The DoD Budget Process
The Next Frontier of Acquisition Reform

Eric M. Lofgren

ABSTRACT

The budget process is the "master controller" of virtually everything that is done in the Department of Defense, yet it hasn't seen real reform since 1961. The current waterfall process from the industrial era requires prediction and control of programs from two years out, and then locks them in for five or more years into the future. Defense acquisition studies have repeatedly asserted the need to move away from program-centric stovepipes and toward portfolio-centric management. Yet half of all Research, Development, Test & Evaluation programs proposed for FY2021 are less than $29 million, with limited flexibility to take advantage of new opportunities. 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 program elements can be consolidated and appropriations reclassified. The goal is to empower mission-driven organizations, allowing them to accelerate innovation by embracing an uncertain learning process through portfolio management.

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 tradeoffs. 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 half-heartedly 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 nearly 60 years later. Yet the program budget presents major difficulties. Studying its implementation in the Pentagon and around the world, budget scholar Arron 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 affect 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

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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. (Heilman, 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." (Hearing, 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 could 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." (Hearing, 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 (Hearing, 1950a). 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 precedent over careful programming requiring at least two years lead time. (Hewes Jr., 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

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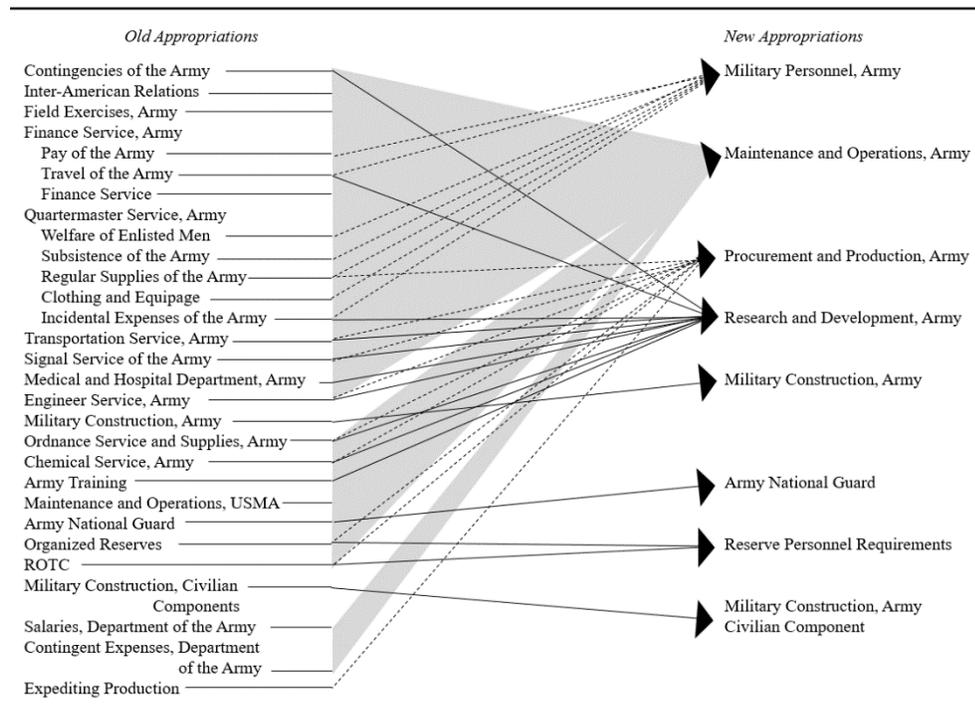
Reproduced from Mosher (1954) depicting Army budget structure before and after the program budget. Note that the old appropriations clearly delineated organization and object. Statistics and "guess-work" was used to force the old appropriations into the new. Based upon Department of the Army, "Pertinent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

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 summarized the problem when he said "there's no such thing as a purpose, or a unifunctional (single-purpose) organization." (1946)

Program budgeting implied that a single organizational unit must handle 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." (Hearing, 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 jointly worked on programs. 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)

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 then 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 (OSA).

The program budget process started from military requirements set by the Joint Chiefs of Staff in the Joint Strategic Objectives Plan and then OSA would issue its Tentative Force Guidance. The services received the directions and made them 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, which proved cumbersome or non-responsive.

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." (Hearing, 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

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

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.

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 "Cen-

tral 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. Table 1 on page 6 summarizes the differences between programming and traditional budgeting practices.

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 noted: "Another significant shortcoming in the requirements process is that the budget process is

Table 1. Comparison of Organizational/Object Budgeting with Program Budgeting

Organizational/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-centric management
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

driven by individual weapon line-items. Thus, the requirements process considers individual weapons first and establishes requirements for next-generation weapons" (2008).

• 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).

• 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 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" (1954).

• 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 US Army rifles)" (AMARC).

• 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 that can achieve 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 over 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 observed, "budget outcomes at the program level are routinely unpredictable." (2011)

- 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." (Hearing, 1975)

- Whereas government used to support a wide array of different com-

ponents 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." (Hearing, 1959a)

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 Lakes) 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 Package Procurement 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." (Hearing, 1969a)

- 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 over 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." (Hearing, 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 5 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 wrote how "We take care of the people, the products and the profits, in that order." (2013)

• 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." (Hearing, 1959b)

• 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 to 35 percent in the Army. (Hearing, 1954) The Navy maintained more than a 30 percent workshare up until the 1970s. (Hearing, 1969b)

• 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 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." (1978)

• 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 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." (1959)

Because the people closest to the work have the best information to make decisions, they should be treated as professionals and allowed to make tradeoff 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 based 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.

Consolidating RDT&E

A brief examination demonstrates the level of control placed on future defense plans. The Army's 2021 budget request, for example, represents less than 2 percent of the Pentagon's total request. Yet it

Figure 2. Notional Structure of Department of Defense RDT&E Program Element.

Note: Base budget RDT&E excludes classified funds.

identifies 182 RDT&E program elements (PEs) that are ultimately subdivided into 2,883 budgeted program account codes (BPACs) in the budget justification documents, detailed across 5,203 pages. From two years ahead, the Army plans and justifies RDT&E project plans to Congress according to BPACs that average less than $10 million each. And then it takes the Army another three years before 90 percent of appropriated RDT&E funds are expended, with limited opportunity to shift priorities. Congress controls the transfer of funds at the PE level, which for Army RDT&E had a median value of $28 million and a mean of $69 million in the 2021 request.

The first phase of budget reform could consolidate RDT&E program elements by the performing technology labs or Program Executive Officers (PEOs). For example, funds destined for the six program offices and directorates underneath PEO Soldier could be allocated directly to the PEO. This enables the PEO to treat the RDT&E of its 130 acquisition programs and another 253 products and non-programs of record as a portfolio (PEO Soldier, 2020). 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.

In all, the Army RDT&E may have something like 24 line-items based on Army organizations which already align with various mission requirements including Soldier, Medical, Aviation, Missiles & Space, and so forth. The consolidation from 182 program elements to 24 represents a contraction by a factor of 7.6, corresponding to an increase in portfolio size from $69 million to $523 million. The Navy, Air Force, and DoD-Wide accounts can be consolidated by similar magnitudes sketched in Figure 2.

Due to the differing requirements of acquisition organizations and their smaller laboratory counterparts, the range of RDT&E program elements can be expected between $200 million and perhaps $2 billion or more. The portfolio sizes are not extravagant. By comparison, a typical venture capital firm allocates $207 million per year, with large firms allocating well over $1 billion annually (FundersClub, 2019). The portfolios are

Figure 3. Notional Mapping of Army RDT&E Structure at the Lowest Level for a Selected Major Thrust, Guided Multiple-Launch Rocket in Budget Activity 6.7.

Dept.	Appropriation	Budget Activity	* // ** // *** Acquisition Program Elements	Major Thrust	BPAC	FY21 ($M)
Air Force	Military Personnel	6.1	JPEO Armaments and Ammo	Aviation Rocket System		
	Reserve Personnel		JPEO Chemical and Bio Defense	End Item Industrial Preparedness		
	Natl Guard Personnel	6.2	JPEO JTRS	Guided Multiple-Launch Rocket	Alt. Warhead	$14.515
	RDT&E		PEO Aviation	Joint Auto Deep Ops Coord (JADOCS)		
	Aircraft Procurement	6.3	PEO Combat Support and Combat	Long Range Precision Fires (LRPF)	Guided MLRS	$61.060
	Other Procurement		PEO Command Control Comm Tactial	Lower Tier Air and Missile Defense		
	Missile Procurement	6.4	PEO Enterprise Information Systems	Missile/Air Defense		
Army	WTCV Procurement		PEO Ground Combat Systems	MLRS Product Improvement		
	Ammo Procurement	6.5	PEO Intelligence, EW, and Sensors	Other Missile Product Improvement		
	Ops & Maintenance		PEO Missiles and Space	Patriot Product Improvement		
	O&M Army Reserve	6.6	PEO Simulation, Training, and Instr.			
Navy	O&M Natl Guard		PEO Soldier			
	Environ. Restoration	6.7	RCCTO			
	Working Capital Fund		Medical Research & Material			
	Military Construction	6.8				
DoD-wide	MILCON Reserve					
	MILCON Natl Guard					
	Base Realign. & Closure					
	Family Housing					

also reasonable when compared to the historical standards of the Department of Defense. For example, the FY 1950 request for the Army's Ordnance Service was $6.8 billion in constant 2020 dollars. (Hearing, 1950b) Two years later during the height of the Korean War, the Ordnance Service requested an astonishing $70 billion constant 2020 dollars. (Hearing, 1952)

In the historical defense budget process, major organizations like the Ordnance Service detailed their appropriations in two primary ways. First, direct and reimbursable obligations by nine object classifications (e.g., wages, facilities), as well as by 14 activity classifications including procurement of ammunition and maintenance of Army aircraft. A summary report on intra-governmental funding transfers was also provided.

An alternative method proposed here would keep the structure and process underlying today's budget shown in Figure 4. The RDT&E appropriations would identify the labs and PEOs as individual program elements. Underneath that, the project (i.e., major thrust) level would identify military outputs. BPACs showing insight one level lower will also be used, particularly for the larger efforts. The structure allows the organizations, usually led by Senate-approved flag officers, the ability to treat their programs as a portfolio. Real-time information systems should provide regular updates to Congress about how funds are moved between projects within the portfolios.

Continued Consolidation

The next increments of reform may be releasing the RDT&E appropriation from

linear budget activities and five-year planning. At the program element 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 on an agile basis. Like the Operations & Maintenance appropriation, RDT&E should not identify budget plans through the FYDP. Over time, the Procurement appropriation may follow a similar trajectory of program element consolidation as RDT&E.

Ultimate Objective

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. Bud-

Table 2. Comparison of the Current and Proposed Appropriation Structure for the Army.

Current Army Appropriations	Proposed Army Appropriations	Type
Military Personnel	Headquarters Department of the Army	HQ + Direct Reports
Reserve Personnel	Army Futures Command	Science & Technology
National Guard Personnel	Aviation and Missile Command	Systems Command
RDT&E	Communications-Electronics Command	Systems Command
Aircraft Procurement	Chemical Materials Activity	Systems Command
Other Procurement	Joint Munitions Command	Systems Command
Missile Procurement	Tank and Armaments Command	Systems Command
WTCV Procurement	Medical Command	Systems Command
Ammunition Procurement	Sustainment Command	Functional Command
Operations & Maintenance	Financial Management Command	Functional Command
O&M Army Reserve	Pay and Expenses of the Army	Military Pay
O&M Army National Guard	Installation Management Command	Functional Command
Environmental Restoration	Training and Doctrine Command	Functional Command
Working Capital Fund	Army Forces Command	Operational Command
Military Construction	Army Service Component Commands	Operational Command
Military Construction National Guard	Military Construction	Military Construction
Military Construction Reserve	Army Reserve	Reserves
Base Realignment and Closure	Army National Guard	National Guard
Family Housing		

get scholar Frederick Mosher reached a similar conclusion back in 1954: "The budget plan and the program plan of a large agency may quite properly and necessarily not be the same thing. Their scope and coverage are almost certain to differ in some respects; their relation to time periods differs; the organization units and individuals primarily concerned for each may be different; the channels through which they proceed may well be parallel but not identical." He recommended a budget along the following lines: (1) each command or technical service should constitute an organic class in the budget; (2) each subcommand, a class at the second level; (3) each installation, a class at the third level; (4) each activity at the installation, a class at the fourth level. (Mosher, 1954) The budget structure proposed in this paper draws on similar logic, though installations at the third level may be replaced with military programs, program offices, or requirements.

To explain the proposed structure, consider the Army subcommands including PEO Aviation, PEO Missiles & Space, Aviation and Missile Life Cycle Command, Security Assistance, and Army Test Center. They all currently report to Army Aviation and Missile Command, which could become its own organic appropriation. Financial authority from the command level to the subcommand level would then move along the same lines as administrative authority. In the Navy, the NAVSEA systems command includes various PEOs such as Ships, Submarines, and Carriers, as well as functional organizations such as Industrial Operations (SEA 04), Systems Engineering (SEA 05), and Warfighting Capability & Enterprise (SEA 06). The Air Force could expose its Major Commands (MAJCOMs) including Air Force Materiel Command and Space Systems Command. The overall appropriation structure currently used

Figure 4. Relationship of Organizations and Capability Areas in the FY 2021 Space Force Acquisition Budget.
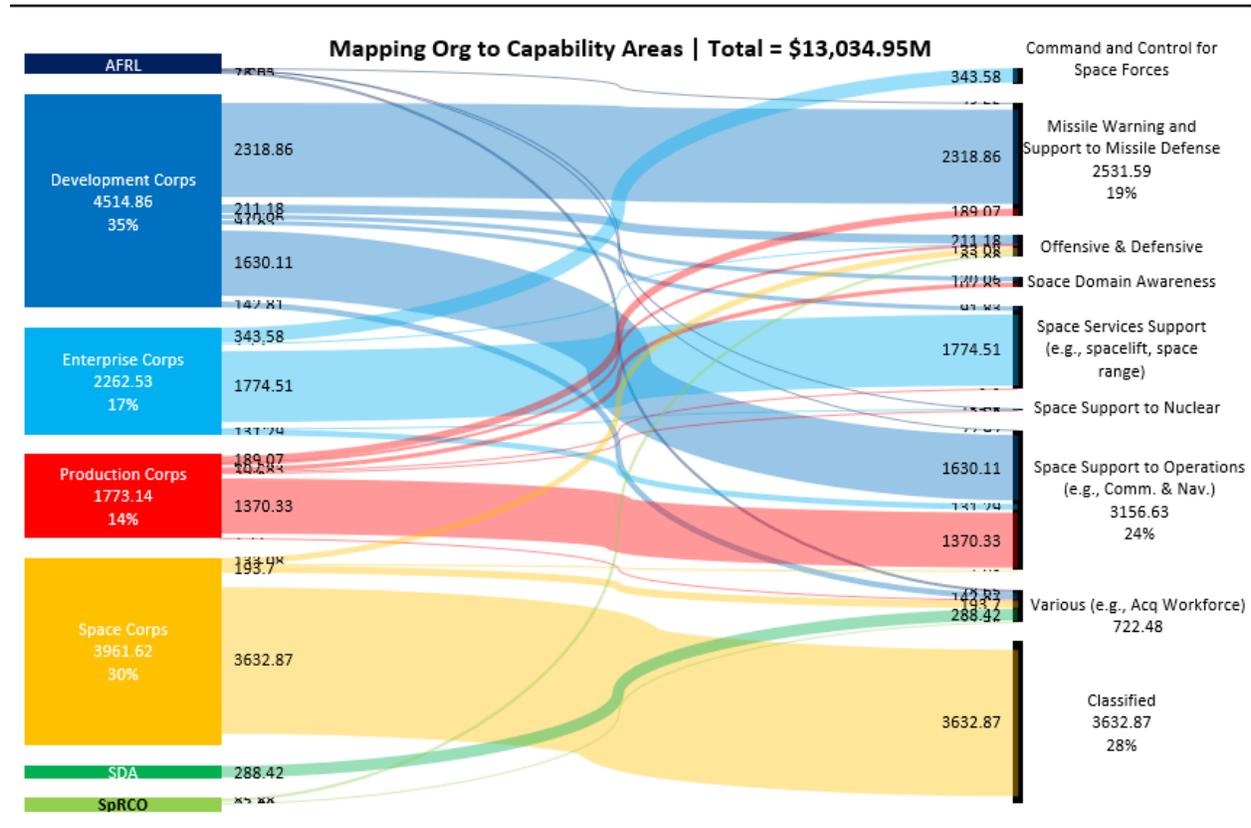
Sankey diagram showing the Space Force's FY 2021 RDT&E and Procurement budget request mapped by the author to SMC 2.0 organizations (left) and their relationship to the Space Force's proposed capability areas (right). Note that a single capability area is jointly performed by several Program Executive Offices. The "Classified" capability area handled by the Space Corps would likely also be spread across capability areas if its contents were known.

by the Army and the proposed structure are side-by-side in Table 2. The matrixing of dedicated systems commands, operational commands, and functional commands reflects the reality of the defense enterprise.

Why Not Capability-Based Budgets?

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 distributed but coherent organizations like the Air Operations Center. (AFSAB, 2003)

More recently in May 2020, the Space Force proposed to Congress an "Alternative Acquisition System." Its "most important recommendation" is the consolidation of budget line items into capability portfolios to "enable agility in

the execution year to rapidly respond to emerging threats and evolving requirements." Examples of capability portfolios included Missile Warning and Defense, Offensive and Defensive Space Control, and Communications and Navigation. The problem with capability portfolios, particularly in the Space Force since it reorganized into Space and Missile Systems Center 2.0, is that it results in a many-to-many relationship between organizations and capabilities. The lab directors and PEOs cannot perform the

portfolio management role if they have only partial interest in program elements shared with other organizations. Movement of funds within the year of execution would likely require the higher levels to adjudicate competing claims for priority. The issue of many-to-many relations between organization and capability area for the Space Force FY2021 RDT&E and Procurement budget is depicted in Figure 4.

Another problem with capability areas is that it focuses attention back on program stovepipes rather than the interrelations of programs. By contrast, organizational budgets focus attention on people and culture. In many cases, existing organizations reflect coherent missions: PEO Enterprise Information Systems in the Army; PEO Unmanned and Small Combatants in the Navy; and PEO Mobility and Training Aircraft in the Air Force. Effective program outcomes often require the coordination of various participant and stakeholder organizations. Some PEOs focus on platforms (e.g., PEO Ships) while others focus on subsystems (e.g., PEO Integrated Warfare Systems) or enterprise services (e.g., PEO Digital). The way defense organizations coordinated themselves in the 1940s and 1950s was through committee structures, such as the Munitions Board and the R&D Board, where leaders jointly agreed to program plans and were simultaneously responsible for their execution. A different historical precedent comes with the Navy's pluralistic interwar organization that included the General Board, the Navy War College, the Bureaus, and the Chief of Naval Operations. (Kuehn, 2008 & Kuehn, 2017)

What About A "Colorless" Appropriation?

In 2019 the Defense Innovation Board recommended the creation of a new "colorless" appropriation for software programs. Funds would not be directed to product lifecycle categories such as RDT&E, Procurement, and O&M. The proposal recognizes the nonlinearity of technology efforts, 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, which is intended to be colorless despite its residency in the RDT&E appropriations. However, 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 innovation than the acquisition appropriations, as perhaps indicated by the Air Force's Big Safari program.

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.

Today's Organizational Budgets

There already exist several examples of organizations successfully managing a portfolio of efforts under consolidated program elements.

• The Joint Artificial Intelligence Center (JAIC) requested $132 million in FY 2021 RDT&E that supports a portfolio of projects within the general mission to develop, test, prototype, and demonstrate innovative artificial intelligence.

• The Space Development Agency (SDA) has its own RDT&E appropriation where $288 million is split across just two program elements.

• The Space Rapid Capabilities Office (SpRCO) is funded through a single RDT&E program element of $104 million.

• The Strategic Capabilities Office (SCO) manages a handful of program elements, by far the largest being Advanced Innovative Technologies which is nearly $700 million in FY 2021 and was over $1 billion in years past.

• The Joint Improvised-Threat Defeat Organization (JIDO) managed a portfolio of projects dedicated to a mission outcome. Up until FY 2020, JIDO had a single program element funded between $100 million and $300 million annually. The Defense Innovation Board highlighted JIDO's budget process as key to its ability to harness agile development across a wide range of new technologies. (Shull, 2019)

Prior Approval

New starts of a program element or project underneath it requires prior approval from the Office of Management & Budget and four Congressional committees (McGarry, 2020). The same is true of terminations. Such restrictions negate the primary benefit of portfolio-management, which is the ability to quickly start, pivot, ramp up, or cancel projects underneath consolidated program elements.

The Section 809 Panel recommended allowing the Pentagon to initiate new starts without prior approval, provided the sufficiency of appropriated funds. A good starting-place, however, is expanded use of the 30-day notification letter to Congress. The process currently only applies to new starts costing less

than $10 million for the entire effort. The dollar thresholds on new starts could be raised and apply only to the life of the appropriation rather than the lifecycle cost of the new start.

Reprogramming

Below-threshold-reprogramming (BTR) refers to the movement of funds between program elements not subject to prior approval. For RDT&E, BTRs are capped at $10 million or 20 percent of the program element, whichever is less. The Section 809 Panel noted that reprogramming thresholds have been falling in real dollar terms. As a percent of the budget title outlays, between 1963 and 2018 the RDT&E reprogramming threshold fell by half (Section 809 Panel, 2019).

Though flexibility within a program element increases with consolidation, flexibility between program elements decreases. The 858 RDT&E program elements in the FY 2021 budget can theoretically accumulate $5 billion in BTRs.[2] Consolidation to roughly 120 program elements result in just $1.2 billion of cumulative BTRs, a contraction of three-quarters. In order to retain similar reprogramming authority without prior approval, the thresholds could be raised.

Oversight

Increased transparency into the Department of Defense is consistent with the goals of budget flexibility. Current communication with Congress comes through justification books, staffer day briefs, and staffer questions. These processes should

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2. Cumulative BTRs can be limited in another way. When a reprogramming crosses an appropriation, it contributes to transfers capped by the General Transfer Authority and the Specific Transfer Authority, which were $4.0 billion and $2.0 billion in FY2020.

continue and be complemented with regular reports showing new starts, funding movements within consolidated program elements, and other critical information. Digital dashboards should provide real-time insight into financial execution status, planned execution burndown, major program events, and PEO synopses of portfolio execution. The organizational structure allows Congress to know exactly who is in charge of what effort and facilitates communication. As Shawn Barnes said when defending budget consolidation, "in today's information environment, there's no reason why would couldn't give [Congress] habitual, routine access to information". (Tadjdeh, 2020)

Further Research

Many research questions remain, including: (1) tracing budget lines to individual organizations; (2) reconciliation with statute and the Financial Management Regulation; (3) assuring transparency and oversight to Congress through modern information systems; (4) barriers to reform in Congress, including the border wall reprogramming dispute;[3] (5)

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3. In FY 2020, the executive branch moved $3.8 billion from defense to the boarder wall program without prior approval of Congress. Because Congress did not restrict the movement of funds through statute, the executive branch claimed it did not require Congressional prior approval to reprogram the funds (McGarry, 2020). In response, the House Appropriations Committee wrote in the Department of Defense Appropriations Bill Report for FY 2021, "The granting of additional budget flexibility to the Department is based on the presumption that a state of trust and comity exists between the legislative and executive branches regarding the proper use of appropriated funds. This presumption

pinpointing conflicts and multiple funding; (6) the assertion of civilian control; (7) treatment of Overseas Contingency Operations funds; (8) a comparison with Goldwater-Nichols principles; (9) the role of program accounting and analysis; (10) the role of the requirements process; and (11) the effect of continuing resolutions.

CONCLUSION

Any change in the budget will require intimate coordination with all stakeholders, include the President and Congress. If policymakers provide program flexibilities through the budget, there will have to be additional reporting mechanisms to keep policymakers 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 budget line items 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

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is presently false." The committee said it "understands" the intent of program element consolidation and "does not reject it outright," but will not reconsider the proposal until "the Department's leadership recommits to honoring Congress's constitutional power of the purse."

value rather then predicted value, policymakers can better pinpoint responsibility and provide rewards or punishment depending on the outcomes. This better reflects the heritage of defense management in the United States found in budgeting to organizations and objects.

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ABOUT THE AUTHOR

Eric Lofgren is a Research Fellow at the Center for Government Contracting in the School of Business at George Mason University (GMU) where he performs research writes and leads initiatives on business, policy, regulatory, and other issues in government contracting. He manages the daily blog Acquisition Talk and produces a podcast with the same name where he speaks with leading experts in the field.

Lofgren was an Emergent Ventures Fellow at Mason's Mercatus Center. Prior to joining Mason, he was a senior analyst at Technomics, Inc., supporting the Defense Department's Cost Assessment and Program Evaluation office. There, he participated in dozens of major defense program cost estimates, led policy development the Contractor Cost Data Reporting system, supported economic studies such as for the Space Industrial Base, Better Buying Power, and uses of inflation and escalation. He has also sup-ported government analyses for the Government Accountability Office, NAVSEA, Canada Public Works, and the Deputy Assistant Secretary of the Army (Cost and Economics).

Mr. Lofgren is an expert in cost estimation and defense contract business data. He has won five best paper awards at the International Cost Estimating and Analysis Association including best paper overall. During his time at George Mason, he has written five reports on the federal contracting data and policies related to the COVID-19 response, a Naval Postgraduate School symposium paper on acquisition reform, and a book manuscript on the history of weapon systems acquisition. He has appeared on Government Matters three times and published several articles in Defense News and the Federal Times.

Lofgren earned his BA in history and economics from Virginia Polytechnic Institute and State University, and his MA in economics from George Mason.

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