IDA Research Notes

IDA Studies and Analyses Center

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Resource Analyses

Issue Overview

Defense resource issues appear in many guises and often do not come with an identifying label. Nevertheless, they can be loosely grouped into three bins:

- Specific investment decisions
- Policies affecting a class of resource decisions
- Assignment of organizational responsibilities for resource decisions and design of decision-making processes

Through the years, IDA has worked extensively on issues in each of these categories, as is illustrated in the articles in this issue of *Research Notes*.

The first article, covering our analysis of the alternate engine program for the Joint Strike Fighter (JSF), is a good example of an analysis of a specific investment decision (page 3). The question was whether the government should procure engines for the JSF from two sources, Pratt & Whitney and General Electric-Rolls Royce. The engines would be physically and functionally interchangeable. There clearly are costs to pursuing two engine programs (e.g., the costs of developing the alternate engine). There also clearly are benefits to dual sourcing (e.g., the potential for lower prices through competition). The issue is whether the value of the benefits exceeds the costs. IDA's study provided a sound basis for a decision by quantifying most of the benefits and costs, and describing the major considerations involved in the few instances in which the value of the benefit or cost could not be quantified.

Three articles in this issue describe studies that focus on the need for changing acquisition policies. The question behind the profit policy analysis (page 13), for example, is whether the returns that existing profit policy provided to defense contractors is sufficient to retain them in the defense industry. Our study of the shipyard industrial base (page 8) and the costs to employers of the Uniformed Services Employment and Reemployment Rights Act (page 11) are, similarly, concerned with determining some of the consequences of particular policies.

The final article in this issue is an example of an analysis of mechanisms used to make resource decisions (page 16). The decisions in this case involve the sizes of retention bonuses offered by the Services for various occupational specialties. Currently, retention bonuses are set by the Services and then adjusted as it becomes known whether changes are required to yield the number of retentions sought. The article argues that a form of an auction mechanism, along the lines of that already being used by the Navy in making assignments, would be better for both the Services and the military members.

Each of the analyses in this issue is unique, driven more by the facts of the particular topic than any methodological guidelines. That said, resource analyses tend to have two features in common: costs, and often cost estimation, as clearly was the case for the analysis of the JSF alternate engine program; and analysis of related resource issues, which usually entails examining how key actors respond to various incentives. The relevant "actors" can be individuals, as is the case in the analysis of TRICARE costs (page 6), or firms, as in the shipyard industrial bases analysis. The "actor" might also be a government organization. Although none of the six studies highlighted in this issue presents a good example of such, many IDA efforts over the years have addressed issues related to processes and organizational behavior that affect resource allocation decisions by the government.

Sound resource analyses draw not only on disciplinary backgrounds such as economics, operations research, and finance, but also on several DoD communities of practice—acquisition, cost estimation, controllership, and test and evaluation. Individual studies may also require people familiar with particular technologies, areas of policy, or DoD organizations or programs. To ensure that the necessary expertise is brought to bear on the problem, IDA conducts resource analyses using teams drawn from across all our research divisions.

Evaluating the Costs and Benefits of Competition for Joint Strike Fighter Engines

by Jim Woolsey

The Joint Strike Fighter (JSF) program is developing and producing the F-35 Lightning II next-generation strike aircraft for the Navy, Air Force, and Marine Corps, and for U.S. allies. The FY 1996 National Defense Authorization Act initiated an engine acquisition program that would allow competition for JSF engines by developing two independent engine designs produced by competing manufacturers. The two engines, the Pratt & Whitney F135 and the General Electric-Rolls Royce F136, would be both physically and functionally interchangeable in the JSF airframe.

The planned production quantities—nearly 2,500 engines for use in U.S. aircraft, the bulk of which would be for the Air Force—were high enough that half of the planned purchase would represent a large production quantity to either Pratt & Whitney or the General Electric-Rolls Royce team, creating strong incentives for competition. Past experience with engines from both manufacturers suggests that they should be price competitive, another important ingredient for a successful competition. However, these factors do not ensure that benefits of competition will justify the costs the second engine would incur, and a succession of DoD budgets submitted to Congress have omitted funding for the second engine.

IDA was asked to analyze the costs and potential benefits of two approaches to providing engines for the JSF, proceeding with the competitive engine program or pursuing a sole-source arrangement with the F135 engine.

Our researchers first considered the investments required to execute a competitive engine program and then determined the potential savings from the competition that would offset those investment costs. Investments included both direct investments, such as the costs associated with development of a second engine, and opportunity costs, such as the loss of economies inherent in larger production quantities. IDA excluded costs associated with propulsion elements common to both engines. We compared potential savings to what had been seen in other competitive programs and evaluated potential benefits of competition beyond price reductions.

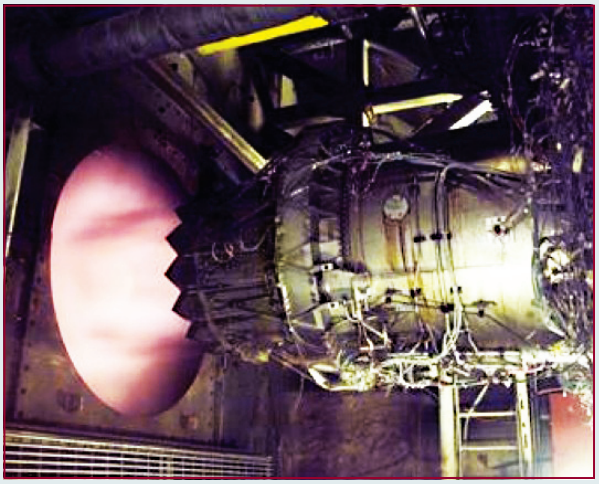

Photo courtesy of the Department of Defense.

A Pratt & Whitney F135 engine, one of two engines slated to power the F-35 Lightning II, undergoes altitude testing at Arnold Engineering Development Center, located at Arnold Air Force Base in Tennessee.

Investments for a Second Engine Program

Pratt & Whitney's F135 engine, a derivative of the F119 used on the F-22 Raptor, was the more developmentally advanced of the two-engine alternatives and was assumed to be the sole source engine in the analysis. Executing the second Engine program, the F136, would require additional investment in all phases of the program life cycle. The engine's design, ground and flight testing, and integration into the JSF aircraft would need to be completed during the System Development and Demonstration phase.

Production of the F136 would reduce the quantities produced of the F135. This would limit F-35 cost reductions during its production and would create an opportunity cost, in that the government would lose the opportunity to purchase the lower cost engines that would have resulted from the higher quantities of the single-engine case. Producing initial spare parts and establishing

repair depot capabilities for the F136 would also require investment. In the support phase of the F136's life cycle, costs of depot repair, sustaining engineering, software support, and component improvement programs would further increase costs.

IDA estimated the sum of these investments, including opportunity costs and excluding any price reductions that competition might produce, to be $8.8 billion in constant fiscal year 2006 dollars. Of that total, $2.1 billion would be spent between 2008 and 2012.

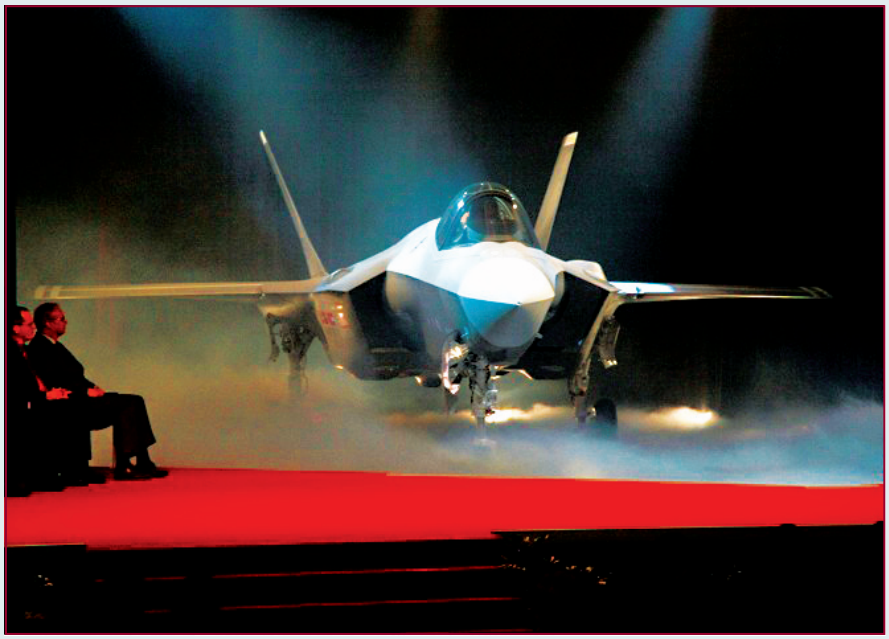

Photo courtesy of the Department of Defense.

The F-35 Lightning II was on display during its inaugural roll-out ceremony.

Potential Price Benefits from Competition

To better understand what could be gained from a JSF engine competition, IDA examined the government's experience with two past military aircraft engine competitions. The first was a U.S. Air Force-initiated competition in 1984 between Pratt & Whitney and General Electric for 2,000 engines for the F-15 and F-16 fighters. IDA looked at two different aspects of this competition. The second competition IDA examined was a competitive dual-sourcing of F404 engines for the U.S. Navy's F/A-18 aircraft. In this case, Pratt & Whitney built engines to the General Electric F404 design and competed in four competitive procurement years, 1986 to 1989. The competition was later terminated. The analysis of these specific cases was supplemented by a broader evaluation of many non-engine competitions.

IDA used these past cases to estimate a gross savings from competition ranging from 11% to 18% of total procurement costs.

Break-Even Analysis

To determine whether the investment in a second engine would be cost-effective, IDA performed a net present value analysis of the investments and potential savings. We found that if competition savings were to come only from production, these savings would have to be 40% of total production costs. Savings of that magnitude would be unlikely given the 11%-18% savings realized in the previous engine competitions examined. If, in addition to competition of procurement costs, the JSF engine's Operations and Support (O&S) phase costs were also effectively competed, the required savings rate would fall from 40% of procurement costs to 18% of total costs. However, DoD has not typically linked procurement and O&S costs in a single competition, and IDA found no historical data with which to estimate plausible O&S savings under such an acquisition strategy.

Without commenting on the likelihood of successful implementation, the study did note that competition could affect prices for O&S services in a range of ways. Even without explicitly competing support services, some O&S savings would flow naturally from the savings in a procurement competition. Some savings in spare parts, for example, could be expected through this mechanism. Elements of O&S can also be tied to the procurement competition by adding O&S metrics to the procurement selection criteria. To take O&S competition a step further by employing a model widely used by the commercial airline industry, support contracts could be bundled with initial engine purchases, thereby directly linking support services with the purchase competition. All elements of the JSF's O&S services could similarly be

packaged into a single acquisition covering design improvements, spare parts, and logistics support.

Other Benefits of Competition

Although potential cost savings are the primary benefit of competition, a decision about whether or not to create a competitive program should also consider other potential benefits. IDA found that competition for the JSF engine could increase force readiness, improve contractor responsiveness, and enhance the industrial base.

The JSF will dominate the U.S. fighter attack force structure as no previous platform has. If a single engine is used, any problem with that engine could potentially ground the entire JSF fleet. Having two independent engine types would reduce the effect of such an engine anomaly on military readiness.

Competition might also improve contractor responsiveness in the form of more favorable contract terms and increased cooperation, as is generally agreed to have been the case since the government introduced competition for fighter engines in the 1980s.

Finally, continuation of the F136 program might ensure that General Electric remains in the industrial base for high-performance military aircraft engines. Without the F136 engine program, General Electric's incentive and ability to maintain the unique capabilities needed to produce these types of engines would be uncertain.

Conclusion

IDA found that creating competition by developing, procuring, and maintaining a second engine for the JSF would require an investment of about $8.8 billion in constant fiscal year 2006 dollars, about $2 billion of which would be required over the next five budget years. If savings from competition were limited to the production phase of the life cycle, the savings would be insufficient to recover the investment needed to create a second engine to compete. To recover this investment over the JSF's life cycle, both procurement and O&S costs would have to be competed effectively to save about 18% of total procurement and O&S cost. DoD has little experience in integrating procurement and O&S in competitions, so IDA had no basis for estimating the plausible savings under such arrangements. Competition could be expected to bring nonfinancial benefits in the form of fleet readiness, contractor responsiveness, and an enhanced industrial base.

Photo courtesy of the Department of Defense.

The F-35 Lightning II takes off for a test flight.

Analysis and Forecasts of TRICARE Costs

by Philip Lurie

Defense Health Program (DHP) costs have increased substantially in recent years due to enhanced benefits and increased beneficiary use of the Military Health System (MHS). From FY 2005 to FY 2007, total DHP costs rose from $25.7 billion to $31.4 billion, an increase of 22%; assuming savings from benefit sustainment initiatives, costs for FY 2008 are expected to remain flat (Figure 1). Most of the increase in DoD costs can be attributed to the Private Sector Care Program.

The DoD's health care benefit, TRICARE, offers eligible beneficiaries three options: Prime, a health maintenance organization that requires enrollment; Extra, a preferred provider organization; and Standard, a fee-for-service program. Care is provided through a system of military hospitals and clinics (direct care) supplemented with networks of civilian health care providers (purchased care). Beneficiaries face minimal or no out-of-pocket expenses for care received in military treatment facilities (MTFs); however, capacity is limited and not all beneficiaries live near an MTF. When beneficiaries are unable to obtain care at an MTF, they must turn to the civilian sector.

Nonenrolled active-duty family members and all retirees face some level of cost sharing for using these purchased care services. However, since TRICARE's inception, DoD has never raised beneficiary deductibles, copays, and enrollment fees. This means that, in real dollars, military beneficiary out-of-pocket costs are actually declining, in sharp contrast to what is happening in the civilian sector. When beneficiary costs go down, utilization and DoD costs go up.

From FY 2001 to FY 2006, government costs for purchased care increased by 19.6% per year, while direct care costs grew by 6.2% annually. The sharp rise in purchased care costs caused total DoD health care costs (exclusive of dental, administrative, and overhead expenses) to increase from $12.7 billion in FY 2001 to $21.0 billion in FY 2006 (Figure 2).

The FY 2007 President's Budget Submission projected a large increase in MHS costs inFY 2007-13, but the projections were largely speculative. To improve out-year budget estimates, DoD asked IDA to develop an evidence-based approach to estimate DoD purchased care costs for non-Medicare-eligible beneficiaries in FY 2007-13 (Medicare-eligible beneficiaries are covered by the Medicare Eligible Retiree Health Care Fund, not the DHP). Although any forecasting model must make assumptions about the future, IDA's approach to determining the drivers of historical health care costs provides a firmer basis for making projections.

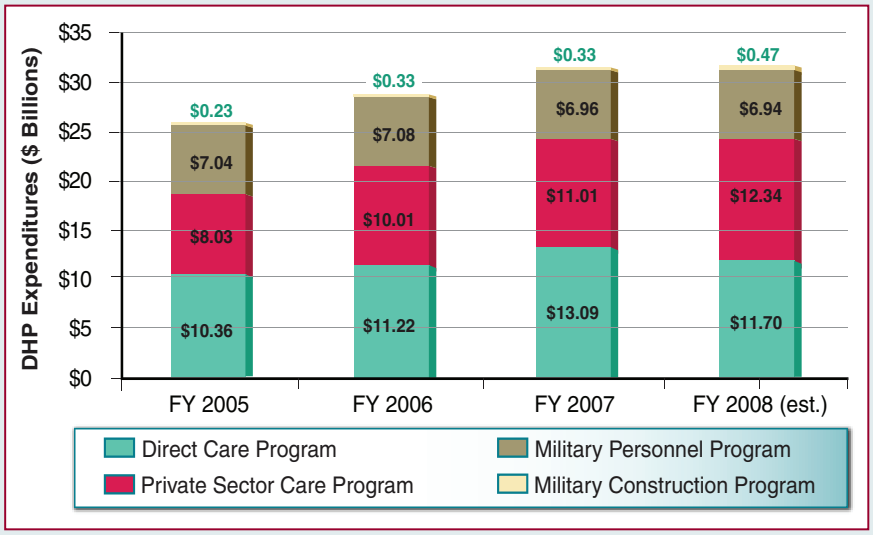

Figure 1. Trends in Defense Health Program Costs

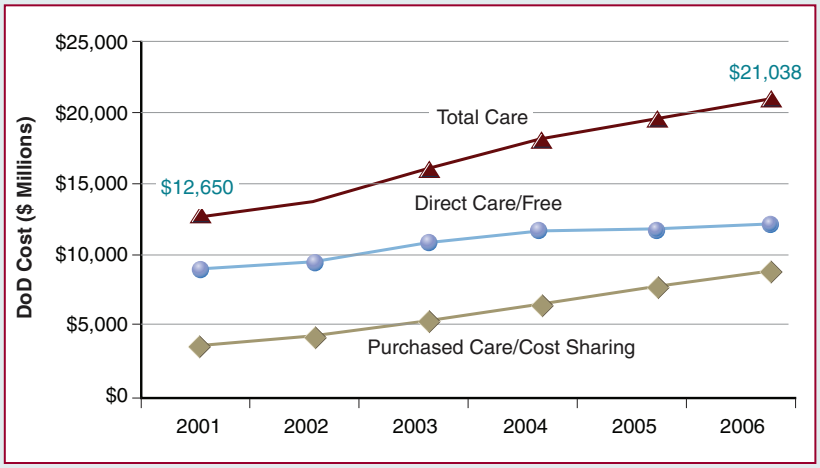

Figure 2. Growth in TRICARE Cost for Beneficiaries Under 65

Findings

We found that a variety of factors contributed to the extraordinary growth in purchased care costs. First, the wars in Iraq and Afghanistan led to large mobilizations of National Guard and Reserve members. Service members and their families receive most of their care in MTFs. This reduces the availability of MTF care for other beneficiary groups who are then forced to use more purchased care, thereby driving up MHS costs.

Approaches and Methodology

Using multivariate regression techniques, IDA estimated the effects of predictor variables on the insurance choices, utilization, and costs per unit of service in FY 2000-06 for military health care beneficiaries under age 65 (Figure 3). Data for the analysis came from health care claims and surveys by DoD, other government agencies, and private companies. IDA used the findings to forecast purchased health care costs in FY 2007-13.

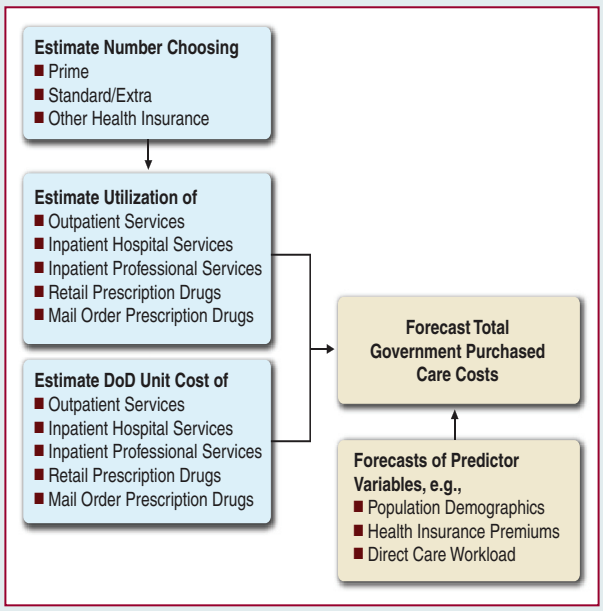

Figure 3. IDA Purchased Care Forecasting Methodology

Second, and more important, in recent years a significant number of retired beneficiaries and their family members switched from private insurance to TRICARE. In FY 2000, about 50% of retired beneficiaries and their family members had private health insurance and did not rely on the MHS for their care. From FY 2000 to FY 2006, beneficiary costs under TRICARE declined, after adjusting for inflation. Meanwhile, civilian health insurance premiums and out-of-pocket expenses increased sharply. As a result, many retirees dropped their private insurance and enrolled in TRICARE Prime. In addition, those who retained their private insurance filed second payer claims with TRICARE more frequently; TRICARE is always second payer when a beneficiary has other health insurance.

Although civilian health insurance premiums and out-of-pocket expenses continue to rise, the rate of growth has slowed. Consequently, compared with recent trends, IDA expects MHS cost growth to abate. However, we expect MHS costs will continue to outpace the growth of health care costs in the civilian economy.

Until IDA developed its forecasting model, DoD had been using extrapolations of historical trends to forecast future purchased care costs, which tended to overstate costs in recent years. Using IDA's forecasts in its annual program reviews, DoD estimates that the costs of military health care will be about $4 billion less in FY 2008-13 than previously planned.

Cost Savings from the Post-Cold War Consolidation of the Defense Industrial Base: A Case Study of the Shipyards

by Scot Arnold

Has the U.S. naval ship industrial base rationalized following the consolidation that occurred from 1995 through 2001? IDA examined the cost and financial structure of the major shipyards for evidence of rationalization following the period of consolidation. In the past, IDA has looked for rationalization in the cost structure of the aircraft and missile sectors of the defense industrial base following their periods of consolidations during the same period. These studies found mixed results: the missile sector rationalized saving the government about $150 million per year while the aircraft industry did not rationalize.

Defense Consolidation and Rationalization

A conclusion from the 1993 bottom-up review of the U.S. defense posture was that a restructured defense industry with fewer assets would be more responsive in the face of declining demand.[1,2] At that time, during a Pentagon dinner referred to as the "Last Supper," Deputy Secretary of Defense William J. Perry signaled to the industry that the Department would support consolidation.

The main goal behind the change in policy was to reduce the fixed overhead cost that had accumulated through the Cold War. There were two mechanisms through which the Department could facilitate mergers: by supporting the transaction through the Hart-Scott-Rodino reviews conducted by the Federal Trade Commission and Department of Justice; and by allowing the post-merger company to recover restructuring costs. The latter was added to the Federal Acquisition Regulation and was later termed "pay-offs for lay-offs." Until 1998, when the government effectively reversed its policy and temporarily halted mergers, the number of contractors dropped precipitously.

The government expected substantial savings associated with the subsequent rationalization or reduction of infrastructure. With the luxury of hindsight, this was a tall order for industry consolidation to deliver through "synergy" savings. The synergy strategy provides shareholder gain when the revenue stays constant while the costs decline as redundancies are eliminated after the two companies are combined. These savings usually require an initial investment such as asset disposal, severance, and clean-up costs. Consolidations are usually difficult transitions whose success is not assured, but they are often necessary to justify the premium the acquirer often pays for the target company.

With defense companies, however, revenue is directly linked to cost, and if synergistic savings lower cost-based revenue, and hence contractor profit, only the government gains. To the extent this is the case, shareholders will not favor consolidation. The benefits from investments in industry

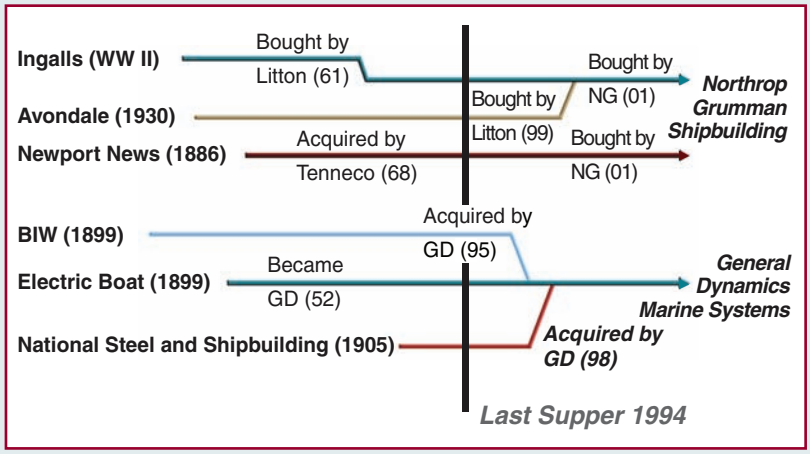

Figure 1. Consolidation of the Major U.S. Naval Shipyard Industrial Base

[1] John M. Deutch, "Consolidation of the U.S. Defense Industrial Base—Opinion," *Acquisition Review Quarterly*, Fall 2001.

[2] Kenneth Flamm, "Post-Cold War Policy and the U.S. Defense Industrial Base," *The Bridge*, Volume 35 (1), Spring 2005.

consolidation-driven rationalization must flow to shareholders first.

After the consolidations, the industry became concentrated in five or so top contractors, and each of these broadened its product base. For example, Lockheed expanded its aircraft, missile, and space businesses and entered into electronics and IT services, all through acquisition of other companies.

The prime contractors now have thousands of contracts at any given time. Inter-contract risk, that is the financial risk to the firm of losing any one contract, is greatly reduced.[3] This diversification has reduced opportunity cost of carrying assets on the balance sheet. As long as there is the potential to eventually yield positive net present value, there is little incentive to "dispose" of underutilized assets.

Figure 1 tracks the history of the six major U.S. shipyards. All six yards remain active today in spite of being consolidated into two corporate entities: Northrop Grumman Shipbuilding (NG) and General Dynamics Marine Division (GD).

While no yards have been closed, we looked for consolidation-driven rationalization using a model of the overhead cost structure, which assumed it is linearly driven by the direct labor cost. We examined historical labor and overhead cost data from the six yards over the course of the consolidations. We used a statistical test to determine whether the data were modeled best with a single line for the entire period or by breaking the periods into shorter groups.

If rationalization was driven by the consolidations we should see that two curves, one for the period before consolidation and one after, would fit the data better than one curve for the entire period. We found, however, that for all of the companies there did not appear to be significant evidence of rationalization savings associated with yard consolidation.

We also looked for evidence of rationalization in the companies' public financial statements. GD continues to invest in its yards; however, its annual asset write-offs have exceeded capital spending for more than ten years. With NG, the situation was clouded by the losses sustained from Hurricane Katrina during a period when the yard was building the lead LPD-17. The combined effects of rebuilding the post-hurricane yard and the lead ship production led to unusually high investment and some operating inefficiencies.

All of the shipyards suffered cutbacks after the end of the Cold War, but these were driven by reductions in business base, not consolidation. For example, in early 1992 the government cancelled the *Seawolf*-class submarine, leaving GD with a large production gap until the next planned submarine, the Virginia class. While they continued to build the remaining two Seawolf-class ships, GD eliminated a substantial amount of its fixed overhead cost. This included eliminating 11,442 jobs throughout the GD Electric Boat division and 6,612 jobs at the yard alone.[4]

Table 1. Select Financial Data for General Dynamics and Northrup Grumman, Year End 2006

Marine Divisions ($ Millions)	Northrop Grumman	General Dynamics
Revenue	$5,311	$4,940
Operating Profit	393	375
Free Cash Flow	123	232
Net Capital Spending	134	17
Total Company		
Revenue	$30,148	$24,063
Operating Profit	2,278	2,527

(Source: Capitol IQ)

[3] From a contractor's perspective, inter-contract uncertainty is probably the most difficult risk to manage. Other risks: operational, liability, credit, market, and liquidity are significantly lower than other capital goods industries from the close relationship with the DoD.

[4] Joan Cavanagh, "Jobs, Jobs, Jobs, and the Defense Industrial Base," in *The Changing Dynamics of U.S. Defense Spending*, p. 137.

It appears as though the government's desire to reap savings through asset rationalization and the industries' desire to make accretive acquisitions were conflicting goals that led to the consolidation that ended in late 2001. Consider the industry today as summarized in Table 1 which shows key financial metrics of the two prime shipyard companies GD and NG from their 2006 reports to the Security and Exchange Commission.

Both marine businesses derive most of their revenue from the government, and are close in revenue and operating profit; however, NG has about half as much free cash flow as GD—which is what investors ultimately care about. This is due mainly to NG's greater net capital spending related to the rebuilding of Hurricane Katrina damages. Figure 2 shows that the free cash flow between 1998 and 2006 has been positive,[5] though more erratic for the NG yards.

Both NG and GD shipyards are cash generating businesses with little incentive to rationalize beyond achieving the efficiencies they need to make their profit goals. Comparing with previous IDA studies of defense industrial base restructuring, we found that the ship sector followed the behavior and outcome of the aircraft industry. Like shipyards, roughly the same number of aircraft plants remained open before and after consolidation. Furthermore there appeared to be little consolidation-driven rationalization savings. This is in contrast to the missile sector where Raytheon closed several plants following its acquisitions of Hughes and Texas Instruments. While we cannot rule out the possibility of incremental rationalization in the ship and aircraft sectors, it appears that the DoD received the savings from the missile sector because physical assets and their associated fixed labor were eliminated after consolidation.

For most of the past ten years, the DoD has been increasing development and procurement budgets. Rising or steady budgets combined with more stringent criteria for the "pay-offs for lay-offs" restructuring cost reimbursement will limit the incentive for the industrial base to eliminate capacity. On the other hand, the shipyards appear to be aggressively trying to improve operating efficiencies; however, with fixed budgets, the acquisition system is more oriented toward reducing variable cost and using the savings to buy more units. The ship industrial base clearly has underutilized assets which are contributing adversely to costs; however, to date and in the foreseeable future there appears to be enough DoD business to profitably support the present business base. More competition might drive these costs down, but the barriers to entry are steep. In the future, the government should not look to industry mergers and acquisitions to drive out fixed cost without also considering the acquisition strategies that could ultimately sustain these costs.

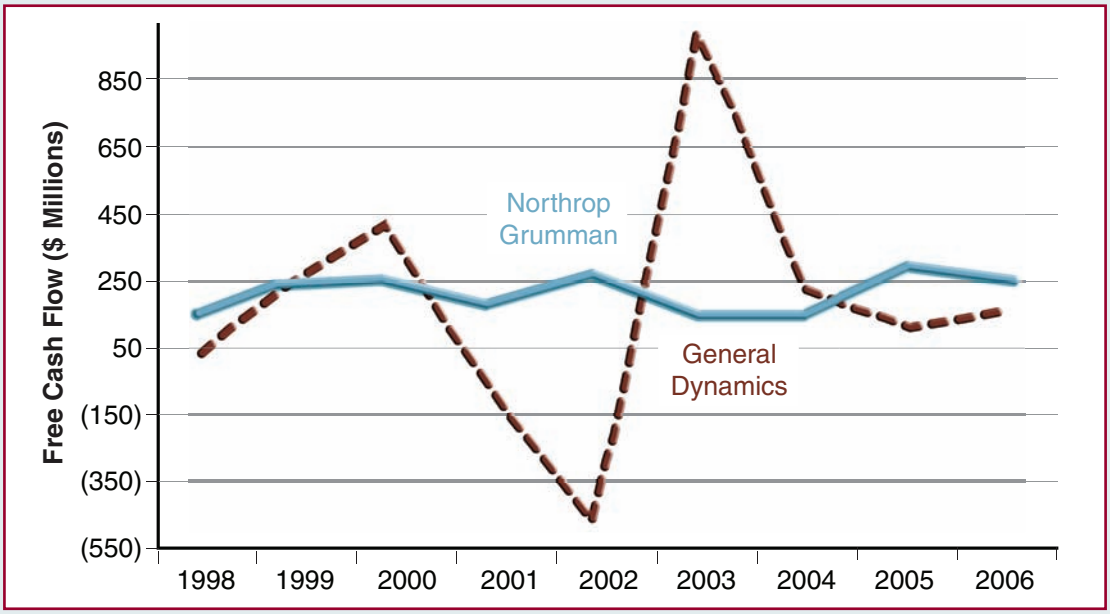

Figure 2. The Historical Free Cash Flow of the Major Shipyard Companies

[5] Prior to 2001, NG Shipbuilding was Newport News and Litton Industries.

The Effects of Reserve Component Mobilizations on Employers

by Colin Doyle

The Uniformed Services Employment and Reemployment Rights Act (USERRA) protects the right of veterans, reservists, National Guard members, and certain other members of the uniformed services to reclaim their civilian employment after being absent due to military service or training. Although USERRA has been in effect since 1994 and during periods in which reservists have faced repeated mobilizations, little is known about the extent to which reservists' absences have actually imposed costs on their civilian employers.

As part of a study IDA undertook to help OSD better understand employer costs associated with USERRA, IDA initially conducted a limited, non-representative employer survey. Respondents stated that they experienced hiring, pay, and training costs for replacement personnel; costs of benefits; workplace dislocation; and, in some cases, lost business or reduced revenue.

In a follow-on, systematic survey of employer costs, IDA worked with a professional survey research company, CALLC, to design a survey that could provide data on all the potential costs identified in our investigation. To develop a respondent sample, IDA drew on the Department of Defense Civilian Employment Identification (CEI) file database, which includes reservists' identification of their civilian employers. CALLC sent out 1,527 survey questionnaires to employers identified through the CEI, of which 997 employers returned at least one part of the two-part survey instrument (response rate of 65%). Of the 997 respondents, 549 said they had employed reservists who were called to active duty.

Employers were asked about several different kinds of workplace adjustments: retraining existing personnel, paying overtime costs to existing employees, costs of search and hiring of replacements, training costs for replacements, and differential wage costs (reflecting the difference in pay between the absent reservist and the replacement).

In each category of employer, the majority of respondents reported no costs from reservist activation (Figure 1). A small number—less than 10%—actually derived gains from reduced salary costs. Between 20% (state and local government agencies) and 35% (large for-profit businesses) of employers in each category reported net costs of workplace adjustment. For those reporting net costs, the median cost varied between $2,320 (for non-profit establishments) and $1,880 (government agencies), with small businesses ($2,001) and large businesses ($1,920) in between.

There were, however, a relatively small minority of employers in each category who experienced much larger costs from reservist activation (Figure 2). Seventy-five percent of affected employers in every category reported workplace costs of less than $5,000, but costs for the other 25% were in some cases much greater. In particular, some small businesses had costs of over $30,000, and some government agencies' workplace costs approached $40,000. Each of those severely affected government agencies was a first responder such as a police department or emergency medical team. The main reasons for the high costs were training costs and

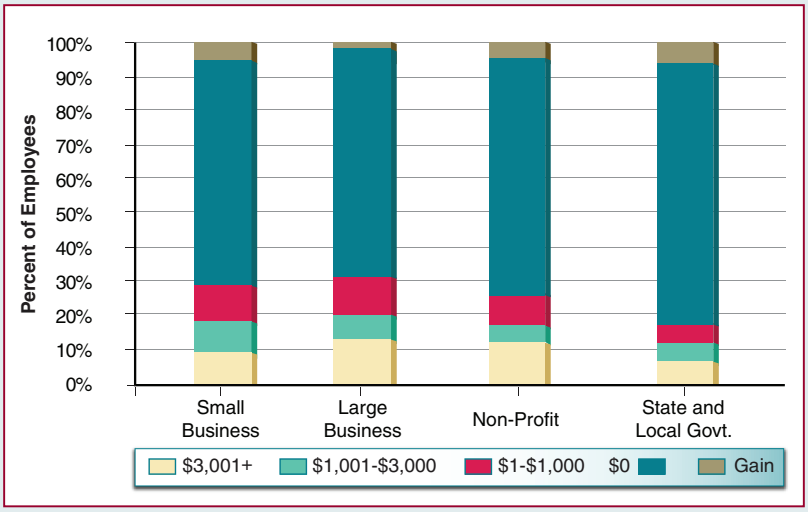

Figure 1. Employers' Workplace Adjustment Costs per Activated Reservist

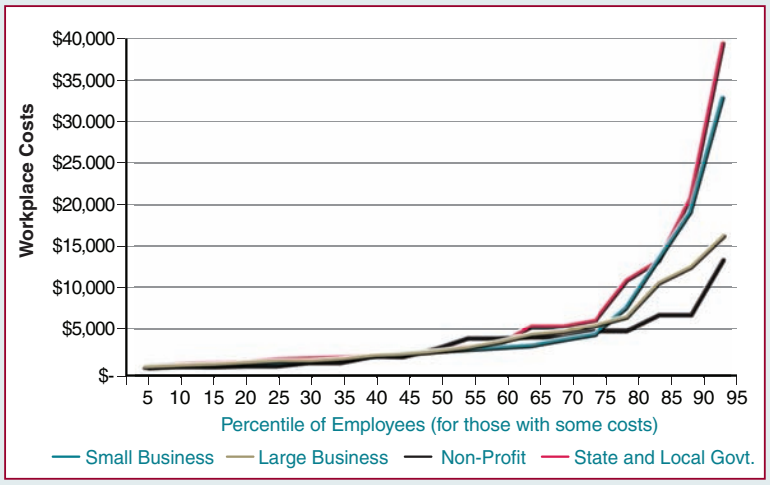

Figure 2. The Distribution of Cost-Incurring Employers in Each Category by the Level of Workplace Costs

the payment of overtime to remaining personnel. For the severely affected small businesses, the high costs were due to the cost of training employees to do the jobs of the mobilized reservists.

IDA's preliminary study of employer costs suggested that among small businesses, one common consequence of reservist mobilization was lost business. Loss of a key employee might mean reduced marketing, diminished productivity, the inability to seek large-scale jobs, or shifts in a firm's output. Some of the respondents to the initial survey reported that they had been driven out of business by their reservists' activations.

The full survey asked employers if they had lost business. While only a small percentage of large firms reported any loss of business, more than 20% of small businesses did so (Figure 3). The amounts claimed to have been lost varied greatly.

In addition to guaranteeing activated reservists the right to return to the jobs they left, USERRA mandates that employers pay some kinds of benefits to reservists during their absence for active duty. In practice, however, the USERRA mandates impose relatively small costs on employers. Health benefits are excluded from USERRA coverage for reservist absences of more than 30 days. Reservists on active duty for more than 30 days are covered by the military's health care system, and family members are eligible for TRICARE coverage while the reservist is on active duty.

Similarly, USERRA mandates that activated reservist employees be credited with the amount of leave they have accrued during their period of active service. However, USERRA applies this provision only to firms whose employment policies provide such leave accrual for employees who are "on furlough or leave of absence." Our survey found that less than 20% of for-profit businesses provide leave accrual during activation.

Even pension costs may impose less of a burden on employers than USERRA would appear to mandate. Under USERRA, employers are required to provide accruals for their absent reservists only if the reservists also make up their required contribution. Since most retirement plans in the private sector are contributory, national data suggest that pension costs associated with reservist mobilization are not likely to be large. The monthly pension costs to employers for participating employees are about $430 for private firms and about $440 for state and local governments.

Conclusion

IDA's analysis of employer costs associated with USERRA indicates that these costs are mostly modest and similar across types of employer. Still, a small number of employers—namely some small businesses and some first-responder agencies—report very large workplace adjustment costs. One-fifth of small businesses also experience losses of business when key employees are activated.

OSD is using our results to guide policy on potential remedies for reserve employers that could be reasonably provided by the federal government.

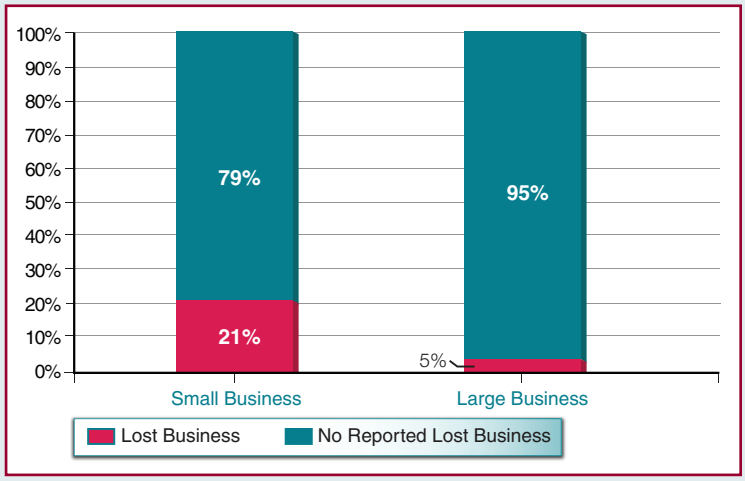

Figure 3. For-Profit Employer Losses from Reservist Activation

Does DoD Profit Policy Sufficiently Compensate Defense Contractors?

by Scot Arnold

The Department of Defense created profit policy to provide economic guidance to contracting officers for negotiating fee paid to contractors that provide goods or services for which there is limited competition. IDA was asked to assess how well DoD's profit policy motivates contract performance and whether it provides contractors with a reasonable return. This article focuses on the latter aspect of the study.

Profit policy encompasses the contract levers available to the government that affect contractor profitability, including:

- Contract type. The contract forms the path that links the profit rewards to the expected contract risks. For example, when technical uncertainty is high, cost plus fixed fee contracts are favored; when it is low a fixed-price-contract structure is capable of providing strong incentives to the contractor. An analogy might be the coarse and fine adjustments on a machine tool.

  The contract choice is the coarse setting, which dictates first-order choices in margin levers and financing policies. Once the contract is set, the contracting office is able to fine tune specific levers and payment policies. Like most machine tools, the fine adjustment does not have enough range to correct the wrong coarse setting; the right contract must be used.
- Contract financing. DoD provides cash financing without interest to fund contractor working capital. For example, for aircraft that take three years to build, the contractor could be receiving monthly payments of between 0 to 100% of the cost of completed work starting when the contract is signed.
- Fee. The Defense Federal Acquisition Regulation Supplement section 215.404, the "weighted guidelines," outlines how much fee should be added to a contract given the types and amount of risk the contractor incurs. These include factors that are set to reflect, for example the technical risk of the underlying project. Other factors are computed based on the amount of capital employed.

To analyze profitability of a given contract, researchers need to know the contract type, the financing policy, and the margin policies.

The Financial Performance of the Defense Industrial Base

DoD uses profit policy to ensure that the industrial base is financially healthy and capable of meeting defense requirements. To illustrate how profit policy in the defense industry differs from practices followed by commercial capital goods companies, we compared the Joint Strike Fighter to the Ford Escape. Both products were conceived and developed during long development programs. Ford spent its own capital to develop the Escape while Lockheed and its partners were paid by the government to develop the new fighter. Once production is started, Ford covered all of its own working capital, i.e., the cash needed to pay for inventory and work-in-process, while government contractors received up to 100% of the final price in monthly progress payments. Consequently, Lockheed began receiving payments almost 12 years before the first aircraft will be delivered, while Ford received its first dollar of revenue many years after the Escape was conceived. This means the automobile company needs a relatively high margin on most of its products to get a reasonable rate of return on its investment. With much less of its own money invested, a defense contractor can get a high return on much lower margin.

Figure 1 shows the operating margin, or earnings before interest and tax (EBIT) divided by revenue, for the defense industry firms in the S&P 500, several of its peer industries, and the broader industry segments to which it belongs. Generally, the defense industry has the lowest operating margins of the group. However, not until we look at what is called "free cash flow" do we get a clear view of the comparative profitability of the defense industry.

Free cash flow represents the cash that is available to investors. An absolute measure of whether investors are being sufficiently compensated for

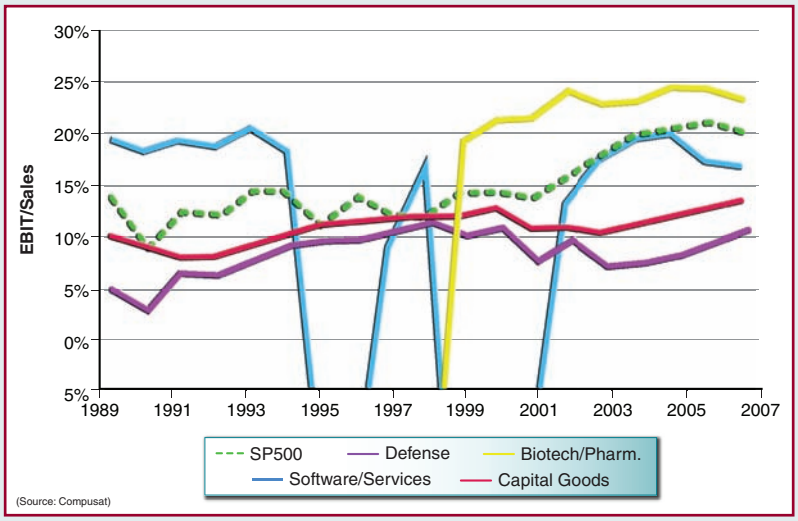

Figure 1. Historical Operating Margins for the Defense Industry, Several Capital-Intensive Peers, and the S&P 500

their investment is to compare the free cash flow returns on invested capital (FCFROIC) with the firm's weighted average cost of capital (WACC). WACC is the average cost of debt and equity a firm must pay its investors.

Figure 2 shows the FCFROIC for the same sectors as Figure 1. The defense industry is among the FCFROIC leaders in the group. Even during the dot-com boom, while the defense sector was lumped in with "value stocks" and out of favor, the sector had strong returns.

Figure 3 takes the analysis one step further to compare the defense industry FCFROIC with the industry WACC. The difference between these Quantities is sometimes called the economic value added (EVA). It measures, historically, whether a firm is building (EVA > 0) or destroying (EVA < 0) shareholder value. In Figure 3, the EVA shows that the industry profits are sufficiently compensating owners for their capital at risk.

This analysis presents a relatively unbiased and consistent measure of absolute performance. WACC serves as a benchmark, below which the industry is not providing sufficient return to justify the associated investment.

IDA also built a cash flow model to estimate the net present value effect of DoD's profit and contract-

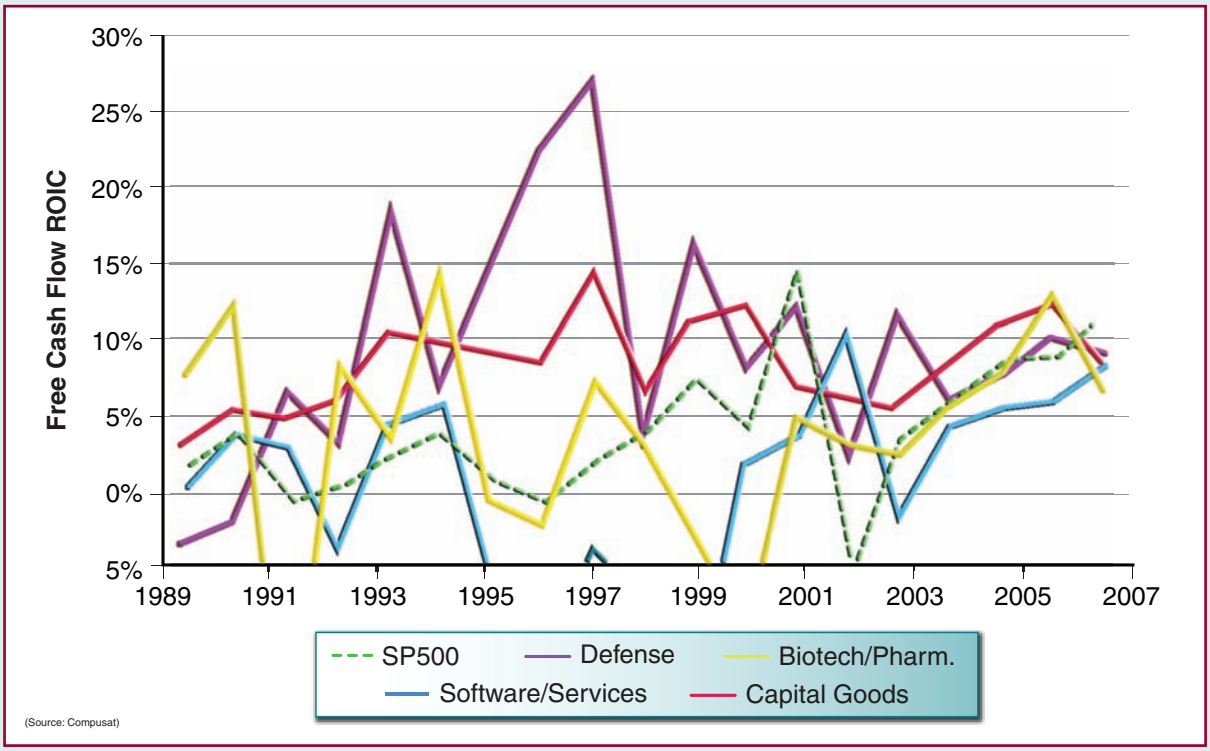

Figure 2. Historical Free Cash Flow Return on Invested Capital for the Defense Industry, Several Capital-Intensive Peers, and the S&P 500

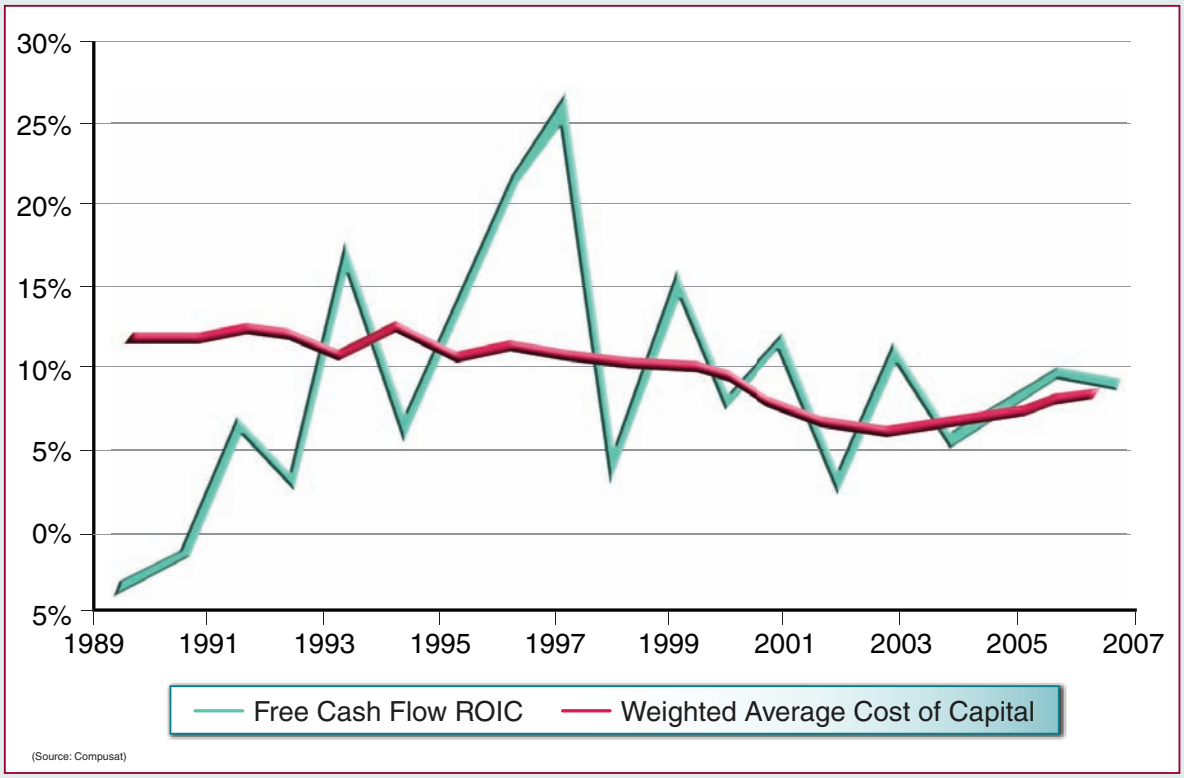

Figure 3. Historical Free Cash Flow Return on Invested Capital and Weighted Average Cost of Capital for the Top Prime Defense Contractors

ing policy on various contract types. The model estimates the value to contractor shareholders of a given contract type, estimated cost, and schedule.

The model estimates the value to the contractor's investors of a complete set of profit policy levers—a critical tool for evaluating policy changes. For example, the model predicts that the contractor for a major program would be indifferent to increasing the progress payment rate of 5 percentage points and reducing the profit margin by 2 percentage points. Since the U.S. Government borrows at a much lower rate than the WACC of most prime contractors, reducing the profit margin could result in substantial savings.

Conclusion

The defense industrial base has performed well for most of the past 20 years. Looking at profit policy and contract finance policy together, we see that low margins are offset by provision by DoD of product and working capital financing. With our valuation model we could estimate the net present value effects of contract financing, such as progress payments, and specific contract margin policies, such as the capital markup. Changes to the policy levers can be tested using the type of analysis underlying our valuation model.

The defense industrial base is financially healthy; IDA's cash flow analysis shows that the profit system delivers strong cash flow value to the contractor shareholders; and the industry emerged from the post-Cold War consolidation wave with far more product diversity, thereby reducing its overall risk. Lockheed, for example, presently has about 4,000 contracts, so the incremental risk of losing any one contract is far lower than when it was mostly an airplane manufacturer. From its position of strength and stability, the industrial base should be capable of accommodating policy changes aimed at strengthening the link between profits and contract outcomes.

Auctions in Military Compensation

by Susan Rose

DoD uses a variety of special and incentive pays to attract or retain Service members with critical skills or in select career fields, compensate individuals for hazardous assignments, and encourage Service members to volunteer for hard-to-fill assignments. Special and incentive pays add an important element of flexibility to the military pay system and have been largely successful in retaining Service members in critical fields and in encouraging volunteers for critical fields or assignments.

Retention bonuses are another tool the Services can use to retain members in selected fields. They are particularly valuable in career fields without special or incentive pays. Retention bonuses, however, have had uneven success. Sometimes their use has led to the retention of more Service members than was intended and sometimes to the retention of fewer. The obvious remedy is to set the level of the retention bonuses offered more accurately. To do this, the Services need to anticipate which occupational specialties will require a bonus and determine the size of a bonus, large enough to retain enough Service members, but not too many. Such a balancing act can be tricky, especially as economic conditions in the private sector are constantly changing.

Why Auctions?

IDA explored how DoD could use auctions to set retention bonus levels high enough to retain the needed number of Service members, but not so high as to result in over retention. An auction is a market mechanism in which goods and services are exchanged on the basis of bids by the participants. Auctions have explicit rules that determine both who receives the good or service and the price at which it is exchanged. The bidders in a labor market auction (workers) compete for the right to sell their labor to the buyer (employer). The low bidder wins.

In a military retention bonus auction, those members with the stronger preference for staying in the military generally will bid less. The amount of the retention bonus offered to bidders will be the one that yields just the retention desired. (Note that the bids are binding.) An auction will then determine the size of the bonus needed to meet military retention requirements, while not over-retaining Service members. Because the retention bonus will be set by the Service member bids, when civilian demand for an occupational specialty increases, the bids will increase. This reduces the burden on the Services to respond to changing economic conditions and increases flexibility.

Thus, auctions offer two main benefits for military compensation. First, they determine the market price, that is, the price that provides just the number of members in the career field that the Service wishes to retain. Second, they provide more flexibility in responding to changing economic conditions and military needs.

Auctions in Labor Markets

Auctions are already being used in both civilian and military labor markets. Among the civilian labor markets, for example, auctions are being used by U.S. hospitals to help meet nursing shortages, which has made it difficult for hospitals to staff all shifts—particularly those at undesirable times. To provide coverage, hospitals have had to rely on nursing agency staff whose hourly costs are much higher than non-agency staff.

To ease the crisis, a number of hospitals have turned to online shift bidding. Nurses log onto a Web site, scan the available shifts, and enter a bid of the hourly wage they require to work the shift. Shifts are awarded to the lowest bidder, holding other factors equal.

Hospitals that use shift bidding find it improves their recruitment and retention by giving nurses more flexibility and control over their schedules. In addition, the change has saved hospitals money by reducing agency staff costs, turnover, and recruit-

[1] Anne Davis, Angela Athis, and Kathy Douglas, "Implementing a Bidding System for Filling Open Shifts," *Nurse Leader,* August 2004, pp. 46-49.

DoD photo by Tech. Sgt. Jerry Morrison, U.S. Air Force.

Secretary of Defense Robert M. Gates gives the oath of reenlistment to U.S. Army Spc. Roy Burkhalter, the 1000th 1st Infantry Division Soldier to reenlist during their deployment, in Baghdad, Iraq, Feb. 11, 2008.

ing costs. Christus St. Joseph's hospital in Houston, Texas, for example, estimates savings of $3.2 million annually from shift bidding.[1]

Among the Services, auctions are being used in the Navy's Assignment Incentive Pay (AIP) program to encourage volunteers and reduce costs for hard-to-fill billets. Prior to the AIP program, sailors could indicate which assignments they were willing to accept, but not the strength of their preference. Under the AIP program, sailor preferences are incorporated into the assignment process. For example, suppose that Sailor 1 would like to be assigned to Naples, Sailor 2 would prefer not to be assigned to Naples, and Sailor 3 is indifferent. Sailors 1 and 3 appeared identical in terms of their preference for Naples. The AIP program allows the sailor to indicate his or her interest in an assignment by submitting a bid, which is the additional monthly pay the sailor requires to prefer that assignment to any other assignment. Sailor 1, who wants to go to Naples, would submit a lower bid than Sailors 2 and 3. The Navy uses the bid and other information, such as qualifications, to make the assignment. In general, the lowest total cost-qualified sailor receives the assignment.[3]

Response to the program has been positive, and the Navy has steadily expanded the program. Application rates for AIP assignments have increased, and, according to a review by the Center for Naval Analyses, the program could yield potential yearly savings of approximately $114 million.[4]

Auctions for Retention Bonuses

The Services offer retention bonuses for a variety of occupational specialties and can raise, lower, or eliminate bonuses several times a year to help meet retention goals.

In the examples cited above, the auctions are conducted for single shifts or single assignments. In each case, there is one winner of each auction. In contrast, a retention bonus auction would offer multiple slots at once and would have multiple winners of each auction.

A retention bonus auction would give the Services more flexibility in managing their forces. Service members interested in continuing military service could submit bids for reenlistment contracts. The Service would decide how many reenlistment

[3] Heidi L. Golding and Gerald E. Cox., "Design and Implementation of AIP," Center for Naval Analyses, CAB D0007827.A2/Final, July 2003.

[4] Peggy A. Golfin, Diana S. Lien, and David Gregory, "Evaluation of the Assignment Incentive Pay (AIP) System," Center for Naval Analyses, CAB D0010240.A2/Final, June 2004.

bonuses to award. The lowest bidders in the auction would be awarded the annual bonus determined by the lowest non-winning bid. For example, if the Service wished to retain 100 Service members, the 100 lowest bidders would receive an annual bonus equal to the 101st lowest bid. By choosing the number of winners, the military can choose the number of Service members to retain. The bonus would adjust automatically to ensure that number of Service members was retained. This would eliminate the need for the Services to try to anticipate the civilian job market when setting bonuses.

Recommendations

During the course of our investigation, IDA explored how DoD could use auctions as part of its retention bonus programs so that it can set bonuses at a level that retains the needed number of Service members. We determined that each Service should be able to design an auction that best suits its needs, starting with an initial pilot program for a single profession. We also recommend that the Services test their designs using controlled simulations and paid volunteers.

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