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Industry Study**

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*Weapons Industry***



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ABSTRACT: The United States (U.S.) government faces many dilemmas as a result of accelerating national debt, not the least of which is how to provide and pay for U.S. national security. Anticipated significant reductions in overall defense spending and military withdrawals from Iraq and Afghanistan over the next five to ten years will greatly impact the entire defense industrial base in the United States. The weapons industry could experience further consolidation and reduced capacity as the Department of Defense will most likely decrease weapon inventories, extend lifecycles, reduce new acquisitions and accept more risk with fewer manufacturers in mature, low tech weapons manufacturing. This study examines several key factors in preserving a domestic weapons industry sufficient to support U.S. national security objectives now and into the future to include development of a defense industrial policy, reduction of unnecessary export controls and enhancement of long-term research and development.

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INTRODUCTION

The response to the attacks of September 11th, 2001 has spurred a significant increase annual defense spending, which has cumulatively almost doubled the appropriated defense budget of the entire 1990's, without including the billions of dollars of supplemental appropriations approved for sustaining efforts in Afghanistan and Iraq. As a result, increased demand for U.S.-produced defense-related products bolstered the domestic defense industrial base to its current condition; however, as U.S. operations in Iraq come to a close and involvement in Afghanistan could begin to taper by mid-2011, the entire defense industry is anxious over an anticipated and potentially sharp downturn in overall defense spending.

Given America's current economic condition and long-term national debt obligations, every aspect of discretionary spending, including defense, will come under intense scrutiny. As stated by Defense Secretary Robert Gates in his speech delivered on May 8th of this year, "the Defense Department must take a hard look at every aspect of how it is organized staffed and operated – indeed, every aspect of how it does business. In each instance we must ask: First, is this respectful of the American taxpayer at a time of economic and fiscal duress? And second, is this activity or arrangement the best use of limited dollars, given the pressing needs to take care of our people, win the wars we are in, and invest in the capabilities necessary to deal with the most likely and lethal future threats?"¹ As we venture into the next decade, new defense-related spending priorities will be established which will change the shape of the defense industry. The Department of Defense (DoD) must develop and communicate of a comprehensive defense industrial policy with the goal of maintaining very high levels of reliability of supply of quality products at best cost. This would help to ensure that the shape of the defense industry in the future supports the needs of U.S. national security.

With an anticipated decrease in overall U.S. Department of Defense (DoD) demand for military hardware including weapons, many weapons manufacturers have targeted foreign markets and pinned their hopes on Foreign Military Sales (FMS) and Direct Commercial Sales (DCS) programs to compensate. However, strict U.S. regulations pertaining to weapon sales, protectionist foreign governments and competition from international firms may prohibit some foreign markets from offering the type of "soft landing" that producers of defense products are hoping for. The U.S. government should closely examine export restrictions with the goal of protecting against the diversion of only advanced defense technologies to existing or future enemies of the U.S. Additionally with an expected decrease in new acquisitions from DoD, resources must be increased for basic research on technologies applicable only for the defense sector and are of little interest to the civilian economy.

In the following report, we will *define the weapons industry* and examine the *current conditions* to include government initiatives, dynamics of the industrial base, and the factors of production. We will then review the *challenges* faced by the industry, to include the affect of decreasing demand from DoD, strict export controls, weapon modernization, and developing technologies. Next, the report will examine the future *outlook* for the weapons industry over the next five to ten years. The report will examine *government goals and roles*, focusing primarily on the ends, ways and means of government regulation and their affects on the weapons industry. The report will provide some recommendations in areas that need development, change, or status quo in government policy. Lastly, the report addresses four issues facing the weapons industry: a soft landing for the weapons industrial base; the state of the U.S. small arms industry; an interagency approach to non-lethal weapons; and research and innovation in the weapons industry.

THE INDUSTRY DEFINED

In the broadest sense, the defense industrial base is the collective manufacturing or technical enterprises whose principal products support the defense of a nation. The Industrial Analysis Center of the Defense Contract Management Agency (DCMA) subdivides the defense industrial base into specifically defined sectors. DCMA defines the weapons sector of the defense industrial base by weapon type to include only cannons, man-portable weapons and mounted weapons.² Even though a weapon is defined as any instrument or tool used to incapacitate, injure or kill, devices such as tanks, ships, and aircraft in and of themselves; and nuclear, biological or chemical weapons are not included in the weapons industry. However, the weapons industry continues to evolve to include developments in “smart” weapons, strap-on accessories such as optics and sensors, unmanned delivery systems, Non-Lethal Weapons (NLW), directed energy weapons and instruments of cyber-warfare.

The 2010 ICAF weapons industry study group focused on the following categories – *small arms, ammunition, optics and sensors*. We also took cursory look at the emerging field of Non-Lethal Weapons. The United Nations defines *small arms* as those weapons manufactured to military specifications and designed for use by one person. This can be more broadly categorized as weapons intended for use by individual members of armed or security forces. This includes revolvers, self-loading pistols, rifles and carbines, submachine guns, assault rifles, and light machine guns.³ *Ammunition* includes explosive projectiles for small arms, other weapon system projectiles and missiles.⁴ *Optics and sensors* include thermal imagery, image intensification/night vision and image magnification devices.

The weapons industry is not only defined by the primary products manufactured, it is also defined by the market environment that influences it. The market for each product category is unique in the current condition, challenges, outlook and the role of government based on the supporting domestic industry, technological maturity, level of competition and importance to national security. Some segments of the weapons industry include dual-use technologies, such as firearms, and are supported by a viable domestic commercial market with many benefits. Other segments of the weapons industry do not have dual-use applications, such as shoulder-fired small arms, and are supported solely by military demand. Some segments are technologically mature while others provide developing defense technologies, such as night-vision technology, and it is in the best interest of the government to preserve this technological advantage from any potential enemy.

This industry study is primarily concerned with weapons manufactured and deployed in defense of the United States with the Department of Defense its largest consumer. It does include weapons used by the military as well as by law enforcement personnel to enforce federal, state and local laws. Domestic and foreign weapons manufacturers compete to meet this demand based on cost, quality, quantity and price. Government regulation heavily influences the shape of the weapons industry and will be discussed in this study.

CURRENT CONDITION

The source of America’s contemporary military and geopolitical dominance lies in the substantial government investment to obtain superior weapon systems in defense of persistent transnational threats. Despite this modern advantage, defense analysts believe “the threat level currently faced by the United States is the highest at any time since the Cold War.”⁵ Vast

differences in global ideologies, “population growth, globalization, and climate change appear to be putting growing pressure on the planet’s resources, increasing the prospect of international conflicts over resources in future decades.”⁶ While these prospective global conflicts would challenge the capacity of the weapons industry, the U.S. domestic weapons industry is currently positioned to meet these challenges. The following section will define the current condition of the weapons industry in the context of government initiatives, the dynamics of the industrial base, as well as factors of production.

Government Initiatives

In general, government policy makers attempt to balance desires for national autonomy with the benefits of international engagement, considering resource constraints and competing strategic national priorities. An entirely self-sufficient weapons industry affords a state both foreign policy and economic autonomy in addition to the ability to prevail militarily.⁷ However, a worldwide view of the weapons industry spreads the sources of goods and services well beyond what would otherwise be a much narrower group of domestic suppliers and at a lower cost. The U.S. government must balance these two opposing, yet valid, viewpoints.

In the United States, the weapons industry is heavily influenced by monopsonistic market forces and U.S. government budget constraints. Since World War II, the American defense budget is the largest discretionary element of the overall federal budget as well as the largest defense budget in the world. Domestic weapons manufacturers have largely met this demand, and have slowly expanded into foreign markets. However, as countries fight to recover from the global financial crisis and accommodate increasing levels of entitlement obligations, overall defense spending in real terms will inevitably decline, even in the United States, as early as the 2011 fiscal budget, which will greatly influence the weapons industry.⁸ With governments worldwide beginning to procure fewer large weapon systems, competition in the weapons industry will increase, putting pressure on current weapons manufacturers to stay in business. The need for a coherent U.S. domestic industrial policy to effectively manage future weapon acquisitions is increasingly paramount.

America’s defense industrial policy is currently facing intense debate between the Department of Defense and Congress regarding the health and competitiveness of its domestic industry due to pressures to reduce defense costs and pressures to boost the economy. In addition to recent scrutiny over “inherently governmental functions,” the 2010 Quadrennial Defense Review advocates reforming acquisition business practices to improve rapidity, maintain domestic supply chain competencies and improve U.S. competitiveness in the global defense export market.⁹ The ongoing debate surrounding foreign suppliers’ contribution to the domestic industrial base recognizes that, historically, protectionist behaviors are costly in terms of international competitiveness and foreign relations with coalition partners.¹⁰ Adding complexity to this debate, the “Annual Industrial Capabilities Report to Congress” highlights that America has a vested interest in items essential to national security while ensuring “robust competition... avoiding monopolistic pricing...and mitigating the risk of cost growth.”¹¹ To manage these objectives, Congress imposes significant externalities upon industry participants at a sizable cost for compliance. Congressional regulation attempts to establish a level playing field for U.S. manufacturers by creating barriers to market entry for foreign manufacturers to enter the U.S. market; however, at the same time regulations restricting dual-use technology exports hamper U.S. expansion into foreign markets. In comparison, defense industrial policies

in Singapore and South Korea have developed a small number of government-designated domestic defense companies, deemed critical to national security, to supply their military weapons systems while procuring other readily available military platforms from the foreign market. These selectively competitive environments have mitigated many of the challenges being debated in the United States. However, as these states expand domestic competition while trying to enter the global export market, their industrial policies will likely face similar challenges to the United States in the future.

Dynamics of the Industrial Base

The modern U.S. weapons industrial base is an amalgamation of private firms of all sizes, with both domestic and foreign origins, with a few government-owned, contractor-operated (GOCO) enterprises that inseparably intertwine industrial-age systems with advanced technologies. Specialized engineering resources are required to develop these complex systems in order to prevent obsolescence throughout each product's lifecycle.¹² Firms compete predominantly on price, quality and product differentiation; and the intensity of competition in the United States has resulted in decreased profit margins in the private industry below that of commercial levels.¹³ Firms are either becoming more specialized, seeking diversification through mergers in other complementary domestic markets or pursuing entry into foreign markets to subsidize declines in revenue. For example, the five remaining American defense conglomerates that have dominated the domestic weapons market, subsequent to the 1993 government-influenced industry consolidation, are increasingly performing more system integration and less component development. Conversely, smaller businesses, under \$500M, control the small arms, shoulder-fired rockets and non-lethal weapons segments, frequently as a sole supplier. Even smaller, boutique firms are increasingly taking a leading role in emerging technologies as evidenced by the current trend in night vision optics technologies.¹⁴ Furthermore, the American government has, through GOCO arrangements, reduced the entire domestic production capability for munitions propellant into a single facility and has retained control over the largest small-caliber ammunition production facility in the world.¹⁵ Due to the continued reduction in domestic component capabilities combined with reliance on sole-source suppliers, "surge would be considerably slower today than [sic] it was during World War II."¹⁶ This phenomenon already occurred in 2009 as multiple armed conflicts and an increase in the domestic demand for small arms resulted in widespread ammunition shortages, in particular .50 caliber ammunition.¹⁷

Despite trends of consolidation, the preponderance of the American weapons industrial base remains relatively healthy, particularly in segments such as small arms, where a thriving firearms commercial market, unique to the United States, augments cyclical defense spending. With a supporting commercial market, further consolidation in the military firearms market would not present a high risk to national security. However, further consolidation in key markets, such as night vision and image intensification technologies, will threaten the domestic competitive environment; increase the dependence upon foreign suppliers for national defense; and present a higher risk to national security.¹⁸

The Center for a New American Security describes this emerging transformation from complete self-sufficiency toward a more global contribution as a "Hub Network," which would imbed foreign components onto nearly every American platform.¹⁹ Evidence of this scenario is currently being exhibited in the on-going competition for the U.S. Air Force's KC-X tanker

program between the large domestic firm, Boeing, and the European Aeronautic Defense and Space Company.²⁰ Competition from foreign suppliers can be mutually beneficial, with limited risk to national security, since it would improve quality and/or reduce price; and as long as the foreign supplier establishes a manufacturing footprint within the United States, the arrangement would also benefit the U.S. economy. While this trend away from self-sufficiency receives significant attention in America, states with smaller weapons industries, such as Singapore, are more accustomed to integrating foreign-produced weapons systems into their force structure without much risk to their national security.

Factors of Production

Fierce competition exists among the increasingly scarce factors of production supporting the weapons industry, such as financial capital, human capital and technology. In addition to commercial capital being harder to obtain due to the financial crisis, defense contract funding is also scarce due to the aforementioned reduction in government procurements and defense budgets. This overall scarcity in obtaining capital, combined with high financial barriers to entry, could stifle innovation by limiting an entrepreneur's ability to enter the weapons industry with a new idea to compete with traditional powerhouses. The U.S. government needs to continue programs that provide capital to small businesses to preserve new innovation and growth.

While the existing labor force supporting the weapons industry currently appears adequate for the large demand, firms have begun strategizing how to deal with a rapidly shrinking pool of scientists and engineers as new college graduates worldwide are lured to more lucrative careers elsewhere. Given the classified nature of most weapon systems, supplementing this shortfall with appropriately credentialed foreign citizens presents a unique challenge not faced by non-defense related industries in the United States. Research in South Korea corroborates that these challenges are not uniquely American issues, particularly regarding maintaining a capable technical workforce. However, Singapore, where the quantity demanded for such highly technical labor is relatively low, addresses the problem with focused and aggressive education programs at all levels coupled with providing higher compensation for qualified engineers and scientists.

Technology, the last factor of production, is essential to sustaining a state's strategic advantage and frequently requires government investment to advance such interests. As the U.S. Army has observed, private firms invest comparatively little in high-risk or long-term research "because there is no linkage to acquisition programs at the outset of research."²¹ Private industry innovation is typically limited to developing near-term product substitutes or marginal process improvements such as "Lean" manufacturing to improve production capacity. For example, ammunition throughput in the United States and South Korea has been improved through process improvements but cannot exceed existing capacity of the aging equipment utilized in the process until the government authorizes new capital expenditures.

In conclusion, the global weapons industry is facing an increasingly complex intersection of geopolitical, regulatory, fiscal and industrial considerations. Each state's foreign policy autonomy lies in its ability to successfully navigate this uncharted strategic climate. While the industrial base in the United States is currently positioned to meet these existing challenges, the opportunities and consequences of surmounting future challenges are even greater for the world's largest producer of weapon systems. The path to ensuring America's military

superiority for future generations undoubtedly includes implementing a coherent domestic defense industrial policy.

CHALLENGES

The weapons industry faces significant challenges due the varying nature of its market. Some segments are supported by both commercial and military customers, while some rely solely on military customers. The Federal Government, specifically DoD, is by far the largest consumer of products in this industry. Consequently, even the largest companies in this industry rely on DoD to provide them with the majority of their revenue. The past eight years have seen very robust times for the weapons industry, but with the economic crisis of the last two years and the winding down of the conflict in Iraq, overall demand within the industry appears to be declining. Therefore, there are four major challenges the weapons industry is facing.

Decreasing Demand from DoD for Weapons and Ammunition

The DoD budget will not increase in real terms for the foreseeable future, and in all likelihood, it will decrease. Consequently, DoD will be looking for ways to save money. Acquisition of new weapon systems and the ammunition needed to support them are most likely targets for funding reductions. Weapons industry leadership is quite aware of this reality. Most company leaders speak of trying to create a “soft” versus “hard” landing when the reductions actually happen. Diversification into different markets or acquiring smaller companies within niche markets to add complementary products are commonly viewed as a path toward a “soft landing.” Additionally, many companies will look at increasing the export of current products as a way to survive. However, foreign markets are limited to those countries without a government-protected domestic industry that can produce substitutable goods. Unfortunately, even these foreign markets are already very competitive. U.S. companies will have to compete on quality and price in order to gain market share in both domestic and foreign markets.

Strict Export Controls

Many U.S. companies have products they would like to sell in foreign markets where they are competitive on quality and price and steal market share away from foreign manufacturers. U.S. weapons are (in most cases) technologically preeminent and of a higher quality. However, the U.S. system of export controls for weapons is among the most restrictive in the world. There is support within the current administration for reform of the export control system understanding the need to market U.S. weapons overseas while protecting critical defense technologies. Secretary of Defense Robert Gates has even called for streamlining the export system by placing decision authority under a single (new) government agency, rather than the convoluted system that has developed over the past 40 years. Export controls should be limited to only those critical technologies, as evaluated by the Department of Defense, and all other weapon products should be allowed for export.

Weapon Modernization

While there have been periodic calls for the replacement of standard-issue carbines and pistols with more modern and reliable weapons, replacement of the entire inventory would be very expensive and would necessitate some level of retraining. Similarly, there has been a push for an upgrade in caliber (from 5.56mm and 9mm) to improve the M-4 and M-9 lethality; however, this would involve significant effort and expense to adjust the ammunition production facility at Lake City and restocking of military stores of ammunition across the globe. Additionally, there is the fundamental question of compatibility with other NATO forces. Therefore, it seems impractical to replace these weapons, or upgrade calibers, within the next two or five years. It's much more likely that the Army and Marines will introduce incremental upgrades to the M-4 and M-9, including more lethal ammunition developed with the assistance of commercial manufacturers.²² The primary challenge for DoD is to determine when modernization needs to occur; modernization too early in a product's lifecycle is costly and unnecessary.

Developing Technologies

While non-lethal weapons (NLW) are firmly entrenched in the U.S. law enforcement community and often purchased by private citizens for personal defense, their adoption by military troops has been sporadic. There is currently no overarching doctrine within DoD for the employment of NLWs in a combat environment.²³ There have been some limited successes with NLWs when employed by highly-trained troops with clear Rules of Engagement, but so far this has not resulted in the development of new tactics, training, and procedures service-wide. New technologies will repeatedly present the question of when to acquire and how to integrate into military doctrine, training and practice.

OUTLOOK

Projections for future years in defense spending by the United States portend a significant downturn with commensurate drops in defense-related procurement.²⁴ Decreases in defense spending will be prompted by a number of factors, including the drawdown of forces in Iraq as required by the November, 2008 Status of Forces Agreement (SOFA) with Iraq, coupled with efforts to address the significant annual deficit and overall debt levels of the United States. As Michael J. Bayer, chairman of the Defense Business Board recently described, "...the growing mountain of debt that is going to trigger the government to act..." will bring about a significant reduction in U.S. defense spending.²⁵

Projections by the Congressional Budget Office (CBO) "...based in part on the President's 2010 budget request and budget justification materials..." along with analysis of announcements made by the Secretary of Defense, conclude that defense resources will drop to approximately 3.1% of GDP by 2013 from current levels of approximately 4.5% of GDP.²⁶ In dollars, this projection sees a drop from 2009 procurement of \$194B to \$177B by 2013, a reduction of just over 8%. This conservative estimate is a good starting point for determining the most probable level of reductions and its impact upon the defense industrial base and the weapons industry. However, considering historic underestimation of projected government spending, especially for new entitlement programs, and previous defense spending downturns, a

20% defense spending reduction is on par with current projections for the next five years.²⁷ Owing to the comparatively inflexible nature of manpower costs and without significant troop level reductions, these spending cuts will be magnified in their effect on operations and maintenance funds, and particularly on acquisition. Even here, the Army and Marine Corps face major recapitalization costs for many years just to replace items as relatively simple as trucks that have worn out through years of use under harsh conditions, much less acquire major new weapon systems.

This significant downturn in defense procurement spending will have major negative ramifications for the U.S. defense industrial base as the commercial sector attempts to adjust to reduced business opportunities. It can be expected that the series of consolidations, mergers and acquisitions that were interrupted by a decade of conflict in Afghanistan and Iraq, will resume with the onset of future defense cuts. Some smaller companies are likely to choose to not compete in certain segments of the weapons market, or even withdraw from the defense market entirely, creating more risk in supporting every national security objective. Larger companies may have to focus their efforts on long-term life cycle support contracts just to survive. Without any kind of government intervention, the United States may completely lose niches of the defense industrial base for which there is no civilian counterpart and rely more on foreign weapons manufacturers.

Recognizing the likelihood of significant reductions on U.S. defense spending, most weapon industry leaders who met with the ICAF weapons seminar in the spring of 2010 intend to expand their overseas sales to offset the expected shrinking of the domestic market. This expectation is understandable given the potential for future arms races in both East Asia and Middle East countries due to the rise of China and the evolving threat of an apocalyptic nuclear-armed Iran respectively. However, significant export controls hobble U.S. firms when competing for foreign sales. The industry will need the support of the current administration and Congress to reduce restrictions on exports of U.S. weapons systems, understanding the need to protect certain advanced technologies such as night vision, or avoid export constraints entirely by off-shoring weapons systems production.

GOVERNMENT GOALS AND ROLE

The United States is engaged in a long war against transnational Islamic terrorists that could extend for many years into the future, similar to the Cold War, and needs to maintain pressure on this persistent adversary. Additionally, the United States needs to maintain those traditional military capabilities necessary to respond to possible future threats from actively or potentially hostile nation states. To fulfill these two responsibilities, Congress will need to provide adequate funds to the Department of Defense.

A primary government role with respect to the weapons industry is to ensure policies and regulations establish and preserve an environment in which industry, public or private, can sufficiently resource military infrastructure in support of national security objectives. In markets that have uniquely military products, the U.S. government, as its main customer, must present a clear industrial policy to ensure industry is properly structured to meet current and future demands. The Defense Department must be clear on military requirements such as when a new weapon system is truly needed; or how much accuracy, lethality or range is absolutely necessary. Depending on the maturity of the technology, the U.S. government should decide on how much

competition is most beneficial with respect to cost. And lastly, based upon best estimates, how much production surge capacity or product stockpiling is required.

However, government actions can constrain industry by limiting competition for too long, placing too stringent export controls, growing complex military specifications that do not allow for innovation, and changing demand signals mid-stream. Regulatory objectives should focus on maintaining our technological advantage, such as the highest generation night vision technologies, with respect to current or potential enemies; ensuring quality products by rewarding innovation and quality, as in the small arms industry; and guaranteeing a robust capacity to meet most probable demands, as in the ammunition industry, while preserving American economic strength through such legislation as the Buy America Act. Current regulatory practices may actually weaken the weapons industry and dampen innovation. Fortunately, the military weapons industry benefits greatly from a highly competitive commercial small arms sector, which provides DoD with a source of innovation and a robust surge capacity. A complementary commercial industry insulates the defense industry as a whole from the worst potential effects of counterproductive regulations. Maximizing dual-use technology and scanning other emerging technologies in the commercial sector for applications to national defense are ways to continue this healthy relationship.

Ends, Ways, and Means of Government Regulation

An examination of the current National Security Strategy and National Military Strategy is necessary to evaluate the sufficiency of the weapons industry as a whole. The most current version of both of these documents dates back to the previous administration; however, it is possible to determine the outlines of the current administration's policy direction by looking to the recent Quadrennial Defense Review (QDR) and various public pronouncements from senior administration officials, notably the Secretary of Defense, Robert Gates.²⁸ From these, it is clear that despite future defense budgets being under extreme pressure, the administration wants to maintain a technological edge while cutting costs and making it easier to share the fruits of our defense industry with our allies.

The other key player in developing the U.S. government's regulatory regime is the Congress. Together with the administration, it works to manage the tension between national security, industrial capacity, economics and stewardship of taxpayer resources by imposing regulations on the defense industry. Among the major purposes of these regulations are:

- *To control technology transfer and maintain a comparative advantage over potential enemies through export controls, codified in the International Traffic in Arms Regulations (ITAR).*
- *To ensure products are manufactured to rigid specifications, guaranteeing that they will perform as required. This is done through the establishment of strict military specifications, applied through the Defense Federal Acquisition Regulation System (DFARS).*
- *To protect American jobs and economic prospects by ensuring that government money spent on defense products benefits Americans with measures such as the Buy American Act.*
- *To protect critical U.S. firms and assets from undue foreign influence, through the Committee on Foreign Investment in the United States (CFIUS).*

Unfortunately, the regulations promulgated to ensure national security, quality, and economic stimulus often work against cost-efficiency and innovation, two of the main goals of the current administration.

Results of Regulation on the Market

The defense small arms market is a market with a mature product. This market is a monopsony, and the customer, the U.S. government, holds a large stockpile of complementary goods such as ammunition. This has the effect of “locking in” the current technology. These factors, along with high start-up costs, combine to limit the number of suppliers in the market and potentially stifle innovation. Innovation is provided by niche manufacturers primarily in optics, sensors or other “accessory” products that amplify the accuracy, lethality or range of the small arms. The barriers to entry in the small arms market are even more pronounced due to comprehensive regulations imposed by its main customer, the U.S. government.

Government regulations do not ensure that the weapons market benefits U.S. domestic manufacturers, neither do they help U.S. manufacturers compete in international markets, nor help spread useful technologies to our allies. A case in point is the restriction placed on night vision technology sales to our closest allies, significantly limiting nighttime combined operations. This is acknowledged in the most recent QDR, which states: “Today’s export control system is a relic of the Cold War and must be adapted to address current threats. The current system impedes cooperation, technology sharing, and interoperability with allies and partners.”²⁹ Other charges against our export control regime include inadequate enforcement mechanisms, too much complexity, and delays that hinder competitiveness.

It is clear that there is room for improvement of defense industry regulations affecting the entire weapons industry. The government can take measures to ensure the long-term comparative advantage of U.S. small arms manufacturers and ensure a robust small arms industry. While the government wrestles with the various competing demands and the large array of stakeholders involved, it will be important to protect one unique aspect of the defense small arms sector – that is, the presence of a strong commercial counterpart that serves as a source of innovation and untapped capacity.

Recommendations

The weapons industry is generally considered a mature market in the United States. Although there is some innovation seen, as in the advanced combat assault rifle, most industry firms are competing on price, quality and product differentiation. Government policies have a large influence on how competitive forces shape the market domestically and internationally, on technological innovation, and on the U.S. economy.

1. Reform Export Controls. Government intervention should be minimized with regard to exports, understanding the need to protect against the dispersion of advanced technologies to current or future enemies. Penetration into new foreign markets is an effective company strategy during periods of accelerating revenue, and is required for survival during periods of declining revenue. It is very likely that defense companies will see significant decreases in government purchases over the next three to five years, and expansion to foreign markets may be required for their survival. Government intervention through ITAR must be streamlined and reduced. The

current system has three major failings: lack of removal of items from the ITAR list which no longer provide our troops with a tactical advantage; an antiquated, paper-driven reporting system; and the laborious requirement for sequential sign-off by multiple organizations within the federal government.

A certified method for removing items from the ITAR must be created. While it is very easy to get on item on the ITAR, under the current processes it is very difficult to remove an item. This results in an inability to sell old, even by several-generations, night vision equipment to our allies in Great Britain and Australia. Additionally, the negative outcomes of a cumbersome system include failure to open legitimate markets for American corporations essential for the weapons industrial base, poor support of our allies who are fighting alongside our soldiers using antiquated equipment, and the projection of a protectionist U.S. government trade philosophy with our overseas partners. ITAR reform should therefore involve streamlining the reporting infrastructure and producing a single IT system for companies requesting ITAR clearance. Lastly, a single point of contact should be created within one of the federal agencies comprised of representatives from all concerned government stakeholders. This would provide a one-stop approval authority for ITAR clearance.

2. No Changes to the Buy American Act. It is reasonable that firearms used in combat by U.S. troops be manufactured in the United States, and that the principal vendor of all component parts be based in the United States. The policy is flexible enough to allow even foreign-owned companies to compete in the U.S. market under certain conditions. The Act does not preclude a foreign company from investing in this market by building a U.S.-based factory, hiring American workers, and purchasing from American subcontractors. In fact, though a percentage of the revenue thus generated is then taken overseas, it is advantageous to the firearms industry because of the benefits from increased competition. As an example, Colt Defense was forced to innovate and create better products in the fully automatic rifle market in order to compete with FN Manufacturing, LLC. The end result is a better automatic weapon for U.S. soldiers. Without the increased pressure from external competition, improvements in fully automatic rifle technology would likely never have occurred. Additionally, factories located in the United States but owned by foreign governments are available for U.S. government takeover in the event of a national mobilization, eliminating the risk that we would lose a large portion of our industrial base in a time of national crisis. The Buy America Act should not be changed to exclude this mutually beneficial arrangement.

3. Support Research and Development and Seek Innovation. One area where government intervention should be increased is in the support for long-term research and development. Corporations in the weapons industry have a fiduciary responsibility to their shareholders or their private owners to produce a profit. This requirement is essential to remain viable in the current business environment, for the employment of a strong heavy machining workforce, and for the maintenance of factories, distribution lines and supply channels. Companies typically project a strategic plan at most three to five years into the future. While this is appropriate long-term thinking for a company, robust research and development requires a 15-20 or even 30-year horizon. The U.S. government is positioned to provide financial support for research and development for long-term projects on technologies that constitute unique niches for national defense and are of little interest in the commercial sector. In conjunction with our universities, but also working with industry, the government can partner to produce (and has had spectacular successes in this regard in the past) future offensive and defensive capabilities in support of our National Security Strategy. Additionally, the Defense Department must continually scan the

commercial industry for innovations that could have military defense applications. Attention should be paid on civilian technologies that can be utilized by our forces. Developing areas such as robotics, automation and information technology networks are all examples of how vibrant commercial innovation can benefit the defense industry as a whole.

4. Preserve Dual-Use Commercial Sectors. Government regulation is also at an appropriate level in the area of private firearms ownership, and care should be taken to avoid government regulation which constrains this market segment. A benefit of the Second Amendment is that the military small arms requirement is complemented by the robustness of a commercial small arms market. However, several factors could limit future benefits including significant and persistent restrictions on commercial sales, successful class-action litigation against firearms companies for individual crimes, or a massive takeover of U.S. firearms production through foreign direct investment. The greatest risk to a healthy commercial market for firearms and the resultant preservation of both sides of the firearms industrial base would involve national restrictions on private gun ownership. Recent legislative and judicial actions seem to indicate a trend toward stability of the principle of lawful private gun ownership. Legislative changes would have to be far-reaching in scope and national in geography to significantly impact commercial sales, which seems unlikely in the foreseeable future.

ESSAYS ON MAJOR ISSUES

Essay 1: Soft Landing for the Weapons Industrial Base

Continued United States withdrawal from Iraq and the announced planned pullout from Afghanistan beginning in 2011 foreshadow significant reductions to defense spending. Current projections from the Congressional Budget Office (CBO) estimate cuts of at least 8%.³⁰ However, considering accelerating national debt levels and extrapolations from previous defense spending downturns post-conflict point to projected cuts of up to 20%.³¹ In the absence of a comprehensive partnered approach between both industry and the Department of Defense (DoD), the impact of these projected cuts on the weapons industrial base may significantly reduce the U.S.' ability to successfully prosecute the next war. What steps can industry and DoD take to better prepare the industrial base for a so-called "soft landing"?

Since World War II, the United States has undertaken four major defense drawdowns. Each one had its own peculiarities driven by contemporary circumstances. In the aggregate however, some commonalities of success can provide valuable lessons today to prepare the weapons industrial base for a successful soft landing. These lessons include expanding exports, seeking diversified business models, and consolidation. For DoD, preparations include developing a long-term acquisition plan that is coordinated with industry focusing resources on critical technology while accepting some risk on the lower technological end of weapons manufacture and development. Taken together, applying these lessons will be critical in helping ensure the nation's weapons industrial base remains viable and ready for the next war.

For the weapons industrial base, expanding exports can help maintain operational assembly lines along with the trained workforce critical to continued technological development. This is particularly true, restrictions permitting, for technologically sophisticated products such as the Patriot Missile System. Items such as the Patriot cannot be easily replicated by indigenous weapons manufacturers abroad therefore offering hope of expanded exports for manufacturers. Raytheon, prime manufacturer of the Patriot, is successfully exporting billions of dollars worth

of the Patriot.³² When International Traffic in Arms Regulations (ITARs) permit, export of weapons systems can help offset reduced domestic demand in the United States.

However, exports are not a panacea. Significant obstacles face the weapons industry as it tries to expand exports. Obstacles to significantly growing exports include aggressive application of ITAR by the U.S. government, protectionism abroad as nations seek to preserve their own domestic weapons industrial base, and a lack of market scale abroad. Reexamination of U.S. ITAR policies and procedures, oriented toward expanding U.S. weapons exports, would facilitate greater U.S. weapons exports, particularly for higher-tech products. However, the industry will most likely not be able to export its way out of the downturn. With the U.S. comprising some 50% of the world's defense spending already, the remaining worldwide demand for weapons is diffused. While increasing exports can help achieve a softer landing, it is not the sole solution.

In anticipation of the impending defense spending downturn, many weapons industry members are seeking diversification of their business base. Some companies, such as Boeing, already diversified during the previous downturn in the 1990's, focus approximately one-half of their business on defense-related items with the other half focused on counter-cyclical commercial aviation. This model worked well for Boeing in the 1990's and may serve as an example for other firms looking toward the future. Smith and Wesson, another example, recently acquired a home and business security firm diversifying their business base while leveraging the company's reputation for personal protection (i.e. firearms). Whether this will prove to be counter-cyclical to their law enforcement, commercial and military weapons sales is yet to be seen. Taser, manufacturer of "neuro-muscular incapacitation" weapons, is another example of a weapons industry diversifying their business base through their expansion into production of multi-media evidence storage devices intended for use by law enforcement and possibly the military.³³ All of these are possibilities for the weapons industrial base to seek diversification of their business base prior to feeling the ill-effects of DoD's impending spending downturn.

A hallmark of previous defense downturns has been industry-wide consolidation. This was most acute during the 1990's when defense procurement had dropped some 69% from levels 13 years earlier.³⁴ What, in 1980, had been an industry with over 70 very large and well-known companies (e.g. Hughes, Rockwell, Fairchild) comprising much of the industrial base had, by 2004, been absorbed, reduced or eliminated down to five major corporations. In 2005, these five companies received 26% of DoD's prime contracts.³⁵ Given this, there isn't much room for further consolidation amongst larger firms. There is some room for acquisition consolidation by larger companies of smaller capitalized firms competing in similar, but niche, markets (e.g. larger aerospace firm acquiring manufacturers of small Unmanned Aerial Vehicles (UAVs)). Mergers and acquisitions of this sort would help provide stability to niche products extending their potential for being produced during future conflicts while providing acquired technology for the larger firm(s).

Ultimately, a successful weapons industrial base soft-landing will not be achieved without DoD-level planning. This should include development of a long-term acquisition plan that is coordinated with industry focusing resources on critical technology while accepting some risk on the lower technological end of weapons manufacturing and development. Eisenhower's "New Look" program accomplished this during the drawdown of the 1950's, focusing significant resources to high-tech research and development while downsizing lower-tech weapons acquisition.³⁶ This postured the United States well for the 1960's conventional arms build-up,

the space race, and dissemination of DoD technological innovation into the commercial sector (e.g. micro-circuitry). The first key step to this preparation is development of a published long-term plan by DoD.

DoD's longer-term acquisition plan is typically outlined in the Future Years Defense Program (FYDP). Failure by the current administration to publish the FYDP with the 2010 budget has left the weapons industrial base guessing as to the long-term acquisition plan for DoD. This must be remedied quickly. Publishing the FYDP accompanied by a National Security Industrial Vision as called for by the Defense Science Board in 2006 are both critical starting points for partnering with industry for a soft-landing.³⁷

This vision and subsequent partnering with industry, accomplished now before the full spending downturn impacts the industrial base, will provide firms time to build strategies for continued survival while further enabling them to focus internal research and development funds towards technologies DoD expressed interest in as outlined in DoD's vision. Finally, DoD may have to accept some level of risk within the lower-tech spectrum of the weapons industrial base including such items as man-portable weapons and small arms. There are too many firms in the domestic marketplace to sustain with significantly lower spending rates while the production ramp-up times for such products are not overly long thereby making them viable categories for acceptable risk in a resource constrained environment.

It is vital that the weapons industry achieve a soft landing. The Department of Defense should pursue the following specific policies to ensure the survival of a viable domestic defense industry that can meet future National Security needs:

1. Develop, publish and coordinate a long-term acquisition plan.
2. Immediately publish a FYDP and an accompanying detailed National Security Industrial Vision.
3. Accept risk in lower-tech defense industries, effectively picking "winners", by announcing decisions years in advance, permitting firms to respond with alternative business models.

Mr. Craig Deatrick, Dept. of the Army

Essay 2: The State of the U.S. Small Arms Industry

The small arms industry in the United States is able to support the current national defense needs. The U.S. government simultaneously supports a healthy and competitive domestic small arms industry while actively limiting their export. However, the industry cannot expect significant growth in Department of Defense (DoD) contracts or in foreign markets. This essay will first analyze the domestic and foreign small arms markets. Second, firm strategies for the future of the industry will be considered. Finally, the essay will comment on current and recommended government policies related to the small arms industry.

Domestic Small Arms Market

The domestic small arms industry can be divided into the military/law enforcement market and the commercial market. The commercial market is further subdivided into sport, self defense, hunting, and collector market segments. While data for the military and law enforcement markets is not publicly available, the domestic commercial firearms market

involves over 200 companies with annual revenues in excess of \$2 billion. Annual production of approximately 3 million firearms includes 1.5 million rifles, 600,000 pistols, and 700,000 shotguns.³⁸ Sales volume has been relatively stable for years with minor fluctuations due to the economy and with anticipatory concerns of increased firearms legislation.

Federal firearms legislation in the United States began in 1934 with the National Firearms Act resulting from public sentiment over Prohibition era violence including Chicago's St. Valentine's Day massacre in 1929 between Irish and Italian organized crime gangs. This legislation taxed purchases of machine guns and sawed-off shotguns and mandated fingerprint and photograph collection with background checks.³⁹ This was followed by the Federal Firearms Act of 1938 which took the step of regulating interstate commerce of small arms. Following the assassination of several key political figures such as John F. Kennedy, Robert Kennedy, and Martin Luther King, Jr., the Gun Control Act was passed in 1968. Among other components, this law banned importation of military surplus weapons, set the minimum age to purchase firearms at 18, and established new licensing and recordkeeping standards for dealers and manufacturers.⁴⁰ As a result of the assassination attempt on President Reagan that permanently injured White House Press Secretary James Brady, the 1993 Brady Handgun Violence Protection Act was passed requiring background checks prior to all firearms purchases.⁴¹

Recent public policy has demonstrated a shift towards support of lawful personal firearms ownership. The Violent Crime Control and Law Enforcement Act of 1994 (commonly referred to as the "Assault Weapons Ban") expired in 2004 and has not been renewed.⁴² In 2005, the Protection of Lawful Commerce in Arms Act was passed, protecting firearms manufacturers from lawsuits concerning the use of their weapons in criminal acts.⁴³ In 2008, the Supreme Court confirmed that the Second Amendment to the Constitution protects an individual's right to keep and bear arms in the case of *District of Columbia vs. Heller*.⁴⁴ Ironically, the anticipation of increased gun control under the Obama administration in 2009 created a measurable increase in demand for commercially available rifles, handguns, and ammunition.⁴⁵

Assuming minimal changes to the federal firearms legislation, the domestic commercial small arms market should remain strong. However, projected decreases in military spending and the anticipated decreased involvement in the current theaters in Iraq and Afghanistan will negatively affect the domestic military small arms market.

Foreign Small Arms Market

Growth in the foreign small arms market is limited by two main factors. The first factor is relatively strong U.S. government export controls. The second factor is the trend for foreign governments to develop an industrial base to produce their own national firearms for their military.

According to the Congressional Research Service in 2006, U.S. small arms export licensing and monitoring regulations are widely considered to be the most transparent and strict in the world.⁴⁶ The U.S. government has a four-pronged strategy to combat illicit small arms trafficking. The first policy is to prevent black market transfers of weapons to international crime organizations, drug trafficking organizations, and terrorists. The second policy is to raise the arms export standards of other nations to the same level as the U.S. The third policy is to improve accountability of U.S. exports without interfering in the legitimate arms trade. The fourth and final policy is to destroy excess stockpiles of small arms, especially in areas where

conflict has ended.⁴⁷ In support of these objectives, the U.S. Congress has passed several robust export laws.

Direct Commercial Sales (DCS) and government to government transfers, called Foreign Military Sales (FMS) are tightly controlled by U.S. law. The Arms Export Control Act (AECA) was passed in 1976 and established the International Traffic in Arms Regulations (ITAR) as a means for the State Department to implement the law.⁴⁸ The State Department's Directorate of Defense Trade Control (DDTC) and the Commerce Department's Bureau of Industry and Security (BIS), in concert with the DoD, facilitate legitimate small arms transactions between the U.S. and the international market.⁴⁹ These regulations and processes create a significant barrier for firms attempting to sell small arms globally, particularly in the case of smaller companies without the administrative infrastructure needed to insure compliance.

Foreign governments increasingly desire internal capabilities for small arms production. As has been the case in Israel, Korea, and Singapore, among others, U.S. firms licensed the manufacture of U.S. small arms for that country's military until they were able to build an industrial base capable of manufacturing their own firearms. These and other developing countries strive for a self-sufficient military industrial base. One of the first steps in this pursuit is to develop the means to produce a military grade firearm and corresponding ammunition. It appears to be a source of national pride to have the industrial and technological capability to field such a weapon. Therefore, the foreign small arms market cannot be depended upon for sustained demand of U.S. exports.

Firearms Industry Strategies

Firms in the small arms industry should develop strategies that will take into account the predicted decreases in the U.S. military demand without depending on anticipated increases in foreign military demand. In order to survive, firearms firms must continue to improve quality, streamline processes to decrease cost per unit production, embrace consumer customization, and diversify product lines to reduce the impact of market segment declines.

Improving quality in both consumer and federal government markets is critically important. At every price point, weapons for both civilian and military use show substantial improvements over those of even ten years ago. The advent of CNC (Computer Numerical Controlled) machining and consolidation of barrel-making technologies have resulted in new standards of accuracy and reliability in even entry level rifles and pistols. Every firm this industry study visited is incorporating some form of process improvement (e.g. Lean Manufacturing, Six Sigma, CPI, etc.).

Future improvements in quality will likely be directed toward satisfying individual consumer needs for stock color/configuration/size, trigger pull, barrel length, interchangeable barrel calibers, and multiple sighting systems. Soon, manufacturers will be required to customize virtually every rifle and pistol in order to maintain business. This will be possible because of the velocity of information flow and the speed of current manufacturing techniques. What once would require a "custom shop" order will soon be done on the Internet, changing the game in the same fashion that Dell Computer revolutionized how we buy personal computers.

Instead of expecting significant long term growth in small arms production, firms would be well advised to diversify their product lines. Areas of logical diversification include the potential high growth fields of non-lethal weapons and homeland security/force protection products and services. Many firms visited are already adopting diversification strategies while

other firms believe that their core competence in small arms production will keep them in business.

U.S. Government Policies

The national defense policy for the small arms industry should be two pronged, focusing on national security and individual rights. First, the U.S. government has the responsibility to provide for the security of Americans. This is achieved by a consistent and transparent small arms export and transfer control policy that emphasizes accountability and standards. Additionally, there is sufficient capacity in private industry to expand to meet wartime requirements due to the robust commercial market. The infrastructure for the surge production of firearms in the event of a military buildup exists within private industry. Conversion of existing plants from civilian manufacture to military manufacture in time of a national mobilization would be relatively straightforward. Assuming U.S. government policies remain in place supporting commercial markets, no substantial changes are needed to enhance the firearms industry's support for our national security strategy.

Second, the American identity is uniquely defined by the individual right to bear arms. Although legislation has evolved to allow the regulation of small arms interstate commerce, the government should be cautious in the pursuit of any additional legislation. In addition to further limiting constitutionally granted individual rights, a substantial decrease in the commercial market for firearms resulting from restrictive legislation would have a detrimental effect on the defense industrial base. Therefore, the government should aggressively enforce existing laws to prevent criminal misuse and illicit transfer of weapons without creating additional regulations. As the world's leading weapons manufacturer, the U.S. government has a distinctive responsibility to carefully consider its policies in relation to the small arms industry. Although free trade and capitalism are basic tenets in America, the common defense of its people and the assurance of individual rights are paramount in the founding documents. Consequently, the government's approach to the small arms industry must balance national security requirements with the preservation of individual freedom and the principles of a free market economy. By limiting further restrictions on domestic markets and exploring methods to safely pursue foreign sales the U.S. government can maintain the health of the small arms industrial base, a critical component of our wartime readiness in support of the National Security Strategy.

Mr. John Dunn, Federal Bureau of Investigation

Essay 3: An Interagency Approach to Non-Lethal Weapons

During the past two decades, the Department of Defense (DoD) has increasingly relied upon the use of non-lethal weapons (NLWs) to separate non-combatants from armed adversaries, determine the intent of potential combatants, and de-escalate hostilities. In the process, NLWs have saved the lives of war fighters, combatants, and civilians, as well as material and infrastructure. In this regard, the reliance on NLWs within DoD is similar to the civilian law enforcement congregate; user intent is universal: less-than-lethal means of incapacitating personnel and/or material, while minimizing fatalities, serious injury, or unwanted damage to property. Still, advancement is needed to enhance DoD's NLW applications. Similarly, shortfalls exist within the civilian law enforcement use of less-lethal weapons. This essay

highlights NLW program gaps within the military and civilian law enforcement domains, and recommends an interagency approach toward the enhancement of seemingly universal requirements, capabilities, and applications. In this discussion, non-lethal weapons and less-than-lethal weapons will be used interchangeably since these terms include armaments designed not to kill. It is argued that, due to the similarities within both domains (i.e. user intent), much can be gained in the way of an interagency approach – gains that not only address department specific shortfalls, but also go beyond these gaps by producing yet to be realized benefits that can be obtained through a whole-of-government effort.

In April 2009, the Government Accountability Office (GAO) published a review of DoD's NLW program, reporting on the extent to which (1) DoD and its Joint NLW Program have developed and fielded applications since the program's creation in 1997; (2) DoD has established and implemented NLW policy, doctrine, and training; and (3) DoD has conducted pre-operational testing and evaluations.⁵⁰ In short, the GAO found that DoD conducted more than 50 R&D efforts, spent in excess of \$385 million, but fielded only 4 NLW technologies; has yet to effectively address acceptable risk for fatality, fully develop implementation policies, or ensure personnel are adequately trained; and does not adequately test and evaluate its NLW applications.⁵¹

Currently, DoD is not alone in its quest to address NLW requirements and shortfalls, as the Department of Justice (DoJ) is currently operating under a similar state of uncertainty regarding less-lethal weapons. In May 2009, the DoJ's Investigative General's (IG) office published a review of the Department's less-lethal weapons program, reporting on the extent to which less-lethal weapons are utilized throughout the Department, the status of training and implementation controls, and the extent to which the Department assesses and oversees new and emerging technologies.⁵² The DoJ/IG found that, while all DoJ law enforcement agencies authorize and train some personnel to utilize agency-specific less-lethal weapons, usage varies widely by component; DoJ's use of force policy does not address the use of less-lethal weapons; policies and training protocols are left to individual components; most non-federal task force members are free to follow their home-agency policies; and DoJ agencies lacked adequate means of assessing less-lethal weapons usage, further hampering efforts to coordinate Department-wide assessments for use in policy, doctrine, or training.⁵³

Given the similarities between the two departments, as pertains to less-than-lethal use of force options (i.e. applications and shortfalls), it is recommended that DoD and DoJ consider the benefits of a whole-of-government approach that will not only serve their departmental interests, but also enhance national interests with respect to the development, use, and furtherance of less-than-lethal technologies. To this end, it is recommended that the departments create a working group to discuss the feasibility of an interagency approach, with the following agenda items:

- Development of a formal interdepartmental non-lethal / less-lethal weapons office with shared responsibility between DoD and DoJ regarding R&D assets, policy development, training protocols, testing, evaluations, and assessments;
- Identification of additional assets with vested interests regarding less-than-lethal weapon applications within the law enforcement and homeland security / defense domains; Development of formal information sharing protocols with such agencies / offices as:

- DoJ's National Institute of Justice, which funds less-lethal weapons research at the state and local levels, and Civil Rights Division, which conducts investigations, to include those involving use of less-lethal weapons at the state and local levels;⁵⁴ and
- Department of Homeland Security (DHS), which routinely provides grants to local and state governments – some of which is used to fund less-than-lethal weapons research and/or procurements.
- Development of national non-lethal / less-lethal terminology, policies, and protocols that cover the full spectrum of military, homeland security / defense, and law enforcement operations, training, and use of force; and
- Development of acceptable risk assessment methodologies, as well as methods of assessing trends and benefits, so as to enhance applications at the end-user level.

During the past two decades, DoD has increasingly relied upon the use of NLWs technology to separate non-combatants from armed adversaries, to determine the intent of potential combatants, and to de-escalate hostilities. In the process, NLWs have saved the lives of war fighters, combatants and civilians, as well as materiel and infrastructure. DoJ has also relied upon the use of less-lethal technologies. However, efforts regarding less-than-lethal technologies have yet to fully satisfy mission and/or end-user objectives. The GAO and the DoJ/IG recently identified several gaps within the departments' less-than-lethal programs regarding oversight, policy, training, implementation, and evaluations. Based upon seemingly universal requirements, DoD and DoJ should consider greater coordination of efforts to enhance user capabilities through national policy, doctrine, training, implementation, assessment, and information sharing standards and protocols. Collaboratively, the departments will be in a better position to not only address their unique program shortfalls, but also bridge the gap between military operations and domestic law enforcement.

Mr. Don Anderson, Dept. of Homeland Security

Essay 4: Research and Innovation

The United States Defense Industrial Base (DIB) has traditionally delivered innovative and technological superior weapons. This has enabled the United States to maintain its technological advantage in the weapons industry to meet diverse military challenges. However, military threats against U.S. interests are developing better technology and encompassing the entire spectrum of armed conflict. The United States must counter these threats with improvements in every type of weapon system from small arms and ammunition to advanced missiles. To meet the challenge of technological change, the U.S. government and DIB must be able and willing to invest in science and technology. Federal government investments in the development and adoption of science and engineering into weapon systems are vital to our national security and critical to defense industry survival. Thus, continued emphasis on government and private industry basic and applied research investments are cornerstones to advances in weapons capabilities and national security.

U.S. Research and Development and National Security

The 2010 Quadrennial Defense Review states “America’s security and prosperity are linked with the health of our technology and industrial base.”⁵⁵ It concludes that DoD “requires a consistent, realistic and long-term strategy for shaping the capabilities of the defense technology and industrial bases, which better accounts for the rapid evolution of technology” in an era of increasing globalization.⁵⁶ The United States as a whole invested an estimated \$368 billion in R&D in 2007, with 26.7% from the federal government.⁵⁷ Additionally, this investment from the United States represents 35% of the total global investment.⁵⁸ While private industry supplies superior weapon systems utilized by our armed forces, federal funds and federally directed programs are essential in stimulating innovation and technological advancements in the U.S. DIB.

In the FY2010 budget, total federal support of basic and applied research in real terms follows the downward trend of the total federal research portfolio; down 6.8% from 2004.⁵⁹ For the first time in recent years, the science and technology budget in DoD will drop 15.6% from FY2009 levels; likewise, DoD R&D will fall 2%.⁶⁰ Science and technology line items fund all of DoD’s investment in basic and applied science and engineering research. Although basic, long-term research is the primary source of new knowledge, and its application drives innovation, R&D has grown as a share of the entire defense budget due to large investments in high-tech weapons systems.⁶¹ Product development, at nearly 90% of all R&D dollars, is due to the huge costs associated with the testing and evaluation of weapons systems.⁶² In contrast, basic research, the backbone of innovation, represents only 2.2% of defense R&D.⁶³ The progress of the U.S. DIB during and after the Cold War has led many to characterize DIB innovation as being primarily focused on “incremental innovation and commercialization at the expense of basic research,” which in the words of one industry analyst is steadily creating a “...crisis as our country increases the long-term economic risks associated with underinvestment” in basic research and development.⁶⁴ There is tremendous pressure on the weapons industry to remain competitive in an environment where the shareholder, as well as to the war fighter, critically scrutinize their performance. As such, government basic research and development resources should be expanded and focused on technologies that constitute unique niches for the defense sector and are of little interest to the civilian economy. Even if major acquisition programs are greatly reduced in the near term, with continued basic R&D, the U.S. government will be able to maintain technological superiority when resources are returned.

Innovation

For continued leadership in weapons development and production, American firms must maintain an environment that encourages innovation. Author Gary Hamel is widely revered for his eight “Design Rules” for perpetually innovative organizations as outlined in his book, *Leading the Revolution*.⁶⁵ Organizations that have the characteristics of his design rules are consistently more innovative and responsive to customer needs because they set the preconditions for producing rapid and innovative solutions. Four of his eight rules are particularly relevant to innovation in the weapons industry. First, an innovative company needs to have unreasonable expectations for its performance, because nonlinear innovation and long-term firm wealth creation always begin with “unreasonable goals.” Next, an organization must see itself as serving a cause, not merely doing

business.⁶⁶ In addition, others must see the organization as a market for innovative products. In the weapons industry, this rule serves as encouragement to capable suppliers to come forward with innovative ideas even before the military expresses a need, providing a positive effect on the defense article and its mission as well as the commercial market. Finally, a company should attempt low-risk experimentation to achieve objectives. This rule does not imply an aversion to risk; rather it stresses the ability to break risk of failure into radical, yet small, low-cost, low risk experiments. It is essentially a willingness to “fail fast” and move on to the next idea if required.⁶⁷ Competition among small arms firms such as Colt Defense, Smith and Wesson, and Fabrique Nationale Herstal USA (FN USA) for military “black” rifle contracts, such as the M-4 carbine replacement, have the capacity to create the conditions for three of Hamel’s rules and to create product differentiation even in a mature market.

Another way to induce competition and innovation in the weapons industry is spiral development “...a cyclical development strategy, wherein a basic capability is fielded, and incremental capability improvements are periodically made in subsequent blocks. By shortening development timetables and ensuring the use of mature technologies, spiral development reduces the risk of program delay or failure.”⁶⁸ Spiral development in the weapons industry would provide several benefits. First, multiple spirals would allow for rapid fielding of proven technologies and capabilities to the war fighter, and then allow insertion of innovations as appropriate. Second, spiral development would allow for minor changes in the system’s requirements and specifications without a need to replace the entire weapon system. The field of Information Technology (IT) is a prime example of rapidly changing capabilities. To support this environment, the acquisition community is experimenting with acquiring IT components separately from the weapon system.⁶⁹ This will allow the IT components to evolve and gain capability and interoperability, and will allow the Services to upgrade the IT components without replacing the entire weapon system. Third, spiral development would “...help foster a robust defense industrial base, with the potential for competition at the beginning of each spiral (creating broader opportunity, encouraging innovation, and also leading to increased pressures on private industry to become more efficient in production).”⁷⁰ The article correctly emphasizes, “...this competition (at each spiral) could often be at the sub-system level—at which new technology frequently evolves most rapidly.”⁷¹ For this strategy to be effective, the U.S. government must demand modular and open architecture in a weapon system as much as possible to allow firms to create and integrate interoperable technologies and it must enact and enforce laws and acquisition processes that protect industry’s proprietary technologies and innovations.

Finally, DoD needs to formalize an effective system for rapid acquisition to encourage innovation in commercial and dual-use weapons-related technologies. DoD must continuously evaluate technologies emerging in the commercial sector and determine if they can apply them to national defense. The focus should be on technologies that can be quickly integrated to defense platforms. To enable this, the DoD acquisition system needs to have budget authority sufficient to respond to changing capability needs and provide fiscal incentives to small firms with innovative technologies to compete at each iteration of a spiral development process. All these changes will enhance the U.S. weapon industry’s capacity and motivation to innovate and, most importantly, better serve the needs of the war fighter.

Mr. John Centafont, Dept. of Defense

CONCLUSION

The U.S. government faces many dilemmas as a result of accelerating national debt, not the least of which is how to provide and pay for U.S. national security. Anticipated significant reductions in defense spending up to 20% and military withdrawals from Iraq and Afghanistan over the next five to ten years will greatly impact the entire defense industrial base in the United States. The weapons industry will experience further consolidation as the Department of Defense will be forced to decrease weapon inventories, extend lifecycles, reduce new acquisitions, and take more risk in low tech weapons manufacturing. Additionally, larger corporations will look for opportunities to expand their portfolios with strategic mergers and acquisitions. However the ultimate outcome, an efficient weapons industry that can continue to provide the U.S. military high-quality and technologically superior weapons remains a vital pillar to current U.S. national security.

The path to ensuring America's autonomy and military superiority into future generations first and foremost includes implementing a coherent defense industrial policy which enables industry to strategically align with government objectives. Secondly, reducing unnecessary export controls into foreign markets will enable the weapons industry to partially compensate for a reduction in domestic spending. Thirdly, retaining, but not expanding, provisions within the Buy America Act will preserve U.S. jobs and support the U.S. economy while providing the U.S. military with quality products. Fourthly, enhancement of government-sponsored long-term research and development will promote innovation and ensure that when defense spending regains footing, the entire defense industry will be postured to produce the most-technologically advanced weapons for our armed forces. And lastly, supporting a vibrant commercial industry, which complements the weapons industry, and seeking dual-use applications as much as possible will help to maintain the benefits of competition and provide a constant and reliable source of advanced weapons.

Endnotes

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