

The US Army War College Quarterly: Parameters

Volume 24
Number 1 *Parameters* 1994

Article 24

7-4-1994

US Military Ammunition Policy: Reliving the Mistakes of the Past?

Jim Courter

L. Steve Davis

Follow this and additional works at: <https://press.armywarcollege.edu/parameters>

Recommended Citation

Courter, Jim, and L. S. Davis. "US Military Ammunition Policy: Reliving the Mistakes of the Past?." *The US Army War College Quarterly: Parameters* 24, 1 (1994). <https://press.armywarcollege.edu/parameters/vol24/iss1/24>

This Article is brought to you for free and open access by USAWC Press. It has been accepted for inclusion in The US Army War College Quarterly: Parameters by an authorized editor of USAWC Press.

US Military Ammunition Policy: Reliving the Mistakes of the Past?

JIM COURTER, L. STEVE DAVIS, and LOREN B. THOMPSON

From *Parameters*, Autumn 1994, pp. 98-110

The current tensions in the Balkans, the Middle East, sub-Saharan Africa, and Northeast Asia are a reminder that the threat of regional warfare is never far away. The Bottom-Up Review of US military strategy and requirements conducted by the Department of Defense in 1993 acknowledged this reality by making the ability to successfully wage two nearly simultaneous major regional contingencies (MRCs) a key measure for shaping the US force structure.[1] The possibility of having to prosecute two wars in rapid succession at widely separated locations also influences the Pentagon's plans for consolidating the defense industrial base.

In the case of Northeast Asia, the prospect of conflict between North Korea's atavistic communist dictatorship and the democratic Republic of Korea also should remind policymakers of a previous regional contingency, and of how poorly conceived US military and industrial plans for that war proved to be. The Korean War that took place from June 1950 until mid-1953 resulted in 33,652 American battle deaths, and produced some very important lessons about how not to prepare for military conflict. The purpose of this article is to focus on a single critical sector of the defense industrial base--the ammunition industry--and to consider present plans for its consolidation in light of the lessons of the Korean War.

The ammunition industry was selected because it is relatively small and unique, but also because its products are essential to the military effectiveness of systems manufactured by much bigger sectors of the defense industrial base. The Defense Department's total budget authority for conventional ammunition purchases in fiscal 1994 is \$1.36 billion,[2] meaning that the industry will eventually realize revenues from this year's budget equivalent to about three days of business by the General Motors Corporation.[3] Clearly, the ammunition industry is no behemoth. However, without its output, weapons such as the M-1 tank that cost billions of dollars to develop and produce would be useless.

The Korean War is considered here because it was the last "major regional contingency" in which the United States engaged that involved intense conventional warfare over a protracted period of time. Moreover, problems arose in the production and distribution of ammunition during the Korean War that illuminate the deficiencies in current munitions planning assumptions. Finally, there is a real danger that US forces may one day soon again find themselves at war on the Korean Peninsula. It is worth remembering the mistakes made during the last Korean conflict in order to avoid reliving them in a future one.

The Decline of the Ammunition Industry

The domestic ammunition industry consists of dozens of public and private facilities producing a vast array of end items, including small arms ammunition, cannon and artillery shells, bombs, grenades, rockets, mines, dispenser munitions, propellant charges, pyrotechnic devices, and explosives. The manufacture of most of these products is supervised by the Army's Armament, Munitions, and Chemical Command, which is responsible for meeting the ammunition requirements of all the military services (except for a small portion of naval munitions). The command manages 246 ammunition end-items from its headquarters at Rock Island, Illinois. Impressive as this number is, it is less than half of the 590 end-items the Army's ammunition experts managed in the early 1990s, before drastic consolidation efforts were begun in response to shrinking budgets.[4]

The pace of consolidation within the domestic ammunition base since 1992 has been so rapid that some observers have referred to it as a collapse. While it is true that procurement accounts in general have declined much faster than other categories of defense spending in recent years, few areas of procurement activity have been hit as hard as ammunition purchases. Between 1985 and 1994, the inflation-adjusted buying power of the Pentagon's procurement budgets fell by 64 percent, compared with a more moderate 34-percent decline for overall defense spending. During the same period,

expenditures for ammunition declined 78 percent. As a result of this precipitous drop, 60 to 80 percent of all domestic ammunition workers have lost their jobs. Industry executives project that one quarter of the remaining workers will be laid off during 1994.[5] By 1995, the government-owned portion of the ammunition base is expected to have fewer than 10,000 employees, compared to 26,000 in 1988.

A similar contraction has occurred in the number of plants producing military ammunition. The munitions industry contains three types of production facilities: government-owned, government-operated (GOGO); government-owned, contractor-operated (GOCO); and contractor-owned, contractor-operated (COCO). GOGO and GOCO facilities generally produce propellants and explosives, and perform the final loading, assembly, and packaging of end-items. COCO facilities usually produce nonexplosive components such as metal shells and fuzes. About 70 percent of ammunition procurement budgets are spent on the latter activities.[6]

The number of both government-owned and contractor-owned facilities has shrunk considerably in recent years. In 1978 there were 286 privately owned plants involved in domestic ammunition production; that number fell to 88 in January 1994, and it is expected to decline to 52 in 1995. The 32 government-owned ammunition plants operating in 1978 were pared to 24 by January 1994 and will fall to 19 in 1995--only nine of which will be active. Thus, in 1995 the total number of operating production facilities in the ammunition industrial base will have dropped from 318 to 71--a 78-percent reduction in less than 20 years.[7] Much of this contraction is due to necessary rationalization of an aging production base, but there is no question that the rapid consolidation of facilities in recent years is primarily a response to shrinking ammunition procurement budgets.

Despite the contraction in funding, facilities, and workforce, the ammunition industry retains a relatively large number of producers. A study prepared by the Office of the Secretary of Defense in October 1993 counted 45 prime contractors and 132 key subcontractors still active in the business. This abundance of participants reflects the peculiar structure of the industry, which consists of scores of unique end-items manufactured in small quantities on dedicated production equipment for a wide range of applications. Because output is so diverse and production lots are so limited in size, there is seldom more than one source for any given item. Further consolidation of the industry will be necessary to bring the number of producers into alignment with anticipated demand, but this process may well exacerbate the vulnerabilities inherent in having only one source--and in most cases only one production facility--for specific munitions.

Emerging Vulnerabilities in Ammunition

The expected contraction of the ammunition production base in response to shrinking procurement budgets has had some beneficial consequences. At the end of the Cold War, the munitions industry was burdened with a huge amount of excess capacity that clearly needed to be eliminated. Cutting the ammunition budget is one way to force government managers to think coherently about which production capabilities are essential and which are superfluous. Reduced demand also encourages marginal producers to abandon the business, so that only the most efficient suppliers remain.

The US Army went through just such a rationalization exercise in 1992. An internal study of the ammunition base concluded that it was "in critical condition and getting worse." [8] The study questioned whether, in its debilitated state, the base could meet the requirement to sustain US forces in two major regional contingencies. The Army subsequently decreased the number of end-items it was managing from 590 to 246, a 58-percent reduction designed to concentrate production efforts on those ammunition types truly relevant to future war requirements. A total of 198 production lines were declared excess, and 32,000 pieces of government-owned equipment were removed from the production base. New purchases of ammunition were restricted to established producers to encourage retention of a reasonably stable and competent supplier community.[9] The rationalized ammunition base is much smaller, but also more sustainable given projected levels of demand for the remainder of the decade.

Unfortunately, ammunition budgets continued to decline after 1992 and are now so small that it is not certain an adequate base can be maintained for even the most essential munitions. As funding has diminished, Defense Department policies arguably have become less and less realistic about the requirements that the ammunition base might need to meet. The department no longer envisions the need to mobilize or surge ammunition production in response to a national emergency; instead it proposes to draw upon existing stockpiles of ammunition in the event of

war, and then gradually replenish supplies once peace is restored. This approach will not work for at least two reasons: portions of the existing stockpile are poorly suited for fighting wars, and the production base is rapidly losing its capacity to replenish wartime consumption while keeping pace with peacetime needs.

The Elusive Stockpile. During the Cold War the US Army accumulated a huge stockpile of ammunition that is currently estimated to contain two million tons of usable items. Present policy calls for the services to draw upon these supplies to prosecute the two nearly simultaneous major regional contingencies described in the Bottom-Up Review. However, a careful analysis of the stockpile's contents reveals that most of these munitions could not reliably sustain US forces in wartime:[10]

- The largest category of stockpiled ammunition--nearly 30 percent of the total--is war reserve stocks for allies (WRSA) stored in Korea, Western Europe, and elsewhere. These munitions are set aside for use by allied forces in wartime and therefore probably would not be available to US forces; some of the WRSA munitions are no longer used in currently fielded US weapon systems.
- A second sizable component of the Army stockpile (about 25 percent of the total) is "applicable training" ammunition, meaning munitions that either were specifically designed for training or that have been in storage for so long that they are considered suitable only for training. Some of these munitions could be used to fight a war, but their reliability is so doubtful that they potentially could place US forces at risk.
- A third portion of the stockpile (also 25 percent) consists of so-called "discretionary" munitions which, while usable in wartime, are not as capable as the most modern ammunition types. Discretionary ammunition--also known as "substitute" ammunition--has less range and lethality than current-generation munitions, so it may require users to take greater risks in wartime; in addition, the reliability of discretionary rounds will become increasingly doubtful in the late 1990s due to their age.
- About 15 percent of the Army stockpile is made up of the most modern and capable munitions, which are known as "applicable go-to-war" munitions. These are the munitions that commanders would prefer to use in all combat engagements, because of their high performance and reliability.
- The smallest category of stockpiled ammunition is "excess" supplies designated for demilitarization or transfer to friendly countries. None of the munitions in this category would be used in wartime by US forces.

Thus, it appears that only 40 percent of the Army's ammunition stockpile has any real relevance to war-fighting, and most of the munitions included in that smaller total are discretionary types that commanders would prefer not to use. But it is precisely that discretionary category of ammunition that constitutes the Defense Department's real reserve for fighting two nearly simultaneous contingencies. The 323,000 tons of munitions in the "applicable go-to-war" category represent less than the amount of ammunition sent to the Persian Gulf region in 1990-91 to prosecute Operation Desert Storm. Obviously, if a second Desert Storm-scale contingency occurred at the same time that US forces were at war elsewhere in the world, the Army would have no choice but to draw upon discretionary stocks.[11]

That would not be a pleasant experience. In armored warfare, for example, it would require US forces to approach closer to enemy tanks before firing (due to the lesser range of discretionary ammunition), possibly putting US tanks within range of the enemy's guns. Many of the specific munitions types in the discretionary category lack the precision, penetration, and explosive power of advanced munitions, so the performance of US forces would almost certainly be degraded. What effect the awareness of these ammunition deficiencies might have on commanders' willingness to take risks is impossible to gauge, but the effect could hardly be positive.

It also should be kept in mind that each major category of munitions in the stockpile in turn consists of many subcategories and ammunition types. For some types of ammunition, the current stockpile is not adequate to support one major regional contingency, much less two. According to knowledgeable observers, the ammunition stockpiles of the other military services exhibit deficiencies similar to those of the Army.

The Eroding Production Base. Even if stockpiled munitions were fully sufficient to sustain two major regional contingencies--which they aren't--the ammunition industry still would be required to replenish munitions within a reasonable period of time after the cessation of hostilities. It can't. In 1992 the Federal Emergency Management Agency (FEMA) assessed the capacity of 35 industrial sectors to support recovery from a conflict. It rated the ammunition sector dead last in its ability to replace critical war supplies in an acceptable time frame and at an

acceptable cost. Military ammunition budgets have declined steadily since FEMA conducted its assessment; since the productive capacity of the industry generally corresponds to budget levels (with a two-year time-lag from appropriations), it can be assumed that the production base has eroded further in the intervening years.[12]

The rapid deterioration of the ammunition industrial base is reflected in a series of industry-funded studies prepared by the Science Applications International Corporation. One study tracked the increasing delays involved in filling requisitions for various types of essential ammunition by comparing the experience of Desert Storm in 1990-91 with the Army's ammunition base ratings in 1992 and the anticipated effect of the fiscal 1994 ammunition procurement budget. It found that whereas during Desert Storm requisitions in all categories of ammunition could be filled within a year, the effect of the 1994 budget would be to lengthen delivery times to more than a year for most ammunition types.[13]

Type	Desert Storm Performance	1992 Army Materiel Command Rating	Effect of 1994 Budget
Small Caliber	-	-	-
20 mm	-	-	-
25 mm	-	-	-
50 cal	-	-	-
30 mm	-	-	-
40 mm	-	-	-
Fuzes	-	-	-
Mortars	-	-	-
Tank	-	-	-
Artillery	-	-	-
Explosives	-	-	-
Propellant	-	-	-
Demo/Detonators	-	-	-

Bombs	-	-	-
Guided Missile Warheads	-	-	-
Mines	-	-	-
Ship Ammo	-	-	-
Rockets	-	-	-
Source: SAIC			
	-	-	-
	less than 6 months	6 to 12 months	more than 12 months

Figure 1. Lead-times to Fill Ammunition Requirements.

A second study prepared by Science Applications International Corporation projected that the productive capacity of the ammunition industrial base would drop to \$3.6 billion in 1994 dollars by the turn of the century, less than a third of its \$11 billion capacity in the mid-1980s. It calculated that even if capacity normally used to meet civilian ammunition needs is included, total capacity will be considerably less than required to meet the consumption and replenishment demand generated by two major regional contingencies. In fact, shortages in certain categories of ammunition are likely if only one regional contingency occurs.[14]

All such projections are based upon problematical assumptions and are scenario-dependent. Nonetheless, pessimism about the capacity of the ammunition industrial base to meet future requirements is clearly warranted:

- Ammunition procurement budgets are not likely to rise above the current, very low amounts for the rest of the 1990s; the productive capacity of the ammunition industrial base therefore probably will stabilize at levels where there is little excess that can be applied to unanticipated needs.
- Most of the munitions that are essential to warfighting are unique to the military. The skills and equipment needed to produce them do not exist in readily transferable form in the commercial marketplace.
- The majority of military ammunition types are now manufactured by single sources at single sites; catastrophic accidents, explosions, or sabotage therefore could completely shut down the production of essential munitions for a significant period of time.
- Modern munitions are more complex than those used in the past; the demanding specifications, wide range of skills, advanced equipment, and extensive array of materials needed to manufacture them all increase the potential for delays in initiating or accelerating production.
- Laws regulating the handling of hazardous materials have proliferated in recent years; compliance with these laws would almost certainly slow efforts to increase ammunition production.

With all of these factors at work, it is possible to imagine circumstances in which the conduct of a future war could be disrupted by ammunition shortages. However, there is no need to be imaginative, because just such a problem nearly occurred during the Korean War. The Korean experience offers useful insights into the current dilemmas of ammunition planning and policy.

The Lessons of Korea

When North Korea invaded the South on 24 June 1950, it presented the United States with its first major regional military contingency of the postwar period. Although US military forces were poorly prepared to wage conventional warfare in Korea, President Truman decided not to use the atomic bomb, preferring instead to respond in a manner proportional to the scale of communist aggression. Fortunately, the unfolding conflict seemed to provide US and South Korean defenders with several advantages. North Korea's weapons generally were no match for those of the United States, and the configuration of the Korean peninsula made it readily accessible to US naval and air forces. Moreover, Korea was only a hundred miles from Japan, where General Douglas MacArthur commanded the largest concentration of US forces outside the continental United States, including four Army divisions.[15]

One issue that received relatively little attention initially was whether ammunition supplies would be adequate to prosecute the war. The United States had produced 20 million tons of ammunition during World War II, and a sizable portion of that output remained in military stockpiles in 1950. For example, the week that hostilities broke out in Korea, the US Army had on hand over six million rounds of its standard 155mm howitzer ammunition. In addition, it had retained an infrastructure for producing ammunition valued at over \$2 billion, including 14 loading plants, 12 powder and explosive works, and three shell factories. When combined with relevant private-sector facilities, this substantial production base seemed capable of meeting any demand generated by the Korean conflict once stocks were depleted.[16]

The stocks for many tactical rounds were so extensive that there was doubt about the need to gear up for production at all. In October 1950, when military planners were preparing a supplemental appropriation request to pay for the war effort, stockpile managers estimated that they had a four-year supply of 155mm rounds on hand and a three-year supply of 105mm rounds, based on past experience with wartime consumption rates. Since few planners expected the war to last that long, a paltry \$374 million was requested for ammunition--primarily to begin the process of mobilizing the production base.[17]

However, optimism about munitions reserves soon faded, and within a few months there was growing concern that units in Korea might face crippling shortages. The turning point came in November 1950, when Communist China entered the war. This widened the scope and intensity of the conflict, leading to a surge in demand for most ammunition types. Consumption of ammunition over the next two years far exceeded the rate planners had expected as outnumbered US and South Korean forces relied heavily on firepower to compensate for their numerical inferiority. For instance, during the battle of Soyang in mid-May 1951, 21 artillery battalions supporting the X Corps fired 309,958 rounds in seven days, well over a thousand tons of ammunition per day. In late August and early September of the same year, fighting near Inje resulted in the use of more than a million rounds of 105mm and 155mm ammunition in only 15 days.[18]

Even the vast stockpiles of ammunition left over from World War II would not sustain these consumption rates for very long. New production would be needed, and quickly. Unfortunately, the ammunition production base was in no condition to manufacture large quantities of munitions anytime soon. Although the government-owned portion of the base was worth more than \$2 billion, only one percent of that amount had been spent on maintaining it each year, and most plants were manned by skeleton crews that would need to be supplemented by newly trained workers. Appropriations for ammunition production during 1946-1950 had averaged less than \$30 million per year, hardly enough to maintain a warm industrial base. Production during 1949 and 1950 had been limited almost entirely to small quantities for new weapons, munitions that obviously were not available in the World War II reserves.[19]

When the danger of ammunition shortfalls became apparent, appropriations for new production were greatly increased. Total ammunition procurement funding in fiscal 1951 rose to \$2.1 billion, far above the \$36 million of the preceding year. A further \$1.1 billion was appropriated in 1952, and \$1.9 billion in 1953. But it took time for these large appropriations to translate into actual output. Not only was the production base cold but the civilian workforce was fully engaged in other pursuits. A major steel strike and lack of capacity in the machine tool industry combined with the government's lethargic contracting procedures to delay production by many months.[20]

Colonel John B. Medaris of the Army's ordnance division shed some light on the cause of the delays in testimony before the Senate Armed Services Committee on 10 March 1953. Medaris explained that "in the establishment of new producers of major components we may properly anticipate that the time from appropriation to first production may be

as much as eighteen months." This was bad enough, but Medaris went on to note that "contracts for the production of some such items may be placed, in some cases, almost a year after the appropriation became available." Medaris concluded that it could take "as much as two and a half years, or sometimes more, after the appropriation" before actual production occurred. This meant some munitions that Congress appropriated money for only weeks after North Korea invaded the South in the summer of 1950 might not find their way to front-line units until early 1953.[21]

Luckily, that was a worst-case scenario. New production of most ammunition types took less time, and shortages of munitions at the front were due more to imbalances in consumption and distribution than to a shortage of operational reserves. The few supply-driven shortfalls that did arise were confined primarily to new ammunition types, rather than the standard tactical rounds in the reserves.[22] Thus it appears that there was no time during the conflict when the war effort was significantly impeded by shortages in the supply of ammunition. But it could have been:

- If the pace of hostilities witnessed in 1951 had continued into 1952 and 1953, ammunition shortages almost certainly would have resulted.
- If the military services had not inherited such a large reserve of ammunition from World War II, production delays would have caused shortages at the front.
- If the war had occurred in the mid-1950s rather than the early 1950s, the stockpile would have been less reliable, the production base more debilitated, and the availability of necessary skills doubtful.
- If a second major regional contingency had occurred at the same time Korea was being fought, or shortly thereafter, the military services probably would have lacked the ammunition needed to fight it effectively.

The latter point is particularly important in light of current ammunition policies. Many of the assumptions guiding ammunition procurement during the early stages of the Korean conflict proved to be wrong. What if these errors had been compounded by the outbreak of a second conflict elsewhere in the world? Secretary of the Army Frank Pace offered this opinion in an appearance before the Senate Appropriations Committee on 7 May 1952: "If we are called upon to help counter one or more other limited communist aggressions elsewhere in the world while we are still engaged in Korea, or even shortly after the war there might end, we will not be able to bring immediate and effective military pressure to bear." [23] Awareness of this danger undoubtedly influenced US policymakers' perceptions of their options during the early years of the Eisenhower Administration. It may have made them less likely to engage in military activities--or more likely to use the atomic bomb.

It is not hard to see the implications of the Korea experience for modern ammunition planners. Clausewitz's concept of friction has as much relevance for logisticians and procurement managers as it does for operational military commanders. Wars seldom occur when and where they are expected. They seldom unfold as anticipated. They frequently make demands on the industrial base that are not reflected in war plans, and efforts to satisfy those demands are often disrupted by unforeseen budgetary, regulatory, technological, and managerial problems. Because so many things can go wrong, and usually do, it is essential that policymakers not engage in wishful thinking about what war will require. The more optimistic plans are, the more likely they are to go awry. Regrettably, the Defense Department's plans for providing US military forces with ammunition in two nearly simultaneous major regional contingencies are beginning to look very optimistic indeed.

Conclusion: Avoiding the Mistakes of the Past

The Defense Department's present approach to ammunition planning and procurement is short-sighted and risks disaster in a future conflict. The existing ammunition stockpile is not adequate to sustain US forces in two nearly simultaneous major regional conflicts, and the industrial base is being allowed to deteriorate to a point where it cannot cover shortages in a timely manner. Unanticipated problems that arose in the consumption and production of ammunition during the Korean War demonstrate the danger of relying too heavily on ammunition reserves or overestimating the responsiveness of the industrial base. To paraphrase philosopher George Santayana, these are mistakes that current US policymakers must either recognize or be doomed to repeat.

The main reason that the ammunition industrial base has been allowed to deteriorate is to save money. Although many policymakers realize that ammunition accounts are not being adequately funded, they have accepted the current state of affairs because they have more pressing budgetary priorities and the threat to US national security is greatly

diminished. However, the lesson of the Korean conflict is that threats can arise rapidly and unexpectedly, while the consequences of bad policies can take years to reverse. It therefore makes little sense to starve ammunition accounts in order to fund other activities; these accounts consume a very small share of total defense spending and yet they are essential to the wartime effectiveness of many of the nation's most costly weapon systems.

In order to prevent further erosion of US ammunition capabilities, three basic steps must be taken. First of all, more money must be spent on procuring modern munitions. Fiscal 1994 funding for all ammunition types for all three military services stands at about one-half of one percent of the defense budget. This amount is not enough to meet peacetime training requirements, much less bolster war reserves.[24] Depressed budget levels will inevitably lead to diminished surge and replenishment capability. Massive increases in ammunition spending are not necessary; but when expenditures for all ammunition procurement fall far below one percent of the defense budget, it is a likely sign that munitions are not receiving the level of resources that they require.

A second step that must be taken is for federal regulatory agencies to permit greater flexibility in the consolidation of the ammunition base. The ammunition sector currently contains too many producers to be supported by projected levels of demand, and further rationalization of excess capacity is therefore necessary. The Defense Science Board recently completed a review of antitrust policy that led it to recommend changes in the way the Defense Department interacts with the Justice Department and the Federal Trade Commission in considering corporate mergers and acquisitions.[25] If implemented, these changes should alleviate the problems that some ammunition producers have faced in trying to form more robust business combinations.

A final, truly essential step is for defense decisionmakers to be more realistic about the requirements that future conflicts might impose on the industrial base. The national military strategy and defense planning guidance must provide a sensible industrial base requirement for ammunition. The present approach of relying on reserves in wartime and replenishing after hostilities have ceased is typical of the flawed policymaking that occurs when threats are diminished and decisionmakers are not thinking clearly about future challenges to national security. New threats eventually will arise, and when they do the policy of not even trying to maintain an ammunition surge capability will have to be changed. It would make more sense to preserve an adequate ammunition base today, rather than having to undertake a costly reconstitution effort in the future.

NOTES

1. Les Aspin, *Report on the Bottom-Up Review* (Washington: Department of Defense, October 1993), pp. 5-12.
2. *Strategic Requirements for the U.S. Munitions Industrial Base* (Washington: The Strategic Assessment Center, Science Applications International Corporation, 2 February 1994), p. 25.
3. According to General Motors' *1993 Annual Report* (p. 31), the company's total revenues in 1993 were \$138.2 billion.
4. Paul L. Greenberg, *Implementation of Ammunition Sector Study* (Rock Island, Ill.: US Army Armament, Munitions, and Chemical Command, 22 September 1993), pp. 2-4.
5. Toby G. Warson, President, Munitions Industrial Base Task Force, *Assessment of Munitions Readiness and the Supporting United States Industrial Base*, Testimony before the Senate Armed Services Committee Subcommittee on Military Readiness and Defense Infrastructure, 13 April 1994, p. 11.
6. *Updated Ammunition Production Base Planning and Restructuring Study* (Rock Island, Ill.: US Army Armament, Munitions, and Chemical Command, July 1993), p. 19.
7. Warson, p. 11.
8. Greenberg, p. 2.

9. Ibid.
10. Warson, pp. 6-7; *Updated Ammunition Production Base Planning*, pp. 12-15.
11. Warson, pp. 6-8.
12. The FEMA study was conducted under contract by the Institute for Defense Analyses as part of the Joint Industrial Mobilization Planning Process using unclassified contingency scenarios suggested by the 1991 Joint Military Net Assessment. See James Thomason, Peter Brooks, and David Graham, *Replenishment Feasibility Assessments for Case Two: A Presentation for Global 1992 Exercise* (Alexandria, Va.: Institute for Defense Analyses, July 1992), pp. 2-11.
13. Warson, pp. 5-6.
14. *Strategic Requirements for the U.S. Munitions Industrial Base*, pp. 29-31, 35.
15. Russell F. Weigley, *The American Way of War* (Bloomington: Indiana Univ. Press, 1973), pp. 382-85.
16. *Ammunition Shortages in the Armed Services* (Washington: Senate Armed Services Committee Preparedness Subcommittee, 15 April 1953), p. 390; *Ammunition Supplies in the Far East* (Washington: Senate Armed Services Committee, 10 March 1953), pp. 99-101.
17. *Ammunition Shortages in the Armed Services*, pp. 346-47.
18. James A. Houston, *Guns and Butter, Powder and Rice: U.S. Army Logistics in the Korean War* (Cranbury, N.J.: Associated Univ. Press, 1989), pp. 160-62.
19. *Ammunition Shortages in the Armed Services*, pp. 246-47; *Ammunition Supplies in the Far East*, pp. 99-101.
20. Ibid.
21. *Ammunition Supplies in the Far East*, pp. 104-05.
22. Houston, pp. 164-66.
23. See also *ibid.*, p. 165.
24. Warson, p. 8.
25. "DoD Announces The Release of The Defense Science Board Antitrust Task Force Report," Department of Defense news release 185-94 (Washington: Department of Defense, 12 April 1994).

Jim Courter is Chairman of the Committee for the Common Defense, the national security arm of the Alexis de Tocqueville Institution. He is also Chairman of the National Base Closure and Realignment Commission. Mr. Courter represented New Jersey's Twelfth Congressional District in the US House of Representatives from 1979 to 1991, where he was a member of the Armed Services Committee and Chairman of the Military Reform Caucus.

Major (P) L. Steve Davis is assigned to the Secretary of the Army's Office for Research, Development, and Acquisition as a Systems Coordinator for Tactical Missiles. He is a graduate of the US Army Command and General Staff College. He has served in a variety of command and staff positions in airborne and light infantry units. He holds a master's degree from the Florida Institute of Technology and is a graduate of the Defense Systems Management College's Program Manager course.

Dr. Loren B. Thompson is a Senior Fellow at the Alexis de Tocqueville Institution and is Executive Director of its Committee for the Common Defense. He is also a partner and senior vice president in Source Associates, Inc., a technical services company. Dr. Thompson has taught graduate seminars in defense analysis at Georgetown and

Harvard universities and served for ten years as Deputy Director of Georgetown's National Security Studies Program. He is the author and editor of *Defense Beat: The Dilemmas of Defense Coverage* (1991) and *Low-Intensity Conflict: The Pattern of Warfare in the Modern World* (1989).

Reviewed 5 May 1997. Please send comments or corrections to carl_Parameters@conus.army.mil.