

LAND COMBAT SYSTEMS

ABSTRACT

Existing ground combat platforms represent the most technically sophisticated, lethal, and survivable fleet of weapons systems in any military force, past or present. The land combat vehicle (LCV) industry, however, is in decline, characterized by low production rates, constrained demand, and uncertainty over new technologies. A high degree of global competition complicates market strategies. Corporate survival depends on seeking efficiencies through downsizing, expanding product lines, negotiating mergers and partnerships, and adapting current processes for low-rate, high-mix production. Despite these strategies, substantial, costly overcapacity remains, which could translate into monies for research and development (R&D). Current production contracts can sustain the industry for 5 years, but without a consensus for new vehicle manufacture or a robust modernization program, the industry may not retain a viable manufacturing capability in the future.

Brigadier General Bjorn Ruud, Norwegian Army

Lt Col Jorge Acevedo, USAF

Mr. Rick Azzarano, Dept. of the Navy

LTC Randy Corbin, USA

LtCol Mike Duva, USMC

LTC Michael Goodroe, USA

Mr. Dale Hanson, Dept. of the Army

COL Gary Knapp, USA

LTC David Mintus, USA

Lt Col Clada Monteith, USAF

CDR Dale Nees, USN

Ms. Linda Nordstrom, Dept. of the Army

COL Hernando Ortiz, Colombian Army

CAPT Frank Pagano, USN

CDR Renee Rodeck, USN

Lt Col Clarence Taylor, USAF

COL Sam Chappell, USA, faculty

Dr. Paul Needham, faculty

COL Paul Severance, USA, faculty

Col Russ Woody, USMC, faculty

PLACES VISITED

Domestic

AM General, South Bend, IN
Defense Advanced Research Projects Agency, Arlington, VA
Detroit Diesel Corp., Detroit, MI
General Dynamics Corp., Land Systems Division, Sterling Heights, MI
General Dynamics Corp., Woodbridge, VA
General Dynamics Corp., Tank Plant, Lima, OH
Letterkenny Army Depot, Chambersburg, PA
Oshkosh Truck Company, Oshkosh, WI
Tank-Automotive and Armament Command (TACOM), Warren, MI
Tank-Automotive Research, Development, and Engineering Center
(TARDEC), Warren, MI
United Defense Ltd. Partnership, Chambersburg, PA
United Defense Ltd. Partnership, York, PA

International

British Aerospace, Royal Ordnance, Nottingham, United Kingdom
General Motors Canada, London, Ontario, Canada
Giat Industries, Roanne, France
Krauss Maffei-Wegmann Wehrtechnik, Munich, Germany
Steyr-Daimler-Puch Spezialfahrzeug, Vienna, Austria
Vickers Defence Systems, Armstrong Works, Newcastle Upon Tyne,
United Kingdom

INTRODUCTION

Over the past 50 years, the United States designed and manufactured some of the finest ground combat systems in the world. Operation DESERT STORM was a global billboard for the quality of products produced by the LCV industry. During the last decade, however, reduced demand brought about significant change in the industry. This change has led to excess industrial capacity, inefficiency, and potentially costly procurement programs.

The existing LCV industrial base is a product of U.S. history. Arsenal, for example, trace their roots back to the War of 1812.¹ Depots were created in World War II to support the maintenance and repair of existing equipment, because private industry was totally consumed with the production of new equipment. After World War II, the government did not immediately demobilize the depots, because it was assumed that all future wars would require large-scale industrial mobilization just as World War II had. With the end of the Cold War, many defense planners no longer anticipate protracted global operations requiring a general mobilization. Rather, they foresee brief conflicts, following which the United States will refit ground forces with upgraded equipment from current inventories.² Consequently, there are questions about the sustainability of the LCV industrial base at current levels and about any need to preserve an industrial base for surge production of current generation armored vehicles.

The major challenges facing the industry are varied and complex:

- Substantial overcapacity in the industrial base
- Industry's capacity to surge production
- Health of subtier vendors
- Requirement for investment in R&D
- Maintenance of competition among remaining prime contractors

Growing technological obsolescence of current systems, the requirement for maintaining unique defense industrial capabilities, the effects of global competition, and an amorphous, asymmetrical threat to national security, compounds these challenges.

THE LAND COMBAT SYSTEMS INDUSTRY DEFINED

The land combat systems industry encompasses a spectrum of systems: tanks, infantry fighting vehicles, artillery and missile systems, tactical trucks, small arms, land mines, and command and control vehicles. The study group confined the scope of this report to tracked

vehicles, tactical wheeled vehicles, and the industrial base—including private industry, depots, and arsenals related to their production and maintenance (Table 1).

Table 1: LCV Domestic Industrial Base

Prime Contractors	Government Facilities
AM General	Albany Maintenance Center
General Dynamics Land Systems	Anniston Army Depot
GM Canada	Barstow Maintenance Center
Oshkosh Truck Company	Letterkenny Army Depot
United Defense Ltd. Partnership	Lima Army Tank Plant
Stewart & Stevenson	Red River Army Depot
	Rock Island Arsenal
	Watervliet Arsenal
	Idaho National Engineering and Environmental Laboratory

Tracked Vehicles

Designed to operate in almost any terrain, tracked vehicles can survive known and projected threats within reasonable risk limits. Today’s domestic tracked vehicles are produced by two prime contractors: General Dynamics Land Systems and United Defense Limited Partnership. They include M1-series Abrams tanks, M2/3-series Bradley Fighting Vehicles, M109-series Paladin self-propelled Howitzers, M88-series Recovery Vehicles, Armored Combat Earthmovers, the M113 Family of Vehicles, the Multiple Launch Rocket System, and the Marine Corps’ Amphibious Assault Vehicle (AAV). Future systems include the Grizzly Obstacle Breacher, the Marine Corps’ Advanced Amphibious Assault Vehicle (AAAV), the Wolverine Heavy Assault Bridge, and the Crusader artillery system.

Tactical Wheeled Vehicles

In support of combat operations, tactical wheeled vehicles transport personnel, equipment, and critical supply items. They also provide mobility for command, control, and communications systems and serve as platforms for crew-served weapons, such as cannons, machine guns, and antitank missile launchers. Tactical wheeled vehicles include a number of platforms, which fall into three main categories according to load-bearing capacity. First, lightweight vehicles (less than 2.5 tons) include the High-Mobility Multipurpose Wheeled Vehicle (HMMWV) in production at AM General Corporation. Second, vehicles of medium weight (2.5–7 tons) include the Army's Family of Medium Tactical Vehicles (FMTV), which are produced by Stewart & Stevenson Corporation. Marine Corps' programs include the Medium Tactical Vehicle Replacement (MTVR), under contract with the Oshkosh Corporation, and the Light Armored Vehicle (LAV) produced by General Motors, Canada. Third, the heavyweight category (greater than 7 tons) includes the Heavy Equipment Transporter (HET), the Heavy Expanded Mobility Tactical Truck (HEMTT), the Palletized Load System (PLS), the Logistics Vehicle System (LVS), and a number of special purpose vehicles in production at Oshkosh Truck Company.

The wheeled fleet of military tactical vehicles, unlike its commercial counterparts, must traverse terrain and distances similar to those required of the combat forces that they support. Although survivability requirements for tactical wheeled vehicles continue to be less stringent than they are for tracked vehicles, load capacity, off-road mobility, reliability, and simplicity of operation and maintenance remain fundamental to their function of supporting combat forces.

In spite of this, tactical wheeled vehicles have more in common with commercial vehicles than do armored tracked vehicles. Their design is less likely to change with the evolving nature of threats and is more conducive to the use of off-the-shelf components and production technologies developed for commercial vehicles. Consequently, commercial options can sometimes satisfy military requirements with a degree of modification, and the production of tactical wheeled vehicles may lend itself more readily to integrated military/commercial production lines that can achieve economies of scale and contain an inherent surge capability for military requirements.

CURRENT CONDITION

Global Environment

The manufacturing industry for LCVs remains a profitable business in many sectors, but is an industry in decline. Many nations continue to reduce their defense budgets due to revised threat estimates or regional financial depression. Although some nations are still potential buyers for new or upgraded tracked and wheeled combat vehicles, competition for these markets is intense. The United States remains the largest aggregate buyer of land systems, and market projections indicate that the Middle East will remain the top importer, followed by Asia and the Pacific Rim countries, Europe, Latin America, and Africa.^{3,4,5} Further, it appears that product sales will shift from heavy tanks toward infantry fighting vehicles and other light armored vehicles over the next 10 years.

Excess supply characterizes the current tank and tank-variant market. High-volume Cold War production rates and arms transfers generated by the Conventional Forces in Europe Treaty have created a market glut for much of the LCV market. Forecasted production over the next 10 years will exacerbate this problem.⁶ Consequently, new tank sales have become particularly difficult, with cutthroat competition characterizing the market. For manufacturers, the surplus represents a potential market for retrofit and modernization in the inventories of less wealthy countries.

The future for new tanks will rest with two distinct customer groups. The first group consists of those countries wanting highly sophisticated tanks with prices in the \$8 million range; the second group includes countries seeking a wider range of less expensive unit prices and technology options. Potential customers in this domain include Turkey, Greece, South Africa, Saudi Arabia, United Arab Emirates, Qatar, Argentina, and South Korea.⁷

The market for medium and light armored vehicles will decline slightly, but is still projected to be good for both mature and new systems well into the next century. Armored wheeled combat vehicles, in particular, remain an important asset in many of the world's military organizations due to the fact that they have lower unit and life cycle costs, reduced maintenance, and greater speed and mobility in most terrain than heavy tracked vehicles. Market projections for this class of vehicles remain positive, as France, Germany, and the United Kingdom

position themselves along with other nations to refit or upgrade their inventories.⁸

Forecasts for light and medium tracked vehicles for the next 10 years reach \$17 billion, with the best sales opportunities in the Middle East, Asia, and Latin America. The trend in this market is the wholesale introduction of the “family of vehicles” concept, which is based on the use of a common chassis. The demand for these systems will bring additional competitors into the market, especially since the rapid technology transfer to developing nations has made it possible for them to produce light tracked combat vehicles. Additionally, the trend away from heavy tanks will introduce some nontraditional competitors looking for alternative sources of revenue. China, Russia, Pakistan, and Turkey are intent on becoming major suppliers in this market, for example.^{9,10}

U.S. Industry Trends

Trends toward industrial consolidation, mergers, acquisitions, partnerships, and internal restructuring continue to characterize the post-Cold War LCV industrial setting. In response to flattening or declining defense procurement budgets and escalating global competition, LCV industries are clearly exploring every possible strategy to improve their competitive posture, expand market share, achieve a dominant market position, and cut costs.

As a result of reduced defense procurement budgets, companies that remain in this industry are reviewing and even redefining their core competencies and determining how they wish to position themselves in the market. In the past, firms operated generally in their own segments of the market (e.g., heavy tracked, light tracked, wheeled combat vehicles). Survival today depends on diversification of products and services, however. Consequently, several firms not only are seeking to expand operations beyond former boundaries and to penetrate the product lines of competitors, but also are examining new opportunities, such as total life cycle contracted logistic support.

Land combat vehicle companies are using both horizontal and vertical acquisitions to enter new markets. Some firms chose to concentrate solely on the defense industry, expanding their business through the acquisition of small defense product companies or subsidiaries divested from corporations exiting the industry. Other firms reduced their reliance on the defense dollar by acquiring commercial companies that complement their traditional product line.

Companies are also seeking partnerships and cooperative ventures to target new markets or expand existing ones. Various strategies have emerged, including collaborative efforts to market foreign products domestically and to co-produce U.S. products abroad. The U.S. government encouraged project partnering in the LCV industry to sustain manufacturing capability.

Firms are achieving internal efficiencies through cost-cutting initiatives, including relocation and consolidation of production operations, reduction of support staffs and suppliers, and outsourcing of non-core competencies where possible. With overcapacity running more than 50 percent across the LCV industry, extensive workforce reductions continue as well; this has created a highly skilled, but rapidly aging workforce—especially in manual production skill sectors, such as machining, welding, and the like.

Despite a reduction in the demand for the traditional hardware produced in the domestic LCV industry, all the competitors have managed to remain profitable by successfully implementing their diverse business strategies. With return on investment as the bottom line when books are balanced at year's end, companies in the LCV industry will continue to seek economies and efficiencies to remain competitive not only domestically, but also internationally as they vie for business with foreign producers.

European Industry Trends

The condition of the LCV industry in Europe is similar to that of U.S. businesses. In the short term, the firms will remain healthy, but they face questions about their economic viability as they approach the end of the next decade. Despite a European trend of nationally oriented, parochial land systems industries, European businessmen have recognized the problems associated with competing in a constrained international sales market and have finally begun to address the issue seriously. Although most European countries still aim to maintain an adequate defense industry capable of meeting their security and economic needs, many firms have begun to consolidate through mergers at the national level and to participate in joint venture projects at the international level. Thus, international mergers may be a long-term result of this trend toward industry integration.

As in the United States, most European LCV manufacturers are systems integrators who rely on subtier vendors to supply up to 80 percent of the components that make up the end item. Facing the

realities of declining markets and seeking business efficiencies, European companies, like those in the United States, have reduced their workforce and are closing redundant or unneeded production facilities. Further, most are seeking to broaden their product lines, to include new and diverse services, and to enter into international partnerships as a means to access new markets.

Unlike U.S. companies, European companies have avoided aging issues in many employee skill sectors. Active recruitment programs, coupled with training internships, have generally produced well-rounded demographic age profiles among those with production-associated skills. As in the United States, however, it remains difficult to recruit and retain engineering and information technology professionals in Europe.

Overcapacity

In the United States, other than the declining defense budget itself, underused excess industrial capacity remains the single greatest impediment to competitiveness in the land combat systems industry. Production facilities were built to mass-produce goods in support of large-scale Cold War requirements. With these requirements at an all time low, most facilities operate at 60 percent or less of their full capacity, and a few operate at only 10 percent of their potential. In commercial facilities designed for high-volume assembly lines, small workforces on limited shifts now produce individual vehicles and tanks on extended production schedules. Furthermore, government arsenals and depots draw off a portion of the production operations required by manufacturing components or refurbishing significant portions of the ground combat weaponry used by the services. Yet, in most cases, they do so with tremendous inefficiencies and at great overhead costs. For example, the government operation at Watervliet Arsenal in New York operates at only about 15 percent capacity. The sprawling Army tank plant in Lima, Ohio was designed to assemble more than 400 vehicles per year and manufacture major subassemblies for more than 800 vehicles, but it currently upgrades only 120 platforms annually, a rate expected to decrease to 24 platforms annually beginning in Fiscal Year 2001 and terminating in Fiscal Year 2005.

CHALLENGES

Significant challenges face the land combat systems industry in the foreseeable future. With military budgets drastically declining for most

of the 1990s, proposed budgets in the Future Years Defense Plan (FYDP) contain only flatline projections for procurement and development. Without significant increases in acquisition dollars generated by savings in other areas, the services' modernization plans will likely be unattainable. Since further reduction of land combat force structure or personnel entitlements appears unlikely, the only other potential source of funding is in the implementation of greater efficiencies and the elimination of political barriers to competitive operations in the industrial base.

Industrial Base

The opportunity to generate efficiencies lies in determining the mix of facilities that best meets the U.S. competing goals of maintaining an efficient, cost-effective, technologically innovative LCV industry, while providing the required capabilities for the military and ensuring adequate flexibility to deal with the uncertain defense requirements of the future. The existing redundancies and high costs of today's various production facilities impede efficiency in providing for the nation's future LCV requirements. The U.S. government must undertake a deliberate effort to eliminate wasteful production facilities consistent with the level of commercial vitality that it seeks in the LCV industry.

Further, reduction of overcapacities in government and commercial facilities would go far to enhance the competitiveness of U.S. firms in the international marketplace by eliminating expenditures on nonproductive overhead. Operators of most production facilities continue to justify costly overcapacity as a requirement to meet future surge capability. This problem is especially acute in the nation's government-owned, contractor-operated (GOCO) and government-owned, government-operated (GOGO) facilities. In spite of this, a current Department of Defense (DOD) viewpoint regards future wars as short-duration affairs for which there is unlikely to be a requirement for a surge in wholesale production in a full-mobilization scenario.¹¹ If that is the case, then the nation will continue to maintain an excess industrial capacity; this is both expensive and wasteful.

Surge Capability

The challenges to be overcome in maintaining an adequate surge capability for the LCV industry include a diminished threat, declining defense budgets worldwide, increased competition, limited production

rates, an aging workforce, and a more diverse product mix. With these challenges in mind, defense planners must evaluate the industry's surge capability to meet future needs under three sets of circumstances: (1) the plant's production line is currently up, running (warm); (2) the production line has been temporarily shut down (mothballed); or (3) the production line has been permanently closed and its infrastructure disposed of (cold). Evaluation of the opportunity costs of maintaining low land combat system production rates must be weighed against the advantages gained by investing in R&D with the attendant risk of incurring lengthy production start times in the event of a national emergency. In general, LCV surge capability is estimated at 10–12 months for a warm production line and 18 months or more for a cold line.¹²

Certainly, skilled production workers will migrate to other manufacturing enterprises, and engineers will apply their talents in other arenas. The industry will not lose the capability of building a tank or any other land combat system, however. It appears that there are sufficient inventories, if modernized, to replace critical systems until a potentially dormant manufacturing capability could be mobilized to meet a future national security threat through new production. This will require adequate mobilization planning to ensure that manufacturers meet the nation's LCV requirements with production lines that may not remain economically viable based on military requirements alone.

Subtier Suppliers

Almost without exception, LCV prime contractors are systems integrators who rely on subtier vendors for most system components. Consequently, suppliers of critical parts and key technical skills are vulnerable to closure or migration out of this industry sector if business is insufficient to sustain a profit margin. The disappearance of subtier vendors could lead to serious readiness problems in the event of a protracted conflict. Once the existing supply of critical parts is exhausted, the minimum timeline to resurrect a cold production line or to create a viable substitute can be up to 18 months.¹³ Although the DOD does not predict a need for a surge capability in the foreseeable future, high-intensity, short-duration conflicts can generate immediate production requirements to support the existing force. For example, spare parts worth \$150 million were taken off the M1A2 tank modernization line to fill requirements in the Persian Gulf during Operation DESERT STORM.¹⁴ Without a warm production line,

reserve stockpiling, or at the very least adequate planning, the nation may find itself without the ability to satisfy a similar requirement in a timely fashion.

The U.S. ground forces have only a few LCVs in the design or early production stages. The Future Scout Vehicle, the Army's Crusader and Grizzly systems, and the Marine's AAV and MTRV represent the only new programs. Remaining programs are modernization efforts for existing equipment that the land forces expect to keep for at least another 30 years. With only 20 percent of the fleet scheduled for modernization, most vehicles in the inventory will have no technology insertion for another three decades. Without production orders, the DOD should not expect the 700 parts suppliers for the Abrams tank to remain in business for another 30 years—producing parts for a 20-year-old system. The challenge will be in finding the parts, dealing with longer delivery times, and accepting the higher costs of limited production runs.

Research and Development

Continued R&D is the key to the revolutionary technological breakthroughs sought by defense planners for the military establishment in the 2030 time frame. Investment in R&D will be critical to success, but the reduction in government procurement spending has caused companies to back away from such investments. Although prime contractors are partnering with their subcontractors in R&D investment efforts, the DOD continues to fund most of the R&D in this industry. In most cases, industry development focuses on research applications targeted to take proven technology to a higher level of performance. Yet, given the state of the industry, there is little likelihood of any revolutionary technological breakthroughs for LCVs in the future without continued government sponsorship and R&D investment.

Maintenance of Competition

There are only two prime contractors producing tracked combat vehicles in the United States: United Defense Limited Partnership (UDLP) and General Dynamics Land Systems (GDLS). Both firms operate significantly below capacity because of the reduced government demand. The merger of these two companies could achieve production efficiencies, but would eliminate domestic competition in the tracked combat vehicle marketplace. The current environment of managed

competition, where no single firm receives all the business opportunities, reflects the government position that a noncompetitive environment is undesirable. The government's intent appears to be maintenance of the status quo through limited orders and threats of antitrust litigation.

This apparent policy does not, however, extend deeper than the prime contractor level. Both UDLP and GDLS are systems integrators that rely on a diverse base of second- and third-tier suppliers to provide needed components and equipment to produce their respective end items. Although the government will likely sustain both major firms in this industry, that same practice is not extended to the lower tier firms.

OUTLOOK

In the Short Term

The LCV industry will remain unchanged in the short term. Domestic production will continue to operate well below capacity. With few new production contracts on the horizon, competition will be intense for any and all business. In many segments, the industry is maintaining production lines through a combination of new production, system upgrades, and extended service life programs.

These system upgrades and extended service life programs represent the primary source of production for the LCV industry. The upgrade of the M1A1 Abrams tank to the M1A2 and the M1A2 System Enhancement Program (SEP) configuration will likely keep the Lima tank plant operating through 2005. The Lima facility is projected to build 465 Heavy Assault Bridges (HABs), using government-provided Abrams SEP hulls. Similarly, the upgrade of the M2 Bradley Fighting Vehicle to the M2A3 configuration will sustain production at UDLP's ground systems facility in York, Pennsylvania, through 2008. Low rate production will generate unnecessary overhead costs at production facilities, however.

The Army's 2.5-ton upgrade for National Guard units and the USMC's Logistics Vehicle System (LVS) programs reflect the emerging trend in the DOD to extend vehicle life through technology insertion, overhaul, and remanufacturing programs. The Army and the USMC have projected extended service programs for the HMMWV, the Medium Tactical Truck (USMC variant only), the 10-ton HEMTT, and the M772 Light Armored Vehicle. Original vehicle manufacturers view these programs as an opportunity to keep their production facilities operating. In the area of new procurement, both the Army and the

USMC plan to procure additional quantities of HMMWVs from AM General, FMTVs from Stewart & Stevenson, and MTRVs and HETS from Oshkosh, which will assist the firms in maintaining warm production lines.

The industry continues to aggressively pursue international sales for its systems, but overselling by domestic manufacturers after Operation DESERT STORM and increased global competition have saturated the marketplace. The expansion of the North Atlantic Treaty Organization (NATO) could provide new opportunities for U.S. and European Union manufacturers as new members upgrade their systems to NATO standards. Greece and Turkey are also in the market for a new main battle tank and associated support vehicles.

Further private industry consolidation may be on the horizon, but it appears that the DOD will attempt to ensure the continuation of adequate competition. Prime contractors should remain competitive, and existing contracts will enable them to survive for the next 9 or 10 years. The Army is the industry's primary customer, however, and its decision to postpone the identification of new LCV requirements dramatically affects the industry beyond the 2005 time frame.

In the Long Term

The long-range future of land combat systems remains ill defined. While the DOD and industry leaders await the results of current R&D and experiments with new force structure designs, they are unable to predict requirements beyond the current FYDP. A review of DOD programming documents revealed no new procurements or upgrades of the Bradley Fighting Vehicle and the Abrams tank beyond Fiscal Year 2008. The only certain major, long-term procurements are the projected purchase of 824 Crusaders, 1,013 AAVs, and follow-on procurements of the FMTV. Incremental procurements of the Grizzly Obstacle Breacher, Heavy Assault Bridge, and Heavy Recovery Vehicle are also planned during this period, but these quantities are not by themselves sufficient to maintain viable production rates at either GDLS or UDLP. If these companies are to maintain a warm production line, they must continue to employ flexible manufacturing techniques to produce, upgrade, or rebuild small volumes of technically diverse systems at lower costs.

In the area of R&D, the United States began work with the United Kingdom on a Future Scout Combat System with a projected fielding date of 2010. Development contracts were awarded to two international

consortia, with UDLP and GDLS as subcontractors in the program.¹⁵ In addition, government-sponsored research continues on advanced materials, armaments systems, and power train subsystems to support a future lightweight, mobile, and lethal combat system.

The challenges and the responses under consideration suggest the following long-term trends:

- Some U.S. firms are unlikely to survive if they must rely on domestic military requirements alone to keep them in production. A strong competitive position in the consolidated global market will determine which firms lead the industry in the next century.
- Without government support, production and development efforts appear inadequate to sustain the base of the two major domestic tracked vehicle producers. Without an increase in government demand, foreign military sales, subsidies, or a major merger or partnership with a foreign competitor, the United States could lose one of these firms in the next 30 years.
- GOCO and GOGO facilities continue to struggle for production opportunities, contributing to the burden of considerable excess capacity and associated overhead costs. An efficient and competitive structure for the next century will not evolve without further restructuring and downsizing of these facilities.
- If new technologies fail to materialize, the land force planners will probably revert to developing block upgrades to current systems.
- Corporate executives will remain reluctant to make capital investments in new manufacturing technology without a financial incentive to do so.
- Foreign military sales may provide an economic incentive to maintain otherwise underused production facilities. Keeping a competitive advantage in the international marketplace will require efficient manufacturing operations, continued commitment to future product development, aggressive global marketing, and some form of cooperative partnerships, however.

GOVERNMENT GOALS AND ROLE

Government shapes the defense industry not only through statutes that regulate commercial operations at home and abroad, but also through its role as the only domestic consumer of the product. In addition, government rigidly controls the issue of profit, either through acquisition and trade regulations, or through price negotiation. The combined influences of a complex regulatory environment and dramatic

reductions in federal spending have caused a deliberate consolidation of the defense industry under a few first-tier corporate giants supported by hundreds of smaller, lower tier companies.

Given the complex operating environment, how can the U.S. government best sponsor or support manufacturers to become more competitive in the world market? The government has the following avenues of support:

- Continue to support R&D by funding government research laboratories, giving tax incentives for industry-sponsored research, and expanding opportunities for cooperative industrial R&D initiatives.
- Provide incentives to recapitalize plant property and incorporate robotics, automation, computer design and processing, and other advanced technologies into the production process where feasible.
- Encourage contractors to provide life cycle systems support to help stabilize the industry and reduce the service support infrastructure.
- Support the defense industry by encouraging the sale of technologically tailored defense systems throughout the world market as a replacement for flagging domestic sales to the government.
- Encourage the development and exploitation of dual-use technology as a commercial advantage for business.
- Seek joint venture partnerships for future vehicle development.
- Review the statutory requirement for 50 percent of depot maintenance to be conducted in military depots.
- Continue to pursue acquisition reform, especially in the area of cumbersome government cost-accounting requirements.

CONCLUSION

The LCV industry is trying to preserve business viability while coping with dwindling production orders, flat procurement budgets, and a sole domestic customer relationship with the DOD. Against this backdrop, the LCV firms have developed a number of creative strategies to cope with uncertainty. The long-term decline in DOD procurement dollars precipitated an industry response consistent with collapsing markets. Domestic and international manufacturers have been participants in horizontal integration via mergers and acquisitions that resulted in a smaller number of larger, more globally oriented firms. Similarly, to ensure control of profitable elements in the subvendor base,

some companies have responded by vertically integrating the production of subcomponents into their own processes.

To maintain a warm production base and sustain ongoing business operations, the LCV industry is waging a three-pronged strategy. First, manufacturers have adapted their manufacturing processes to accommodate low-rate production of high-mix end items. This action preserves plant capacity and a highly skilled workforce. Second, firms pursue unit cost reduction programs aggressively at every opportunity to sustain returns on investment and position themselves for future competition. Third, the industry is attempting to develop new business enterprises that capitalize on existing and expanded core competencies.

On balance, the LCV industry is managing the stressful transition from a Cold War growth posture to the complex realities of post-Cold War frugality. This “holding action” is successfully preserving the LCV industrial base for the near term. Without either a consensus for new vehicle manufacture or a robust modernization program of legacy fleets, however, the industry may not retain a viable manufacturing capability in the future.

¹ Watervliet Web Page, <http://www.wva.army.mil>, May 12, 1999.

² Jacques S. Gansler, *Defense Conversion* (Cambridge, MA: MIT Press, 1998), p. 10.

³ “The Market for Tanks,” *Forecast International/DMS*, May 1998, p. 2.

⁴ “The Market for Light Tracked Vehicles,” *Forecast International/DMS*, July 1998, p. 1.

⁵ “The Market for Light Wheeled Vehicles,” *Forecast International/DMS*, February 1999, p. 2.

⁶ “The Market for Tanks,” p. 2.

⁷ “The Market for Tanks,” p. 4.

⁸ “The Market for Light Tracked Vehicles,” p. 1.

⁹ “The Market for Light Tracked Vehicles,” pp. 1–2.

¹⁰ “The Market for Light Wheeled Vehicles,” p. 2.

¹¹ Transforming Defense—National Security in the 21st Century, National Defense Panel Report to the Secretary of Defense, December 1997, p. 77.

¹² Based on interviews with various industry representatives. Depending on the lead-time to stockpile raw materials and subassemblies, recruitment, and training of workers, and assembly or expansion of design and production supervisory teams, estimates to restart end-item production range from 6 months to upwards of 2–5 years.

¹³ Based on interviews with various industry representatives.

¹⁴ Douglas Menarchik, *Powerlift—Getting to Desert Storm: Strategic Transportation and Strategy in the New World Order* (Westport, CT: Praeger Publishers, 1993).

¹⁵ "Ministry of Defence: Britain and United States in Joint Battlefield Reconnaissance Programme," *M2 Communications Ltd, Coventry*, July 9, 1998, *Proquest*, June 8, 1999.