

CONSOLIDATION OF THE U.S. DEFENSE INDUSTRIAL BASE

John Deutch

The U.S. government has promoted defense industry consolidation in the past decade as part of its acquisition reform policies, to help control costs and promote efficiency. But when the Department of Defense (DoD) reversed its pro-consolidation policy, defense firms were left financially less secure from the acquisitions and mergers — and the hoped-for reductions in tangible assets have been marginal. What is the best way forward?

As the administration of George W. Bush considers national security priorities for the 21st century, it will necessarily address the health of the U.S. defense industry and consider policies designed to ensure an industrial base adequate to meet U.S. security needs. During most of the post-Cold War decade, the industry has faced a relatively stagnant defense budget. Notwithstanding improvements in efficiencies, the net return on invested capital has been inadequate for many of the leading firms. Share prices, which tumbled in 1998 and 1999, have recovered somewhat during the past two years, as a result of improved performance by several firms and the expectation of near-term defense budget increases. However, I believe there is a crisis in the defense industry with origins

that need to be better understood if effective policies are to be adopted.

The first Clinton administration acknowledged strains on the defense industrial base and put into place two policies to address this problem: acquisition reform¹ and an industry consolidation policy. Although much remains to be done, there has been considerable progress on acquisition reform. On the other hand, the success of the consolidation policy that attempted to balance the number of competing firms with efficiency has been more controversial.

In 1993, analysts assigned by Secretary of Defense Les Aspin to conduct a “bottom-up review” of U.S. defense posture concluded that the defense industry needed to be restructured. Then Deputy Secretary of Defense William J.

Perry announced to industry leaders, at what has come to be referred to as the “Last Supper,” the Department of Defense (DoD) policy to encourage consolidation.

In July 1993, serving as the Undersecretary of Defense for Acquisition and Technology, I introduced rules for sharing savings from consolidation between DoD and industry. The Defense Science Board formed a task force, composed of defense industry executives and government lawyers, to address the antitrust issues raised by the consolidation policy. In the five-year period of 1993–1998, many major defense firms merged or were acquired.

In 1998, DoD unexpectedly reversed the pro-consolidation policy and urged the Department of Justice (DOJ) to reject the proposed merger of Lockheed Martin and Northrop and the proposed General Dynamics acquisition of Newport News Shipbuilding.

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The absence of a clear signal ending the consolidation policy is unfortunate because it left several defense firms stranded on a

different course. In the spring of 2001, both General Dynamics and Northrop/Litton made offers for Newport News Shipbuilding, thus re-opening the industry consolidation question for the Bush administration.

Here I will review the reasoning behind the pro-consolidation policy, to assess what went right and what went wrong, and speculate on the way forward for the U.S. defense industry.² My purpose is to

stimulate thinking about one central proposition: Given the likely level of defense expenditures over the long term, the health of the U.S. defense industry depends on reducing the asset base devoted to defense by both the commercial and government sectors.

RATIONALE FOR THE PRO-CONSOLIDATION POLICY

The Aspin-Perry team proposed the necessity of consolidation because of the more than 40 percent drop, in real terms, of DoD investment expenditures — procurement plus research and development (R&D) plus construction — and the expectation that these expenditures would not return to the mid-1980s Cold War levels. If the industrial base was properly sized during the higher level of expenditures of the mid-1980s, the inevitable conclusion was that, in the 1990s and beyond, the defense industry infrastructure had to shrink by as much as 40 percent to remain in balance with declining post-Cold War defense budgets. It followed that it was necessary to reduce the assets allocated to defense, in both private and public sectors.

The purpose of the consolidation policy was to encourage mergers that reduced the level of assets allocated to defense. At the time, DoD focused on reducing physical assets: property, plant, and equipment. Total assets include tangible assets (physical assets plus working capital) and intangible assets or “goodwill.”

If assets were not reduced, smaller defense budgets would mean unit costs would rise, inevitably placing downward pressure on profit margins available to

industry. If returns on capital declined, defense aerospace companies essential to a strong defense infrastructure would be in trouble, and this was not in the interest of the nation, DoD, or stockholders. The policy intent was to encourage the companies, through normal capital market mechanisms, to make rational business decisions that would result in fewer assets devoted to defense.

Accordingly, DoD sought to reduce the asset base or “infrastructure” committed to defense. For government-owned facilities, downsizing meant an aggressive effort through the Base Reduction and Consolidation (BRAC) process to close bases and government-owned shipyards, depots, and laboratories. For the private sector, downsizing demanded a pro-consolidation policy. The DoD leadership recognized that the government was unlikely to be successful at directing exactly how consolidation should take place. Instead, sharing cost savings from consolidation would give industry an incentive to downsize. Industry and the capital markets would determine the best manner to adapt to the new policy.

Congressional reaction to these initiatives was negative. Downsizing means fewer jobs in congressional districts; Congress never likes to see less government expenditures at home, despite agreeing with the general proposition that downsizing is needed. Congress termed DoD defense industry policy “payoffs for layoffs” and placed limitations on government sharing of savings with private industry.

Congress also resisted BRAC, but permitted four rounds of closures before refusing in 1997 to renew the authority. Paradoxically, Congress was more

successful at slowing the process of asset downsizing than reducing the rate of decline in defense employment. Private sector defense jobs decline at least in proportion to reductions in defense contracts.

EARLY CONSEQUENCES OF INDUSTRY CONSOLIDATION

Between 1993 and 1998, there was a burst of defense industry mergers and acquisitions. Some companies were sellers, for example, General Dynamics, Loral (after 1996), Ford Aerospace, Texas Instruments, and North American Rockwell. Other companies were buyers, notably Raytheon, Martin-Marietta, Lockheed, Loral (before 1996), and Boeing. There was a significant decline in the number of prime contractors and top system integrator companies in the defense-aerospace sector.

The impact of each transaction depended on the business circumstances of the firm from the potential for greater efficiency from downsizing to increasing market share. But there were also both positive and negative impacts on the financial situation of a company that were influenced by the financing strategy of the acquiring company and that, in turn, inevitably influenced the behavior of the firm.

When two companies effect a stock-based merger (and pool their balance sheets³), the resulting balance sheet is

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simply the sum of the balance sheets of the two entities. If one company acquires the other, the seller takes the proceeds and puts the resources to productive use elsewhere in the economy. The acquiring company pays for the purchase by using available cash, issuing new equity, and taking on new debt. If the purchase price exceeds the book value of the acquired company, an intangible asset or “goodwill” is created on the balance sheet.

In fact, most of the consolidation of the 1990s took place by acquisition rather than merger; and taking on significant amounts of new debt, financed most of the transactions. There was a significant increase in the level of assets employed

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as a result of goodwill and an accompanying increase in debt burden for most of the large acquiring defense companies, notably Lockheed-

Martin and Raytheon. Because of the larger debt burden, operating cash flow and income needed to increase to pay the additional interest charges,⁴ if net income and return on equity was to remain fixed.

There are two good reasons why companies are willing to take on new debt or issue equity as a significant part of the cost of an acquisition. First, the acquiring and selling firms may see value in combining their intellectual property, know-how, and customer relationships, which are not explicitly carried on the balance sheet as an asset. Second, there may be synergy and efficiency in the operations of the combined companies that lead to

lower costs or more competitive products, thus justifying a premium over book value. However there are also cases when the acquiring company may just be over-paying.

In my view, all three of these reasons were evident in the industry consolidation process of the early 1990s. There is no question that the desire to acquire complementary technology and intellectual capital were significant factors in many of the transactions. Moreover, we know that the combinations presented opportunities for efficiency improvements, because, I believe, in all cases, the surviving combined companies were able to report significant cost savings to the U.S. government.⁵ Unfortunately, the sharing of these cost savings between the government and the companies, intended by DoD policy and anticipated by defense firms, did not happen because of congressional restrictions and the opposition to “payoffs for layoffs.”

In the 1993–1998 period of euphoria, defense companies experienced significant increases in equity prices based on the expectation of revenue growth and margin improvement from cost savings. In 1998, the outlook for the industry began to darken for several reasons. First, DoD reversed the consolidation policy. Second, expected cost savings were not shared with the companies, and hence margins were squeezed, especially from increasing interest payments on debt required to fund acquisitions. Third, defense companies making acquisitions were overly optimistic about the expected growth in top-line revenues from DoD, foreign military sales, and commercial spin-offs of defense technology. The anticipated increase in defense outlays had not materialized.

Finally, some key companies found it difficult to manage their expanded enterprises effectively in all respects and to meet their optimistic financial targets. The capital markets quickly shifted to more glamorous (at that time) dot.com and high-tech stocks not associated with defense.

THE DEFENSE INDUSTRY IN 2000

The consolidation process came to an abrupt end in 1998, when DoD and the DOJ became concerned about the impact of industry consolidation on competitiveness. DoD turned down the proposed Lockheed Martin acquisition of Northrop and the proposed acquisition by (a re-emergent) General Dynamics of Newport News Shipbuilding. But DoD did not indicate whether further downsizing was necessary and, if so, how it was to be achieved. After all, DoD's responsibility for the national defense demands that the department be concerned with the long-term strength of the defense industrial base. But how should this be achieved?

By the beginning of 2000, the defense industry was in a much different position than anticipated in 1993. Assets were not significantly reduced, profit margins had declined, and government outlays for defense investment were still flat. For several companies, return on equity had fallen to below the cost of capital to service their debt. Several of the leading companies had been downgraded by the financial credit agencies,⁶ so that their debt was on the verge of not being investment grade. This means that their cost of capital rises, and funding investment is more expensive.

During the period from 1993 to 1998 the level of assets of defense firms did not fall, and profit margins declined significantly. This of course is a generalization for the entire sector as of 2000.⁷ Some companies closely followed the trend (e.g., Lockheed Martin, Raytheon, and TRW); others did not (General Dynamics, Boeing, and Northrop). But for DoD prime contractors, on average, the net move in assets has not shown a decline, but return on equity has declined. (The situation for mid-tier contractors is somewhat different, although this sector has also experienced considerable consolidation since 1985.)

There are a number of reasons why it is difficult to collect financial data to substantiate this trend. The balance sheets of companies that were acquired are not always comparable to the reporting of the subsequent parent company. Frequently, the historical data are not in a form that permits tracking of the variables of interest. For example, the concern here is with company sales to DoD, not total sales which may include both commercial sales and sales to foreign governments.

Moreover, data is not always available for different asset categories of interest (e.g., tangible assets such as working capital and property, plant and equipment) and goodwill. Nevertheless, some estimates are possible. For the top five defense contractors,⁸ in the six-year period from 1993

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to 1999, the value of total assets (intangible plus tangible) rose 32 percent. In that same period, the value of tangible assets fell 7 percent.

For this calculation, the asset base for each of the top five contractors (in 1999), the 1993 asset base is the sum of the assets of the firms acquired during the six-year period. The data further indicate that the companies were more efficient, at least using the measure of productivity of operating assets: between 1993 and 1999, the operating asset “turns” (i.e., the ratio of revenue to operating assets) improved from 1.59 to 1.94 — an impressive 20 percent.

The startling fact is that tangible (i.e., operating) assets have decreased relatively little, and total assets have increased

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significantly during the six-year period. The reason that tangible assets have not declined more significantly (as intended by the pro-consolidation policy)

is that the incentive is not there. The Pentagon’s originally intended incentive of sharing cost savings has simply not occurred.⁹

I do not have data to confirm that a similar trend in asset growth has also occurred at second- and lower-tier defense firms, although that is my impression. However, even if the trend is restricted to primes, it is a problem for the entire defense industry because supplier firms depend on the health of the primes.

Defense companies understandably have become concerned about the future.¹⁰

With profits and equity prices falling, companies have moved to reduce capital investment and cut discretionary Research and Development (R&D). The industry and DoD worry about retention of talented technical people who understandably are attracted and recruited by the technology firms in the commercial sector.

The industry speaks of several ways that this adverse trend might be reversed. First, DoD investment (procurement plus research, development, test, and evaluation, RDT&E) outlays have increased significantly during the past five years, thus regaining a significant fraction of the decline experienced in the late 1980s and early 1990s. The DoD budget estimate is given in Table 1.¹¹

There is some optimism that the DoD investment account will continue to increase at 5 percent per year. Past history suggests that these projections of DoD investment increases may prove optimistic, which will only make matters worse for the defense industry. Further increases in investment require an increase in the defense budget; this seems unlikely given the tax cuts and shrinking surplus.

Moreover, an increasing portion of these new R&D and procurement funds may not find their way to the largest defense companies that focus on platforms, such as new combat ships or aircraft or system integration. The reason is that the changes in technology (referred to as the “revolution in military affairs”), depend more on information technology than hardware platforms.

Advances in information technology now make it possible for joint military commanders to have near-real-time information available about the size and disposition of enemy forces. When this

Budget Authority	Fiscal Year		
	1996	2001	2002
Procurement	42	62	62
RDT&E	35	41	47
Total DoD	254	296	329
<small>^a In billions of (current) \$</small>			

Table 1. DoD Budget Estimate^a

“battlefield awareness” is coupled with highly accurate munitions and the capability for information warfare, it is possible to imagine a newly configured U.S. military capability that can assure superiority in any conceivable conventional major military conflict situation for some decades to come.

This new military power requires many fewer traditional platforms — combat aircraft, ships, and armored vehicles — and much greater reliance on reliable and secure information networks that can distribute precise information to the appropriate level of command. Secretary of Defense Rumsfeld has indicated a preference for the DoD to seek such “transformational” weapons systems.

Second, industry has aggressively expanded its share of the international arms market, but the potential here is limited by export controls on the most desirable high-performance systems and by the shrinking of the size of this market.

Third, there is the related interest in increasing trans-Atlantic cooperation in the hope of opening new markets in Europe. At present, this possibility seems limited, because European defense budgets are declining, and Europe is moving

toward a so-called “European defense and security identity,” which includes strengthening the European defense industry base. Moreover, if trans-Atlantic partnerships, joint ventures, or mergers take place, without a reduction in assets employed on both sides of the Atlantic, the basic problem — too much defense industrial base for anticipated defense needs — is not effectively addressed.

Put another way, the European defense and aerospace industry faces the same problem as does the U.S. defense industry.¹² But adjustment in Europe is likely to be even more difficult than in the United States because of the stronger state role in Europe. Consolidation between U.S. and European defense companies that does not result in a smaller infrastructure does not do the trick.

Finally, defense and aerospace companies have been aggressively seeking ways to enter commercial markets. An individual company may or may not be successful in this effort; the record indicates that larger companies will find it difficult to be competitive. At the same time that defense and aerospace companies are seeking commercial opportunities, DoD is quite appropriately seeking to reform

its procurement practices to make greater use of commercial products and services.

Today, in the age of information technology, commercial companies can meet DoD needs at lower cost, and frequently they are technically more advanced than defense companies. Increasing emphasis on information technology means that procurement and R&D are likely to shift increasingly away from traditional aerospace and defense companies to commercial firms.

To summarize, as a result of acquisitions, many companies in the defense and aerospace industries have added to their debt, which has resulted in lower earnings, cash flow, and credit ratings. Cash flow and profitability have generally

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declined, and there are few opportunities to grow out of this problem. Not surprisingly, market valuations have declined

(although during 2000 there was a general recovery from the lows). The net result is companies and talented individuals are leaving the industry and those companies that remain must reduce expenditures on internal R&D and other efforts to create new technology and ideas for the future. But robust stock prices should not be taken as a reliable indicator of good health of defense firms.

CHOICES FOR GOVERNMENT POLICY

This weakness of the U.S. defense industry is certainly not in the interest of

the nation. Not surprisingly, Congress has seized upon this problem. Since Congress does not know exactly what to do, it has taken the time-honored action of establishing a “Commission on the Future of the U.S. Aerospace Industry” (Section 1092 of the Fiscal Year 2001 Defense Authorization Act) to study the problem and bring forth recommendations. What is the range of choices open to the commission?

As a monopsonist, DoD has great power in the defense market, but how should it exercise its clout? There are three broad choices:

- Do nothing.
- Take prudent short-run measures.
- Introduce new financial incentives.

There is a great deal to recommend the first option of doing nothing. Any action that benefits the defense companies is sure to be attacked immediately as using taxpayer money to bail out firms that made mistakes. Moreover, the defense industry is not homogeneous, and therefore, each firm is in different financial circumstances. Also great differences exist between the large system integrator and prime contractor firms and the lower-tier supplier firms.

Any set of actions means that some firms will benefit more than others, so DoD will be properly called upon to defend the particular measures it puts into place. I do not envy the new DoD officials who will try to put together a consensus on what should be done — seeking agreement between the industry, Congress, and other interested executive

branch parties, such as the Office of Management and Budget.

It is surely true, however, that nothing should be or will be done until there is clear agreement on the nature of the problem and the desired solution. I believe there is wide agreement on the nature of the problem but much less agreement on the desired solution. The reason for this apparent paradox is that we are not clear about the kind of defense industry we need for the future. This lack of clarity in turn is caused by uncertainty about the threats we will face, and therefore the nature and size of the military forces we will need to provide for the common defense.

Secretary of Defense Donald Rumsfeld's comprehensive effort to redefine the defense force's need in the future is a necessary step toward deciding on what aspects of the present defense industry should be encouraged, and what part of the industry should be allowed to wither away. Nevertheless, we will be reluctant to take action because of an understandable suspicion that the government is not very good at that sort of industrial policy; the incentives it sets, all too often, prove ill chosen.

Within the range of plausible future security scenarios, it is possible to identify with some degree of certainty the type of defense companies the country will need. These companies will need to perform the technically complex and demanding task of system integration. They will have to manufacture high-performance platforms (e.g., nuclear submarines, combat aircraft, missiles, and combat support systems that will remain the backbone of our conventional military capability). They must build networks

that task, collect, process, exploit, and distribute intelligence. Moreover, these companies need proficiency at dealing with the DoD acquisition system. That is no easy matter despite the considerable progress in DoD acquisition reform.

But this specification leaves out a lot. The assumption is that the required asset base will be much smaller, but how small? And, what about second- and third-tier suppliers? Will there be more horizontal consolidation? More important is a question about the change in the nature of defense. To what extent are existing contractors focused on platforms needed in the information-age warfare model? Will the traditional defense primes or the commercial sector provide much of the new network-based warfare systems? The answer to these questions influences the policy options the government should consider.

Uncertainty and prudence thus leads to the second option: short-run measures that will help maintain the aerospace and defense industry, without embarking on a major alternative course of action. Several proposals in this vein have been put forward: increase progress payments on contracts,¹³ speed contractor payments and recognize subcontractor billing earlier, reduce the number of controlled contractor line item numbers, increase use of multiyear procurements; and, going forward, improve the sharing of cost savings from downsizing. Note that sharing cost

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savings does not address the size of the government infrastructure, and that it does not necessarily mean that financial assets will be reduced proportionally to reductions in tangible assets, on which the sharing of cost saving is based.

All of these measures increase cash flow and improve profitability of defense companies generally at relatively low cost. I certainly favor their adoption. But none of the short-term measures address the

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central problem of excess capacity in the defense sector. Adopting measures whose main effect is

reducing the cost of capital for defense companies certainly helps them deal with their short-run financial predicament, but it does little to encourage reducing the asset base of the sector.

The third policy option is for DoD to set new financial incentives that will move the defense industry in the desired direction of shedding assets, while remaining politically acceptable and fair to all firms in the sector. Let me explore one proposal, to demonstrate how difficult a task it will be to craft an acceptable policy measure.

One measure that would ease the considerable debt burden of defense firms is to make interest payments an allowable charge to contracts. But this would hardly be an incentive to reduce assets. In fact, it would be a disincentive. Once the government agrees to pay a portion of the interest charge, the effective cost of capital declines. The financial incentive must be linked to a requirement to reduce assets.

How would a proposal look that links short-run cash-flow benefit with a commitment to reduce asset levels devoted to defense? One way is to permit interest payments on a given amount of debt to be charged as an expense to DoD contracts, if the contractor agrees to reduce the level of assets devoted to defense in the future by a specified amount and for a specified period of time. This arrangement seeks to improve the profitability of defense firms in the short run, while moving to the long-term goal of reducing unneeded assets. Ideally, this offer would be extended only to those firms that had less efficient or less needed assets and capability.¹⁴

It is most improbable that a mechanism of this sort would ever be adopted. First, it assumes an enormous amount of latitude in government action as to who might benefit from the proposal. Typically, the government is not good at making such judgments. Second, the assistance mechanism amounts to a significant subsidy available only to firms who have debt. A company that is not leveraged and relies on equity is disadvantaged. Third, the program is designed to assist contractors who have had traditional business with DoD and hence can identify the portion of their business assets that is dedicated to defense.

But how would this assistance program encourage the increasing number of commercial firms who sell products and services to DoD to do business with it? And what about the many supplier firms who serve DoD only by subcontract to primes?

Meanwhile industry consolidation proposals continue to come forward for DoD and antitrust approval. The government

will soon decide whether to allow the previously mentioned General Dynamics and Northrop/Litton offers to purchase Newport News Shipbuilding; both companies have offered about \$2.6 billion for the company. Newport News has assets of about \$1.5 billion and long-term debt of about \$0.5 billion; if the transaction is approved approximately \$0.6 billion will need to be financed by either additional debt or capital.

Effectively, the assets employed in nuclear powered shipbuilding will increase whoever “wins.” Perhaps the synergies from the acquisition will lead to cost reductions that make the transaction profitable for the company and attractive to the government; the extent of profitability for the company depends to a significant degree on how much sharing of cost savings is allowed by DoD.

Almost certainly DoD is considering how to balance the opportunity to cut costs (which need not be to the benefit of either contractor) with desire to preserve some degree of competition. The consequence that either of the transactions will result in greater assets being devoted to the already capital-intensive nuclear ship platforms industry is probably not being considered.

We face a policy problem that is not easy to resolve. A consolidation policy seeks to achieve a balance between competition and efficiency in order to keep defense costs low. Too much consolidation leads to an arsenal system with a single public or private supplier without competition to encourage new ideas and lower costs. Too little consolidation means that the tangible and financial asset base of the industry is too large and costs too high. The balance depends not only on

the number of firms involved in a particular sector (e.g., combat aircraft), but also on the total size of the asset pool committed and how it is configured.

The correct balance depends, importantly, on the future sustained level of defense spending. I suspect (despite today’s optimism) that the likely future level will not be adequate to support the current size of the defense industry base. Accordingly, consideration will be given to how consolidation might take place at both the prime and subcontractor level in a way that assures competition, innovation, and cost containment.

I come to three conclusions. First, DoD needs to state a clear policy for defense consolidation, so that the rules going forward are understood by the defense industry. This policy should be clearly based on the defense industry infra-

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structure needed to support the U.S. defense posture. The policy should describe the criteria the government will use for granting approval and, the standard for horizontal and vertical integration and for cross-border transactions.

Second, DoD should return to the earlier policy of sharing savings from shrinking the tangible asset base. This is the single most important incentive for industry to downsize. Cost sharing does not assure reductions in particular areas. But DoD is unlikely to craft a new policy that provides significant incentives to reduce infrastructure in those areas that in someone’s judgment deserve to be smaller,

given the present and future security environment. It is just too hard to formulate a policy that will be both equitable and politically acceptable.

Third, market forces eventually will bring the private defense industry to a size at which return on invested capital is judged to be reasonable in light of anticipated risks and returns. (A similar market mechanism does not exist for the public sector enterprise of shipyards, depots, and laboratories, so we cannot anticipate a natural economic downsizing evolution here).

If the government does not take decisive action, there will be a long wait for a healthier environment. Most important, we should remember that the public

objective is to assure a defense industrial base (public plus private) that meets our security needs — market criteria are means to this end but not an end in themselves. We should not rely on financial markets to give us a properly sized defense industrial base.

Finally, defense firms on both sides of the Atlantic should avoid acquisitions that result in the commitment of greater financial assets, unless reductions in tangible assets, such as plant, property, and equipment, can be identified to justify the additional debt or invested capital required to close the transaction. Relying on optimistic projections of cash flow and operating income is not enough.

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John Deutch is a former Under Secretary of Defense for Acquisition and Technology, Deputy Secretary of Defense, and Director of Central Intelligence. He is a board member of Raytheon, one of the defense contractors mentioned in this article. He currently is Institute Professor in the Department of Chemistry, Massachusetts Institute of Technology.

(E-mail address: jmd@mit.edu)

ENDNOTES

1. Acquisition reform refers to improving the Department of Defense development, procurement, testing, and maintenance of needed products, services, and systems.
2. There have been a number of studies of the defense industrial base. One is the Defense Science Board Task Force report, "Preserving a Healthy and Competitive U.S. Defense Industry to Ensure our Future National Security" (April 2000). Another was done by Booz, Allen, & Hamilton: "U.S. Defense Industry Under Siege — An Agenda for Change," J. R. Harbison, T. S. Moorman, Jr., M. W. Jones, & J. Kim (July 2000).
3. It is likely that the Financial Accounting Standards Board will eliminate the use of pooling and require purchase method accounting. At the same time it will revise the treatment of goodwill, eliminating amortization and requiring impairment testing. The accounting consequence for defense firms is not clear but in any case not germane to my main argument.
4. Interest on debt is not an allowable charge to government contracts.
5. The General Accounting Office (GAO) has documented saving in some cases. See the GAO report "Defense Restructuring Costs: Information Pertaining to Five Business Combinations" (GAO-NSIAD-97-97).
6. See exhibit 3, page 4 of the Booz, Allen, and Hamilton study cited in Endnote 2.
7. The most recent transaction, Northrop-Grumman's acquisition of Litton, announced on December 21, 2000, continues the trend but is less egregious. Northrop paid \$5.1 billion, including adopting debt of \$1.3 billion, for Litton. Litton's annual report for 2000 list assets of \$4.8 billion: \$0.9 billion is property, plant, and equipment, and \$1.3 billion is goodwill.
8. The top five firms, in terms of DoD sales, are Boeing, General Dynamics, Lockheed-Martin, Northrop-Grumman, and Raytheon. I am indebted to Frank Caine, Chief Financial Officer of Raytheon for assistance in gathering this data.
9. E. Gholz and H. M. Sapolsky argue that while there have been many mergers, there has been little reduction in defense industry production lines or physical asset base. See their 1999 article in *International Security* (Vol. 24, pp. 5–51).
10. The American Institute of Aeronautics and Astronautics (AIAA) seriously addresses these issues. See, for example, "Defense Reform 2001 — A Blueprint for Action (*Proceedings*, February 14–15, 2001, Washington, D.C.).

11. National Defense Budget Estimate for 2001 [On-line]. Table 6.9, www.dtic.mil/comptroller/fy2001budget (June 27, 2001). DoD news release No. 287-01, giving President Bush's amended fiscal year 2002 defense budget. DoD procurement for RDT&E fell from \$160 billion in fiscal year 1987 to \$85 billion in fiscal year 1997 in fiscal year 2001 dollars.
12. My impression is that the consolidation that has occurred within Europe, for example the formation of European Aeronautics Defense and Space Company (EADS), has taken place without a reduction in capacity.
13. Indeed, DoD recently announced an increase in the rate of progress payments on contracts.
14. Such a proposal might well send equity prices of participating firms skyrocketing. In order to avoid a "windfall" profit from this regulatory change, the financial package might include warrants for the government (much as was done in the Chrysler bailout in the 1970s) to assure that the taxpayer gains, if some agreed equity price ceiling was exceeded.