capabilities that are necessary to maintain and repair the weapon systems and other military equipment"[61] at a GOGO facility. Note that maintenance and repair is defined by 10 U.S.C. §2460 as "material maintenance or repair requiring the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary," and does not include procurement or outright manufacturing. Furthermore, 10 U.S.C. §2474 demands the Service Secretaries "designate each depot-level activity or military arsenal facility of the military departments…as a Center of Industrial and Technical Excellence (CITE) in the recognized core competencies of the designee." To accomplish this, DoD should develop a single GOGO CITE for combat vehicle, preferably at ANAD. The Defense Base Realignment and Closure Act of 1990, as amended, is the ideal tool to use in bringing about the needed consolidation of all maintenance and repair capability at ANAD. The U.S. military is well positioned to engage in such a protracted process at this time due to the young age of its current fleet of combat vehicles.

Second, the government should establish a single CV manufacturing center to preserve CV specific capacity during the future environment of low demand. The GOCO arrangement at JSMC sustains the needed manufacturing capability, but employs a management system that favors the current managing contractor, while providing little incentive for efficiency or production innovation. A single manufacturing center, either at JSMC or consolidated at ANAD, should be managed by U.S. Army Installation Command or a 3rd party to allow different competing firms access to production facilities upon contract award. The combination of private sector design and manufacturing with government-supported infrastructure allows for some degree of commercial competition in a segment that would otherwise lack sufficient market volume to sustain private sector presence.

Third, the DoD must promote export of defense items through such programs as FMS, FMF, and DCS with consideration of current and future ITAR restrictions.[62] This will help ease the burden on industry, as the fiscal constraints that exist today do not seem likely to go away anytime soon. The acquisition community is pursuing this effort through Better Buying Power 2.0 by "increasing the incorporation of defense exportability features in initial designs" because the "export of defense products to our friends and allies provides for economies of scale that reduce costs for all customers, including U.S. domestic customers, greater commonality and interoperability with our global partners, and strengthened relationships."[63] This effort, however, is not likely to be sufficient. The government needs to reduce the over classification of items under ITAR, as well as adopt best practices in defense exports such as the system used by Canada.

Finally, because of the current fiscal constraints along with the relative youth of its current fleet of combat vehicles, it would be prudent for the DoD to focus on the modernization of its existing assets through ECPs as opposed to executing all the desired procurements of next generation vehicles as outlined in the *Army Equipment Modernization Plan* and elsewhere.[64] There will be insufficient funding within a FYDP to meet all the desired procurements. Additionally, it is uncertain that the requirements for these next generation vehicles are final. Accordingly, the incorporation of required additional capabilities via ECP into existing platforms is the preferred approach.

HEDGING STRATEGY

As the DoD should develop a strategy that not only addresses the nature of the LCS industry but also helps shape it to create the environment desired, it should also consider preventing the development of the alternate environments while mitigating the exogenous contingencies. As previously discussed, the DoD should take steps to prevent the negative effects of defense firm globalization, US firms exiting the CV market, and the consolidation of the LCS industry while mitigating the effects of further defense budget cuts and the development of significant, unforeseen threats to national security.

As previously stated, the negative effects of defense firm globalization are the diffusion of technology, a loss of capital investment, and obstacles to maintaining the US defense supply chain. The sustainment of key GOCO and GOGO-like facilities is vital in preventing this. These facilities maintain unique machining and manufacturing equipment needed to produce CV transmissions and heavy armored vehicle hulls. Support of legacy vehicles such as the M1Abrams tank and the use of conventional transmission and armor technologies in future combat vehicles such as the ACV and GCV necessitates continued maintenance of the GOCO manufacturing capabilities.

Although support and sustainment of the GOCO manufacturing capabilities is essential, the government must identify opportunities to reduce underutilization and decrease overhead costs.

A strategy to use key manufacturing equipment more efficiently must take a holistic approach toward restructuring the facilities and management structure that supports current GOCO facilities. Although technically and politically challenging, consolidation of government equipment within a single facility such as JSMC or ANAD provides a more efficient means to maintain these essential manufacturing capabilities. Likewise, DoD may consider a strategy to transition the sustainment of the manufacturing equipment and facilities from contractor administration to government depot management. These steps would help protect the government's interests in maintaining industrial base stability and increasing efficiency. Transition of GOCO machinery to government control and management would also increase the potential for competing firms to use the equipment for the development and production of future combat vehicles, reducing the requirement for market competitors to sustain expensive capital infrastructure that contributes to excess aggregate capacity.

To prevent US firms from exiting the CV market, regulation and synchronization of CV program schedules provides a method of sustaining and supporting the industrial base. For example, sequencing the development and production phases of the ACV and GCV programs would extend the use of key GOCO manufacturing facilities for a longer duration. In concept, one program would remain in development as the more mature program proceeded into production. As production neared completion, the developmental program would prepare to enter its production phase. Sequencing major combat vehicle programs also maintains and extends industry interest towards investment in the technologies needed to compete within the United States and global defense marketplace.

Additionally, the LCS industry is seeking to expand international sales to offset the impact of the shrinking US defense budget and prevents further industry consolidation. FMS helps sustain the DIB by maintaining revenues needed to develop new and competitive technologies and vehicle designs, which is a direct interest of DoD. Meanwhile, LCS industry representatives expressed concerns that U.S. policies impede or reduce competitiveness of U.S. LCS vehicles in the global market. Specifically, delays and complications associated with ITAR inhibit, and in some cases preclude, potential sales. While industry recognized the need for ITAR, members recommended reforms to expedite ITAR approval of legacy systems that had a long history of international sales. DoD should advocate for the LCS industry to attain ITAR reforms promoting increased international sales while maintaining the intent and controls intended by the policy. The effort would benefit DOD by offsetting the costs needed to sustain the key infrastructure associated with the LCS industry.

Although consolidation and efficient use of key GOCO infrastructure can reduce procurement and sustainment costs associated with CVs, it adds the detrimental effect of reducing industry's overall capacity to surge in response to wartime requirements by collocating critical industry infrastructure at one location. Combat losses, or a demand for increased production of new vehicles, could outstrip the capacity of a leaned out CV industry. The acquisition strategy reflected in the recent fielding of MRAPs, provides an example of how industry can overcome capacity issues to meet emerging requirements with alternative vehicles that use technology already existing in the commercial sector. Additionally, to mitigate probably production delays resulting from the retooling of centralized manufacturing facilities to field new systems the government should seek to codify the processes similar to those used to support the urgent, rapid MRAP acquisition strategy. In doing so, DoD would mitigate the potential ramifications

associated with the exogenous contingencies of further defense budget cuts and the development of a significant, unforeseen threat to national security.

CONCLUSION

The LCS industry is in decline and faced with excess production capacity. This is due to decreased demand from the DoD for CVs and TWVs, and a marked reduction in defense procurement spending. Accordingly, the DoD must develop a strategy to manage current industry conditions effectively while developing new conditions favorable towards achieving its interests of maintaining a viable DIB, maintaining the primacy of U.S. weapons systems, and attaining economic efficiency within its acquisition programs.

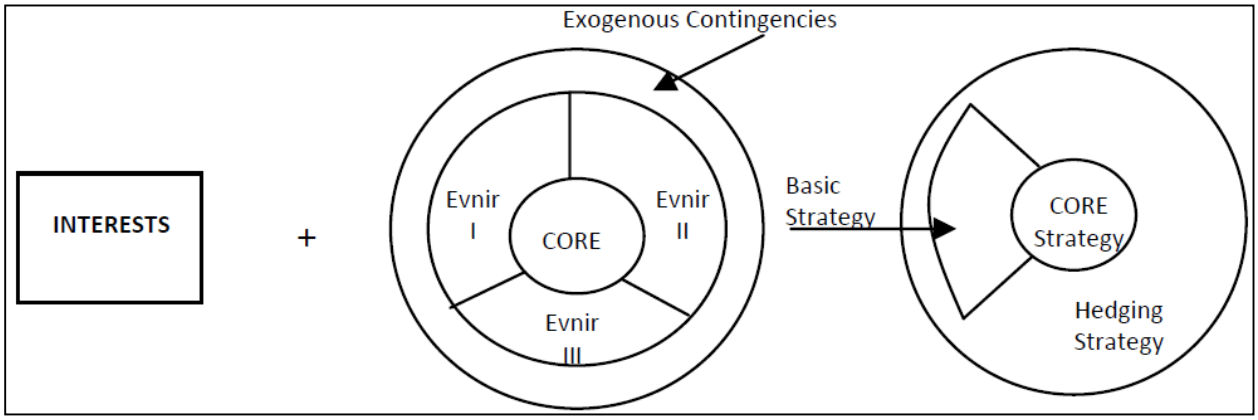
Maximized private sector production, sustained capital and surge capacity, viable sustainment and refurbishment capacity, and continued U.S. technological superiority of weapons systems are the characteristics that define the industry environment most favorable for the attainment of DoD interests. Obstacles to attaining DoD interests include the technology diffusion associated with a globalized LCS industry, a loss of CV production capability resulting from a partial market failure, and a significant reduction in competition due to large firm consolidation. Other uncontrollable factors, such as increased reductions in defense spending and unforeseen threats to national security, further complicate the DoD's capability to achieve its interests within the LCS industry.

Upon analysis of these preferred and alternate environments, the DoD should adopt the following strategy objectives for shaping the LCS industry:

- Increase investments in R&D
- Focus acquisition reform on the requirements process
- Balance available workload between the four categories of competitors
- Develop single, government owned LCS manufacturing center of excellence
- Promote/streamline the FMS process while encouraging international competition
- Focus on modernization of existing systems vice reset/refurbishment while capitalizing on fleet age to mitigate risk
- Sustain key GOCO facilities while investing in facility optimization/modernization
- Regulate and synchronize CV program schedules to prolong demand signals within the LCS industry
- Reform, but retain, ITAR to encourage international competition while protecting U.S. competitive advantages
- Codify the rapid acquisition processes demonstrated in the mid-2000s

Implementing these strategy objectives not only assists the DoD in accomplishing its objectives in the near term, but also ensures the maintenance of a LCS industry capable of producing the ground systems needed for the United States respond to all national security threats across the range of military operations now, and in the future.

APPENDIX A: Ascher-Overholt Model for LCS Strategy Development



DoD Interests:
- Maintain a Defense Industrial Base capable of supporting the U.S. national security strategy
- Ensure the primacy of U.S. defense systems and capabilities
- Optimize economic efficiency

Core Environment:
- DoD monopolist buyer in oligopolic market
- Products include TWVs, PVs, CVs
- Competitors are defense firms, commercial firms, GOCO facilities, and GOGO facilities
- Near-term outlook defined by declining demand and excess production capacity
- Long-term outlook defined by existing trends

Preferred Environment:
- Maximized privatized production through workload distribution
- Maintenance of capital and surge capability
- Capacity for viable sustainment and refurbishment
- Sustainment of U.S. technological superiority

Alt Env 1: Globalization
- Diffusion of technology
- Loss of capital investment
- Obstacles to U.S. defense supply chain

Alt Env 2: Partial Market Failure
- Loss of CV production capability
- Loss of specialized work force
- Reduction in R&D

Alt Env 3: Industry Consolidation
- Loss of competition
- Inability to control unit per cost
- Reduced IR&D

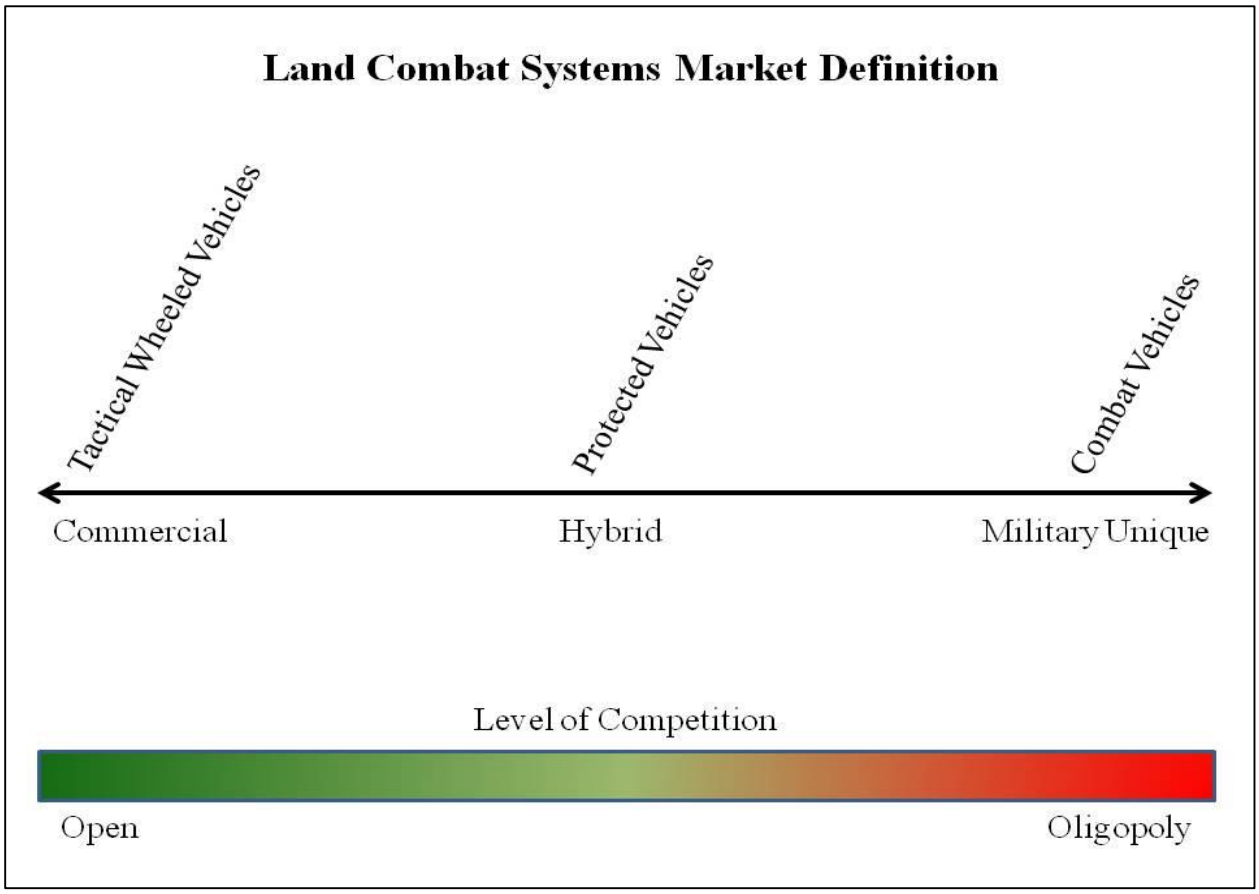
Exogenous Contingency:
- Unforeseen reductions in DoD budget
- Unforeseen threats to U.S. national security

Core Strategy Objectives:
- Increased investments in R&D
- Focus acquisition reforms on the requirements process
- Balance available workload between competitors

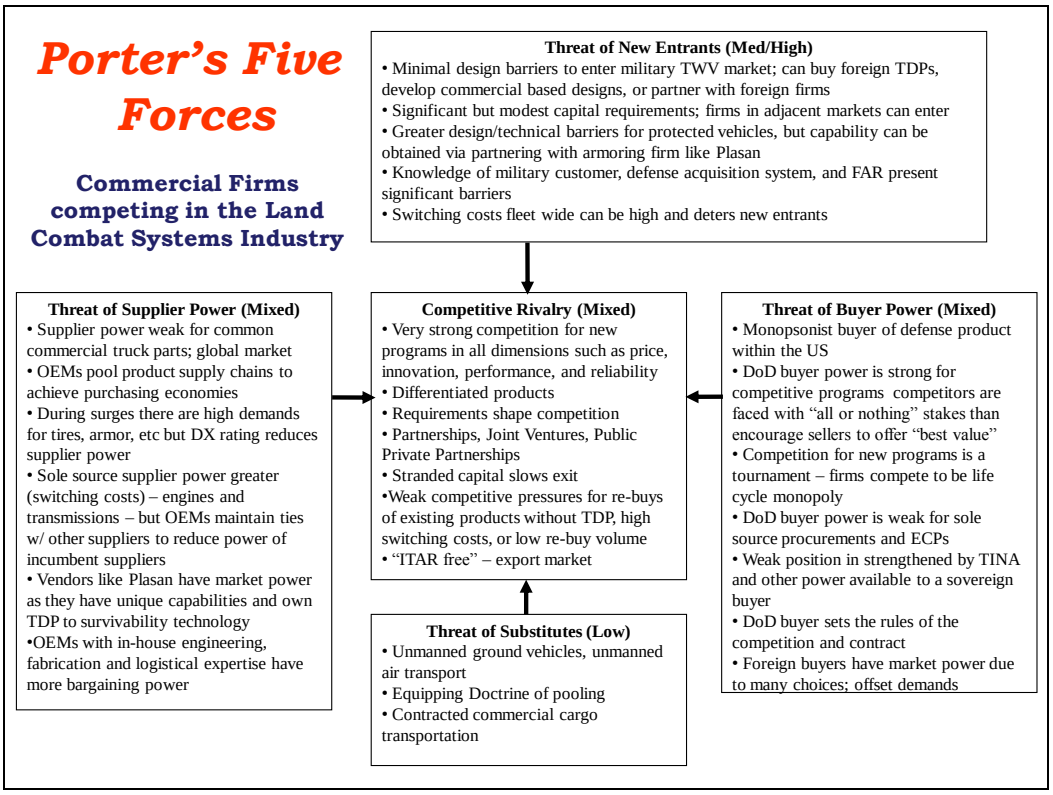
Basic Strategy Objectives:
- Develop single, government owned manufacturing center of excellence
- Promote/streamline FMS while encouraging international competition
- Focus on modernization vice reset/refurbishment capitalizing on fleet age to mitigate risk

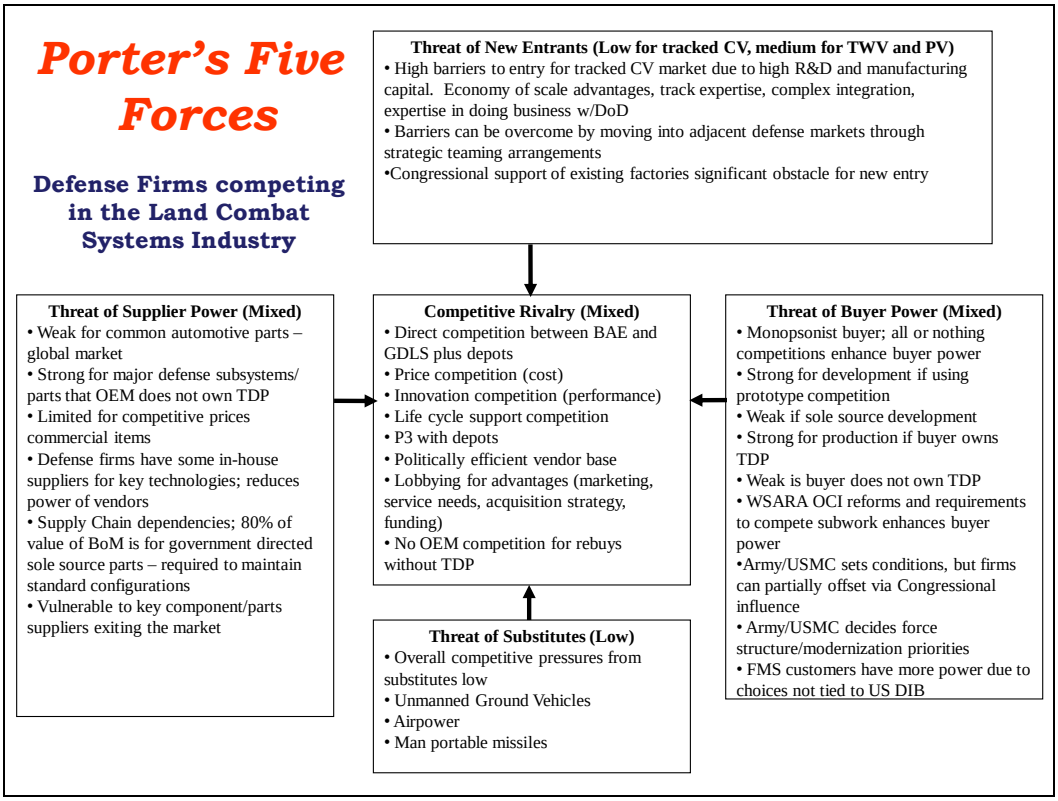
Hedging Strategy Objectives:
- Sustain key GOCO facilities
- Invest in GOCO facility optimization
- Regulate and synchronize CV program Schedules
- Reform, but retain, ITAR
- Codify rapid acquisition processes

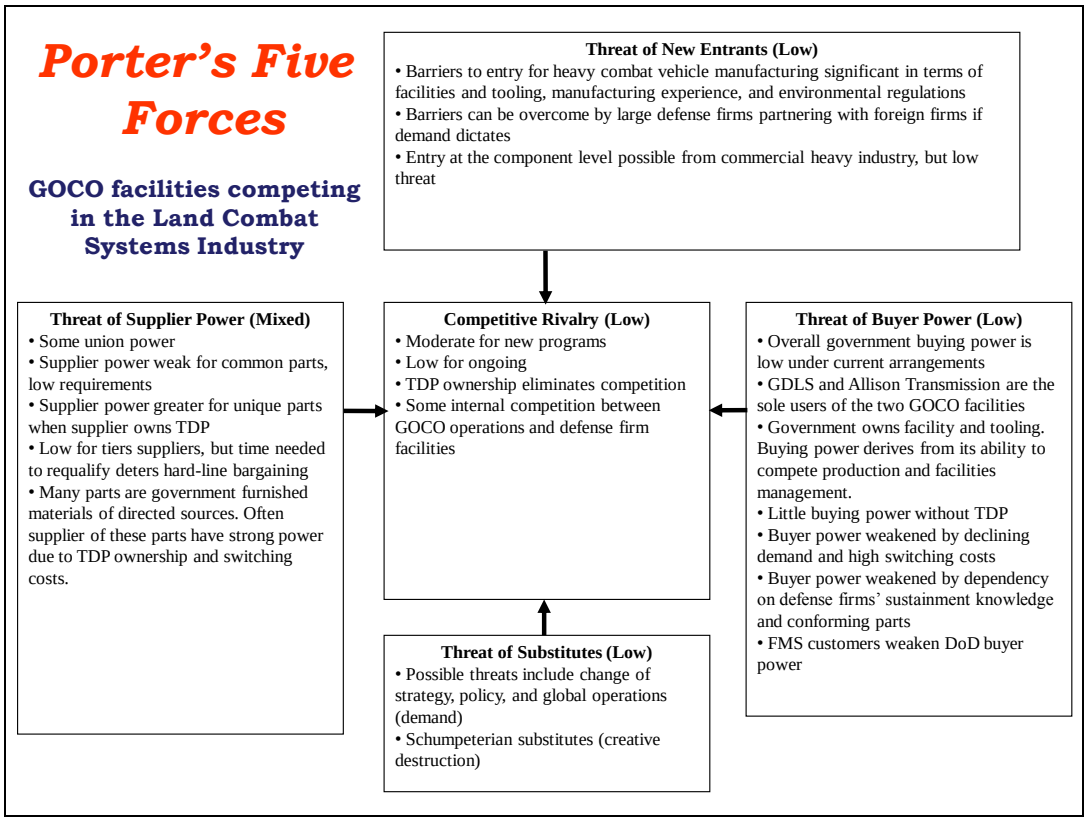
APPENDIX B: Land Combat Systems Market Definition

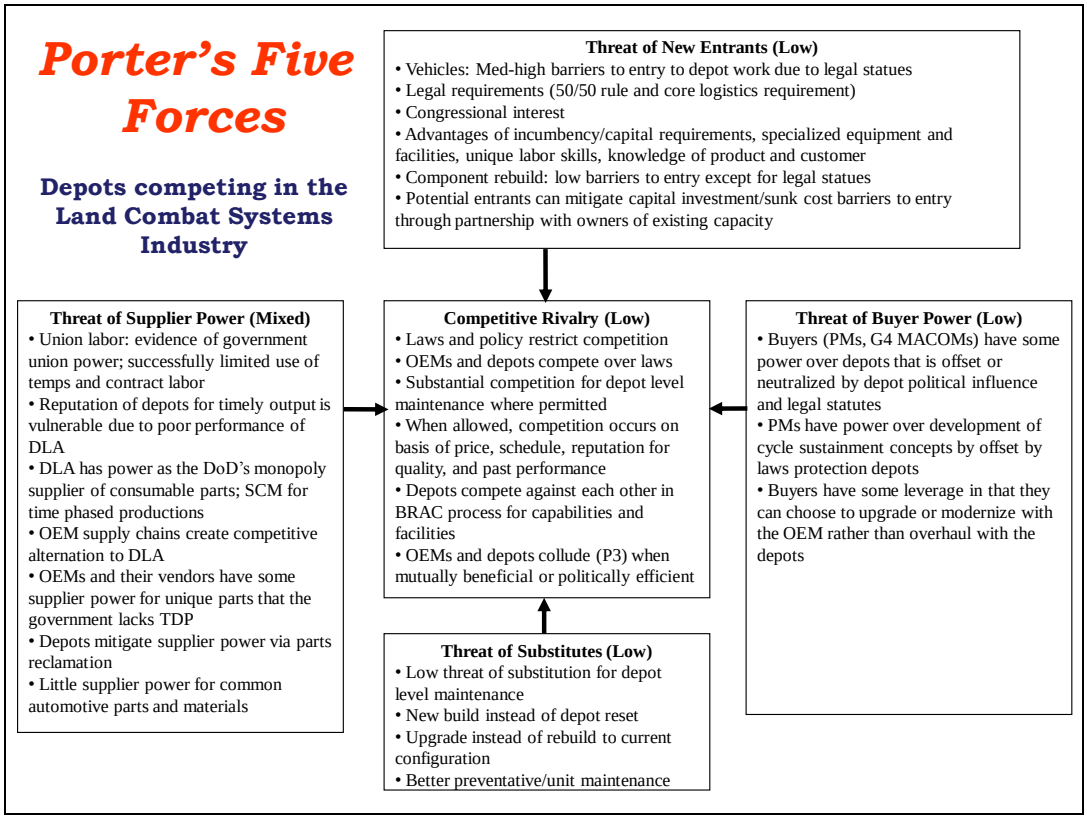


APPENDIX C: Porter's Five Forces Analyses for Competitors






Porter's Five Forces
GOCO facilities competing in the Land Combat Systems Industry
Threat of New Entrants (Low)
• Barriers to entry for heavy combat vehicle manufacturing significant in terms of facilities and tooling, manufacturing experience, and environmental regulations
• Barriers can be overcome by large defense firms partnering with foreign firms if demand dictates
• Entry at the component level possible from commercial heavy industry, but low threat
Threat of Supplier Power (Mixed)
• Some union power
• Supplier power weak for common parts, low requirements
• Supplier power greater for unique parts when supplier owns TDP
• Low for tiers suppliers, but time needed to requalify deters hard-line bargaining
• Many parts are government furnished materials of directed sources. Often supplier of these parts have strong power due to TDP ownership and switching costs.
Competitive Rivalry (Low)
• Moderate for new programs
• Low for ongoing
• TDP ownership eliminates competition
• Some internal competition between GOCO operations and defense firm facilities
Threat of Buyer Power (Low)
• Overall government buying power is low under current arrangements
• GDLS and Allison Transmission are the sole users of the two GOCO facilities
• Government owns facility and tooling. Buying power derives from its ability to compete production and facilities management.
• Little buying power without TDP
• Buyer power weakened by declining demand and high switching costs
• Buyer power weakened by dependency on defense firms' sustainment knowledge and conforming parts
• FMS customers weaken DoD buyer power
Threat of Substitutes (Low)
• Possible threats include change of strategy, policy, and global operations (demand)
• Schumpeterian substitutes (creative destruction)


Porter's Five Forces
Depots competing in the Land Combat Systems Industry
Threat of New Entrants (Low)
• Vehicles: Med-high barriers to entry to depot work due to legal statues
• Legal requirements (50/50 rule and core logistics requirement)
• Congressional interest
• Advantages of incumbency/capital requirements, specialized equipment and facilities, unique labor skills, knowledge of product and customer
• Component rebuild: low barriers to entry except for legal statues
• Potential entrants can mitigate capital investment/sunk cost barriers to entry through partnership with owners of existing capacity
Threat of Supplier Power (Mixed)
• Union labor: evidence of government union power; successfully limited use of temps and contract labor
• Reputation of depots for timely output is vulnerable due to poor performance of DLA
• DLA has power as the DoD's monopoly supplier of consumable parts; SCM for time phased productions
• OEM supply chains create competitive alternation to DLA
• OEMs and their vendors have some supplier power for unique parts that the government lacks TDP
• Depots mitigate supplier power via parts reclamation
• Little supplier power for common automotive parts and materials
Competitive Rivalry (Low)
• Laws and policy restrict competition
• OEMs and depots compete over laws
• Substantial competition for depot level maintenance where permitted
• When allowed, competition occurs on basis of price, schedule, reputation for quality, and past performance
• Depots compete against each other in BRAC process for capabilities and facilities
• OEMs and depots collude (P3) when mutually beneficial or politically efficient
Threat of Buyer Power (Low)
• Buyers (PMs, G4 MACOMs) have some power over depots that is offset or neutralized by depot political influence and legal statutes
• PMs have power over development of cycle sustainment concepts by offset by laws protection depots
• Buyers have some leverage in that they can choose to upgrade or modernize with the OEM rather than overhaul with the depots
Threat of Substitutes (Low)
• Low threat of substitution for depot level maintenance
• New build instead of depot reset
• Upgrade instead of rebuild to current configuration
• Better preventative/unit maintenance

APPENDIX D: List of Acronyms

AAV	Assault Amphibious Vehicle
AAV-U	Assault Amphibious Vehicle-Upgrade
ACV	Amphibious Combat Vehicle
AMPV	Armored Multipurpose Vehicle
ANAD	Anniston Army Depot
APC	Armored Personnel Carrier
BAE	British Aerospace Engineering Systems
BBP	Better Buying Power
BRAC	Base Realignment and Closure
CBO	Congressional Budget Office
CITE	Center of Industrial and Technical Excellence
COCO	Contractor Owned Contractor Operated
COTS	Commercial Off the Shelf
CV	Combat Vehicle
DARPA	Defense Advanced Research Projects Agency
DASD	Deputy Assistant Secretary of Defense
DCS	Direct Commercial Sales
DIB	Defense Industrial Base
DLA	Defense Logistics Agency
DoD	Department of Defense
DPAS	Defense Priorities and Allocations System
DSS	Defense Security Services
ECP	Engineering Change Proposal
EMD	Engineering Manufacturing Development
EFV	Expeditionary Fighting Vehicle
EU	European Union
FAASV	Field Artillery Ammunition Supply Vehicle
FCS	Future Combat System
FMF	Foreign Military Financing
FMS	Foreign Military Sales
FMTV	Family of Medium Tactical Vehicles
FY	Fiscal Year
FYDP	Future Years Defense Plan
GCV	Ground Combat Vehicle
GCTVS	Ground Combat Tactical Vehicle Strategy
GDLS	General Dynamics Land Systems
GMV	Ground Mobility Vehicle
GOCO	Government Owned Contractor Operated
GOGO	Government Owned Government Operated
HEMTT	Heavy Expanded Mobility Tactical Truck
HET	Heavy Equipment Transporter
HHI	Herfindahl-Hirschman Index
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IED	Improvised Explosive Device

IFV	Infantry Fighting Vehicle
IR&D	Independent Research and Development
ITAR	International Trade in Arms Regulation
JLTV	Joint Light Tactical Vehicle
JSMC	Joint Systems Manufacturing Center
LAV	Light Armored Vehicle
LCS	Land Combat Systems
LVSR	Logistical Vehicle System Replacement
MIBP	Manufacturing and Industrial Base Policy
MLRS	Multiple Launch Rocket System
MPC	Marine Personnel Carrier
MRAP	Mine Resistant Ambush Protected
MTVR	Medium Tactical Vehicle Replacement
NATO	North Atlantic Treaty Organization
NMS	National Military Strategy
NSS	National Security Strategy
O&M	Operations and Maintenance
OCI	Organizational Conflicts of Interest
OCO	Overseas Contingency Operations
OEM	Original Equipment Manufacturer
P3	Public-Private Partnership
PIM	Paladin Integrated Management
PM	Program Manager
PV	Protected Vehicle
R&D	Research and Development
RDT&E	Research Development Testing and Evaluations
S2T2	Sector-by-Sector, Tier-by-Tier
SSA	Special Security Agreements
TD	Technology Development
TDP	Technical Data Package
TINA	Truth in Negotiations Act
TWV	Tactical Wheeled Vehicle
USG	United States Government
USMC	United States Marine Corps
USSOCOM	United States Special Operations Command
WSARA	Weapon Systems Acquisition Reform Act

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