INSTITUTE FOR DEFENSE ANALYSES

Defense Department Profit and Contract Finance Policies and Their Effects on Contract and Contractor Performance

Scot A. Arnold, Project Leader
Bruce R. Harmon
Karen W. Tyson
Kenton G. Fasana
Christopher S. Wait

February 2009

Approved for public release;
distribution unlimited.

IDA Paper P-4284 (Revised)

Log: H 09-000132

This work was conducted under contract DASW01-04-C-0003, Task AH-7-2774, for the Office of the Deputy Under Secretary of Defense (Industrial Policy). The publication of this IDA document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that Agency.

INSTITUTE FOR DEFENSE ANALYSES

IDA Paper P-4284 (Revised)

Defense Department Profit and Contract Finance Policies and Their Effects on Contract and Contractor Performance

Scot A. Arnold, Project Leader
Bruce R. Harmon
Karen W. Tyson
Kenton G. Fasana
Christopher S. Wait

PREFACE

The Institute for Defense Analyses (IDA) prepared this paper for the Deputy Under Secretary of Defense (Industrial Policy) under a task titled "Profit Policy Research." The task objective is to evaluate the degree to which the Office of the Secretary of Defense's profit policy affects both performance on defense contracts and the finances of the contracting firms. This paper explores how the policy is applied in practice and how it relates to contract performance and financial results.

Thomas P. Frazier and Stanley A. Horowitz of IDA were the technical reviewers for this paper.

TABLE OF CONTENTS

Executive Summary S-1

A. Objective and Presentation Plan 1

B. Does Practice Follow Policy? 5

1. Contract Financing 8
2. Margin Policy 9
3. Data Analysis 18
4. Targets versus Policy 19

C. Does Policy Influence Contract Performance? 28

D. Does Policy Provide Adequate Contractor Profit? 37

E. Synthesis of Findings and Implications 54

Appendix: Target Factor Correlations A-1

Abbreviations B-1

References C-1

LIST OF FIGURES

1. Defense Industry Capital Spending 31

2. S&P 500 Defense Industrial Base Average Quarterly Price Earnings Ratio 48

3. Customer Advances in Excess of Incurred Costs 49

LIST OF TABLES

A-1. Estimated Directional Pairwise Correlations A-1

A-2. Estimated Directional Pairwise Correlations versus Expectation A-2

EXECUTIVE SUMMARY

This study as a whole is concerned with two questions about profit policy. First, in what respects does profit policy provide incentives or disincentives with respect to cost growth, schedule slips, and the performance features of a system eventually provided to the Department of Defense? Specifically, we are interested in whether or not profit policy can reliably and predictably be manipulated to encourage desirable outcomes on particular contracts. Second, does profit policy provide an "adequate" profit to defense contractors; that is, a profit large enough to retain those firms in the defense industries?

Each of these two questions presents several distinct issues, which IDA approached using different methods and data. Here we provide a broad overview of the study to facilitate navigation through the sections of the paper that describe these issues, methods, and data.

THE ELEMENTS OF PROFIT POLICY

"Profit policy" in its narrowest sense refers to what are called the "weighted guidelines" for establishing the fee paid to a contractor over and above the cost of the work called for in the contract. In broad terms, the weighted guidelines provide guidance to contracting officers on the amount of fee that should be paid to compensate contractors for bearing non-reimbursable expenses and various amounts and types of risk. The guidance, however, is stated in terms of several distinct elements (for example, the fee reflecting the amount that the contractor has committed to facilities). The expectation within the weighted guidelines policy is that the total fee to be paid is determined as the sum of the individual components established according to the guidelines. This point needs to be noted because the individual elements of fee may incentivize different aspects of contractors' decisions.

The term "profit policy" as used in this study is broader than just the weighted guidelines. We include in it as well guidance on what type of contract to use in various situations (for example, during development as opposed to during production) and policy on contract financing (for example, on progress payments).

PROFIT POLICY VERSUS FEE DETERMINATION IN PRACTICE

Contract financing is of intense interest to contractors and payments on individual contracts are visible to those in the Department of Defense who are charged with monitoring contract compliance. Thus, there is little doubt that practice on contract financing is reasonably well aligned with policy. The same cannot so confidently be asserted for policy on the use of various contract types and the weighted guidelines. In each of these cases, there is more room for judgment and decisionmaking is comparatively decentralized and may be to some degree a matter of negotiation between the government and the contractor.

To the extent that practice is detached from policy, changes in profit policy will be detached from changes in incentives perceived by contractors. This is not necessarily only a theoretical possibility. In particular, some argue that fees typically are not determined, as the weight guidelines dictate, as the sum of individual elements; rather, the total fee is first determined and then the magnitudes of the individual elements are adjusted as necessary. If this were the case, the policy’s goal of offering discrete incentives and rewards for each element would be lost.

The first part of this report provides the main results of our exploration of whether observed results correspond reasonably well to what the weighted guidelines mandate. Our results are mixed. On the one hand, we found that the pattern of allowed fees on contracts that are cost plus fee (CPF) and firm fixed price (FFP) is generally in accord with expectations. We also found that the elements of fee are not so closely correlated with one another as they would be if they were adjusted to fit within a predetermined total (that is, when one element goes up, another does not predictably go down.) These two results argue that changes in guidance on the individual elements of the weighted guidelines can be used to incentivize contractors in some ways.

On the other hand, some of our results do not seem to be entirely consistent with expectations based on the weighted guidelines. First, the difference in average fees for a sample of contracts (as a percentage of anticipated cost) on CPF contracts and FPF contracts seems to be anomalously small. We found that three of the five elements of profit policy account for the bulk of the variation in fees, which implies that the weighted guidelines in practice are a more limited tool than they might seem to be from the statement of the policy.

CONTRACT OUTCOMES, CONTRACT TYPE, AND WEIGHTED GUIDELINES

It is reasonable to expect that firm-fixed-price contracts, which give contractors a strong financial incentive to control costs, would exhibit better cost performance than cost-plus contracts. Previous studies, however, have generally a found relatively weak correlation between contract type and contract outcomes. We approached the question with more recent and different data, but got basically the same result as previous studies. In our analysis, fixed-price incentive (firm target) (FPIF) contracts, in comparison to cost-plus-incentive fee (CPIF) contracts, showed less cost growth, but only modestly less, and the result was not statistically robust. This result is not an indication that incentives on FPIF contracts are nearly the same as those on cost-based contracts; clearly, they are not. Rather, it probably indicates that the effects of these incentives are masked by other factors. Unfortunately, our analysis provided no insight into what these “other factors” might be.

Our study also provides additional evidence of a previously recognized relationship between the weighted guidelines and contractors’ cumulative capital investments. More precisely, we found that contractors’ capital investment was closely coupled to the increases in the “facilities capital employed” mark-up as defined in the weighted guidelines. We found that initiatives intended to increase capital investment did in fact raise capital-to-labor ratios at defense firms, and that was the case until the policy was changed during the military drawdown following the end of the cold war. Earlier studies by IDA and others have also shown some correlation between share ratio (the degree to which contractors had direct financial incentives to control costs) and favorable cost growth outcomes.

FINANCIAL PERFORMANCE—WEIGHTED GUIDELINES AND CONTRACT FINANCING

The weighted guidelines govern fee as a percentage of cost anticipated at the time of contract award. That cost is a large element of profitability, but it is not a sufficient measure of profitability as such. The measure of profitability depends on fee in relationship to the funds that the firm has committed (including those embodied in fixed assets) and working capital. The amount of working capital that the firm requires depends (given contract type) on financing policy. At one extreme, the government pays most costs not long after they are paid out by the contractor, and the firm requires comparatively little working capital. In other cases, the government pays the contractor only at various contract milestones, and the contractor may require substantial working capital balances. The overall policy, however, appears to reduce the working capital cost for defense contractors when compared to other capital goods firms.

We built a valuation model to examine the effect of contract financing on the financial value of a firm. This type of modeling is an essential component of understanding any proposed or current policy. In this study, we used it to show that financing through progress payments is a powerful determinant of profitability and must be included with the fees paid to contractors in assessing profitability.

We note that defense contractors sometimes point to data suggesting that these profits are inadequate. For example, one point often made is that the earnings of defense contractors as a percentage of sales are lower than those of other industries. We found that this is true. At roughly 5–10 percent of sales, earnings of defense companies are typically a lower fraction of total sales than those of firms in other industries.

Our study shows clearly, however, that the profits of the major U.S. defense contractors are above the levels required to keep them in the defense industrial base.

Return on sales and similar measures may be, in some circumstances, useful comparative indexes of profitability. But defense firms are different than typical firms in other industries for a variety of reasons, particularly in the amount of capital required for a given project. Capital requirements for defense firms are reduced by the financing effects illustrated in our valuation model and by government investments such as direct research and development payments. A measure of profitability that captures this effect is the free cash flow return on invested capital. By this measure, defense firms generally outperform those of the other industries we examined, including pharmaceuticals, software, and services, and the overall S&P 500. Top defense firms also generally achieve returns on capital that are higher than their cost of capital, a key standard of profitability.

CONCLUSIONS

The most clear-cut and important conclusion of this study is that, over the 20-year period considered, the returns achieved by the set of large defense contractors examined were sufficient to retain them in the defense industries.

In addition, the study:

- Demonstrates quantitatively the importance of policy on contract financing to the profitability of defense contractors;
- Provides evidence that changes in the weighted guidelines generally can be expected to translated into changes in allowable fees;
- Adds to the evidence that contract type effects the results obtained on particular contracts; and
- Provides further evidence that the fee allowed for facilities capital employed leads defense firms to invest in greater mechanization and thereby conserve on direct labor hours.

Probably the most important question raised by this study, and on which the evidence presented is silent, is why we do not observe a stronger relationship between contract type and contract performance. There is no doubt that (at least within limits) contract terms can be structured to provide targeted financial incentives for certain outcomes. Hence, the relatively weak effects that we and others have observed seem to require that “other things” strongly influence observed outcomes, but it is not clear what these “other things” are.

A. OBJECTIVE AND PRESENTATION PLAN

Objective

- Does practice follow policy?
- How does profit policy affect:
  - Contract performance?
  - Contractor financial results?

2

The objective of this study was to assess how well the Office of the Secretary of Defense's profit policy motivates contract performance and whether it provides contractors with a reasonable return. We elucidate how the profit policy works and assess the degree to which it is followed. We know the defense industrial base enjoys periods of profitability; we address, however, whether these profits are a result of the policy or perhaps a more arbitrary rule applied by contracting officers—as has been suggested.

We investigated financial performance issues for the contract and the contractor separately. We also assessed whether contractor profits are effectively conditional on their contract performance. By looking at the questions separately, we were better able to establish whether the profit policy provides reasonable returns to contractor shareholders, assuming satisfactory contract performance. We believe the Department intends for contractors to have reasonable return for satisfactory contract performance as indicated by a recent policy memorandum from the Director, Defense Procurement, Acquisition Policy and Strategic Sourcing, in the Office of the Deputy Under Secretary of Defense for Acquisition, Technology and Logistics.[1] The memorandum calls for up to 50 percent of the award fee to be available to contractors who perform satisfactorily in the execution of the contract.

[1] Shay Assad, (Director, Defense Procurement, Acquisition Policy and Strategic Sourcing), memorandum to the Service Secretaries and Defense Agency Directors, April 24, 2007.

Presentation Plan

- Does practice follow policy?
  - What is the profit policy and its levers?
  - Analysis of profit targets
  - Analysis of *actuals*
- Does policy influence contract performance?
  - Contractor behavior
  - Contract outcomes
- Does policy provide adequate contractor profit?
  - Defense contracting business model
  - Integrating the policy levers with cash flow modeling
  - Industry analysis
- Synthesis of findings and implications

3

The main objective of this task was to understand how the profit policy affects contract performance and contractor financial results. An important indicator for how well the policy works is how the policy is applied in practice, and we address that first here.

We present our findings in three main parts: Does the practice follow the policy or regulation? How does the policy relate to contract performance? How does the policy relate to how contractors perform financially?

In analyzing how practice follows policy, we first describe our interpretation of the policy by identifying the key policy levers. We then examine how the policy is followed by comparing the policy guidance to the profit targets set by contracting officers in a database of 6,000 Air Force and Army contracts. We further examine the correlation between policy and practice by actual profits from historical Contractor Cost Data Reports (DD Form 1921, Cost Data Summary Report).

We look at both earned value management data and actual cost and profit data to get an indication whether contract type has any effect on contract budget and schedule performance. Finally, we look at the effect of a specific profit lever, facilities mark-up, and show that the policy has modified contractor behavior in the past.

The last element of the three-part objective was to look at the financial effect of the policy on the industry. Since most of the industry is publicly traded, we look here at accounting profits. However, we also build up the theoretical intrinsic value of DoD contracts using an incremental profit model (i.e., a discounted cash flow analysis of a stand-alone business added to an ongoing operation). Additionally, we present our analysis of economic profits in the market valuation of major acquisitions.

We finish by summarizing our findings and suggesting possible policy implications of our research.

B. DOES PRACTICE FOLLOW POLICY?

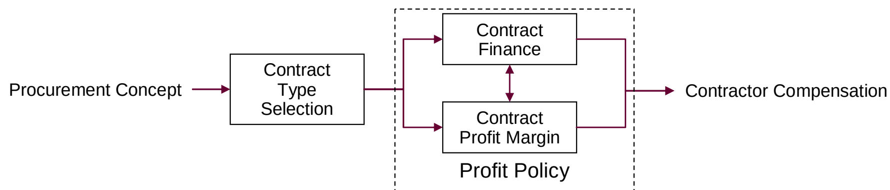
IDA

Presentation Plan

- Does practice follow policy?
  - What is the profit policy and its levers?
  - Analysis of profit targets
  - Analysis of *actuals*
- Does policy influence contract performance?
  - Contractor behavior
  - Contract outcomes
- Does policy provide adequate contractor profit?
  - Defense contracting business model
  - Integrating the policy levers with cash flow modeling
  - Industry analysis
- Synthesis of findings and implications

Profit Policy and Contract Type[1]

- The key link between contract type choice and profit policy is project risk management
  - Which party can manage project risks best?
    - High technical risk (e.g. SDD) : government
    - Low technical risk/high efficiency risk (e.g. production): industry
  - Cost plus (CP): suitable for high technical risk
  - Fixed price (FP): suitable for low technical risk
  - Incentive layers can bridge CP/FP across a risk continuum
- How to apply profit policy depends on selecting the appropriate contract type–selecting the wrong contract cannot be fixed with profit policy



4

[1]Selecting contract types is described in FAR 16.1. Contract financing is described in DFARS Part 232. Contract pricing is described in DFARS Part 215.4.

While choosing the type of contract is not part of profit policy; the execution of profit policy depends entirely on the type contract employed since a contract forms a path that links the profit rewards to the expected contract risks. The government and the contractor must mutually determine the appropriate contract for the acquisition. Where the technical uncertainty is high, the government is best able to manage the risk, and a cost-reimbursement contract, such as a cost-plus-fixed or award-fee contract, is appropriate. When technical uncertainty is low and the need for process efficiency is high, the fixed-price-contract structure is capable of providing strong incentives to the contractor to manage the risks.

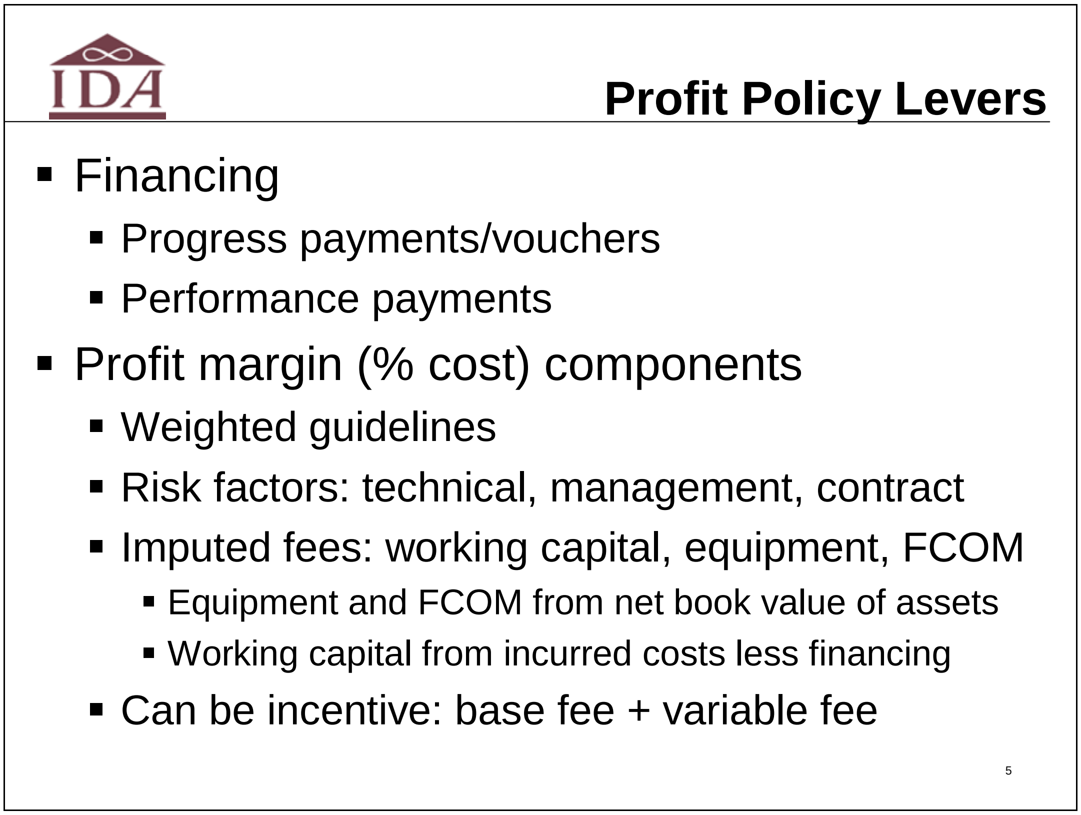
As a frame of reference, over the past decade most of the Defense Department's acquisition expense consists of the following types of contracts:

- Fixed-price contracts—55–60 percent
- Cost-plus-fixed-fee (CPFF) contracts—11–17 percent
- Cost-plus-award-fee (CPAF) contracts—11–14 percent
- Incentive-fee contracts–6–8 percent

A detailed breakdown and analysis of cost by contract type is presented later in this section.

The linkage between the contract type and profit policy is even more pronounced when you consider the effect of picking the inappropriate contract for the acquisition. For example, when a fixed-price contract is used for a *development* program with high technical uncertainty, the profit policy has little structure to help the contractor manage cost growth risk. Should costs grow, as they frequently do in development programs, they will quickly eliminate the contractor's profit and likely lead to substantial losses. The industrial base cannot sustain acquisition losses on a recurring basis, and more likely the government would either voluntarily allow the contract to be renegotiated or be liable to equitable readjustment litigation. At the other end, a cost-plus-fixed-fee *production* contract does not provide the contractor with sufficient incentives to find more efficient production methods. In both cases, the profit policy is incapable of structuring the profit incentives of the wrong type of contract for a given acquisition.

When the proper contract is chosen, the profit and contract financing policies have many levers that can be used to tailor the incentives to specific risks and uncertainties of the acquisition. Thus, the choice of contract may be thought of as a *de facto* profit policy lever. 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.



Our concept of the profit policy includes margin levers as well as contract finance policy. To exclude the latter from the former denies the critical cash flow dynamics that distinguish the defense industrial base from other industrial sectors. We explore the defense industrial business model later (see slide 22, page 38)—this model rests on the relationship between profit margins (margin levers in the policy) and contract financing.

1. Contract Financing

The length of defense acquisition programs means the Defense Department has had to develop contract financing tools to fund contractor working capital. Ultimately, we intend to evaluate the policy using discounted cash flow analysis so that the effect of both profit and contract financing policies will be considered.

Contract financing is mainly associated with monthly funding of the contractor's working capital as a percentage of work complete. For example, for aircraft that take 3 years to build, the contractor could be receiving monthly payments of up to 90 percent of the price of completed work. If the contract is CPFF, the contractor can receive payment of 100 percent of the cost incurred. Presently, the payments include a portion of the fee. Upon final delivery (e.g., completing the DD Form 250, Material Inspection and Receiving Report), the government will pay the remaining unpaid balance.

Performance payments are preferred over progress payments by both contractors and the government. With performance-based payments, the contractor receives a pre-agreed payment for completing a pre-agreed milestone. The government sees two chief benefits from this type of payment: (1) the contractor has an incentive to complete its work on time (or early) since only then will it receive payment, and (2) since performance-based payments are not based on actual costs incurred, there is a lower audit load for the Defense Contract Audit Agency. Contractors prefer performance-based payments as well since they have a high degree of control over when they get paid; they do not need to be audited at the time of each payment; and performance payments cover up to 90 percent of the pre-agreed price at the milestone instead of up to 80 percent of cost with progress payments.

2. Margin Policy

Profit policy refers mainly to the levers described in the Defense Federal Acquisition Regulation Supplement (DFARS) section 215.404. These rules guide how much profit margin should be added to a contract given the types and amount of risk the contractor incurs. The main risk factors are performance and contract. Performance risk includes technical and management components. Technical risk is the amount of uncertainty related to the technology level of the acquisition. Technology level could include complexity, program maturity, stringency of tolerances or specification, schedule, warranties, and so on. The "technical" profit margin for standard technologies ranges from 3 to 7 percent of cost,[2] but there is an incentive margin that could add 4 percentage points for using innovative technologies.

Management performance risk is based on the degree of management effort needed to execute the contract in such areas as cost control, source selection, complex integration, international coordination, and the like. The fee amount will also depend on the contractor's history of contract execution quality. The technical and management performance margins are multiplied by weight factors (that add to unity) to amplify their relative importance. This is where the concept of weighted guidelines emerges. For

2 For defense contracts, profit margin refers to a percentage of cost.

example, if the technical and management margins are 11 percent and 7 percent, respectively, the resulting equally weighted margin would be 9 percent.

Contract risk arises from cost risk the contractor assumes as dictated by the different contract types. The contract risk fee should be thought of as compensation or provision for the risk that costs exceed the target level. For cost-plus contracts, this risk has minimal effect on the contractor except for short-term working capital since the costs are regularly and fully reimbursed using payment vouchers—the guideline range of profit for this category is between 0 percent and 1 percent. The risk is unbounded for firm-fixed-price (FFP) contracts where the guideline range is 4–6 percent.

The three imputed fees are working capital; equipment; and facilities cost of money (FCOM). The working capital profit is estimated by multiplying the total allowable contract costs, adjusted for the level of contract financing, times the Treasury interest rate times a length factor.[3] The length factor is a look-up table in the DFARS 215.404-71-3 that yields a factor between 0.4 and 2.9 for contracts that span from 21 months or less to 76 months or more, respectively. The working capital fee is not applied to cost-plus contracts where public vouchers are employed or to other contracts that do not receive progress payments.[4]

If the contractor receives no contract financing (e.g., progress or performance-based payments) the contract risk margin is increased by 2 percentage points. If they receive performance-based payments, the contract risk margin is increased by 1 percentage point. It is reasonable that the working capital fee would increase with the contract length since the contractor accumulates working capital at the rate of 1 minus the progress payment rate.

The equipment and the FCOM are similarly computed fees. The equipment "mark-up" is based on the net book value of the facilities employed by the contract. (Facilities now exclude land and buildings.) Net book value is the initial cost of the asset less accumulated depreciation. The net book value is multiplied by a factor that ranges between 10–25 percent. The same basis is used to calculate the FCOM though instead of the mark-up factor, the net book value is multiplied by the Treasury rate.

---

3 The Treasury rate is updated semi-annually and can be obtained from the "Treasury Direct" Web site at http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdirsemi.htm.

4 Public vouchers are a form of contract financing.

Note that the FCOM is considered reimbursement of a cost and not a profit, though it is excluded from the allowable costs in the working capital fee. The facilities cost is covered under the cost accounting standards, not DFARS 215.404. Generally, interest is an unallowable contract cost. However, FCOM was introduced in October 1976, during periods of high inflation and interest rates. We consider it a profit here since we are modeling the effect of the profit and contract financing levers on the *after-tax un-levered free cash flow*. This is the cash flow available to bond and stock holders after taxes and a provision for future business (i.e., capital expense) are paid.

Looking at the entire profit policy from a practical and less didactical perspective makes it difficult to exclude the FCOM from profit since it is intended to directly compensate either equity or debt holders—the Defense Department does not dictate nor anticipate capital structure. In the income statement, this would fall under operating earnings or earnings before interest and taxes (EBIT).

Finally, we mention that the profit policy and contract menu merge in the use of base and variable fees. These contract structures have a minimum fee (i.e., the minimum performance fee) and a variable fee that depends either on an objective metric (incentive fee) or a subjective basis (award fee). The incentive fee is covered under DFARS 215.404 while the award fee is under separate regulations.

The contractor's profit from an incentive fee contract follows the following formula where the desired metric is less than the target:

$$\text{Profit} = \text{Target} + \text{Share Ratio} \times (\text{Target Metric} - \text{Actual Metric})$$

Additionally, the contract ceiling and maximum fee are part of the total risk-adjusted cash flow analysis. Generally, in a fixed-price incentive (firm target) (FPIF) contract, the contractor could book a loss if the actual cost greatly exceeded the target. Award fee contracts do not have an objective profit rule like incentive fees; however, the Defense Department has established the amount of fee for which a contractor is eligible based on a subjective rating: unsatisfactory (0 percent); satisfactory (≤ 50 percent); good (50–75 percent); excellent (75–90 percent); and outstanding (90–100 percent).[5]

---

[5] Shay Assad memorandum, op. cit.

Current System Adopted April 2002

- Reduced emphasis on investment in facilities
  - Removed factor for buildings
  - Cut equipment investment weight by 50% (35%->17.5%)
  - Addressed concern about overcapacity
- Other changes increased allowed returns:
  - Added G&A to cost basis—consistent with other government agencies
  - Increased performance risk factor
  - Optional cost efficiency factor—an additional 1-4% cost margin for cost reduction efforts that benefit the pending contract
  - Net effect is small

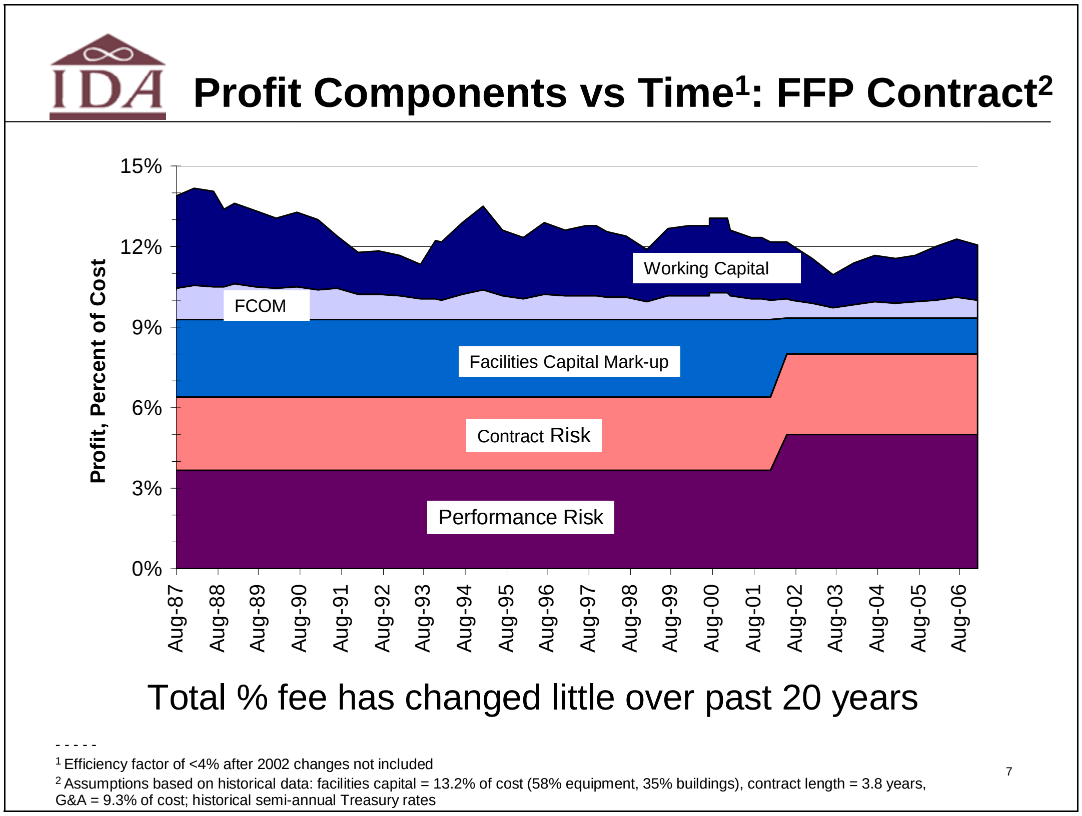
6

DoD profit policy originated after World War I, when concerns arose about profiteering under cost-plus-a-percentage-of-cost contracts. In 1934, legislation limited profits on prime and subcontracts for aircraft (12 percent) and naval vessels (10 percent). At the beginning of World War II, contracts for war materiel were exempt from profit restrictions under the War Powers Act of 1941, but a year later, the government again was given the right to determine a fair profit after delivery.

Weighted guidelines were instituted in 1964 as a structured system for determining profit based on risk assumed by the contractor, difficulty of the task, financing, and past performance. The system was refined over the next 2 decades. In the 1980s, the guidelines were revised to increase incentives for investment.

The current system, adopted in April 2002, was restructured to account for reduced government demand following the end of the cold war. To discourage overcapacity, the "mark-up" factor for building investment was removed, and the weight of the equipment investment factor was cut in half (mid-point went from 35 percent to 17.5 percent).

On the other hand, three changes allowed increased returns: General and Administrative (G&A) expenses were added to the cost basis, consistent with other government agencies; the performance risk factor was increased for technology; and the government permitted an optional cost-efficiency factor—an additional 1–4 percent cost margin for cost reduction efforts that benefit the pending contract. (As we will see, the cost efficiency factor has been little used.)



This slide shows calculated profits, i.e., the expected policy profits, expressed as a percentage of total costs for 20 years. We tracked the policy over this period to show the effect of shifts or changes in the regulations. Changes in profit rates over time reflect changes in the weighted guidelines as well as changes in the treasury rate that affect the FCOM and working capital portions of profit. Percentages are calculated on total costs including G&A expenses but excluding FCOM. The discretionary efficiency factor instituted in 2002 is not portrayed.

To create the time series of profits shown above, it was necessary to assume representative values for several factors. Most of the input we used was averages taken from a sample of fixed-cost contract data available in Contractor Cost Data Reports (CCDRs). An estimate of G&A as a percentage of cost was needed; until the 2002 policy change, G&A was not included in the base used to calculate contract and performance risk profit. The CCDR sample shows G&A averages 9.3 percent of direct costs (i.e., excluding G&A). Both FCOM and the facilities capital markup are calculated based on the book value of the facilities capital used on the contract. Given that FCOM is reported in the CCDRs, and we collected data for the corresponding contract lengths and Treasury rates, the value of facilities capital was imputed from this information. The resulting average value of facilities capital was 13.2 percent of total costs. As there were different facilities, capital mark-up rates on equipment and buildings (land was always excluded, as are buildings after 2002) we needed an estimate of the facilities components. Unfortunately, these data cannot be found in the CCDRs; instead we used information from the 1985 Defense Financial and Investment Review (DFAIR)[6] as reported by William Rogerson.[7] These data show percentages of 58 percent for equipment and 35 percent for buildings. The DFAIR information is also consistent with the CCDR estimate of facilities capital as a percentage of cost. Contract length is also required to calculate working capital profit—the average value for the CCDR sample is 3.8 years.

For each profit category where a range of possible values is allowed by the policy (as stated in DFARS 215.404), we used the "normal" or midpoint value in our calculations. We did not have data for contract and performance risk values prior to 1987; this is why we do not include any calculations prior to 1987.

The results show the profit percentages to be relatively stable throughout the 20-year period. The volatility in percentages for working capital and FCOM reflects changes in Treasury rates, which are reported at 6-month intervals. Some small changes in calculated working capital profits arose from changes in progress payment rates. These changes are masked in the figure by the larger changes due to interest rates. The substantial changes in policy in 2002 are shown to have offset one another in terms of total profit percentage. As noted above, this is absent the inclusion of profits based on the efficiency factor—which we will see is rarely used.

---

6 Michael T. Laurence, "1984 Defense Financial and Investment Review (DFAIR): Survey of Defense Procurement Personnel Results and Findings," Defense Manpower Data Center, December 1984.

7 William P. Rogerson, "An Economic Framework for Analyzing DoD Profit Policy," RAND Corporation, R-3860-PA&E, 1992.

2005 Contract Type by Amount[1,2]

	CPAF	CPFF	CPIF	FPIF	FFP	Other	Total	
Aircraft, related equipment, and spares	$ 8,729	$ 3,309	$ 1,367	$ 927	$ 28,306	$ 1,235	$ 45,362	16%
Electronics/ Communication Equipment	2,995	3,686	619	577	14,191	5,319	27,388	10%
Construction	1,061	1,959	58	220	18,547	768	22,613	8%
Missile and Space Systems	4,553	3,482	2,209	537	6,159	1,333	18,274	6%
Ships	2,924	2,680	478	3,942	2,122	516	12,662	4%
Combat Vehicles	459	829	23	214	5,336	891	7,751	3%
Weapons	554	575	110	3	2,969	251	4,462	2%
Ammunition	78	53	242	0	3,562	38	3,974	1%
Total	$ 21,354	$ 16,574	$ 5,106	$ 6,421	$ 81,192	$ 10,352	$ 142,486	51%
Services	$ 12,771	$ 12,992	$ 6,613	$ 607	$ 31,358	$ 16,985	$ 81,325	29%
Petroleum Other Fuels and Lubricants	$ -	$ 6	$ -	$ -	$ 10,505	$ 51	$ 10,562	4%
Subsistence	-	-	-	0	9,164	10	9,174	3%
Non-Combat Vehicles	-	112	10	-	6,229	158	6,509	2%
Medical/Dental Supplies and Equipment	27	12	-	-	3,596	113	3,749	1%
Textiles, Clothing and Equipage	34	26	-	-	2,748	267	3,074	1%
Other	896	2,129	529	72	18,300	6,627	25,120	9%
Grand Total	$ 33,135	$ 31,851	$ 12,259	$ 7,100	$ 163,092	$ 34,564	$ 282,000	100%
	12%	11%	4%	3%	58%	12%	100%	

- Most contracts are FFP (includes FFP w/ EPA) or CPFF
- CPAF important in services and development
- FPI mostly used in ship production and aircraft LRIP

[1]Analysis of Federal Procurement Data System (FPDS) data
[2] Other: cost sharing, fixed price re-determination, cost no fee, labor hours, combination, fixed price level of effort, time and materials

8

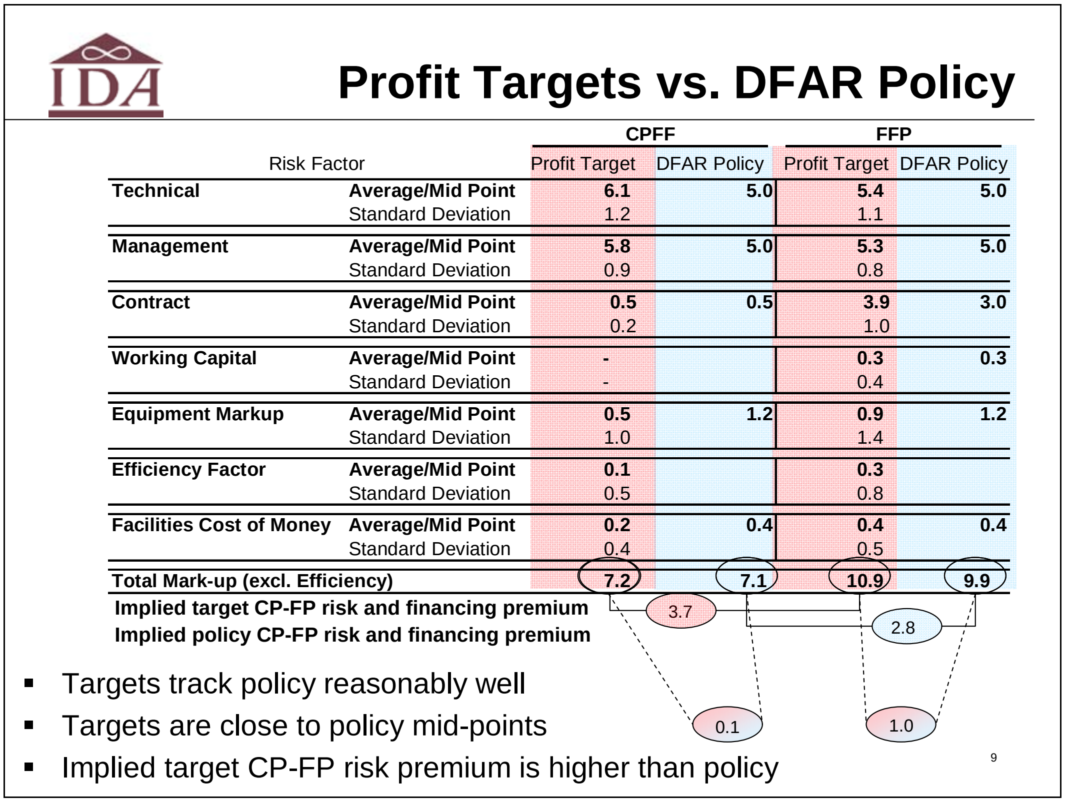
For perspective in the subsequent analyses of the profit and contract finance policy application, we summarize here what types of contracts are being used today by the Defense Department. The above slide shows the breakdown contract values exceeding $225,000 for FY 2005 by contract type and category. The categories are the descriptions of DoD "Use Codes." We have listed only the top five contract categories that account for roughly 90 percent of the total expense. We see that most contracts are firm-fixed-price contracts. Cost-plus-fixed-fee and award-fee contracts also make up a substantial amount of the total.

The FFP category includes contracts with economic pricing adjustment (EPA) clauses. The EPA clause is important for long-term contracts such as multi-year procurements where the contractor has a significant exposure to inflation risk. An EPA allows the contractor to increase the contract price if labor or materials inflation exceeds an agreed threshold. In most long-term contract cases, the government is in the best position to absorb inflation risk unless there is reason to believe the contractor can achieve efficiencies that more than offset it. For example, in a multi-year contract, the contractor has an informational advantage on cost until the next contract negotiation. During this period the contractor should seek to increase its productivity as much as possible since it will be able to keep the profits. The government should take the inflation risk only if inflation is volatile or expected to rise substantially, or if there is little productivity gain possible. In some commercial contracts, the supplier is expected to offset inflation with productivity gains.[8]

The CPAF contract has become an important alternative to the CPFF for development and service contracts. It is preferred by contractors because its limits are not defined by the guidelines in DFARS 215.404 and can enable the contractor to make higher gains on development contracts. This is important to contractors as the Defense Department enters into fewer major acquisitions. Contractors state they must be able to make high profits on development in isolation from production to remain competitive with other high-technology industries. The CPAF contract is used where there are no clear objective metrics that could be used to develop an incentive fee structure. CPAF contracts are used mainly in development and services where there is either a high degree of technical uncertainty or performance is not defined with quantitative metrics.

Cost-plus and fixed-price-incentive-fee contracts are less common now than in the past. Incentive-fee contracts are appropriate for production programs where there is a residual risk of design changes, such as ships, satellites, or aircraft low-rate initial production.

8 Ford Motor Company purchasing manager, telephone conversation with Scot Arnold, 1993.



Risk Factor		CPFF Profit Target	CPFF DFAR Policy	FFP Profit Target	FFP DFAR Policy
Technical	Average/Mid Point	**6.1**	**5.0**	**5.4**	**5.0**
	Standard Deviation	1.2		1.1	
Management	Average/Mid Point	**5.8**	**5.0**	**5.3**	**5.0**
	Standard Deviation	0.9		0.8	
Contract	Average/Mid Point	**0.5**	**0.5**	**3.9**	**3.0**
	Standard Deviation	0.2		1.0	
Working Capital	Average/Mid Point	**-**		**0.3**	**0.3**
	Standard Deviation	-		0.4	
Equipment Markup	Average/Mid Point	**0.5**	**1.2**	**0.9**	**1.2**
	Standard Deviation	1.0		1.4	
Efficiency Factor	Average/Mid Point	**0.1**		**0.3**	
	Standard Deviation	0.5		0.8	
Facilities Cost of Money	Average/Mid Point	**0.2**	**0.4**	**0.4**	**0.4**
	Standard Deviation	0.4		0.5	
Total Mark-up (excl. Efficiency)		**7.2**	**7.1**	**10.9**	**9.9**

This slide presents our analysis of the DD Form 1547 database of Air Force and Army contracts using policy guidelines in DFARS 215.404. DD Form 1547, Record of Weighted Guidelines Application, tracks the contracting officer's use of the policy levers and is required for every negotiated contract; however, only the Air Force and Army forms are in the electronic database to which we had access. The form contains a contract cost breakdown and the elements of the profit targets listed above. The red column in the slide lists the "profit targets" estimated from the DD Form 1547 database. We calculated the sample means and the standard deviation of over 6,000 contracts in the Air Force and Army database. We compare those sample means, in red, above, to the "normal value" listed in DFARS 215.404-71-2 and -3, shown in blue, above.

3. Data Analysis

The risk factors are listed as percentages of allowable costs. The DFAR policy and the profit targets can be compared directly for the top three factors shown in the slide. The DFARS does not provide "normal values" for the remaining factors as a percentage of allowable cost; instead, it provides a procedure for calculating the target.

The efficiency factor, rarely used in the actual targets, similarly has no “normal value” for the efficiency factor given by the DFARS; it is simply not to exceed 4 percent. The lack of guidance may be a partial cause for the lack of usage for this factor.

The bottom four factors are imputed fees based either on allowable cost, contract length, or net book values unique for each contract. Thus for the working capital, equipment markup, and FCOM, the amounts in both the target and policy columns are based on the sample average allowable cost, length, and net book value from the DD Form 1547 database. While the DFARS does not provide “normal values” for these factors, it does provide a “normal value” for the equipment markup rate, 17.5 percent, which was used in our estimate of the policy amount.

4. Targets versus Policy

The technology, management, and contract risk factor targets were all set above the DFARS “normal value.” The technical policy level (blue) is the normal value for standard technical risk. For contracts with enough innovative technologies to receive the “technology incentive” designation (see slide 9), the policy would have a normal value of 9 percent in lieu of 5 percent. Notice that while the technical target is higher than the norm for the FFP contracts, it is only 0.4 points higher, versus 1.1 points for CPFF contracts. This small difference likely reflects the use of more mature technology in FFP contracts than CPFF contracts. The nature of these targets is illustrated by looking at the technology risk factor distribution. Both contract samples have multi-modal technology target distributions: the FFP has a small secondary peak at 9 percent while the CPFF sample has two equal size peaks at 5 and 7 percent and a small peak at 9 percent. These peaks could be due to the use of the technology incentive for selected contracts. However, it is not clear why the CPFF targets peak at 5, 7, and 9 percent in lieu of 5 and 9 percent (i.e. the normal values for the standard and incentive technology factors respectively). One possibility is that many contracting officers may view the risk factor range as a continuum from 3 to 11 percent in lieu of the guideline where the standard range is from 3 to 7 percent and the incentive range is from 7 to 11 percent.

The FFP contract risk factor distribution is bimodal with a primary peak at 3 percent and another one that is 20 percent smaller at 5 percent. These peaks correspond to the normal value for FFP contracts with progress payments (3 percent) and for those without contract financing (5 percent). Looking deeper at the data, we find that indeed FFP contracts with and without financing have mean contract risk factors 3.2 and 4.8 points respectively. Thus even though the sample averages appear to exceed the normal values listed in slide 9, by looking at the structure of these samples we conclude that they are actual consistent with the more detailed values in the DFARS.

Similarly, we see that the management risk factor is 0.5 points lower for FFP contracts than CPFF contracts. As with the technical risk factor, it is likely that FFP contracts require less effort to achieve performance targets and more effort on production efficiency. It then follows that the main difference between the FFP and CPFF targets is the 3.4 point spread between the contract risk factor targets. This reflects the contractor's higher exposure to cost risk in FFP contracts.

Note that the working capital profit target appears only under the FFP contracts. This is because the contractor with a CPFF contract is fully reimbursed during the course of the contract through public vouchers. This result follows the policy exactly.

Not all contracts had targets for working capital, equipment markup, and FCOM, which lowers the sample means over what they would have been if we averaged only over the population with non-zero targets for these factors. This is also true for the efficiency factor. Most contracts did not have a target for the efficiency factor, and the few that did had targets between the policy range of 1–4 percent.

Just as the relative position of the total CPFF and FFP targets is consistent with the policy, the implied risk premium, or difference between the two total targets, while higher than the simple guideline in the chart, is consistent with a more detailed accounting of the contract samples relative to the DFARS. The next slide shows this same trend for actual contract data.

FP-CP Risk and Financing Premium

	CP	FP	FP Higher/ (Lower) than CP		
Actual Profit Rates[1]	7.6	10.5	2.9	%	
Variance Explanation					
Working capital profit			2.3	%	Imputed: Treas. rate, contract size/length
Other unexplained			0.6		Must cover performance, contract, and equipment profit
Total Variance			2.9	%	

- Imputed working capital profit compensates contractor for financing work-in-process not covered by progress/performance payment
- Working capital financing profit depends on: progress payment rate; contract length; Treasury rate
- Imputed financing profit accounts for most of the difference between FP/CP contracts -- indicates risk premium is low

s[1] Actual profit rates were estimated from completed contracts as reported in Contractor Cost Data Reports (CCDRs)

10

Cost-plus (CP) and fixed-price (FP) contracts differ from one another in at least two important ways. In a cost-type contract most of the working capital is provided by the government, while in the fixed-price case the contractor must finance the working capital not provided by progress payments.[9] In cost-type contracts (CPFF, no incentives), the government carries all risks for cost overruns, while in a firm-fixed-price contract, the risk is born by the contractor. These differences should manifest themselves in profit differences between cost-plus and fixed-price contracts.

We calculated average profit percentages for each contract type using the CCDR data sample. CCDRs report the realized profits (including FCOM) for contacts that have been completed, or are near completion. Given this, we calculate average profit percentages for each contract type. The result is 7.6 percent for CPFF contracts and 10.5 percent for FFP contracts with a 2.9-precent difference between the two.

Although the individual policy lever components of the actual profit are not reported in the CCDR (excepting FCOM), we can estimate the implied working capital

9 CP contractors must fund minimum inter-payment working capital (as low as 1 month) and any hold-back—presently 3 percent for income taxes.

portion of profit for each fixed-price contract. The data used include the contract length factor calculated from the contract length, and the Treasury rate relevant at the time of the contract. We calculated the working capital profit for each contract using this data, which yielded an average profit of 2.3 percent.[10] Note that we are not assuming that the implied working capital profit fully compensates the contractors for their costs. In fact, Rogerson argues that the policy lever systematically undercompensates working capital costs.[11]

Given the framework explaining the profit differences between CPFF and FFP contract profits, most of the 2.9-percent delta between the two is taken by the working capital profit, leaving only a small implied risk premium of 0.6 percent to account for the other factors—mainly the contract risk factor.[12] That the simple policy outlined in slide 9 (page 18) with a 2.8-percent implied risk premium is close to the actual implied risk premium of 2.9 percent is mostly coincidence. The actuals database spans from the 1970s to the early 1990s, making comparison between the ex post profits to the present policy guidelines complicated and not necessarily illuminating.[13]

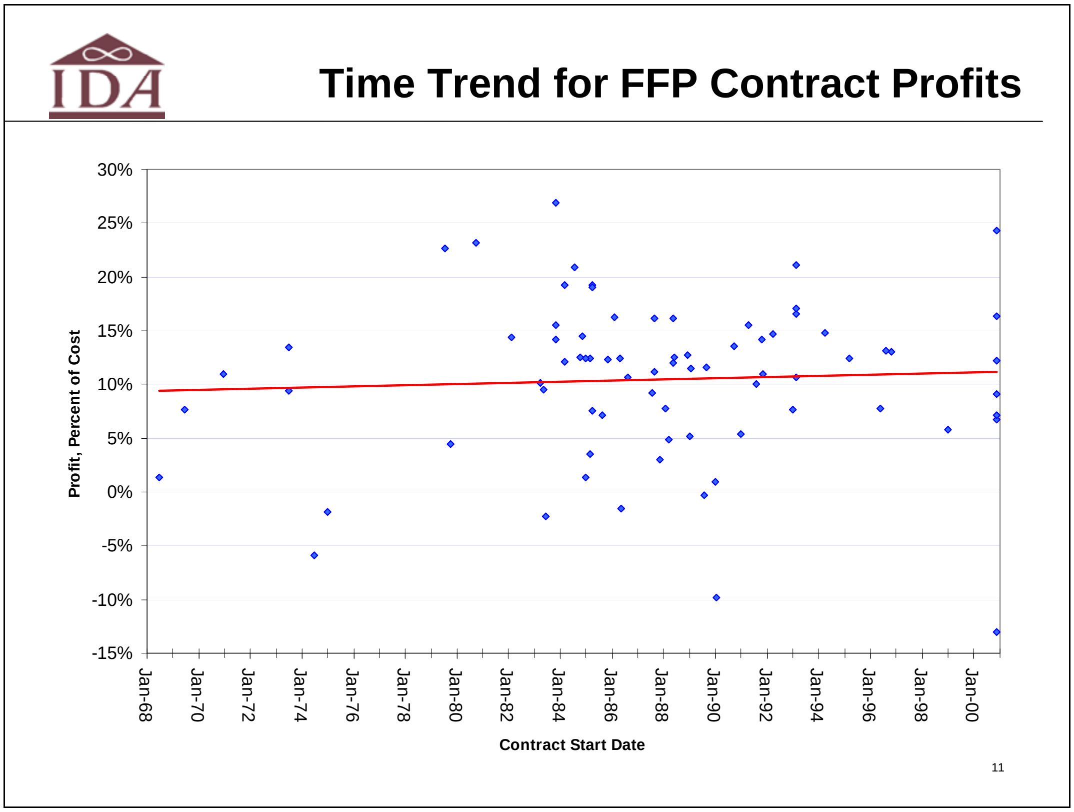
---

10 The 2.3 percent is identical to the value calculated by Rogerson using representative data. Note it is much higher than the target value of 0.3 percent reported in the previous slide. This disconnect can be explained by several phenomena. The target data are taken from the recent past while the CCDR includes contracts going back to the 1970s—because of this, the typical Treasury rate used is much higher. Also, the CCDR data include mostly major weapon system contracts with an average length of 3.5 years, while the target profit data are likely to include many more short contracts, with many FFP contracts not receiving financing profit at all.

11 Rogerson, "An Economic Framework for Analyzing DoD Profit Policy," op. cit.

12 Rogerson approaches the comparison between FFP and CPFF profits somewhat differently. He assumes the policy-specified risk premium and other profit components and then calculates a residual that he interprets as economic profit; that residual is 4.1 percent for CPFF contracts and 0.6 percent for FFP. Thus, an alternative explanation may be that the FFP risk premium is not too low, but the economic profits for CPFF contracts are too high relative to FFP. In either case the policy implications may be similar.

13 It is also not fruitful to compare the details between the sample targets in slide 9 (p. 18) and the sample behind the actuals in slide 10 (p. 21). While the two sets of data (i.e., the targets and actuals) show implied risk premiums that are different by about only 1 percentage point, their compositions are very different in terms of time frames and scale. The time-scale is important since the targets are from a broad range of programs, whereas the actuals are mostly major defense acquisition programs (MDAPs). The actuals span decades (1970s to early 1990s), while the targets span several years, 2002–2005. Not only has the policy changed, but the interest rates for the actual contracts were much greater than in recent history.



The CCDR data provided the opportunity to test many hypotheses regarding realized profits. The data in this slide show no statistically significant time trend in profit percentages for FFP contracts; the results were the same for the other contract types. We also tested hypotheses about the effect of the budget environment and changes in profit policy rules; we did not find any statistically significant relationships.

The lack of evidence of a time trend in realized profit percentages is consistent with our earlier portrayal of the stability over time of top-line profit percentages calculated from the profit rules.

Target Factor Correlations

	Technical	Management	Contract	Wkg Capital	Equipment[1]	Efficiency	FCOM
Technical	1.0	0.7	(0.2)	(0.1)	(0.2)	0.1	(0.1)
Management	0.7	1.0	(0.1)	(0.1)	(0.2)	0.1	(0.1)
Contract	(0.2)	(0.1)	1.0	0.2	0.1	0.1	0.1
Working Capital	(0.1)	(0.1)	0.2	1.0	0.1	0.1	0.1
Equipment	(0.2)	(0.2)	0.1	0.1	1.0	0.0	0.9
Efficiency[1]	0.1	0.1	0.1	0.1	0.0	1.0	0.0
FCOM	(0.1)	(0.1)	0.1	0.1	0.9	0.0	1.0

- Equipment should be positively correlated to FCOM and the working capital factor
- Industry claims profit calculations start at bottom line[2]
  - Thesis implies factors adjusted to negotiated bottom line
  - Observed negative correlations imply some factors offset, but there is much variability in levels and bottom lines
  - Efficiency factor does not seem to follow this claim

-- - - -

[1] All correlations, except for the equipment/efficiency pair, were significant at the 1% level using a two-tailed t-test.

[2] Discussions with Lockheed, Raytheon, and Jack Cloos of IDA.

12

The three reasons to look at lever correlations are as follows: (1) to see if there is any evidence of offsetting levers to maintain a stable bottom line (recall the long-term stability of FFP contract profit margins); (2) to see if the policy is used as expected from the guidelines; and (3) to see if there is any clear redundancy or conflict in the way the levers are used.

We have looked at how the individual profit policy levers are used to build the total contract profit target. Now we look at how the levers are used relative to each other. If each lever is applied individually according to the regulation, we would expect correlations between some of the levers. For example, we expect positive correlation for the working capital factor and the FCOM since they both use the same Treasury rate. We also expect positive correlation between the FCOM and the equipment factor, which both use the same net book value of assets. However, there are other effects, such as contract type, that could drive correlation. For example, fixed-price contracts should have lower technology-related risks than cost-plus contracts. Thus, the contract type may be a second-order effect causing profit levers to have a positive or negative correlation.

While there appear to be several cases of unexpected pairwise correlation, further analysis of these coefficients did not yield any strong indication of offsetting. Furthermore, the unexpected, but small, positive correlations weigh against significant systemic offsetting. An appendix to this paper presents a more detailed description of the analysis of target factor correlations in slide 12.

Principal Component Analysis of Profit Targets

Factor Matrix[a]

	Factor		
	1	2	3
Technical	-.451	.677	.121
Management	-.451	.641	.158
Contract	.278	-.190	.669
Working Capital	.178	-.052	.277
Equipment Markup	.828	.327	-.055
Efficiency	.017	.047	.197
FCOM	.880	.437	-.076

Extraction Method: Un-weighted Least Squares.

[a] 3 factors extracted. 8 iterations required.

Seven factors collapse to three

- Equipment and FCOM move together
- Technical and management risk are weighted together
- Contract risk is important
- Efficiency and working capital are insignificant

Guidelines usage is simpler than implied policy

13

Based on the guidelines in the regulation, several of the levers are related or have a fine distinction. The implication may be that the guidelines are more complex than necessary and might be improved with fewer, more broadly defined levers. For example, can the goals of the contract risk and working capital levers be achieved with just one lever? Could fewer non-overlapping levers achieve the objective with less complexity?

We used factor analysis to determine if we could use fewer levers to explain the variation in the DD Form 1547 data. We do not go into the details of the data reduction technique here, but factor analysis identifies and ranks “factors” based on the correlations between the variables—in this case the profit levers. This ranking provides the researcher with a way to reduce the number of factors needed to model the system. In our case, we have seven levers we suspect could be reduced in number and still yield the expected profit target per contract. Our factor analysis indicated that the DD Form 1547 profit target data could be modeled with three factors: one that captured the elements of the equipment and FCOM levers (yellow); one that captured the elements of performance risk (red); and one that captured the elements of contract risk (green). Factor three also appears to capture the effect of the working capital lever. However, the fact that the working capital and efficiency levers were not used as much as the other levers played a role in reducing their overall effectiveness in modeling the data.

Our factor analysis indicated that the profit levers could be reduced from seven to three. This is a substantial change that would require major revisions to the regulation.

C. DOES POLICY INFLUENCE CONTRACT PERFORMANCE?

Presentation Plan

- Does practice follow policy?
  - What is the profit policy and its levers?
  - Analysis of profit targets
  - Analysis of *actuals*
- Does policy influence contract performance?
  - Contractor behavior
  - Contract outcomes
- Does policy provide adequate contractor profit?
  - Defense contracting business model
  - Integrating the policy levers with cash flow modeling
  - Industry analysis
- Synthesis of findings and implications

IDA

Facilities Cost Incentives

- Facilities capital markup (FCM) and facilities cost of money (FCOM) introduced into DoD contracting in 1977
- FCM rate on equipment increased from 8% to 35% (1977-1987) and then decreased to 17.5% in 2002
- IDA studies of the military aircraft industry showed the capital/labor ratio (K/L) almost doubled from the early 1970s to the 1990s
- IDA also found a significant downward effect on aircraft unit labor costs due to higher K/L over this same period

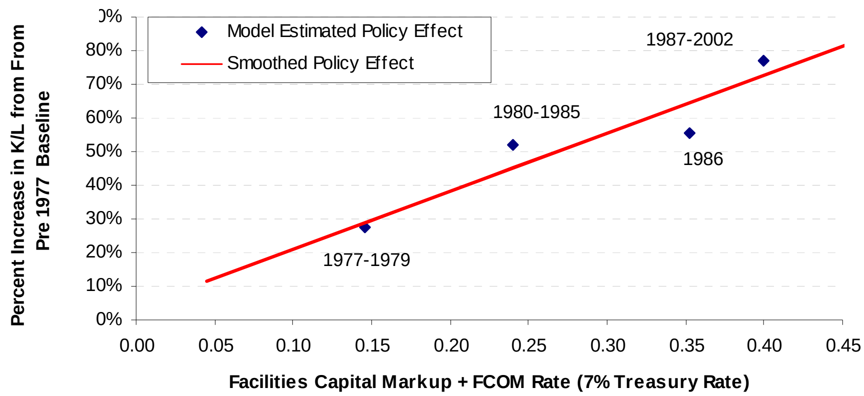
15

We began our analysis of the effect of the policy by evaluating whether policy changes can affect the behavior of firms. We examined the facility capital markup as a case study of policy meant to illicit a specific behavior from firms. In the 1970s, analyses of the defense industrial base found lower facilities capitalization relative to other manufacturing industries. Profit policy incentives were employed to help bridge the gap. Changes in policy started in 1977 with the introduction of the facilities capital markup and FCOM. FCOM has kept its basic form since 1977, but the facilities markup on equipment incrementally increased from its initial 8 percent to 35 percent in 1987. The facilities markup was decreased to 17.5 percent in 2002.

IDA analyzed the effects of these changes on the capital intensity of military aircraft producers from the early 1970s to the late 1980s. These analyses showed a large and statistically significant effect of the changes in profit policy on the capital/labor ratio (K/L), with K/L almost doubling over this period.

To measure the benefits to the government of higher K/L, IDA examined the effects on individual aircraft programs that were built by these same producers during the period of increasing K/L ratios. The analyses showed that the increased K/L ratios resulted in a statistically significant decrease in unit manufacturing hours.

Effect of Policy Changes on K/L*



Policy motivated higher capital investment

- - - - -

* Thomas P. Frazier, Matthew S. Goldberg, and Thomas R. Gulledge, Jr., "Department of Defense Profit Policy and Capital Investment in the Military Aircraft Industry" *The Review of Economics and Statistics,* Vol. 74, No. 3 August 1992, pp. 394-403.

16

This slide portrays the results of an IDA study (subsequently published in *The Review of Economics and Statistics*, as referenced in the slide) showing the effects of changes in the facilities capital markup (FCM) on K/L.[14] The study used a binary dummy variable to distinguish each change in policy regime. The estimated coefficients of the dummy variables can be interpreted as percentage changes in K/L due to the policy changes; each point on the graph corresponds to a policy regime. As pre-1977 rules did not provide for FCOM, its effect is added to the facilities markup, with an assumption of a 7-percent Treasury rate. The regression line shows a continuous representation of the policy effect.

We had data only through the late 1990s, so the analysis did not extend past the latest regulation change in 2002. We can see from contractor financial reports, however, that since the end of the cold war, capital spending (Figure 1 shows net capital expense as CAPEX = capital spending – depreciation) has declined dramatically. Two factors could

---

14 T. P. Frazier, M. S. Goldberg and T. R. Gulledge, "DoD Profit Policy and Capital Investment in the Military Aircraft Industry," IDA Paper P-2359, March 1990.

be at work: a direct scale-down in response to lower DoD demand, and lower spending in expectation of the facilities capital markup rule change. The rule change was apparently discussed for many years prior to implementation.[15] Contractors would factor expected profitability of assets in their capital budgeting.

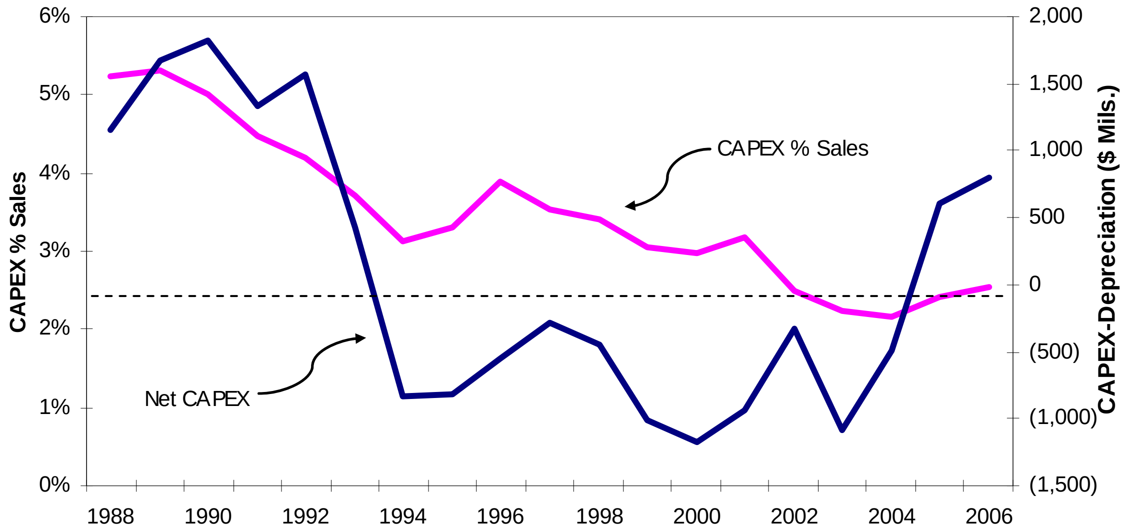


Figure 1. Defense Industry Capital Spending

15 From a conversation with Eleanor Spector, Lockheed Martin, summer 2007.

Contract Type vs. Cost Performance

- Measured the Cost Performance Index (CPI) at completion for various contract types
- Used data from 860 contracts from 165 programs
- Controlled for program size, phase, service, and presence of a re-baseline
- Tests of Schedule Performance Index (SPI) and Composite Performance Index (SCI) yielded similar results

17

We used the earned value data from 860 contracts covering 165 programs to see if we could find any relationship between contract type and performance. Performance is defined as the cost performance index (CPI) at contract completion.

Our expectation was that if the profit policy was relatively ineffective, fixed-price contracts would have stronger incentives for good performance. From Rogerson, we expect good contract performance with fixed-price contracts since the contractors' profits are at risk.[16] We might expect that cost-plus contracts would constitute a higher fraction of poor performing contracts for two reasons. First, the contractors' profits are more certain regardless of outcome. Second, cost-plus contract vehicles tend to be used for development contracts, which have greater technical uncertainty than the production contracts for which FFP vehicles are most often used.

16 Rogerson, "An Economic Framework for Analyzing DoD Profit Policy," op. cit.

Contract Type vs. CPI: Results

- In production no significant differences between contract types (FFP is slightly better)
- In development, CPAF is slightly better than non-CPAF contracts
- Data do not show a correlation between contract type and performance

18

We found no significant differences in CPI among contract types. While in production, FFP contracts had a slight improvement over other types, but the difference was not material. Similarly, we found CPAF contracts had an advantage in development, but again the difference was not material. In general then, there appears to be no strong correlation between contract types and CPI.

Case Studies of Program Outcomes

- Others have studied incentive contracts
  - RAND[1,2]: lower cost growth but question overall savings
  - IDA[3]: higher share to contractor reduces cost growth
  - GAO[4,5]: Incentives work; awards have not
- IDA examined cases of large aircraft development efforts
  - All incentive contracts: CPAF, CPI, FPI
  - Programs: B-1A and B, F-15A, F/A-18A and E/F, F-22A, C-17A, and C-130 AMP
  - Contract cost growth based on estimates at completion in CCDR data
  - Compared contract cost growth with profit earned

- - - - -

[1]Irving N. Fisher, "A Reappraisal of Incentive Contracting Experience," RAND Corporation, Memorandum RM-5700-PR, July 1968
[2]John R Hiller., and Robert D. Tollison, "Incentive Versus Cost-Plus Contracts in Defense Procurement," *Journal of Industrial Economics*, Vol. 26, No. 3, March 1978, pp. 239–248
[3]Jack Cloos, Dennis D. Kimko, and Thomas P. Frazier, "Cost Sharing Arrangements on Incentive Contracts," briefing, December 12, 2001.
[4]GAO, Incentive Contracts, Examination of Fixed-Price Incentive Contracts, NSIAD-88-36BR, November, 1987
[5]GAO, Defense Acquisition: DoD has Paid Billions in Award and Incentive Fees Regardless of Outcomes, GAO-06-06, December, 2005

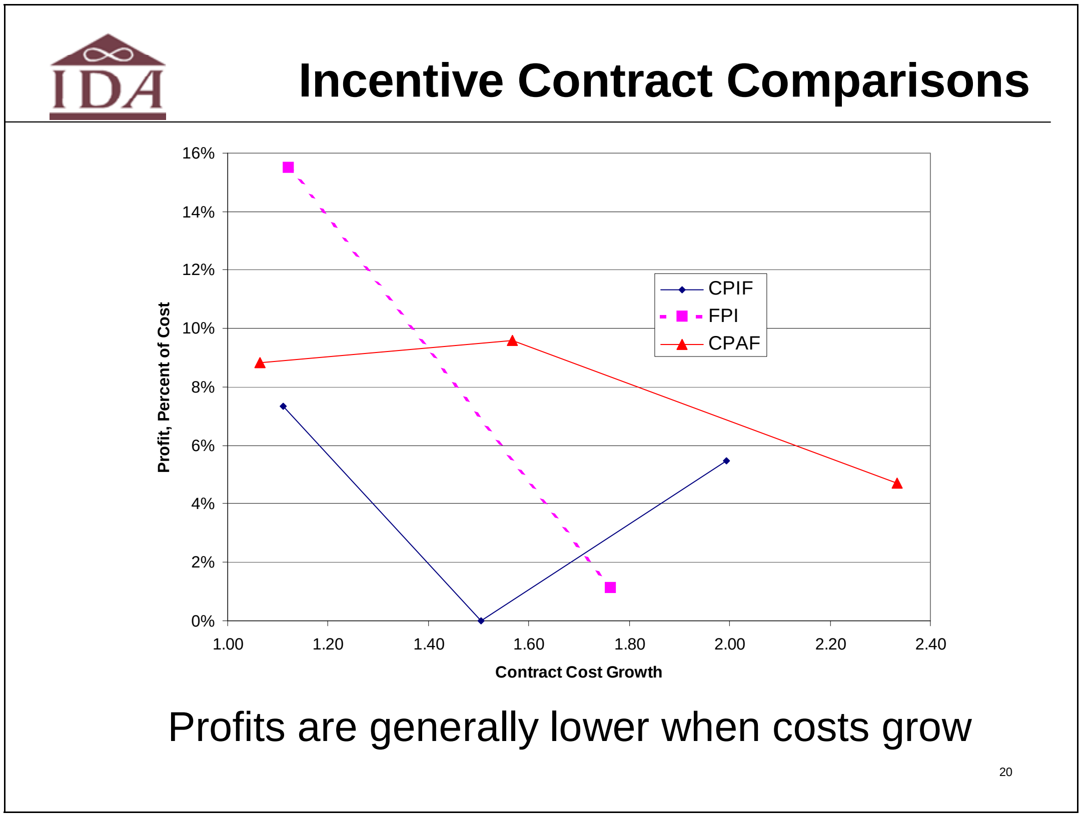
19

The effects of contract type on program outcomes have been explored in previous analyses. The 2005 Government Accountability Office (GAO) study (referenced in the slide) criticizes the implementation of award-fee contracts; they argue that even contracts with large overruns and otherwise poor performance have been paid most of their award fees. The implication of their critique is that the government is creating moral hazard by rewarding poor performance. They note that incentive contracts appeared to provide better contract outcomes. However; RAND's 1968 study (referenced first in the slide) found that incentive contracts had lower cost growth but did not appear to cost less. The implication is that contracts are negotiated to a higher price, lowering the prospect of growth. IDA found that cost growth declined the higher the incentive share ratio. The Defense Department has directed agencies and the services move towards more incentive in lieu of award fee contracts.[17]

We explored this issue further by comparing cost performance and profits from CCDR data for large aircraft development contracts across different incentive contract

[17] Shay Assad memorandum, op. cit.

types, including cost plus award fee (CPAF), cost plus incentive (CPI), and fixed price incentive (FPI). The sample included the B-1A and B-1B, F-15A, F/A-18A, F/A-18E/F, C-17A, and C-130 Aircraft Modernization Program (AMP). Generally, CCDRs are provided by the contractor at 6-month intervals starting from the beginning of the program. The reports not only include expenditures to date, but also estimates at completion (EACs). In our analyses, we treated the EAC reported in the initial CCDR as the baseline cost for the contract. The EAC in the last submission was considered the final cost. The ratio of the two was the measure of cost growth. Profit percentages were also taken from the CCDRs.



This slide shows the relationship between cost growth and profits for the selected aircraft contracts. The chosen cases show a diversity of outcomes for programs with clear success at cost control (cost growth < 1.2) as well as those with less success. Not surprisingly, the FPI contracts show the clearest relationship between cost growth and profits. The CPAF cases are generally consistent with the case made by the GAO, although the worst offender in terms of cost growth did receive a smaller profit percentage than the other CPAF contracts. The CPI cases are more diverse; one case with cost growth received no profit, and another a respectable profit. A likely explanation for this anomaly is that the high-cost-growth contract that received profit was subject to renegotiation due to changes in government requirements.

Although these cases do not constitute a statistically meaningful sample, they are suggestive about the types of contracts that provide the closest link between cost-performance and profit.

D. DOES POLICY PROVIDE ADEQUATE CONTRACTOR PROFIT?

Presentation Plan

- Does practice follow policy?
  - What is the profit policy and its levers?
  - Analysis of profit targets
  - Analysis of *actuals*
- Does policy influence contract performance?
  - Contractor behavior
  - Contract outcomes
- Does policy provide adequate contractor profit?
  - Defense contracting business model
  - Integrating the policy levers with cash flow modeling
  - Industry analysis
- Synthesis of findings and implications

How To Analyze the Industry

Who Pays for the Major Elements of the Product Cycle Expense						
Product	Pre Program/SDD	Facilities & Buildings	Tooling	R&D/SDD	Working Capital	Unit Profit
JSF	Customer	Lockheed	Customer	Customer	Cust./Lock.	Customer
Escape	Ford	Ford	Ford	Ford	Ford	Customer
	R&D	**CAPEX**		**R&D**	**Financing**	**Profit Margin**

- Profit Margin = Profit/Sales: the fraction of sales that goes to creditors, IRS, owners
- Free Cash Flow = After-tax profit – net CAPEX - Δworking capital: cash available to creditors and owners after adjusting for investing in ongoing and future business projects
- Expect high profit margins from businesses that must fund all phases of a product life cycle (cars, drugs, software)
- Cash flow compares across industries even where customers pay costs up front (e.g. Defense)
- Free cash flow[1] is the best measure of intrinsic value

22

- - - - -

[1]Discounted at the appropriate cost of capital

The Defense Department must ensure that the industrial base is capable of meeting defense requirements. Consequently, profit policy must consider the financial health of the firms in the industrial base. This section examines the business model of the largest of these firms.

The defense industry has a unique place among its corporate peers in other industries. It deals with high technology hardware and software, manufactures equipment and products such as aircraft, and provides services. It typically has long product cycles and does not have many retail customers. It can therefore be compared to capital goods manufacturers such as Caterpillar, automotive manufacturers such as Ford, or information technology suppliers such as IBM.

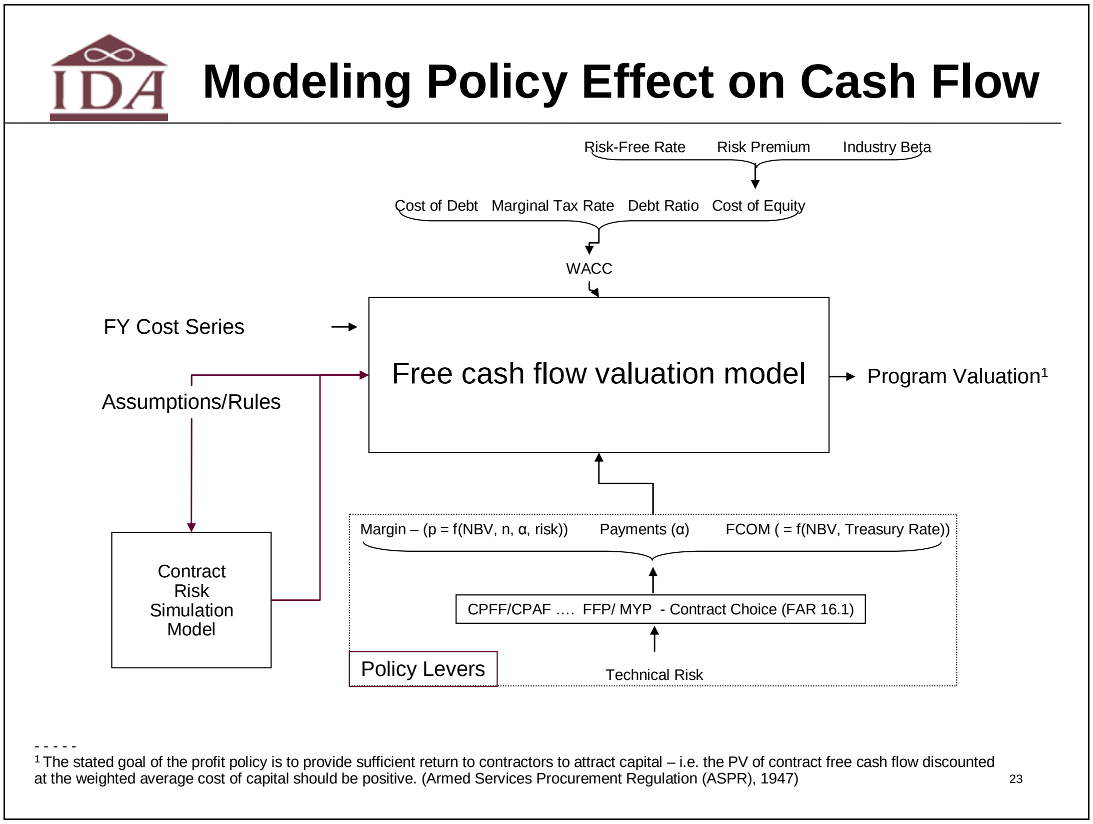
Let us compare the Joint Strike Fighter (JSF) to the Ford Escape. Both the JSF and the Escape were conceived and developed during long pre-development and system development and demonstration (SDD) programs. Although there are many technical differences, the key difference is financial: a commercial company must spend its own capital to develop products while government contractors usually receive substantial revenue for both pre-SDD and SDD. Commercial companies must either raise capital through public or private markets or use retained earnings.

During product development, commercial companies must invest in their production tooling and facilities. The government typically buys unique tooling for defense production up front. The government commits to paying for unique facilities over the course of production, such that if the contract is terminated the contractor can recoup its costs. This last point does not help cash flow, but it reduces the risk of an investment.

Once production is started, most commercial companies must fund their working capital either internally or through the capital markets, while government contractors can receive progress payments. For a new product, an automotive company may not receive a single payment from a customer for many years after the product is first conceived. A defense contractor receives regular payments as the work, both development and production, is performed.

The net result is that the automobile company needs a relatively high margin on most of its products to pay a reasonable rate of return on its investment. Since the defense contractor has much less of its own money invested, it can get a much lower margin and still have a high return. The best way to value the two products equivalently is by estimating net present value (NPV) of the cash flows over their lifetime. Using this method we see how low margins early in the life of a program can have as much or more value than higher margins later.

In the analysis that follows, we examine the industry profit margin and free cash flow returns on invested capital. Profit margin is defined as the operating profit or earnings before interest and tax (EBIT) divided by revenue. Free cash flow is defined as cash flow less capital spending less the change in non-cash working capital from the prior year (non-cash working capital is accounts receivable less accounts payable). Specifically we look at unlevered free cash flow that is based on EBIT rather than net income. Unlevered free cash flow to the firm (FCFF) is cash available to bond holders and equity owners. FCFF return on invested capital (ROIC) is the FCFF divided by the average of the present and prior years' invested capital or total liabilities plus book equity less non-debt liabilities (e.g., accounts payable). This ratio can be compared to the firm's weighted average cost of capital (WACC). WACC is the cost of debt plus the cost of equity both weighted by the market values debt and equity, respectively. The cost of equity is estimated using the capital asset pricing model (CAPM). In the CAPM, the cost of equity equals the risk-free interest rate plus the industry beta times the equity market risk premium. The risk-free rate is an interest rate that is free from credit default or other risks. Typically in the United States, we can use a Treasury bill or note with a maturity similar to the investment horizon. The industry beta is the average beta for the companies in the defense industry, where beta is the slope of the line when the monthly returns of the company or industry index are regressed against the monthly returns of the market (e.g., the S&P 500). Alternatively, beta is the covariance between the company and the market returns divided by the variance of the market returns. The market risk premium is the difference between the market rate of return and the risk-free rate. The market risk premium can be estimated from historical returns or from the rate implied in the price of the market index.



To examine the effect of profit policy on profitability, we built a model that has the program cost projections and the profit policy levers as input and NPV as output. The model starts with program cost projections, layers on the profit and contract financing policy, estimates the levered WACC as the discount rate, and finally calculates the NPV of the contract. Specific model input includes profit policy levers (including contract type); contract cost project by fiscal year; WACC input; and various business rules such as capital structure. The model simulates the income statement, balance sheet, and cash flows of a business whose sole product is the program. We show some results from the model in the next slide.

The Importance of Financing

- Valuation model captures the importance of contract financing[1] on notional MDAP

	90%	95
Production Progress Payment Rate	90%	95
Net Present Value ($ Mils)	$ 485	$ 485
Total Fee ($ Mils)	18,814	14,280
Fee % of Sales	11%	9%
Fee Savings	$ 4,534	
Added Interest	(897)	
Total Savings	$ 3,637	

- 5 ppt of payment rate = 2 ppt of margin
- Profit margins are not enough to measure the value of a DoD contract
- Need free cash flow model to evaluate profit policy

- - - - -

[1]We are not proposing to raise progress payments to 95%, the purpose is to show the effect of a 5 ppt increase in the rate.

24

The cash flow analysis shows the importance of financing on profitability. This slide shows the NPV of an example program the size and duration of the JSF. The NPV is $485 million, with a fee in then-year dollars of $18.8 billion. The margin is 11 percent of sales. The progress payment rate is 90 percent, which is the maximum rate for performance-based payments. The point of this example is to show, by using the profit policy model, the effect of increasing the payment rate by 5 percentage points while reducing the fee margin 2 points and maintaining the NPV at $485 million. The 2-percentage-point fee reduction yields a nominal dollar savings of $4.5 billion less $0.9 billion for additional national debt service cost for a net savings of about $3.6 billion. The government’s lower cost of capital helps achieve the net savings.

We are not advocating increasing the payment rate to 95 percent; rather, this analysis shows the trade-off possible between contract financing and profit margin. The effect is far less dramatic on smaller programs. In another notional example, $1.2 billion over 6 years, with a 12.4-percent profit margin and a progress payment rate of 80 percent has an NPV of $10 million. Keeping the NPV at $10 million, we can raise the payment rate 5 percentage points to 85 percent and lower the profit rate by 3 percentage points to 9.4 percent. The gross savings from fee reduction, however, is $59 million.

IDA

Discussions: Industry[1]

- Lowest profit margins of its industry peers
- Improved cash flow is from performance payments and investment efficiencies
- Cash flow return[2] lags—industry compares unfavorably on a growth and value basis
- The trend is bad—R&D programs increasing share of DoD outlays
- Returns on R&D lag production: 14% CPAF target equals to 5-6% return-on-sales
- Profit policy appears to be less important to services—more competitive
- Contractor discussions reflected AIA comments to DPAP

- - - - -

[1]Boeing, Raytheon, Northrop, Lockheed, AIA, and CACI

[2]AIA uses a proprietary CFROIC metric from CS Holt

25

To gain an industry perspective on profit policy, we conducted interviews with representatives from Boeing, Raytheon, Northrop Grumman, Lockheed, and CACI. We also obtained a copy of an Aerospace Industries Association (AIA) briefing that described their perspective on the financial status of the defense industrial base. The AIA briefing was a basis for its submission in response to the Defense Procurement and Acquisition Policy office's request for comments during the summer of 2007.[18]

The industry is not generally satisfied with the use of the weighted guidelines. Most contractors claim the contracting officer wants to negotiate the profit to a specific aggregate level, say 12 percent, without building it up using the guidelines. Our analysis of the Form 1547 database did not find conclusive evidence of this behavior. Representatives from one firm stated that the weighted guidelines would provide sufficient profits, but the contracting officers do not use the tool. Other contractors did not share this opinion; rather, they did not see that the guidelines provided sufficient return for development contracts. Representatives from another

18 Search for Docket I.D. DARS-2007-0044 and DARS-2007-0046 at www.regulations.gov.

firm did not feel that the prospect of a production contract remained sufficient incentive to perform on a low-return development contract because sole-source procurement contracts are becoming less frequent.

All contractors saw that development needed to have good returns on its own. Several commented that low-return contracts with high-risk technologies that might be important to the government were hard to staff with their best talent. Their rationale is that top employees do not want to work on contracts that have low returns for the company; they want to work on the high-profile, high-profit programs as is the case in the commercial world. CPAF contracts are preferred by all of the contractors for development work because of the higher potential returns.

The AIA report generally portrays the defense industry as lagging behind its commercial peers both in profit margin and in cash flow ROIC. As we show later, we agree the defense industrial base lags behind its commercial peers on profit margin, but we believe it is among the leaders of cash generators and shareholder value.

Service contracts are an emerging area of increasing importance that the weighted guidelines do not address well. The major prime contractors are gaining a greater share of the defense services sector. Northrop Grumman has developed a separate corporate entity so it can target new business more competitively. This entity's business unit has lower overhead costs than the other sectors of the company. Service contracts have a high degree of inter-contract risk for the incumbent provider. The re-compete cost and competition are high relative to the other areas of acquisition in the Defense Department. One contractor that primarily provides services saw that while the weighted guidelines did not sufficiently address services, the industry competition probably makes the guidelines irrelevant. The issue for service providers is to effectively manage the wage they pay employees and the rate paid by the government. The contractor has a risk that they will need to bring in higher-priced labor than originally expected to satisfy contract requirements.

The AIA showed the income statement analysis below to illustrate how a 14-percent CPAF profit margin (on cost) target ends up being no more than a 5–6 percent return on sales (ROS).[19]

Estimated cost	$100	
Base fee	2	
Award fee pool	12	
Total CPAF contract value	$ 114	
Fee potential: 14%	$14	
Award fee score – 85%	(2)	Corresponds to an “excellent” rating by the guidance set in the policy memo dated April 24, 2007
Share of award fee due to team—30%	(3)	Award fee (not base fee) is usually shared with team
Total fee earned by prime	$9	
Less un-allowed costs	(1)	
Total fee realized	$ 8	AIA notes the return on sales is 7.2%
Assume costs increase 35%	$135	Assuming cost growth was not due to contractor performance, the realized fee remains $8
Final return on cost	5.9%	= 8/136
Final return on sales	5.4%	= 8/147

While this is an excellent illustration of how a target profit margin on cost is translated into an actual margin on sales, it hints at how important it is to look not at margins but at cash flow to observe the health of the industry. Sharing revenue with a partner or cost growth, when it is the customer’s fault, both contribute to diluting the ROS; however, this is not all that important once you know the prime contractor’s income statement is a pass-through for these elements. Progress payments and other government funding make the risks of these pass-through costs inconsequential. Investors should be able to figure this out, or the contractor can disclose the information in its earnings releases. Regardless, pass-through costs have no effect on the cash flow—they may have an effect on the present value of the cash flow depending on the contract

[19] Aerospace Industries Association, “Assessing the Health of the Defense Industry,” 2005.

finance policy. Progress payments should offset any increases to working capital precipitated by the pass-throughs.

The industry focuses a great deal of attention on the low margins for defense companies—and they are lower than many industries. But as outlined in slide 22 (page 38), the defense industrial base has a unique relationship with its main customers that involves a balance of contract financing and profit margins. Certainly profit margins are important, but consideration of free cash flow can make a single digit profit margin quite reasonable. Consider again the $1.2 billion contract discussed in the annotations of the previous slide. A cost-plus contract, with full reimbursement vouchers, could yield positive NPV even with profit on cost margin targets as low as 2–3 percent. Of course, this is a result from a model, but the financial relationships are intact—with the right contract financing, low margins can yield positive NPV—and since the discount rate here is the WACC, positive NPV projects cover their cost of capital and therefore contribute positively to shareholder returns.

Discussions: Wall Street Analysts

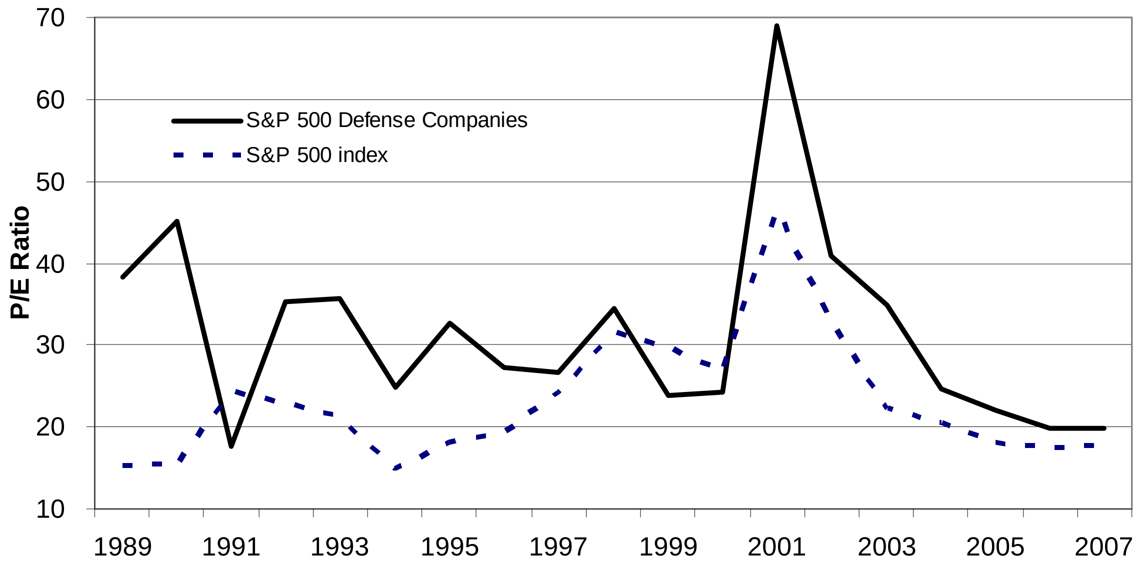
- We interviewed:
  - Heidi Wood, Morgan Stanley
  - Joe Campbell, Lehman Brothers
  - Pierre Chao (formerly CSFB, now CSIS) - Contributed to industry AIA profitability analysis
- They said:
  - The industry is a strong cash generator, but must look at full cycle
  - The industry appears regulated
  - It needs to attract the same talent as Apple
  - Not positioned to respond nimbly in the GWOT
  - Performance payments have led to “negative working capital”
  - Returning to progress payments would save billions without reducing budget authority
- Also:
  - Byron Callan (formerly Prudential Securities now Perella Weinberg) – helped develop industry analysis as consultant
  - Jack Gansler – IDA briefed DSB with preliminary industry analysis

26

To gain additional perspective on the financial health of the firms in the defense industrial base, we contacted several sell-side analysts from the brokers, as well as Pierre Chao of the Center for Strategic and International Studies (CSIS).[20] All but one analyst agreed that the defense industry is a strong generator of cash. One analyst termed the industry a traditional favorite among value investors who prefer cash flow ROIC as a valuation metric. Lately the analyst sees that growth investors, like the ones who helped drive up the dot-coms, have invested in the industry effectively pushing the price/earnings (P/E) ratio multiples to higher levels just after the dot-com crash and 9/11. See Figure 2. We see that the defense industry generally exceeds the P/E ratio of the S&P 500 except during the technology boom period in the late 1990s when value stocks were not favored. The industrial base P/E ratio has returned to normal levels in recent years as its earnings have risen and high expectations for future growth have diminished. However, growth investors are still looking for the industry to continue growing (i.e., growth in earnings per share, EPS). As the Defense Department’s budget growth has

20 Formerly a sell-side analyst with Credit Suisse First Boston (CSFB).

slowed, the industrial base has increasingly had to return cash to investors as large dividends or stock repurchase programs (like many other commercial companies).



Source: S&P 500 defense industrial base index constructed with Compustat database; S&P 500 data from Robert J. Shiller (online database: http://www.econ.yale.edu/~shiller/data.htm).

Figure 2. S&P 500 Defense Industrial Base Average Quarterly Price Earnings Ratio

Another analyst commented, before the credit crunch in the summer of 2007, that the lack of growth and the abundance of cash in the industry could reintroduce the risk of dramatic merger and acquisition deals. This risk would be driven by the same factors (i.e., post cold-war defense consolidation) as in the 1990s, though with the added advantages (to the buyers) of the leveraged buy-out (LBO). The LBO makes money for investors by using the debt capacity and excess cash of the target company for the acquisition and to pay the new owners large up-front special dividends and management fees. Defense companies have substantial excess cash and plenty of debt capacity. Fortunately, from an industrial policy workload perspective, the credit crunch of 2007 has dampened the market for the structured financial products necessary for large buy-outs.

The markets will eventually recover from the credit debacle of 2007 and the same investment principles will emerge once again to drive deals. Defense companies appear to fit the criteria for LBOs, high cash generators, once their prices become affordable. This is a risk that will emerge if and when the DoD budget stops growing at the same rates of recent history.

One analyst commented that the industry appeared to be in trouble because it did not spend enough on research and development (R&D) and did not have the right business proposition to attract the best and brightest talent. Like several defense companies, the analyst felt the low profit margins could not attract top talent. A recent study of the space industrial base reveals a dearth of certain levels of talent.[21] However, we have not been able to get enough clarity into this issue to understand if it really is related to the profit policy. We have not seen any direct evidence that the profit policy is a barrier to attracting good talent to defense companies.

Finally, one analyst commented on the growing cash balances of prime defense contractors. This analyst linked the growing balances and negative working capital to lower oversight of the payments process since the 1980s. We speculate that some of this effect is linked to the growing use of performance-based payments since they are not directly linked to expenses. Figure 3 gives some indication on the levels of these cash balances (i.e., unearned revenue liability accounts sometimes called “customer advances in excess of costs”). However, contractors attribute these accounts to a mixture of payments, particularly international payments that require a substantial deposit.[22]

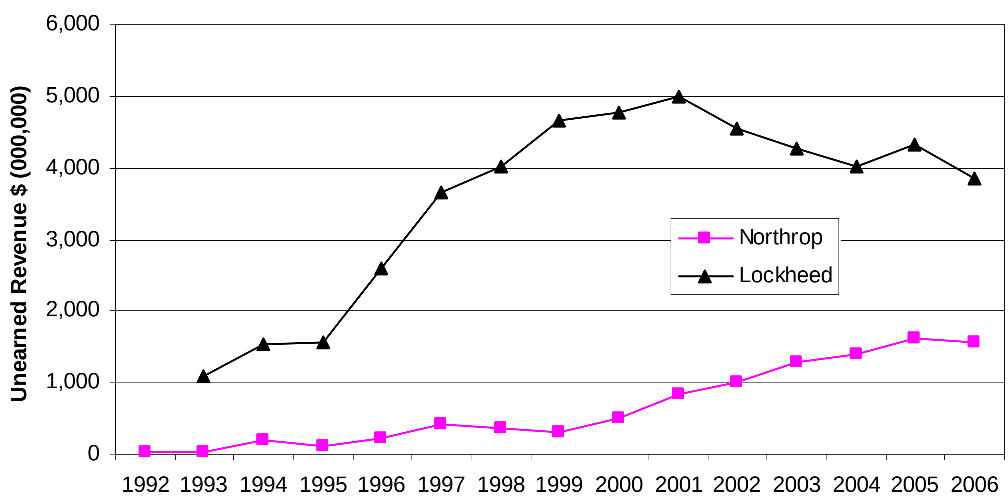
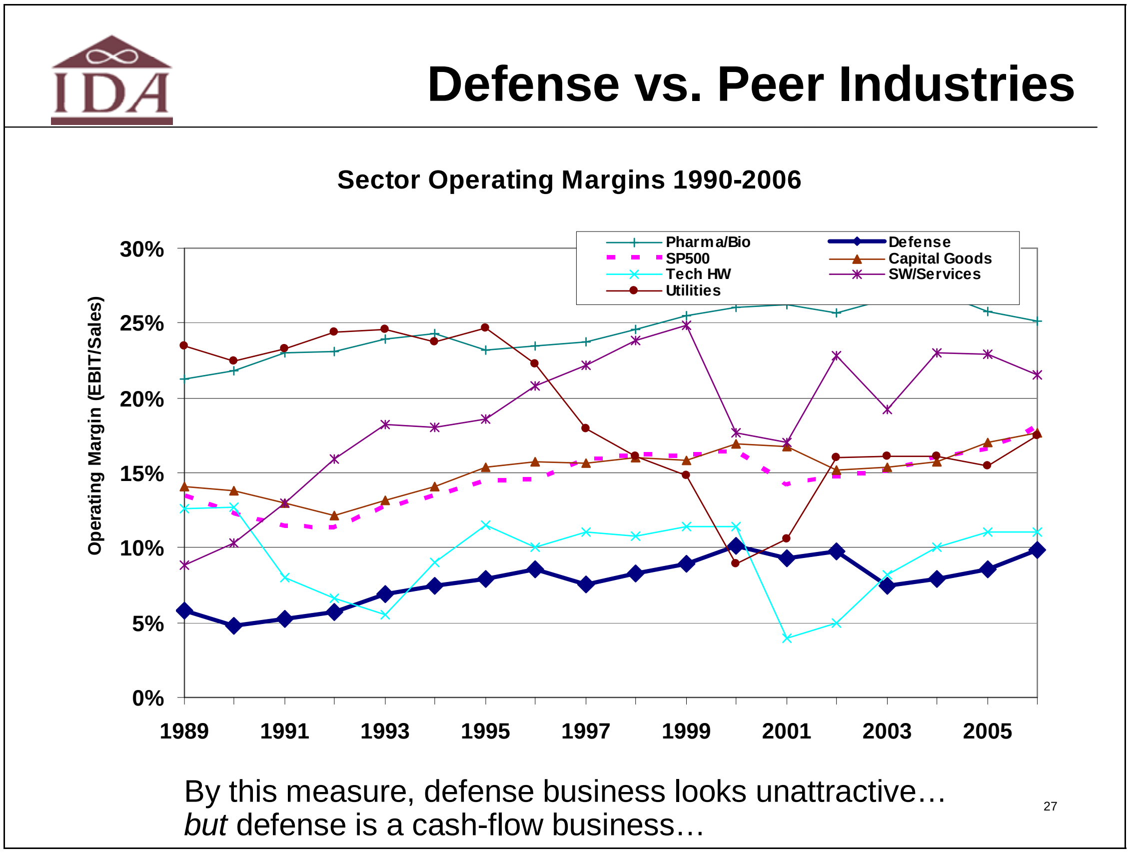


Figure 3. Customer Advances in Excess of Incurred Costs

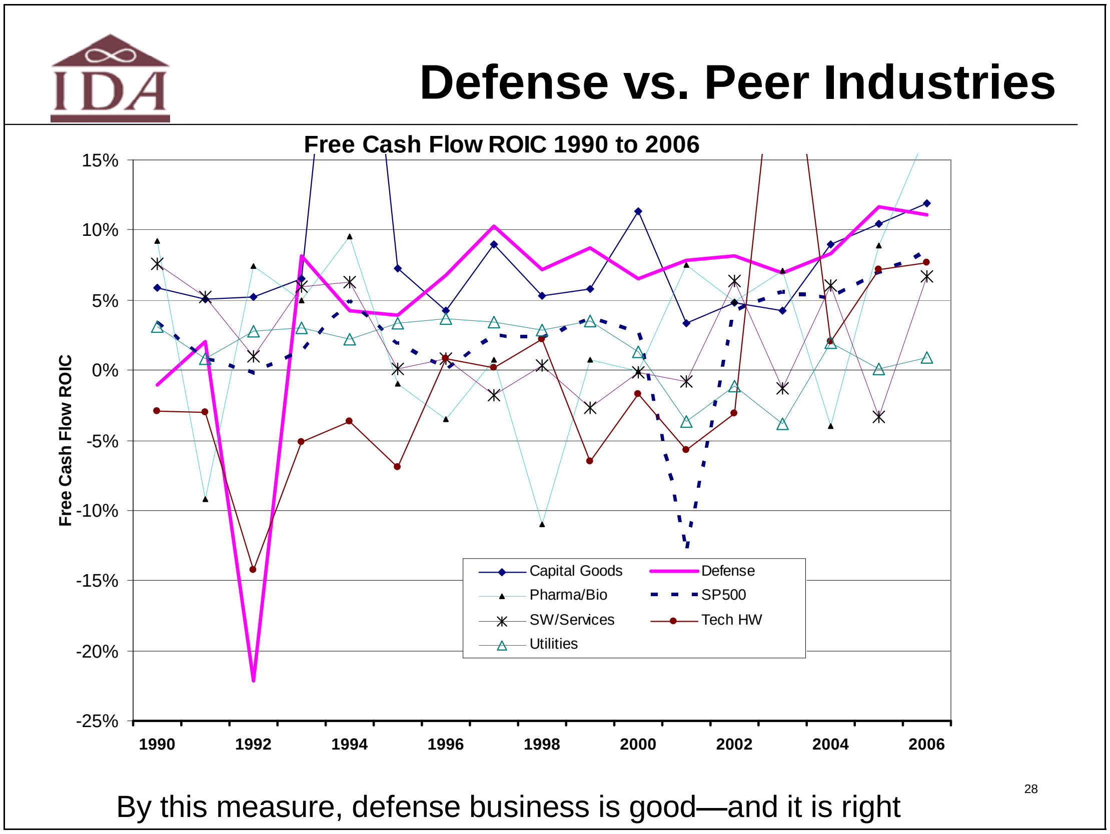
---

21 John l. Thurman, “National Security Space Industrial Base Study,” 39th DoD Cost Analysis Symposium, February 2006.

22 Lockheed requires a minimum downpayment of 20 percent on foreign sales, including Foreign Military Sales; however, they did acknowledge that some of the cash accumulated in the account is due to performance-based payments (discussion with Jerry Kircher, VP Investor Relations, November 2007).



Now we revisit the financial performance of the defense industrial base. The above slide shows the operating margin, or EBIT/revenues, for the defense industry, several of its peer industries, and the broader industry segments to which it belongs. We see that aside from 1993 and the sharp slow down after 2000, the defense industry has the lowest profit margins of the group. However, as we discussed in slide 22 (page 38), profit margin is only part of the valuation equation. Not until we look at cash flow do we see the true value of the defense industry.

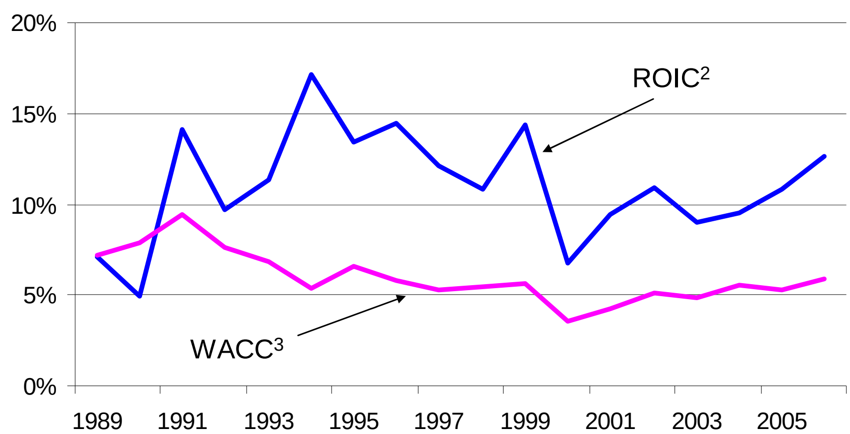


The financial structure of the defense prime contractors is leaner than other industrial firms due to the unique relationship between defense firms and the Defense Department. With prime contractors the Defense Department provides significant project financing and directly funds research, development, and some capital expense. Consequently prime contractors require considerably less of their own capital to generate revenue and subsequently free cash flow than commercial industrial firms. This distinction is seen in the higher free cash flow return on invested capital when comparing the top defense firms to other industrial firms.

The above slide shows the unlevered free cash flow ROIC for the defense industry, select peer industries, and the broader industry segments to which it belongs (i.e., the capital goods and S&P 500 sectors). Since the post-Gulf War (and post-cold war) recession in the early 1990s, the defense industry has been among the free cash flow ROIC leaders in the group. Note that even during the dot-com boom, while the defense sector was out of favor (along with other value stocks), the sector had strong returns.

Defense Industry Average Returns[1]

General Dynamics, Lockheed, Northrop, Raytheon



Defense adds to shareholder value over most of the last 20 years (ROIC>WACC)

-- - - -

[1]Data set did not represent a complete industry cycle
[2]ROIC = after-tax earnings/prior-year-end capital
[3]WACC = debt/capital*average annual interest rate +equity/capital*(T-bill rate+ industry Beta*implied market risk premium)[29]

The strong performance of defense firms can also be seen by comparing ROIC to WACC. Here we plot the simple ROIC for the top defense contractors:

$$ROIC = EBIT\ (1 - Tax\ Rate)/Prior\ Year\ End\ Capital$$

We compare this quantity against the firm's 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. The benefit of this analysis is that it presents a relatively unbiased and consistent measure of absolute performance. Return on assets (ROA) or return on equity (ROE) is difficult to use to evaluate performance without a benchmark. This is not to say that industry management cannot use other measures to drive better performance.

For our purposes, however, EVA shows that the industry profits are sufficiently compensating owners for their capital at risk. Economists would term positive shareholder value (EVA > 0) as economic rent. This analysis does not say the industry profits are excessive, although it does indicate that defense contracts are sufficiently profitable. We believe, given the high concentration of defense business for this group of companies, that if the profit policy did not adequately compensate contractors, firms would not yield positive shareholder value. We cannot readily discern from this analysis if the main value driver is the margin, contract financing, or the overall acquisition strategy whereby the government provides so much of the product investment and R&D.

E. SYNTHESIS OF FINDINGS AND IMPLICATIONS

Presentation Plan

- Does practice follow policy?
  - What is the profit policy and its levers?
  - Analysis of profit targets
  - Analysis of *actuals*
- Does policy influence contract performance?
  - Contractor behavior
  - Contract outcomes
- Does policy provide adequate contractor profit?
  - Defense contracting business model
  - Integrating the policy levers with cash flow modeling
  - Industry analysis
- Synthesis of findings and implications

Synthesis of Findings

- How policy is applied:
  - FFP-CPFF target spread agrees with policy
  - Target profits agree with policy norms
  - Evidence permits hypothesis that margin levers are not always used independently
- Policy effect on contract performance:
  - Policy has demonstrated ability to change contractor behavior
  - No performance differences observed across contract type
- Policy effect on industry financial results:
  - Defense firms sufficiently reward investor risk—due in part to the policy
  - Contract financing is critical to offsetting low margins

31

We explored profit policy from three different perspectives: how the policy is applied; its effect on contract performance; and its effect on industry financial performance.

In spite of claims by contractors that contracting officers use the policy to justify pre-conceived bottom-line targets, we found no conclusive evidence of this behavior. We found from the DD Form 1547 data that profit targets follow the policy. Though targets for individual risk factors, and in total, appeared to be set above policy (see slide 9, page 18), when studied at finer detail, they are seen to more closely conform to the DFARS. We found that the spread between cost-plus and fixed-price contracts was higher than policy, but this difference is explainable by analyzing the sample at finer detail.

Three findings indicate that the FFP profit rates are sufficient: they have been stable for the past 20 years; more than half of the Defense Department's contract expenses are FFP contracts; and the defense industrial base appears to yield returns greater than its cost of capital. From our cash flow analysis of the profit policy, we believe cost-plus profit rates may be higher than they need to be from a risk-reward basis. We found some evidence that the profit levers are not used independently. This was not necessarily inconsistent with the policy, but it suggests the battery of levers overlaps. It is possible the policy goals could be affected with fewer levers. Such a dramatic change to the policy should be studied more since it would require a major revision of the regulation.

We found evidence that profit policy has modified contractor behavior in the past. The historical changes in the capital labor ratio for aircraft production have been correlated to the facilities capital markup policy. Contractor financial reports provide some evidence that capital spending (Figure 1) has declined dramatically. Two reinforcing factors could be at work: a direct scale-down in response to lower DoD demand, and lower spending in expectation of the facilities capital markup rule change.

We found through selected case study analysis that incentive and award contracts appear to provide an incentive toward less cost growth. This finding is consistent with several other prior studies.[23] However, our analysis of earned value data revealed little cost performance difference between contract types. This result indicates changing contract types may not improve contract performance; however, the earned value data analysis should be expanded to look at other potential drivers. One issue could be the low fraction of contracts that uses incentive fees relative to fixed-price and cost-plus contracts. We believe there are compelling reasons to look to incentive fees for better contract outcomes, but we cannot deny the long-term trend away from their usage.

Finally, we found that financially, the defense industrial base has performed very well for most of the past 20 years. We used Lockheed, Raytheon, Northrop Grumman, and General Dynamics as a proxy for the defense industrial base since they derive so much of their revenue from U.S. government contracting. There is an implicit agreement between the industrial base and the government that the beneficial trade-off against low margins is generous product and working capital financing. We also saw the effect of financing on profit with our valuation model where 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. This type of modeling is an essential component of understanding any proposed or current policy.

---

[23] Irving N. Fisher, "A Reappraisal of Incentive Contracting Experience," RAND Corporation, Memorandum RM-5700-PR, July 1968; John R. Hiller and Robert D. Tollison, "Incentive Versus Cost-Plus Contracts in Defense Procurement," *Journal of Industrial Economics*, Vol. 26, No. 3, March 1978, pp. 239–248; and Jack Cloos, Dennis D. Kimko, and Thomas P. Frazier, "Cost Sharing Arrangements on Incentive Contracts," briefing, December 12, 2001.

We found some evidence that contractors are receiving generous advance billings that we believe are a result of the trend toward performance-based payments. Given the government's comparative advantage with its low cost of capital, we believe the government ultimately benefits by paying up front with less total fee. More analysis is needed to determine whether the trade-off between profit margin and contract finance policy could be optimized toward better contractor performance.

Implications

- Present policy appears to be a network of overlapping levers
- Policy changes should be stress-tested with rigorous cash flow and risk analysis
- Trends vs. cycles:
  - Strong cash generation/accumulation as cycle peaks (cyclic)
  - Shift from product acquisition to development (trend)
  - Diversified industrial base—less risk on one contract (trend)
- Industrial base is doing well at cycle peak, but:
  - Industry sensitivity to profit levers influenced by emerging trends
  - Asset intensive industry still sensitive to revenue volatility

Good time to strengthen link between outcome and reward—but mind the trends and cycles

32

We see from our factor analysis that the profit policy appears to have overlapping levers—though the analysis of DD Form 1547 data shows that contracts generally follow the policy.

Overlapping levers imply, on a practical level, that the guidelines could be simplified. A separate cost-benefit analysis should be performed to compare the cost of developing a new set of policy guidelines to the uncertain benefit of a simplified policy. Since it appears the policy levers are mostly used independently, having extra levers might offer flexibility when it is needed; however, contractors generally believe the guidelines are used after contracts and target profits have been negotiated.

We believe FFP contracts provide sufficient risk-reward benefits for two reasons: on average the profit policy provides the industry with profits that exceed their cost of capital; and about 60 percent of defense acquisitions use fixed-price contracts. We suspect that if there is any slack in the risk-reward continuum it is at the CPFF end. This is reinforced by the profit model discussed on slide 23 (page 41). Since cost-plus contracts are fully reimbursed, we find they can yield positive NPV even with target margins well below the 7-percent average in the DD Form 1547 database. Without further study we cannot infer margins should simply be changed; at this point we would prefer to explore a mix of changes to the margin and financing polices. For example, would the application of performance-based payments to cost-reimbursed contracts provide a more tolerable incentive to contractors than trying to force incentive fees or FFP contracts on development programs?

We propose that changes to the policy incorporate ease of implementation. We also propose that the set of policy levers be tested using discounted cash flow. Our analysis indicates a simpler policy may be at least as effective as the present one. A simpler policy might allow contracts to better reflect the distribution of risks. We do not believe the government should model the cash flow of each contract; however, a cash flow valuation model can allow policy makers to better understand the relative effects of the profit levers.

The government is in a good position to investigate adjustments to the profit and financing policies that may drive better performance for three reasons. First, the defense industrial base is financially healthy. Second, our cash flow analysis shows that the profit system delivers strong cash flow value to the industrial base shareholders. Third, the industry emerged from the post-cold war consolidation wave far more concentrated (fewer companies) with greater product diversification. Product diversity in this case provides financial diversification. 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.

APPENDIX: TARGET FACTOR CORRELATIONS

Table A-1 provides our expectations for pairwise correlations in the target factors, (as discussed in slide 12, subsection B.4).

Table A-1. Estimated Directional Pairwise Correlations

	Technical	Management	Contract	Working Capital	Equipment	Efficiency	FCOM
Technical	100	+	+/–	0/–	0	0	0
Management		100	0/+	0	0	+	0
Contract			100	0	0	0	0
Working Capital				100	0/+	0	+
Equipment					100	0	+
Efficiency						100	0
FCOM							100

The reasons behind these expectations are as follows:

- Technical-Management: We might expect a positive correlation since projects with high technical risk will need a high level of management control for successful execution.
- Contract-Technical: In general we would expect that technical risk might drive contract risk for a given contract type; however, through the second order contract effect we expect some negative correlation. We saw that fixed-price contracts have higher contract risk and lower technical risk profit targets than cost-plus contracts (see slide 9 in section B). High technical risk contracts are usually cost-plus while low technical risk contracts are usually fixed-price; the latter type contract has higher contract risk than the former.
- Contract-Management: We would expect these risk factors to have common drivers—though contract risk is more related to cost risk in fixed-price contracts while management control of performance risk appears to be more related to meeting high-reach requirements on cost-plus developmental contracts.
- Working Capital-Technical: We do not expect correlation other than the contract effect. The guideline is no working capital profit for cost-plus contracts—where technical risk is higher.
- Working Capital-Management: We do not expect correlation.

- Working Capital-Contract: Based on the guidelines and the contract effect, we expect some positive correlation.
- Equipment-Working Capital: We do not expect correlation other than the contract effect—working capital profit is paid mostly on fixed-price contracts with more emphasis on production where higher fixed assets are common.
- Equipment-Technical: We do not expect correlation other than from the contract effect.
- Equipment-Management: We do not expect correlation.
- Equipment-Contract: We do not expect correlation.
- Efficiency-Working Capital: We do not expect correlation.
- Efficiency-Technical: We do not expect correlation.
- Efficiency-Management: We expect some positive correlation since the skills needed to manage performance risk should contribute to cost efficiencies.
- Efficiency-Contract: We expect some positive correlation since the factors that drive contract risk should drive the need to achieve cost efficiencies.
- Efficiency-Equipment: We expect some positive correlation since capital assets can be used to gain efficiencies.
- FCOM-Technical: We do not expect correlation.
- FCOM-Management: We do not expect correlation.
- FCOM-Contract: We do not expect correlation.
- FCOM-Working Capital: We expect positive correlation since both levers use the Treasury rate in their calculation.
- FCOM-Equipment: We expect positive correlation since both levers use the net book value of assets in their calculation.
- FCOM-Efficiency: We expect some positive correlation since capital assets can be used to gain efficiencies.

Does the estimated correlation matrix agree with expectations? See Table A-2.

Table A-2. Estimated Directional Pairwise Correlations versus Expectation

	Technical	Management	Contract	Working Capital	Equipment	Efficiency	FCOM
Technical	100	Yes	Yes	Yes	No	No*	No*
Management		100	No*	No*	No	No	No*
Contract			100	Yes	No*	No*	No*
Working Capital				100	Yes	No*	No
Equipment					100	Yes	Yes
Efficiency						100	Yes
FCOM							100

* Despite our expectation, small correlations exist for these pairs.

For the most part, the correlation matrix agrees with our expectation (i.e., cells in the above table with "Yes"). For cells that contain a "No" with an asterisk, we did not expect but found small ($|\rho| \leq 0.1$) correlations.[1] We cannot easily explain why these correlations are observed, but we do not see them signifying any material systemic behavior.

We identify the cases that merit discussion with a simple "No." We did not expect but found enough correlation ($|\rho| \geq 0.1$) to merit concern with equipment with technical, equipment with management, management with efficiency, and working capital with FCOM.

For management performance risk and efficiency, while the sign is as expected, we were surprised there is not a stronger correlation since efficiencies should only be possible through management control. We suspect the lack of contracts with any efficiency factor profit target could play into the unexpected small correlations between it and the other levers.

We expected a stronger positive correlation between working capital with FCOM since they are both dependent on the Treasury rate. While the sign of the weak correlation is as expected, we would expect the common factor for imputed profit targets to have a stronger effect. However, we do not see a conflict since the correlation between working capital and equipment is consistent in sign with the correlation between working capital and FCOM.

Finally, the contract effect may explain the case of equipment and management and technical performance risk where we expected no correlation but estimated a negative coefficient. The equipment factor would most likely be important in production contracts requiring high fixed asset levels, while the performance risk factors appear to be more dominant in cost-plus contracts.

While there appear to be several cases of unexpected correlation, pairwise analysis of these coefficients does not yield any strong indication of offsetting. Furthermore, the unexpected, but small, positive correlations weigh against significant systemic offsetting. Anecdotally, contractors claimed that this practice is common by contracting officers and yet we find no strong evidence that this is true from the data. We suspect that most of the correlations coefficients, while statistically significant, are not materially significant and can be ignored.

---

1 $\rho|$ represents the absolute value of the correlation between two factors.

We see as well from the correlation estimates that the large correlations are mostly consistent with the policy (e.g., equipment with FCOM). We also see there does not appear to be substantial overlapping or conflicting use of the levers.

ABBREVIATIONS

AIA	Aerospace Industry Association
AMP	Avionics Modernization Program
CAPEX	capital expense
CAPM	capital asset pricing model
CCDR	Contractor Cost Data Report
CP	cost plus
CPAF	cost-plus award fee
CPFF	cost-plus fixed fee
CPI	cost performance index
CPIF	cost-plus incentive fee
CSFB	Credit Suisse First Boston
CSIS	Center for Strategic and International Studies
IDA	Institute for Defense Analyses
IDFAIR	Defense Financial and Investment Review
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
DSB	Defense Science Board
EAC	estimate at completion
EBIT	earnings before interest and tax
EPA	economic pricing adjustment
EPS	earnings per share
EVA	economic value added
FAR	Federal Acquisition Regulation
FCFF	free cash flow to the firm
FCM	facilities capital markup
FCOM	facilities cost of money
FFP	firm fixed price

FPDS	Federal Procurement Data System
FPI	fixed price incentive
FPIF	fixed price incentive (firm target)
G&A	General and Administrative
GAO	Government Accountability Office
GWOT	Global war on terror
HW	hardware
IDA	Institute for Defense Analyses
IRS	Internal Revenue Service
IT	information technology
JSF	Joint Strike Fighter
K/L	capital/labor ratio
LBO	leveraged buy-out
LRIP	low-rate initial production
MDAP	major defense acquisition program
MYP	multi-year procurement
NPV	net present value
P/E	price/earnings
ppt	percentage point
PV	present value
R&D	research and development
ROA	return on assets
ROE	return on equity
ROIC	return on invested capital
ROS	return on sales
S&P	Standard and Poor’s
SCI	Composite Performance Index
SDD	system development and demonstration
SPI	Schedule Performance Index
SW	software
WACC	weighted average cost of capital

REFERENCES

Assad, Shay (Director, Defense Procurement, Acquisition Policy and Strategic Sourcing), memorandum to the Service Secretaries and Defense Agency Directors, April 24, 2007

Cloos, Jack, Dennis D. Kimko, and Thomas P. Frazier, "Cost Sharing Arrangements on Incentive Contracts," briefing, December 12, 2001

Fisher, Irving N., "A Reappraisal of Incentive Contracting Experience," RAND Corporation, Memorandum RM-5700-PR, July 1968

Frazier, Thomas P., Matthew S. Goldberg and Thomas R. Gulledge, Jr., "DoD Profit Policy and Capital Investment in the Military Aircraft Industry," IDA Paper P-2359, March 1990

Frazier, Thomas P., Matthew S. Goldberg, and Thomas R. Gulledge, Jr., "Department of Defense Profit Policy and Capital Investment in the Military Aircraft Industry," *The Review of Economics and Statistics*, Vol. 74, No. 3, August 1992, pp. 394–403

GAO, "Incentive Contracts, Examination of Fixed-Price Incentive Contracts," NSIAD-88-36BR, November, 1987

GAO, "Defense Acquisition: DoD has Paid Billions in Award and Incentive Fees Regardless of Outcomes," GAO-06-06, December, 2005

Hiller, John R., and Robert D. Tollison, "Incentive Versus Cost-Plus Contracts in Defense Procurement," *Journal of Industrial Economics*, Vol. 26, No. 3, March 1978, pp. 239–248

Laurence, Michael T., "1984 Defense Financial and Investment Review (DFAIR): Survey of Defense Procurement Personnel Results and Findings," Defense Manpower Data Center, December 1984

Rogerson, William P., "An Economic Framework for Analyzing DoD Profit Policy," RAND Corporation, R-3860-PA&E, 1992

Thurman, John L., "National Security Space Industrial Base Study," presented at the 39th DoD Cost Analysis Symposium, February 15, 2006

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*
xx-02-2009

2. REPORT TYPE
Final

3. DATES COVERED *(From - To)*
Dec 2007-Feb 2009

4. TITLE AND SUBTITLE
Defense Department Profit and Contract Finance Policies and Their Effects on Contract and Contractor Performance

5a. CONTRACT NUMBER
DASW01-04-C-0003

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S), Last Names First
Arnold, Scot A.
Harmon, Bruce R.
Tyson, Karen W.
Fasana, Kenton G.
Wait, Christopher S.

5d. PROJECT NUMBER

5e. TASK NUMBER
AH-7-2774

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Institute for Defense Analyses
4850 Mark Center Drive
Alexandria, VA 22311-1882

8. PERFORMING ORGANIZATION REPORT NUMBER
P-4284 (Revised)

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Deputy Under Secretary of Defense (Industrial Policy)
241 18th Street
Crystal Square 4, Suite 501
Arlington, VA 22202

10. SPONSOR/MONITOR'S ACRONYM(S)
DUSD(IP)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The Defense Department, through the military services, buys equipment and services for which no open market exists. In negotiating the contracts for these acquisitions, the government has policy guidelines to aid the contracting officer in developing a reasonable amount of profit to pay the contractor. The goal of profit policy is a contract price that reimburses the contractor for its costs, provides the necessary incentives to yield beneficial performance, and to provide the contractor with sufficient risk reward. The effect of profit policy on contractor profits is inextricably linked to the type of contract financing policy the government uses in an acquisition. We look at the effectiveness of the two policy tools, profit and contract financing, on achieving contract outcomes and contractor financial performance. We also look at how the policies are implemented by the Defense Department. Our methodologies include analyses of profit target setting and actual contract results data in addition to using discounted cash flow modeling to value a contract or contract stream to an investor.

15. SUBJECT TERMS
Profit Policy; Department of Defense; Defense Industry; Defense Contractors; Contract Incentives; Profits; Contractor Costs; Contractor Performance; Contract Finance Policy

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON (Last Name First)
Unclassified	Unclassified	Unclassified	Same as Report	78	Vehmeier, Dawn
					19b. TELEPONE NUMBER (*Include area code*) 703-602-4322

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI-Std Z39-18