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# Fixed vs. Flexible Approaches to Improving Capital Investment in Military Depots<sup>1</sup>

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## Introduction

The military depots form a vital component of America's defense capability, providing for the repair, rebuilding, and major overhaul of weapon systems (e.g., ships, armored vehicles, missile systems, and aircraft), their parts, assemblies, and subassemblies<sup>2</sup>. In FY 2014, the DoD spent \$31.4 billion on depot-level maintenance and repair work (Office of the Assistant Secretary of Defense, Logistics & Materiel Readiness [OASD(L&MR)], 2015).

As of 2007, each of the three military departments is required by law to make an annual capital investment in its depots at a rate of at least 6% of their combined average revenue.<sup>3</sup> The required investments have been made to support military construction, facilities maintenance and repair, and equipment procurement and process installation.

This requirement was enacted in response to the deteriorating capabilities of depots during the 1990s, which lawmakers and military leaders attributed to insufficient investments

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<sup>1</sup> This is an abridged, preliminary version of the final report, which will be released in June 2018.

<sup>2</sup> The DoD maintains a wide range of weapon systems, including 237 ships, 14,444 aircraft/helicopters, 884 strategic missiles, and 391,520 ground combat and tactical vehicles (OASD[L&MR], 2015). In FY 2014, approximately 53% of the depot-level workload was accomplished in government-owned facilities; the remainder was accomplished by the private sector in commercial facilities (OASD[L&MR], 2015).

<sup>3</sup> Through the use of revolving fund structures (i.e., working capital funds), the depots earn revenue via the "sale" of their services to military customers (i.e., military operating units); see Part IV "Funding Capital Investment."



in facilities, equipment, and human capital. According to the Government Accountability Office (GAO; 2001a), this lack of investment could be traced to the “DoD’s downsizing of its depot infrastructure and workforce since the end of the Cold War, [which] was done without sound strategic planning” (p. 3).

Indeed, by the end of the millennium, the DoD had outsourced a number of logistical support functions to the private sector, including weapon system maintenance and repair activities, with some arguing that inadequate consideration was being given to the definition and protection of so-called “core” capabilities.<sup>4</sup>

In light of increasing budgetary pressure at all levels of government, improving strategic investment decision-making—the process of correctly identifying, evaluating, and selecting among projects that will have the greatest impact on the organization’s ability to perform its mission—is of critical importance. In the case of military depots, there is debate over whether the mandated minimum investment requirement facilitates or inhibits strategic investment decision-making.

For instance, although the law does not place upper limits on annual capital investment, there is an implicit assumption that 6% is and will continue to represent an adequate (minimum) level of investment *and* that previous years’ revenues represent the appropriate sum upon which to base the 6%. This is unlikely to be the case. At the same time, it might be argued that in the absence of dedicated funding, routine investment in depots will be overlooked—that it, in fact, was overlooked—to fund more visible, higher-profile programs and projects. This report explores the impact of funding mechanisms on decision-making, investment levels, and capabilities.

Barrett and Greene (2013) assert that “when funds are dedicated, often from a special revenue stream,” the advantage of consistent funding “buffers a program from the powerful wind of changing political climate” (p. 1). They contrast dedicated funding (or “earmarking”) with “one-fund-fits-all” (i.e., general fund financing), which gives legislators and managers more financial flexibility to move funds as needs change.

They conclude, “Unfortunately, there’s no overridingly best practice here—no black or white... but understanding the pros and cons of both routes to funding holds out the hope of coming to the right answer for a particular project” (p. 1). This report evaluates these pros and cons, as well as any barriers to change, within the context of military depot funding. Ultimately, it seeks to determine if and how current capital investment policy should be modified in order to optimize depot capabilities.

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<sup>4</sup> Since 1984, law has required that the DoD maintain a government owned and operated logistics capability (including personnel, equipment, and facilities) to ensure “a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements” (10 U.S.C. § 2464).



## Capital Investment Requirement

The 2007 National Defense Authorization Act (NDAA; 10 U.S.C. § 2476), *Minimum Capital Investment for Certain Depots*—like the statues (Core<sup>5</sup>, 50/50<sup>6</sup>) that preceded it—was enacted to safeguard and strengthen the DoD’s organic capabilities in the face of downsizing, base closures, and the preference for increased contracting.

Prior to its enactment, the Air Force, in its 2002 *Depot Maintenance Master Plan*, committed to allocate \$150 million each fiscal year for six years, beginning in 2004, in order to correct for years of underinvestment (DoD, 2006). The Air Force noted that past capital investment, which had averaged 3% of total depot revenue, led to a significant equipment purchase backlog of approximately \$200 million. *The Air Force Depot Maintenance Strategy*, published for the first time in 2002, envisioned an annual capital investment level of 6% of revenue (DoD, 2006). According to the Air Force, this level of investment was in line with levels seen in the private sector (DoD, 2006).<sup>7</sup>

In 2005, Congress commended the Air Force for its proactive capital investment strategy. In Section 324 of the 2006 NDAA, entitled *Sense of Congress Regarding Depot Maintenance*, Congress stated that “the *Depot Maintenance Strategy and Master Plan of the Air Force* reflect the essential requirements for the Air Force to maintain a ready and controlled source of organic technical competence, thereby ensuring an effective and timely response to national defense contingencies and emergency requirements.” It is perhaps unsurprising, then, that a version of the Air Force plan made its way into law a couple years later.

Meanwhile, in 2006, the DoD issued an overarching *Depot Maintenance Strategic Plan*, which articulated its plans for “ensuring its organic depot maintenance infrastructure is postured and resourced to meet the national security and materiel readiness challenges of the 21st century.” The *Strategic Plan* formalized the 6% investment figure cited by the Air Force across the DoD:

Each DoD Component that operates organic depot-level maintenance activities will establish a programming goal for depot maintenance capital investment. The minimum annual funding target for each DoD Component

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<sup>5</sup> 10 U.S.C. § 2464—core logistics capability statute—reads, in part, as follows: “It is essential for the national defense that the Department of Defense maintain a core logistics capability that is Government-owned and Government-operated (including Government personnel and Government-owned and Government-operated equipment and facilities) to ensure ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements.”

<sup>6</sup> 10 U.S.C. § 2466 states that “not more than 50 percent of the funds made available in a fiscal year to a military department or a Defense Agency for depot-level maintenance and repair workload may be used to contract for the performance by non-Federal Government personnel of such workload for the military department or the Defense Agency.”

<sup>7</sup> The 6% figure was based on an Air Force study that examined capital investment levels in commercial firms engaged in maintenance, repair, and overhaul (MRO). The study concluded that MRO firms’ capital investments averaged out to about 6% of revenue. Commercial firms make capital investments to further business objectives; previous years’ revenues may be a consideration, but do not form the explicit basis upon which investments are made.



will be an amount equal to six percent of its combined funded core-sustaining workload. Expected implementation is not later than the FY 2009–14.

The *Strategic Plan*, like the 1996 policy, used core-sustaining workload as the basis for investment. A year later, the *Strategic Plan* was superseded by the minimum investment requirement, and, like the Air Force strategy, used total revenue as the basis.

The 2007 statute, 10 U.S.C. § 2476<sup>8</sup>, reads as follows:

Each fiscal year, the Secretary of a military department shall invest in the capital budgets of the covered depots of that military department a total amount equal to not less than six percent of the average total combined maintenance, repair, and overhaul workload funded at all the depots of that military department for the preceding three fiscal years.

The statute warrants a second read in order to appreciate the details and their implications. One should note the following:

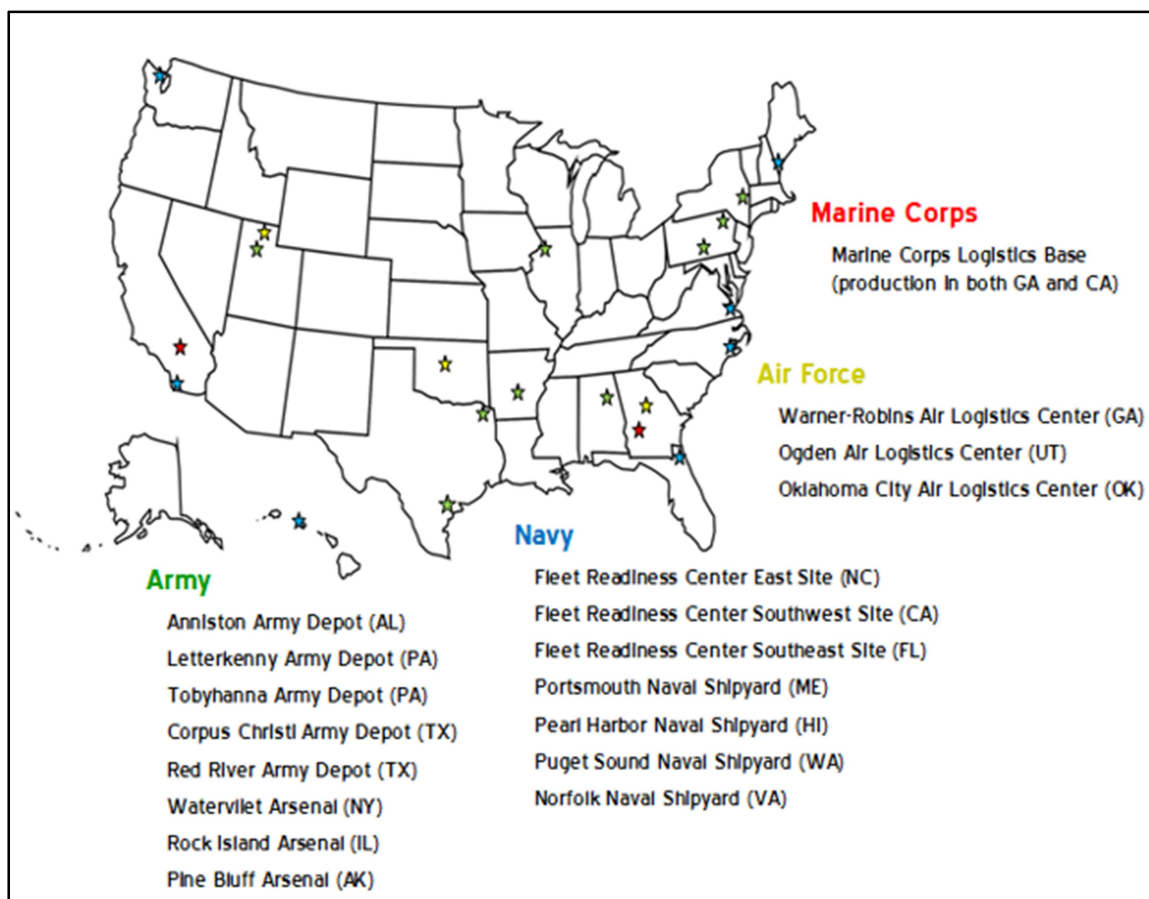
- The 6% requirement is a “floor,” as opposed to a “ceiling.” Some of the military departments have invested well over 6% in a given year.
- The statute does not require uniform investment across a military department’s covered depots.
- The basis for the calculation is the “workload funded at *all* the depots of that military department [emphasis added],” but only investments made in the “covered” depots count toward meeting the 6% requirement.<sup>9</sup>

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<sup>8</sup> The Secretary of Defense may waive the requirement for reasons of national security.

<sup>9</sup> For example, the Army’s organic industrial base comprises 13 depots and arsenals, but only investments made in the eight “covered” depots count toward meeting the 6% requirement.





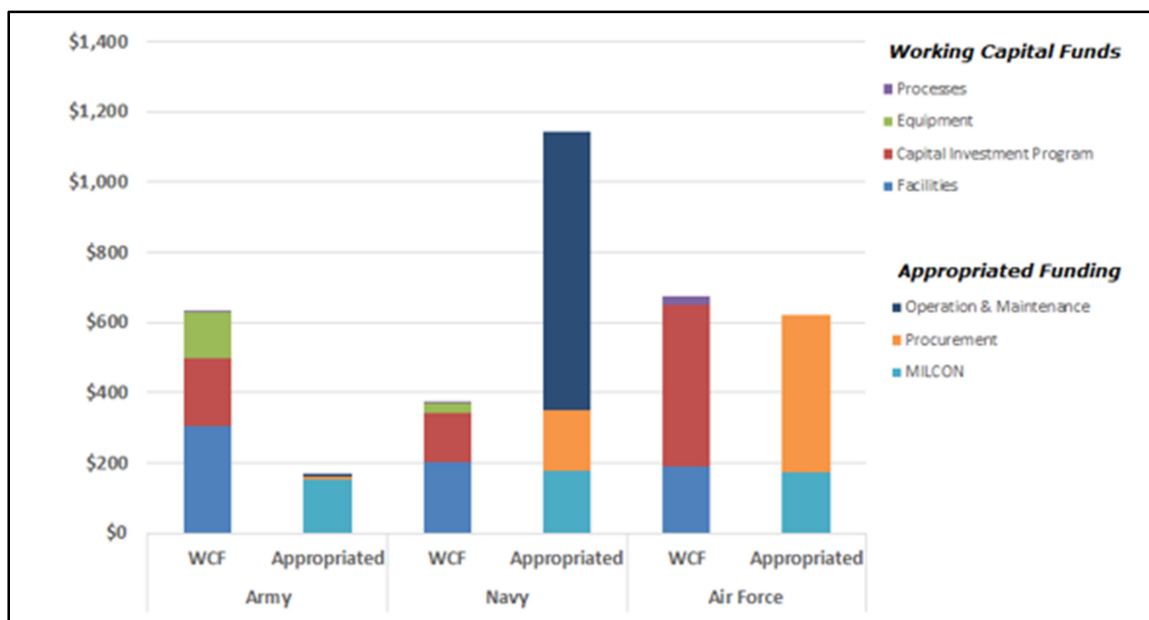
**Figure 1. 20 Covered Depots**

### Funding Capital Investment

Capital investment in the military depots is financed through direct congressional appropriation and through the military departments' working capital funds.<sup>10</sup> Working capital funds have been in use by the DoD, and other government organizations, for several decades. Support organizations (e.g., the depots) set their own rates and manage cash flow. In effect, each depot relies on revenue from the "sale" of its services (to DoD customers and, less often, to other U.S. government and foreign customers) in order to finance their operations.

Figure 2 compares the sources of capital investment funding within the Air Force, Navy, and Army over a three-year period between FY 2015 and FY 2017. Note the relative lack of uniformity among the three departments in terms of the composition of investment sources. In particular, the Air Force and Navy have relied significantly more on appropriated funding in recent years. In fact, representatives from the Air Force have noted that if not for the high levels of appropriated funding, the department would have found it very challenging to meet the 6% requirement (DoD, 2014).

<sup>10</sup> The Navy's shipyards are not funded through working capital funds, but through appropriations.



Note. Navy data was obtained from Navy Working Capital Fund Budget Justifications, FY 2017 and FY 2018. Air Force data was obtained from Air Force Working Capital Fund Budget Estimates, FY 2017 and FY 2018. Army data was obtained from Army Working Capital Fund Budget Estimates, FY 2017 and FY 2018.

**Figure 2. Sources of Capital Investment (\$ Millions), FY 2015–2017**

The capital investment program (CIP) is an important component of any department’s working capital funds. The program allows the depot to depreciate a capital asset by reallocating its cost over its useful life. In effect, the depot is able to acquire needed assets without having to significantly increase customer rates. Purchases funded through the other components of the depot’s working capital fund (i.e., processes, equipment, and facilities accounts; see Figure 8) are expensed (i.e., the whole cost amount is placed on the depot’s income statement).

The CIP provides “the framework for planning, coordinating, and controlling NWCF resources and expenditures to obtain capital assets” (DoN, 2016). The four approved capital budget investment categories within the CIP are Automated Data Processing (ADP) and Telecommunications Equipment; Non-ADP Equipment; Software Development; and Minor Construction (DFMR, 2016).<sup>11</sup> Equipment purchased through the CIP have a unit cost greater than \$250,000 and a useful life of two or more years (FY 2017 AWCF Budget; DoN, 2016).

The military depots must use a cost comparison or a pre-investment economic analysis to justify proposed capital investments under the program. For investments with an estimated cost of under \$1,000,000, a cost comparison must be included in the depot’s capital budget submission. The comparison must present a differential cost display (i.e., the

<sup>11</sup> Minor construction is generally limited to projects that cost \$750,000 or less; for projects impacting health, safety or environment, the figure is \$1,500,000 or less. Larger construction projects are funded through the military construction appropriation (see Figure 2).

total costs attributed to each alternative) using the payback period capital budgeting procedure.<sup>12</sup> For capital investment projects with a cost of \$1,000,000 or more, the depot must submit a pre-economic analysis that presents a differential cost display using the net present value approach.<sup>13</sup>

The development of pre-economic analyses can pose a challenge to the depots. At some depots, there are a limited number of personnel capable of developing the analyses. A greater challenge is that cost tracking at the depot level is limited and often does not provide the data necessary to develop a timely, comprehensive analysis. As a result, the military command with jurisdiction over the depot may reject the economic analysis. This can be a major setback given that the CIP approval process is seen by the depots as slow and inefficient to begin with; in fact, the turnaround time for approval often extends to three years. During this period, the depot is required to update its analysis to reflect changing costs and assumptions. Contractor quotes, when updated, often exceed the 10% tolerance permitted by law. Depot personnel must then develop a new analysis or “down scope” the project.

This lengthy and, at times, bureaucratic process can lead depot personnel to try to reduce the purchase cost of a capital asset to below the CIP minimum threshold of \$250,000, especially when the estimate only narrowly exceeds this minimum in the first place. Indeed, one can find examples of facilities and pieces of equipment that cost just under \$250,000 at some depots. In some cases, these may be suboptimal solutions.

### Investment Limitations

Prior to 2012, 10 U.S.C. § 2476 stated, “The capital budget of a depot includes investment funds spent on depot infrastructure, equipment, and process improvement in direct support of depot operations.” Concerned that some depot operating expenses were being funded under the guise of capital investment, Congress sought to clarify the law. The 2012 NDAA was amended to read: “The capital budget of a depot includes investment funds spent to *modernize or improve* the efficiency of depot facilities, equipment, work environment, or processes in direct support of depot operations, *but does not include funds spent for sustainment of existing facilities, infrastructure, or equipment* [emphasis added].”

This constraint has generated some confusion over what, exactly, constitutes a capital investment. The Defense Executive Steering Committee (DoD, 2014) provides some examples of projects that, under the current definition, *cannot* be justified as capital expenditures: the replacement of the roof and fire suppression system of an aircraft hangar; renovation of an avionics repair shop; or a new corrosion control building. Many would argue that these types of expenditures *necessarily* “modernize or improve efficiency.” Indeed, under criteria used by the Internal Revenue Service—which include “rebuilding property after the end of its economic useful life” and restoring property or equipment to “like new” condition—examples such as these would be considered capital expenditures. In effect, the

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<sup>12</sup> Payback period shows the number of years it takes to break even from undertaking the initial expenditure, by discounting future cash flows and recognizing the time value of money.

<sup>13</sup> Net present value analysis evaluates the cash flows forecasted to be delivered by a project by discounting them back to the present using the time span of the project and the firm’s weighted average cost of capital.





law limits the depots' ability to finance certain projects through the CIP, projects that in the commercial sector would almost certainly fall under the category of capital investment and whose costs would be depreciated over time. Thus, new investment in the depots may come at the expense of needed maintenance—a problem that 10 U.S.C. § 2476 was originally enacted to address.

## Depot Capabilities

Despite some recent improvements and with some notable exceptions, depot capabilities remain at suboptimal levels. In July 2017, *National Defense* reported that “certain service chiefs, the administration, and some in the media have stated that U.S. military mission capability and readiness could increasingly be considered a national security problem” (Captain, 2017, p. 17). *U.S. Naval Institute Proceedings* reports from 2016 and 2017 have stated that “virtually all of the naval services' helicopters, the F/A-18, and Harriers are at or below 50% readiness levels” (Captain, 2017, p. 17). Of course, not all of the services' readiness challenges can be traced to inadequate capital investment in depots.

However, many of them can be. At the department level, the absence of strategic investment planning, in particular, has contributed to declining readiness levels. A cursory examination of the *Army's Depot Maintenance Enterprise Strategic Plan, 2008–2025* reveals it to be less of a strategy than a to-do list. Cited objectives include “update infrastructure planning” and “establish an integrated human capital plan.” The plan does not state how or when these are to be accomplished. In 2009, the GAO stated that the lack of a “meaningful department wide assessment” of the shortcomings of organic depots has left the DoD with no way to accurately determine whether they have the resources and capabilities to meet sudden threats and warfighter needs (GAO, 2009a).

In 2010, the GAO published another report entitled *Improved Strategic Planning Needed to Ensure That Air Force Depots can Meet Future Requirements*. The report found that the Air Force's failure to use benchmarks to evaluate the adequacy of investment funding called into question “its assertion that its depots are postured and resourced to meet future maintenance challenges.” A year earlier, the GAO released a similar report that questioned the capabilities of Army and Marine Corps depots (GAO, 2009b). All three of the services' strategic plans were criticized for not using a results-oriented management framework to help ensure that they were positioned to meet future needs.

As recently as September 2017, the GAO found that despite the Navy's development of an improved investment plan in 2013, its shipyards and equipment remain in poor condition, with backlogged maintenance projects having grown by 41% over five years to a Navy-estimated \$4.86 billion that will require 19 years to complete. The poor condition of the shipyards has contributed to the Navy's inability to meet operational needs. According to the GAO, “In fiscal years 2000 through 2016, inadequate facilities and equipment led to maintenance delays that contributed in part to more than 1,300 lost operational days—days when ships were unavailable for operations—for aircraft carriers and 12,500 lost operational days for submarines” (GAO, 2017, p. 1). The GAO concluded that unless the Navy adopts a “comprehensive, results-oriented approach to addressing its capital investment needs, [it] risks continued deterioration of its shipyards, hindering its ability to efficiently and effectively support Navy readiness over the long term” (GAO, 2017).

The lack of adequate strategic planning by the military departments has led to “at least seven instances of recommendations to create a single depot maintenance command or manager as the preferred direction in the evolution of the organic depot maintenance capability and as a way to achieve the desired performance” (Avdellas et al., 2011, p. 1-2). Avdellas et al. (2011) notes that those recommendations have been advanced by various



bodies including Congress, DoD review panels, the GAO, and the Joint Staff. Yet none has been implemented. Instead, according to Avdellas et al. (2011), “We observe a continuation of the multitude of customer-provider encounters playing out in weapon system acquisition and sustainment, without a consistent or integrated strategic vision” (p. 1-2). Some capabilities are far from “world class” or “best of breed.” Often, the distribution of capabilities is uneven if not bimodal: At one depot, state-of-the-art equipment and some new facilities stand out against a landscape of aging buildings, near-obsolete testing equipment, and shelves of metal parts left exposed to the elements.

Whether, and to what extent, the present lack of strategic planning can be attributed to inadequate military leadership, cultural artifacts within the DoD, segmented lines of authority, congressional interventions, or other causes can be debated. It should also be recognized that solutions that work in the commercial sector, especially those aimed at improving economic efficiency, may not work well within large public organizations. According to Nutt (2005),

The external environment of a public organization is littered with political considerations. The views of opinion leaders, outright manipulation by legislators and interest groups, and opposition to an agency’s prerogatives are more important than economic issues, which are crucial for private organizations (Levine et al., 1975). Disagreements, reciprocity, and quid pro quos can occur at any time and, within limits, are permissible ingredients in public decisions. Bargaining is required to find the permissible arenas of action. How things are viewed and understood by stakeholders holds more salience than the accuracy of claims. The meaning of a claim is derived from opinions as well as facts. *If economic reasoning, such as efficiency, is applied, it must be preceded by a decision to deal with efficiency questions, which often has political undertones* [emphasis added]. (p. 293)

Nutt (2005) goes on to say that public sector decision-makers generally “have weaker power bases” and that they “lack the funds to make investments that reshape systems they manage” (p. 297). He concludes that decision-makers in public organizations are “more apt to use consultative or networking practices to make decisions” and, critically, “less apt to make decisions using analytical and speculative practices, seeing them as more risky” (Nutt, 2005, p. 298).

To improve depot capabilities, approaches to funding capital investment must be considered carefully. As Nutt (2005) suggests, “oft-repeated call[s] for public-sector organizations to adopt private sector practices” (p. 292), though well-intentioned, may be misguided. The optimal approach must balance private sector practices with public sector realities.

## Fixed Funding

In principle, the government should allocate funds, irrespective of their source, in such a way as to maximize benefits to the citizenry. Critics of earmarking—the legislative provision mandating that approved funds be spent on specific projects—support their position by arguing that an earmarking provision is an “unnecessary constraint in the utility-maximization problem of allocating the last dollar to yield equal marginal utility in every direction” (Teja, 1988, p. 523).

The advantages of earmarking include a guarantee of funding, predictability and budget planning, and the potential to depoliticize future funding decisions. The primary disadvantages revolve around budgetary inflexibility: “Earmarked revenues, not program



needs or benefits relative to the competing priorities, may determine overall funding levels for the programs” (Michael, 2015, p. 5). Public spending, it is argued, should be determined by deliberate policymaking.

However, it is unclear whether and to what extent such deliberation occurs, even in the absence of earmarking. As Teja (1988) has observed, “it is implicitly assumed that expenditures under general fund financing are indeed periodically reviewed and adjusted to ensure that no program is under- or overfunded,” an assumption he describes as “highly questionable.”

In any case, earmarking some percentage of revenue for capital investment is not unique to the military depots. Because earmarks that are derived from recurring sources of revenue (e.g., annual taxes) “implicitly promise funding of at least the level of the earmark” (Michael, 2015, p. 1), they provide some measure of predictability, which can improve budgeting, planning, and decision-making. The state of Missouri amended its constitution in 1996 to create a separate Facilities Maintenance Reserve Fund to dedicate general fund dollars toward maintenance. The fund was gradually phased in from 1998 to 2007, dedicating 0.1% of the state’s general revenue to the fund in its first year, and increasing by 0.1% over the next 10 years. Since 2007, 1% of the general revenue is transferred into the fund each year.

Of the various earmarking schemes that have been tried, there is a general consensus that earmarking “benefit taxes” or user fees for related expenditures is preferable (Wilkinson, 1994; Transport Research Center, 2008). A 2008 study by the Transport Research Center notes that earmarking can have “an element of the benefit approach<sup>14</sup> to equity in taxation, i.e., the idea that people should be paying according to the benefits they receive from consuming a commodity” (p. 150). Taxes levied by the state on gasoline, which are then used to fund transportation infrastructure, are often cited as examples. Not only does this type of earmark link supply and demand, but it informs the taxpayers of the cost of the services that they are consuming.

On this basis, the depot investment requirement might be viewed quite favorably given that mandatory spending is a function of funded workload (i.e., supply and demand are linked). Moreover, because much of the capital investment requirement is funded through the working capital funds, the military activities that rely on the depots have some visibility into the cost of their operations (through the rates that they pay), which, in principle, serves to further ensure that the earmarked funding is used effectively and efficiently.

Some have argued that general fund financing inhibits sound capital investment decision-making. Bratland (2010), for example, has asserted that the public sector simply does not have the ability to invest effectively in public infrastructure. He points to the sustained lack of investment in transportation infrastructure throughout the country, which, though often politicized, is a real and growing problem. According to the American Society of Civil Engineers, cumulative infrastructure investment needs will total \$2.7 trillion by 2020, rising to \$10 trillion by 2040 (Cullen, 2013). Anticipated funding will cover only 60% of these needs through 2020, dropping to 53% by 2040. The corresponding investment gaps are

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<sup>14</sup> The benefit theory of taxation states that each citizen should be called upon to pay taxes in proportion to the benefits derived by him from services provided by the government.



estimated to total \$1.1 trillion by 2020, growing to \$4.7 trillion by 2040 (Cullen, 2013). Bratland (2010) asks the question, “Is the neglect of public infrastructure endemic to its governmental provision and management and thus inevitable?” The answer, according to Bratland, is “Yes.” He writes,

The maintenance problem arises from the absence of ownership of public infrastructure and the fact that the infrastructure’s benefits yield no appropriable sales revenue that can serve as a guide to maintenance. Hence, neglect appears to be inherent in the fact of government provision. Labeling components of infrastructure as public capital is simply a metaphor that misleads the electorate into thinking public infrastructure can be successfully maintained. (p. 38)

Bratland (2010) concludes, “Legitimate capital concepts suggest that ownership and maintenance of infrastructure facilities should never be placed within the government’s scope of responsibility” (p. 41). Again, there is reason to be more optimistic with regard to depot investment; as discussed, 10 U.S.C. § 2476 links investment to revenue through the working capital fund structure in a way that imitates, albeit imperfectly, the private sector. In other words, the depots *do* “yield an appropriable sales revenue that can serve as a guide” to capital investment.

The precise role for government earmarks may turn on whether and to what extent infrastructure—and the tendency to neglect it—is representative of public sector capital assets generally. If we are destined to neglect the maintenance, recapitalization, and capital improvement of public sector assets, including military facilities and equipment, then earmarking funds for these purposes may be the only acceptable recourse outside of privatization.

## Flexible Funding

Earmarking lies on the far end of a continuum spanning fixed and flexible approaches to capital investment. On the other end lies real options analysis, which applies option valuation techniques to capital budgeting decisions. Traditionally, managers in the public and private sectors have relied on discounted cash flow techniques<sup>15</sup> in order to determine whether a proposed capital investment should be made. Future net cash flows are estimated over the anticipated life of a given project; if the value that is obtained is higher than the current cost of the investment, then (in theory) the investment should be made. In practice, however, this coarse-grain approach to investment decision-making fails to take into account a number of variables that may influence a project’s profitability vis-à-vis the status quo or other investment possibilities.

Specifically, traditional cash flow techniques fail to capture the benefits associated with *flexibility* as it pertains to project size, timing, and process (i.e., the so-called “real options” available to management; Schubert & Barenbaum, 2007). By assigning value to flexibility, private and public sector organizations can make more informed capital budgeting decisions.

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<sup>15</sup> The most commonly used techniques include net present value, internal rate of return, profitability index, breakeven time, and payback period (Chan, 2004).



However, real options are often given little consideration because the value of said benefits is far more difficult to assess relative to the costs. Thus, public sector managers, in particular, tend to view capital investment decision-making as an exercise in “straightforward cost minimization” (Schubert & Barenbaum, 2007). In the private sector, on the other hand, the relevant benefits are quantified in terms of a discrete figure—profit—the motivation for which lends itself more readily to the real options approach. Today, firms rely on several different option-pricing models.

Many factors reinforce the public sector’s tendency to resist real options analysis. For instance, the pressure “to use it or lose it” strongly discourages the value of waiting. Rather, there is a tendency to spend as investment funding becomes available, which invariably leads to under or overinvestment. Schubert and Barenbaum (2007) describe the tendency for public sector managers to “overbuild”:

A public sector manager is likely to design a budget that overbuilds assets such as schools and water treatment facilities in order to serve future growth potential rather than to wait and see if such potential growth becomes more likely. In the scenario where the manager waits, and the potential growth occurs, the manager will need to go back and argue for more resources, when in the overbuilding scenario they need only argue for the financial resources once. (p. 144)

In other instances, where there is pressure to obligate limited funds quickly, investments are likely to be narrowly conceived and, hence, less effective in terms of contributing to strategic objectives.

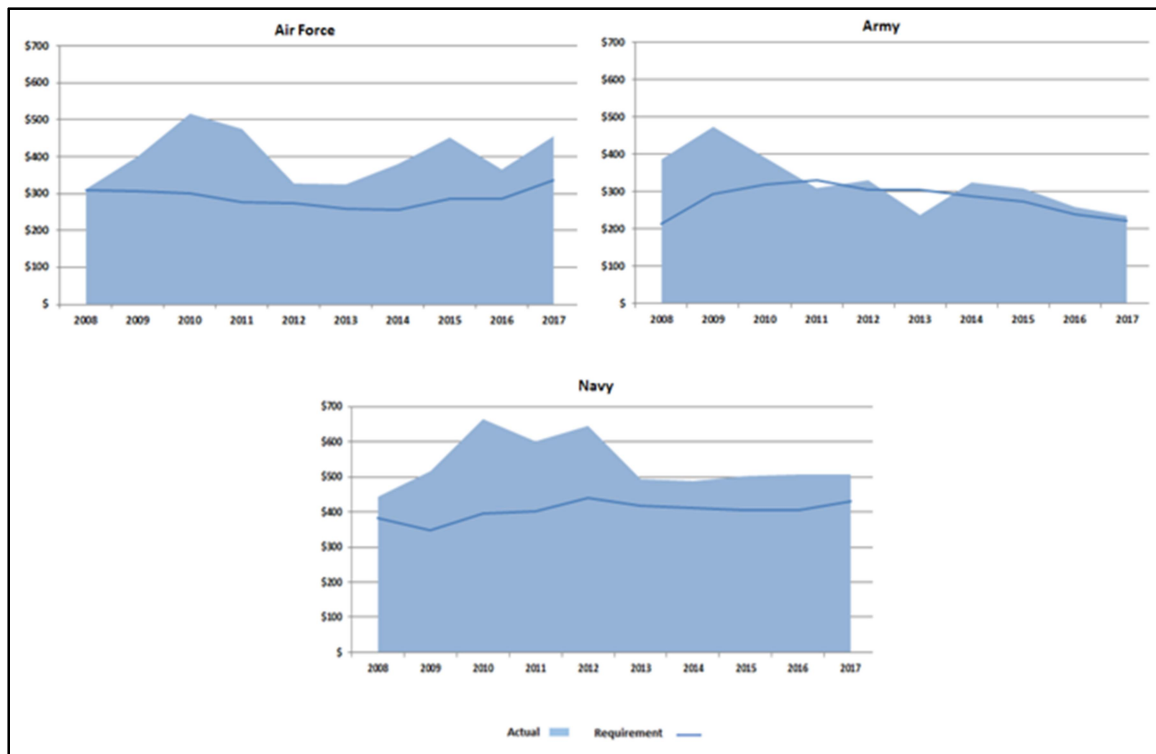
Historically, real options, even in their crudest form (e.g., wait vs. invest), have seldom been considered within the context of depot capital investment. The portrayal provided by Glass and Schwartz of the Logistics Management Institute in 1988 paints an unflattering picture:

Capital investments [in the military departments’ depots], by and large, are made piecemeal, primarily to enhance peacetime operating efficiency or capability. They are biased toward projects that provide quick payback. Pressure to obligate funds quickly exacerbates the tendency to undertake small, easily justified, short-term projects. By using this piecemeal approach, the military services are missing the benefits of an integrated series of investments following a planned, technological direction. Most importantly, they are risking their depots’ abilities to accomplish essential wartime missions. (p. iii)

The military services have argued that the minimum investment requirement, by its very nature, discourages and undervalues investment flexibility. According to the DoD’s Maintenance Executive Steering Committee (DoD, 2014), the military departments view the minimum investment requirement as a needless burden that “forces” investment in lower priority projects while discouraging or delaying investment in more costly, higher priority programs. In other words, the requirement undermines the ability to engage in strategic investment decision-making. However, the portrayal by Glass and Schwartz suggests that better investment decisions would not necessarily have been made in the absence of the requirement. Better strategic investment planning is needed at the department level in order to benefit from more flexible approaches to capital investment.



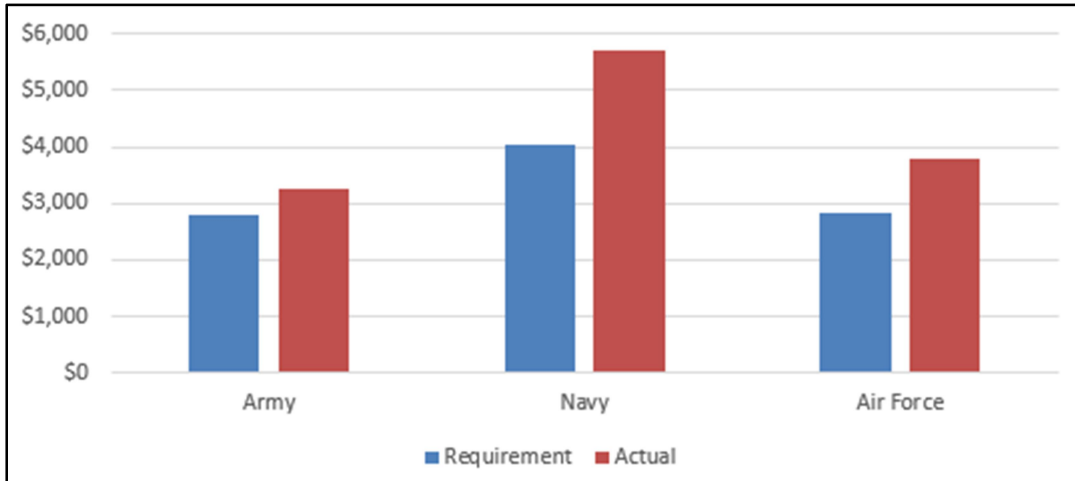
## Trends by Military Department



Note. USMC data was included in Navy figure. Navy data from 2008–2013 was obtained from DoD (2014). Navy data from 2013–2017 obtained from Navy Working Capital Fund Budget Justifications. Air Force data was obtained from Air Force Working Capital Fund Budget Estimates, 2008–2017. Army data was obtained from Army Working Capital Fund Budget Estimates, 2008–2017.

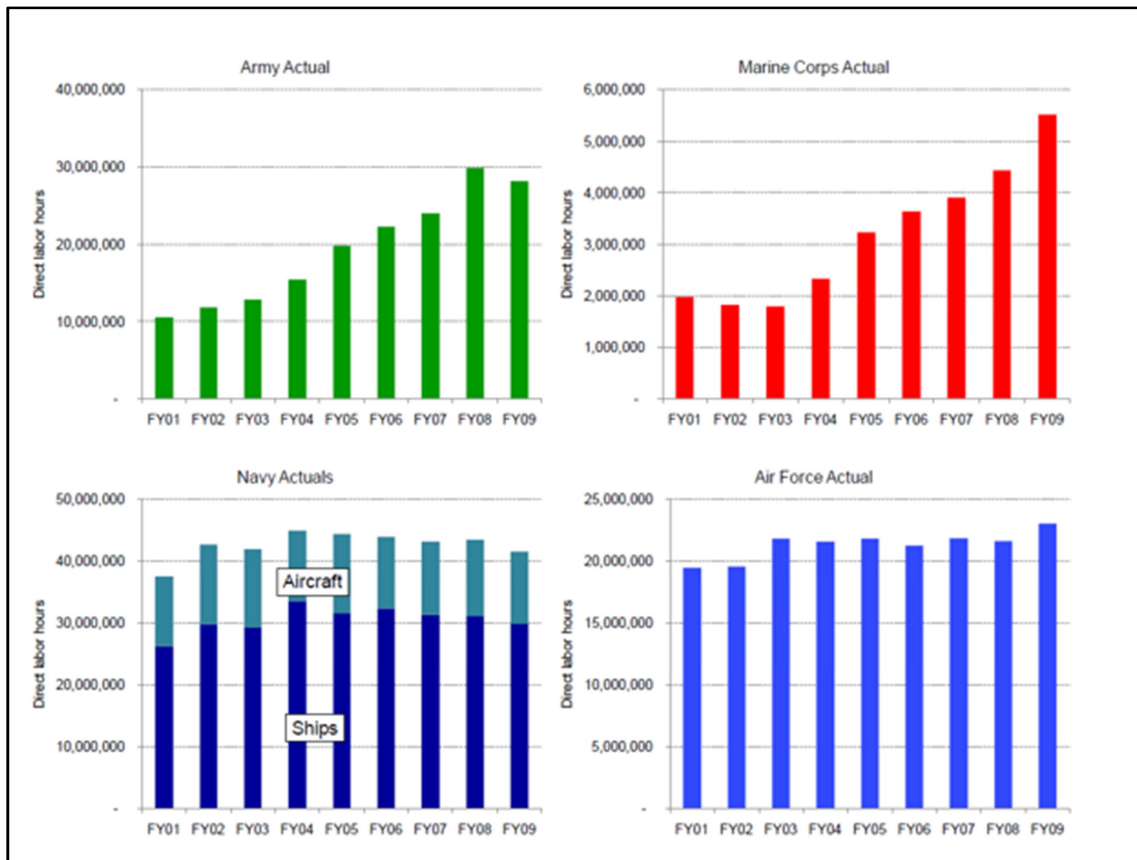
**Figure 3. Capital Investment in Depots by Military Department (\$ Millions), Actual and Requirement, 2008–2017**

Figure 3 shows the actual annual capital investments made by each of the military departments and the corresponding annual investment requirements since the law came into effect. As discussed previously, representatives from all of the military departments have stated that it has been a challenge to meet the minimum investment requirement. The Navy and the Air Force, however, have not only met, but have exceeded, the minimum requirements. As for the Army, the investment landscape exhibits a significant peak in 2009, but also valleys corresponding to years in which the investment requirement was not met. Although it should be noted that the Army's cumulative investment has exceeded 6% of total revenue since the minimum requirement was put into effect; in total, the Army has invested \$3.2 billion, or 6.9% of total revenue between 2008 and 2017 (see Figure 4).



*Note.* USMC data was included in Navy figure. Navy data from 2008–2013 was obtained from DoD (2014). Navy data from 2013–2017 was obtained from Navy Working Capital Fund Budget Justifications. Air Force data was obtained from Air Force Working Capital Fund Budget Estimates, 2008–2017. Army data was obtained from Army Working Capital Fund Budget Estimates, 2008–2017.

**Figure 4. Cumulative Capital Investment in Depots (\$ Millions) Between 2008 and 2017, Requirement and Actual**



Note. The Army DLHs reflect work at the five major organic depots only.

**Figure 5. Depot Repair and Maintenance Workloads by Military Service, Expressed in DLHs, 2001–2009**  
(Avdellas et al., 2011)

Interestingly, the relationship between weapon system use and required maintenance is not straightforward; moreover, this relationship varies considerably among the military services. Figure 5 compares the depot repair and maintenance workloads by military service, expressed in DLHs, between 2001 and 2009, a period marked by high levels of overseas military engagement. Whereas the Army and Marine Corps exhibited significant sustained increases in depot workloads, the Navy and Air Force workloads remained relatively stable, following modest post-2001 increases. Avdellas et al. (2011) explain that “this level of demand from the Air Force and Navy reflects the operation of an essentially constant inventory of aircraft and ships” (p. 1-4). In a RAND report, Cook, Ausink, and Roll (2005), writing about the Air Force, provided some additional insight:

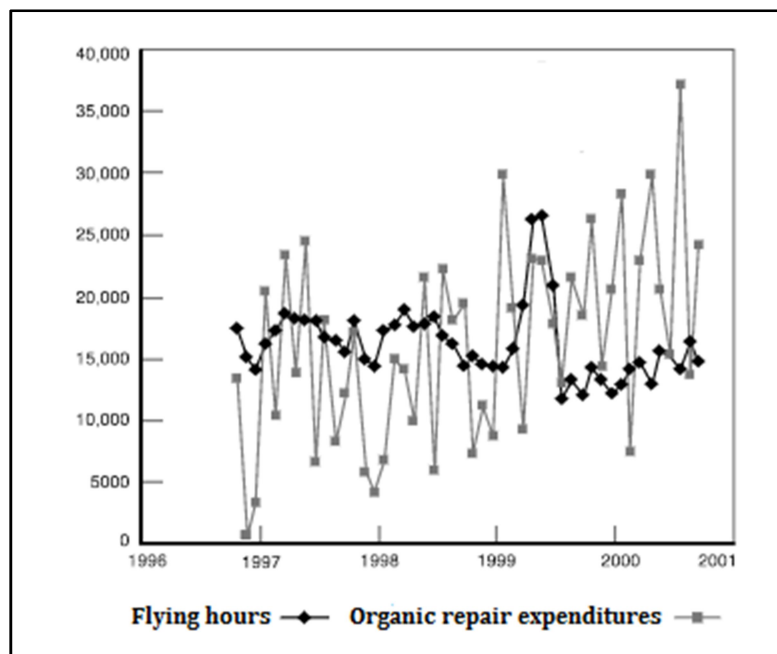
Surge has become part of regular ongoing depot activity instead of an unusual event. Furthermore, recent contingencies in which there have been increases in flying hours have not led to overwhelming increases in depot repair. Depot work is not necessarily linked to actual demand at a fixed point in time; appropriate planning can help the depots proactively prepare for expected conflicts. (xiii)

In fact, an earlier RAND report, Keating and Camm (2002) could not find “any category of organic [Depot Maintenance Activity Group; DMAG] expenditures that is consistently positively correlated with flying hours across multiple weapon systems” (p. xv).



Figure 6, which compares C-135 flying hours and organic repair expenditures, illustrates this lack of correlation.

In contrast, increasing workloads within Army and Marine Corps depots were attributed directly to “the added intensity of equipment operation in combat” (Avdellas et al., 2011, p. 1-4). These differences in workload (steady and predictable vs. unsteady and unpredictable) have obvious implications with regard to the 6% investment requirement given in that it is based on depot revenue, which, in turn, is a reflection of workload (specifically, direct labor hours). Needless to say, maintaining adherence to the investment requirement is likely less challenging when demand is steady and predictable in that investments can be made in conjunction with long-term strategy, rather than in response to a changing workload.



**Figure 6. C-135 Flying Hours and DMAG Organic Repair Expenditures**  
(Keating & Camm, 2002)

The Army, in particular, may find it challenging to meet the investment requirement (if based on higher wartime revenues) following a drawdown from combat (when workloads are declining). Recall that the minimum investment requirement is based on total average revenue from the *preceding three years*. In effect, the law can force overinvestment during a period of declining resources, which is not an enviable position for an organization to find itself in. The challenge is even greater given that capital investment within the Army has been financed primarily through the working capital fund (rather than appropriations) in recent years. In response to this challenge (i.e., overinvestment during periods of declining workloads), OSD has proposed a forward-looking calculation method that bases the 6% target on total average revenue from the previous year, the execution year, and the following three years (i.e., the budgeted, planned, and programmed revenue).

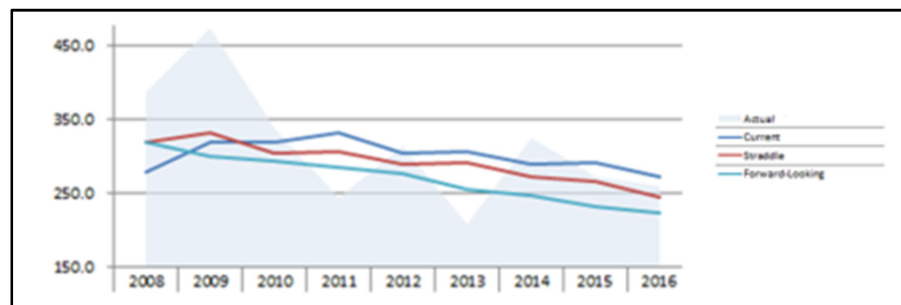
It is not immediately clear whether this proposal represents a durable solution to the problem of overinvestment. One can envision a situation in which revenues are projected to increase rapidly following a prolonged period of operational stability. The military department may not need to make the required capital investments based on increased revenue projections; rather, greater investment may be needed following a drawdown from combat in

order to recapitalize worn assets—in which case the current calculation method may prove preferable. In any event, it is unlikely that Congress would support a calculation method that relies so heavily on projected revenue.<sup>16</sup>

The Army, for its part, has proposed a reasonable compromise that bases the 6% target on average revenue from the *previous year, the execution year, and the future budget year*. During periods of steadily declining revenues, the “straddle” method generates minimum investment requirements that are lower than those generated by the current method, but higher than what would be generated by OSD’s forward-looking method. Conversely, during periods of increasing revenues, “straddle” would generate minimum requirements higher than the current method but lower than the forward-looking approach.

Figure 7 compares the effect of the current, straddle, and forward-looking methods on the Army’s minimum investment requirement in light of actual revenues generated between 2008 and 2016 and projections between 2017 and 2019. Revenues during this period declined significantly (from \$5.9 billion in 2008 to \$3.7 billion in 2016). As the graph indicates, using the straddle method would have resulted in a reduction to the minimum investment requirement of about \$20 million annually.

Because the forward-looking method’s basis for investment spans five years, the line that is generated is comparably smoother, which translates to an investment requirement that is more consistent over time. By altering the Army’s proposal to include the preceding *two* years of revenue, the execution year, and the following *two* years, the peaks and valleys generated by the straddle method could be made similarly less prominent.



**Figure 7. A Comparison of the Three Calculation Methods During a Period of Declining Revenues (\$ Millions)**

Note, however, that the shortfalls in actual investment (in 2011 and 2013) occur even when the forward-looking method is employed. This is not to say that the minimum investment requirement should necessarily be altered to accommodate such shortfalls in the future; at the same time, they draw attention to the reality of competing priorities and budgetary unpredictability. The military departments should have some added flexibility to

<sup>16</sup> *Eliminate OCO funding from the requirement?* The Army has also proposed that funding provided through the overseas contingency operations (OCO) fund be eliminated from the calculation method. This proposal undermines the linkage between revenue and investment that, as described previously, serves to justify fixed investment strategies in the first place; in other words, the proposal ignores the reality that investment and recapitalization needs are driven, in large measure, by the use, and subsequent wear and tear, of existing capital assets.

adjust to an unpredictable environment, especially considering that such flexibility could also serve to strengthen investment options analysis and facilitate strategic decision-making.

## **Recommendations and Conclusion**

Based on the history of capital investment in military depots, our examination of the positives and negatives associated with fixed and flexible funding, the discussion on real options analysis, and trends in depot investment, we offer the following recommendations.

### **Recommendations**

#### **Develop and implement detailed strategic plans to properly guide capital investment.**

- In some cases, the military departments lack detailed and comprehensive strategic investment plans. Without these plans, it will be challenging for depot leadership to pursue, develop, and execute integrated series of investments that ensure that the depots are able to provide the needed capabilities to meet future organic maintenance and repair requirements. Without these, it is difficult to convince Congress that the military departments have a plan to make the needed investments in the depots.

#### **Maintain—but modify—the minimum investment requirement to encourage strategic investment decision-making.**

- Given the lack of detailed and comprehensive investment plans and the historical challenges in making adequate investments that ensure the sufficiency of organic capabilities, a minimum investment requirement is warranted. However, in its current form, the requirement can lead to overinvestment during periods of declining revenues and potential underinvestment during periods of increasing revenues. A minimum requirement that bases the 6% target on revenue from the preceeding year, the year of execution, and the following year, or—to further reduce year-to-year fluctuations in the requirement—the preceeding two years, the year of execution, and the future two years, will improve investment effectiveness.

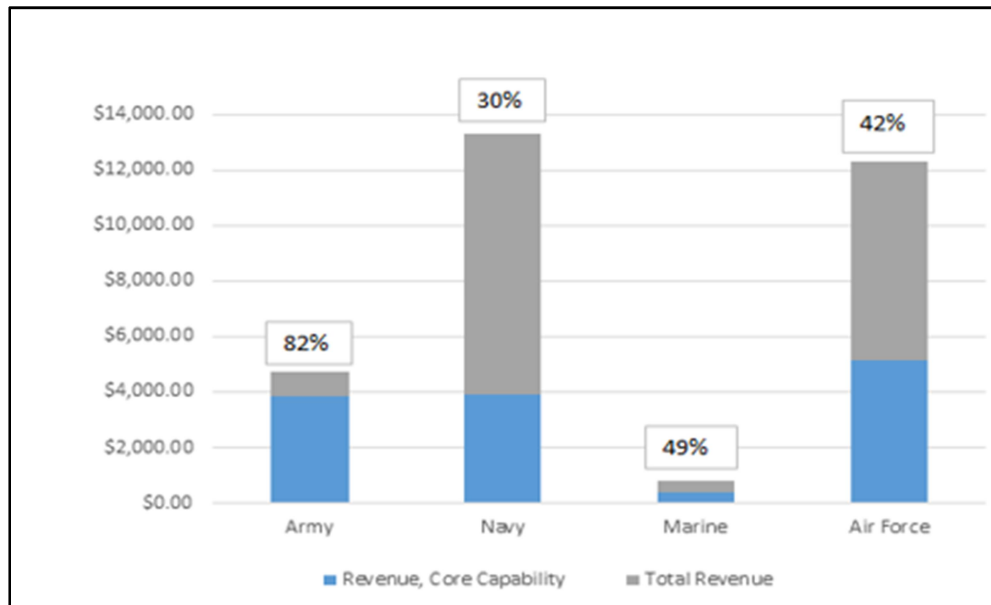
This change alone may not provide the flexibility necessary to facilitate strategic decision-making and ensure that the planned intergrated series of investments are made. As discussed, investments have historically taken the form of small, short-term projects—a tendency that may be exacerbated by the annual investment requirement. Lawmakers may wish to consider modifying the requirement to enhance flexibility by, for example, allowing the military departments to credit any annual investment in excess of 6% to the future minimum requirement, thereby providing department leadership some additional leeway in formulating their investment strategy.

#### **Continue to base the minimum investment requirement on total revenue.**

- Proposals to base the investment requirement solely on revenue generated by “core” workload, or those that seek to eliminate from consideration OCONUS funding, represent misguided attempts to reduce the *required level of investment* by narrowing the *basis for investment*. If the required funding level (6% of revenues) is believed to be too high, then the 6% figure should be reconsidered at some point in the future. Narrowing the basis for investment has the potential to mask investment needs, if, for example, non-



core or OCONUS-generated workload increases relative to core workload (a problem that is exacerbated by the fact that defining core requirements is a largely subjective enterprise that relies on methodologies that are not consistently applied).



Note. The information in this figure came from data submitted in the DOD 2014 Biennial Core Report (GAO, 2016) and OUSD(AT&L; 2016).

**Figure 8. Revenue Generated by Core Capabilities as a Percentage of Total FY 2016 Revenue**

Finally, eliminating core from the investment basis would have a highly disparate impact on the military services. Figure 8 shows revenue generated by core capabilities as a percentage of total FY 2016 revenue for each of the military services. Were the requirement to be based solely on core-sustaining workload, the Army, which has struggled the most to meet the investment requirement would see minimal relief, whereas the Air Force and Navy requirements would fall considerably.

**Modify the minimum investment requirement so that qualifying investments are not limited to the covered depots.**

- The revenue generated by *all* of a military department's depots forms the basis for the 6% investment requirement; hence, it stands to reason that all of a department's depots should be made eligible for investment under the requirement. At present, a significant amount of the basis for the investment requirement is generated by software maintenance, yet many of the facilities that perform this maintenance are not "covered" under the current requirement.

### **Widen and clarify the definition of capital investment.**

- The depots should rely on a standard definition of capital investment to ensure that the investment requirement does not inadvertently lead to increases in deferred maintenance. As discussed, rebuilding infrastructure after the end of its economic useful life or restoring it to “like new” condition constitute capital investment under standard definitions. Consequently, the depots must “expense” equipment and facilities that, under a standard definition of capital investment, would be allocated over time. Relying on a standard definition also helps reduce any grey area that might lead to needless bureaucratic meddling, added expense, or schedule delay.

### **Streamline the CIP approval process.**

- The approval process for depot-level capital investments should be made flatter and faster. In some cases, CIP expenditures must be approved by a 4-star command. The structure of the working capital fund system may already provide sufficient constraints on capital investment decision-making at the depot level. In other words, customer sensitivity to increasing rates may serve to adequately promote sound capital investment at the depot level. Could not the subordinate commands, to which the depots already report, provide the necessary approval? The higher-level commands should devote more time and resources to developing long-term strategic investment plans that guide depot-level decision-making.

### **Study the potential for funding larger construction projects through the CIP.**

- Recall that, at present, construction projects valued at more than \$750,000 can only be funded through congressional appropriation (which is often difficult to obtain). Consequently, there has been a longstanding tendency—which persists to this day—to “build groups of very small facilities” (Glass & Schwartz, 1988), when larger facilities would have been better economic investments. Funding larger construction projects through the working capital funds would provide military customers, the DoD, and Congress with a better understanding of the true cost of depot maintenance and repair, while improving the cost efficiency and effectiveness of capital investments.

### **Continue to pursue public-private partnerships.**

- Public-private partnerships have allowed the DoD to harness the best mix of capabilities from the government and commercial sectors in many areas, including depot maintenance. The DoD should continue to pursue appropriate partnerships to the extent possible.

Depot labor rates do not fully reflect the associated indirect costs; as a result, the rates are often lower than those seen in the commercial sector (Captain, 2017), which can provide an incentive for firms already performing depot-level maintenance to partner with the DoD (through a direct sales



agreement<sup>17</sup>) in order to gain access to depots' personnel, equipment, and facilities. PPPs provide a "win-win" for both parties, improving depot capabilities, reducing costs, and enabling compliance with 50/50 and core requirements.

### **Conclusion**

In the absence of dedicated funding, needed investment in capital assets can be overlooked. When funding is dedicated, unnecessary or shortsighted investments are sometimes made. Fortunately, fixed and flexible funding strategies are the two end-points on a continuum that spans a significant middle ground. Within the context of depot investment, the optimal balance has not yet been achieved. We believe that the above recommendations will generate the necessary shift along the continuum toward increased flexibility, thereby strengthening the military depots' capabilities and ensuring that their vital role in safeguarding America's security is maintained.

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<sup>17</sup> Under a direct sales agreement, the contractor is held accountable for accomplishing the depot's funded workload via an outcome-based support contract. The contractor, in turn, "subcontracts" with the depot to acquire organic repair and maintenance services at the depot's hourly labor rate.



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