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The Last Frontier of Acquisition Reform: The Budget Process

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Abstract

In the last half of the 2010s, acquisition policy-makers returned their focus to rapid prototyping, modular open systems, commercial practices, and related concepts. With a number of alternative acquisition pathways created, many believe the last thing standing in the way of speed and agility is workforce culture. It is curious, however, how the most important tool in defense management has escaped reform since Robert McNamara installed it nearly 60 years ago. The program budget is the master controller of the acquisition system. It is an inherently top-down waterfall process based on "whiz kid" notions of linearity, determinism, and reductionism. This paper explores the wisdom of the traditional budget process based on organization rather than program. It proposes a 21st century agenda for budget reform, including specific examples of how Army appropriations can be gradually reclassified. The goal is to empower mission-driven organizations, allowing them to embrace an uncertain learning process using portfolio management. Financial management may then move out of the industrial era to better reflect a complex adaptive system view of the defense acquisition system.

Introduction

One of the buzzwords in defense acquisition is portfolio management. The Section 809 Panel's 2018–2019 reports highlighted the need to move from "program-centric to portfolio-centric" acquisition. It allows organizations to adapt more quickly to changing information by making trade-offs. The Section 809 Panel, however, argued that "portfolio management does not require a change in the overall federal approach for capital budgeting." This paper takes the other side of the argument. Without significant budgetary reform, defense management will remain program-centric. After all, the Pentagon's resource management system was founded on the concept of the *program budget*.

At first, Pentagon leaders halfheartedly implemented the first program budget in Fiscal Year 1952. However, when Robert McNamara took the helm as secretary of defense in 1961, programming was installed so dramatically that the budget process remains virtually identical more than 60 years later. Yet the program budget presents major difficulties. Studying its implementation in the Pentagon and around the world, budget scholar Aaron Wildavsky concluded in 1978 that "program budgeting does not work anywhere in the world it has been tried." Revisiting the question in 2013, Allen Schick concurred. He found program budget efforts "were rarely successful."

The programming aspect of the budget is the root cause of persistent issues facing requirements, acquisition, contracting, and workforce culture. This paper seeks to start a conversation on budget reform for the 21st century. It starts with a brief history of the defense budget. It then analyzes how program budgeting affects innovation. Finally, a roadmap to budget reform is proposed for constructive debate. The paper recommends program elements be aggregated into more meaningful categories that allow mission-driven organizations to exercise portfolio management. Such flexibility reflects the wisdom found in traditional methods of financial control dominant in the United States up through the 1950s.

History of the Defense Budget

Military budgets had a long-standing basis in organization and object. For example, organic appropriations for the Army identified organizations like the ordnance department, signal corps, and quartermaster, as well as object-oriented appropriations like military pay. The Navy had its system of bureaus including engineering, aeronautics, construction and repair, and so forth. Line-items under the appropriations identified objects of payment, such as wages, facilities, and supplies. In other words, financial control within the Army and Navy were based on *inputs*, such as the number and salary of positions filled. Financial control did not provide top planners the ability to determine the ends to which organizations worked. Budgets did not shape *outputs*.

The progressive era was marked by a desire for government to do more. Before World War I, the term *bureaucracy* conjured up notions of efficiency. It built on principles of straight-line hierarchy, zero redundancy, and neutral experts. Information flowed up to the top for analysis, and decisions flowed down for execution. However, information on the cost of achieving an output was hard to come by. Costs were managed in the same manner they were budgeted. It did not properly facilitate the economic analysis required to optimize future plans. If budgets were classified in terms of program outputs to be achieved rather than organizational inputs to be bought, then top planners could rationally calculate future action and measure performance.

Perhaps the first major discussion of the program budget arose between 1910 and 1912 during the Taft Commission on Economy in Government (Hagen, 1968). However, only select municipalities implemented the concept. In the 1920s, General Motors experimented with a programming system where it simultaneously planned car models two years out, developed cars a year out, and executed the current year model (Novick, 1967). Program budgeting, however, didn't make it to the federal level of government until 1949.

At the time, the Department of Defense had just been created along with a new service, the Air Force. Bitter disputes raged over the allocation of the shrinking budget, reportedly leaving the first Secretary of Defense James Forrestal weeping at his desk (Heilbrunn, 1992). When Forrestal's long-time friend Ferdinand Eberstadt led a task force on defense management, he pointed to the budget as "the principal means by which the Secretary of Defense carries out his duties to establish policies and programs, to exercise direction and control, and to take appropriate steps to eliminate duplication and overlapping" (*Report to the Commission*, 1948).

In Eberstadt's mind, the secretary of defense didn't need complete administrative control over the military departments. Instead, his review of the budget would assure policy goals were accomplished. But that required the budget identify program outputs rather than organizational inputs. One glaring problem was that the existing system couldn't control new program starts. For example, the Navy's supercarrier and Air Force's long-range bomber—which many considered duplicative—had future cost implications that were unaffordable. The secretary of defense needed a method for analyzing and approving military programs.

Eberstadt took it upon himself to draft Title IV of the National Security Act Amendment of 1949. In a bit of marketing, the program budget was titled the "performance budget" (*Implementation of Title IV*, 1953). By illuminating the cost of outputs, government programs could be measured and run on the basis of profit-and-loss (Burrows, 1949). The goal required identifying not just programs, but funds used for investment versus operations (*To Improve Budgeting*, 1950). This version of the program budget, including appropriations for Research, Development, Test & Evaluation (RDT&E) and Procurement, subdivided into program elements, continues to exist into the 21st century.

Yet the first program budget, scheduled for Fiscal Year 1952, never got fully implemented. The emergencies of the Korean War led to a series of crash budgets, which took precedence over careful programming requiring at least two years lead-time (Hewes, 1975). For several years after Title IV was enacted, the performance budget remained very much a "paper" plan. For the Army, where organizations and programs misaligned, some "scoffed" at it and passed budgets "whether or not the 'program' has caught up to it." Even the Air Force—which organized itself around the program budget concept—was "still regarded by many, including some of its own staff, as being an opportunistic and largely 'unplanned' organization" (Mosher, 1954).

Administrative scholar Frederick Mosher commented on the rise of the program budget. "It represents a quite radical departure from previous practice and previous ways of thinking," Mosher wrote in 1954. "Not only must new estimating methods and control techniques be developed; the very minds of the citizen, the Congressman, and perhaps most of all, the administrator must be trained to think in different terms. For all of our history—and long before it—we have conceived of financial management in the accounting terms of items to be paid for rather than of programs to be accomplished."

Mosher argued how the program budget led to two major problems. First, the problem of time. The programming process forced another layer of planning on top of the traditional budget process. Programs had to be articulated two years in advance of funding receipt in order to accommodate the one year allotted to budget preparation and review. Moreover, it can take four or more years for the agencies to obligate and then spend authorized funding. Program plans are thus articulated potentially six or more years ahead of execution. Mosher concluded that programming was impossible at the average installation because it doesn't have information that far in advance.

The second problem, of classification, impacted organizations. Mosher pointed the simple example of Fort Benning. The commander should plausibly have all his functions funded through a single source aligned with his military program. However, in support of Fort Benning is a medical facility. Should the head of the medical facility report through Fort Benning's commander and his military program, or through the surgeon general and his medical program? If the former, the surgeon general loses control of the medical care program, the total cost of which is not under his appropriation. If the latter, the commander at Fort Benning—a multi-function organization—begins to lose all control over his subordinates with each of them reporting to a different program and boss. Mosher demonstrated how the same issues in medical care extended to military personnel, training, installation support, and perhaps most of all, the technical services and bureaus, whose operations supported nearly every identifiable military program (Mosher, 1954). Herbert Simon (1946) summarized the problem when he said, "there's no such thing as a purpose, or a unifunctional (single-purpose) organization.".

Program budgeting implied a single organizational unit handles all aspects of a budgeted project. As former Secretary of Air Robert Lovett explained, "The whole idea of the performance budget is to set up a unit that is going to cost so much, put some fellow in charge of it, and give him the authority and hold him responsible" (*Implementation of Title IV*, 1953). The result is strong central direction from the staff because the program was devised prior to the performing organization. The Air Force aligned themselves to the program budget from the start because they did not have a long history of in-house technical services or bureaus. The Air Staff was comparatively strong, managing the portfolio of systems project offices (SPOs).

The Army and Navy did not adjust so quickly. Rather than complying, the Navy molded its program structure around the existing structure of its bureau system. The fundamental basis remained organizational. Funds for an aircraft carrier, for example, had to be spread across the

Bureaus of Engineering, Construction and Repair, and Aeronautics, if not others as well, because of their interdependency.

Unlike the Navy, the Army attempted to comply with the program budget. But unlike the Air Force, it had strong technical services which worked on programs jointly. The result was a mismatch. In the Army's budget process, the technical services sent up budget information by organization and object to the Army staff, which then translated the information using "statistics and guesswork" into program elements for submission to Congress. The appropriations were then translated back by the staff for lower level administration. No longer would the chiefs of the technical services go before Congress as independent pleaders for funds. It marked a shift in the balance of power from line to staff organizations.

Though change was set in motion, the program budget was not fully implemented. Instead of budgets reflecting carefully programmed plans balanced by the secretary of defense, a compromise was struck. During the Eisenhower administration, a budget ceiling was provided to the services who largely had free rein over further allocations (Huntington, 1959).

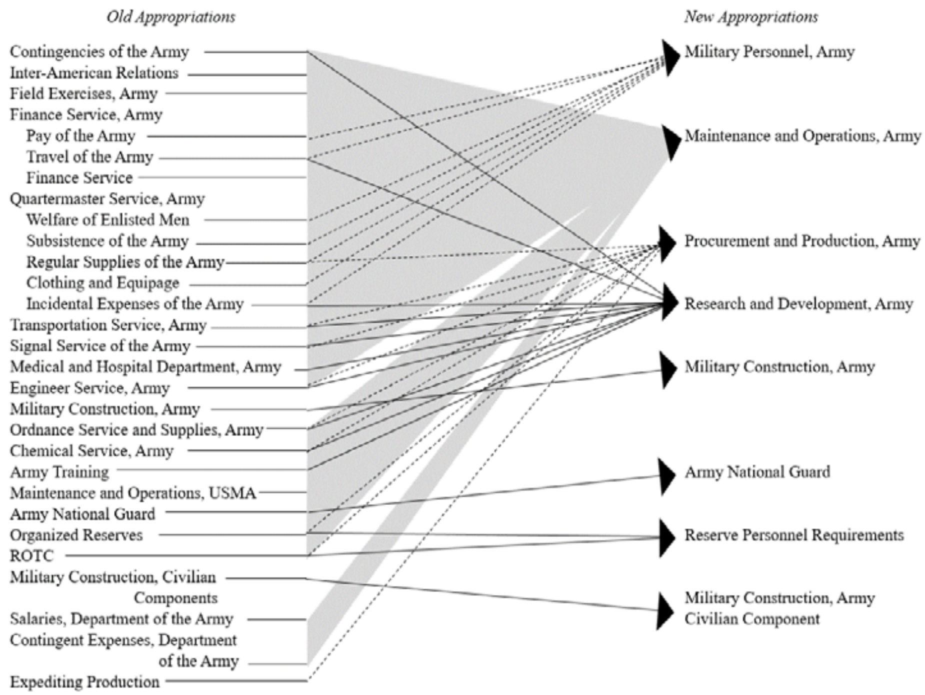

Figure 1. Reproduced from Mosher (1954) depicting Army budget structure before and after the performance budget. Note that the old appropriations clearly delineated organization and object. Statistics and "guess-work" was used to force the old appropriations into the new. Based upon Department of the Army, "Pertinent Data on Revised Budget Structure Based on Fiscal Year 1952 Budget Estimates as Transmitted to Congress."

While dormant, the program budget concept continued to find support through the 1950s in the economics department at RAND. Perhaps more clearly than others before, RAND analysts including Charles Hitch, Alain Enthoven, and David Novick recognized how the program budget required a revolution in quantitative analysis. Data from cost accounting systems could inform the cost of systems and components that extended down from program elements. This would inform the cost-side of the equation to balance the optimization of engineering specifications. The whole of the defense system could be then brought under rational management from an impartial group at the top which has access to the best cost-effectiveness information.

In 1960, Charles Hitch and Roland McKean published *The Economics of Defense in the Nuclear Age* where they laid out their vision for the twin concepts of program budgeting and systems analysis. Presented in the economic jargon of the day, the authors explained that the goal was to "facilitate an economic calculus within the services" (Hitch & McKean, 1960). They called it the Planning-Programming-Budgeting System, or PPBS. Former comptroller and current president of Ford Robert McNamara got tapped for secretary of defense the next year. Seeking to implement the PPBS as quickly as possible, he placed Hitch as comptroller and his "whiz kid" colleague Enthoven as director of the Office of Systems Analysis.

The program budget process started from military requirements set by the JCS in the Joint Strategic Objectives Plan. The service staffs then interpreted the requirements into well-defined program packages in the Draft Presidential Memoranda (DPMs), submitted for review by OSA and the secretary of defense. The systems analysis laying out a quantified program plan became unquestionably the largest factor in Secretary McNamara's decisions (Roherty, 1970).

After elaborate stages of review and revision, ASD Comptroller then tied together all the information for the entire Department of Defense. The result—reminiscent of socialist industrial plans—is a Five-Year Defense Program (FYDP),[1] a register of approved program elements with budget estimates for the next five years. The services could only request changes to the FYDP by submitting a Program Change Proposal (PCP) to OSA. Program formulation became increasingly prescribed by Tentative Force Guidance (TFG).

The TFX aircraft, later the F-111, became an early test of McNamara's managerial philosophy. It required a long program definition phase in which costs and specifications were estimated according to a systems analysis. The single system sought to fulfill Air Force and Navy requirements for interceptor, fighter-bomber, *and* strategic bomber. Even legend of the Atlas ICBM Bernard Schriever said of the TFX, "I completely agree with the steps that are being taken with respect to it" (*Systems Development and Management*, 1962). The program quickly became a fiasco of incredible proportions. By the end of the 1960s, the Air Force had not developed a successful fighter in nearly a decade, leading to heavy use of Navy aircraft and missiles during the Vietnam War.

When Melvin Laird took the helm at the Pentagon in 1969, he promised change from McNamara's overly centralized decision process. But rather than reforming the PPBS itself, what Laird accomplished was the devolution of programming initiative to the military services. Systems analysis and program budgeting remained central tools of management. John Dawson wrote in *Armed Forces Comptroller* in 1972 how "today is not a replay of the 1950s" because PPBS principles were "firmly established" throughout the department (Young, 2009).

The program budget was only ever applied to the acquisition functions, RDT&E and Procurement. The operating appropriations for Military Personnel and Operations & Maintenance (O&M) have a fundamental basis organization, object, or activity. Program analysis focused primarily on the acquisition budgets, though the outcome wasn't always the plan. In 1962, David Novick hoped that the programming system could be applied to military operations.

The core aspects of the PPBS have not been seriously addressed since the 1960s. Titles have changed. For example, the Draft Presidential Memorandum is now the Program Objectives Memorandum. Virtually unchanged are the appropriations, the justification books, and the entire process surrounding it. In 2001, the PPBS was rebranded the Planning-Programming-Budgeting-Execution, or PPBE, process. It is one of the three primary management systems as described in the Defense Acquisition Guide, along with the requirements and 5000-series acquisition processes. Yet the PPBE must be considered the most important tool for shaping the Department of Defense. Programs can succeed without validated requirements or approved milestones, but never without money.

[1] Today it is called the Future Years' Defense Program.

How the Budget Affects Innovation

The budget necessarily looks to the future. Line-items based on particular projects and outputs necessitate numerous predictions about future states of technology, the economy, threats, and user preferences. The predictions must extend for many years if not decades. The rational calculus of choice demands that lifecycle cost estimates be compared for alternative programs. As Charles Hitch wrote, “Economic efficiency demands that alternative programs, of different sizes and using qualitatively different weapon systems, be costed *prior* to the selection of the preferred program” (emphasis added; Hitch & McKean, 1960).

The program budget’s reliance on prediction makes it fragile to fundamental uncertainties and changes of information. These “unknown unknowns” frequently confront attempts to create new military technologies. Before the PPBS, the services confronted uncertainty with incremental decision making. For example, a 1963 RAND study found that of the Air Force’s six most recent fighters, four ended up with different engines than originally planned, three with different electronic systems, and five with different airframes. Similarly, the Army solved ballistic missile reentry through repeated trial-and-error testing, one material and shape at a time, rather than articulating a low-risk plan based on exhaustive models and studies (Poole, 2013). These typical examples highlight how innovation cannot always proceed as planned, without zigzags or breaks.

Flexibility associated with trying things out, learning what works, and updating plans became increasingly difficult in the post-PPBS years. Noticing the problem, PPBS co-founder Roland McKean later commented how “central responsibility for programs several years ahead and a natural desire to keep the agencies from constantly reopening issues may convert what ought to be sequences of decisions into one-shot decisions” (McKean & Anshen, 1965).

As a partial remedy, McKean recommended providing “untrammeled funds for R&D” to the lower levels, and keeping parts of the budget “to be scheduled” (McKean & Schlesinger, 1967). This better aligned with traditional methods. Previously, financial control did not limit the initiative of the line organizations, allowing them to make use of local knowledge and exercise management by real options. After the PPBS, program budgets had to be planned two or more years in advance, creating a significant lock-in problem. Figure 2 summarizes the differences between programming and traditional budgeting practices.

Organization/Object Budgeting	Program Budgeting
• Inputs……………………………………..	• Outputs
• Incremental choices…………………	• Long-range choices
• Technology push……………………	• Requirements pull
• Respond to change…………………..	• Implement a plan
• Synthesis/induction/empirical………	• Analysis/deduction/theoretical
• Continuous planning………………..	• Planning as discrete event
• Portfolio management………………	• Program offices
• Partitioned contracts………………..	• Lead systems integrator
• Trial-and-error………………………	• Optimization
• Line organization…………………...	• Staff office
• Parochial doers……………………...	• Neutral experts
• Complex……………………………	• Complicated
• Iterative feedback…………………...	• Linear stage-gates
• Agile development…………………	• Waterfall development
• People focused………………………	• Project focused
• Bottom-up…………………………..	• Top-down
• Working groups/networks…………..	• Hierarchy
• Combinatorial innovation…………...	• “Weapons” approach
• Options……………………………...	• Lock-in
• Dynamic…………………………….	• Static
• Loosely coupled……………………	• Tightly coupled
• Redundancy…………………………	• Performance
• Hedged bets…………………………	• Single-best approach
• Competition…………………………	• Monopoly
• Exchange……………………………	• Allocation
• Interactions create structure………..	• Structure creates process
• Adapts to the unexpected…………..	• Is fragile to the unexpected

Figure 2. Comparison of Organizational/Object Budgeting and Program Budgeting

The following will sketch the various ways program budgeting affects four major areas of defense management: requirements, acquisition, contracting, and workforce.

Requirements: The logic of the program budget is impossible to disentangle from the requirements process. The program initiates in response to an articulated military need. Requirements help set the parameters upon which alternative specifications are measured, costed, and selected. The formal requirements process sprang in response to systems analysis and program budgeting.

- In order to be justified as low risk, requirements usually gravitate towards defining the technical and performance characteristics of a system rather than a broadly stated mission outcome. As Jacques Gansler (2008) noted: “Another significant shortcoming in the requirements process is that the budget process is driven by individual weapon line-items. Thus, the requirements process considers individual weapons first and establishes requirements for next-generation weapons.”.

- Requirements setters do not often have a technical background themselves. Major J. M. Lutton described how requirements were often set in 1975: “The project officer, usually without detailed technical knowledge himself, had to develop the required item characteristics without a factual basis and put them into a document. Where did he get the characteristics? You guessed it—from a fertile and sometimes overactive imagination!”
- More often than not, large defense firms carry the overhead to market concepts to military officials in order to influence the requirements. It can act as a barrier to entry for other firms. An executive of a defense contractor boasted in 1970, “We have the technical superiority and are on the offensive. We spoon-feed them. We ultimately try to load them with our own ideas and designs, but in such a way that, when they walk away from the conference table, they are convinced it was their idea all along” (Sims, 1970).
- The requirements approach, as an absolute need to achieve military policy, encourages the services to “build up a case” for what they want. As Frederick Mosher (1954) commented, it can lead to an irresponsible attitude within the services that can be expressed: “This is what I need. … It will not be possible to do my job without all of it. If you make any cuts, you assume full responsibility for any dire consequences which may result.”.
- Often, the best military systems did not respond to requirements. These include continuous aim-firing (Morison, 1966), the atomic bomb (AMF, 1966), ballistic missiles (Perry, 1967), the jet engines (Perry, 1979), the F-16 and F-18 (Lofgren, 2018), and more recently the internet, GPS, night vision, lasers, stealth, and UAVs (Hagan, 2011). As the Army requirements and concepts panel wrote in 1974:

  > In the opinion of our team, historically the most successful developments or the most useful operational equipment have not resulted from the “requirements” process, while building and trying equipment in response to a good idea has a much higher batting average—particularly if normalized to resources expended. Significant examples can be cited where the establishment actively resisted the introduction of a materiel system (Jeep, Christie Tank, P-51 Fighter Aircraft, SIDEWINDER and the previously mentioned U.S. Army rifles). (Office of the Secretary of the Army, 1974)
- Requirements are best utilized when continuously generated with user interaction, rather than as a discrete event before technical demonstration. Just as technology should react to requirements, requirements must react to the fast-paced change in technology. As William Roper commented, “The technology changes that quickly … CONOPS [concept of operations] and the warfighting approaches are going to have to adapt at a speed that’s equivalent” (Tirpak, 2020).

The traditional budget based on organization and object allows managers to decide upon projects regardless of whether the style is requirements pull or technology push. Often, users are not good at specifying their needs when it comes to transformative technologies. Innovators bring new products into the world and satisfy unrecognized needs. However, user requirements are important to make it fit-to-purpose and for guiding incremental improvements. Ultimately, a nonlinear interaction of requirements and technology improves the rate of progress fastest. The traditional budget doesn’t bias the interaction, whereas the program budget implies a linear movement from requirements to technology.

Acquisition: The milestone acquisition process is a linear stage-gate approach to technology. One effect of program budgeting is that it fixes attention on fully integrated weapon systems. Each program is built “full-stack” with tightly coupled interfaces, rather than built up from a family of components, standard interfaces, and enterprise toolsets to drive down scale.

- Programs are planned to proceed from prototyping to development, test, and production without concurrency or iterative feedback. For example, the V-22 Osprey was intended to replace the CH-46 in the 1980s. Rather than moving linearly through the milestones, V-22 full-scale development took three iterative rounds and more than 20 years before an operational version could be fielded (Whittle, 2011). The example also shows how new technologies are expected to meet all requirements on the first try, rather than fielding a minimally viable product and iterating on a steeper progress curve than the prior system.
- Changes to program plans, whether within the fiscal year or through the FYDP, undermines the purpose and integrity of the program budget concept. Updating programs through reprogramming or otherwise reflects execution of an ad hoc plan, rather than the approved baseline plan. Equally volatile is the justification process, where requests are modified by numerous layers of review in the Pentagon and Congress. As Heidi Brockmann (2011) observed, "budget outcomes at the program level are routinely unpredictable."
- Milestone acquisition decisions, such as initiation into Engineering and Manufacturing Development, does not release program funding. Milestone decisions must be anticipated through the budgeting process two years in advance in order for funds to be available on time. The acquisition and budget plans mirror each other, but are only formally connected at the level of the service secretary or deputy secretary of defense.
- With more than 50 offices involved in a regular Milestone B decision, it is unlikely that transformative or novel technologies will be approved. As Boeing's former chief designer George Schairer recognized:

  > Anything that the majority agrees to probably is wrong for tomorrow. It is right for today, but probably not right for tomorrow. I wonder about such wild ideas as you would ever fly an airplane with a jet engine or have an atomic bomb or radar, or many of the great things we base our defense upon. At the time they were initiated, certainly any group of 10 people you could have get together, presumably knowledgeable, would probably have voted them all down. (*Major Systems Acquisition Reform*, 1975)
- Whereas government used to support a wide array of different components and subsystems independent of particular weapons, the program budget provides most component funding through programs. Chairman of the Board of General Electric Ralph Cordiner described the shift in 1959:

  > Where the need was once for a large number of general-purpose components and subsystems, the demand is increasingly for complete systems and even supersystems. The need for components of very high reliability and advanced design remains, but they must more and more be planned in context with the concept and design of the system of which they are to be a part. (*Weapon Systems Management*, 1959)
- Enterprise tools like Cloud One and Platform One in development by the Air Force fundamentally serve multiple programs. Such efforts are difficult to get funded because they represent enabling technologies rather than program outputs. William Roper said, "Airplanes look awesome. Satellites look cool. And they are made in people's districts and flown in people's states and employ people. Digital transformation … is harder to fit into the budget process" (Barnes, 2019).

Traditional budgets identified organizations, some of which aligned with programs, such as the Navy's Bureau of Construction & Repairs and Bureau of Aeronautics, while others provided components, enabling tools, and cross-functional support, such as the Bureau of Engineering and the Bureau of Ordnance. These independent organizations competed and cooperated with each other on an ever-evolving set of programs, which could be managed as a portfolio by the bureau chiefs. Rather building each program “full stack,” government organizations either developed components (e.g., missiles from China Lake) or provided significant technical support to prime contractors (e.g., ship construction in Norfolk).

Contracting: The program budget also forces the linear waterfall approach onto the contracting process. Contract requirements must reflect the detail of the program plan. The size and scope of the program task gravitates to a single major contract awarded to a Lead Systems Integrator, whose team and technical plan is detailed in their proposal. The program budget biases contracts to major winner-take-all efforts. The long planning period of the budget also means there is little money available for new technologies or companies not anticipated by the program plan.

- If a company demonstrates a new technology that military users want, and all parties are ready for the next stage, it will take a minimum of two years for a new program plan to get justified through the bureaucracy and approved by Congress. This is called the “valley of death” for technology transition. The current-year program executes a plan devised two years earlier. Moreover, the five-year budget plan creates additional inflexibilities to updating. Traditional budgets did not constrain the redirection of funds to different purposes, enabling rapid movement of funds to scale emerging technologies.
- In order to assign responsibility to contractors on multi-year efforts, programmed budgets often push towards integrated contract orders. For example, Total Procurement Package and Total System Performance Responsibility had an entire acquisition outsourced in a couple major contracts estimated at the beginning. These often encounter the familiar problems of buy-in, lock-in, and bail-out. A report on military spending prepared for Congress in 1969 concluded that “total-package and other large contracts should be broken down into smaller, more manageable segments” (*Report on Military Spending*, 1969).
- Various components of the total system often progress at different speeds. Information learned in one area may cause extensive rework, and following the set plan may cause neglect of opportunities. As RAND analysts wrote in 1958:

  > Any attempt to schedule an entire R&D program at one time is likely to lead to inefficiency, either because plans for the later stages may have to be scrapped and remade on the basis of information yielded by early tests, or because, in pursuing premature plans, a development program may fail to profit from new information gained along the way. Either case will cause delays, or raise costs, or both. (Klein et al., 1958)

- Partitioned contract tasks allow the program plan to remain open to learning and updating. Oliver Williamson described five advantages of partitioned contracts: (1) reduces uncertainty/discretion and increases reliability of evaluation; (2) supports parallel R&D efforts; (3) supports work on adaptable components that provides optionality; (4) permits more competition and increases eligible contractors; (5) lends itself to sales and employment stabilization (Williamson, 1967).
- Program budgets require program-oriented reporting systems to measure progress to plan. These systems extend down to the contractors, who must update their cost accounting systems to track a Work Breakdown Structure of end-item components to support future estimates. Waterfall planning and control systems like Earned Value Management were installed at contractors in order to provide timely updates to necessary changes in the budgeted plan. They represent a rigid encumbrance on management.

- The program budget has been described as a contract between policy-makers and administrators, outlining the requirements, cost, and schedule of work to be performed. Though it isn't legally enforceable, programming represents a tightly coupled contract of enumerated requirements. Inflexible requirements are often carried forward through industry contracts. Whereas the F-4's development contract had only two pages of specifications in 1955, a decade later the C-5A solicitation contained 1,500 pages (Poole, 2013). By 1980, the C-17 specification consisted of more than 13,500 pages (Watts, 2008). As Frederic Scherer testified, "given the kinds of technical problems characterizing modern-day weapons developments, inflexibility of contractual instruments is incompatible with economy" (*Weapon Systems Acquisition Process*, 1971).

The traditional budget looks like a relational contract. Instead of limiting discretion of the performer by fully defining the requirements and incentives, relational contracts are loose and vague. They provide flexibility to adapt to unpredictable situations though a lack of specificity as to exactly what is supposed to get done and how. When government organizations have flexibility in defining the program, they keep their options open by partitioning program tasks across components and time. Partitioned tasks allow for more competition and faster feedback on performance. Contracts can thus depend more on reputation than legally binding requirements.

Workforce: One of the major impacts of the program budget is that it puts projects and functions ahead of people and organizations. It pulls crucial decisions away from those with the best and most timely knowledge and gives it to those at the top, with less knowledge of the particulars and has no responsibility for execution. The program budget has coincided with the lengthening of programs beyond human timelines of accountability. Where once, brand new fighter aircraft and nuclear submarines could be fully developed in five years, it now takes 10 or 20 years.

- While organizational budgets evoke the response, "How can we trust people to do the right thing?" it is not true that program budgets work in a zero-trust environment. Because the estimating and decision process is so complicated, it requires high levels of competency and trust. Allen Schick wrote,

  > Without exception, performance-based reforms can be effective only in well-managed governments which have low corruption, elevated levels of public trust, highly-skilled and well-motivated public employees, reasonably efficient and accessible public services, attentive media and groups, and the freedom of citizens to communicate their concerns to government. (Schick, 2013)
- While industrial era processes required tight controls over repetitive labor, the information era requires the cultivation of knowledge workers. The program budget shifted attention away from people and toward programs. However, fast-paced innovation requires a focus on training and culture, better supported by organizational budgets. As John Boyd often said, it's "People, ideas, and hardware—in that order!" (Wilcox, 2012). Decades later, famed tech entrepreneur Ben Horowitz (2013) wrote how "we take care of the people, the products and the profits, in that order."
- Professionals have a desire to contribute their knowledge and experience to solving hard problems. They do not desire executing standing orders in the program plan, turning budgets into purchases for hire in a routine process. As Hyman Rickover put it, "As long as a man will accept dictation in a technical matter he is not a professional person" (*Organization and Management of Missile Programs*, 1959).
- The program budget caused the loss of in-house technical knowledge for the services. Programming implied the unifunctional SPO concept, which only became

institutionalized in the Army and Navy after the technical services and bureaus lost their statutory role in 1962 and 1966, respectively. In the 1950s, government in-house performance on R&D was roughly 25%–35% in the Army (*Organization and Administration*, 1954). The Navy maintained more than a 30% workshare up until the 1970s (*Department of Defense Appropriations*, 1969).

- Since the rise of the program budget, in-house effort has been minimal. Yet in-house technical knowledge is crucial for making a smart buyer. The ability to evaluate depends often times on the person's ability to do the work itself and stay current on advances. Starting with Kessel Run in 2017, the Air Force has begun to bring back in-house product development in the form of software. In 2020, there are well over a dozen "software factories" in the Department of Defense using a combination of military, civilian, and contractor coding talent.
- The program budget creates incentives to conceal errors rather than exposing them for correction. Approved program plans are assigned to managers not responsible for their conception, but whose careers depend on things not failing. As Aaron Wildavsky (1978) wrote, "Line-item budgeting, precisely because its categories (personnel, maintenance, supplies) do not relate directly to programs, are easier to change. Budgeting by programs, precisely because money flows to objectives, makes it difficult to abandon objectives without abandoning simultaneously the organization that gets its money for them."
- Managers will often be open to lower budgets so long as they have greater freedom of decision rights. When executing what is often thought to be a flawed plan, managers will spend more time padding budgets to minimize personal risk. As Samuel Huntington (1959) noted, "The subordinate, if forced to choose, normally prefers fewer resources and greater freedom to allocate them as he sees fit than more resources less subject to his control. The result is a balance in which the subordinate acquiesces in the authority of the superior to limit resources while the superior leaves to the subordinate a relatively free hand in how he uses them."

Because the people closest to the work have the best information to make decisions, they should be treated as professionals and allowed to make trade-off decisions. Tighter feedback loops between action and outcome, between appropriation and expenditure, and between plan and reality, will increase accountability of the workforce. This is possible within the incremental decision framework of traditional budgets on organization and object.

Budget Reform Proposal

If the 21st century is about competition, moving fast, iterating, and knowledge work, then how could the defense budget process be reformed to align with these realities? The first thing to acknowledge is the monumental impact of budget reform. Any change should move deliberately. The second thing to acknowledge is that the traditional budget, which lasted into the 1950s, has centuries of accumulated lessons built into it but also needs updating for the new millennium.

The following will propose a multi-phase plan for replacing the program budget with a classification system of mission-driven organizations. It uses the Army as an example for how the reclassification might work. While the proposal is as thoroughly ambitious as it is incomplete, the intent is to draw attention and discussion to the question of budget reform.

Phase I: Consolidating B.A. 6.4. The Pentagon has occasionally consolidated program elements into more meaningful portfolios. In the late 1990s, there was a Reinvention Team dedicated to program element consolidation (AFAR, 1998). The impacts primarily coalesced in the Air Force which consolidated C4ISR program elements in the early 2000s. They did so according to “nodes” which often aligned with organizations like the Air Operations Center (AFSAB, 2003).[2]

A good place to start consolidating program elements is RDT&E Budget Activity 6.4, which represents entry into the prototyping phase of the acquisition system. Inflexibility in B.A. 6.4 is one of the most glaring problems in the Pentagon’s ability to access commercial innovators. Funding gaps of two or more years are common. Creating flexibility in B.A. 6.4 is crucial for bridging the valley of death for the next generation of technologies and companies.

The Army’s Fiscal Year 2021 request, for example, has 39 program elements in B.A. 6.4. Those program elements are subdivided into 96 projects in the justification books with funding estimated out five years. For the upcoming fiscal year, the 96 projects are further subdivided into 285 project sublines and more than 600 cost categories. The detail conjured up over two years of programming and review restrict the ability for managers to exercise real options.

The first phase of budget reform could consolidate B.A. 6.4 program elements by the performing technology labs or Program Executive Officers (PEOs). For example, planned B.A. 6.4 funding destined for the six program offices and directorates underneath PEO Soldier would be allocated directly to the PEO without project line-itemization. This allows the PEO to treat technology transition funding as a portfolio. Funds can quickly be routed to the most promising projects available in the year of execution rather than from two years before. The PEO could assign funds to the program offices with the best plans or start specialty projects which could mature into their own program offices.[3]

RDT&E budget activities reflect the larger problem of linearized product development. B.A. 6.4 funding is often transitory to the rest of the acquisition process. Defense labs, PEOs, and related organizations will still need to lay in five-year plans due to the variance in prototyping starts. For example, the Army’s Rapid Capabilities and Critical Technologies Office had purview over about $286 million of B.A. 6.4 funding in FY 2020 but requires more than $714 million in FY 2023 to execute prototyping for hypersonic missiles and air defense. That plan can be laid in the FYDP for organizations like the RCCTO as a whole to be managed as a portfolio. Changes to future year budgets for B.A. 6.4 can be updated incrementally from a service-wide level.

Phase II: Consolidating RDT&E. While B.A. 6.4 funding can ebb-and-flow for organizations at the PEO level, total funds for RDT&E as a whole will more consistent year-to-year. The same operation that was performed for B.A. 6.4 can be done for the RDT&E appropriation as a whole. RDT&E will have no budget activities or program elements, but rather expose line-items based on technology labs, PEOs, and related organizations or systems commands. The organizations can be connected to enterprise-level requirements rather than particular weapons programs.

For example, the Army’s 2021 budget request had 267 RDT&E program elements. These program elements are ultimately subdivided into 2,883 project sublines in the Army’s RDT&E budget justification documents, detailed across 5,203 pages. From two years ahead,

[2] More recently, there has been minor consolidation of prototyping efforts in RDT&E Budget Activity 6.4, including: (1) the Army’s Technology Maturation Initiative; (2) the Navy’s Rapid Prototyping, Experimentation, and Demonstration initiative, and (3) the Air Force’s Strategic Development Planning and Experimentation office. However, for the FY 2021 budget request, only the Air Force treated the program element as a portfolio. The $219 million requested was delineated by two projects: Experimentation and Prototyping. The Air Force briefly explained for Experimentation, “specific plans are not detailed to prevent locking into an approach that will likely shift.” For Prototyping, a few sentences were given on the general types of technologies and requirements.

[3] The author agrees with the Section 809 Panel recommendation for permitting “the initiation of all new starts, provided Congress has appropriated sufficient funding” (2019, Vol. 3, Pt. 1, Rec. 52).

the Army plans and justifies RDT&E project plans to Congress in buckets that average less than $10 million each. It takes the Army another three years before 90% of appropriated RDT&E funds are expended, with limited opportunity to shift priorities.

Currently, PEO Soldier manages 130 programs of record, with another 253 products and non-programs of record managed by six program offices or directorates (PEO Soldier, 2020). Rather than justifying budgets for each program discretely, the replacement would perhaps expose PEO Solider as a single RDT&E line-item. In all, the Army may have something like 31 line-items based on Army organizations, which already align with various mission requirements including Medical, Aviation, Ground Combat, and so forth. Each line-item may continue having narratives of project plans and accomplishments, but without identifying funding at the project level.

Army Futures Command	Assistant Secretary of the Army (Acquisition, Logistics & Technology)
Staff + Direct Reports	Staff + Direct Reports
Armaments Center	JPEO Armaments and Ammunition
Army Research Lab	JPEO Chemical and Biological Defense
Aviation & Missile Center	JPEO JTRS
Comms-Electronics RDE Center	PEO Aviation
Chemical & Biological Center	PEO Command Control Communications Tactical
Data & Analysis Center	PEO Combat Support and Combat Service Support
Ground Vehicles Systems Center	PEO Enterprise Information Systems
Soldier Center	PEO Ground Combat Systems
Cross-Functional Teams	PEO Intelligence, EW, and Sensors
Futures & Concepts Center	PEO Missiles and Space
	PEO Simulation, Training, and Instrumentation
	PEO Soldier
	Rapid Capabilities and Critical Technologies Office
	Medical Research and Materiel Command
	AL&T Integration Office
	Tank-automotive Life Cycle Command
	Aviation and Missile Life Cycle Command
	Communication-Electronics Life Cycle Command
	Joint Munitions & Lethality Life Cycle Command

Figure 3. Notional Structure of Army Acquisition Budget Elements

Each mission-funded organization may also identify their estimated obligations in two broad classifications. First, by object such as personnel, travel, transportation, facilities, and contracts. Second, by activity such as Joint Capability Areas or MIL-STD 881 system types. Organizations may freely transfer funds between object or activity, as well as between themselves, so long as the flows are later reported.

This aligns well with traditional budgets. For example, the 1952 Army budget request had 24 organic appropriations totaling $13.7 billion. Of the total, $5.1 billion went to the Ordnance Service, which detailed its costs in two major ways. First, direct and reimbursable obligations by nine object classifications, as well as by 14 activity classifications including procurement of ammunition and maintenance of Army aircraft. A report on intra-governmental funding transfers was also provided.

On a related topic, in 2019 the Defense Industrial Board recommended the creation of a new "colorless" appropriation for software programs. It doesn't segregate programs by RDT&E, Procurement, and O&M. The proposal recognizes the nonlinearity of effort, particularly software which has foundations in agile and DEVOPS practices. This marks the realization of a decade-long reform initiative (Morig, 2013).

The FY 2021 budget introduced RDT&E B.A. 6.8 for software pilots. Yet this appropriation doesn't appear to be truly "colorless" because it doesn't integrate funding from the O&M activities supporting the software programs. B.A. 6.8 is a special activity within RDT&E alone. The Phase II recommendation essentially expands B.A. 6.8 from software pilots to include all of RDT&E, identified by organization rather than program.

Moving to a "colorless" appropriation before programming is addressed presents numerous issues. Not only does it lead to knotty questions over program ownership, previously unidentified program funds would have to be pulled out of the O&M appropriation. That would make the O&M slice of funds *less flexible.* Currently, O&M funds do not require program justification and five-year budget estimates. The O&M appropriation, ironically, can react faster to innovations than the acquisition appropriations.

First, program line-items must be traced to—and replaced with—mission-driven organizations. Then distinctions between RDT&E, Procurement, and O&M can be removed. The objective is to increase flexibility in the acquisition appropriations, not decrease flexibility in O&M.

Phase III: Future Years Defense Program. The next increment of reform may be releasing the RDT&E appropriation from five-year planning. At the higher level, year-to-year budgets shouldn't fluctuate as much due to a staggered progression of a portfolio of systems through the development cycle. The mission-funded organizations can then make decisions incrementally and favor modularity in the RDT&E portfolio.

Like the Operations & Maintenance appropriation, RDT&E would not identify budget plans through the FYDP. Quantity production of major hardware like capital ships and aircraft may still require program line-items and five-year estimates in the Procurement appropriation because of their large costs and long-term implications. However, smaller hardware buys and the primary structure of Procurement may start consolidating along similar lines as RDT&E.

Phase IV: Organizational Budget. Eventually, after much experimentation and calibration with the previous phases, the linear appropriations of RDT&E, Procurement, and O&M may be replaced with mission-driven organizations. Acquisition and sustainment organizations may roll into their logical systems commands. For example, Army PEO Aviation, PEO Missiles & Space, and Aviation and Missile Life Cycle Command may roll under Army Aviation and Missile Command. All are already co-located at Redstone Arsenal. Some mappings may require choices, such as PEO Soldier. Located in Fort Belvoir, it doesn't neatly fit under any existing systems command. Perhaps it reports to headquarters or even Army Forces Command.

Instead of the acquisition functions reporting directly to the service acquisition executive and sustainment functions reporting to military commanders, there will be an integrated command for development, production, and sustainment. Each service acquisition executive may be able to delegate ACAT IC programs to the command level, ACAT II programs to the subcommand level (e.g., PEO), and ACAT III/IV programs to the program office or installation level. This pattern reflects the current delegation of authority in the services.

Assistant Secretary of the Army (Acquisition, Logistics & Technology)	Systems Command Structure
Medical Research and Materiel Command…………	Army Medical Command
PEO Aviation……………………………………….	Aviation and Missile Command
PEO Missiles and Space……………………………	Aviation and Missile Command
Aviation and Missile Life Cycle Command………..	Aviation and Missile Command
JPEO Chemical and Biological Defense……………	Chemical Materials Activity
PEO Command Control Communications Tactical...	Communications-Electronics Command
PEO Enterprise Information Systems………………	Communications-Electronics Command
PEO Intelligence, EW, and Sensors………………...	Communications-Electronics Command
PEO Simulation, Training, and Instrumentation……	Communications-Electronics Command
Communication-Electronics Life Cycle Command...	Communications-Electronics Command
Staff + Direct Reports………………………………	HQ Department of the Army
Rapid Capabilities and Critical Technologies Office	HQ Department of the Army
Acquisition Support Center…………………………	HQ Department of the Army
AL&T Integration Office…………………………...	HQ Department of the Army
PEO Soldier………………………………………...	HQ Department of the Army
JPEO Armaments and Ammunition………………...	Joint Munitions Command
Joint Munitions & Lethality Life Cycle Command...	Joint Munitions Command
PEO Combat Support and Combat Service Support..	Tank-automotive and Armaments Command
PEO Ground Combat Systems……………………...	Tank-automotive and Armaments Command
Tank-automotive Life Cycle Command……………	Tank-automotive and Armaments Command

Figure 4. Notional Mapping of Army Acquisition Organizations to Major Commands

The overall appropriation structure currently used by the Army and the proposed structure are side-by-side in Figure 5. The matrixing of dedicated systems commands, operational commands, and functional support reflects the reality of the defense enterprise.

Current Army Appropriations
Military Personnel
Reserve Personnel
National Guard Personnel
RDT&E
Aircraft Procurement
Other Procurement
Missile Procurement
WTCV Procurement
Ammunition Procurement
Operations & Maintenance
O&M Army Reserve
O&M Army National Guard
Environmental Restoration
Working Capital Fund
Military Construction

Proposed Army Appropriations	Type
Headquarters Department of the Army...	HQ + Direct Reports
Army Futures Command……………….	Science & Technology
Aviation and Missile Command……….	Systems Command
Communications-Electronics Command	Systems Command
Chemical Materials Activity…………...	Systems Command
Joint Munitions Command……………..	Systems Command
Tank and Armaments Command………	Systems Command
Medical Command……………………..	Systems Command
Sustainment Command………………...	Functional Support
Financial Management Command……..	Functional Support
- *Pay and Expenses of the Army*……….	Military Pay
- *Contracting Command*……………….	Functional Support
- *Security Assistance Command*……….	Functional Support
Installation Management Command…...	Functional Support
Training and Doctrine Command………	Functional Support

Military Construction National Guard	Army Forces Command………………..	Operational Command
Military Construction Reserve	Army Service Component Commands…	Operational Command
Base Realignment and Closure	Military Construction…………………..	Military Construction
Family Housing	Army Reserve…………………………..	Reserves
	Army National Guard…………………..	National Guard

Figure 5. Comparison of Current Appropriation Structure for the Army with the Proposed Appropriations

In the justification documents, each appropriation may detail subcommands (e.g., labs, PEOs, life-cycle centers, component commands). Moreover, each subcommand may estimate obligations by classifications based on object and activity. Additional ad hoc information on past project outcomes, work load indicators, and future plans can be provided in a combination of qualitative and quantitative data.

There are many questions that remain for research, including: (1) expanding analysis for the services and defense-wide; (2) reconciling with statute and the Financial Management Regulation; (3) tracing budget lines to individual organizations; (4) pinpointing conflicts and multiple funding; (5) the assertion of civilian control; (6) treatment of Overseas Contingency Operations funds; (7) a comparison with Goldwater–Nichols principles; (8) the role of program accounting and analysis; (9) the role of the requirements process; (10) the effect of continuing resolutions; and (11) the wisdom of shifting budget directly to the service labs, which currently obtain a large percentage of funding through programs owned by acquisition organizations.

Conclusion

Any change in the budget will require intimate coordination with all stakeholders, including the president and Congress. If policy-makers provide program flexibilities through the budget, there will have to be additional reporting mechanisms to keep policy-makers informed about where the funding actually went, how the programs performed in test and operations, and what roadmaps are in place. In other words, program analysis and cost-effectiveness will remain important but will not be married to the budget process.

Portfolio management has long been a goal in defense acquisition. It remains elusive because the budget process focuses attention on individual weapons. Limited program element consolidation and calls for greater reprogramming authority do not provide the necessary flexibilities.

A promising reform agenda has appropriations tied to major organizations rather than programs. Congress could then rigorously check up on what actually happened, tightening the feedback cycle of accountability. By delegating authority, emphasizing speed, and measuring real value rather than predicted value, policy-makers can better pinpoint responsibility and provide rewards or punishment depending on the outcomes. This better reflects the heritage of defense management found in budgeting to organizations and objects.

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