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CUTTING THE HIGH COST OF WEAPONS

INTRODUCTION

As the Reagan Administration cuts the cost of almost all federal programs, the defense budget is soaring. In fiscal year 1982, Congress appropriated $214 billion for defense -- up from $190.2 billion in FY 1981 and $172.9 billion in FY 1980 (in constant FY82 dollars). Thus far the American public has supported this increased spending, including the planned expenditures of $258 billion in FY 1983 and $1,475 billion for the FY 1983-1987 period in constant FY 1983 dollars.

Yet this robust pro-defense consensus could be threatened by the exorbitant cost of armaments. Today, for example, a fighter plane can run $30 million, a battle tank $2.5 million, an attack submarine $580 million, and a field gun $350 thousand -- to say nothing of the $3 billion price tag on a new aircraft carrier or an estimated $220 million for a strategic bomber. Even when adjusted for inflation, the costs of these weapons are easily double-digit multiples of their World War II and Korean War predecessors. In all, the Pentagon is spending some $84 billion in the current year as the share of the defense budget for weapons procurement and military research and development; in 1983-87, it intends to spend about $600 billion for these items.

These figures per se are staggering. Making matters worse is the widespread suspicion that the Defense Department, by not carefully monitoring weapons cost, is risking high cost overruns. In addition, media reports focus on production delays, noncompetitive contracts, and stories of highly sophisticated, expensive weapons that have taken fifteen to twenty years to develop and yet displayed disappointing performance in the field. Indeed, servicemen complain about poor workmanship as well as the difficulty of maintaining and operating such complicated weapons.

The high cost of weapons is emerging as a major issue in the coming debate over the FY 1983 defense budget. It will provide a ready justification for paring down the Administration's defense budget requests in the minds of many Congressmen, who will be under extreme political pressure as the budget-cutting process continues in non-defense areas. If the Administration wants to preserve the pro-defense consensus, it will have to bring the cost of weapons under control.

Weapons cost must be lowered for another reason. For the past fifteen years, the U.S.S.R. has been expanding its arsenal enormously -- apparently to achieve military advantage over the United States and its allies. As huge as the Reagan Administration defense budgets seem, they are not sufficient to prevent the Soviets from attaining military superiority. Longtime defense underfunding cannot be completely compensated by lowering the unit costs of weapons. But if the U.S. is to have any chance at all of offsetting the Soviet arms buildup within the current budget constraints, it must vastly improve the economic efficiency of its weapons procurement. How the Administration meets this challenge may thus become a very important test of the Reagan defense policy.

THE GROWTH OF WEAPONS COST

During World War II, the U.S. equipped its armed forces with vast numbers of cheap tanks, artillery pieces, planes, and ships. A P-51 Mustang fighter, for example, cost about $500,000 in FY 1981 dollars, an M-1 Sherman tank cost $150,000, and even an Essex-class aircraft carrier cost only $225 million.

Today's weapons are orders of magnitude more expensive. In general, aircraft today cost twenty-five times more than World War II types. Armored vehicles and ships cost ten times more. The Air Force's top-line fighter, the F-15 Eagle, for example, comes with a $33 million price tag.[1] It is typically armed with air-to-air missiles, the infra-red homing AIM-9 Sidewinder, and the radar-guided AIM-7 Sparrow, the latest versions of which cost about $73,000 and $150,000 respectively. The Navy is paying about $39 million for its fleet air defense fighter, the F-14 Tomcat, which when fully armed carries six AIM-54 Phoenix missiles each costing $2 million. The Army's new main battle tank, the M-1 Abrams, costs about $2.7 million a copy. It will be used in conjunction with the new $1.5 million infantry fighting vehicle, the M-2 Bradley, and the AH-64, a $35 million attack helicopter. Naval surface combatants also do not come cheap. The price of 91,000-ton nuclear-powered Nimitz-class aircraft carrier is about $3.0 billion without its complement of aircraft. The fleet's new air-defense guided missile cruiser of the CG-47 class costs over $1 billion.

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[1] For an explanation of methods of determining weapons costs, see Appendix.

Table I
The Cost of Modern Weapons

System	Unit Price FY1982 (millions of dollars)	Quantity Procured FY1982
Army		
M-1	2.7	665
M-2 IFV	1.5	600
AH-64	34.9	14
UH-60	6.4	96
Patriot	2.7	244
Hellfire	0.12	1,075
TOW II	0.015	12,000
Air Force		
F-15	33.3	36
F-16	12.7	120
ALCM	1.3	440
AIM-7 Sparrow	0.149	1,560
AIM-9 Sidewinder	0.073	1,800
AGM-65D Maverick	0.5	490
Navy		
FFG-7	323.9	3
SSN-668	581.7	2
CG-47	1,017.5	3
F-14	39.4	30
F-18	38.4	63
AIM-54 Phoenix	2.1	72

U.S. weapons procurement and military R&D budgets have not grown proportionally to maintain inventory levels of high-cost modern weapons. The real cost of fighter aircraft over the last two decades has been rising at a rate of 10 percent a year. Cost growth for other major weapons systems, such as surface ships, tanks, and air defense systems, has been only slightly less. For all weapons and support equipment, the real cost of modernization has been increasing an average of about 6 percent a year.[2] This means the United States should have spent some $2.4 trillion on weapons procurement and R&D over the last twenty years to maintain its arsenal at constant 1960 inventory levels. Military investment expenditures for the period, however, amounted to $1.5 trillion, for an investment shortfall of $900 billion.

Because of this shortfall, the Services have bought fewer and fewer weapons. The Army bought 24,000 M-48 tanks in the

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[2] Leonard Sullivan, Jr., "Correlating National Security Strategy and Defense Investment," in W. Scott Thompson, ed., From Weakness to Strength: National Security in the 1980s (San Francisco: Institute for Contemporary Studies, 1980), p. 343.

1950s and 1960s and 13,000 M-60 tanks in the 1960s and 1970s. It can afford to buy only 7,000 M-1 tanks in the 1980s. Throughout the early and mid-1960s, the Air Force bought an average of 850 aircraft a year. Since the Vietnam War, it has procured an average of only 250 aircraft annually. Air Force tactical fighter strength has dropped from more than 4,000 in 1964 to about 2,500 today. The Navy/Marine Corps active fighter/attack inventory has shrunk from about 2,800 in 1960 to less than 1,500 today. Even in the Reagan FY 1982 budget, the Navy's aircraft procurement will be forty-one fewer than needed just to cover losses through accident and retirement of older aircraft. The FY 1983 budget requests eleven fewer than needed. The Navy's inventory of active surface combatants and submarines shrank from a total of 444 in 1964 to 289 in 1975. The fleet has grown in size since then, but due to underfunding in the Carter years, it will again contract before the Reagan Naval programs can take effect.

The Services have been caught in a vicious circle. The high cost of weapons and shrinking defense budgets have forced them to purchase fewer weapons, and the resulting lower production runs in turn have raised the unit prices even higher, forcing yet further cutbacks and still higher unit costs. Take the F-15 for example. In 1972, the Air Force planned to buy 729 F-15s over a seven-year period with peak production of 144 aircraft a year and a $20.5 million unit price (FY 1982 dollars).[3] Budget constraints in the mid and late 1970s, however, forced the Air Force to lower the annual procurement rate, first to 115, then to 72, then to 42, and finally to 30 and a program extended for five additional years. This delay increased the cost by about $10 million per plane.

The expensive new weapons that the U.S. has been deploying over the last decade and a half are highly capable. Indeed, despite the smaller inventories, America's more expensive armed forces today are also more powerful than those of fifteen years ago, when measured against an absolute standard of military power. In the meantime, however, U.S. defense responsibilities have broadened. In 1975, the U.S. could rely on Iran to guarantee the free flow of oil from the Persian Gulf against all but direct military threats from the Soviet Union. Today, defense of the Gulf oilfields rests almost entirely with America's fledgling Rapid Deployment Force. Revolution and Cuban intervention in Central America, the rise of Soviet-backed regimes in Angola, Ethiopia, and South Yemen, and Libya's adventurism have also put additional burdens on U.S. defense resources. At the same time, Soviet military power has grown dramatically as the Communist Party has been running the Soviet economy on a semi-mobilized war footing. These developments prompt many experts to argue that the U.S. needs more weapons in its arsenal.

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[3] U.S. Senate, Department of Defense Appropriations FY 1973 (Washington, D.C.: U.S. Government Printing Office, 1972), p. 478.

THE CARLUCCI INITIATIVES FOR LOWERING WEAPONS COST

The high cost of weapons has been a problem for some time. Ten years ago, John S. Foster, then Undersecretary of Defense for Research and Engineering in the Pentagon, warned that "We can no longer continue to buy adequate quantities of weapons if the unit procurement and lifetime costs of weapons continue to soar."[4] Since the late 1960s, the problem of rising weapons cost has been carefully studied by many private research organizations and government agencies -- the Rand Corporation, the Defense Department, the General Accounting Office, the Committee on Government Procurement, the 1970 Blue Ribbon Defense Panel, the Defense Science Board, and others -- all of whom have made specific recommendations for streamlining the weapons acquisition process and lowering weapons cost. Some measures have been instituted. But the problem persists; indeed, it is worsening.[5]

The Reagan Administration has placed high priority on the reform of the weapons acquisition process. Last April, Deputy Secretary of Defense Frank C. Carlucci presented thirty-two initiatives for reducing weapons cost, shortening development time, and improving weapons support and readiness. Among the recommendations for reducing costs:

- increased use of multiyear funding;
- production of weapons at more efficient rates;
- full funding of programs to maintain program stability;
- better inflation and program cost estimates;
- reduction in the number of DOD directives;
- relief from burdensome government regulations;
- more advantageous use of competition;
- greater use of standardized subsystems and support equipment;
- modernization of defense plant equipment.

The Carlucci initiatives do not address some of the major causes of growth in weapons cost. Nevertheless, they constitute a fairly comprehensive list of measures which, if implemented, would do much to lower costs. The underlying notions, however,

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[4] Quoted in General Accounting Office, "Cost Growth in Major Weapon Systems," March 28, 1973, p. 35.

[5] For a discussion of some of the earlier studies and their recommendations, see GAO, ibid.

are not new. For the past ten years, such measures have been urged -- but with little success. The roots of high weapons cost run deep in American weapons procurement culture. As such, old habits have to be uprooted and special interests neutralized. What is needed is nothing less than a sustained, long-term turnaround in the nation's weapons procurement practices.

WHY DO AMERICAN WEAPONS COST SO MUCH?

There are many causes for the high cost of American weapon systems. They are related to 1) weapons design, 2) budgetary and management practices of the Defense Department and Congress, and 3) inefficiency in the defense industrial base.

Table II
The Causes of Weapons Cost Growth

Design	Budget/Management	Defense Industry
o the quest for qualitative superiority	o budget instability	o subcontractor bottlenecks
o lack of interservice standardization	o low production rates	o low productivity
o failure to use available commercial parts	o cost and inflation misestimates	o labor instability and shortages
	o lack of competition	

The Quest for Military Superiority

"The greatest single factor in the cost growth [of our weapon systems]," a 1972 GAO report concluded, "stems from continuously expanding requirements."[6] In World War II, America relied on vast numbers of weapons to defeat the forces of its outnumbered enemies. In the postwar period, the U.S. and its allies have come to rely on qualitative superiority to counter the enormous Soviet numerical advantages. America's weapons design strategy, as expressed by Dr. William Perry, Undersecretary of Defense for Research and Engineering in the Carter years, has been "to offset the Soviet advantage in numbers by applying technology to equip our forces with weapons that outperform their Soviet counterparts."[7]

Soviet modernization efforts pursued vigorously over the past decade have forced the U.S. to develop ever more technologically complex weapons to achieve performance superiority. Of late, however, a growing body of defense experts have been criti-

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6 GAO, ibid., p. 4.
7 Quoted in Armed Forces Journal, April 1981, p. 21.

cizing the Services for designing weapons in accordance with an erroneous strategy of attrition, with little regard for the severe operational conditions of real-life combat, and with an unjustified faith in technological solutions to what are not fundamentally hardware problems.[8] One of the most common charges is that of "gold-plating," where a useless or marginally useful capability is added to a system. Judgments about the military utility of a performance capability, however, rest on assumptions about the nature of combat, and on this there is widespread disagreement within the defense community.

What is not in dispute is that the Services have set stringent performance requirements for weapons in order to achieve highly favorable exchange ratios in combat with a numerically superior foe. In many cases, the Services are pushing technology to the limit to achieve performance objectives. In other cases, technology is tried-and-true, but the design is complex and difficult to build. This is a costly design strategy. By some estimates, pushing for that extra 5 to 10 percent of performance can raise the price of a weapon system anywhere from 20 to 50 percent.[9]

It is time to rethink America's weapons design strategy in terms of cost efficiency, the rationale being that, with the savings achieved, the Services could buy more, albeit individually somewhat less capable, weapons. In the long run, America would be able to field a more potent military force for its defense dollars. This assessment is shared by the Defense Science Board, a senior advisory group to the Secretary of Defense composed of ex-military officers and defense experts from academia and industry. In a 1979 study entitled "Reducing the Unit Cost of Equipment," the Board recommended that "The requirements process should explicitly consider quantity versus quality in equipment. Some recent tests suggest that the quality of U.S. equipment is not making up for numerical deficiencies. We must provide incentives to the requirements process to prevent gold-plating and reduce recurring costs, so we can buy new equipment in larger quantities that better support total force capability."[10]

The Services and the Department of Defense, of course, have not been oblivious to design costs. In 1972, the Pentagon bowed to congressional pressure and adopted a "design-to-cost" policy that directs the Services to give equal importance to performance and cost. During the 1970s, efforts were made to design lower-cost alternatives to some of the more expensive systems then in development and production. The Air Force, for example, developed

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8 See, for example, the briefing by the Congressional Military Reform Caucus, December 14, 1981, and Franklin C. Spinney, Defense Facts of Life (1980).

9 Jacques Gansler, The Defense Industry (Cambridge, Massachusetts: MIT Press, 1980), p. 279.

10 Quoted in GAO, "Implications of Highly Sophisticated Weapons Systems on Military Capabilities," PSAD-80-61, June 30, 1980, p. 7.

the F-16 as the low-priced item in a "high-low" mix of fighters. The Navy developed its own lightweight fighter/ attack aircraft, the F/A-18, as a "cost effective" alternative to a F-14/A-7 mix. The FFG-7 was developed as a cheap escort vessel to be used in low threat environments. The Army, after experiencing large cost overruns with the MBT-70 tank and the Cheyenne helicopter programs, cancelled these and developed "cheaper" models, the M-1 and the AH-64.

The results of these "design-to-cost" attempts have been mixed. The F-16 by almost all criteria is a success. It is probably the finest dogfighter flying today. Its cost: a relative bargain at $17 million. The F/A-18, on the other hand, is a "design-to-cost" disaster. As a fighter it is much less capable than the $39 million F-14 but costs only $1 million less. It is only marginally -- if at all -- superior to the $12 million A-7E in the attack role.[11] The Army's AH-64 helicopter has suffered truly astronomical cost overruns -- $2 billion in the last quarter of calendar 1981 -- and is still plagued by design defects after almost two decades of development.[12]

The Services, it would seem, have trouble sticking to their designs. With infuriating regularity, "design-to-cost" weapon systems are upgraded during development as designers come up with new ways of deploying available or new technology to meet expanding performance requirements. Technological feasibility -- not a sober assessment of the threat -- is the driving force behind design. To take full advantage of the latest technological breakthroughs, program managers stretch out the development of their weapon systems. As a result, weapons are now taking ten to twenty years to develop, two and three times longer than a decade and half ago. An example of the attitude of American weapons designers that "good is not enough" is the Army's night vision binoculars. The Army could have equipped its soldiers with a decent set of night vision binoculars years ago but has delayed deployment while it seeks an ever more capable system in the light of state-of-the-art technology.[13]

The Pentagon is becoming sensitive to the problem of lengthy weapons development. Carlucci Initiative #2 in fact recommends that most new systems be designed with "pre-planned product improvement" (P^3I) in mind. P^3I is an evolutionary design strategy, much used by the Soviets and occasionally used by the U.S.,

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11 Jeffrey Record, "Ground the F-18 Program," New York Times, November 2, 1981, p. A23.

12 For information on problems with the AH-64, see "AH-64 Decision Postponed," Aviation Week and Space Technology, December 7, 1981, p. 23; and Benjamin F. Schemmer, "Press Reports of Army AH-64 Demise Exaggerated, But Costs Pose Dilemma," Armed Forces Journal, January 1982, pp. 58-60.

13 Robert C. Toth and Norman Kempster, "U.S. Pushing Technology to the Limit," Los Angeles Times, September 10, 1980, p. I 16.

as in the F-4 and B-52. It calls for deploying weapons in a relatively austere form and then sequentially upgrading them by adding advanced subsystems as they are developed. P^3I would quicken the pace of modernization of American armed forces. It could also effect significant savings in development costs.

Less clear, however, is what the Defense Department will do about the issue of gold-plating. The Carlucci Initiatives are silent on the subject. What is needed is a high-level review of the nation's weapon design philosophy, including an official statement of policy on the matter to guide the Services in their research and development efforts.

Interservice Standardization of Weapons

A major achievement of Robert McNamara's Pentagon reorganization during the 1960s was the establishment of a unified and centralized weapons design process to eliminate the wasteful duplication caused by the development of Service-specific weapons. It has made some headway. All the Services, for example, use the Sidewinder and Sparrow missiles. The Air Force and the Navy use both missiles in an air-to-air role. Sparrow is also used by the Navy in a shipboard surface-to-air system, Sea Sparrow, and the Army uses the Sidewinder in its Chaparral air defense system. And, after much pressure from Congress, the Air Force joined with the Navy in procuring the F-4 for fighter and bomber roles. The two Services will also be procuring the General Dynamics Tomahawk cruise missile and the Hughes Advanced Medium Range Air-to-Air Missile (AMRAAM).

The list of standardization's lost opportunities and failures, however, is longer than that of its successes. For example:

- The Navy and Air Force today both have their own strategic intercontinental ballistic missile programs, the Trident II and the MX.[14]

- The Navy and the Air Force failed to settle on a common lightweight fighter in the 1970s, resulting in development of both the F-18 and the F-16.

- On a smaller scale, the Navy rejected a design for a lasar-guided projectile that could have been fired from both its 5" gun and the Army's 155mm howitzer. The result: costs for the two systems ran three times what they would have for a standardized weapon.[15]

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[14] It is too late now to develop a common missile to serve as the successor to the Minuteman ICBM and the Trident I SLBM. The threat posed by Soviet strategic nuclear superiority demands that both the MX and the Trident II missile programs be developed as quickly as possible.

[15] Statement of Anthony R. Battista before the House Committee on Armed Services, Research and Development Subcommittee, Hearings on Military Posture: Defense Department Authorization for Appropriations for FY 1977, February 3, 1977, pp. 65-69.

Joint development programs are hard to sell because each Service wants the system to reflect its own special needs. In many cases, common weapon programs would be militarily unsound if performance were sacrificed for commonality. Nevertheless, a number of joint programs could be attempted. Take the VTXTS trainer. Both the Air Force and Navy are in the market for a new jet trainer. A common system could save at least $1 billion in development costs alone. The Navy is also looking at the possibility of extended-range, over-the-horizon surface-to-air systems, required by the Army as well. One system may also satisfy the Air Force's need for a special operations, search-and-rescue helicopter, the Navy's need for a vertical on-board delivery vehicle, short-range anti-submarine warfare platform, and search-and-rescue helicopter, and the Marine Corps' need for a medium assault helicopter.[16]

Carlucci Initiative #21 urges the development and use of standardized operational and support subsystems for service-specific weapons. Programs for common weapons should also be pursued vigorously by the Pentagon. Common weapons, by some estimates, easily could save $1 billion a year through lower development costs and higher volume production. Congress should be notified of all common weapon systems under consideration by the Undersecretary of Research and Engineering and should receive a full explanation from the Services when viable joint programs are not accepted.

Use of Commercial Products

An area of cost savings not considered in the Carlucci Initiatives is the increased use of commercially produced components and supplies for weapons and support systems. The Heritage Foundation's 1980 report Mandate for Leadership pointed out that:

> The Military acquisition community has become accustomed to developing its own equipment for everything from transport vehicles to administrative computers. Such an approach may have been justified in earlier times when military technology was in fact far ahead of the civil sector....However, the situation has now changed dramatically. In many cases, military technology is now considered behind its commercial equivalents. Moreover, since most commercial equipment exists in vastly larger quantities than its military equivalent, it works more reliably, and more people are trained in its maintenance (which must, because of commercial competition and pressure, be kept far more simple).[17]

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16 Jay C. Lowndes, "Defense Studies Specialized Aircraft," Aviation Week and Space Technology, October 5, 1981, pp. 81-82.

17 Tidal W. McCoy, et al., "Defense," in Charles L. Heatherly, ed., Mandate for Leadership (Washington, D.C.: The Heritage Foundation, 1981), p. 133.

DOD Directive 5000.87, issued in the mid-1970s, directs the defense agencies to consider off-the-shelf equipment and services whenever possible. But the Services still overlook opportunities for using commercial products. The M-1 tank, for example, requires specially designed hydraulic fluid that is more expensive than commercial fluids of comparable quality and is more flammable and hence dangerous for tank crewmen. By some estimates, DOD could cut weapons cost by close to $1 billion a year through increased use of commercial products.[18]

Budget Instability

In planning for weapons procurement, the Services and the Office of the Secretary of Defense have invariably assumed a steady growth in the defense budget over a period of at least five years. Since World War II, however, the longest period of sustained defense budget growth has been three years; over the long run, defense expenditures have declined.

The effects of such budget instability on weapons programs have contributed significantly to higher weapons cost through:

- cancellation of programs during lean years after large sums have been spent on R&D;
- program stops and starts which increase costs (the four-year delay in production of the B-1 bomber cost over $1 billion);
- program stretchouts leading to lower procurement rates and higher unit costs (between 1975 and 1980 yearly procurement rates for F-16s fell from 160 to 98; for F-15s, from 72 to 30; and for A-10s, from 144 to 60 -- leading to increased unit costs of 30 to 40 percent);
- minimal investment by the defense industry in plant modernization, thus lowering productivity;
- the abandonment of defense production by numerous sub-contractors, resulting in less competition.

Defense economists agree that steady growth in the defense budget would do much to reduce weapons cost. Such budget stability could be achieved if Congress were to enact Five-Year Defense Authorization and Appropriations Bills, a measure which has long been sought by the military. It seems ironic that, while Congress has had substantial experience in voting long-term funding commitments for domestic social programs, some of which automatically claim billions of dollars of revenue each year, it has thus far failed to consider a similar legal commitment to long-term defense

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18 Gansler, op. cit., p. 222.

budget growth as the most effective response to the Soviet arms buildup. Yet the benefits of long-term defense budgets would be substantial. They would:

- o demonstrate American resolve to prevent Moscow's attaining military superiority. This could convince the Kremlin that it has nothing to gain by continuing its arms build-up;
- o introduce stability into military planning;
- o help to lower the cost of weapons.

Long-term defense budgets might also help to sustain the domestic defense consensus by creating new habits of thought and spending. Disagreement clearly exists on how much automatic growth should be assured by a Five Year Defense Budget. But even a level of 3 percent annual real growth in compliance with a 1977 pledge to NATO, with additional funds negotiated each year to help the United States catch up to the U.S.S.R., would lower the cost of weapons significantly.

Multiyear Procurement

Five-Year Defense Budgets would not necessarily fix funding for individual programs. In many cases, however, multiyear contracts for procurement could save 10 to 20 percent by:[19]

- o bringing stability to industrial planning and permitting efficient purchase of materials;
- o reducing administrative costs and overhead;
- o providing greater incentives for plant investment; and
- o enhancing continuity of subcontractor supply lines, thereby reducing production bottlenecks.

Multiyear contracts would also have the collateral benefit of improving the nation's capability for mobilization in times of crisis.

Advanced procurement of components and parts used in the production of weapons that are funded in later years is a related cost savings measure that can be used either on its own or in combination with multiyear procurement. According to the American Defense Preparedness Association, a professional, nonprofit organization of ex-government officials, scientists, and defense industry executives, advance procurement alone could save up to 4

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19 The estimate is that of Deputy Secretary of Defense Carlucci. Memorandum on "Improving the Acquisition Process," April 30, 1981, p. 3.

percent of production costs.[20] "Extended" advance procurement, which would permit advanced funding for the recurring costs of labor and machines, could save up to 8 percent alone and 25 percent in combination with multiyear procurement.

In the 1970s, Congress was disappointed in the results of several multiyear contracts awarded for major shipbuilding and Army modernization programs and, as a result, set stringent requirements on their application. These restrictions have been removed and the FY 1982 defense budget contains funding for multiyear contracts on the F-16 fighter, the C-2 carrier-on-board aircraft, and the Troposcatter radio. The F-16 contract alone should save about $250 million on the $3 billion program. DOD is requesting funds for an additional fourteen multiyear contracts for savings of $125 million in 1983 and $1 billion in the FY 1981-1987 period. The additional funds necessary to support these contracts should be appropriated by Congress.

Multiyear contracts are applicable mainly to programs with a firm production commitment, a fixed quantity of weapons to be produced, and low-risk technology, criteria that currently rule out many of DOD's major weapon programs. In a few years, however, multiyear contracts might be feasible for the F/A-18, the M-1 tank, the M-2 infantry fighting vehicle, and the Patriot missile system, as these systems attain more production experience. Multiyear contracting has been the focus of the procurement effort in Congress. It typifies a simple measure that could bring about impressive savings. It would not, however, be a cure-all for the problem of high weapons cost as it could only contribute about 5 percent of the savings possible through all reform measures combined.

Low Production Rates

When production rates are low, the unit cost of weapons rises substantially. DOD could significantly lower costs merely by increasing production rates. The Administration has accordingly made this a fundamental goal of its acquisition policy, with the FY 1982 and FY 1983 budgets calling for higher production rates on a number of weapon systems in anticipation of significant savings -- $470 million in FY 1982 and $568 million in FY 1983.

Producing weapons at higher rates, however, has some problems. Without additional funding, it can be achieved only at the cost of reducing or even killing other programs. In fact, the Services have been told to identify forty programs in research, development, testing, evaluation, or procurement to be cancelled from the FY 1983 budget in order to free money to fund thirty priority programs at cost effective production levels.[21] Two victims of DOD's

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20 "A Report on the ADPA Seminar 'Use of Multiyear Concepts in Defense Acquisitions,'" American Defense Preparedness Association, 1981, p. 5.

21 "Progress Reported on DOD's Acquisition Initiatives," Armed Forces Journal, December 1981, p. 77.

procurement policy in the FY 1982 budget were the Army's Roland SAM system and the P-3C Orion antisubmarine warfare aircraft. This comes at a time when the U.S. is struggling to prevent the Soviet Union from attaining overall military superiority. What is really needed is a defense budget large enough to fund all the programs in development and production necessary to meet the Soviet military threat.

Cost Overruns

The GAO reported in 1972 that DOD weapons programs were running about 40 percent higher than original estimates. Today, overruns average 100 percent and more for the life of a program. Overruns are serious because they lead to program budget shortfalls, to which the Services typically respond by lowering procurement rates, stretching out programs, or cutting costs elsewhere, such as in the operations and maintenance account. As a result, weapons cost mounts and readiness deteriorates.

In FY 1982, for example, the Army has had to cut procurement of M-1 tanks from 720 to 633. Procurement of M-2 infantry fighting vehicles will have to be reduced by 75 in the FY 1983 budget to stay within budget limits. Funds authorized in the budget for fourteen AH-64 helicopters will buy only eleven, because the unit price increased from $26 million to $35 million. Without substantial extra funding, the Pershing II missile program, which has grown by 110 percent in the last few months, may have to be cut by 66 percent and the program stretched out for several additional years.[22] All because of unexpected cost increases.

What causes the overruns? Design changes generally account for only 3 percent. "Misestimates" of production costs usually add another 10 to 15 percent. Quantity and schedule changes, such as reductions in weapons procurement and schedule stretchouts, are responsible for 10 percent of the cost growth. But the biggest factor, typically 65 percent, is inflation's accelerating far beyond the wildest projections. When factoring inflation into budget requests, the Pentagon by and large has used estimates prepared by the Office of Management and Budget for the economy as a whole.[23] OMB estimates have routinely been far too optimistic, however, and have created a situation causing DOD shortfalls of as much as $6 to $7 billion a year for the past five years.[24]

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22 See "Press Reports on AH-64...," "Fighting Vehicle Costs Require Production Cut," and "Pershing II Costs More Than Double," Armed Forces Journal, January 1982, pp. 58-61.

23 With the exception of shipbuilding programs, which have for many years used different inflation assumptions.

24 For a discussion of the impact of inflation misestimates on the budget, see Hearings on the Effect of Inaccurate Inflation Estimates on Defense Budgets, House Government Operations Committee (Washington, D.C.: Government Printing Office, 1981).

After being provided with years of stories like these, overruns here, shortfalls there, what does the public think? By far the most dangerous aspect of cost overruns is obviously that ultimately they will so undermine the credibility of the Defense Department that support for defense funding will be destroyed. Then the whole issue of high cost becomes moot.

A number of Carlucci Initiatives address overruns. Recommendation #4 calls for full program funding to reduce cost overruns due to schedule changes. Recommendation #6 calls for more realistic estimates of development and production costs. Contractors frequently submit artificially low estimates of program costs with the hope of recovering costs later. Assuming that Congress would be very reluctant to approve some programs if their actual cost were known, DOD has often gone along with these low estimates to make a program fit available funding. Carlucci Initiative #6 aims at stopping this practice of "buying into" a weapons program. Higher cost estimates of programs would probably mean funding of fewer programs, but those funded would be managed more effectively.

Recommendation #16 calls for more realistic inflation projections in defense budgeting, an objective that has eluded the Reagan Administration thus far. The Congressional Budget Office, which has a far better track record than OMB in its public inflation projections, has argued that the Administration's inflation estimates are far too optimistic and will result in a $4 billion defense shortfall in FY 1982 and an $81 billion shortfall over the next five years.[25] The Defense Science Board projects inflation in weapons procurement at 20 percent and a much greater shortfall. In its FY 1983 program budgeting, the Defense Department is using higher inflation figures for four classes of weapons: combat ships, aircraft, tracked armored vehicles, and missiles. But these higher inflation assumptions (roughly 8.9 percent instead of 6.9 percent for defense budget outlays as a whole) are still not high enough. The Pentagon can no longer afford inflation driven cost overruns. It must find more effective ways to assess and deal with the rate of inflation -- a very difficult task.

Congress has attempted to control the situation through an amendment to the FY 1982 Defense Authorization Act that requires DOD representatives to appear before Armed Services Committees of both chambers to explain cost overruns of more than 10 percent in R&D or 15 percent in production. The Secretary of Defense himself must give an accounting if the overruns are 25 percent or more. How much this will control overruns is uncertain. If DOD program estimates continue to fall wide of the mark, Congress may have to require that program estimates be submitted with a range of possible inflation assumptions and perhaps even to rely on an upgraded congressional weapons program staff to provide independent estimates.

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25 Peter J. Ognibene, "In Military Procurement, More Bucks Don't Always Produce a Bigger Bang," National Journal, December 12, 1981, p. 2194.

Greater Price Competition

Competition for defense dollars is fierce, but DOD systematically has failed to take advantage of it to procure weapons at lower cost. Only 8 percent of DOD's contracts are formally advertised, and only 32 percent are negotiated competitively with two or more suppliers. The remaining 60 percent are "sole source," for which the Pentagon relies on in-house "should cost" analyses to control costs. According to the GAO, the Defense Department has not successfully controlled costs with this technique.[26]

"Second sourcing," that is, dividing up the production of a weapon between two contractors and awarding production shares on the basis of holding down costs, appears to be an effective method of introducing more competition. It has already been used successfully, for example, to lower the production costs of an early version of the Sparrow missile by 60 percent from $173,000 each in 1976 to $71,000 in 1980. It is also being used in the production of Los Angeles-class attack submarines and FFG-7 class frigates. Second sourcing requires additional "start up" costs and could dilute economies of scale. In cases of large production runs, however, it could be used to substantially lower overall costs of a weapons program. DOD appears eager to employ second sourcing as a cost-reducing measure and is currently considering a number of candidates, including the M-1 tank. Congress should appropriate the necessary "start up" funds for second source programs. When the production run is too low to warrant second sourcing, future contracts could be made contingent upon success in holding down costs.

Costs could also be lowered by opening up the defense market to foreign producers. For example, Brazil currently has a light armored vehicle that meets all the specifications for use with the U.S. Rapid Deployment Force at one-fifth the cost of comparable U.S.-built systems. For national security reasons, the U.S. may not want to become dependent on foreign sources for such major weapons systems as fighters and ships. But foreign competition in light weapons could bring down costs appreciably.

Subcontractor Bottlenecks

Procurement attention almost always focuses exclusively on prime contractors, the giants of defense industry, such as McDonnell-Douglas, Lockheed, General Dynamics, and Todd Shipyards. Yet between 50 and 60 percent of the value of a major weapon purchase is subcontracted. And it is here that problems mount.

Prime contractors rely on some 50,000 subcontractors, a base that has been shrinking. For example, in 1967 the aerospace

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26 GAO, "Impediments to Reducing the Costs of Weapon Systems," PSAD-80-6, November 8, 1979, pp. 40-41.

industry was serviced by about 6,000 subcontractors. Thirteen years later, only 3,000 were left. Forgings, used in landing gear struts, large wing spars and bulkheads, and jet engine turbine blades, among other things, have been hard hit, the industry having lost 26 percent of its plants since 1967. The Army, similarly, has had trouble obtaining turret and hull castings. In 1961, there were three sources of tank turret castings and two sources of tank hulls. Today, only Blaw-Knox Foundry of East Chicago produces either. After the 1973 Arab-Israeli War, the U.S. tried -- without success -- to boost production of M-60 tanks to fill stockpile shortages created by transfers of armor to Israel. Blaw-Knox was already working at full capacity filling civilian orders, and the Pentagon had to get in line. Other critical components with few suppliers are: aircraft radar systems, with two suppliers; aircraft engines, two; aircraft landing gears, three; aircraft navigational systems, two; and infrared systems, two.

The shrinking subcontractor base contributed significantly to the dramatic increase in lead time necessitated in 1975-80 for deliveries of a large number of critical materials and components used in weapons production. The delays in turn led to program stretchouts and higher weapons cost. Due to a lag in commercial aviation production in 1981, lead time for a number of materials and components (for example, aluminum and titanium extrusions, forgings and castings) was cut almost in half, but lead time for avionics systems remains close to the high 1979-80 levels.[27] Defense industrial executives are predicting another sharp rise in lead time in the 1983-84 period when the B-1 and other weapon systems enter full production. The problem remains the lack of manufacturing capacity at the subcontractor level.

Table III
Increasing Lead Times for Selected Critical Components

Item	1975	1979	1981
Castings	30-32 weeks	65-70 weeks	60 weeks
Forgings	40-50	78-89	60
Precision Forgings	40-50	100-105	60

Source: "Materials, Suppy Shortages Ease," Aviation Week and Space Technology, January 4, 1982, p. 39; and J. Gansler, The Defense Industry, p. 66.

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27 "Manufacturers Facing Surplus in Materials," Aviation Week and Space Technology, January 11, 1982, pp. 64-73.

Table IV
Lead Times for Equipment to Supply F-16 Production

Item	1978	1979	1981
Actuators	12 months	32 months	26 months
Hydraulic Valves	10	26	24
Hydraulic Pumps	14	17	18
Power Supply	12	17	15
Battery Charger	12	13	13

Source: "Manufacturers Facing Surpluses in Materials," Aviation Week and Space Technology, January 11, 1982, p. 64.

As the subcontractor base has shrunk, demand has outstripped supply, and the price of key components has increased. As an example, in FY 1974-1975 the prices of electron tubes, relay arms, and variable resistors increased by an average of 75 percent, due almost solely to "monopoly pricing."[28]

Subcontractors have been fleeing the defense market for fundamentally two reasons: 1) the boom and bust nature of defense spending; and 2) the difficulty they have in recovering costs accrued in doing business with the Defense Department. There is a lack of sufficient "flow down" of benefits from prime contractors. Subcontractors operate under more severe business conditions than prime contractors. Subcontracting work, for example, is done on a fixed-fee basis and is hence more vulnerable to inflation and other disruptions in the economy. Profits are low; profits on sales average 2.7 percent for small defense contractors, compared to 5.5 percent for similar commercial businesses. Competition is stiffer than at the primary contracting level.

A steady flow of defense funds ensured by Five-Year Defense Bills and multiyear contracts would help to keep subcontractors in defense work and to entice new firms into the market. A further enticement would be a reduction in the red tape accompanying a federal contract. Today, defense firms are spending $8 billion a year to comply with over 200 Defense Department and Service-specific procurement directives required for doing defense work. A 20 percent reduction in such directives would save $116 million a year in weapons cost.[29] Substantial savings could also be achieved by exempting defense firms from the countless federal

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28 Gansler, ibid., p. 131.

29 Frank C. Carlucci, Memorandum on "Improving the Acquisition Process," April 30, 1981, p. 15.

regulations designed to promote various socioeconomic objectives, such as employment of the handicapped, rehabilitaton of prisoners, protection of the environment, and employee health and safety.

Low Productivity

Productivity growth rates for the manufacturing sector of the U.S. economy are the lowest of the Western industrial nations. The productivity growth rate of the defense sector is even lower than that of the manufacturing sector overall. The aerospace industry has been investing less than 2 percent of its sales in new capital, compared to investment rates of 8 percent overall in the U.S. economy and 4 percent in the manufacturing sector. Because of low investment, 60 percent of manufacturing equipment in the defense industry is over 20 years old.

Defense contractors' reluctance to invest in new equipment stems from a number of causes. Topping the list is budget instability and uncertainty over future contracts. In addition to such problems as high interest rates that are faced by all American industry, defense contractors often cannot get adequate financing from the banks in the first place, because of the high risk/low profit nature of their business. Another important factor is the Defense Department policy of basing profits on production costs, which serves as a disincentive to lowering such costs in the hope of increasing profits and is a sure road to low productivity.

To encourage private investment in the defense industry, Congress in 1981 repealed Cost Accounting Standard 409 and enacted more liberal tax policies as part of the Reagan Administration's general economic program. Congress also repealed the Vinson-Trammel Act which set limits on defense contracts. And new ideas have come from Jacques Gansler, defense economist and former Undersecretary of Defense for Material Acquisition, who has argued persuasively that the Defense Department should be concerned not so much with lowering profits as a way to lower weapons cost, but rather with lowering production costs even if this entails higher contractor profits. Writes Gansler in his study The Defense Industry:

> A 1976 survey confirmed that the contract negotiators consider it their job to attack the profits of defense suppliers. This is the wrong perspective for these negotiators to have; rather, they should attempt to reduce the total price of the equipment of which profit is only a small percentage. If the cost base could be reduced significantly, perhaps even by allowing a slightly higher profit, the government (and therefore the public) would be far better off -- particularly if this increased profit could be reinvested to achieve higher productivity and if its presence resulted in healthier, more effective defense-industry suppliers.[30]

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30 Gansler, op. cit.

The Defense Department has tried linking profits to investment, but this policy has not been working well.[31] Nevertheless, the GAO maintains that linking profits to investments can be useful in lowering weapons cost. DOD's profit-investment policy therefore should be reexamined in order to encourage badly needed new investment.

The Department of Defense has been promoting two programs for modernizing the defense industrial base. In 1963, it established a Value Engineering program which, through both private industry and DOD efforts, seeks to discover and implement new cost saving manufacturing techniques using existing machines and labor skills. The GAO has reported a good return on investment in this program. From 1963 to 1978, DOD saved $6.5 billion (FY 1979 dollars) on the cost of weapons; savings in 1978 alone were about $0.5 billion.[32] Unfortunately, in the last few years, program managers have lost interest in the Value Engineering program, a tendency that should be reversed.

The second DOD modernization effort is the Manufacturing Technology (MANTECH) program in which DOD invests in the development of new production techniques using computer controlled multi-purpose machines. In its FY 1983 defense budget, the Pentagon will seek a major increase in MANTECH funding -- $0.5 billion to be spent over the next five years[33] -- a program that deserves full congressional support.

Labor Problems in the Defense Industry

There are widespread shortages of skilled manpower in the defense industry, a situation expected to get worse. By 1985, for example, there will be a shortage of some 250,000 machinists. Shortages of engineers, statisticians, and computer professionals could approach 50 percent, 85 percent and 80 percent respectively of needed levels. If the situation does not change, wages will increase and with them, weapons cost.

Some sectors of the defense industry also suffer from a highly unproductive workforce. The shipbuilding industry, for instance, currently has an annual turnover rate of 40 percent as many of its workers transfer to other industries. Studies indicate that a worker is only 50 percent efficient during his first two years on the job. The resulting lack of experienced skilled workers has cost the Defense Department millions of dollars in botched production jobs.[34]

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31 GAO, op. cit., pp. 28-31.

32 Ibid., pp. 40-41.

33 "$6 Billion Aimed at Beefing Up U.S. Arms Plants," Chicago Sun Times, November 25, 1981, p. 15.

34 This is true for Air Force and Army weapons programs as well as the more publicized Navy shipbuilding contracts. See, for example, "An Air Force Chief Laments Shortage of Engineers," Journal of Commerce, November 18, 1981, p. 4.

Labor shortages are best solved by a free market, which means that higher wages will be necessary in the near term to entice more qualified people into defense work. In the long run, however, labor costs should stabilize or rise at a lower pace. The government can help solve this problem by monitoring the labor needs of the defense industry, publicizing the opportunities available, and encouraging American youth to seek careers in defense work.

REFORM MEASURES AND COST SAVINGS

There are a number of ways to lower the present exorbitant cost of weapons. How much any of them singly or in combination could save would depend on the vigor with which they were pursued. In its FY 1983 Annual Report to Congress, DOD claims savings in FY 1982 of about $1 billion from acquisition reform measures such as multiyear contracting, higher production rates, and productivity enhancements. Savings of $7.6 billion are projected for the period FY 1983-87 from currently planned initiatives.[35] Savings should grow considerably as further measures are put into effect. Indeed, according to conservative estimates by Jacques Gansler, savings of 10 percent of DOD's procurement and R&D budget, should be possible each year as a result of the measures discussed in this paper.[36] Because of their interdependency, it would be misleading to simply sum the individual savings estimates. Total annual savings, however, could be roughly $8.5 billion.

As indicated earlier, one of the most effective ways to reduce weapons costs is simply to increase production rates. There are a number of weapons which for sound military reasons should be produced at higher rates. This, however, will require an expansion of the defense budget to avoid cutting back on other needed weapon systems. Other measures that would require higher immediate defense spending to achieve overall and long-term cost savings in weapon production are the MANTECH and Value Engineering programs, multiyear procurement contracts, second sourcing in production, and better inflation/production cost estimates. Indeed, a significant portion of the increase in weapons funding requested for FY 1983 has been requested in order to implement the Defense Department's acquisition reforms. This investment will be returned eventually in the form of cheaper weapons and an expanded military capability. In the short run, however, procurement reforms will not cuts costs substantially. It will take at least five years before major savings of several billion dollars a year can be achieved. In the meantime, cutting weapons program budgets from spending levels outlined by the Defense Department in its FY 1983-87 Five-Year Plan would only aggravate the problem of high weapons cost.

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35 Caspar Weinberger, Department of Defense Annual Report to the Congress, Fiscal Year 1983, p. III-212.

36 Gansler, op. cit., pp. 221-223.

Table V
Summary of Cost Savings

Reform Measure	Estimated Annual Savings (Billions of FY 1982 Dollars)
o more cost conscious weapons design	2.3
o more vigorous interservice standardization	1.2
o greater use of commercial components	0.9
o Five-Year Defense Budget bills	0.7
o multi-year procurement	0.9
o better cost estimates	0.7
o more competititon at prime contractor level and expanded sub-contractor base	2.7
o exemption of defense firms from socioeconomic regulations	0.8
o reduction in DOD directives	0.2
o greater labor stability and skilled manpower pool	0.7
o intensification of DOD's MANTECH and Value Engineering programs	0.5

CONCLUSION

Lowering the cost of weapons is one of the few efforts supported by all sides in the defense debate. But two obstacles block prompt and effective measures. First, there are numerous special interests with a stake in business as usual, including Congressmen who allow local economic interests to determine weapons programs at the cost of economic efficiency, defense industry executives who use their political clout to guard their firms' contracts from competition,[37] and program managers who are judged by their ability to win defense dollars to sustain Service programs.[38] Second, a comprehensive reform package has

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37 For an especially revealing illustration of the way in which defense firms supported by local Congressmen can hinder DOD economizing efforts, see Deborah M. Kyle and Benjamin F. Schemmer, "Why U.S. Weapons Lag: Army Secretary, Defense Logistics Agency Pressure From Fixing Chem Warfare Mess," Armed Forces Journal, April 1981, pp. 27-29.

38 For a brief treatment of the pressures faced by program managers to manipulate programs for continued funding, see Defense Resources Management Study, Final Report by Donald B. Rice (Washington, D.C.: Government Printing Office, 1979), pp. 27-37.

yet to be studied and approved by all the relevant participants in the weapons acquisition process.

It is now up to the Reagan Administration 1) to demonstrate that lowering the cost of weapons is a high priority not be be impeded by special interests, and 2) to coordinate the efforts of the Defense Department, Congress, and the defense industry in devising a comprehensive program to cut weapons cost. Without such high-level attention to this program, the soaring price tags on arms systems threaten to erode the national consensus that is enabling the U.S. at last to begin challenging the Soviet dash for military superiority.

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APPENDIX

A Note About Weapons Cost Figures

Figures for the cost of weapons as reported in defense publications and the media differ widely. This is because there are a number of ways to calculate the cost of a weapon, and it is not always clear which cost accounting method is being used. The most widely used methods are the following:

(1) unit cost determined by dividing the R&D, procurement, and related military construction costs of the program in current dollars by the number of weapons procured.

Every three months, the Defense Department publishes a Selective Acquisition Report (SAR), which gives the R&D, procurement and military construction costs for DOD's top forty-five to fifty weapon programs. According to this cost accounting method, for example, the cost of the Army's M-1 tank program, as reported in the September 30, 1980, SAR, is $18.8 billion, for a unit cost of $2.68 million. Because this cost accounting method uses a mixed bag of dollars, however, it is a poor measure of the true cost of a weapon. It would be far more useful to the defense community and Congress if the Pentagon would calculate program costs in constant dollars. For purposes of comparing capability per dollar, it would also be helpful to know what the cost of a program would be for a common fixed number of weapons. It is misleading to compare unit costs of two weapons, say, the F-14 and the F-18, based on different quantities.

(2) unit cost based on total "lifetime" cost, that is, development and production costs plus operations and maintenance expenditures (which typically are equivalent to development and production costs).

(3) unit cost of a weapon as purchased in the current fiscal year defense budget; that is, total procurement budget for a weapon system -- "fly-away" cost plus cost of initial spare parts -- divided by the number of weapons purchased. This figure is highly dependent on the number of weapons purchased (the more bought, the lower the unit cost) and on the maturity of the program (newer programs have more production problems reflected in higher unit costs).

It is important to keep these different cost accounting methods clearly in mind when following the defense budget debates in Congress. The various participants in the debates are not above manipulating weapons cost figures to press home their arguments. Weapons cost in this paper are given in constant dollars as in method (3) unless otherwise specified.