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**Reform of Budgeting for Acquisition: Lessons from Private
Sector Capital Budgeting for the Department of Defense**

30 September 2006

by

Jerry L. McCaffery, Professor, Naval Postgraduate School

Lawrence R. Jones, Professor, Naval Postgraduate School

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Current trends in federal budgeting move us to conclude that the argument for implementing capital budgeting in the federal government should be revisited. It is clear that significant changes would have to occur in the present system if private sector capital budgeting methods were adopted by the DoD and other agencies of the federal government. However, there are examples of public organizations that have made this leap. The governments of New Zealand, Australia and the United Kingdom, as well as most of the states in the US, have adopted some private budgeting methods with varying degrees of success. This report explores how capital budgeting is practiced in the private sector, in other governments and how some of this could be applied in the federal government and Department of Defense. The report also provides a brief critique of DOD acquisition budgeting.

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Abstract

Current trends in federal budgeting move us to conclude that the argument for implementing capital budgeting in the federal government should be revisited. It is clear that significant changes would have to occur in the present system if private sector capital budgeting methods were adopted by the DoD and other agencies of the federal government. However, there are examples of public organizations that have made this leap. The governments of New Zealand, Australia and the United Kingdom, as well as most of the states in the US, have adopted some private budgeting methods with varying degrees of success. This report explores how capital budgeting is practiced in the private sector, in other governments and how some of this could be applied in the federal government and Department of Defense. The report also provides a brief critique of DOD acquisition budgeting.

Keywords: budgeting, federal government budgeting, capital budgeting, acquisition budgeting, budget reform, federal budget reform, private sector capital budgeting

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Disclaimer: The views represented in this report are those of the author and do not reflect the official policy position of the Navy, the Department of Defense, or the Federal Government.

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Executive Summary

It has been argued that the U.S. federal government and other public agencies should adopt “corporate” methods of budgeting to include the use of separate capital and operating budgets that are prevalent in the private sector. In the past, this argument has not made much progress, but the current trends move us to consider that this argument should be revisited. It is clear that significant changes would have to occur in the present system if private budgeting methods were adopted by the DoD and other federal agencies, but there are examples of public organizations that have made this leap, as the governments of New Zealand, Australia and the United Kingdom, as well as most of the states in the US, have adopted some private budgeting methods with varying degrees of success. This report explores how capital budgeting is practiced in the private sector and in other governments, and how some of this experience could be applied in the federal government and Department of Defense. The report also provides a brief critique of DOD acquisition budgeting.

Keywords: budgeting, federal government budgeting, capital budgeting, acquisition budgeting, budget reform, federal budget reform, private sector capital budgeting

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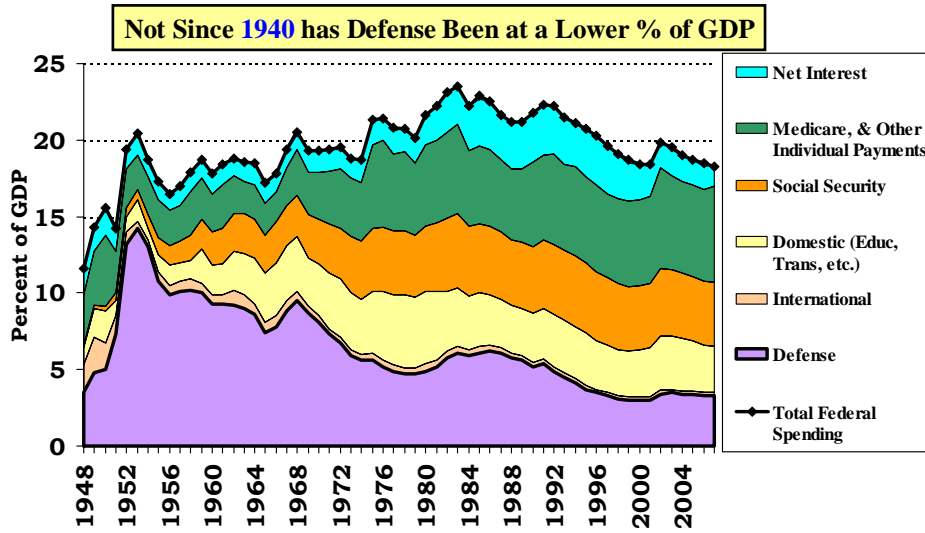
Introduction

The ongoing replacement of Department of Defense (DoD) capital assets, as well as other much needed capital investments, will likely take place during a time of decreasing, or at least slowly growing financial resources over the long term. Some of this is due to the growth of entitlements, some to the size of the predicted deficit. Still another pressure is the long-term cost of military activity in Afghanistan and Iraq, predicted by CBO to be \$450 billion over the next ten years. In addition, the Department of Defense is in the midst of an era of “transformation” under Secretary of Defense (SECDEF) Donald Rumsfeld that calls for the modernization of DoD warfighting doctrine, capital goods and business systems. The budgeting system has already been modified during Rumsfeld’s tenure (McCaffery & Jones, 2004, p. 403-435). Occasionally, it has been argued that the federal government and other public agencies should adopt “corporate” methods of budgeting to include the use of separate capital and operating budgets that are prevalent in the private sector. In the past, this argument has not made much progress, but the current trends enumerated above move us to consider that this argument should be revisited. It is clear that significant changes would have to occur in the present system if private budgeting methods were adopted by the DoD and other public organizations, but there are examples of public organizations that have made this leap, as the governments of New Zealand and Australia, as well as most of the states in the US have at least adopted some private budgeting methods with varying degrees of success.

History Indicates Change Necessary

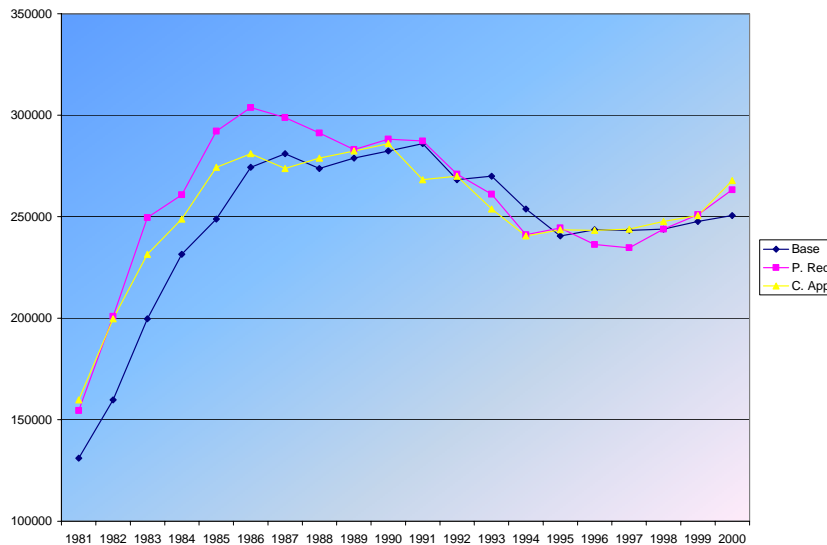
From a historical dimension, Defense appears to be a declining share of the federal budget, set amongst a set of steadily growing accounts. From a historical perspective, DoD spending looks like it follows relatively smooth, if declining, path.

Figure 1. Federal Spending as a % of GDP

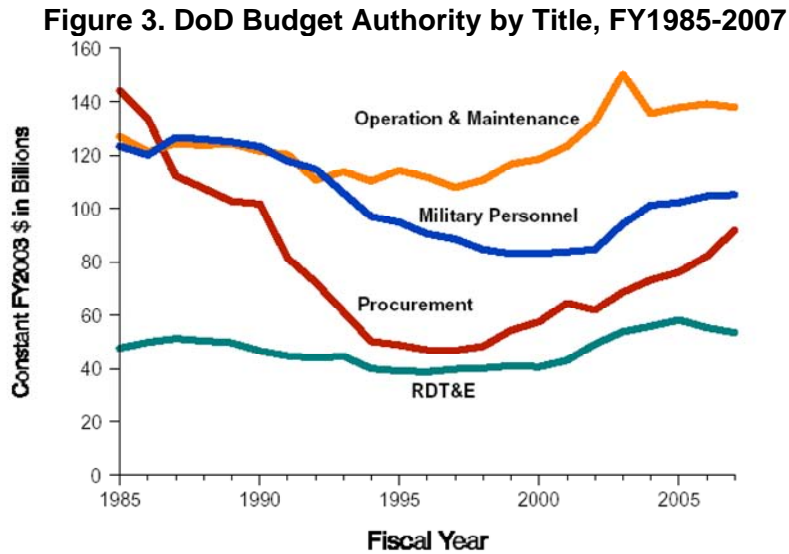


Over the last 20 years, the Defense line again looks relatively smooth, although some turbulence appears. The Reagan buildup is apparent, as is some difference in support for Defense between the President and Congress.

Figure 2. Defense Budget, 1981-2000

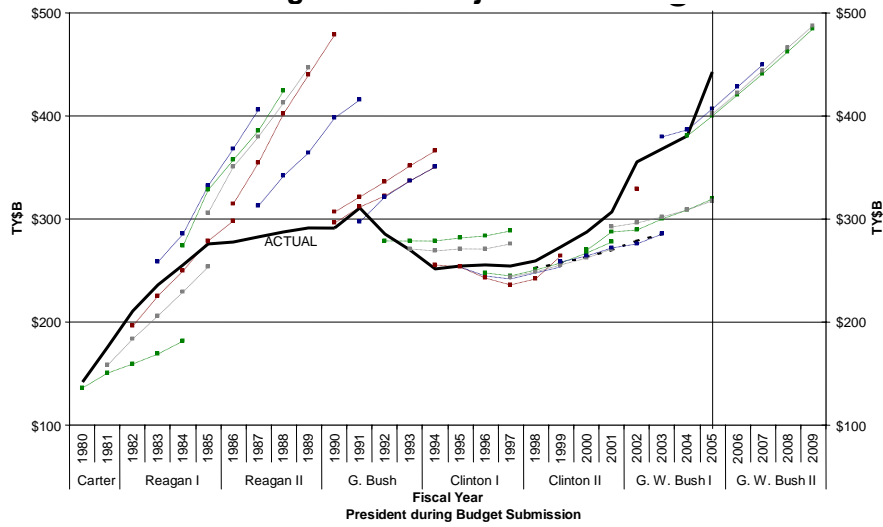


A study of accounts within the DoD indicates that this picture is not as smooth as it seems. The peace dividend at the end of the Cold War is apparent. It is also clear that the procurement account is the most volatile.



When the Future Year Defense Plan (FYDP) is overlaid on the DoD budget, it is clear that the future rarely unrolls as expected. Over twenty years, only the 1982 FYDP unrolled about as expected. Reality moved away from the other years as often as the second year of the FYDP. This gives rise to the adage, “Everyone gets well in the outyears... But the outyears never arrive.”

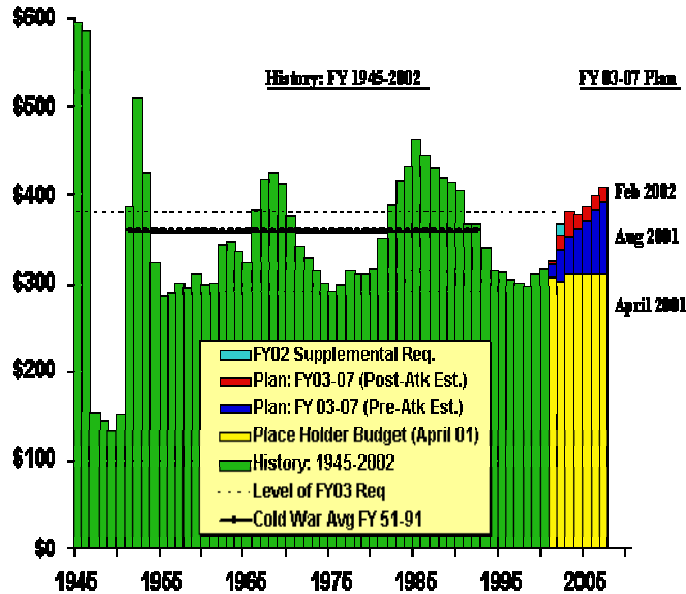
Figure 4. President's Budget FYDP Projections vs. Actual Defense Budget



This picture of volatility and unpredictability has long historical roots.

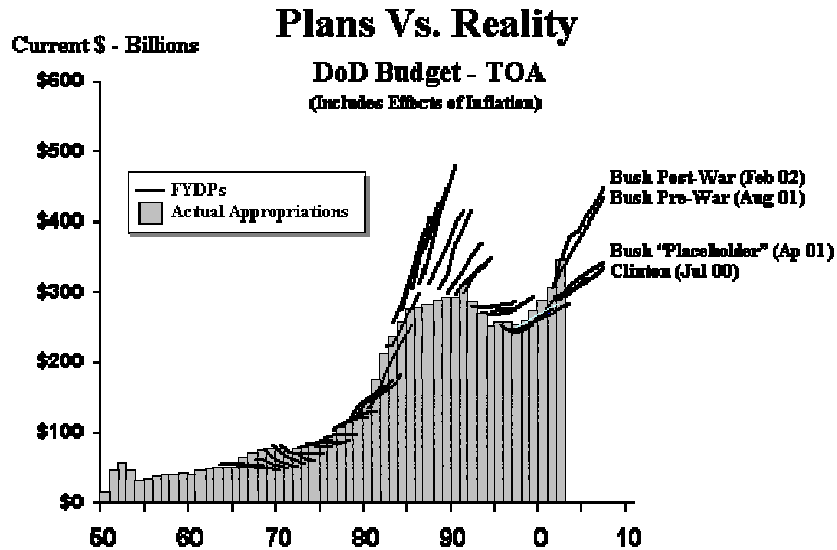
Figure 5. Evolution of the FY2003-2007 Plan in a Historical Perspective

DoD Budget Authority (FY2003 Const \$ - Billions)



In fact, the disagreement between the FYDP and reality may be traced back to the 1960's.

Figure 6. DoD Budget - TOA



It is not unexpected then, that as plans change, so do budgets; this includes budgets for the procurement accounts and weapons system acquisition patterns. For example, the Raptor program shows increasing expense and decreasing numbers over its 20-year lifecycle.

Figure 7. The Raptor Program

The current DoD resource allocation system is PPBE, a system that includes capital and operational budgeting through the DAS-JCIDS-PPBE process.

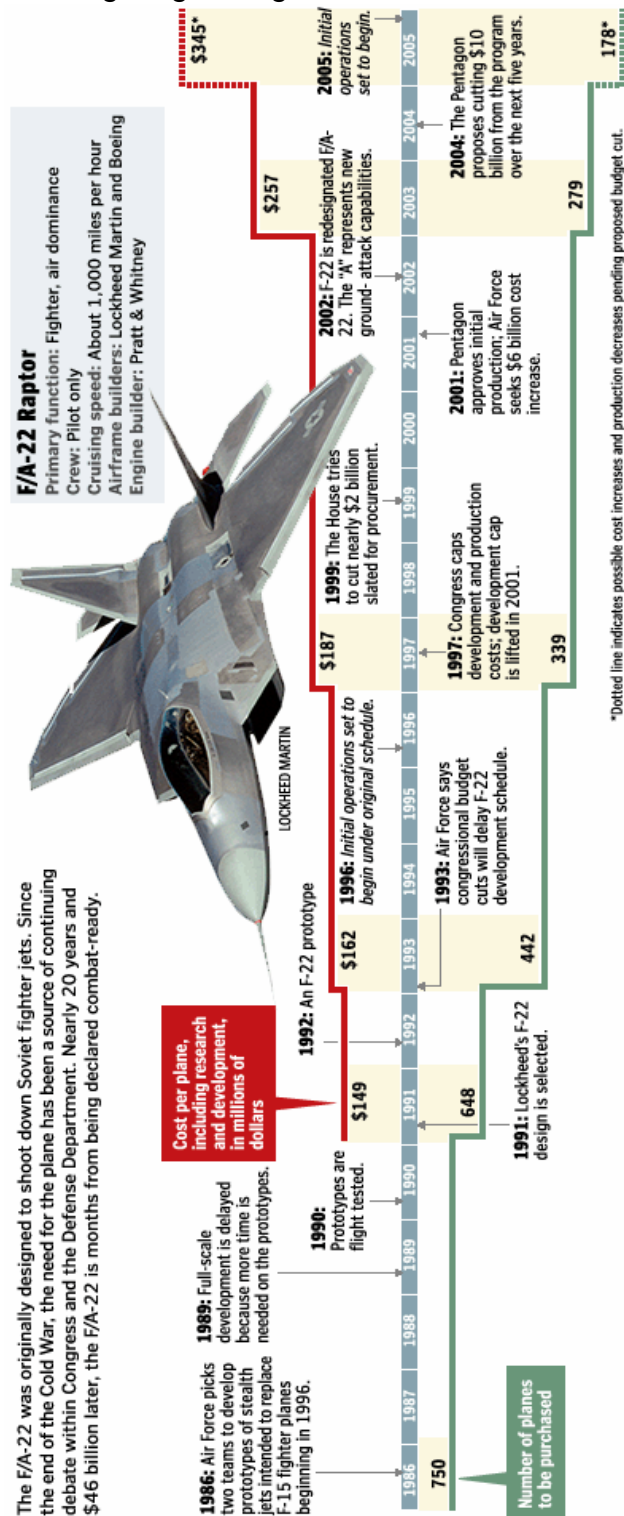
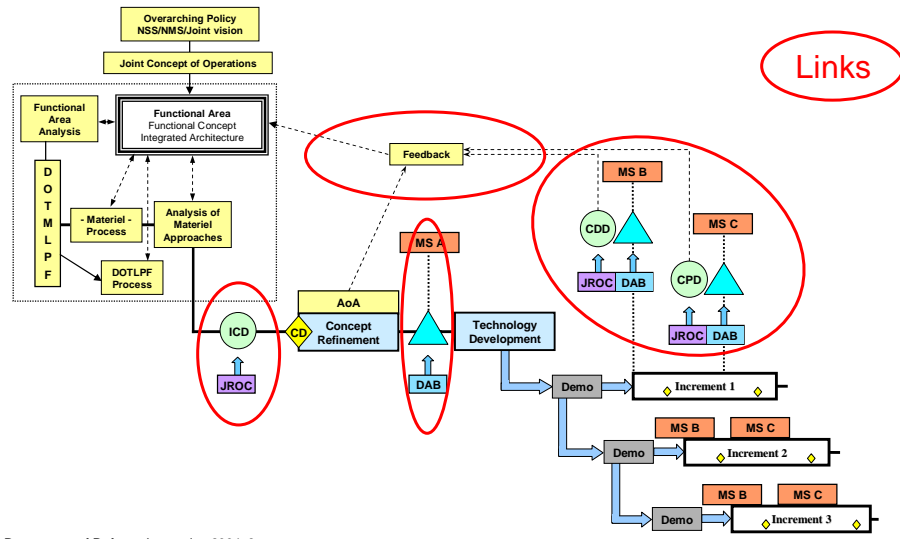


Figure 8. The Budget Processes

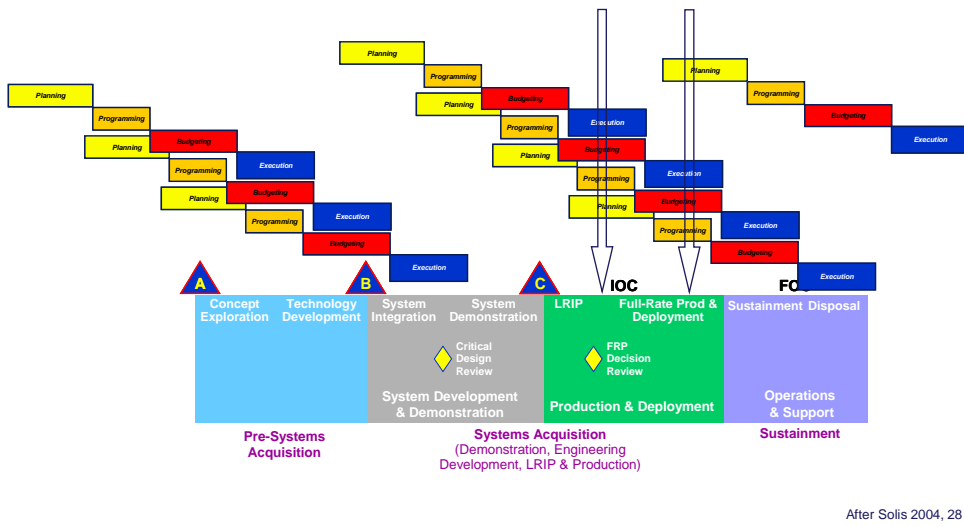
Links: JCIDS ↔ DAS



From Department of Defense Instruction 2004, 3

Figure 9. The Budget Processes (Continued)

Links: PPBE ↔ DAS

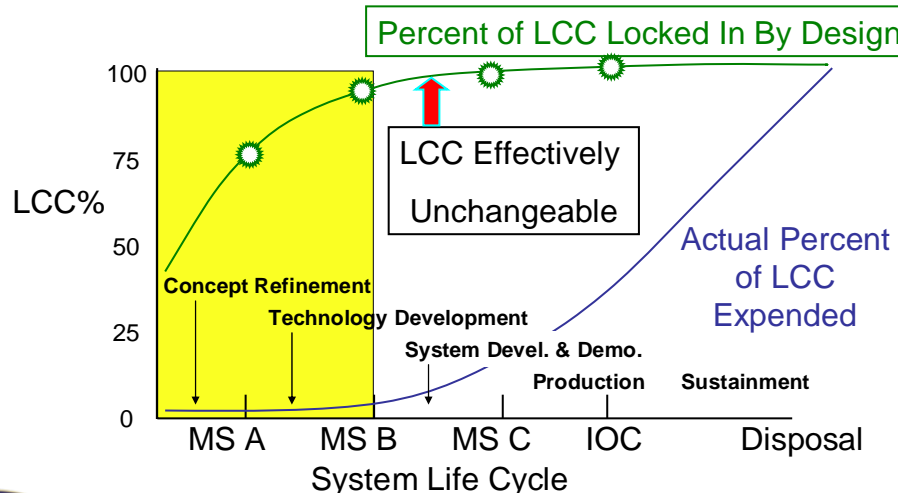


After Solis 2004, 28

However, the story that these diagrams tell is that most of the lifecycle cost of weapons systems is locked in before they enter the budget system. The rest of the story is the reciprocal adjustment of program-to-budget as annual budgets encounter

the volatility of reality, as may be seen in the Raptor example. Moreover, often procurement accounts are “robbed” to fund operating missions.

Figure 10. Early Decisions Set the Course for Total Ownership Costs (Boudreau, 2005)



We suggest that perhaps it would be wise to separate capital and operating budgets for the DoD. The current system is operable, but its overhead and administrative costs are high, top-level people have to pay constant attention to it, and weapons systems are always in danger of being delivered late or over-budget and under requirements. In fact, DoD has already recognized this and begun the movement.

QDR Recommends Capital Budget

The 2006 Quadrennial Defense Review has recommended that DoD establish a capital account for major acquisition programs. This recommendation mirrors the outcome of the Defense Acquisition Performance Assessment study directed by Deputy Secretary of Defense Gordon England. In its findings in December, 2005, this study recommended:

The Secretary of Defense should establish a separate Acquisition Stabilization account to mitigate the tendency to stretch programs due to shortfalls in the Department of Defense non-acquisition accounts that ultimately increases the total cost of programs. This will substantially reduce the incidence of “breaking” programs

to solve budget year shortfalls and significantly enhance program funding stability. (Defense Acquisition Performance Assessment, 2005, p. 10).

In effect, the panel recognized that acquisition account leaders could not protect the acquisition accounts from acting as a bank for the operating accounts during budget execution—thus the recommendation that DoD’s procurement, research and development budget be separated from the overall defense budget. This separation:

would help prevent the kind of financial whiplash that causes cost overruns, said retired Air Force Lt. Gen. Ronald Kadish, panel director and a vice president at Booz Allen Hamilton, a government consulting firm in Fairfax, Va. The panel found that every dollar taken from a program induces \$4 of cost increases in later years... Though many in Washington blame the uncertainty on Congress, Kadish said most of the damage was self-inflicted by the Pentagon. (Ratnam, 2005).

In its work comparing best practices in industry and DoD acquisition programs, the GAO sent out surveys to 185 Category I and II DoD programs managers in April, 2005 (GAO, 2005, November—The response rate was 69%. See page 19-20 for a discussion of methodology.). Their responses illustrate some of this turbulence. Results from this study indicate that the problem is not only the non-acquisition accounts robbing the acquisition accounts, but also that the DoD has flaws in what could be called its capital budget process: it starts too many programs and fails to prioritize programs in process so that resources may be shifted to the most appropriate program when necessary in a distressed fiscal environment (e.g., when costs of raw materials or labor rise). The GAO says:

The primary problem, according to many program managers and verified by GAO’s work, is that DoD starts more programs than it can afford and does not prioritize programs for funding. This creates an environment where programs must continually compete for funding. Before programs are even started, advocates are incentivized to underestimate both cost and schedule and overpromise capability. (GAO, 2005, November, pp. 8-9)

Program manager comments tend to blame OSD for part of the problem, as well as funding instability.

Figure 11. Highlights of Program Manager Comments Regarding Competition for Funding (GAO, 2005, November, p. 40)

- OSD staff has reduced funding without any understanding or appreciation for program impacts. It appears that the staff makes arbitrary cuts.
- OSD has a very near-term execution year focus, resulting in great instability. In reality, it should provide much more strategic vectors for the Department instead of short-term adjustments to fix more tactical-level funding needs.
- My experience is that the [service] and OSD typically cut programs to pay top down bills.
- There is no such thing as funding stability in DOD. Funding reductions and program stretchouts are the norm due to top down fiscal bills that occur during the execution year. The Pentagon must pay the bills, therefore it takes funds from the programs, thereby contributing to program stretchout, cost increases, inefficiencies, etc.
- Unstable funding results in pressure to do aggressive things in order to minimize the impact of budget cuts on schedule and performance. I believe this has been a major factor in recent...program execution problems.
- Our product is considered a support function. When funding gets tight, we have been considered a bill payer for others, even if it has "broken" our program.

Source: GAO survey.

As Figure 11 intimates, program managers believed that they were operating in an environment where there was unfair competition for funding (GAO, 2005, November, p. 40). The results were all too predictable. The next two figures indicate some of the dimensions of the problem. First, in Figure 12, most program managers believed that the parameters of their program were reasonable at the start, with about 24% falling in the some (18%) or little or no (6%) categories.

Figure 12. To What Extent Were the Parameters of Your Program Reasonable at Program Start? (GAO, 2005, November, p. 43)

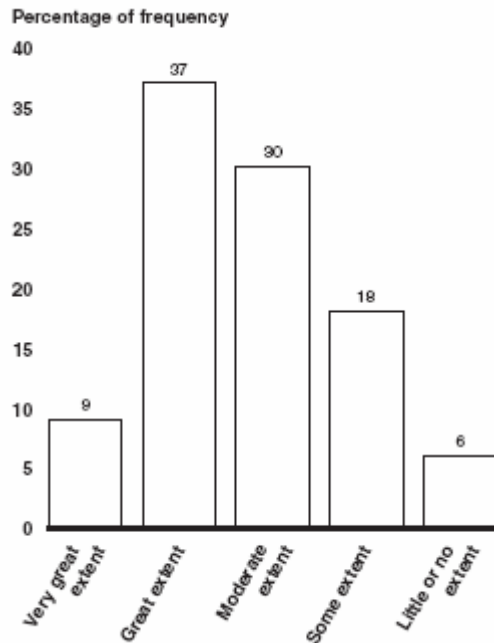
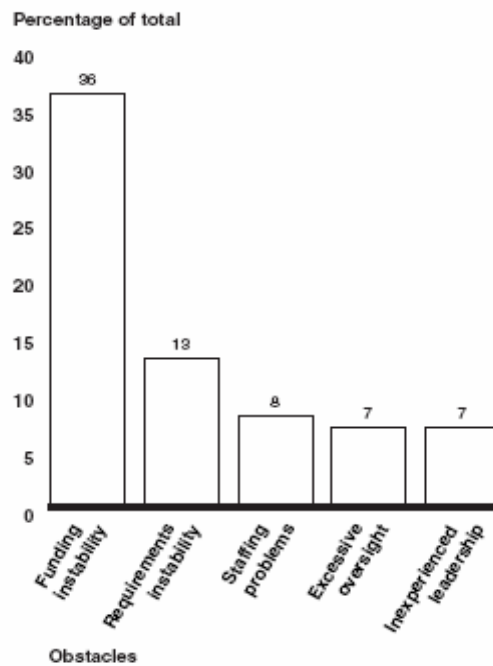


Figure 13. How Program Managers Responded to an Open-ended Question on What Were the Biggest Obstacles They Faced (GAO, 2005, November, p. 44)



Source: GAO survey.

In response to an open-ended question on biggest obstacles, 36% of the managers responded that funding instability was the biggest obstacle, almost three times the number who mentioned requirements instability, the next category. What these evidences seem to hint is that much of the cause of acquisition turbulence lies in the funding mechanism.

In Secretary England's confirmation hearings, both the Senate and House Armed Services Committees expressed an interest in improving acquisition practices, an interest that was specified in the reports on the DoD authorization bill. For example, the Senate report accompanying S1042, the Senate version of the Defense Authorization bill, notes that after nearly twenty years of reform since the Packard Commission Report and Goldwater-Nichols, "major weapons systems still cost too much and take too long to field." The committee added, "Funding and requirements instability continue to drive up costs and delay the eventual fielding of new systems. Constant changes in funding and requirements lead to continuous changes in acquisition approaches" (Senate Report, 2005, May 17, p. 345—see also House Conference Report, 2005, May 20, pp. 354-356).

The end of this thread lies in the recommendations and findings made in the *QDR* in language that went beyond the establishment of a capital account, to include a capital budgeting process:

Fourth, to manage the budget allocation process with accountability, an acquisition reform study initiated by the Deputy Secretary of Defense recommended the Department work with the Congress to establish "Capital Accounts" for Major Acquisition Programs. The purpose of capital budgeting is to provide stability in the budgeting system and to establish accountability for acquisition programs throughout the hierarchy of program responsibility from the program manager, through the Service Acquisition Executive, the Secretaries of the Military Departments and the Office of the Secretary of Defense. Together, these improvements should enable senior leaders to implement a risk-informed investment strategy reflecting joint warfighting priorities. (Quadrennial Defense Review, 2006, February, pp. 67-68)

This process would be supported by a procedure that would rest on joint collaboration among the warfighter, acquisition and resource communities, with the warfighters assessing needs and time-frame and the acquisition community contributing technological judgments on technological feasibility and “cost-per-increment” of capability improvement. The budget community’s contribution would be an assessment of affordability. These inputs would be provided early in the process, before significant amounts of resources are committed. The QDR also recommended that the DoD, “begin to break out its budget according to joint capability areas. Using such a joint capability view—in place of a Military Department or traditional budget category display—should improve the Department’s understanding of the balancing of strategic risks and required capability trade-offs associated with particular decisions” (Quadrennial Defense Review, 2006, February, pp. 67-68). The DoD promised to explore this approach later with Congress. History indicates that Congress clings tenaciously to the appropriation structure currently in place because it serves Congress’s purposes, but it is good to remember that all that is now familiar was once new.

In the figure below from the GAO work on Best Practices (2005, p. 59), program managers reported on what types of authority they thought they needed. The implications are clear: program managers believe they need more authority to execute their programs and efficiently allocate the resources they have been given, without undue and unnecessary oversight, without needlessly complicated reporting requirements. The GAO found that program managers expressed frustration with the time required of them to answer queries of oversight officials, “many of which did not add value. Some program managers, in fact, estimated that they spent more than 50 percent of their time producing and tailoring and explaining status information to others”(GAO, 2005, November, p. 46). The GAO also noted, “program managers commented that requirements continue to be added as the program progresses and funding instability continues throughout. These two factors alone cause the greatest disruption to programs, according to program managers (GAO, 2005, November, p. 45).

Perusal of the comments below indicate that a capital account process will cure some of the problems program managers reported, but not all, without dramatically changing reporting arrangements in the military departments.

Figure 14. Highlights of Program Manager Comments on What Types of Authority They Need (GAO, 2005, November)

- Program managers need to have more ability to control their funding in order to make more efficient system and production trade-offs. Program managers also need more ability to work with the warfighter to pursue moderate or even high risk strategies when the payoff for the warfighter warrants such a change. Program managers also need the ability to directly interface with OSD and with Congress and should not be restricted through service staffs in order to facilitate communications.
- Program managers should be able to select and award most contracts versus going to the PEO or service acquisition executive for a decision.
- I believe program managers should be allowed to spend small amounts of underrun as they see fit for their program. Too often, any underrun is taken to pay for other programs.
- [We need] more authority to budget for and manage management reserves. The [planning and budgeting] process is too slow to react to new funding requirements to mitigate program risks.
- In the current environment, we do not control the numbers of military, civilian, or contractor personnel that work in the program office. We do not have the authority to hire and fire personnel, or to seat personnel in our office space. We do not have the authority to get adequate tools for our people to do their work, such as computers, printers, copiers, telephones, etc.
- Once appropriated by Congress, program managers should have more flexibility to transfer between program elements and budget accounts, and also the service and major commands should have less ability to remove funds that are being properly executed in order to transfer them to other programs.
- Program managers should be given authority to move funds between colors of money. Colors of money greatly reduce the flexibility that program managers often need to make tradeoffs within their programs.
- [We need authority] to be able to fire or replace people immediately or affect their bonus.
- [We need authority] to give monetary awards to support professionals.
- The key is not more authority; it is allowing program managers to fully exercise the authority they already have. No program manager minds reasonable oversight, but the current level of oversight is unreasonable.

Source: GAO survey.

In the next section, we assess the state of capital budgeting in the DoD and the private sector.

Capital Budgeting in the DoD and the Private Sector

A. DoD Capital Budgeting Principles and Methods

The process of budgeting for capital assets in the Department of Defense (DoD) is a complex process with many moving parts. While DoD employs some of the same techniques for evaluating capital projects as organizations in the private sector do, such as cost-benefit analyses, it does not have a separate capital budget and must take many other factors into account when designing its plan for capital spending. The process of budgeting for capital assets in the DoD, as well as other federal agencies and departments, is governed by rules set forth by the Office of Management and Budget (OMB), in legislation passed annually by Congress, in the Financial Management Regulations (FMR), in federal appropriation law and other laws and administrative rules. Additionally, DoD proposals for new capital projects “must be supported by elaborate analytical justifications and reviewed and approved by hundreds of people all along the line from the lowest to the highest echelon” (Jones & Thompson, 1999).

1. **Definition of Capital Assets**

Capital assets, as defined by OMB, are “land, structures, equipment, intellectual property, and information systems that are used by the Federal Government that have a useful life of two years or more” (OMB, 2003).

2. **Principles of Budgeting for Capital Assets**

Before any capital spending is included in the President’s Budget, the DoD must satisfy the principles of planning, costs and benefits, financing, and risk management requirements as set forth by OMB.

a. **Planning**

When planning for investments in capital assets, the DoD must ensure that the following criteria are met:

- The asset must support the core missions of the DoD.
- No other private or public agency can support the function more efficiently than the DoD.
- The asset should support work processes that reduce costs, improve effectiveness, and make maximum use of commercial, off-the-shelf technology.
- The asset must demonstrate a return-on-investment superior to any other alternative. Returns can include improved mission performance, reduced cost, and increased quality, speed, or flexibility.
- The asset must reduce risk. This basically means that fully tested pilots or prototypes are pursued before proceeding with full funding for the end item.
- If the investment is planned for more than one asset (i.e., 100 Joint Strike Fighters), then it must be implemented in phases as narrow in scope as practicable, with each phase delivering a measurable net benefit independent of future phases.
- The asset should employ an acquisition strategy that allocates the risk efficiently between the Government and the contractor, uses competition, ties contract payments to performance, and takes advantage of commercial technology (OMB Circular A-11, Appendix J).

OMB uses this information to determine the feasibility of the investment, set the basis for full-funding, and for deciding whether the capital purchase has been justified well enough to be included in the budget (OMB, 2003).

b. Costs and Benefits

In addition to meeting the above criteria, DoD justification for the purchase of any particular capital asset must include a cost-benefit analysis. The asset's total lifecycle costs must be compared to the benefits that it is expected to provide. However, as is the case for many of DoD capital asset proposals, the benefits of the asset may be hard to define in monetary terms, which is why the focus is generally placed on lifecycle costs. Additionally, when comparing different capital projects, it may be determined that each asset provides essentially the same benefit. For example, if DoD is evaluating two competing designs (i.e., from two different contractors) for a new weapons system, even though the design may be different, the benefit provided by each one may essentially be the same. In these instances, DoD can conduct a cost-effectiveness analysis of the competing programs/assets (OMB, 1992). The standard used in conducting cost-benefit analysis is net present

value. This process involves assigning monetary values to the benefits and costs of the asset, discounting these values using an appropriate discount rate (set by OMB), and subtracting the sum of discounted costs from the sum of discounted benefits. Capital investments with a positive net present value are preferred to those with a negative net present value.

DoD may also conduct a cost-effectiveness analysis when justifying a capital asset proposal. As stated in OMB Circular A-94, “A program is cost-effective if, on the basis of lifecycle cost analysis of competing alternatives, it is determined to have the lowest costs expressed in present value terms for a given amount of benefits.” This type of analysis is used when benefits either can not be monetized or it is not practical to monetize the benefits. As noted previously, this is often the case for DoD weapons systems. However, when benefits can not be monetized, OMB encourages DoD to supplement cost-effectiveness analyses with information that quantifies the benefits in physical measurements or effectiveness measures (OMB, 1992). For example, DoD may quantify the benefits of a new aircraft in terms of increased readiness percentages, capability to deliver more ordnance than current aircraft, or lower maintenance costs.

c. Financing

OMB has established principles of financing that DoD must consider when proposing spending for capital assets. The principles include the following: (1) full funding, (2) regular and advanced appropriations, and (3) separate funding of planning segments (OMB, 2003).

Full funding refers to the Budget Authority (BA) required to complete a “useful segment” of a capital investment. Congress must appropriate the BA before DoD can incur obligations for the capital asset. A “useful segment” is, “a unit of a capital project that can be economically or programmatically useful even if the entire project is not completed” (GAO, 1998). Full funding ensures that all costs and benefits are taken into account at the same time that decisions are made by Congress to provide or not provide BA for a capital investment. Full funding also helps to ensure lower

acquisition costs, prevent cancellation of projects, and ensure that enough funding is provided to maintain and operate the assets (OMB, 2003).

Full funding by regular appropriation in the budget year is recommended by Congress and the GAO because it allows decision makers to make tradeoffs between competing capital projects as well as other spending purposes. However, this may result in “spikes” in the budget that are not good for the DoD or Congress. Given the large dollar amounts required for many DoD capital asset acquisitions, this situation often presents itself. In situations like this, a combination of a regular appropriation in the budget year and some advance appropriations in subsequent years may be necessary to fully fund a capital project (OMB, 2003).

Planning for a capital asset should be funded separately from the actual purchase of the asset. The DoD needs information in order to plan, develop designs, compute costs and benefits, and assess risk levels for capital projects. Most of this information comes from the Research, Development, Test, and Evaluation (RDT&E) process. Separate funding for RDT&E and procurement helps to ensure that costs, schedules, and performance goals are known prior to proceeding to actual procurement of the assets (OMB, 2003).

d. Risk Management Requirements

Risk management is an important aspect in the process of budgeting for capital assets. The DoD must conduct a thorough risk analysis for each capital asset acquisition in order to minimize cost overruns, schedule problems, and assets that fail to perform as expected. Risk analyses should define how risks will be minimized, monitored, and controlled. Finally, the DoD must, “ensure that the necessary acquisition strategies are implemented to reduce the risk of cost escalation and the risk of failure to achieve schedule and performance goals” (OMB, 2003).

3. Planning Phase of the Capital Programming Process

Detailed and comprehensive planning is even more necessary when trying to manage limited budgetary assets, which is the situation with most federal agencies, including the Department of Defense. Budgeting and planning, therefore, must be linked together in order for success. “There can be no good budget without a plan, and there can be no executable plan without a budget to fund it” (Capital Programming Guide, 1997).

The planning phase is the nucleus of the capital budgeting process used in most federal agencies. Decisions yielded by the planning phase are applied throughout the budgeting and other phases, and information from the other phases feeds back into the planning phase. The six steps in the planning phase are 1) strategic and program performance linkage, 2) baseline assessment and identifying the performance gap, 3) functional requirements, 4) alternatives to capital assets, 5) choosing the best capital asset, which focuses on benefit/cost and risk analysis, and 6) the agency capital plan, which is to include an inventory of existing capital assets (*President’s Conference Staff Budget Staff Paper, 1998*). Each of these steps will be discussed in greater detail below.

a. Strategic and Program Performance Linkage

The Government Planning and Results Act (GPRA) established the legal requirements for federal agencies to develop strategic plans and link these plans to requests for budgetary resources. The capital programming process (a.k.a. capital budgeting) is an important piece of any agency’s strategic planning process. Quality strategic plans should detail the agency’s needs for particular capabilities, identify the capital assets that are needed to accomplish the goals of the agency’s plan, and delineate the results that these capital assets will produce. The agency’s strategic plan also needs to take into account the estimated budgetary resources that will be available and define goals and objectives for each major program based on the agency’s mission (Capital Programming Guide, 1997).

In 1996, the Government Accountability Office (GAO) produced a study that described three practices that are extremely important for strategic planning to have the desired impact. The three practices are as follows:

- Involve all the pertinent stakeholders to include Congress, the Administration, customers, service providers, employees, and interest groups.
- Take an assessment of the agency's internal and external environments in an effort to anticipate future difficulties so that appropriate adjustments can be made.
- Align the agency's activities, processes, and resources to support results that are in line with the mission.

These practices are similar to the Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses that private corporations use in their strategic planning processes.

Agency strategic plans should produce goals and objectives for its programs. These goals and objectives, embodied in an agency annual performance plan, should detail how outputs will be achieved and describe the role that particular capital assets will play in achieving the desired outcomes. This information essentially defines "how much bang we are getting for the public's buck" (OMB, 1997). The better an agency is able to link a capital asset to a strategic, mission-related outcome, the more likely it will be able to justify the resource request associated with that capital asset.

b. Baseline Assessment and Identifying the Performance Gap

The Office of Management and Budget has established that federal agencies should conduct planning through Integrated Project Teams (IPT) that brings together several disciplines to evaluate the capabilities of existing capital assets. This evaluation will help provide information needed for identifying performance gaps between current and planned results. Additionally, the assessment of current assets should include information concerning functionality, lifecycle costs and the affordability of lifecycle costs, risk, and the agency's ability to manage risk. This information for every agency program enables the agency to examine their entire collection of capital assets when trying to define alternatives to fill performance gaps.

c. Functional Requirements

If it is determined that an agency's current capital assets cannot bridge the performance gaps, the gaps need to be defined in terms of additional performance requirements that need to be met. The agency must take care not to define these requirements in terms of specific equipment, but rather in terms of mission requirements, capabilities needed, cost objectives, and constraints. As these functional requirements are being generated, the capabilities of other assets and/or processes must be considered. For example, it may be determined that a new, technologically advanced capital asset is needed to meet a program's goal. However, if the other assets that support this "new" asset have obsolete technology which will not "work" with the new asset, simply buying the new asset may not enable that program to meet the desired requirements.

d. Alternatives to Capital Assets

Once the requirements have been defined, the agency must now determine whether a new capital asset is needed to meet the requirement. In general, given the expense involved with the purchase of many capital assets, agencies should spend considerable effort to determine if there may be procedural or process improvement actions that can be taken to meet the defined requirement. The Office of Management and Budget has suggested that federal agencies should answer the following questions prior to making the decision to purchase new capital assets:

1. Does the investment in a major capital asset support core/priority mission functions that need to be performed by the Federal Government?
2. Does the investment need to be undertaken by the requesting agency because no alternative private sector or governmental source can better support the function?
3. Does the investment support work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial, off-the-shelf technology (COTS)?

Only if the answer to all of these questions is "yes," should the agency proceed with an acquisition of a new capital asset. Even if all questions are answered positively, the agency is still encouraged to consider all viable alternatives to meet the requirement including the use of human assets

e. Choosing the Best Capital Asset

The IPT needs information from management to determine if resources will be available for the purchase of new capital assets when the decision to purchase new capital assets has been made. Emphasis needs to be placed on innovative proposals from private industry contractors that make full use of competition between vendors. The IPT should also explore the use of commercial off-the-shelf technology and non-developmental items (NDI) in an effort to mitigate costs associated with purchasing a particular capital asset (OMB, 1997).

After a list of alternatives has been compiled, cost-benefit analyses need to be conducted, taking into account acquisition costs and numerous other lifecycle costs as well as the benefits that the asset will provide. Where possible, these benefits should be monetized and compared with the costs associated with the asset. The time value of money should also be included in the analysis. Specific and detailed attention should be placed on obtaining realistic and credible estimates of lifecycle costs of the asset

Risk must be taken into account and planned for with every capital asset acquisition. Risk comes in numerous forms to include schedules' risk, cost risk, risk of project failure, and interdependency issues with other assets/programs. When developing a strategy to mitigate and manage risk, the IPT needs to consider all sources of risk and high risk should only be accepted when it can be justified by high expected returns from the asset (OMB, 1997).

The planning phase of the capital programming process must also include the development of plans for contract type, competition strategies, and management of capital assets during their lifecycle. The plans set forth in these areas are no less important than those discussed above and are critical to acquiring an asset that will truly meet the needs of the agency while delivering the required mission-related results (OMB, 1997).

f. The Agency Capital Plan

The final step in the planning process is the development of an agency capital plan. This capital plan should be part of the larger strategic plan for the agency and should detail the long-term decisions made with respect to the agency's capital asset portfolio. OMB currently encourages the federal agencies to develop these plans, but there is no "requirement" for agencies to have them.

The Agency Capital Plan is the most important output of the planning phase. However, the agency should not treat the plan as "set in stone" but rather a living document that can change as plans and priorities change over time. This document should serve as the agency's primary document for capital asset planning and can also be used to create budget justifications to Congress. This comprehensive plan should include, at a minimum, the following items:

- Statement of the agency's mission, strategic goals, and objectives
- Description of the planning phase
- Baseline assessments and identification of performance gaps
- Justification of spending requests for proposed new assets
- Staffing requirements
- Timing issues
- Plans for proposed capital assets once purchased and in use
- Summary of the risk management plans

Finally, the Agency Capital Plan should include a detailed description of how each asset in the agency's portfolio will enable the agency to achieve its outcome and output goals (that are defined in the strategic plan).

4. Budgeting Phase of Capital Programming Process

The budgeting phase of the capital programming process, which can also be called the "justification" or "approval" phase, formally begins when the agency, such as the Department of Defense, submits its request for capital asset acquisitions to the Office of Management and Budget. The OMB will then make its recommendation to the President for the construction of the President's Budget. This phase ends when Congress appropriates funding and the OMB apportions

funds to the DoD for the purchase of capital assets. If the decision is made not to fund the acquisition, it could return to the planning phase for submission the next year or the capital investment may be subject to further DoD review to determine if another investment better suits DoD strategic goals (Capital Programming Guide, Section II). The specific steps in the budgeting phase are briefly described below:

- **Step 1: Agency Submission for Funding:** In this step, the agency submits its budget, which includes the portfolio of capital assets approved by the agency head, such as Secretary of Defense (SECDEF) in the case of the DoD, to the OMB for approval. The submission should be in harmony with the principles of budgeting for capital assets detailed above. The OMB will then analyze the agency's submission, often asking the agency to provide additional information, and make its recommendation to the President.
- **Step 2: Passback:** In this step, the agency is notified of OMB's recommendation to the President. If the agency's justification for the asset is not in compliance with the principles of budgeting for capital assets, they may have to make substantial changes to their initial request to include changes to funding levels, performance goals, and financing alternatives. The agency also has the option to appeal (reclama) OMB's recommendation to the President.
- **Step 3: Agency Revision:** The agency may have to make adjustments to its proposal for capital spending due to changes that took place during the pass-back phase.
- **Step 4: Approved for the President's Budget:** Once the agency's proposal has made it through OMB scrutiny, it is now included in the President's budget proposal to Congress.
- **Step 5: Congressional Approval/OMB Apportionment:** If Congress approves the proposal, it appropriates Budget Authority and the OMB apportions the BA to the DoD and the other federal agencies. After apportionment, Congress, the OMB, and other parties within the agency monitor the procurement process and implement corrective actions if necessary (OMB, 1997).

5. GAO Executive Guide: Leading Practices in Capital Decision-Making

In fiscal year 1997, the federal government spent \$72.2B on capital assets. Of this amount, \$52.4B, or roughly 73 percent, was spent for defense-related capital assets. Federal agencies, including the Department of Defense, are challenged with demands to improve performance in fiscally restrained environments. As a result, it is increasingly important for federal agencies to make effective capital acquisition choices, implement those choices well, and maintain the capital assets embodied in these choices over the long term.

The Government Accountability Office developed the *Executive Guide: Leading Practices in Capital Decision-Making* as a supplement to OMB's more specific Capital Programming Guide. *The Executive Guide* "identifies attributes that are important to the capital decision-making process as a whole, as well as capital

decision-making principles and practices used by outstanding state and local governments and private sector organizations.” The guide also provides information about the Coast Guard in an effort to determine the applicability of these principles and practices to a federal agency. *The Executive Guide* is not meant to be a detailed rulebook, rather it is meant to be illustrative in nature and serve as a complement to the Capital Programming Guide. In constructing *The Executive Guide*, the GAO identified and studied several government and private organizations that are recognized for outstanding capital decision-making practices. The organizations studied are as follows:

- State of Maryland
- State of Minnesota
- State of Missouri
- State of Virginia
- State of Washington
- Dayton, Ohio
- Montgomery County, Maryland
- Phoenix, Arizona
- Ford Motor Company
- General Electric
- Mobil Corporation
- Texas Instruments

The Executive Guide divides the desired capital budgeting attributes into five broad principles as follows:

Principle 1: Integrate organizational goals into the capital decision-making process.

Principle 2: Evaluate and select capital assets using an investment approach.

Principle 3: Balance budgetary control and managerial flexibility when funding capital projects.

Principle 4: Use project management techniques to optimize project success.

Principle 5: Evaluate results and incorporate lessons learned into the decision-making process.

B. Private Sector Capital Budgeting Principles and Methods

This section will describe the capital budgeting process for organizations in the private sector. Specifically, the section will define capital budgeting, discuss the primary capital budgeting decision criteria, introduce some guidelines that are used to make capital spending decisions, and explain how risk is incorporated into the capital budgeting process in the private sector.

1. Capital Budgeting in the Private Sector

Capital budgeting is the area of financial management that establishes the criteria for investing in long-term projects. More often than not, these projects involve the acquisition of property, plant, and equipment. Simply put, capital budgeting is “The decision-making process with respect to investment in fixed assets” (Keown et al., 2005). This decision-making process helps private organizations determine whether or not to accept or reject a proposed capital investment project. A fixed asset, also known as a capital asset, is defined as, “A long-term, tangible asset held for business use and not expected to be converted to cash in the current or upcoming fiscal year, such as manufacturing equipment, real estate, etc.” (<http://www.investorwords.com>). Since cash can be classified as a “benefit” to the private firm, one can combine the two definitions above and restate the definition of capital budgeting as the decision-making process that is used to purchase assets that provide long-term benefits to the organization.

2. Capital Budgeting Criteria

Competition is intense in the private-sector marketplace. Once a firm comes up with a profitable investment project, competitors often rush in—which results in reduced prices and profits. Due to this, private-sector firms must have a strategy to consistently generate ideas for new capital projects. Without a consistent flow of new capital projects (or projects that improve existing products), the firm will not be able to grow, or even survive, in the private-sector marketplace. Like most public sector organizations, many private firms have Research and Development (R&D) operations or departments that are tasked with coming up with proposals for new

capital projects and designing improvements to existing products (Keown et al., 291-292). How are the capital project proposals generated by R&D evaluated to determine profitability for the private firm?

Few methods are available to execute capital budgeting. These include the simple payback period method (PB), the net present value method (NPV), the profitability index (PI) method, and the internal rate of return method (IRR). Over the past fifty years, the focus on a particular method has shifted almost every decade. The internal rate of return and the net present value techniques slowly gained in popularity until today, where they are now used by virtually all major corporations in decision-making (Keown et al., 2005).

In addition to the existing methods, computer modeling recently became available to financial managers. This technique bridges the gap between theory and practical application.

Choosing the appropriate methodology to execute capital budgeting is very important. This review will discuss a few aspects of capital budgeting: net present value, the internal rate of return, the payback method, computer modeling, and risk considerations. Furthermore, it will introduce how the Fortune 1000 companies execute capital budgeting.

a. Net Present Value

The discounting methods of cash flow are based on discounting cash inflows and outflows to their present values. Therefore, this technique considers the time value of money. Clark, Hindelang, and Pritchard (1989) define the net present value computation as follows:

$$NPV = \sum_{t=0}^n \frac{CI_t}{(1+k)^t} - CO_0$$

CO = present value of the after-tax cost of the project

CI = the after-tax cash inflow to be received in period t

k = appropriate discount rate or hurdle rate

t = time period

n = useful life of asset

The goal of using this formula is to determine whether the net present value is equal to, less than, or greater than zero. If the NPV is positive, then the project is expected to yield a return higher than the required rate. If NPV is zero, then the yield and required rate are expected to be equal. Lastly, if NPV is less than zero, then the yield is expected to be below the required rate. The significance of the net present value results is that, normally, only those projects with a value equal to or greater than zero will be considered. This NPV formula was widely used in the 1990s. The formula being used today, according to Keown et al., (2005), has been slightly modified; yet, the goal remains the same.

$$NPV = \sum_{t=1}^n \frac{FCF_t}{(1+k)^t} - IO$$

FCF= annual free cash flow in time period t

K = the appropriate discount rate; that is, the required rate of return or cost of capital

IO = the initial outlay

N = the project's expected life

As Clark et al. (1989) observed:

We support our preference for the NPV model as the unique evaluation technique that consistently helps firms to maximize common shareholder's wealth positions. Whenever mutually exclusive projects are being evaluated, only the NPV model will consistently show the firm the project or set of projects that will maximize the value of the firm.

Today's view of using the NPV model for its benefits has not changed much. "Acceptance of a project using the NPV criteria adds to the value of the firm, which is in harmony with the private firm's goal of maximizing shareholder value" (Keown et al., 2005).

The use of the NPV method when selecting projects seems the most appropriate because it takes into account cash flows as opposed to accounting profits. It also considers the time value of money, which makes the calculation more realistic. Lastly, the NPV method is sensitive to the true timing of benefits received from a project. The only difficulty with the NPV method is accurately determining the exact required rate of return. To overcome this obstacle, many firms use the cost of capital as the required rate of return. This rate is the most emphasized in current finance practices.

The NPV capital budgeting decision method is superior to simpler capital budgeting decision methods for four major reasons:

1. It deals with free cash flows rather than accounting profits.
2. It is sensitive to the true timing of benefits received from a project.
3. It incorporates the time value of money which supports a rational comparison of a project's benefits and costs.
4. Acceptance of a project using the NPV criteria adds to the value of the firm, which is in harmony with the private firm's goal of maximizing shareholder value (Keown et al, 2005).

b. Internal Rate of Return

The internal rate of return is another discounted cash flow method used for capital budgeting decisions. By definition, the internal rate of return (IRR) is that rate which exactly equates the present value of the expected after-tax cash inflows with the present value of the after-tax cash outflows (Clark et al., 1989).

The internal rate of return is not easily identified. Few tools are available to determine the internal rate of return. One of these tools is identifying the discount factor. This calculation consists of dividing the initial outlay by the yearly average expected cash inflows. Upon finding the discount factor, it is compared against

compound interest and annuity tables to determine what percentage corresponds to that specific discount factor. The percentage selected is then used as a starting number to multiply the cash inflows by until a NPV close to or greater than zero is found. Therefore, if the percentage selected does not give a NPV of zero or greater, then the number is adjusted up or down until it reaches the targeted value.

Once the IRR of a project has been determined, it is then compared to the required rate of return. The purpose is to decide whether or not the project is acceptable. If the IRR is equal to or greater than the required rate of return, then the project is acceptable. Of course, projects can also be ranked in accordance with IRRs. The project with the highest IRR would be rank number one, the second highest IRR would be ranked number two, and so forth.

There are cases where the sign of the cash inflows varies over the life of the project. This type of situation brings about variable internal rates of return. When encountering multiple IRRs over the life of a project, other evaluative calculations are used to account for the variability. This methodology, however, is very seldom practiced.

The Internal Rate of Return method requires estimating a rate of return based on the discount factor. Each discount factor does not have a unique corresponding rate. Therefore, financial managers use an “approximation” in selecting the IRR. The NPV calculation is more precise, and therefore is preferred over the IRR methodology for capital budgeting.

The internal rate of return (IRR) criterion helps private firms determine a capital project’s rate of return. “Mathematically, it is the discount rate that equates the present value of the (cash) inflows with the present value of the (cash) outflows” (Keown et al., 2005). A capital project is accepted by the firm if its IRR is greater than the firm’s required rate of return (i.e., cost of capital). On the other hand, a capital project is rejected if its IRR is less than the firm’s required rate of return. The IRR method exhibits the same advantages as the NPV method and yields similar

accept-reject decisions. However, the reinvestment rate assumption imbedded in the IRR method is inferior to that of the NPV method (Keown et al., 2005).

c. Payback Method

The payback method uses the number of years of cash flow required to recapture the original cost of an investment, normally disregarding salvage value (Osteryoung, 1979). There are two approaches to calculating the payback value. The first method is used when annual cash flows are equal in value. For example, if the initial outlay of a project is \$20,000, the life of the project is five years, and the annual cash flow is \$2,000 then the payback calculation is as follows:

$$\text{Payback} = 20,000/2,000 \qquad \text{Payback} = 10 \text{ years}$$

The second method of calculating the payback value is applicable when the annual cash flows are unequal. In this case, two calculations take place: the annual cash flow and the cumulative cash flow. The values of the cumulative cash flows are used in calculating the payback. Table 1 illustrates uneven cash flows and the payback computation.

Table 1. Evaluation of Projects (Osteryoung, 1979)

Table I. Evaluation of Projects with Unequal Cash Flow Using Payback		
Initial Cost \$15,000 Life (in years) 5		
Year	Annual Cash Flow	Cumulative Cash Flow
1	\$2000	\$2,000
2	4000	6,000
3	6000	12,000
4	7000	19,000
5	3000	22,000

The cumulative cash flow in any year is the summation of the prior year's cumulative total and the annual cash flow for the current year. The initial cost for this project was \$15,000, which is not clearly identified as a cash flow. Therefore, to find the payback, a bracket must be identified where \$15,000 falls in. In this case, the initial outlay of \$15,000 falls between \$12,000 and \$19,000. As a result, the payback time for this project will be 3 years and a fraction. To compute the fraction, the difference between \$15,000 and \$12,000 (\$3,000) will be divided by the next cash flow, which is \$7,000. The fraction then results in a value of 0.43. The final payback period is 3.43 years.

Calculating payback is a very simple method. Smaller firms whose budgets are limited are more prone to use the payback method based on its simplicity. However, the payback method does not account for additional cash flows after the payback period, which neglects including the value of the additional cash flows in the decision-making process. Another disadvantage of the payback method is that it neglects the relationship of timing and yields.

d. Inflation and Discount Rates

One of the most difficult challenges in using quantitative methods to determine the feasibility of capital investment projects is to accurately determine inflation and discount rates over the life of a project.

Drury and Tayles (1997) in their article "Misapplication of Capital Investment Appraisal Techniques," observe: "Firms are guilty of rejecting worthwhile investments because of the improper treatment of inflation in the financial appraisal. Inflation affects both future cash flows and the cost of capital that is used to discount the cash flows." Cash flows can be expressed in real terms (today's current purchasing power) and nominal terms (purchasing power at the time the cash flow occurs). Therefore, inconsistency in using nominal versus real terms can lead to miscalculations of the real value or benefits of a project. As a result, the NPV of projects can be understated or overstated. Long-term projects are most susceptible to mismatching of inflation because failing to include inflation in cash flows estimates compounds with time.

In other cases, some cash flows do not fully adjust with the general rate of inflation or simply do not adjust at all. For example, lease payments and fixed-price purchase or sale contracts do not change with the inflation rate. Therefore, to convert future cash flows to real cash flows, they must be deflated by the general rate of inflation.

e. Computer Modeling and Capital Budgeting

Among the many benefits technology has brought about, simulation modeling is one of the applications beneficial to capital budgeting. Computer modeling has become one of the most important tools in an attempt to close the gap between theory and application. When considering capital budgeting, "Special attention must be paid to the timing of receipts and outlays; and the handling of fixed and variable costs, accounting depreciation, working capital, interest expense and opportunity costs" (Harris, 1982). In capital budgeting, projects are evaluated by considering the incremental cash flows resulting from the investment. There are two specific

aspects to consider when working with cash flow projections: the investment decision (which projects to undertake) and the financing decision (how will the projects be financed). Computer modeling can include many of the theoretical implications while integrating real-life investment factors and financing decisions. The model can be established to dynamically show transformations over the life of the project as a result of economic changes, like changing market rates or declining asset usage. Furthermore, a firm's ending cash-balance comparisons can be included with and without the project. Modeling is very useful in cash-flow projection. The models can help eliminate some of the theoretical uncertainties of net present value analysis.

Harris (1982) states: "There are six steps involved in developing and using a computer model when analyzing capital projects: 1) Define the model, 2) gather information, 3) develop the baseline forecast, 4) evaluate the baseline forecast, 5) perform a sensitivity analysis, 6) evaluate capital expenditures."

As described by Harris, the first step in building a capital project model is to define the model. In defining the model, the following relevant factors should be included: 1) level of complexity, 2) list of inputs, 3) list of desired outputs, 4) number of programs to be evaluated, 5) the extent of interactions and linkages between programs, and 6) financial information. The next step is to gather information. The amount of information to be gathered will be dependent on step one. The scope of the information can include financial, statistical, fiscal, budgetary, and demographic data. The third step is to build a baseline forecast. This forecast includes two phases. One of the phases covers the estimated demand for the capital asset and estimated usage, while the other encompasses the financial forecasts associated with such demand. Once the baseline has been established, step four will evaluate the baseline forecast. Evaluating the baseline consists of management reviewing the forecast's reasonableness, validity, and accuracy.

When evaluating the baseline, management must take into account trends in utilization, financial condition, profitability, required rate increases, and the

attractiveness of the cash flows. Step five consists of performing a sensitivity analysis. Many firms use Excel-based applications, such as linear programming in Excel Solver, to produce a sensitivity analysis report. This report presents the marginal change or effect resulting from changing the variables' values within the model. Another approach to conducting a sensitivity analysis is to incorporate assumptions relating to capital expenditures to assess the incremental effect on a capital program. The analyst can determine a possible distribution of outcomes by modifying exogenous assumptions (i.e., inflation rates) and assigning probabilities to the possible range of changes. Based on these outcomes, ranging from least probable to most probable, management can better prepare for offsetting those undesirable results. Harris observes that the last step is to evaluate capital expenditures. This step relates to modifying investment expenditures and the effects these changes have on possible outcomes.

Computer modeling offers speed and accuracy in simulating complex situations for capital budgeting. Additionally, modeling offers analysts a dynamic medium in which to assess many different and possible outcomes.

3. Capital Budgeting Guidelines

Like many organizations in the public sector, private firms have guidelines or “rules” that apply to the capital budgeting process. However, unlike the specific rules and laws that federal agencies (such as the DoD) must follow when proposing capital investments, these guidelines are not “written in stone.” Essentially, the guidelines used by private firms exist for one purpose, and that is to help firms determine how to measure the value of capital investment projects. The decision criteria discussed above assumed that a capital project’s cash flows were known. In reality, estimating the cash flows associated with a particular capital investment project is a difficult process. Additionally, not all cash flows associated with a capital project are relevant in measuring its value. The guidelines detailed in the next several paragraphs help private firms measure the value of capital projects by defining relevant cash flows (Keown et al., 2005).

The first guideline is that private firms should use free cash flows rather than accounting profits to measure the value of capital projects. Accounting profits are “booked” when “earned,” which may or may not mean that the firm actually has “cash in hand.” Free cash flows from a project can be reinvested by the firm and they “correctly reflect the timing of benefits and costs—that is, when the money is received, when it can be reinvested, and when it must be paid out” (Keown et al., 2005).

Another guideline is that firms must only consider the *incremental* cash flows associated with the acceptance of a capital project proposal. This requires firms to look at the company as a whole and determine after-tax cash flows both with and without the project. Additionally, incremental expenses must be considered. Will the purchase of new machinery require that employees receive additional training? If so, the cash flow associated with this training must be subtracted from the expected cash inflows of the new machinery (Keown et al., 2005).

Next, private firms must consider how the capital project will affect the cash flows from existing products and operations. For example, if a firm is considering the launch of a new product line, it must thoroughly analyze the expected effects (in terms of cash flows) this will have on their current product lines. Will the new product cannibalize sales from existing products or will the new product bring increased sales to existing products? Questions like these, as well as many others, must be answered before a new capital project is accepted (Keown et al., 2005).

Finally, private firms must remember to consider sunk costs and opportunity costs during the capital budgeting process. Sunk costs are cash flows that have already been spent on the project. For example, if a firm has already spent money for a market feasibility study of a new product, the cash flow associated with this expense is “sunk” and should not be included in the capital budgeting analysis. Opportunity costs are “cash flows that are lost because a given [capital] project consumes scarce resources that would have produced cash flows if that project had been rejected” (Keown et al., 2005). For example, if a firm owns vacant land and

builds a strip mall on it, the opportunity cost for the strip mall project is the forgone cash flows if the land had been used for some other purpose. Keown makes this final point about opportunity costs: “opportunity cost cash flows should reflect net cash flows that would have been received if the project under consideration were rejected. Again, we are analyzing the cash flows to the company as a whole, with or without the project” (2005).

4. Risk and Capital Budgeting

Capital budgeting requires financial managers to make decisions regarding the commitment of resources to courses of action that are normally very expensive. Additionally, more often than not, these decisions are very costly and not reversible. To have successful outcomes in capital budgeting, managers must accurately anticipate future business and economic conditions. Risk, therefore, can be described as the delta between the decisions made and actual future outcomes. To deal with risk and choices in an appropriate and preferably objective manner, management must evaluate all capital investment proposals as rigorously as possible. As the volatility of the business environment increases, those firms who are best able to navigate these uncertainties will prove to be the most successful in the long run.

In evaluating capital budgeting decisions, financial managers must carefully identify and qualify financial risks. Two main considerations financial managers must take into account are:

1. Are they aware of all future states of the economy, business, and market trends?
2. Are they able to place a probability and value on each of those states?

To better understand how managers evaluate or attempt to answer these questions, several terms must be defined. Clark et al. (1989) highlight five specific types of risks: business, investment, portfolio, cataclysm, and financial. These risks are defined by Clark et al as follows:

- **Business risk** is the variability in earnings that is a function of the firm's normal operations (as impacted by the changing economic environment) and management's decisions with respect to capital intensification. It should be noted that business risk considers only the variability in Earnings before Interests and Taxes (EBIT).
- **Investment risk** is the variability in earnings due to variations in the cash inflows and outflows of capital investment projects undertaken. This risk is associated with forecasting errors made in market acceptance of products, future technological changes, and changes in cost related to projects.
- **Portfolio risk** is the variability in earnings due to the degree of efficient diversification that the firm has achieved in its operations and its overall portfolio of assets.
- **Cataclysm risk** is the variability in earnings that is a function of events beyond managerial control and anticipation.
- **Financial risk** is the variability in earnings that is a function of the financial structure and the necessity of meeting obligations on fixed-income securities.

Based on the many risks described above, managers must draw from a group of alternatives to quantify the risks they face. Statistical methods and simulation are two of the most widely-used approaches to determine risk probabilities and values.

Statisticians have presented both the absolute and relative measures of risk. Absolute measures of dispersion include the range, mean absolute deviation, variance, standard deviation, and semi-variance. The relative measure of dispersion is simply the coefficient of variation. Each measure has a unique equation to determine its value. Additionally, all of these measures present high and low benchmarks against which to compare and determine the risk of the investment.

Once the measures have been computed, a comparison and interpretation must be done among all the possible investments and the correlations of the measures to determine which alternative is the best overall. The absolute statistical measures provide valuable insight with regards to risk. Mainly, the relative measure of dispersion or coefficient of variation indicates the level of risk per dollar of expected return. Lower coefficients of variation translate into lower risk.

5. Incorporating Risk into the Capital Budgeting Process

Not all projects can be treated equally in regards to risk. Each investment project has its unique level and type of risk. Therefore, to properly incorporate risk

into investment analysis, two methods have been developed. These two methods are the certainty equivalent approach and the risk-adjusted discount rate.

In the 1980s, the concept of certainty equivalent was described as follows: “The certainty equivalent method permits adjustment for risk by incorporating the manager’s utility preference for risk versus return directly into the capital investment process” (Clark et al., 1989).

This concept has remained consistent in its purpose throughout time until the present. Keown et al. (2005) presents a more updated definition: the certainty equivalent approach involves a direct attempt to allow the decision-maker to incorporate his or her utility function into the analysis. This approach allows the financial manager to substitute a set of equivalent riskless cash flows for the expected cash flows. Subsequently, these cash flows are discounted back to the present using the NPV criteria. Once the calculation is completed, the project with a net present value equal to or greater than zero is selected. While this approach accounts for the utility factor, it can be an arbitrary approach. Two different financial managers can look at the same project with different riskless rates. Therefore, if presented with this situation, which of the two managers is correct? In reality, both managers could be right since the riskless measure is based on a relative assessment as opposed to a hard factual guideline. This approach is not widely used because of the potential bias that can stem from the “riskless” assessment.

The next approach is the risk-adjusted discount rate. The definition used in the 1980s was: “The rationale underlying the use of the risk-adjusted discount rate (RADR) technique is that projects which have greater variability in the probability distributions of their returns should have these returns discounted at a higher rate than projects having less variability of risk.” The RADR concept concentrates on the variability of risk. Therefore, it adjusts the discount rate to accommodate greater or lesser risk. Likewise, today’s approach to this method focuses on the same principle. “A method for incorporating the project’s level of risk into the capital-budgeting process, in which the discount rate is adjusted upward to compensate for

higher than normal risk or downward to adjust for lower than normal risk” (Keown et al., 2005).

The method of risk-adjusted discount rates seems more plausible when incorporating risk into capital budgeting for two reasons. First, financial analysts should consider the stakeholders reactions to new investments if the risk associated with them is different than the firm’s typical risk. Second, adjusting the discount rate upward or downward accounts for the variability of returns based on risk.

The most significant difference between the two methods hinges on the point at which the adjustment for risk is incorporated into the calculations. Also, the risk-adjusted discount rate makes the implicit assumption that risk becomes greater as time windows expand.

Based on the many risks described above, managers must draw from a group of alternatives to quantify the risks they face. Statistical methods and simulation are two of the most widely-used approaches to determine risk probabilities and values.

The previous discussion has ignored the role of risk and uncertainty in private-sector capital budgeting. In fact, even when firms use the criteria and guidelines detailed above, the cash flows used in their analysis of a capital project are only estimates of “what is *expected* to happen in the future, not necessarily what *will* happen in the future” (Keown et al., 2005). However, even though private firms can not know with 100% certainty what cash flows will result from investing in any particular capital project, they can estimate a range of probabilities for the cash flows. Likewise, private firms will have to make estimates on interest rates related to their future costs of capital.

The more common method the private firms use for incorporating risk is through risk-adjusted discount rates. The use of this method is “based on the concept that investors demand higher returns for more risky projects” (Keown et al., 2005). In this process, the discount rate used in the NPV criterion is adjusted upward or downward in accordance with the level of risk inherent in the capital

investment under consideration. If a capital project is determined to be riskier than normal, the discount rate is adjusted upward. If the level of risk for the project under consideration is higher than the firm's "typical" project, then management must assume that the firm's shareholders will demand a higher rate of return for taking on this additional risk. By appropriately adjusting the discount rates for the risk level of the project under consideration, the firm can ensure to the best of their ability across a portfolio of projects that their capital budgeting analysis will yield projects that increase the profits of the firm and ultimately increase shareholder value (Keown et al., 2005).

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Reform Options

This research examined the capital budgeting practices and principles used in both public- and private-sector organizations. The Government Accountability Office (GAO), President Clinton's Commission to Study Capital Budgeting (PCSCB), and others performed several studies which resulted in several proposed improvements to the current system of capital budgeting in the federal government.

First, if budget reforms are going to be made, management reforms must be made simultaneously to ensure the reforms are properly implemented and all persons involved are aware and able to make the appropriate changes. This is especially true if one of the reforms is decentralizing the decision-making process. Decentralizing the decision-making process could prompt the use of performance budgeting, where departments are rated (and rewarded) on their success of reaching predetermined goals. Authority for capital asset purchases could be shifted down to the department level (i.e., the DoD would decide which assets to buy) instead of Congress holding virtually all decision-making authority. Even though SECDEF Rumsfeld's request for "broadened discretionary powers" in the Defense Transformation Act (DTA) was denied by Congress, his ideas have considerable merit since the departments are the most closely involved with the day-to-day business they conduct (McCaffery & Jones, 2004).

Since federal agencies have much tighter constraints than businesses in the private sector, it is difficult to provide incentives for agencies to manage their assets. However, along with continued use of the Bush Administration's Performance Assessment Rating Tool (PART), Congress could adopt policies similar to Australia and New Zealand and allow the agencies, including the DoD, to raise and keep revenues from selling or renting out existing assets (President's Commission to Study Capital Budgeting, 1999). If good PART scores are rewarded in the budget process and agencies are allowed to keep revenues from the sale of assets, there are at least two incentives for agencies to manage their assets well.

If performance-based budgeting is used, the strategic plans of the departments could play a much larger role in the capital budgeting process. Although the Government Performance and Results Act (GPRA) requires agencies to submit five-year strategic plans, the plans are only prepared every three years and are currently not used directly in considering appropriation requests, which includes requests for capital spending. If a move towards performance budgeting and a more decentralized decision-making process was made, these plans would need to have results-oriented goals that could be measured, so that agencies could be rated on their performance (possibly via PART). For the DoD, this would mean that the Future Years Defense Plan (FYDP), DoD version of the agency capital plan, would play a larger role in the decision-making process regarding capital asset purchases. Also, the Office of Management and Budget (OMB) should evaluate the plans and Congress should use the strategic plans and OMB evaluation as decision-making tools when considering appropriation requests. Taking into account the considerable amount of time that most federal agencies spend preparing their strategic plans in accordance with GPRA, it seems reasonable to suggest that these plans be used for decision-making purposes.

Additionally, it would be useful for planning purposes if the strategic plans and budgets were tied to the lifecycles of the capital assets. Although the Capital Programming Guide directs agencies to consider lifecycle costs and compare them to expected benefits, the lifecycle costs are not directly linked to the agency's strategic plans. If the capital asset's lifecycle costs were tied to strategic plans, funding for the maintenance and replacement of assets could be planned in advance. The plans should also include any future outlays for capital assets that are planned (such as land, buildings, and new weapon systems). If a lifecycle is estimated for an asset, then the department would know when it will be necessary to replace the item, and this can be included in the plan. Therefore, even if there is no proposal or recommendation for the actual item that will replace the asset, funding needs can be more accurately forecasted (President's Commission to Study Capital Budgeting, 1999).

In an effort to assist agencies in making decisions on capital asset investments, the agencies should continue to prepare annual financial statements as required by the CFO Act. It should be noted, however, that preparation of financial statements simply for CFO compliance should not be the goal. The goal should be preparation of financial statements that are used to aid in better decision making. In addition, the agencies could prepare detailed breakdowns of existing capital assets. The information in these reports would then be consolidated by the OMB and used to assist the agencies in preparing long-term capital plans, similar to DoD FYDP, as well as to assist OMB in reviewing and assessing those plans (President's Commission to Study Capital Budgeting, 1999).

Most states have separate capital budgets. Analysis of the case study on state capital budgets prompts the question of if there should be a separate capital budget at the federal level. While there are many critics of a separate capital budget at the federal government or agency level, there has been a proposal for instituting separate capital acquisition funds (CAF) at the agency level. A segment of the agency's appropriations would be placed in the CAF and could only be used for acquiring large capital assets. The CAF would borrow from the Treasury and charge operating units rent equal to the amount of debt service. Additionally, the CAF would inherit all of the agency's existing capital assets in an effort to capture all agency costs of capital. Separate funds for capital acquisition should help agencies better plan and budget for capital assets. The agencies could then be held accountable for planning and budgeting and, presumably, would be more likely to use their resources efficiently. These funds would also smooth out the budget authority required by agencies and would help to reduce potential spikes in the budget associated with full funding requirements. An important aspect of introducing separate capital acquisition funds, however, is the definition of capital assets. OMB would have to issue guidance on what constitutes a capital asset to ensure implementation is consistent throughout the agencies (President's Commission to Study Capital Budgeting, 1999).

While the Government Accountability Office (GAO) originally agreed with and supported the President's Commission to Study Capital Budgeting recommendation to implement capital acquisition funds, they have recently published a study stating that the proposed benefits of CAFs can be achieved through simpler means (GAO, 2005).

The GAO states that CAFs, as a financing mechanism for federal capital assets, would ultimately increase management and oversight responsibilities for the Treasury Department, the Office of Management and Budget (OMB), the Congressional Budget Office (CBO), and the departments and agencies that would utilize CAFs. While recognizing that CAFs might improve decision-making and remove (for the most part) spikes in Budget Authority (BA) associated with large dollar capital assets, GAO states that some federal agencies are using different approaches that address these problems through much simpler means (GAO, 2005).

The federal agencies that the GAO studied are using asset management systems which are allowing them to assess the condition of existing capital assets, estimate funding levels for maintaining these assets, and assign priorities to maintenance and improvements for capital assets. Other agencies are currently using cost information from their accounting systems to assist in the agency's budgeting decisions. However, additional improvements in agency cost-accounting systems is needed before they can fully inform the agency's capital planning and budgeting decisions (GAO, 2005).

The GAO's study of several capital-intensive federal agencies, coupled with several interviews with officials from Congress, Treasury, and the OMB, has led them to conclude that CAFs, as they had been proposed by the President's Commission to Study Capital Budgeting, are too complicated for implementation because of the additional budget complexities that they create. Additionally, interviews with executive and congressional officials led the GAO to believe that a proposal to institute CAFs, even on a pilot basis, would have few, if any, proponents.

Because of these reasons, the GAO recommends that the focus should be placed on improvement and widespread implementation of asset management and cost-accounting systems to address the problems that CAFs were proposed as a solution for (GAO, 2005).

Spending caps could be placed on capital spending to encourage decision-makers to set priorities and make tradeoffs, which could result in capital spending that provides the most benefit. This could be done in the context of re-instating the Budget Enforcement Act spending caps that have expired. With spending caps, decision-makers would focus resources on achieving the long-term objectives and spend capital dollars on the most cost-effective assets (President's Commission to Study Capital Budgeting, 1999), much like what is common practice in private-sector organizations. Agencies will also ensure that capital assets invested in are required to accomplish their mission as defined by their strategic plan.

While spending caps encourage efficient trade-off decisions, when combined with the current full-funding requirements, spending caps can lead to a bias against capital projects in the budget process. However, as previously noted, full funding in the current budget process is important for controlling acquisition costs and ensuring adequate resources to operate and maintain capital assets. Although there seems to be incompatibility between spending caps and full-funding, the GAO has identified strategies that have been successfully used by selected agencies to accommodate capital spending within the current budget controls imposed by Congress (Posner, 1998). These strategies take into account the presumed reluctance of Congress to approve separate capital budgets, capital acquisition funds, or decentralized decision-making at the agency level.

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Conclusions

The current practices of the DoD and the federal government are clearly less than perfect and often lead to capital asset expenditures that are not as efficient or as effective as needed. Obviously, if discretionary dollars continue to be limited, and the current budgeting practices are leading to inefficient and ineffective use of capital dollars, something needs to change. Budgeting changes at the federal government level would certainly require Congressional and Executive commitment if any progress is to be made. Some of the recommendations require Congress to give federal agencies more control of their budgets; and there has been very little Congressional interest in sharing their “power of the purse.” The result has been efforts, in the form of laws and regulations, mandating federal agencies to be more efficient in their use of resources with an emphasis in becoming more “business-like.”

Recent efforts by the DoD and other federal agencies have improved conditions to some degree. Several foreign governments and many states have been successful in implementing capital budgeting practices that are prevalent in private-sector companies. Likewise, the DoD and other federal agencies have instituted some of these same practices. However, more progress needs to be made. More research should be done, and serious commitments need to be made from Congress and federal agencies to improve the budgeting processes. Thorough examination of private-sector capital budgeting practices in states and other countries coupled with proposals made by the PCSCB, the GAO, and others, provide valuable insights with respect to changes that should be assessed in terms of their application in the Department of Defense.

In our view, the Department of Defense (and most of the federal government for that matter) should adopt and implement capital budgeting. In doing so, the DoD probably ought to completely discard PPBES¹ and replace it with a long-range and accrual-based planning and budgeting process, i.e., ending what we know as programming and the POM. In effect, programming is only effective at the end-game

anyway—but preparing and processing the POM wastes huge amounts of valuable DoD staff time and energy that can be put to better use. Also, ideally, the period for obligation of *all* accounts in the new DoD budget process would permit obligation over a period of two or three years for all accounts—including fast spend accounts including O&M, MILPERS, etc. The reason for multiple-year obligation for all accounts is to enable more effective budget execution and end the highly wasteful and inefficient end-of-year "spend it or lose it" incentive syndrome. This change would, of course, require the approval of Congress. However, the DoD could implement long-range budgeting (including capital budgeting) as a part of the overall reform—while Congress continues to operate on the annual budget cycle it prefers (for a number of reasons related to serving constituent and member interests). No change in the federal budget process can be made unless it permits Congress to continue to do its business according to the incentives faced by members. To think otherwise is naïve. Still, as noted above, the only part of the reform advocated here that would require explicit congressional action is lengthening the obligation period for all accounts to two or three years (as has been done internationally, in the UK and other countries, for example). This change would require Congress to modify certain provisions of appropriation law. Otherwise, the DoD could implement a long-range accrual based budgeting system on its own, subject to gaining approval of and support for it from Congress—but it would not require change in law. In essence, it is incumbent on the DoD to persuade Congress to support the change—and this will only occur if the DoD is able to show members how they, the DoD and the American taxpayer will be better off as a result of the reform.

In addition, the defense acquisition decision process is so flawed and excessively bureaucratic that it, too, should be replaced completely by a new process that would enable capital asset investment analysis of alternatives, decision making and execution in a much shorter period of time, involving far fewer participants, and in synchronicity with a long-range planning and accrual budgeting process that places emphasis on performance rather than input and process variables. The system, as it operates presently, is an incredible and wasteful triumph of process over substance. Also, we wish to observe that if we really want to run the

DoD like a business (i.e., using smart business practices) the best way to accomplish this goal is to make it a business— through increased contracting of all essentially non-governmental functions to the private sector. In our view, so much of what the DoD acquisition and contracting bureaucracy does (and does badly) could and should be performed entirely outside of government. However, full exploration of these proposals must and will be made in other papers, the research for which is ongoing as we complete writing this document.

¹Some might argue that the MILPERS and O&M accounts should be kept in a modified PPBE-like process. We have no problem with this idea, but divorced of capital asset decisions, keeping PPBE as a budgeting system seems overly bureaucratic. What system the remaining DoD accounts should use is another good topic of inquiry with the basic question being what kind of system serves a set of accounts, several of which have been relatively stable -- MILPERS and CIVPERS -- in O&M and O&M itself which historically has been relatively stable at the topline, but riddled with within-year adjustments and shot with pork and congressional special-interest items not requested by the DoD.

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References

- Bierman Jr., H., & Smidt, S. (1980). *The capital budgeting decision* (5th ed.). New York: MacMillan Publishing Co., Inc.
- Boudreau, M. (2005, May). Acquisition Conference presentation. Second Annual Acquisition Research Symposium (May 18-19, 2005). Monterey, CA: Naval Postgraduate School.
- California state administrative manual (n.d). Retrieved March 15, 2005 from <http://sam.dgs.ca.gov/default.htm>.
- Cooper, W., Morgan, R., Redman, A., & Smith, M. (2002). Capital budgeting models: Theory vs. practice, 26(1/2). Retrieved May 8, 2005 from <http://proquest.umi.com/pqdweb?index=0&did=636769801&SrchMode=1&sid=2&Fmt=4&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1130189677&clientId=11969>.
- Executive summary. (2005, December). Defense acquisition performance assessment, p. 10.
- Fixed asset. Definition. Retrieved from <http://www.investorwords.com>
- Drury, C., & Tayles, M. (1997). The misapplication of capital investment appraisal techniques. *Management Decision*, 35(2). Retrieved July 17, 2005 from <http://proquest.umi.com/pqdweb?index=0&did=117543017&SrchMode=1&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1130188340&clientId=11969>.
- General Accounting Office (GAO). (1998). *Executive Guide: Leading practices in capital decision making*. Retrieved September 12, 2005 from <http://www.gao.gov/archive/1998/ai98110.pdf>.
- General Accounting Office (GAO). (2005). *Capital financing. Potential benefits of capital acquisition funds can be achieved through simpler means*. Retrieved September 12, 2005 from <http://www.gao.gov/new.items/d05249.pdf>.
- GAO. (2005, November). Best practices: Better support of weapon system program managers needed to improve outcomes. GAO report to the subcommittee on Readiness and Management Support, Committee on Armed Services, US Senate. GAO-06-110.
- Graham, J., & Campbell, H. (2002). How do CFOs make capital budgeting and capital structure decisions? [Electronic Version]. *Journal of Applied Corporate Finance*, 15, 8-23. Retrieved July 23, 2005 from

- http://faculty.fuqua.duke.edu/~charvey/Research/Published_Papers/P76_How_doCFOs.pdf.
- Harris, J. (1982). Computer modeling. *Healthcare Financial Management: Journal of the Healthcare Financial Management Association*, 36(6), 10-18.
- Hush, L., & Perof, K. (1988). The variety of state capital budgets: A survey. *Public Budgeting & Finance*, 8(2), 67-80.
- House Conference Report 109-89 to HR 1815. (2005, May 20), pp. 354-356.
- Jog, V., & Srivastava, A. (1994). Corporate financial decision making in Canada. *Revue Canadienne des Sciences de l'administration*, 11(2). Retrieved July 24, 2005 from <http://proquest.umi.com/pqdweb?index=28&did=44078&SrchMode=1&sid=7&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1130274611&clientId=11969>.
- Jones, L. R., & Thompson, F. (1999). *Public management: Institutional renewal for the twenty-first century*. Stanford, CT: JAI Press.
- Keown, A., Martin, J., Petty, J., & Scott Jr., D. (2005). *Financial management principles and applications* (10th ed). New Jersey: Prentice Hall.
- McCaffery, J. L., & Jones, L. R. (2004). *Budgeting and financial management for national defense*. Greenwich: Information Age Publishing.
- Office of Management and Budget (OMB). (2003). Circular No. A-11: *Preparation, submission, and execution of the budget*. Retrieved May 20, 2005 from http://www.whitehouse.gov/omb/circulars/a11/current_year/a_11_2003.pdf.
- Office of Management and Budget (OMB). (1992). Circular No. A-94: *Guidelines and discount rates for benefit-cost analysis of federal programs*. Retrieved May 20, 2005 from <http://www.whitehouse.gov/omb/circulars/a094/a094.html>.
- Office of Management and Budget (OMB). (1997). *Capital programming guide: Supplement to OMB Circular A-11, Part 3: Planning, budgeting, and acquisition of capital assets*. Retrieved May 20, 2005 from <http://www.whitehouse.gov/omb/circulars/a11/cpgtoc.html>.
- Osteryoung, J. (1979). *Capital budgeting, long term asset selection* (2nd ed). Columbus, Ohio: Grid Publishing Inc.
- President's Commission to Study Capital Budgeting. (1998, January 30). *Statement of Michael B. Enzi before the President's Commission to study capital budgeting*. Retrieved June 3, 2005 from http://clinton3.nara.gov/pcscb/wt_enzi.html.

- President's Commission to Study Capital Budgeting. (1998, March 6). *Statement of Paul L. Posner before the President's Commission to study capital budgeting*. Retrieved June 3, 2005 from http://clinton4.nara.gov/pcscb/wt_posner.html.
- Public Policy Institute of California. (1992). *How does California make its infrastructure decisions?* Retrieved June 3, 2005 from http://www.ppic.org/content/pubs/RB_600MNRB.pdf.
- Quadrennial Defense Review*. (2006, February). pp. 67-68.
- Ratnam, G. (2005, December 12). Big programs survive QDR: US services eye personnel cuts to save weapons. *Defense News*.
- Report of the President's Commission to study capital budgeting*. (1999). Retrieved June 3, 2005 from <http://clinton3.nara.gov/pcscb/report.html>.
- Robinson, M. (2002). Financial control in Australian government budgeting. *Public Budgeting & Finance*, 22(1), 80-94.
- Ryan, P. & Ryan, G. (2002). Capital budgeting practices of the Fortune 1000: How have things changed? *Journal of Business and Management*, 8(4). Retrieved July 17, 2005 from <http://proquest.umi.com/pqdweb?index=0&did=331635391&SrchMode=1&sid=7&Fmt=4&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1130190815&clientId=11969>.
- Satya, P., & Puja, G. (2004). How close are NPVI and IRR as criteria for project choice in real life? *Finance India*, 18. Retrieved July 17, 2005 from <http://proquest.umi.com/pqdweb?index=14&did=842824341&SrchMode=3&sid=1&Fmt=4&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1130274156&clientId=11969&aid=1>.
- Senate Report 109-069 to Senate Bill 1042 Title VIII. (2005, May 17). Acquisition Policy, p. 345.
- Smith, G., & Jacobs, K. (1999). New Zealand: The dynamics behind a reinvented government. *International Journal of Public Administration*, 22(2).
- Tresch, R. (2002). *Public finance: A normative theory* (2nd ed.). San Diego, CA: Academic Press.
- Van Horne, J. (1989). *Fundamentals of financial management* (7th ed.). New Jersey: Prentice Hall.
- Zeller, T., & Stanko, B. (2005). How risky are your capital expenditures. *Strategic Finance*, 86(8), 44-49.

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Technical Reports

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Presentations, Publications and External Forums

Rendon, Rene. "Commodity Sourcing Strategies: Supply Management in Action." Published as "Commodity Sourcing Strategies: Processes, Best Practices, and Defense Initiatives." *Journal of Contract Management* 3, no.1 (2005): 7-21.

Doerr, Ken, Ira Lewis, and Donald Eaton. "Measurement issues in Performance Based Logistics." *Journal of Public Procurement* 5, no. 2 (2005): 164-186.

Eaton, Donald, Ken Doerr, and Ira Lewis. "Performance Based Logistics: A Warfighting Focus." *US Naval Institute Proceedings*. (In Press).

Doerr, Ken, Donal Eaton, and Ira Lewis. "Performance Based Logistics." Presented to the International Defense Acquisition Resource Management Conference. Capellen, Luxembourg, 2004.

Kang, Keebom, and Ken Doerr. Workshop: Metrics and Performance Evaluation in Performance Based Logistics. Presented at Future Naval Plans & Requirements Conference. San Diego, CA. October 2005.

Boudreau, Michael, and Brad Naegle. "Total Ownership Cost Considerations in Key Performance Parameters and Beyond." *Defense Acquisition Research Journal* 38, no.2 (2005): 108-121.

Boudreau, Michael, and Brad Naegle. Workshop: Setting up Acquisition for Total Lifecycle Supportability Performance. Presented at the Institute for Defense and Government Advancement Conference: Total Lifecycle Systems Management. Arlington, VA. 2005.

Kang, Keebom, Ken Doerr, Uday Apte, and Michael Boudreau. "Decision Support Models for Valuing Improvements in Component Reliability and Maintenance." Submitted to the Journal of Defense Modeling and Simulation in July 2005 for possible publication. Currently the article is being reviewed by referees.

Franck, Raymond (Chip). "Business Case Analysis and Contractor vs. Organic Support: A First-Principles View." Presented at the Western Economic Association International Annual Conference. San Francisco, CA. 5 July 2005.

Dillard, John, and Mark Nissen. "Computational Modeling of Project Organizations under Stress." In review.

Dillard, John. "Centralization of Defense Acquisition Programs." Accepted for publication in the Defense Acquisition Research Journal (2005).

Nissen, Mark E., and John Dillard. "Computational Design of Public Organizations." In review.

IS4710 - Qualitative Methods. This research-seminar course has integrated the results of the FY05 Dillard-Nissen research into the students' course project.

Dillard, John T. "Centralized Control of Defense Acquisition Programs." IAMOT 2004 - New Directions in Technology Management: Changing Collaboration between Government, Industry and University. 3 -7 April 2004.

Dillard, John T. "Centralized Control of Defense Acquisition Programs: A Comparative Review of the Framework from 1987-2003." BPP Research Colloquium. 25 November 2003.

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