

MUNITIONS INDUSTRY STUDY REPORT 1996

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ABSTRACT

The munitions industrial base is in the process of adjusting to changes in the strategic environment. Reductions in munitions procurement are threatening the United States's ability to meet national security objectives.

- . The reduced demand for munitions worldwide *cannot maintain the current industrial base*.
- . The U.S. industrial base *continues to shrink* as a result of low production requirements.
- . *An increase in global competition* is eroding the U.S. competitive advantage.
- . Global partnerships and *cooperative arrangements* will become the mainstay of industrial survival strategies.
- . *New relationships between government and industry* must emerge to allow for new cooperation and partnership agreements.
- . The current stockpile of "preferred" precision-guided munitions (PGM) *may not support a strategy based on two major regional contingencies (MRC) in the near term*.
- . *No major government intervention is required* at this time to bolster the U.S. munitions industry.

INTRODUCTION

This report assesses the current state of the U.S. munitions industry, the challenges it faces, and its outlook. We also offer recommendations to the government and the industry for the continued health of the munitions industrial base.

Our assessment of the industry is based on research, discussions with representatives of the government and industry, and visits to contractor plants and government installations in the United States, and Europe (i.e., the United Kingdom, France, and Germany). Most facets of the industry

were represented--from the extremely high-technology areas of precision-guided multiple warhead missiles to the generally lower-technology, industrial production of bombs, explosives, and propellants. At each location, we investigated the latest munitions technologies, systems, programs, business practices, and challenges. Our study of the industry was enhanced by guest speakers from the Offices of the Secretary of Defense (OSD) for Industrial Affairs and Science and Technology, the U.S. Army Single Manager for Conventional Ammunition (SMCA), the Munitions Industrial Base Task Force (MIBTF), the Air Force Program Executive Office for Conventional Strike, and the Army Industrial Operations Command.

THE MUNITIONS INDUSTRY DEFINED

The sheer number of components in the industry made a thorough analysis of every product impossible within the confines of the study. Therefore, we divided munitions into three sectors: ammunition, which includes such munitions as projectiles, bombs, fuses, mortars, mines, explosives, and rockets; precision-guided munitions (PGMs), which consist of all classes of conventionally armed guided missiles, smart bombs, and torpedoes; and weapons of mass destruction (WMD), which cover nuclear, biological, and chemical weapons. The characteristics of the industry as a whole are shown in Table 1.

Table 1. Salient Features of the Munitions Industry

Is essential for military readiness	Requires long lead times for production
Entails high risks	Uses limited production runs
Is mature	Is dangerous (because of hazardous material used)
Produces a unique military application	Entails extensive land requirements (for safety, testing, etc.)
Is a monopsony	Is difficult to enter

Today's munitions are complex and sophisticated. They use a wide variety of technologies, including nuclear physics, advanced case technology, stealth (low observables), optics, advanced and agile manufacturing, composite materials, metallurgy, metal machining, guidance and

navigation systems, software, fusing, microelectronics, propellants, and explosives.

The munitions industry, like the rest of the defense industry, is shrinking. The move is toward greater consolidation and more partnerships among domestic and international corporations as producers strive to survive and achieve economies of scale.

Excess production capacity remains in both the private and public sectors of the industry, even after dramatic downsizing and consolidation. Production rates are 30-40 percent of capacity, according to some industry representatives. Declining production exacerbates the effect of high overhead costs, which increases prices and forces firms to reduce costs further in order to remain competitive. The number of firms leaving the industry reflects the magnitude of the problem. As of 1996, only 52 prime, privately owned contractors remained in business, compared with 286 in 1978.

New relationships are forming under teaming and systems management arrangements. Firms that were once bitter rivals are now partners in the marketplace. Competition has taken a new turn, and cooperation, the new strategy for competing for limited defense dollars, is leading to further consolidation in the munitions industry, thus further limiting competition.

Cuts in Department of Defense (DoD) procurement dollars (reduced 75 percent since 1985) have hurt the munitions industry. An analysis of munitions funding from FY 1996 through FY 2001 indicates that available resources trail requirements by more than \$20 billion. The chairman of the Joint Chiefs of Staff, Gen. John Shalikashvili, asked Defense Secretary William Perry to increase arms procurement in fiscal year 1997. Warning of dire consequences if the decade-long plunge in defense procurement spending is not reversed, the chairman said that \$60 billion per year in procurement funding was required to adequately recapitalize (including munitions).

High quality remains the hallmark of the U.S. munitions industry. Statistical Process Control techniques and International Standard Organization 9000 certification further promotes high-quality workmanship in the munitions industry. In the past, mass and high-volume

production were the key to the munitions industry's profit, but today the industry tends toward limited-quantity production, which in some cases does not fully support the use of automation, thereby reducing efficiency and possibly profitability. Munitions are produced in government-owned, government-operated (GOGO); government-owned, contractor-operated (GOCO); and contractor-owned, contractor-operated (COCO) facilities. Each of the armed services is responsible for its own peculiar munitions (e.g., U.S. Navy torpedoes); however, the U.S. Army, designated the SMCA, oversees the acquisition and production of conventional ammunition for all the services.

The international demand for munitions has declined significantly in recent years and, even in the most optimistic forecasts, exports cannot compensate for the excess defense industrial capacity that currently exists. The international market has led to intense competition for export sales, which have become more important to the financial viability of defense contractors as their domestic business base declines. Southeast Asia and the Middle East are currently the only growing markets for military equipment, including munitions, while demand elsewhere has generally decreased.

Five countries--the United States, the United Kingdom, France, Germany, and Russia--account for 86 percent of export arms sales, with China a close sixth. France and Russia in particular are very strong competitors in the PGM market.

AMMUNITION

Munitions in this sector include products that contain some type of energetic material (such as explosives and incendiaries) and are unguided after they are fired. (Small-caliber ammunition was not part of the study.) Ammunition items are becoming increasingly sophisticated, employing highly sophisticated fuses and penetrators constructed from advanced materials.

The ammunition industrial base relies heavily on defense requirements, and its products have few commercial applications. The establishment of an ammunition production facility requires large capital investments in equipment as well as considerable real estate in remote areas.

Current Conditions

The ammunition production base, both government and contractor, has declined drastically as defense has downsized. The large decrease in COCO plants is the result of contractors consolidating, going out of business, or leaving the ammunition industrial sector. The GOCO base is being reduced to six active ammunition plants. Of the remaining plants, six became Group Technology Centers (GTCs) in the 1990s under the AMMO-FAST 21 concept in an effort to retain critical core capabilities and technical skills. Each GTC is responsible for several families of ammunition, such as tank ammunition, grenades, or small arms.

Reductions in ammunition funding have been dramatic. With the exception of increases to support Desert Storm, ammunition funding has declined at a rate twice that of the rest of the DoD acquisition budget. From a \$5.6 billion industry high in FY 1985, the budget reached a low of \$501 million in FY 1994. FY 1995 and FY 1996 saw an increase to just over \$1 billion through congressional add-ons to the DoD budget. As the government minimizes its funding of research and development (R&D) programs, the private sector, faced with increased costs and decreased production, is hard pressed to bear the burden of R&D funding. Thus, advances in technology, which gave the United States its edge in the past, may be at risk. The drastic reductions in funding have caused the industrial base to shrink and have made it very difficult for the ammunition sector to remain solvent.

- . The MIBTF, consisting of representatives from companies in the ammunition production base, completed a study of the ammunition production base in October 1993. The task force concluded that:
- . The base could not support demands for the most modern, "preferred" ammunition for one major regional contingency (MRC), much less two simultaneous MRCs.
- . Production capacity was insufficient to meet the requirement to replenish ammunition stocks after a conflict.
- . The munitions industrial base was in crisis and could be saved only by

increased, steady spending on ammunition (Strategic Assessment Center, 1993).

A 1994 follow-up review by the MIBTF reached essentially the same conclusions.

In contrast, studies completed by the OSD in 1995 found that although considerable financial distress exists within the base, both the production capacity and the technological capability of the ammunition sector are sufficient to meet the DOD's requirements for ammunition production and replenishment (Industrial Operations Command, 1995). The OSD recognized that industry has responded to reduced ammunition procurement by restructuring, shrinking, and, in some cases, closing factories. The result may be more single producers for certain products and the need to contract with a sole source for ammunition needs. The OSD concluded that the situation did not threaten the DOD's ability to supply the armed forces with sufficient quantities of high-quality ammunition.

The great differences in the conclusions drawn by the MIBTF and the OSD are largely the result of differing preliminary assumptions. For example, the OSD study sent 154 letters to producers in the base but received only 29 responses. The OSD assumed that if a company did not respond to the data request, it was financially healthy, even though companies in financial distress may have been reluctant to provide adverse financial information to the government for fear that it might jeopardize their consideration for future contract awards. If the OSD had assumed financial distress rather than health for companies that did not respond, the results in all likelihood would have been very different. As for the MIBTF study, the fact that the task force was composed of representatives from companies whose very survival is dependent upon defense ammunition budgets understandably affected their conclusions. Notably, it was in response to the MIBTF view that Congress increased ammunition budgets in FY 1994 (\$1 billion), FY 1995 (\$300 million), and FY 1996 (\$300 million).

Our study concluded that the health of the base is more robust than that presented by the MIBTF but less stable than the optimistic OSD view.

After examining the replenishment issue in its March 1995 Function Area Assessment for Ammunition, the Department of the Army's SMCA concluded that replenishment times for *every family* of ammunition were within Defense Planning Guidance (DPG) requirements. However, the SMCA cautioned that continued drawdown of war reserve stocks to meet training needs could erode this capability. Moreover, for a few individual ammunition items *within a family*, replenishment times were not within DPG boundaries. The army is studying these items in order to take corrective action.

Challenges

- . The huge U.S. ammunition stockpile contains more than enough ammunition to fight two MRCs but consists largely of older, less capable ammunition that may not be effective against a future threat. Furthermore, the stockpile is short in the area of "preferred" munitions. Its sheer size results in low production requirements for the foreseeable future and provides an open invitation to expand the use of ammunition in training.
- . As the industrial base shrinks, employees retire or are released without replacements, taking critical industry skills and knowledge with them.
- . The industry is experiencing insufficient private sector R&D in the face of limited short- and long-term returns.
- . Overhead costs have become a significant challenge because firms operate at uneconomical production rates.
- . U.S. producers are increasingly pursuing world markets in fierce competition for scarce defense dollars.
- . Foreign competition has increased dramatically as advanced ammunition technology has become readily available worldwide and the U.S. government reduces its investment in R&D.
- . Ridding itself of old, unwanted conventional munitions has become a tremendous challenge to the DoD. Approximately 400,000 tons of

conventional munitions, nearly 10 percent of the stockpile, now await disposal. Each year, the services designate nearly 70,000 additional tons of munitions for demilitarization (environmentally safe destruction of unwanted munitions), a potential \$70 million annual business opportunity.

Outlook

Although the production and technological capabilities of ammunition support the current national security strategy, there is a shortage of "preferred" munitions, and replenishment time has become a serious concern. In addition, the continuing shrinkage of the U.S. production base may eventually decrease the U.S. capability to replenish stocks and could result in dependency on foreign producers for replenishment.

The shrinking base is causing an increase in the number of sole-source producers, resulting in increased prices, reduced flexibility, and little or no surge capacity. The current stockpile is aging and may become both unreliable and obsolete, given the lack of modernization of munitions and the advancement of future threats.

In FY 1994, the Army Materiel Command and the SMCA described the conventional ammunition base as weak. As a result of government programs and policies, such as AMMO FAST-21, and efforts by private commercial concerns to consolidate, the base stabilized in FY 1995. Although industrial base assessments are incomplete for FY 1996, no significant change in status is anticipated as the base remains in transition.

Over the last 10 years, the demilitarization sector of the munitions industry has exhibited rapid growth. A multimillion dollar opportunity, demilitarization gives aggressive contractors an excellent opportunity to remain in the business, retain key technical skills, and make a profit.

PRECISION-GUIDED MUNITIONS (PGM)

Current Conditions

Although the United States remains the world leader in PGM technology and production, other nations, primarily in Europe, are rapidly increasing

market share. As U.S. and foreign PGM funding levels and production rates are reduced, the procurement of PGMs, as the munition of choice, consumes a larger percentage of the total munitions budget. In fact, Congress reported in 1995 that the military services have bought or are developing 33 PGM types (19 types in inventory and 14 types in development) (General Accounting Office, 1995).

Like those in the ammunition sector, firms in the PGM sector are consolidating, merging, shutting down plants, and laying off skilled personnel in an effort to remain economically viable. The industry is concerned that the loss of critical skills may limit its ability to support future contingencies. The significant lead times required to restart PGM production lines may be aggravated by the lack of availability of suppliers or by outdated technical data packages.

At the same time, there is great debate over whether current PGM stocks are sufficient to support two near-simultaneous MRCs. In our opinion, there is a mismatch between the current U.S. strategy, which reduces platform force structure, and reliance on precision-strike munitions as force multipliers. There are *not* enough "preferred" PGMs for two MRCs. Furthermore, until the new weapons (including global positioning system [GPS]-guided weapons) are fully integrated into the stockpile, the gap between U.S. PGM supplies and requirements will continue.

Another trend is the growing number of joint ventures between U.S. manufacturers and especially among European producers. Although the United Kingdom, France, and Germany are looking more and more toward joint ventures with U.S. firms, such ventures are not currently received with much enthusiasm in the United States, primarily because of concerns about technology transfer.

Both U.S. and European firms are finding it more necessary to export their products. European companies cannot achieve efficient economies of scale unless they get other nations to join in their PGM programs. At the same time, U.S. firms are increasingly dependent on exports as domestic requirements decline. The result is growing collaboration: within Europe to compete with U.S. merged industry giants and between U.S. and European firms not only to achieve economies of scale but simply to survive.

In short, the current approach in the PGM industry reflects the theory that a small part of a big pie is better than no pie at all.

Challenges

Perhaps the most formidable challenge is the necessity to downsize while retaining skills that are critical to the industry. The trend toward international collaborative PGM programs challenges the Departments of Defense, Commerce, and State to find innovative ways to accept and encourage future international cooperative ventures.

In addition, both the government and industry must seek a healthy balance between PGM procurement and R&D funding to ensure future technological competitiveness and maintain U.S. military preparedness through leading-edge technology.

Outlook

The downsizing trend is not over, and PGM producers will have to consolidate further. Because the base has decreased by about 60 percent since 1989, most PGM producers have acknowledged that their surge capacities have been cut by at least the same amount. For economic and political reasons, many PGM producers feel it will be essential to collaborate internationally on future PGM programs.

The study group concluded that while the PGM industrial base will be smaller, it will be highly productive and more efficient. Industry projections of the PGM market show reduced demand, with very limited sales by those contractors who learn to compete globally and are able to survive the contraction. Paradoxically, both foreign cooperation *and* foreign competition are expected as firms unite to survive while developing specific areas of specialized expertise (e.g., fuses, propellants).

Foreign military sales, which capitalize on global demand, could provide significant additional revenue to U.S. suppliers. Historically, however, foreign buyers are influenced by U.S. procurement decisions, which are viewed as signals of U.S. confidence in the system and predictions of availability of continued post-production support. While foreign military

sales have the potential to bolster contractors' revenue, the DoD severely restricts the export of sensitive PGM technology.

WEAPONS OF MASS DESTRUCTION (WMD)

Current Conditions

The U.S. stockpile contains adequate nuclear weapons to support the national security strategy. The goal is to maintain a credible nuclear capability while drawing down an aging inventory that will be extended well beyond its originally intended shelf life. No large-scale development of new warheads is currently anticipated. Today's emphasis is on stockpile management with an absolute focus on surety--safety, security, and reliability.

A large chemical weapons stockpile consisting of 30,000 tons of bombs, projectiles, mines, and rockets is being demilitarized, and no development or new production is planned. Chemical weapons production ceased in the late 1960s, and under international treaty all U.S. chemical weapons will be destroyed. The destruction of the stockpile presents both a challenge to the government and a rare opportunity to contractors in the shrinking defense industry. The total cost of the destruction program is estimated at over \$12 billion.

By public law, the United States does not maintain a biological weapons inventory. Aside from a small stock of research agents, the United States does not hold any biological weapons, nor are any in production.

Challenges

Numerous challenges exist in preserving the skills and facilities to effectively maintain the current U.S. capability in WMDs. Without nuclear weapons production, maintaining a reliable nuclear stockpile depends upon critical capabilities that have no corresponding civilian applications, such as the production of tritium and neutron generators.

Under the Nuclear Test Ban Treaty, full, live weapons testing is prohibited. Ensuring the complete reliability of the smaller number of retained nuclear weapons demands a rigorous surveillance process, but

technical expertise in national laboratories is rapidly eroding. Advances in computer modeling and materials testing are essential as the stockpile ages with unknown effects. To make these advances, the industry must monitor and maintain the skills and expertise of the core cadre of experienced engineers and technicians. Aggressive recruitment of young engineers and scientists must continue in order to bolster the work force and to maintain the specialized skills this sector of the industry demands.

The demilitarization of chemical weapons remains a significant challenge. Public Law 99-145 (1985) directed the DoD to destroy the entire chemical weapons stockpile not later than September 30, 1994, but when technical problems and citizen opposition to incineration caused delays, Congress granted an extension to December 31, 2004. The U.S. chemical stockpile will be destroyed in nine chemical incinerators.

The demilitarization of obsolete or treaty-banned chemical and nuclear stockpiles in the United States and abroad poses severe scientific, engineering, and technical challenges that are surpassed only by the unprecedented demands of the cleanup of the environment around production facilities. The technological considerations of environmental cleanup and its cost remain significant challenges.

Outlook

The downsizing of the nuclear weapons industry continues. On February 29, 1996, Secretary of Energy Hazel R. O'Leary announced plans to reduce the U.S. nuclear weapons production complex to 20 percent of peak capacity by 2005. The production base will produce only those nuclear components that support the present stockpile. Personnel will also be reduced by 10-15 percent as parts and maintenance facilities are downsized.

The overall outlook for the U.S. nuclear weapons sector is for a smaller, more streamlined, but carefully tailored industry sized to match the nation's long-term needs. The retention of core capabilities may depend on finding productive commercial uses for the national laboratories.

Reduced R&D activity is the result of decreased funding and prohibitions against live testing. To sustain confidence in the stockpile, ongoing R&D

efforts must focus on the advanced computer-modeling and material-testing techniques required to stay ahead of unknown aging effects.

The requirement to maintain the stockpile must be joined with the necessity to preserve the industrial and knowledge base. The national laboratories, specially equipped as the repository of intellectual property, are not fully occupied or adequately challenged by stockpile maintenance alone. Partnerships with private industry in which costs are shared equally (the work is performed for half the price at the government's expense) are viewed by critics as "good deals" for private corporations and are not without controversy. Transition to private ownership or consolidation may be worthy of consideration and further study.

GOVERNMENT GOALS AND ROLE

International

The European strategy for the munitions industry, dramatically unlike the U.S. strategy, relies heavily on joint international development. The United Kingdom, which has the most progressive and truly competitive government policy, welcomes competition for its munitions requirements from the United States or any other capable manufacturer. Other European governments, particularly that of France, have to deal with many more social constraints (such as limitations on work force reductions) and tend to subsidize their munitions producers. The result is that European manufacturers are less efficient and less able to effect changes that would increase industry productivity.

As the United Kingdom, France, and Germany shrink their industries, they are abandoning the goal of being entirely self-sufficient in *all* of their munitions requirements. Instead, they are retaining capabilities in fewer, selected areas of expertise and relying on imports of components or entire systems for munitions they cannot produce themselves.

The international environment is also complicated by defense offsets (i.e., compensation demanded by foreign buyers as part of a sale), foreign dependency concerns, and inconsistent government export policies. Defense offsets have become critical to securing export agreements. Any

successful export strategy now requires the innovative use of sophisticated offset packages.

United States

The U.S. approach emphasizes a balance between meeting national security requirements and diminishing defense resources. In this vein, U.S. policy is primarily hands-off, relying more on market forces to reshape the industry. Several government initiatives, such as the Multi-Missile Factory and Agile Manufacturing processes, are aiding the industry in identifying more efficient production strategies.

In the current fiercely competitive environment, the governments of some munitions-exporting countries are increasing their support of their industries. The frequency with which senior-level government officials lobby for export sales has been increasing in the past few years. In this environment, the United States has to walk a fine line between being a peacemaker and pursuing aggressively promoting U.S. munitions sales abroad--while not providing taxpayer-funded financial incentives. The U.S. munitions industry needs this balanced support.

Both the government and industry must continually adjust to the realities of the world market. To maintain competitiveness, the government must engage and support industry more actively--not to subsidize it, but to remove impediments to its success.

Although acquisition reform seems to have lost some of its momentum in the last two years, the government is still counting on achieving significant savings in all areas of defense procurement to fund modernization and operations readiness.

In contrast with the European approach of maintaining only selected areas of expertise, the U.S. approach appears to focus on retaining technical expertise in *all* areas of munitions development and production. Current U.S. policy also emphasizes protecting U.S. technologies at the expense of global partnerships. U.S. manufacturers are also somewhat protected by a U.S. practice that procures over 90 percent of munitions requirements from domestic producers.

The increasing U.S. reliance on foreign components has given rise to concern over the level of dependency and calls by industry for protectionist policies. Such policies must be prudently developed and not followed blindly, or they will undermine interoperability and two-way trade with U.S. allies as well as drive up component costs. The United States cannot afford to cut off its access to the best available technologies, which in some cases will be from foreign sources.

In an attempt to improve U.S. international business, the government has recently adopted policies aimed at easing restrictions on forming global partnerships. These initiatives, if successful, hold promise for the future.

Current U.S. export policies are inconsistent, contradictory, and outdated. For example, while policies stress cooperation, the process prohibits technology transfer, precludes jobs offshore, and restricts deals without lucrative offsets. A complete review of government policies--balancing technology transfer concerns with prudent foreign sales opportunities--is overdue. For instance, the U.S. government should reinvent the export-licensing process so that it responds better to the growing number of valid export requests.

CONCLUSIONS

The munitions industry is adapting to changes caused by reduced production requirements and increased foreign competition. The ammunition sector in particular continues to suffer from the defense drawdown. Although the United States remains the world leader in munitions technology, the nation's ability to rapidly produce high-technology weapons on a large scale has diminished.

Findings

- The munitions industrial base continues to shrink as production requirements are reduced. Munitions producers will continue to use consolidation as an industrial survival strategy. Surviving producers will be fewer in number but highly productive and more efficient.
- Although the capabilities of the U.S. PGM stockpile are impressive, current stocks do not support the sheer number of "preferred"

weapons required to conduct two MRCs. The addition of the GPS family of guided munitions will improve this shortfall, but not before the turn of the century.

- As a direct result of the success of U.S. weapons in the Gulf War, the United States became the world's leading supplier of high-technology munitions. Since that time, global competition, especially in the area of PGMs, has intensified to the point where the U.S. competitive advantage is eroding.
- Survival strategies in the industrial base vary from company to company and from country to country. One emerging strategy that almost all embrace is cooperative arrangements and global partnerships. Although the United States is generally considered an unreliable partner by some European Union countries, cooperative agreements will remain a primary industrial strategy.
- New government-industry relationships are emerging as a result of the new requirements for cooperation and partnerships. Industries cannot establish global partnerships unless the government works to remove impediments.

Recommendations

Industry

- To ensure long-term survival, support other government acquisition reform initiatives, such as "best-value" contracting, which emphasizes past performance, and fully embrace the expanded use of commercial acquisition practices with both their customers and their suppliers.
- Support joint government-industry initiatives such as the agile manufacturing concept for ammunition and the multimissile factory initiative.
- Adopt a long-term approach to R&D by investing in efforts to remain competitive in the area of next-generation munitions.

- . Continue to identify and seek opportunities to form global partnerships.

Government

- . Reinvigorate government acquisition reform, including the full range of innovative approaches, and enforce its implementation at *every* level of government.
- . Authorize multiyear funding for munitions programs to provide much-needed stability in funding and production.
- . Eliminate duplication of oversight in Congress.
- . Overhaul the U.S. export-licensing process to ensure that U.S. producers remain competitive in the global market.
- . Fund service PGM requirements fully to support tomorrow's force structure--one that relies on PGMs as force multipliers.
- . Stimulate munitions R&D efforts by removing obstacles and providing incentives to industry.
- . Continue collaborative partnerships with industry and move toward the privatization of the national laboratories.

In the final analysis, the munitions industry is troubled but not desperate. There is reason for concern, but no major government intervention is currently required other than that recommended in this report.

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