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THESIS

**A FUNCTIONALLY ALIGNED AND SERVICE-AGNOSTIC
U.S. MILITARY: AN EVOLUTION OF THE
DEPARTMENT OF DEFENSE FORCE STRUCTURE**

by

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December 2023

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**A FUNCTIONALLY ALIGNED AND SERVICE-AGNOSTIC U.S. MILITARY:
AN EVOLUTION OF THE DEPARTMENT OF DEFENSE FORCE STRUCTURE**

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ABSTRACT

Just as the post-World War II international order catalyzed the 1947 National Security Act, and the criticality of joint interoperability motivated the 1986 Goldwater-Nichols Department of Defense Reorganization Act, the pivot to strategic competition during fiscal constraints should inspire institutional evolution. This thesis examines whether a reorganization of the Department of Defense (DOD) into a functionally aligned, service-agnostic military could reduce inefficient overhead in budget and personnel, as well as capability redundancies experienced among services. This analysis used system dynamics modeling and simulation to study the DOD as a complex adaptive system against three variables: time, money, and personnel. Assuming the U.S. enters two wars over the next 70-year period, this research found that 1) adopting a functionally aligned, service-agnostic force structure with a 10% reduction in overhead prior to the first war could potentially save \$24.35 trillion after the second war; and 2) this realignment might decrease the need from a projected 13 million active-duty force size across all services at the drawdown from the second war to a forecasted 1.3 million personnel Inherently Joint Force at the same time period. Further recommended research includes the continued use of systems modeling that incorporates more robust capability and materiel analysis, in order to investigate benefits of a functionally aligned service-agnostic U.S. military force structure.

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LIST OF ACRONYMS AND ABBREVIATIONS

AD	Active Duty
AFSC	Air Force Specialty Code
CCP	Chinese Communist Party
CY	Calendar Year
DELAY	The DELAY builtin delays inputs by a delay duration ¹
DOD	Department of Defense
FY	Fiscal Year
GDP	Gross Domestic Product
GHOSTED	A variable alias, which is a copy of a stock, flow, or converted permitting use of the original variable elsewhere in the model ²
HISTORY	The HISTORY builtin returns the value of a variable at a prior time in the simulation ³
MILCON	Military Construction
MOS	Military Occupational Specialty
NEC	Navy Enlisted Code
O&M	Operations and Maintenance
PRC	People’s Republic of China
R&D	Research and Development

¹ “Delay Builtins,” ISEE Systems, accessed December 8, 2023, https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Delay_builtins.htm#SMTH1.

² “Creating a Variable Alias (Ghost),” ISEE Systems, accessed November 20, 2023, https://www.iseesystems.com/resources/help/v2/Content/03-BuildingModels/Creating_variable_aliases.htm.

³ “Data Builtins,” ISEE Systems, accessed December 8, 2023, https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Overview_Builtins.htm.

RANDOM	The RANDOM builtin generates a series of uniformly distributed random numbers between a <i>minimum</i> and <i>maximum</i> specified value. RANDOM samples a new random number in each iteration of a model run ⁴
SMTH1	The SMTH1 builtin calculates a first-order exponential smooth of input, using an exponential averaging time of averaging time, and an optional initial value <i>initial</i> for the smooth. If you don't specify an initial value, SMTH1 assumes the value to be the initial value of input ⁵
STEP	The STEP builtin generates a one-time step change of specified height, which occurs at a specified time ⁶
USA	United States Army
USAF	United States Air Force
USD	United States Dollars
USMC	United States Marine Corps
USN	United States Navy

⁴ “Statistical Builtins,” ISEE Systems, accessed December 8, 2023, https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Statistical_builtins.htm#RANDOM.

⁵ ISEE Systems, “Delay Builtins.”

⁶ “Test Input Builtins,” ISEE Systems, accessed December 8, 2023, https://www.iseesystems.com/resources/help/v2/Content/08-Reference/07-Builtins/Test_input_builtins.htm.

EXECUTIVE SUMMARY

This thesis examines whether a reorganization of the Department of Defense (DOD) into a functionally aligned, Service-agnostic military enterprise could reduce inefficient overhead in budget and personnel, as well as capability redundancies currently experienced among Services. The DOD’s realignment from counterterrorism operations to strategic competition against rising peer adversaries faces the significant challenges of rising national debt, fiscal constraints, and budgetary uncertainty.¹ Concurrently, more now than any time since the end of the Cold War, the United States military finds itself in a modernization race against high-end adversaries—and its lead is waning. United States government and DOD officials publicly acknowledge the need to modernize through innovation, rapid technology fielding, and divestment of legacy systems.² What is less addressed—but vastly more important—is the modernization of the DOD force structure. Just as the post-World War II international order catalyzed the 1947 National Security Act and the criticality of joint interoperability motivated the 1986 Goldwater-Nichols Department of Defense Reorganization Act, the pivot to strategic competition should inspire institutional evolution.

The current DOD force structure supports Service-derived inefficiencies, leading to wasteful duplicative spending and potential misallocation of limited resources such as budget, manpower, and materiel. Further, the current system of Service-led advocacy results in overlapping or duplicated warfighting capabilities among Services. Challenges associated with integration and coordination among Services hampers both the effectiveness of current operations and the development of future capabilities. Commonalities among combat arms and support missions do not necessarily imply unity of effort and interoperability among the Services—each Service maintains distinct

¹ “The Fiscal & Economic Challenge,” Peter G. Peterson Foundation, 2023, <https://www.pgpf.org/the-fiscal-and-economic-challenge>.

² Terri M. Cronk, “DOD Innovation Speed Must Increase to Modernize,” DOD News, last modified August 7, 2020, <https://www.defense.gov/News/News-Stories/Article/Article/2305705/dod-innovation-speed-must-increase-to-modernize/>; John Grady, “Lawmakers Argue U.S. Must Divest Legacy Systems to Keep Up With China’s Technology Growth,” USNI News (blog), November 2, 2020, <https://news.usni.org/2020/11/02/lawmakers-argue-u-s-must-divest-legacy-systems-to-keep-up-with-chinas-technology-growth>.

processes, training and resource variants, hardware, software, and requirements, forcing the implementation of a patchwork of “joint overlays” to connect Service capabilities.³

This analysis focused on the transition away from the DOD “as it currently exists” as a Service-centric force, and towards the DOD “as it could be” as an Inherently Joint force organized along function lines using system dynamics modeling and simulation to study the DOD as a complex adaptive system.⁴ The model bounded the system to include four Services (Army, Air Force, Navy and Marine Corps) and therefore does not include the Coast Guard, National Guard Bureau, Reserve Component, or interagency partners. The primary variables considered are years, dollars, and number of personnel; there is no materiel assessment. Systems dynamics modeling revealed a non-linear relationship for both budget and manpower requirements over time, emphasizing changes in force structure implemented in the short-term yield significant savings in budget and manpower the long-term. This non-linear effect is magnified during periods of simulated armed conflict, where large increases in combat-related funding typically occur.

Assuming the U.S. enters two wars over the next 70-year period, this research found:

1. Adopting a functionally aligned, Service-agnostic force structure with a modest 10% reduction in overhead prior to the first war could potentially save a total of \$24.35 trillion dollars in FY23 money after the second war, or an average of \$347.88 billion annually. Cost-savings are realized at an increasingly greater magnitude as time progresses.
2. This realignment might decrease the need for a projected 13-million active duty force size across all Services at the drawdown from the second war to a forecasted 1.3 million-personnel Inherently Joint Force at the same time period. Manpower savings are realized at an increasingly greater

³ James Kitfield, *Prodigal Soldiers: How the Generation of Officers Born of Vietnam Revolutionized the American Style of War* (New York: Simon & Schuster, 1995), 220.

⁴ Wayne Porter, “Complex Adaptive Systems” (lecture, Naval Postgraduate School, Monterey, CA, April 26, 2023).

magnitude as time progresses. As an example, a simplified simulation of the Joint Capability for Long Range Precision Fires personnel requirement results in a decrease to one-fifth of the required Service-based personnel when forces are converted to an Inherently Joint force structure over the entirety of the timeline modeled.

This research also identified the following trends:

1. There is a strong link between percent gross domestic product (GDP) growth, Total DOD Budget, and Total Force Size. Changes in economic conditions have a downstream effect on defense spending, and changes to force structure affect budget requirements upstream.
2. As each Service's active duty force size increases, so too does the expense of executing assigned Functions. Furthermore, as the Joint Force operating in support of Combatant Commands only requires a limited percentage of the total Service-based capacity, the Joint expenditure on the Function is significantly smaller. Since the U.S. military presents its combat forces in a Service-supplied joint construct via the Combatant Commands, there may be unrealized savings by maintaining redundant Service capabilities outside what the Combatant Commands are employing.
3. Budget requirements experience non-linear growth over time. This effect is magnified during periods of war when the U.S. typically allocates higher funding towards combat operations. Therefore, the monetary expenses of waging a second war are far higher than the first over time.
4. Manpower requirements experience non-linear growth over time. This effect is magnified during periods of war when the U.S. typically grows its force size. Therefore, the manpower requirements of waging a second war are far higher than the first over time.
5. Non-linear increases in both budget and manpower requirements forecasted across multiple periods of conflict illustrate a short-term conflict, estimated to begin five years from now as perhaps speculated

with the People’s Republic of China (PRC), inflicts a monetary and personnel cost that may be unsustainable or intolerable when effects are forecasted into the “next war.”

Based on these findings, it is recommended systems dynamics modeling continue investigating potential means and benefits offered by implementing a Functionally Aligned Service-Agnostic U.S. military force structure. More robust modeling of complex Joint Capabilities such as the Long Range Precision Fires is necessary, as well as materiel requirements as this model was bounded to budget and manpower. This thesis provides a baseline simulation capability as a decision support tool to assist leadership in exploring force structure options as the DOD looks to future conflict. As “we cannot continue to mortgage our future by being wedded to the technology of the past,” the DOD should not be wedded to a Service-centric force construct as it devises competitive plans and strategies to support U.S. national interests.⁵

⁵ *FY23 Department of Defense Budget Hearing: Written Statement before the Senate Armed Services Committee*, FY23 Department of Defense Budget Hearing, (2022) (statement of General Mark A. Milley, CJCS), 7, <https://www.armed-services.senate.gov/imo/media/doc/CJCS%20PB23%20Written%20Statement.pdf>.

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To my husband—looking forward the next adventure with you, as always.

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I. PROBLEM RELEVANCE, STRATEGIC QUESTION, AND BACKGROUND

A. PROBLEM RELEVANCE

Now, more than any time since the end of the Cold War, the United States military finds itself in a modernization race against high-end adversaries—and its lead is waning. United States government and Department of Defense (DOD) officials publicly acknowledge the need to modernize through innovation, rapid technology fielding, and divestment of legacy systems.¹ What is less addressed—but vastly more important—is the modernization of the DOD force structure. Just as the post-World War II international order catalyzed the 1947 National Security Act and the criticality of joint interoperability motivated the 1986 Goldwater-Nichols Department of Defense Reorganization Act, the pivot to strategic competition should inspire institutional evolution.

In his written statement at the Senate Armed Services Committee FY23 Department of Defense Budget Hearing, the Chairman of the Joint Chiefs of Staff, General Mark Milley, requested \$773 billion, and was allocated \$816.7 billion, to modernize and transform the Joint Force to remain ready, agile, and capable.² The large budget request was advertised to maintain a leading edge compared to strategic competitors in the realms of weaponry, capability, and doctrine. The FY24 Defense Appropriations Bill is even larger—providing \$831.8 billion, with the Senate Appropriations Subcommittee Chair stating the budget “invests in our ability to stay ahead of the threat.”³ The DOD’s realignment from counterterrorism operations to strategic competition against rising peer

¹ Cronk, “DOD Innovation Speed Must Increase to Modernize”; Grady, “Lawmakers Argue U.S. Must Divest Legacy Systems to Keep Up With China’s Technology Growth.”

² Milley, testimony on *FY23 Department of Defense Budget Hearing*; Julia Mueller, “Progressives Propose Bill to Slash Defense Budget by \$100 Billion,” *The Hill* (blog), February 22, 2023, <https://thehill.com/policy/defense/3869625-progressives-propose-bill-to-slash-defense-budget-by-100-billion/>.

³ “Bill Summary: Defense Fiscal Year 2024 Appropriations Bill,” United States Senate Committee on Appropriations, July 27, 2023, <https://www.appropriations.senate.gov/news/majority/bill-summary-defense-fiscal-year-2024-appropriations-bill>.

adversaries is poised to strike headlong into rising national debt, fiscal constraints, and budgetary uncertainty.⁴

Naturally, post-conflict periods incur a decrease in defense funding. As such, the Congressional Budget Office projects forecasts the percent Gross Domestic Product (GDP) allocated to the Defense Budget will fall from 3.1% in FY23 to 2.8% by FY33—well below the 50-year average of 4.3%.⁵

The 2022 National Defense Strategy acknowledges the international military power landscape is changing and places the People’s Republic of China (PRC) at the forefront of the strategy problem set.⁶ In response, the Joint Force is reorienting against the PRC as the pacing threat. Decades of concerted Chinese Communist Party (CCP) economic, technological, scientific, educational, military, planning, and investment produced a strategic competitor bent on redefining the international rules-based order by 2050, and military parity with the U.S. by 2035 including a true blue-water navy.⁷ Significantly, “to beat the [U.S.] at war” and to exploit U.S. capability seams, the PRC restructured and downsized its forces to free up resources and increase force interoperability and agility.⁸

⁴ Peter G. Peterson Foundation, “The Fiscal & Economic Challenge.”

⁵ “The United States Spends More on Defense than the Next 10 Countries Combined,” Peter G. Peterson Foundation, April 24, 2023, <https://www.pgpf.org/blog/2023/04/the-united-states-spends-more-on-defense-than-the-next-10-countries-combined>.

⁶ “2022 National Defense Strategy,” Department of Defense, 2022, 1, <https://media.defense.gov/2022/Mar/28/2002964702/-1/-1/1/nds-fact-sheet.pdf>; Ronald O’Rourke, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, CRS Report No. R43838 (Washington, DC: Congressional Research Service, 2019), <https://congressional-proquest-com.libproxy.nps.edu/congressional/result/congressional/congdocumentview?accountid=12702&groupid=100340&parmId=1857F633F54>.

⁷ International Crisis Group, *Competing Visions of International Order in the South China Sea*, Asia Report No. 315 (Brussels, Belgium: International Crisis Group, 2021), 22, <https://www.crisisgroup.org/asia/north-east-asia/china/315-competing-visions-international-order-south-china-sea>; Office of the Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China – 2020: Annual Report to Congress* (Washington, DC: White House, 2020), 4, <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-dod-china-military-power-report-final.pdf>; Yoji Koda, “China’s Blue Water Navy Strategy and Its Implications,” Center for New American Studies, last modified March 20, 2017, <https://www.cnas.org/publications/reports/chinas-blue-water-navy-strategy-and-its-implications>.

⁸ John Tirpak, “Kendall: Beijing Totally Restructured Its Military to Beat the U.S.,” *Air & Space Forces Magazine*, January 17, 2023, <https://www.airandspaceforces.com/kendall-beijing-totally-restructured-military-to-beat-us/>.

Furthermore, apparently “unconstrained by culture” the PRC sidestepped “longstanding ‘stovepipes’ of organization, making its forces more agile and effective.”⁹

B. STRATEGIC QUESTION

The strategic question addressed in this thesis is thus stated: how could a reorganization of the Department of Defense into a functionally aligned, Service-agnostic military enterprise reduce inefficient overhead in budget and personnel, as well as capability redundancies currently seen among Services?

C. BACKGROUND

The current system of Service-led advocacy results in overlapping or duplicated warfighting capabilities among Services, particularly in areas such as aircraft, infantry and security, and combat support functions. The examples abound: Infantry is common between the Army and the Marine Corps. Police forces are common in all branches except the Marine Corps. Support services such as administration, intelligence, logistics, communications, medical, and force support (finance, transportation management office, contracting, construction management, etc.) are duplicated in all Services. There are numerous other examples of redundancies.

Redundancy is not the sole issue plaguing the Services and acquisition process—integration and coordination challenges among Services hampers both the effectiveness of current operations and the development of future capabilities. Commonalities among combat arms and support missions do not necessarily imply unity of effort and interoperability among the Services. Each Service maintains distinct processes, training and resource variants, hardware, software, and requirements, forcing the implementation of a patchwork of “joint overlays” to connect Service capabilities.¹⁰ These overlays can be in the form of joint liaison offices, embedded personnel, software to translate proprietary coding languages between hardware, and programs such as Joint All-

⁹ Tirpak. “Kendall: Beijing Totally Restructured Its Military,”

¹⁰ Kitfield, *Prodigal Soldiers*, 220.

Domain Command and Control and Joint All-Domain Operations.¹¹ Each Service also maintains its own Offices of Congressional and Legislative Affairs to advance institutional interests and secure funding.

The current DOD force structure supports Service-derived inefficiencies, leading to wasteful duplicative spending and potential misallocation of limited resources such as finances, manpower, and materiel capability. Resource guarding occurs when an organization feels its resources, budget, or personnel are threatened by a competing interest, such as a sister Service or emerging technology. It is the guarding, or fencing off, of the threatened assets to prevent others from having any or all of it. The common practice of “use it or lose it” or “goldwatching” encourages Services to spend the entirety of an allocated budget, even when unnecessary, to ensure a similar allocation the following fiscal year.¹² Commanders and military Service branches instinctively, and under mandate, protect allocated resources and manpower favoring institutional preservation.¹³ It would seem logical there is an inflection point when inter-organizational resource sharing or organizational restructuring is more beneficial, and more important.

The phenomenon of institutional inertia obstructs the effort required to create a change within an organization, or to influence the speed or direction of the change.¹⁴ A small, agile, growth-mindset organization harbors less institutional inertia than a large,

¹¹ Joint Chiefs of Staff, *Joint Task Force Headquarters*, JP 3-33 (Washington, DC: Joint Chiefs of Staff, 2018), https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_33.pdf; John R. Hoehn, *Joint All-Domain Command and Control*, CRS Report No. IF11493 (Washington, DC: Congressional Research Service, 2022), <https://sgp.fas.org/crs/natsec/IF11493.pdf>; “All-Domain Operations in a Combined Environment,” Joint Air Power Competence Centre, September 2021, <https://www.japcc.org/flyers/all-domain-operations-in-a-combined-environment/>.

¹² S. Zimmerman et al., *Movement and Maneuver: Culture and the Competition for Influence Among the U.S. Military Services* (Santa Monica, CA: RAND Corporation, 2019), 11, <https://doi.org/10.7249/RR2270>.

¹³ Dima Adamsky, *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the U.S., and Israel* (Redwood City: Stanford University Press, 2010), 83–84; Zimmerman et al., *Movement and Maneuver*, 13, 190.

¹⁴ Herman Aksom, “A Theory of Institutional Inertia – Organizational Change and Practice Variation” (master’s thesis, University of Jyväskylä, Finland, 2021), ResearchGate https://www.researchgate.net/publication/351774271_A_theory_of_institutional_inertia_I_Organizational_change_and_practice_variation.

bulky, fixed-mindset one.¹⁵ Institutional inertia is an unfortunate byproduct of each Service’s unique identity – its founding, heritage, customs and traditions, and associated claim to domain dominance.

D. FRAMING THE PROBLEM

Institutional change becomes more difficult the larger and more well-established the organization; large, bureaucratic organizations are often unable to swiftly change at the macro level and are, understandably, hesitant to relinquish hard-fought-for power and influence.¹⁶ Challenges to cross-domain synergy are currently acknowledged as: 1) bringing varied and specific expertise to bear on the problem; 2) training and education shortfalls; 3) manning, and 4) classification and compartmentalization of capabilities.¹⁷ The military has repeatedly exhibited slow progress in implementing changes due to Service culture and traditions, especially when the change creates a new military Service or devalues currently dominant military systems.¹⁸ “The Services are currently the most powerful competitors” in the DOD, and there will be a struggle between loyalty-to-Service and loyalty to national policy and military strategy.¹⁹ Additionally, there exists a very real challenge to making effective and lasting change within the DOD’s force structure while preserving positive system qualities such as innovative competition,

¹⁵ Catherine Cote, “Growth Mindset vs. Fixed Mindset: What’s the Difference?,” *Harvard Business School Online: Business Insights* (blog), March 10, 2022, <https://online.hbs.edu/blog/post/growth-mindset-vs-fixed-mindset>.

¹⁶ Kitfield, *Prodigal Soldiers*, 281; Thomas G. Mahnken and James R. FitzSimonds, “Revolutionary Ambivalence: Understanding Officer Attitudes Toward Transformation,” *International Security* 28, no. 2 (2003): 112–48, <http://www.jstor.org/stable/4137470>; Zimmerman et al., *Movement and Maneuver*, 192; Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, (Santa Monica, CA: RAND, 1989), 204. https://www.ndu.edu/Portals/59/Documents/AA_Documents/Officer%20Prep%20Courses/Lesson%201/The%20Masks%20of%20War%20-%20Service%20Cultures.pdf?ver=2019-05-22-125817-220

¹⁷ United States Joint Staff Joint Force Development (J7) – Future Force Development, *Cross-Domain Synergy in Joint Operations Planner’s Guide* (Washington, DC: Joint Chiefs of Staff, 2016), 8, https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/cross_domain_planning_guide.pdf?ver=2017-12-28-161956-230.

¹⁸ Mahnken and FitzSimonds, “Revolutionary Ambivalence,” 113.

¹⁹ Zimmerman et al., *Movement and Maneuver*, 184; James R. Locher, “Has It Worked?: The Goldwater-Nichols Reorganization Act,” *Naval War College Review* 54, no. 4 (2001): 54, <http://www.jstor.org/stable/26393873>.

pride in organization and dominance in capability. The Services primarily compete in four arenas: resources, personnel, current roles and missions, and future institutional security.²⁰ However, Services can make change if, 1) Services acknowledge they are the “ultimate practitioners of new ways of war;” 2) an innovation climate is fostered; 3) the next generation of change-accepting leadership promotes to senior leadership positions at key timeframes; and, 4) military officers are recognized for their expertise. Furthermore, staff officers at the highest level of DOD leadership already argued for more interdependence among Services, with an emphasis on unified capability versus capacity.²¹ Implementation of the Goldwater-Nichols Act overturned the notion that relationships within the DOD were “fixed and unchangeable,” proving a well-established institution could implement sweeping change when provided proper mandate and motivation.²²

Unfortunately, sweeping organizational changes are usually catalyzed by crucible events such as evolving doctrine and service rivalry in back-to-back world wars or catastrophic mission failures.²³ Figure 1 illustrates this point, where items in red on the timeline are crisis and conflict events, and items in black are organizational updates to the DOD. It is important to also note significant reforms did not occur during armed conflict, but resulted because of friction during the conflict.²⁴ Figure 2 is a depiction of this phenomenon, where the blue bars across the bottom portray the periods of armed conflict between 1927 and 2019. Figure 2 also highlights the “typical life cycle” of DOD structural reform—approximately every 40 years, or the career span of one generation of senior level leadership. Therefore, a 40-year armed conflict cycle induces a 40-year structural reform cycle. Today’s strategic environment is arguably driving DOD warfighting theory,

²⁰ Zimmerman et al., *Movement and Maneuver*.

²¹ Wayne Porter and Mark Mykleby, “Rethinking America’s Joint Force: Strength and Credibility in a Constrained Fiscal Environment,” *American Foreign Policy Interests* 34, no. 2 (March 2012): 57–68, <https://doi.org/10.1080/10803920.2012.666148>.

²² Zimmerman et al., *Movement and Maneuver*, 187.

²³ Kitfield, *Prodigal Soldiers*, 216.

²⁴ Lindsey Eilon and Jack Lyon, *White Paper: Evolution of Department of Defense Directive 5100.01 ‘Functions of the Department of Defense and Its Major Components’* (Washington, DC: Office of the Secretary of Defense, 2014), I, <https://dml.armywarcollege.edu/wp-content/uploads/2022/12/DOD-CMO-White-Paper-Evolution-of-5100.01-2020-Update.pdf>

strategy, concepts and doctrine towards a truly integrated joint and all-domain force, and as the DOD's worldwide commitments drawdown, opportunity exists to implement significant reform prior to the next round of crisis and conflict.



National Military Establishment (NME) National Security Act (NSA) of 1947 (Public Law 80-253)

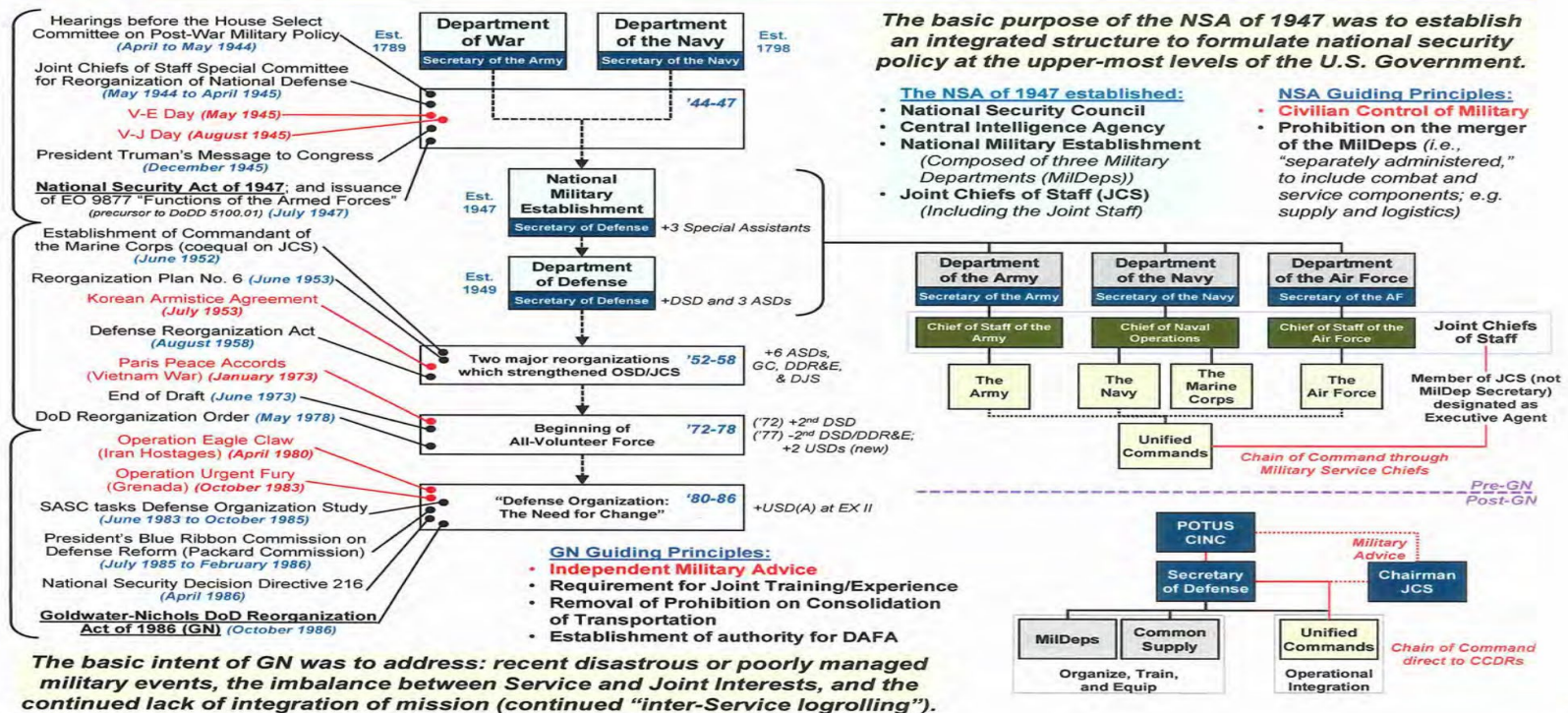
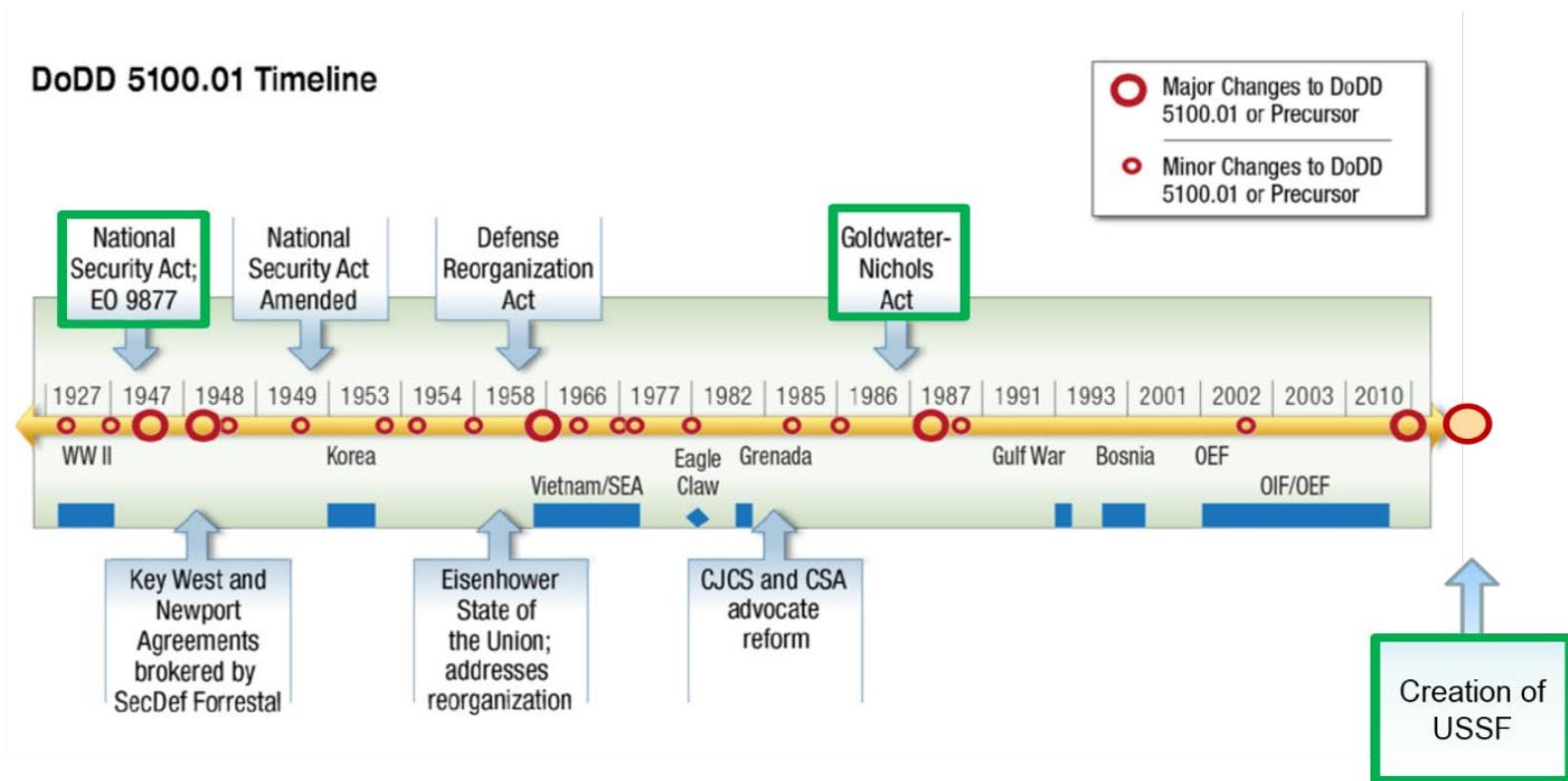


Figure 1. National Military Establishment.²⁵

²⁵ Source: Directorate for Organizational Policy and Decision Support, *Organization and Management of the Department of Defense; Resource Guide v3.2* (Washington, DC: Department of Defense, March 2019), 5, <https://irp.fas.org/agency/dod/org-man.pdf>.



The Department of Defense undergoes significant reformation on an approximate 40-year lifecycle while outside a period of crisis and conflict.

Figure 2. Modifications to DODD 5100.01 on a Timeline.²⁶

²⁶ Adapted from Eilon and Lyon, *White Paper: Evolution of Department of Defense Directive 5100.01 'Functions of the Department of Defense and Its Major Components'*, A34.

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II. THE DEPARTMENT OF DEFENSE AS A SYSTEM

The DOD is the largest U.S. federal agency and one of the most complex government organizations in the world, employing approximately 1.3 million uniformed military and 750,000 civilians.²⁷ The DOD is also a complex adaptive system; “able to anticipate the future by taking current actions based on expected outcomes that produce competitive advantage,” and has the ability to “change its rules in response to environmental change.”²⁸ The DOD continually revises rules of interactions among its subcomponents, resulting in perpetually changing behavior due to non-linear dynamics.²⁹ It experiences evolution (the adaptation of many parts with varying individual criteria), aggregate behavior (behavior emerging from the interaction of the parts) and anticipation (the development of rules anticipating the consequences of certain responses).³⁰ The DOD is also hierarchal (where relationships within subsystems are stronger than relationships between subsystems), self-organizing (dynamic organizational structure which responds to changes in the environment and goals), and adaptive (structure and behavior senses and responds to its environment).³¹

A. SYSTEM BOUNDARIES

The Functionally Aligned and Service-Agnostic U.S. Military system dynamics model bounded the system to include four Services (Army, Air Force, Navy and Marine Corps), and does not include the Coast Guard, National Guard Bureau, Reserve Component, or interagency partners. The primary variables considered are years, dollars,

²⁷ “Department of Defense,” Performance.gov, accessed December 8, 2023, <https://trumpadministration.archives.performance.gov/defense/#:~:text=The%20Department%20of%20Defense%20is,is%20the%20nation's%20largest%20employer.>

²⁸ Porter, “Complex Adaptive Systems.”

²⁹ John H. Holland, “Complex Adaptive Systems,” *Daedalus* 121, no. 1, (Winter, 1992): 17–30, <http://www.jstor.org/stable/20025416>; Porter, “Complex Adaptive Systems.”

³⁰ Holland, “Complex Adaptive Systems”; Porter, “Complex Adaptive Systems.”

³¹ Donella H. Meadows, *Thinking in Systems: A Primer* (London: Earthscan, 2009), 83; Holland, “Complex Adaptive Systems.”

and number of personnel. This research is scoped without a materiel assessment and limited Joint Capability assessment, as the Congressional Budget Office acknowledges difficulty in quantifying and standardizing assessment of combat capability.³²

B. CAUSAL LOOP DIAGRAM

A Causal Loop Diagram, as depicted in Figure 3, shows the major sources of power and influence within each of the Service departments and how the Services contribute to the Joint Force. The Causal Loop Diagram is labeled with link types and polarities, as well as overall loop behavior, in accordance with John Sterman’s text “Business Dynamics: Systems Thinking and Modeling for a Complex World”.³³ Solid lines represent material connections and dashed lines represent information connections. The polarity of causal links between variables is marked to indicate positive or negative feedback. Positive polarity indicates that as the cause increases, the effect also increases above what it would otherwise have been.³⁴ Further, if the cause decreases, the effect also decreases below what it would otherwise have been.³⁵ In a loop, overall positive polarity, labeled “R,” depicts reinforcing behavior. Negative polarity indicates that as a cause increases, the effect decreases below what it would otherwise have been, and vice versa.³⁶ In a loop, overall negative polarity, labeled “B,” depicts balancing, or goal-seeking behavior.

³² Congressional Budget Office, *The U.S. Military’s Force Structure: A Primer, 2021 Update*, (Washington, DC: Congressional Budget Office, 2021), 8. <https://www.cbo.gov/system/files/2021-05/57088-Force-Structure-Primer.pdf>

³³ John D. Sterman, *Business Dynamics: Systems Thinking and Modeling for a Complex World* (Jeffrey J. Shelstad, 2000), 142, <https://www.tandfonline.com/doi/full/10.1057/palgrave.jors.2601336>.

³⁴ Sterman, 139.

³⁵ Sterman, 139.

³⁶ Sterman, 139.

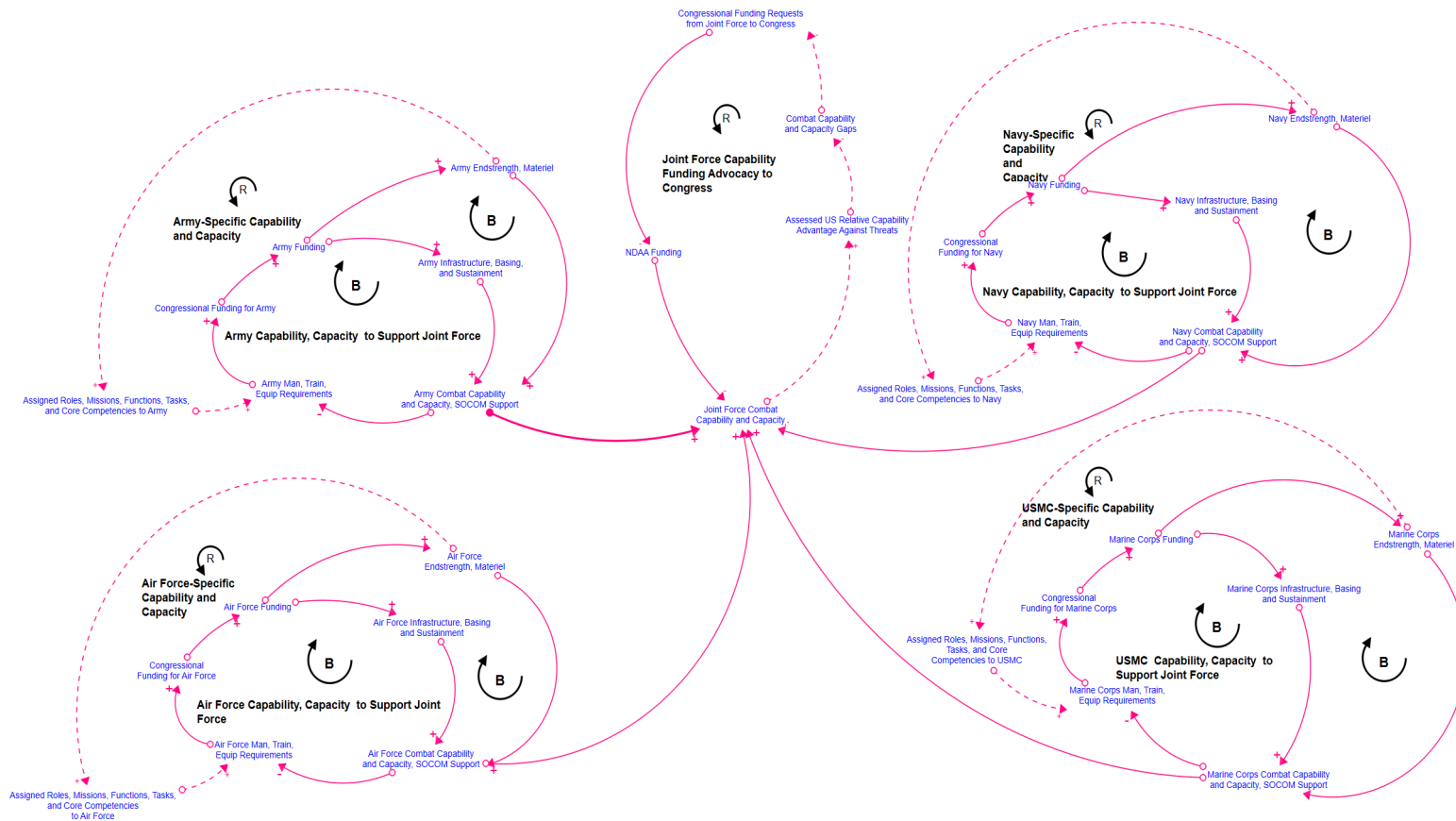


Figure 3. Causal Loop Diagram.³⁷

³⁷ Source: Sarah Skogsberg-Karnowski, "Causal Loop Diagram," (unpublished model data, September 10, 2023).

From the central node of the “Joint Force Combat Capability and Capacity,” there are five hubs: one for each of the U.S. military Service “Capability, Capacity to Support Joint Force,” and one for the “Joint Force Capability Funding Advocacy to Congress.” Reference Figure 4 for a representative Service-related loop. Within each Service, there are three loops: 1) the inner loop, representing the links between congressional funding and capability and capacity, 2) the middle loop, representing the links between congressional funding and materiel endstrength, and 3) the outer loop, representing information links between roles and missions, capability, and training requirements. The primary elements are “Combat Capability and Capacity,” “Man, Train, and Equip Requirements,” “Congressional Funding,” “Service Funding Allocation,” “Endstrength Material,” “Infrastructure, Basing and Sustainment Requirements,” and “Assigned Roles, Missions, Functions, Tasks and Core Competencies.” Of these interactions, the only reinforcing behavior (negative polarity) is the link between “Combat Capability and Capacity” and “Man, Train and Equip Requirements”; all other polarities within each Service are positive, indicating a balancing behaviour within the inner and middle loops of each Service. The outer loop displays reinforcing behavior, suggesting that as “Assigned Roles, Missions, Functions, Tasks and Core Competencies” increase, so does “Man, Train, Equip Requirements,” “Funding,” and “Material Endstrength.”

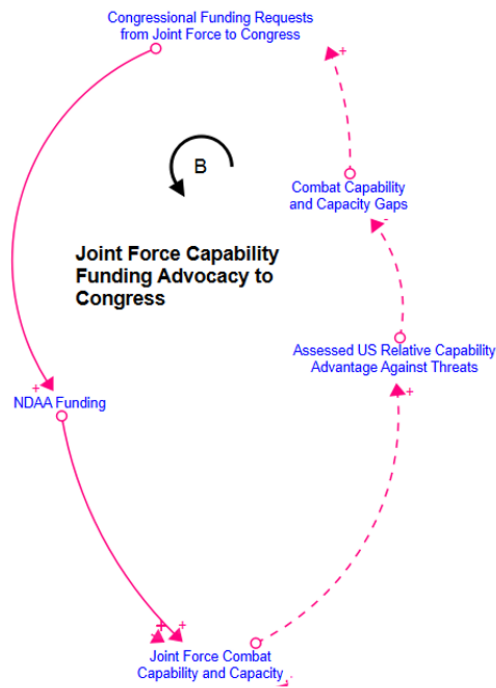


Figure 5. Joint Force Capability Funding Advocacy to Congress.⁴⁰

This Causal Loop Diagram is further useful in illustrating institutional inertia preserving status-quo and resistance to change within the DOD, while identifying the Service Chiefs (as the heads of each Service) and the Chairman of the Joint Chiefs of Staff (head of force employment of the Joint Force Combat Capability) as key stakeholders within any attempt at organizational restructuring. It is important to note that while polarities and identification of balancing or reinforcing behavior is a useful output of a Causal Loop Diagram, the strength of this behavior cannot be measured without a Stock and Flow model complete with data. Additionally, this Causal Loop Diagram does not address interactions between the Joint Force and Combatant Commands requiring further analysis.

⁴⁰ Source: Skogsberg-Karnowski, “Causal Loop Diagram.”

III. POTENTIAL STRATEGIC APPROACHES

In order to understand how the DOD force structure could evolve, it must be understood how it has already evolved, and more importantly, why it evolved the way it did. The United States Air Force was created as a separate uniformed Service branch under the National Security Act of 1947, and the Goldwater-Nichols Act of 1986 was implemented as a “jointness” forcing function between the uniformed Services. These cases are of particular interest because they are two vastly different solutions applied to solving identified gaps in the application of military power, separated by 40 years—the full life cycle of armed conflict and DOD structural reform. The development, implementation, and strategic effectiveness of air power in the victory of World War II drastically changed doctrine and Service requirements. Unity of effort in dominating the Air Domain was consolidated under the Air Force, creating a Service “coequal” to the Navy serving the Maritime Domain and the Army serving the Land Domain. The creation of a new branch signals two things: 1) the recognized importance of capability unity of effort; and 2) U.S. military might is structurally organized by domain dominance. The Goldwater-Nichols Act was borne from the catastrophic failure of OPERATION EAGLE CLAW—a 1980 U.S. attempt to rescue 52 hostages held in Iran. Caused by interservice rivalry and joint interoperability failures, the aborted mission resulted in the loss of eight servicemember’s lives, four service members injured, the destruction of two aircraft and the abandonment of five helicopters.⁴¹ The implementation of Goldwater-Nichols signals two things: 1) the recognized importance of collective unity of effort; and, 2) military operations are not successful when forces are oriented by domain and Service alone.

With these two case studies and the Causal Loop Diagram in mind, three strategic approaches are suggested 1) Domain Alignment, 2) Functional Alignment, and 3) The Hybrid. Each of these is summarized in Figure 6. The Domain Alignment approach capitalizes on currently existing organizational structure to maintain an implementation

⁴¹ Richard Lamb, “This Is What Special Ops Learned 40 Years Ago from Operation Eagle Claw,” *MilitaryTimes*, April 24, 2020, <https://www.militarytimes.com/opinion/commentary/2020/04/24/this-is-what-special-ops-learned-40-years-ago-from-operation-eagle-claw/>.

timeline of approximately five years, which is accepted as the planning number for implementing force structure changes.⁴² The resulting system behavior is expected to remain very similar to the behavior captured in the Causal Loop Diagram, with additional links created between the individual Services prior to presenting Combat Capability and Capacity to the Joint Force. This approach is the most palatable to stakeholders because it is familiar, utilizes existing command relationships and policy structures, and echoes previous advocacy.⁴³ However, this approach does not challenge the assumption domain dominance is the most effective alignment, and instituted changes may not reach the tipping point required to overcome institutional inertia within the Services (permitting backsliding into previous problematic behavior).

The Functional Alignment approach fundamentally challenges organizational assumptions, deep-dives strategic and operational capability requirements, and up-ends the current Causal Loop Diagram. It leverages the Joint Force Combat Capability and Capacity centrality as the justification to reorganize away from the Services into a Functional Combat Capability alignment rather than by Service-domain. Because of the significant reform associated with this approach, the implementation timeline is expected to be 7–22 years based on Future Years Defense Program cycles and will experience significant institutional resistance to change.

The Hybrid strategic approach is a compromise between the Domain and Functional Alignment approaches, acknowledging there is goodness in the Service construct as it currently exists while also pursuing realignment of shared domain-agnostic capabilities such as law enforcement, medical, intelligence, logistics, finance, installation and mission support, acquisitions, information and technology support, etc. The implementation timeline is expected to be 7–10 years as it leverages many existing structures but could ultimately create unintended additional complexity by layering a new command and relationship structure on top of an already-complex system structure.

⁴² Congressional Budget Office, *The U.S. Military's Force Structure: A Primer, 2021 Update*, 14.

⁴³ Wayne Porter and Mark Mykleby, "Rethinking America's Joint Force: Strength and Credibility in a Constrained Fiscal Environment," *American Foreign Policy Interests* 34, no. 2 (April 2012): 57–68, <https://www-tandfonline-com.libproxy.nps.edu/doi/full/10.1080/10803920.2012.666148>.

<p>Strategic Approach 1 Domain Alignment Reallocate roles, functions and missions by <i>domain</i></p> <p>Enforce delineation and collaboration between services</p> <p>Time Horizon: 5 years</p> <p>Strengths:</p> <ul style="list-style-type: none"> • Most palatable and familiar • Uses existing COMREL and policy structures <p>Weaknesses:</p> <ul style="list-style-type: none"> • Does not challenge assumption domain dominance is the most effective alignment • May not reach tipping point to overcome institutional inertia (backsliding) 	<p>Strategic Approach 2 Functional Alignment Divest from Service-centric model, and reorganize based on <i>function</i></p> <p>“Service-agnostic, functionally-aligned, singular United States Military”</p> <p>Time Horizon: 7-22 years</p> <p>Strengths:</p> <ul style="list-style-type: none"> • Challenges fundamental organizational assumptions • Deep-dives strategic and operational capability requirements <p>Weaknesses:</p> <ul style="list-style-type: none"> • Requires massive organizational upheaval • Decades-long timeline • Attracts strong antibodies 	<p>Strategic Approach 3: The Hybrid (compromise) Reorganize <i>shared</i> domain-agnostic capabilities while maintaining Service structure</p> <p>Law enforcement, medical, intelligence, logistics, finance, installation and mission support, acquisitions, communications, etc.</p> <p>Time Horizon: 7-10 years</p> <p>Strengths:</p> <ul style="list-style-type: none"> • More palatable option than complete reform • “Trial” space before full implementation <p>Weaknesses:</p> <ul style="list-style-type: none"> • Could create complexity rather than streamlining
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Figure 6. Strategic Approaches.⁴⁴

For reasons identified in the Problem Relevance and Background section, this thesis pursues the Functional Alignment strategic approach. Current joint integration forcing functions such as Joint All-Domain Operations, Joint Warfighting Concept, and the Joint All-Domain Command and Control project are indicative of the rudder-steering currently driving the independent military Services towards interconnectedness.⁴⁵ Aligning by warfighting function could be the first step towards a truly integrated Service-agnostic force.

⁴⁴ Source: Sarah Skogsberg-Karnowski, “Skogsberg-Karnowski_DA4480 Assignment 3” (unpublished graduate report, June 14, 2023), 30.

⁴⁵ Kris Osborn, “Pentagon Crafts New ‘Joint Warfighting’ Concept,” *Warrior Maven: Center for Military Modernization*, August 22, 2021, <https://warriormaven.com/history/integrated-deterrence-space-force/>; Hoehn, Joint All-Domain Command and Control.

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IV. FUNCTIONALLY ALIGNED SERVICE-AGNOSTIC U.S. MILITARY STOCK AND FLOW MODEL

System dynamics models, and their data-enabled structures, mathematically represent systemic interactions between variables creating problematic behavior.⁴⁶ The Functionally Aligned Service-Agnostic U.S. Military model, developed for this research in Stella Architect 3.5, assumes the course of action to correct parochial Service tendencies and increase support to the Joint Force combat capability is to pursue a Functionally Aligned, Service-agnostic structure within the future DOD as recommended in the previous section. The model is constructed with a User Interface allowing the user to toggle between the DOD system “as it currently exists”—divided among Service lines—and a potential system “as it could be,” where the DOD is Inherently Joint and organized along Functional lines. The primary parameters modeled are years, dollars (U.S.), and number of personnel. This approach is symbiotic with the Congressional Budget Office’s methodology, which acknowledges “historically, large changes in the [DOD]’s budget have eventually affected most of the department’s activities...consequently, [the Congressional Budget Office] projects that a large change in the force structure would, after several years, alter almost all of [DOD]’s operation and support accounts.”⁴⁷ Furthermore, The Congressional Budget Office admits there is “no generally agreed upon way to measure combat capability directly and quantitatively. Force structure is the simplest and least subjective way to describe combat capability, although it has many limitations.”⁴⁸

Due to the model’s size, a full depiction is not provided in this paper; however, each component is discussed in subsequent sections. This model makes extensive use of modules and sectors to simulate smaller groupings of the subsystems comprising the DOD. Encapsulated within each module are elements, including the following:

⁴⁶ Sterman, *Business Dynamics: Systems Thinking and Modeling for a Complex World*.

⁴⁷ Congressional Budget Office, *The U.S. Military’s Force Structure: A Primer, 2021 Update*, 12.

⁴⁸ Congressional Budget Office, 8.

1. Module: a self-contained, well-defined model with the ability to connect to other models.⁴⁹ Modules are particularly useful when representing hierarchical systems or creating large or complex models
2. Stock (Reservoir): measurable material or information⁵⁰
3. Flow: an element that transfers accumulations directionally⁵¹
4. Converters: an element that converts inputs to outputs, by holding values constant, defining external inputs to the model, calculating algebraic relationships, or serving as the repository for graphical functions⁵²
5. Stock (Queue): a type of stock used to model ‘first in, first out’ operations, multiple inflows, and multiple outflows⁵³
6. Sector: permits organization of the model into distinct parts for partial simulations⁵⁴
7. Connector (Material): an element used to connect model variables to each other⁵⁵

Elements filled with GREEN coloring are tied to a User Interface with user-defined values, either in an ON/OFF SWITCH or selectable via rheostat. Elements filled in CYAN are seeded, or initialized, with specific values based on historical data. Elements without a fill color are strictly computational. Elements boxed in YELLOW are used as inputs within other modules throughout the model; this annotation serves to highlight links and interactions more-easily between subsystems. A pictorial representation of each element is shown in Figure 7.

⁴⁹ “Stella Software Online Help,” ISEE Systems, 2023, <https://www.iseesystems.com/resources/help/v3/>.

⁵⁰ Sterman, *Business Dynamics: Systems Thinking and Modeling for a Complex World*.

⁵¹ ISEE Systems, “Stella Software Online Help.”

⁵² ISEE Systems.

⁵³ ISEE Systems.

⁵⁴ ISEE Systems.

⁵⁵ ISEE Systems.

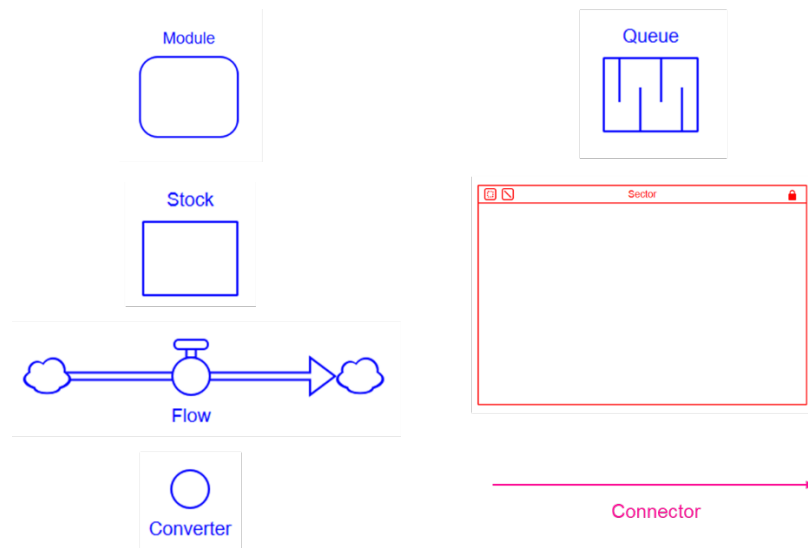


Figure 7. Model Elements

A. MODEL STRUCTURE: “DOD BUILDING BLOCKS” AS MODULES

The overarching structure of this model, encapsulating six different modules and labeled as “The Department of Defense Building Blocks,” is shown in Figure 8. Discussion of each module listed below occurs further in this chapter.

1. DOD Budget
2. [Service] Budget
3. Appropriations Budgets
4. Force Composition
5. Functional Budgets and Capacities
6. Joint Capabilities

The Department of Defense Building Blocks

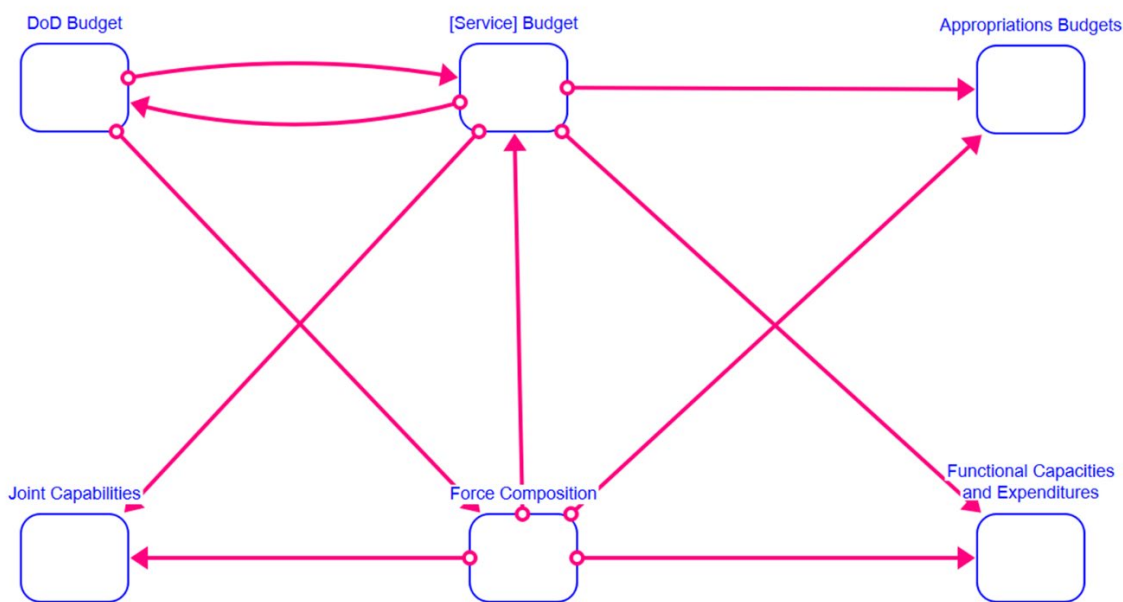


Figure 8. Functionally Aligned Service-Agnostic Module Structure.⁵⁶

B. MODEL STRUCTURE – BUDGET MODULES

There are three budget-related modules: 1) “DOD Budget”; 2) “[Service] Budget”; and 3) “Appropriations Budgets.” The Functionally Aligned and Service-Agnostic U.S. Military stock and flow model focuses extensively on budgetary considerations as it is a widespread quantifiable comparative tool used across commercial, government, and military sectors. Further, extensive accessible data exists describing U.S. government spending.

1. DOD Budget

The “DOD Budget” module, shown in Figure 9, simulates the effects of changes in the U.S.’ GDP based on the typical historical allocation to the DOD budget. Percent allocation from GDP is used as the commonly-accepted reference point for economic

⁵⁶ Source: Sarah Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final” (unpublished model data, December 3, 2023).

analysis to illustrate the “size of federal government spending compared with economic activity.”⁵⁷ A SWITCH to “Activate Combat Funding,” tied to the User Interface discussed in SECTION F: USER INTERFACE, illustrates the effects of a selectable increased percent GDP STEP allocation in the next five years to the Defense Budget for a period of 10 years in the event of major armed conflict (SWITCH position to ON). This armed conflict cycle recurs every 30 years for as long as the model is set to run (the default is a period of 70 years to show two iterations of armed conflict on the total 40-year conflict cycle). Further discussion on this 40-year cycle can be found in Chapter I Section D. When the SWITCH is in the OFF position, the percent GDP allocated to the Defense Budget is randomized within a historical range of -3.5% (times of economic decline) to 7.0% (times of economic boom).⁵⁸ The related “Increased Combat Funding” element is tied to a selectable rheostat titled “Percent GDP allocated to Combat Funding” in the User Interface, allowing the user to manually change the baseline percent GDP allocation to the Defense Budget during the periods armed conflict. While historical average shows the U.S. typically allocates 3.1% GDP to the DOD (and FY23 was 5.5% GDP), World War I combat funding increased to 20% GDP and World War II funding increased to 41% GDP.⁵⁹ Figure 108 through Figure 112 in APPENDIX A DATA SOURCES depict historical data trends. Table 1 describes each element within the module.

⁵⁷ “Fiscal Data Explains Federal Spending,” accessed November 27, 2023, <https://fiscaldata.treasury.gov/americas-finance-guide/federal-spending/>.

⁵⁸ Trading Economics, “United States GDP Growth Rate,” Trading Economics, n.d., <https://tradingeconomics.com/united-states/gdp-growth>.

⁵⁹ U.S. Government Spending, “US Government Defense Spending History with Charts,” U.S. Government Spending, n.d., https://www.usgovernmentsspending.com/defense_spending_history.

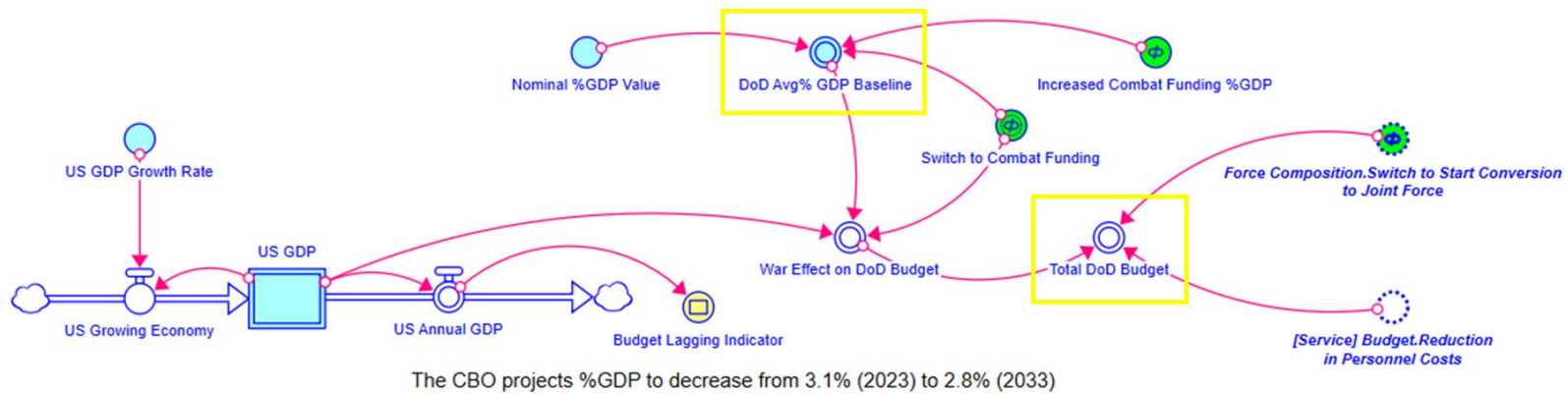


Figure 9. “DOD Budget” Module.⁶⁰

⁶⁰ Adapted from Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 1. Description of DOD Budget Elements

Element Name	Type	Description	Formula
US GDP Growth Rate	Converter	Historic average GDP growth rate with randomness introduced ⁶¹	RANDOM(-.035, .07, .023)
US Growing Economy	Inflow	Annual changes to U.S. GDP based on percentage change to current GDP	US_GDP*(1+US_GDP_Growth_Rate)
US GDP	Stock	Current U.S. Real GDP in FY23 USD	22230000000000 ⁶²
US Annual GDP	Outflow	Annual U.S. GDP	HISTORY(US_GDP, TIME)
Switch to Combat Funding	Switch, ON or OFF	Inject increased DOD funding based on conflict	ON (1) or OFF (0)
DOD Avg% GDP Baseline	Converter	Historical percentage allocation of U.S. GDP to DOD Budget in peacetime (Switch OFF) and wartime (Switch ON)	IF (Switch_to_Combat_Funding > 0) THEN (Nominal_%GDP_Value + STEP(Increased_Combat_Funding_%GDP,4, 10, 30)) ELSE Nominal_%GDP_Value
War Effect on DOD Budget	Converter	Changes DOD funding based on position of Switch to Combat Funding	IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN War_Effect_on_DOD_Budget – “[Service]_Budget”.Reduction_in_Personnel_Costs ELSE War_Effect_on_DOD_Budget
Total DOD Budget	Converter	Calculation of Total DOD Budget based on percent GDP allocation	IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN War_Effect_on_DOD_Budget – “[Service]_Budget”.Reduction_in_Personnel_Costs ELSE War_Effect_on_DOD_Budget
Budget Lagging Indicator	Converter	Not currently in use, planned for future incorporation as a lagging indicator in budget calculations	DELAY(US_Annual_GDP, 1)
Nominal %GDP Value	Converter	Historic average percentage GDP allocated to the Total DOD Budget with randomness introduced ⁶³	RANDOM(.02, .07, .055)

⁶¹ Trading Economics, “United States GDP Growth Rate.”

⁶² YCharts, “US Real GDP,” YCharts, n.d., https://ycharts.com/indicators/us_real_gdp.

⁶³ U.S. Government Spending, “US Government Defense Spending History with Charts.”

Element Name	Type	Description	Formula
Increased Combat Funding %GDP	Converter, user-defined value	Percentage GDP allocated to Total DOD Budget in times of active combat. Initialized at 20% based on WWI funding levels	0.2 ⁶⁴
[Service] Budget. Reduction in Personnel Costs	Ghosted Converter	Calculates estimated personnel savings when DOD is converted to Inherently Joint Force	Inherently_Joint_Force_Estimated_Savings*(Original_Personnel_Costs [Army]+Original_Personnel_Costs [Air_Force]+Original_Personnel_Costs [Navy]+Original_Personnel_Costs [Marine_Corps])
Force Composition. Switch to Start Conversion to Joint Force	Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)
US Annual GDP	Outflow	Annual GDP	HISTORY(US GDP, TIME)

⁶⁴ U.S. Government Spending.

2. Service Budget

The “[Service] Budget” module, shown in Figure 10, simulates the typical percent allocation of the Total DOD budget to each of the four modeled Services: Army, Air Force, Navy, and Marine Corps. Additionally, there is an element for “Inherently Joint,” which behaves in a Service-like manner when the model is simulating Inherently Joint parameters as selected by the “Start Conversion from Services to Joint Force” SWITCH in the User Interface. This module contains most feedback elements to determine the cost savings associated with personnel number changes due to converting to an Inherently Joint Force. The “Average Annual Cost per Service Member” converter, linked to a selectable rheostat in the User Interface, allows forecasting based on increasing personnel cost trends. In this module, this variable only functions when the SWITCH to “Start Conversion from Services to Joint Force” is ON. Due to global pandemic ramifications to worldwide and domestic economics, personnel costs are higher than average and are initialized at \$140,000 per service member annually.⁶⁵ The elements of this module are arrayed by Service to visually declutter the model. Table 2 describes each element within the module.

⁶⁵ Jon Harper, “Pentagon Personnel Costs at Historic High,” *National Defense*, October 19, 2021, <https://www.nationaldefensemagazine.org/articles/2021/10/19/pentagon-personnel-costs-at-historic-high>.

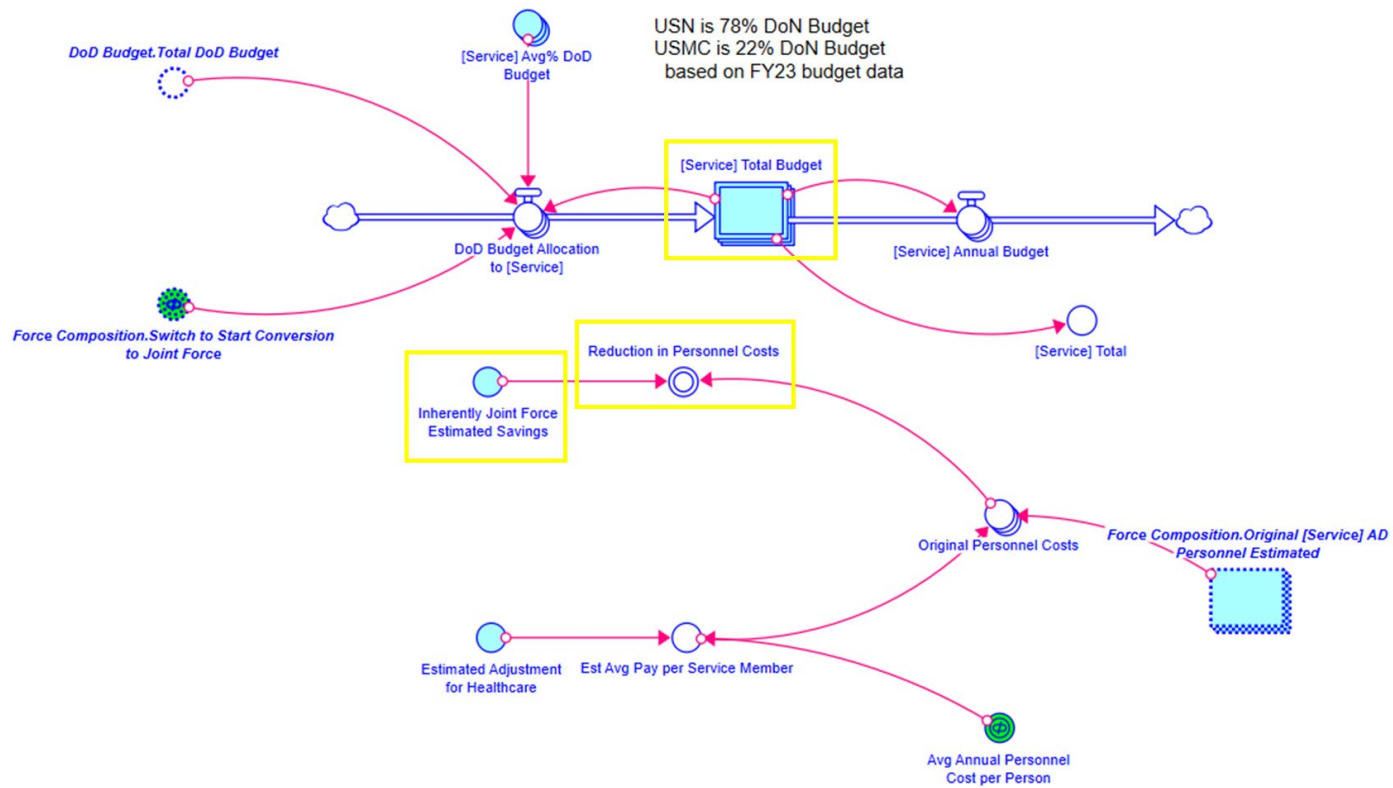


Figure 10. [Service] Budget Module.⁶⁶

⁶⁶ Adapted from Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 2. Description of Service Budget Elements

Element Name	Type	Description	Formula
DOD Budget. Total DOD Budget	Ghosted Converter as Input	Calculation of Total DOD Budget based on percent GDP allocation	IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN War_Effect_on_DOD_Budget – “[Service]_Budget”. Reduction_in_Personnel_Costs ELSE War_Effect_on_DOD_Budget
Force Composition. Switch to Start Conversion to Joint Force	Ghosted Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)
[Service] Avg% DOD Budget	Converter	Static percentage of Total DOD Budget allocated to each Service according to calculations from FY23 budget in FY23 USD	Army: 177315000000/1195276300190 ⁶⁷ Air Force: 234116000000/1195276300190 ⁶⁸ Navy: (230848000000-50300000000)/1195276300190 ⁶⁹ Marine Corps: 50300000000/1195276300190 ⁷⁰
DOD Budget Allocation to [Service]	Inflow	Calculation of each Service’s Total Budget	Army: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN “[Service]_Avg%_DOD_Budget”[Army_%DOD_Budget]* DOD_Budget.Total_DOD_Budget ELSE 0 Air Force:

⁶⁷ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request* (Washington, DC: Office of the Under Secretary of Defense, April 2022), A-2, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2023/FY2023_Budget_Request_Overview_Book.pdf; USA Spending, “Government Spending Explorer,” n.d., USA Spending.gov, <https://usaspending.gov/explorer>.

⁶⁸ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2; USA Spending, “Government Spending Explorer.”

⁶⁹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2; USA Spending, “Government Spending Explorer.”

⁷⁰ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2; USA Spending, “Government Spending Explorer.”

Element Name	Type	Description	Formula
			<p>IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN “[Service]_Avg%_DOD_Budget”[Air_Force_%DOD_Budget]*DOD_Budget.Total_DOD_Budget ELSE 0</p> <p>Navy: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN “[Service]_Avg%_DOD_Budget”[Navy_%DOD_Budget]* DOD_Budget.Total_DOD_Budget ELSE 0</p> <p>Marine Corps: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN “[Service]_Avg%_DOD_Budget”[Marine_Corps_%DOD_Budget]* DOD_Budget.Total_DOD_Budget ELSE 0</p> <p>Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN MAX (0, DOD_Budget.Total_DOD_Budget- (“[Service]_Total_Budget”[Inherently_Joint_Total_Budget] – Reduction_in_Personnel_Costs)) ELSE 0</p>
Reduction in Personnel Costs	Converter	Calculates estimated personnel savings when DOD is converted to Inherently Joint Force	Inherently_Joint_Force_Estimated_Savings*(Original_Personnel_Costs [Army]+Original_Personnel_Costs [Air_Force]+Original_Personnel_Costs [Navy]+Original_Personnel_Costs [Marine_Corps])
Inherently Joint Force Estimated Savings	Converter	Static percentage estimated savings when DOD is converted to Inherently Joint Force	.10
Original Personnel Costs	Converter	Calculated personnel costs based on DOD Service-centric model	Est_Avg_Pay_per_Service_Member*Force_Composition.Original_Service_AD_Personnel_Estimated
Force Composition. Original Service AD Personnel Estimated	Ghosted Stock	DOD Force size by Service, initialization values based on FY23 budget request ⁷¹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)

⁸² Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

Element Name	Type	Description	Formula
Est Avg Pay per Service Member	Converter	Calculated total expense per service member including healthcare	Avg_Annual_Personnel_Cost_per_Person*Estimated_Adjustment_for_Healthcare
Estimated Adjustment for Healthcare	Converter	Adjustment for healthcare costs per servicemember	4
Avg Annual Personnel Cost per Person	Converter, user-defined	Annual cost per service member, annually	140000 ⁷²
[Service] Total Budget	Stock	Each Service's Total Budget in FY23 USD, initialization values based of FY23 budget request ⁷³	Army: 177315000000 Air Force: 234116000000 Navy: 230848000000-50300000000 Marine Corps: 50300000000 Inherently Joint: 0
[Service] Annual Budget	Outflow	Annual Service Total Budget	Army: HISTORY("[Service]_Total_Budget"[Army_Total_Budget], TIME) Air Force: HISTORY("[Service]_Total_Budget"[Air_Force_Total_Budget], TIME) Navy: HISTORY("[Service]_Total_Budget"[Navy_Total_Budget], TIME) Marine Corps: HISTORY("[Service]_Total_Budget"[Marine_Corps_Total_Budget], TIME) Inherently Joint: HISTORY("[Service]_Total_Budget"[Inherently_Joint_Total_Budget], TIME)
[Service] Total	Converter	Summation of each Service's budget	"[Service]_Total_Budget"[Army_Total_Budget]+"[Service]_Total_Budget"[Air_Force_Total_Budget]+"[Service]_Total_Budget"[Navy_Total_Budget]+"[Service]_Total_Budget"[Marine_Corps_Total_Budget]

⁷² Harper, "Pentagon Personnel Costs at Historic High."

⁷³ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

3. Appropriations Budgets

The “Appropriations Budgets” module simulates the allocation of money from the Total Service Budget to the five modeled appropriations categories (Personnel Costs, Operations and Maintenance Costs, Procurement Costs, Research and Development Costs, and Military Construction Costs) comprising the vast majority of each Service’s budget. Figure 113 and Figure 114 in APPENDIX A DATA SOURCES depicts FY23 Appropriations data. Each appropriations category is modeled as a subsystem contained within a sector, and the elements within each sector are arrayed by Service to visually declutter the model. The United States Marine Corps is assumed to be allocated 22% of the total Department of the Navy budget (reciprocally, the United States Navy is allocated 78% of the total Department of the Navy budget) within each appropriations category. This allocation is based on Total Service Budget calculations from the FY23 budget requests, and those percentages are carried forward from the [Service] Budget module into other modules throughout the model. Inherently Joint calculations, dependent on the “Start Conversion to Joint Force” SWITCH position, assume the average percent allocation from each of the Services towards each appropriation category. The Appropriations Budgets module accepts input from the calculated Service Total Budgets as an output from the [Service] Budget module. Common elements between all sectors are described in Table 3.

Table 3. Description of Common Appropriations Budgets Elements

Element Name	Type	Description	Formula
[Service] Budget.[Service] Total Budget	Ghosted Stock as Input	Each Service’s Total Budget in FY23 USD, initialization values ⁷⁴	Army: 177315000000 Air Force: 234116000000 Navy: 230848000000-503000000000 Marine Corps: 503000000000 Inherently Joint: 0
Force Composition. Switch to Start Conversion to Joint Force	Ghosted Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)

⁷⁴ Office of the Under Secretary of Defense (Comptroller), A-2.

a. *Service Personnel Costs*

The “[Service] Personnel Costs” Sector, shown in Figure 11, simulates the allocation of money from the Total Service Budget to the Personnel appropriations category. The elements of this sector are arrayed by Service to visually declutter the model. Table 4 describes each element within the sector.

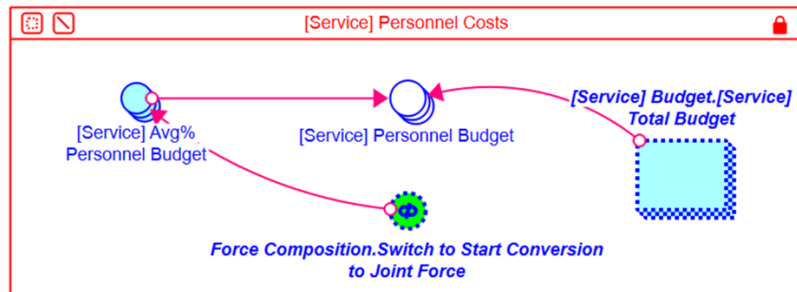


Figure 11. [Service] Personnel Costs Sector.⁷⁵

⁷⁵ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 4. Description of Personnel Costs Sector Elements

Element Name	Type	Description	Formula
[Service] Avg% Personnel Budget	Converter	Percent of Service Budget allocation to each Service’s Personnel Appropriation based on FY23 USD	Army: 69073000000/17731500000 ⁷⁶ Air Force: 46326000000/234116000000 ⁷⁷ Navy: 58484000000/230848000000 ⁷⁸ Marine Corps: 58484000000/230848000000 ⁷⁹ Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint Force > 0 THEN .28 ELSE 0
[Service] Personnel Budget	Converter	Calculation of each Service’s Personnel Appropriations category	Army: “[Service] Avg% Personnel Budget”[Army_%_on_Personnel]* “[Service]_Budget”.[Service]_Total_Budget”[Army_Total_Budget] Air Force: “[Service] Avg% Personnel Budget”[Air_Force_%_on_Personnel]* “[Service]_Budget”.[Service]_Total_Budget”[Air_Force_Total_Budget] Navy: “[Service] Avg% Personnel Budget”[Navy_%_on_Personnel]* “[Service]_Budget”.[Service]_Total_Budget”[Navy_Total_Budget] Marine Corps: “[Service] Avg% Personnel Budget”[Marine_Corps_%_on_Personnel]* “[Service]_Budget”.[Service]_Total_Budget”[Marine_Corps_Total_Budget] Inherently Joint: “[Service] Avg% Personnel Budget”[Inherently_Joint_%_on_Personnel]* “[Service]_Budget”.[Service]_Total_Budget”[Inherently_Joint_Total_Budget]

⁷⁶ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

⁷⁷ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁷⁸ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁷⁹ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

b. Service Operations and Maintenance Costs

The “[Service] Operations and Maintenance Costs” Sector, shown in Figure 12, simulates the allocation of money from the Total Service Budget to the Operations and Maintenance (O&M) appropriations category. The elements of this sector are arrayed by Service to visually declutter the model. Table 5 describes each element within the sector.

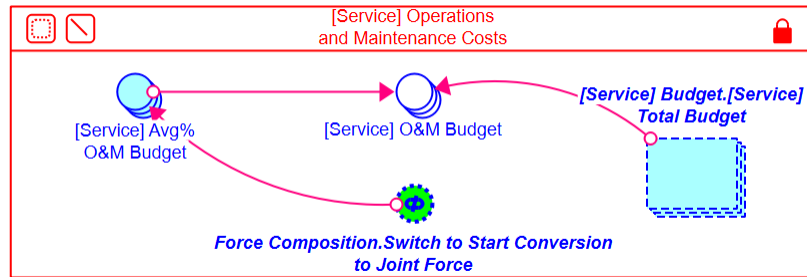


Figure 12. [Service] Operations and Maintenance Costs Sector.⁸⁰

⁸⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 5. Description of Operations and Maintenance Costs Sector Elements

Element Name	Type	Description	Formula
[Service] Avg% O&M Budget	Converter	Percent of Service Budget allocation to each Service's O&M Appropriation based on FY23 USD	Army: 70241000000/17731500000 ⁸¹ Air Force: 73096000000/234116000000 ⁸² Navy: 77705000000/230848000000 ⁸³ Marine Corps: 77705000000/230848000000 ⁸⁴ Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN .35 ELSE 0
[Service] O&M Budget	Converter	Calculation of each Service's O&M Appropriations category	Army: "[Service] Avg% O&M Budget"[Army_%_on_O&M]* "[Service]_Budget"."[Service]_Total_Budget"[Army_Total_Budget] Air Force: "[Service] Avg% O&M Budget"[Air_Force_%_on_O&M]* "[Service]_Budget"."[Service]_Total_Budget"[Air_Force_Total_Budget] Navy: "[Service] Avg% O&M Budget"[Navy_%_on_O&M]* "[Service]_Budget"."[Service]_Total_Budget"[Navy_Total_Budget] Marine Corps: "[Service] Avg% O&M Budget"[Marine_Corps_%_on_O&M]* "[Service]_Budget"."[Service]_Total_Budget"[Marine_Corps_Total_Budget] Inherently Joint: "[Service] Avg% O&M Budget"[Inherently_Joint_on_O&M]* "[Service]_Budget"."[Service]_Total_Budget"[Inherently_Joint_Total_Budget]

⁸¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

⁸² Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁸³ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁸⁴ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

c. Service Procurement Costs

The “[Service] Procurement Costs” Sector, shown in Figure 13, simulates the allocation of money from the Total Service Budget to the Procurement appropriations category. The elements of this sector are arrayed by Service to visually declutter the model. Table 6 describes each element within the sector.

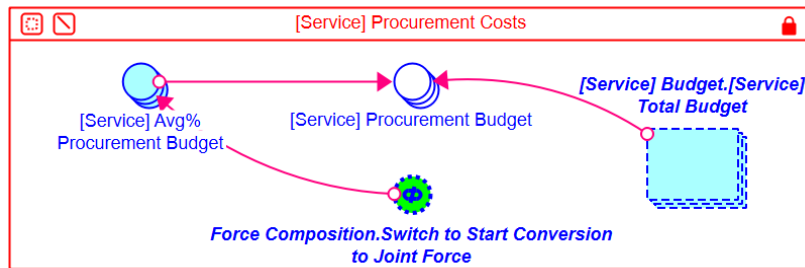


Figure 13. [Service] Procurement Costs Sector.⁸⁵

⁸⁵ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 6. Description of Service Procurement Costs Sector Elements

Element Name	Type	Description	Formula
[Service] Avg% Procurement Budget	Converter	Static calculation of percentage of FY23 Service Budget to Service Procurement Appropriations category	Army: 22344000000/17731500000 ⁸⁶ Air Force: 51704000000/234116000000 ⁸⁷ Navy: 65985000000/230848000000 ⁸⁸ Marine Corps: 65985000000/230848000000 ⁸⁹ Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN .21 ELSE 0
[Service] Procurement Budget	Converter	Calculation of Service Budget allocated to Procurement Appropriations category	Army: “[Service]_Avg%_Procurement_Budget”[Army_%_on_Procurement]* “[Service]_Budget”.[Service]_Total_Budget”[Army_Total_Budget] Air Force: “[Service]_Avg%_Procurement_Budget”[Air_Force_%_on_Procurement]* “[Service]_Budget”.[Service]_Total_Budget”[Air_Force_Total_Budget] Navy: “[Service]_Avg%_Procurement_Budget”[Navy_%_on_Procurement]* “[Service]_Budget”.[Service]_Total_Budget”[Navy_Total_Budget] Marine Corps: “[Service]_Avg%_Procurement_Budget”[Marine_Corps_%_on_Procurement]* “[Service]_Budget”.[Service]_Total_Budget”[Marine_Corps_Total_Budget] Inherently Joint: “[Service]_Avg%_Procurement_Budget”[Inherently_Joint_%_on_Procurement]* “[Service]_Budget”.[Service]_Total_Budget”[Inherently_Joint_Total_Budget]

⁸⁶ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

⁸⁷ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁸⁸ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁸⁹ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

d. Service Research and Development Costs

The “[Service] Research and Development Costs” Sector, shown in Figure 14, simulates the allocation of money from the Total Service Budget to the Research and Development appropriations category. The elements of this sector are arrayed by Service to visually declutter the model. Table 7 describes each element within the sector.

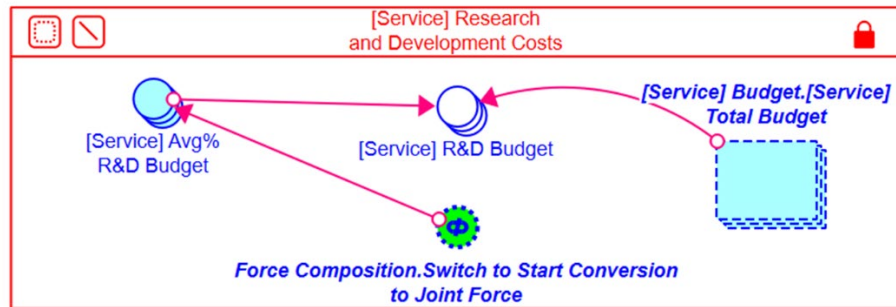


Figure 14. [Service] Research and Development Costs Sector.⁹⁰

⁹⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 7. Description of Service Research and Development Costs Sector Elements

Element Name	Type	Description	Formula
[Service] Avg% R&D Budget	Converter	Static calculation of percentage of FY23 Service Budget to Service Research and Development Appropriations category	Army: 1371000000/17731500000 ⁹¹ Air Force: 59954000000/234116000000 ⁹² Navy: 24079000000/230848000000 ⁹³ Marine Corps: 24079000000/230848000000 ⁹⁴ Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN .14 ELSE 0
[Service] R&D Budget	Converter	Calculation of Service Budget allocated to Research and Development Appropriations category	Army: “[Service]_Avg%_R&D_Budget”[Army_%_on_R&D]* “[Service]_Budget”.[Service]_Total_Budget”[Army_Total_Budget] Air Force: “[Service]_Avg%_R&D_Budget”[Air_Force_%_on_R&D]* “[Service]_Budget”.[Service]_Total_Budget”[Air_Force_Total_Budget] Navy: “[Service]_Avg%_R&D_Budget”[Navy_%_on_R&D]* “[Service]_Budget”.[Service]_Total_Budget”[Navy_Total_Budget] Marine Corps: “[Service]_Avg%_R&D_Budget”[Marine_Corps_%_on_R&D]* “[Service]_Budget”.[Service]_Total_Budget”[Marine_Corps_Total_Budget] Inherently Joint: “[Service]_Avg%_R&D_Budget”[Inherently_Joint_%_on_R&D]* “[Service]_Budget”.[Service]_Total_Budget”[Inherently_Joint_Total_Budget]

⁹¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

⁹² Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁹³ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁹⁴ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

e. Service Military Construction Costs

The “[Service] MILCON Costs” Sector, shown in Figure 15, simulates the allocation of money from the Total Service Budget to the MILCON appropriations category. The elements of this sector are arrayed by Service to visually declutter the model. Table 8 describes each element within the sector.

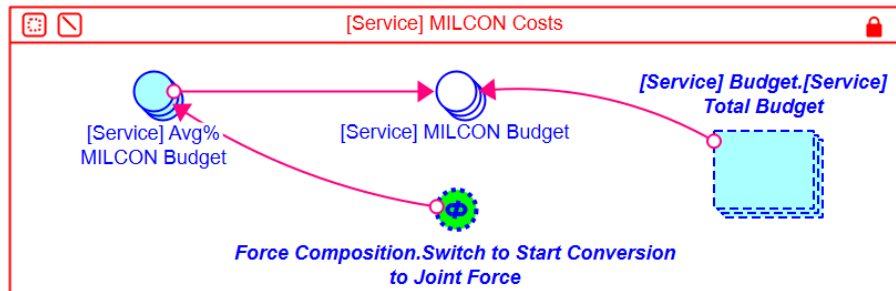


Figure 15. [Service] Military Construction Costs Sector.⁹⁵

⁹⁵ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 8. Description of Service Military Construction Costs Sector Elements

Element Name	Type	Description	Formula
[Service] Avg% MILCON Budget	Converter	Static calculation of percentage of FY23 Service Budget to Service MILCON Appropriations category	Army: 1310000000/17731500000 ⁹⁶ Air Force: 2368000000/234116000000 ⁹⁷ Navy: 3889000000/230848000000 ⁹⁸ Marine Corps: 3889000000/230848000000 ⁹⁹ Inherently Joint: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN .01 ELSE 0
[Service] MILCON Budget	Converter	Calculation of Service Budget allocated to MILCON Appropriations category	Army: “[Service]_Avg%_MILCON_Budget”[Army_%_on_MILCON]* “[Service]_Budget”.[Service]_Total_Budget”[Army_Total_Budget] Air Force: “[Service]_Avg%_MILCON_Budget”[Air_Force_%_on_MILCON]* “[Service]_Budget”.[Service]_Total_Budget”[Air_Force_Total_Budget] Navy: “[Service]_Avg%_MILCON_Budget”[Navy_%_on_MILCON]* “[Service]_Budget”.[Service]_Total_Budget”[Navy_Total_Budget] Marine Corps: “[Service]_Avg%_MILCON_Budget”[Marine_Corps_%_on_MILCON]* “[Service]_Budget”.[Service]_Total_Budget”[Marine_Corps_Total_Budget] Inherently Joint: “[Service]_Avg%_MILCON_Budget”[Inherently_Joint_%_on_MILCON]* “[Service]_Budget”.[Service]_Total_Budget”[Inherently_Joint_Total_Budget]

⁹⁶ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-2.

⁹⁷ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁹⁸ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

⁹⁹ Office of the Under Secretary of Defense (Comptroller), A-3, A-2.

C. MODEL STRUCTURE: FORCE COMPOSITION

The “Force Composition” module, shown in Figure 16, is dependent on the “Start Conversion from Services to Joint Force” SWITCH and simulates the size of each of the Services in relation to percent GDP growth, supported by reasonable approximate historical trends, and accounts for annual separations and retirements. The SWITCH and “Conversion Rate to Inherently Joint Force” elements, both tied to user-defined parameters in the User Interface relate to building Joint capability and capacity. The SWITCH to “Start Conversion from Services to Joint Force” specifies whether the model is run “as the system exists” with a Service-centric force structure (SWITCH OFF), or if the U.S. military is modeled “as the system could be” converted to an Inherently Joint Force (SWITCH ON). The “Conversion Rate to Inherently Joint Force” rheostat is enabled with the SWITCH to “Start Conversion from Services to Joint Force” ON, and selects the conversion rate to transfer Service personnel to Inherently Joint billets (similar to United States Air Force members transferring to the United States Space Force). The module accounts for force size growth and reduction as a downstream effect of changes in overall funding based on GDP, as well as annual separations and retirements. The elements of this sector are arrayed by Service to visually declutter the model. Table 9 describes each element within the module.

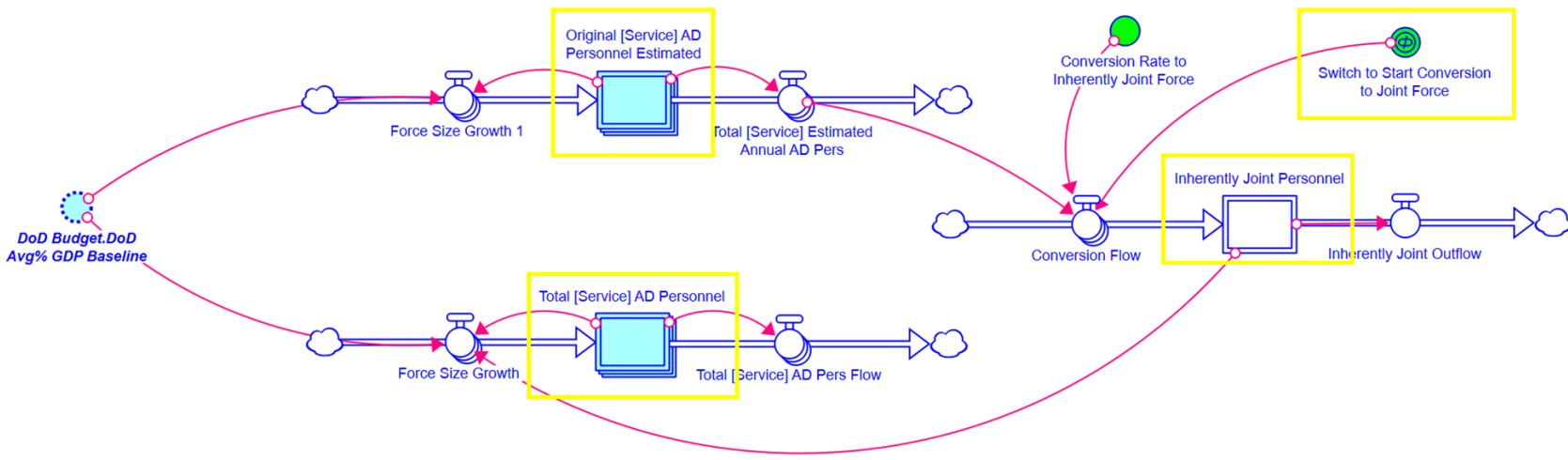


Figure 16. Force Composition Module.¹⁰⁰

¹⁰⁰ Adapted from Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 9. Description of Force Composition Elements

Element Name	Type	Description	Formula
DOD Budget. DOD Avg% GDP Baseline	Ghosted Converter as Input	Historical percentage allocation of U.S. GDP to DOD Budget in peacetime (Switch OFF) and wartime (Switch ON)	IF (Switch_to_Combat_Funding>0) THEN (Nominal_%GDP_Value+STEP(Increased_Combat_Funding_%GDP,4, 10, 30)) ELSE Nominal_%GDP_Value
Force Size Growth 1	Inflow	Calculated force size changes based on GDP	SMTH1((Original_Service_AD_Personnel_Estimated)* (1+DOD_Budget.DOD_Avg%_GDP_Baseline), 2)
Original [Service] AD Personnel Estimated	Stock	DOD force size by Service, initialization values based on FY23 request ¹⁰¹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Total Service Estimated Annual AD Pers	Outflow	Annual DOD force size by Service	HISTORY(Original_Service_AD_Personnel_Estimated, TIME)
Force Size Growth	Inflow	Calculated force size changes based on GDP and conversion to Inherently Joint Personnel	SMTH1((Total_Service_AD_Personnel - Inherently_Joint_Personnel)*(1+DOD_Budget.DOD_Avg%_GDP_Baseline), 2)
Total [Service] AD Personnel	Stock	DOD force size by Service, initialization values from FY23 budget request ¹⁰²	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)

¹⁰¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁰² Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
Total [Service] AD Pers Flow	Outflow	Annual DOD force size	HISTORY(Total_[Service]_AD_Personnel, TIME)
Conversion Flow	Inflow	Flow of annual converted Inherently Joint troops	<p>Army: IF Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Conversion_Rate_to_Inherently_Joint_Force* Total_Service_AD_Pers_Flow [Army] ELSE 0</p> <p>Air Force: IF Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Conversion_Rate_to_Inherently_Joint_Force* Total_Service_AD_Pers_Flow [Air_Force] ELSE 0</p> <p>Navy: IF Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Conversion_Rate_to_Inherently_Joint_Force* Total_Service_AD_Pers_Flow [Navy] ELSE 0</p> <p>Marine Corps: IF Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Conversion_Rate_to_Inherently_Joint_Force* Total_Service_AD_Pers_Flow [Marine_Corps] ELSE 0</p> <p>Inherently Joint: "Total [Service] Estimated Annual AD Pers"[Inherently Joint]</p>
Switch to Start Conversion to Joint Force	Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)
Conversion Rate to Inherently Joint Force	Converter, user-defined	Annual conversion rate from Service personnel to Inherently Joint Personnel	.10
Inherently Joint Personnel	Stock	Initialization value for Inherently Joint Personnel	0
Inherently Joint Outflow	Outflow	Annual Inherently Joint personnel flow	HISTORY(Inherently_Joint_Personnel, TIME)

D. MODEL STRUCTURE: “TIER 1” FUNCTIONAL MODULES

The “Functional Budgets and Capacities” module includes 13 sub-modules describing the Functions the Services categorize capabilities into when managing manpower and resources (shown in Figure 17). Each Service then presents Functional personnel to the Joint Force to meet Combatant Command capability and capacity requirements. These Functions are relatively shared, or common, between Services and will be referenced as “Tier 1 Functions.” The “Functional Capacity and Expenditures” modules simulate manpower, funding expenditures, and Joint Capacity based on the overall force composition and average cost per service member by accepting inputs from the “[Service] Budget” module and the “Force Composition” module. The sub-modules additionally include a selectable percentage of Service-based manpower capacity presented to the overall Joint Capacity fielded in the Combatant Commands. The sub-modules are programmed further upstream to be dependent on whether the model is run in the force’s current configuration of Service-based capability or with the “Switch to Start Conversion to Joint Force” SWITCH ON to simulate the new Inherently Joint force structure. Tier 1 Functions are grouped separately than more complicated Tier 2 Functions (discussed in the Model Structure – “Tier 2” Capability Module section), which require more granular analysis of the Service’s individual job specialty contributions to a Joint Capability. Table 29 and Table 30 in APPENDIX B JOINT FUNCTIONS depict categorizations of Tier 1 Functions, and those Joint Functions recognized by the DOD in this paper include:

1. Administration
2. Vehicle and Machinery Mechanic
3. Transportation and Material Handling
4. Support Service
5. Protective Service
6. Media and Public Affairs
7. Machine Operator and Production
8. Human Resource Development

9. Healthcare
10. Engineering Science and Technical
11. Electronic and Electrical Equipment Repair
12. Construction
13. Combat Specialty¹⁰³

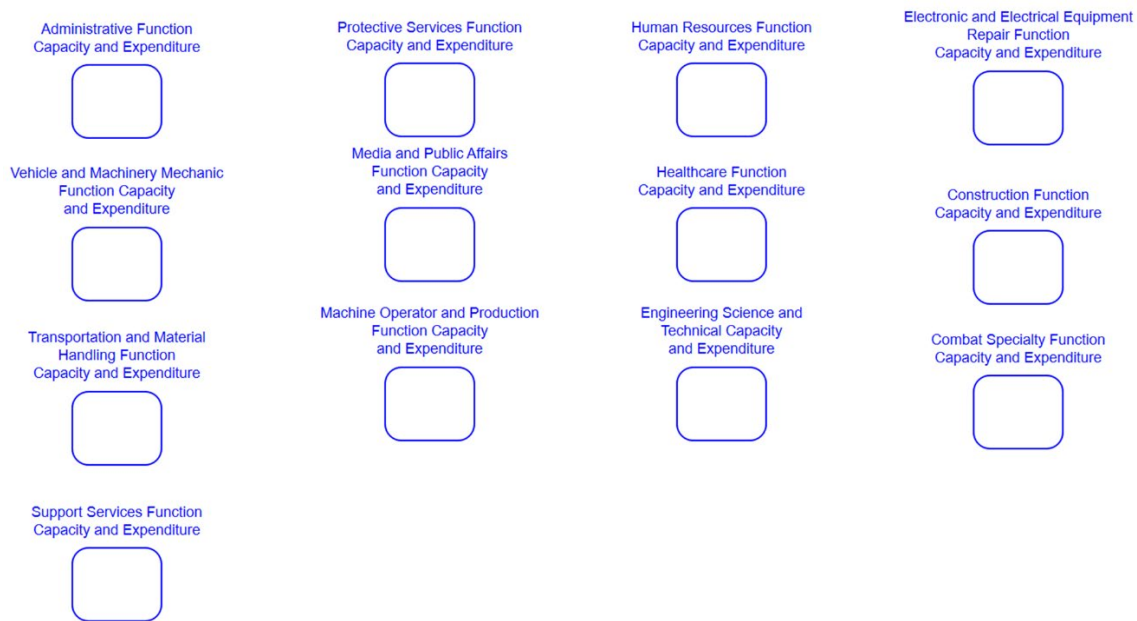


Figure 17. Functional Capacity and Expenditures Module.¹⁰⁴

1. Administration Function Capacity and Expenditure

The “Administration Function Capacity and Expenditure” module, shown in Figure 18, simulates allocation of each Service’s manpower and expenditure toward its Service-based Administrative needs, as well as its allocation of Service-based Administrative job specialty personnel to the Joint Force Administrative Function combat

¹⁰³ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*, (Washington, DC: U.S. Bureau of Labor Statistics, n.d.), <https://www.bls.gov/ooh/military/military-careers.htm>.

¹⁰⁴ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

capability requirement, ultimately fielding the Joint Administrative Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Administrative personnel provided to the Joint Force Administrative Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 10 describes each element within the module.

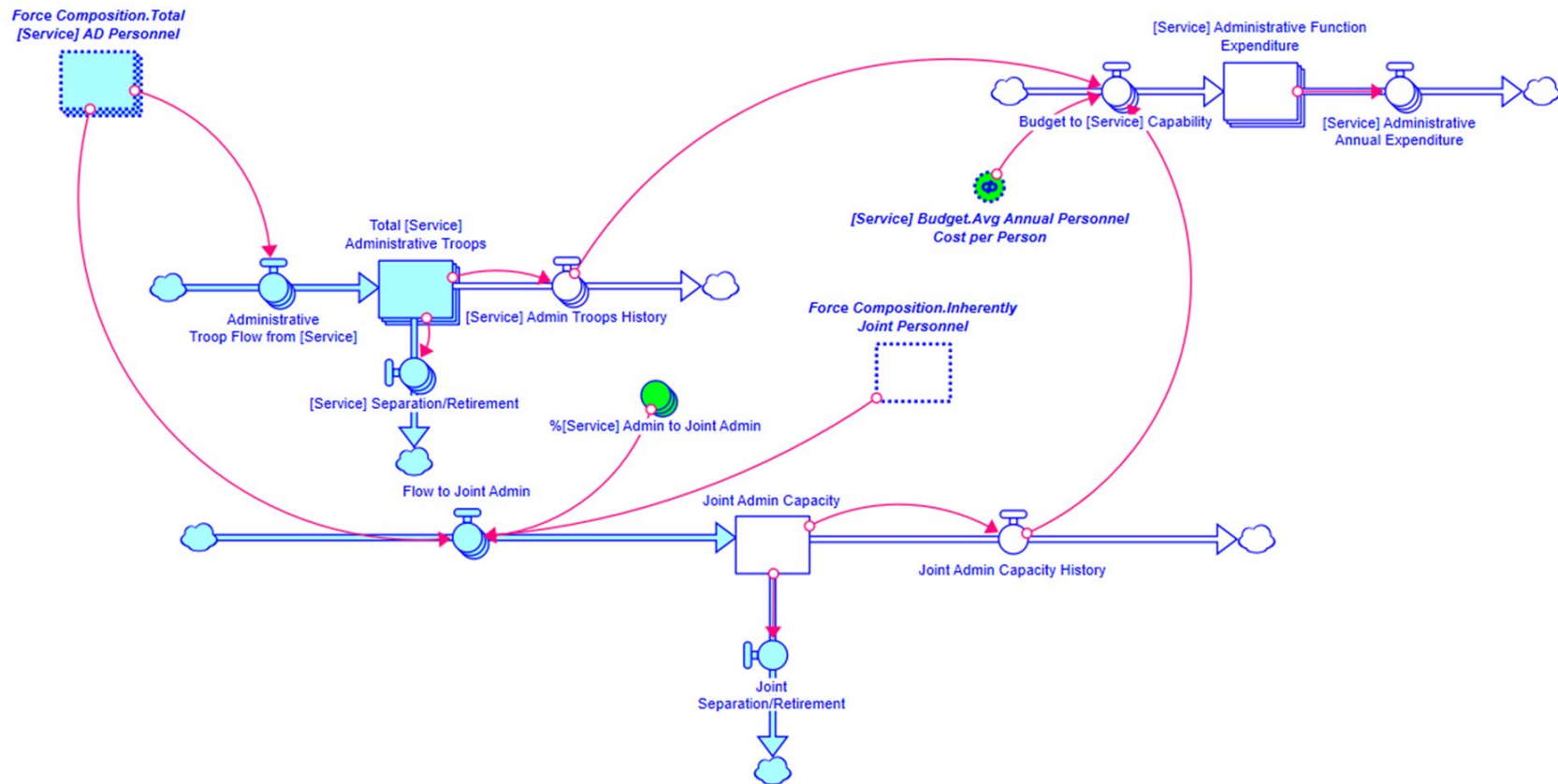


Figure 18. Administration Function Capacity and Expenditure Module.¹⁰⁵

¹⁰⁵ Source: Skogsberg-Karnowski.

Table 10. Description of Administration Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁰⁶	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Administrative Troop Flow from [Service]	Inflow	The flow of Administrative Personnel as a percentage from the Services based on CY22 data ¹⁰⁷	Army: .01*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .04*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .06*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .07*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .04*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Administrative Troops	Stock	Initialized number of Administrative Personnel by Service based on CY22 data ¹⁰⁸	Army: 5073 Air Force: 13253 Navy: 20393 Marine Corps: 11933 Inherently Joint: 0
[Service] Separation/ Retirement	Outflow	Expected Separations and Retirements by Service	.14*"Total_[Service]_Administrative_Troops" ¹⁰⁹

¹⁰⁶ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁰⁷ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁰⁸ U.S. Bureau of Labor Statistics.

¹⁰⁹ U.S. Department of Labor, "Transition Assistance Program," n.d., <http://www.dol.gov/agencies/vets/programs/tap>.

Element Name	Type	Description	Formula
		calculated as a percentage from average annual total	
[Service] Admin Troops History	Outflow	Annual total number of Service-produced Administrative Personnel	HISTORY(“Total_[Service]_Administrative_Troops,” TIME)
Flow to Joint Admin	Outflow	Flow of allocated Service Administrative Personnel to Joint Administrative Capacity	<p>Army: $.01 * \text{Force_Composition.}^{\text{Total_}[Service]_AD_Personnel}[\text{Army}] * \text{“}\%[\text{Service}]_Admin_to_Joint_Admin”[\text{Army}_%_to_Joint_Function]$</p> <p>Air Force: $.04 * \text{Force_Composition.}^{\text{Total_}[Service]_AD_Personnel}[\text{Air_Force}] * \text{“}\%[\text{Service}]_Admin_to_Joint_Admin”[\text{Air_Force}_%_to_Joint_Function]$</p> <p>Navy: $.06 * \text{Force_Composition.}^{\text{Total_}[Service]_AD_Personnel}[\text{Navy}] * \text{“}\%[\text{Service}]_Admin_to_Joint_Admin”[\text{Navy}_%_to_Joint_Function]$</p> <p>Marine Corps: $.07 * \text{Force_Composition.}^{\text{Total_}[Service]_AD_Personnel}[\text{Marine_Corps}] * \text{“}\%[\text{Service}]_Admin_to_Joint_Admin”[\text{Marine_Corps}_%_to_Joint_Function]$</p> <p>Inherently Joint: $\text{Force_Composition.Inherently_Joint_Personnel} * \text{“}\%[\text{Service}]_Admin_to_Joint_Admin”[\text{Inherently_Joint}_%_to_Joint_Function]$</p>
%[Service] Admin to Joint Admin	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Administrative Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition.Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Admin Capacity	Stock	Number of Joint Administrative Personnel	Initialized at 0

Element Name	Type	Description	Formula
Joint Separation/ Retirement	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Admin_Capacity ¹¹⁰
Joint Admin Capacity History	Outflow	Annual total number of Joint Administrative Personnel	HISTORY(Joint_Admin_Capacity, TIME)
Budget to [Service] Capability	Inflow	Calculation how much Services pay for Administrative capability	<p>Joint: Joint_Admin_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Admin_Troops_History”[Army_Administrative_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Admin_Troops_History”[Air_Force_Administrative_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Admin_Troops_History”[Navy_Administrative_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Admin_Troops_History”[Marine_Corps_Administrative_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Admin_Troops_History”[Inherently_Joint_Admin_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	14000 ¹¹¹

¹¹⁰ U.S. Department of Labor, “Transition Assistance Program.”

¹¹¹ Harper, “Pentagon Personnel Costs at Historic High.”

Element Name	Type	Description	Formula
[Service] Administrative Function Expenditure	Stock	Each Service's total Administrative Function Expenditure ¹¹²	Joint: 0*140000 Army: 5073*140000 Air Force: 13253*140000 Navy: 20393*140000 Marine Corps: 11933*140000 Inherently Joint: 0*140000
[Service] Administrative Expenditure	Outflow	Each Service's annual Administrative Function expenditure	HISTORY("[Service]_Administrative_Function_Expenditure," TIME)

¹¹² U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

2. Vehicle and Machinery Mechanic Function Capacity and Expenditure

The “Vehicle and Machinery Mechanic Function Capacity and Expenditure” module, shown in Figure 19, simulates allocation of each Service’s manpower and expenditure to its Service-based Mechanic needs, as well as its allocation of Service-based personnel to the Joint Force Mechanic Function combat capability requirement, ultimately fielding the Joint Mechanic Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Mechanic personnel provided to the Joint Force Mechanic Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 11 describes each element within the module.

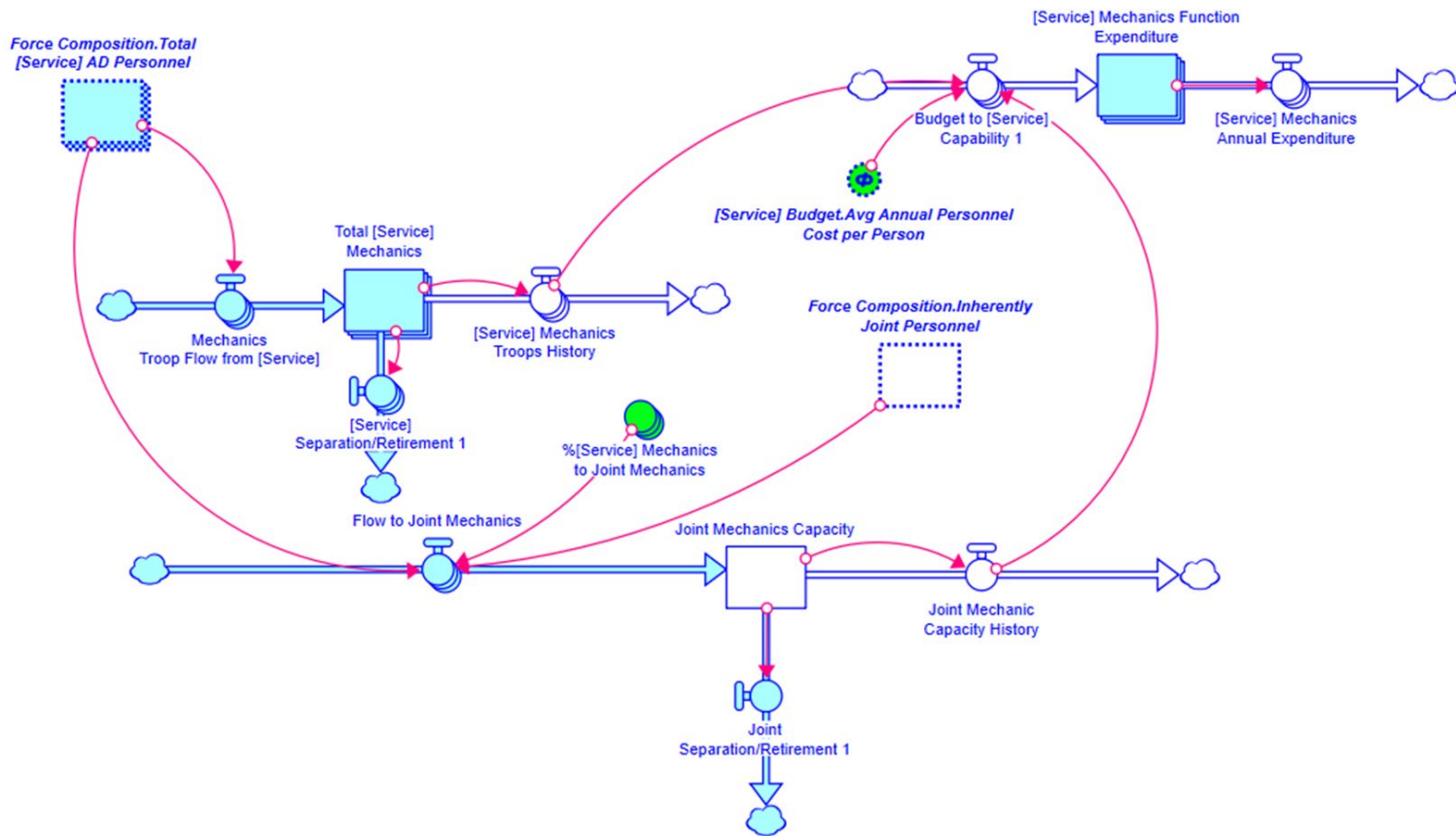


Figure 19. Vehicle and Machinery Mechanic Function Capacity and Expenditure Module.¹¹³

¹¹³ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 11. Description of Vehicle and Machinery Mechanic Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹¹⁴	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Mechanics Troop Flow from [Service]	Inflow	The flow of Mechanic Personnel as a percentage from the Services based on CY22 data ¹¹⁵	Army: .09*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .14*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .14*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .1*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .12*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Mechanics	Stock	Initialized number of Mechanic Personnel by Service based on CY22 data ¹¹⁶	Army: 44481 Air Force: 47360 Navy: 49821 Marine Corps: 18042 Inherently Joint: 0
[Service] Separation/ Retirement 1	Outflow	Expected Separations and Retirements by Service	.14**Total_[Service]_Mechanics" ¹¹⁷

¹¹⁴ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request, A-4*.

¹¹⁵ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹¹⁶ U.S. Bureau of Labor Statistics.

¹¹⁷ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		calculated as a percentage from average annual total	
[Service] Mechanics Troops History	Outflow	Annual total number of Service-produced Mechanic Personnel	HISTORY("Total_[Service]_Mechanics," TIME)
Flow to Joint Mechanics	Outflow	Flow of allocated Service Mechanic Personnel to Joint Mechanic Capacity	<p>Army: $.09 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Army}] * \text{"\%}[Service]_Mechanics_to_Joint_Mechanics"[\text{Army}_\%_to_Joint_Function]$</p> <p>Air Force: $.14 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Air_Force}] * \text{"\%}[Service]_Mechanics_to_Joint_Mechanics"[\text{Air_Force}_\%_to_Joint_Function]$</p> <p>Navy: $.14 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Navy}] * \text{"\%}[Service]_Mechanics_to_Joint_Mechanics"[\text{Navy}_\%_to_Joint_Function]$</p> <p>Marine Corps: $.1 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Marine_Corps}] * \text{"\%}[Service]_Mechanics_to_Joint_Mechanics"[\text{Marine_Corps}_\%_to_Joint_Function]$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{"\%}[Service]_Mechanics_to_Joint_Mechanics"[\text{Inherently_Joint}_\%_to_Joint_Function]$</p>
%[Service] Mechanic to Joint Mechanics	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Mechanic Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Mechanics Capacity	Stock	Number of Joint Mechanics Personnel	Initialized at 0

Element Name	Type	Description	Formula
Joint Separation/ Retirement 1	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Mechanics_Capacity ¹¹⁸
Joint Mechanics Capacity History	Outflow	Annual total number of Joint Mechanics Personnel	HISTORY(Joint_Mechanics_Capacity, TIME)
Budget to [Service] Capability 1	Inflow	Calculation of how much Services pay for Mechanics capability	<p>Joint: Joint_Mechanic_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Mechanics_Troops_History”[Army_Mechanics]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Mechanics_Troops_History”[Air_Force_Mechanics]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Mechanics_Troops_History”[Navy_Mechanics]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Mechanics_Troops_History”[Marine_Corps_Mechanics]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Mechanics_Troops_History”[Inherently_Joint_Mechanics]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg Annual	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹¹⁹

¹¹⁸ U.S. Department of Labor, “Transition Assistance Program.”

¹¹⁹ Harper, “Pentagon Personnel Costs at Historic High.”

Element Name	Type	Description	Formula
Personnel Cost per Person			
[Service] Mechanics Function Expenditure	Stock	Each Service's total Mechanics Function Expenditure ¹²⁰	Joint: 0*140000 Army: 44481*140000 Air Force: 47360*140000 Navy: 49821*140000 Marine Corps: 18042*140000 Inherently Joint: 0*140000
[Service] Mechanics Expenditure	Outflow	Each Service's annual Mechanics Function expenditure	HISTORY("[Service]_Mechanics_Function_Expenditure," TIME)

¹²⁰ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

3. Transportation and Material Handling Function Capacity and Expenditure

The “Transportation and Material Handling Capacity and Expenditure” Function module, shown in Figure 20, simulates allocation of each Service’s manpower and expenditure toward its Service-based Transportation needs, as well as its allocation of Service-based Transportation job specialty personnel to the Joint Force Transportation Function combat capability requirement, ultimately fielding the Joint Transportation Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Transportation personnel provided to the Joint Force Transportation Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 12 describes each element within the module.

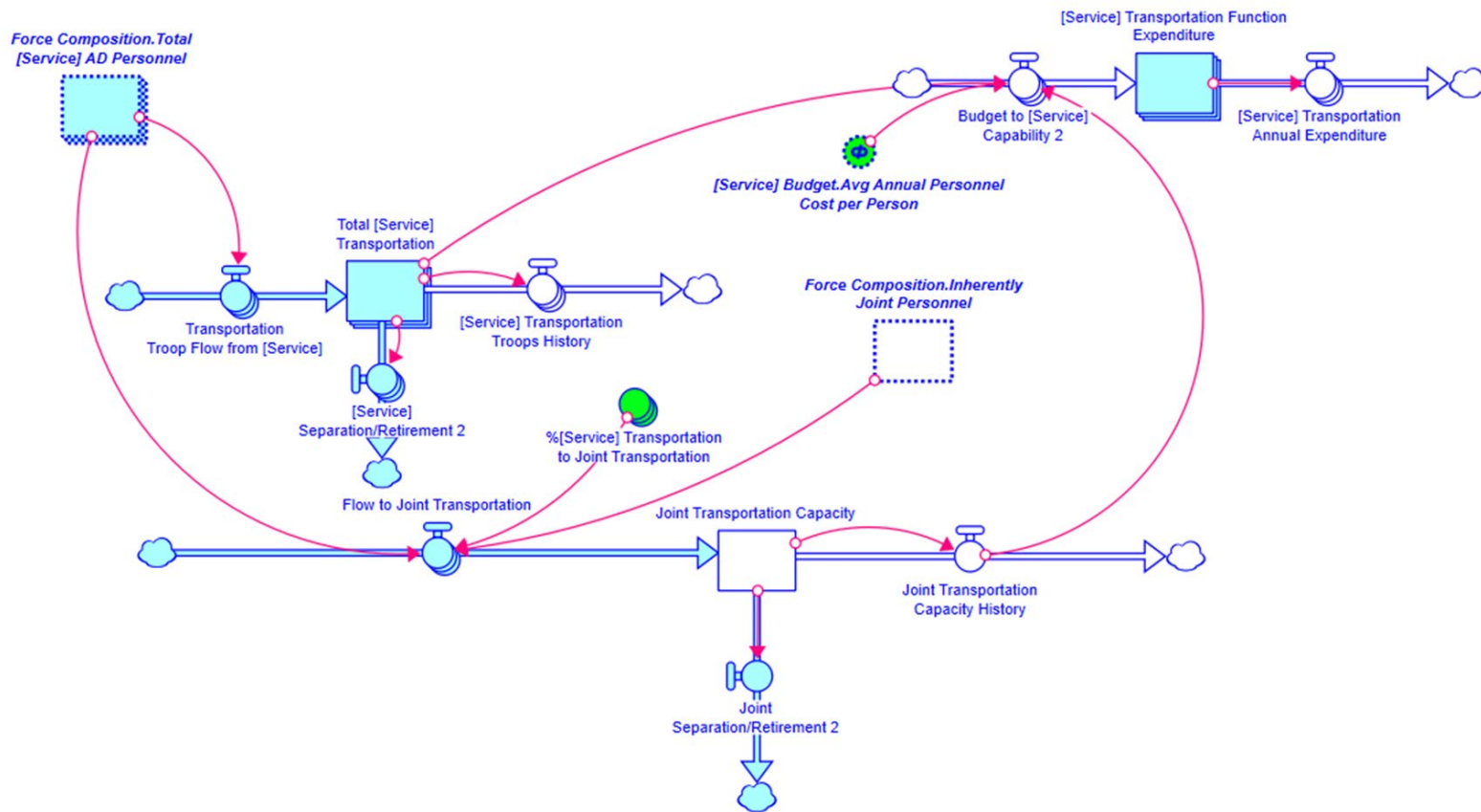


Figure 20. Transportation and Material Handling Function Capacity and Expenditure Module.¹²¹

¹²¹ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 12. Description of Transportation and Material Handling Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹²²	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Transportation Troop Flow from [Service]	Inflow	The flow of Transportation Personnel as a percentage from the Services based on CY22 data ¹²³	Army: .1*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .09*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .11*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .13*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .11*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Transportation	Stock	Initialized number of Transportation Personnel by Service based on CY22 data ¹²⁴	Army: 48865 Air Force: 29098 Navy: 38445 Marine Corps: 23428 Inherently Joint: 0

¹²² Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹²³ U.S. Bureau of Labor Statistics *Occupational Outlook Handbook: Military Careers*.

¹²⁴ U.S. Bureau of Labor Statistics.

Element Name	Type	Description	Formula
[Service] Separation/ Retirement 2	Outflow	Expected Separations and Retirements by Service calculated as a percentage from average annual total	.14**Total_[Service]_Transportation" ¹²⁵
[Service] Transportation Troops History	Outflow	Annual total number of Service-produced Transportation Personnel	HISTORY("Total_[Service]_Transportation," TIME)
Flow to Joint Transportation	Outflow	Flow of allocated Service Transportation Personnel to Joint Transportation Capacity	<p>Army: .1 *Force_Composition."Total_[Service]_AD_Personnel"[Army]* "%[Service]_Transportation_to_Joint_Transportation"[Army_%_to_Joint_Function]</p> <p>Air Force: .09 *Force_Composition."Total_[Service]_AD_Personnel"[Air_Force]* "%[Service]_Transportation_to_Joint_Transportation"[Air_Force_%_to_Joint_Function]</p> <p>Navy: .11 *Force_Composition."Total_[Service]_AD_Personnel"[Navy]* "%[Service]_Transportation_to_Joint_Transportation"[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .13 *Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps]* "%[Service]_Transportation_to_Joint_Transportation"[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* "%[Service]_Transportation_to_Joint_Transportation"[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Transportation to Joint Transportation	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Transportation Personnel allocated to Joint Capacity	Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1

¹²⁵ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Transportation Capacity	Stock	Number of Joint Transportation Personnel	Initialized at 0
Joint Separation/ Retirement 2	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Transportation_Capacity
Joint Transportation Capacity History	Outflow	Annual total number of Joint Transportation Personnel	HISTORY(Joint_Transportation_Capacity, TIME)
Budget to [Service] Capability 2	Inflow	Calculation of how much Services pay for Transportation capability	<p>Joint: Joint_Transportation_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “Total_[Service]_Transportation”[Army_Transportation] *”[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “Total_[Service]_Transportation”[Air_Force_Transportation] *”[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “Total_[Service]_Transportation”[Navy_Transportation]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “Total_[Service]_Transportation”[Marine_Corps_Transportation]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint:</p>

Element Name	Type	Description	Formula
			“Total_[Service]_Transportation”[Inherently_Joint_Transportation]* “[Service] Budget”.Avg Annual Personnel Cost per Person
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹²⁶
[Service] Transportation Function Expenditure	Stock	Each Service’s total Transportation Function Expenditure ¹²⁷	Joint: 0*140000 Army: 48865*140000 Air Force: 29098*140000 Navy: 38445*140000 Marine Corps: 23428*140000 Inherently Joint: 0*140000
[Service] Transportation Expenditure	Outflow	Each Service’s annual Transportation Function expenditure	HISTORY(“[Service]_Transportation_Function_Expenditure,” TIME)

¹²⁶ Harper, “Pentagon Personnel Costs at Historic High.”

¹²⁷ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, “Pentagon Personnel Costs at Historic High.”

4. Support Services Function Capacity and Expenditure

The “Support Services Capacity and Expenditure” Function module, shown in Figure 21, simulates allocation of each Service’s manpower and expenditure toward its Service-based Support needs, as well as its allocation of Service-based Support job specialty personnel to the Joint Force Support Function combat capability requirement, ultimately fielding the Joint Support Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Support personnel provided to the Joint Force Support Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 13 describes each element within the module.

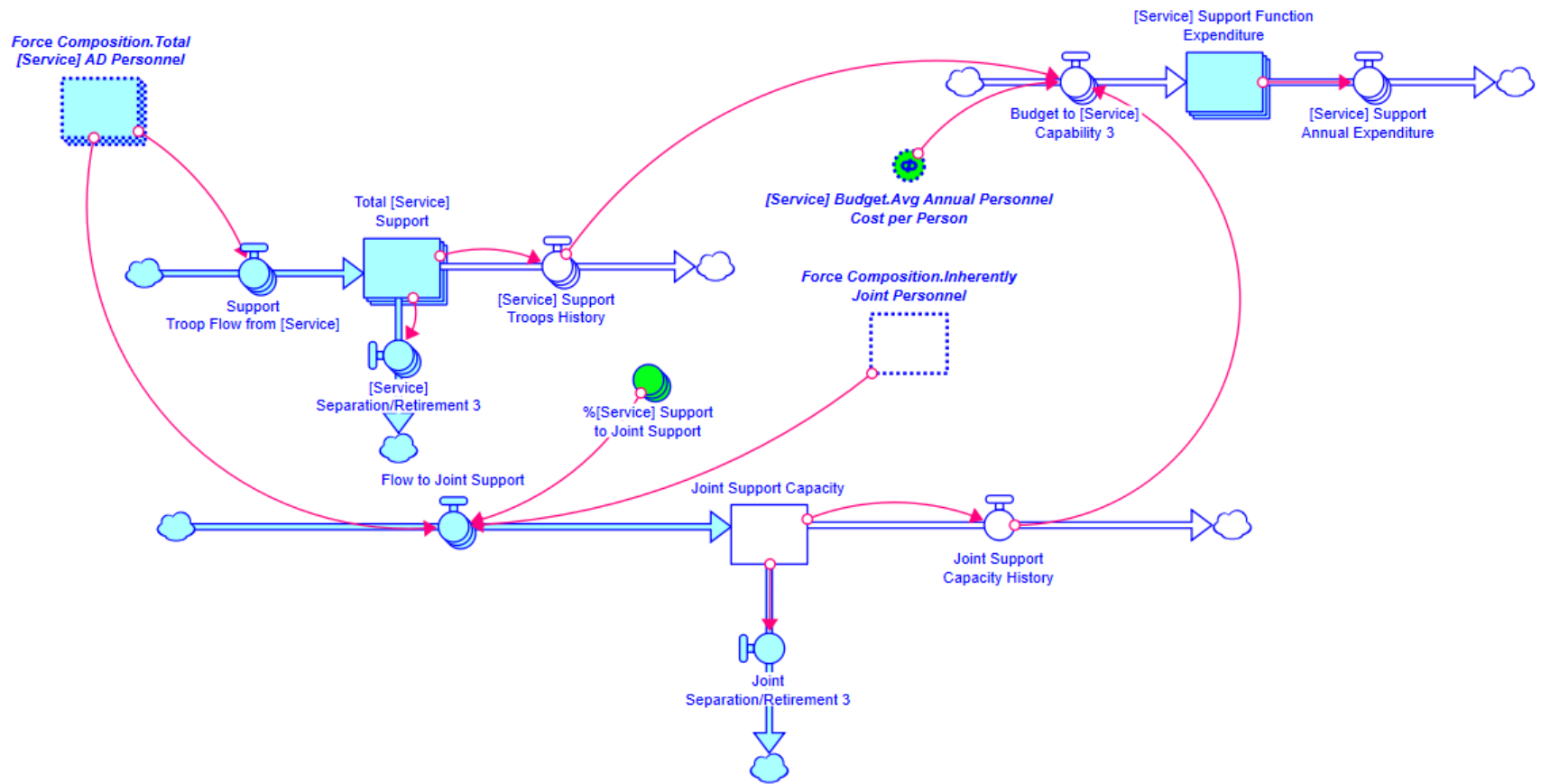


Figure 21. Support Services Function Capacity and Expenditure Module.¹²⁸

¹²⁸ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 13. Description of Support Services Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹²⁹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Support Troop Flow from [Service]	Inflow	The flow of Support Personnel as a percentage from the Services based on CY22 data ¹³⁰	Army: .02*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .02*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .03*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .01*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .02*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Support	Stock	Initialized number of Support Personnel by Service based on CY22 data ¹³¹	Army: 8574 Air Force: 5553 Navy: 8861 Marine Corps: 2058 Inherently Joint: 0
[Service] Separation/ Retirement 3	Outflow	Expected Separations and Retirements by Service calculated	.14*"Total_[Service]_Support" ¹³²

¹²⁹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request, A-4*.

¹³⁰ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹³¹ U.S. Bureau of Labor Statistics.

¹³² U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		as a percentage from average annual total	
[Service] Support Troops History	Outflow	Annual total number of Service-produced Support Personnel	HISTORY(“Total_[Service]_Support,” TIME)
Flow to Joint Support	Outflow	Flow of allocated Service Support Personnel to Joint Support Capacity	<p>Army: $.02 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{“}\%[Service]_Support_to_Joint_Support”[Army]_ \%_to_Joint_Function}$</p> <p>Air Force: $.02 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{“}\%[Service]_Support_to_Joint_Support”[Air_Force]_ \%_to_Joint_Function}$</p> <p>Navy: $.03 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{“}\%[Service]_Support_to_Joint_Support”[Navy]_ \%_to_Joint_Function}$</p> <p>Marine Corps: $.01 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{“}\%[Service]_Support_to_Joint_Support”[Marine_Corps]_ \%_to_Joint_Function}$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{“}\%[Service]_Support_to_Joint_Support”[Inherently_Joint]_ \%_to_Joint_Function}$</p>
%[Service] Support to Joint Support	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Support Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Support Capacity	Stock	Number of Joint Support Personnel	Initialized at 0

Element Name	Type	Description	Formula
Joint Separation/ Retirement 3	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Support_Capacity ¹³³
Joint Support Capacity History	Outflow	Annual total number of Joint Support Personnel	HISTORY(Joint_Support_Capacity, TIME)
Budget to [Service] Capability 3	Inflow	Calculation of how much Services pay for Support capability	<p>Joint: Joint_Support_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Support_Troops_History”[Army_Support]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Support_Troops_History”[Air_Force_Support]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Support_Troops_History”[Navy_Support]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Support_Troops_History”[Marine_Corps_Support]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Support_Troops_History”[Inherently_Joint_Support]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg Annual	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹³⁴

¹³³ U.S. Department of Labor, “Transition Assistance Program.”

¹³⁴ Harper, “Pentagon Personnel Costs at Historic High.”

Element Name	Type	Description	Formula
Personnel Cost per Person			
[Service] Support Function Expenditure	Stock	Each Service's total Support Function Expenditure ¹³⁵	Joint: 0*140000 Army: 8574*140000 Air Force: 5553*140000 Navy: 8861*140000 Marine Corps: 2058*140000 Inherently Joint: 0*140000
[Service] Support Expenditure	Outflow	Each Service's annual Support Function expenditure	HISTORY("[Service]_Support_Function_Expenditure," TIME)

¹³⁵ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

5. Protective Services Function Capacity and Expenditure

The “Protective Services Function Capacity and Expenditure” module, shown in Figure 22, simulates allocation of each Service’s manpower and expenditure toward its Service-based Protective needs, as well as its allocation of Service-based Protective job specialty personnel to the Joint Force Protective Function combat capability requirement, ultimately fielding the Joint Protective Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Protective personnel provided to the Joint Force Protective Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 14 describes each element within the module.

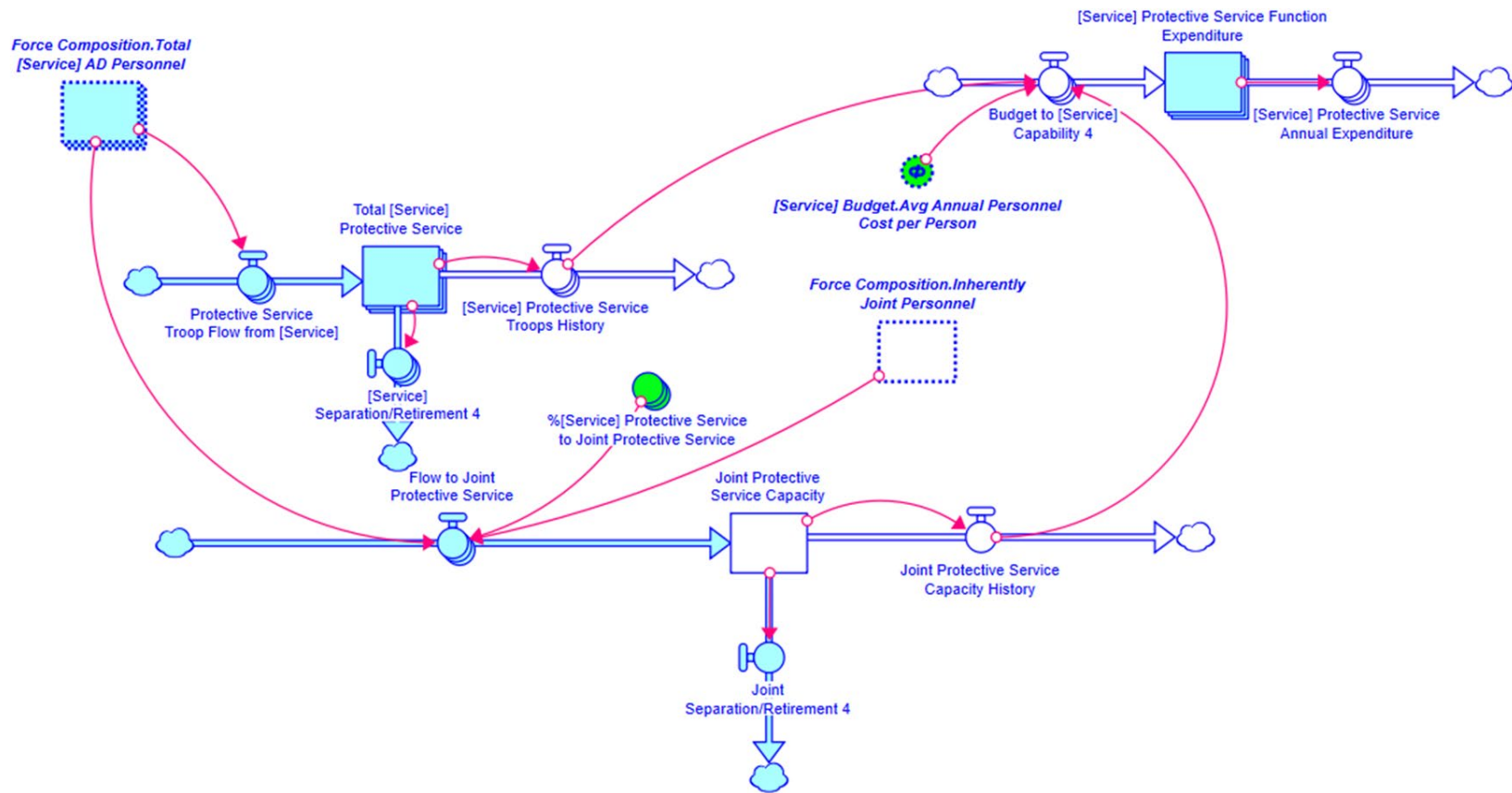


Figure 22. Protective Services Function Capacity and Expenditure Module.¹³⁶

¹³⁶ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 14. Description Protective Services Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹³⁷	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Protective Service Troop Flow from [Service]	Inflow	The flow of Protective Service Personnel as a percentage from the Services based on CY22 data ¹³⁸	Army: .04*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .11*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .04*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .03*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .06*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Protective Service	Stock	Initialized number of Protective Service Personnel by Service based on CY22 data ¹³⁹	Army: 20382 Air Force: 34700 Navy: 13686 Marine Corps: 4872 Inherently Joint: 0
[Service] Separation/Retirement 4	Outflow	Expected Separations and Retirements by	.14**Total_[Service]_Protective_Service" ¹⁴⁰

¹³⁷ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request, A-4*.

¹³⁸ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹³⁹ U.S. Bureau of Labor Statistics.

¹⁴⁰ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		Service calculated as a percentage from average annual total	
[Service] Protective Service Troops History	Outflow	Annual total number of Service-produced Protective Service Personnel	HISTORY("Total_[Service]_Protective_Service," TIME)
Flow to Joint Protective Service	Outflow	Flow of allocated Service Protective Personnel to Joint Protective Capacity	<p>Army: $.04 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [Army] * \text{"\%}[Service]_Protective_Service_to_Joint_Protective_Service"[Army]_to_Joint_Function]$</p> <p>Air Force: $.11 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [Air_Force] * \text{"\%}[Service]_Protective_Service_to_Joint_Protective_Service"[Air_Force]_to_Joint_Function]$</p> <p>Navy: $.04 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [Navy] * \text{"\%}[Service]_Protective_Service_to_Joint_Protective_Service"[Navy]_to_Joint_Function]$</p> <p>Marine Corps: $.03 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [Marine_Corps] * \text{"\%}[Service]_Protective_Service_to_Joint_Protective_Service"[Marine_Corps]_to_Joint_Function]$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{"\%}[Service]_Protective_Service_to_Joint_Protective_Service"[Inherently_Joint]_to_Joint_Function]$</p>
%[Service] Protective Service to Joint Protective Services	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Protective	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>

Element Name	Type	Description	Formula
		Personnel allocated to Joint Capacity	
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Protective Service Capacity	Stock	Number of Joint Protective Service Personnel	Initialized at 0
Joint Separation/Retirement 4	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Protective_Service_Capacity ¹⁴¹
Joint Protective Service Capacity History	Outflow	Annual total number of Joint Protective Service Personnel	HISTORY(Joint_Protective_Service_Capacity, TIME)
Budget to [Service] Capability 4	Inflow	Calculation of how much Services pay for Protective Service capability	<p>Joint: Joint_Protective_Service_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Protective_Service_Troops_History”[Army_Protective_Service_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Protective_Service_Troops_History”[Air_Force_Protective_Service_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Protective_Service_Troops_History”[Navy_Protective_Service_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>

¹⁴¹ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
			Marine Corps: "[Service] Protective Service Troops History"[Marine Corps Protective Service Troops]* "[Service] Budget".Avg Annual Personnel Cost per Person Inherently Joint: "[Service] Protective Service Troops History"[Inherently Joint Protective Service Troops]* "[Service] Budget".Avg Annual Personnel Cost per Person
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹⁴²
[Service] Protective Function Expenditure	Stock	Each Service's total Protective Function Expenditure ¹⁴³	Joint: 0*140000 Army: 20382*140000 Air Force: 34700*140000 Navy: 13686*140000 Marine Corps: 4872*140000 Inherently Joint: 0*140000
[Service] Protective Expenditure	Outflow	Each Service's annual Protective Function expenditure	HISTORY("[Service] Protective Service Function Expenditure," TIME)

¹⁴² Harper, "Pentagon Personnel Costs at Historic High."

¹⁴³ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

6. Media and Public Affairs Function Capacity and Expenditure

The “Media and Public Affairs (PA) Capacity and Expenditure” Function module, shown in Figure 23, simulates allocation of each Service’s manpower and expenditure toward its Service-based Media and PA needs, as well as its allocation of Service-based Media and PA job specialty personnel to the Joint Force Media and PA Function combat capability requirement, ultimately fielding the Joint Media and PA Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Media and PA personnel provided to the Joint Force Media and PA Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 15 describes each element within the module.

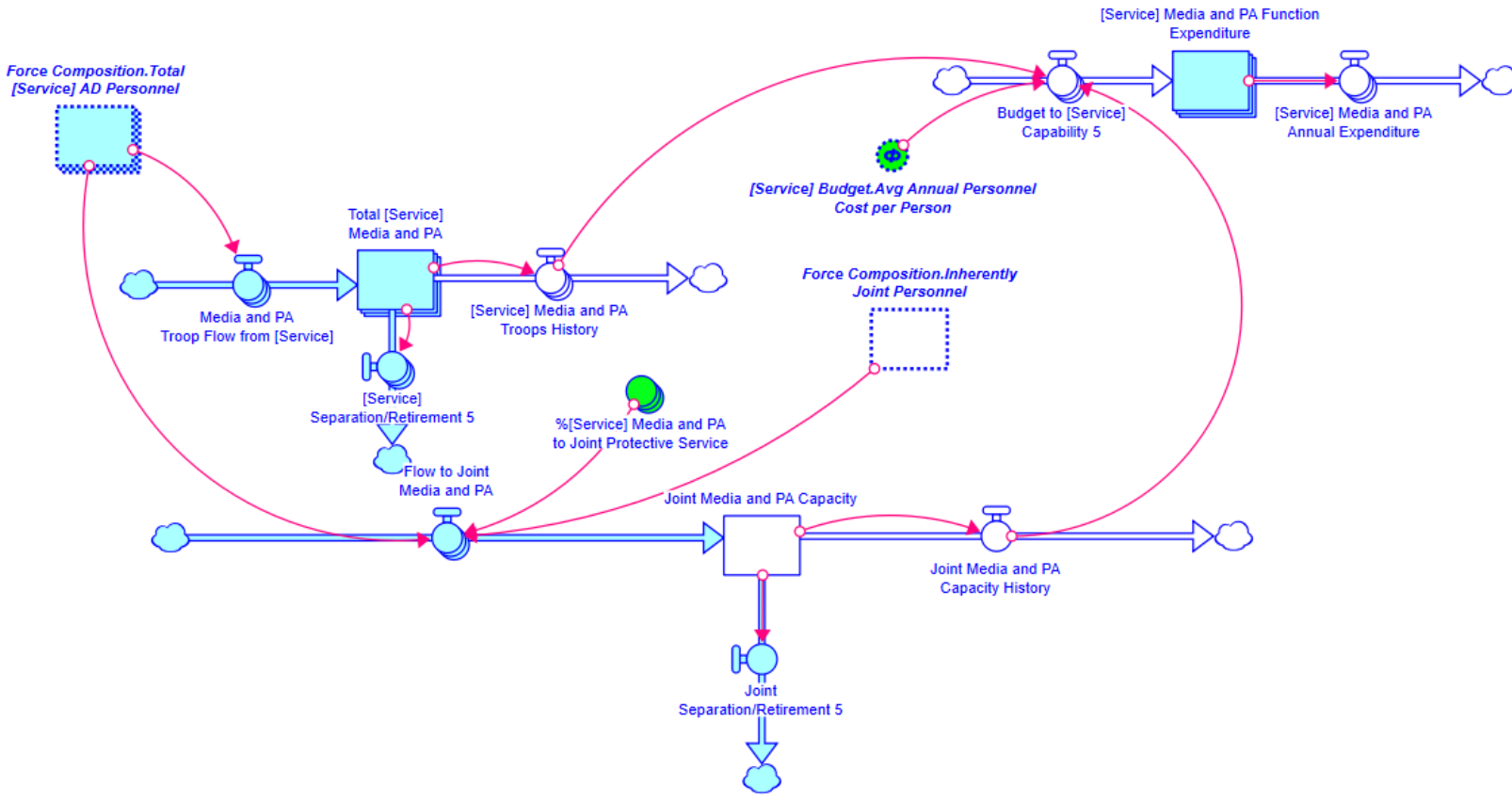


Figure 23. Media and Public Affairs Function Capacity and Budget Module.¹⁴⁴

¹⁴⁴ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 15. Description of Media and Public Affairs Function Capacity and Budget Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁴⁵	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Media and PA Troop Flow from [Service]	Inflow	The flow of Media and PA Personnel as a percentage from the Services based on CY22 data ¹⁴⁶	Army: .01*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .02*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .01*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .009*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .01*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Media and PA	Stock	Initialized number of Media and PA Personnel by Service based on CY22 data ¹⁴⁷	Army: 5245 Air Force: 6769 Navy: 3804 Marine Corps: 1597 Inherently Joint: 0
[Service] Separation/Retirement 5	Outflow	Expected Separations and Retirements by	.14*"Total_[Service]_Media_and_PA" ¹⁴⁸

¹⁴⁵ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁴⁶ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁴⁷ U.S. Bureau of Labor Statistics.

¹⁴⁸ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		Service calculated as a percentage from average annual total	
[Service] Media and PA Troops History	Outflow	Annual total number of Service-produced Media and PA Personnel	HISTORY("Total_[Service]_Media_and_PA," TIME)
Flow to Joint Media and PA	Outflow	Flow of allocated Service Media and PA Personnel to Joint Media and PA Capacity	<p>Army: .01 *Force_Composition."Total_[Service]_AD_Personnel"[Army]* "[%Service]_Media_and_PA_to_Joint_Protective_Service"[Army_%_to_Joint_Function]</p> <p>Air Force: .02 *Force_Composition."Total_[Service]_AD_Personnel"[Air_Force]* "[%Service]_Media_and_PA_to_Joint_Protective_Service"[Air_Force_%_to_Joint_Function]</p> <p>Navy: .01 *Force_Composition."Total_[Service]_AD_Personnel"[Navy]* "[%Service]_Media_and_PA_to_Joint_Protective_Service"[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .009 *Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps]* "[%Service]_Media_and_PA_to_Joint_Protective_Service"[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* "[%Service]_Media_and_PA_to_Joint_Protective_Service"[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Media and PA to Joint Media and PA	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Media and PA Personnel allocated to Joint Capacity	Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1

Element Name	Type	Description	Formula
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Media and PA Capacity	Stock	Number of Joint Media and PA Personnel	Initialized at 0
Joint Separation/Retirement 5	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Media_and_PA_Capacity ¹⁴⁹
Joint Media and PA Capacity History	Outflow	Annual total number of Joint Media and PA Personnel	HISTORY(Joint_Media_and_PA_Capacity, TIME)
Budget to [Service] Capability 5	Inflow	Calculation of how much Services pay for Media and PA capability	<p>Joint: Joint_Media_and_PA_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Media_and_PA_Troops_History”[Army_Media_and_PA]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Media_and_PA_Troops_History”[Air_Force_Media_and_PA]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Media_and_PA_Troops_History”[Navy_Media_and_PA]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps:</p>

¹⁴⁹ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
			<p>“[Service]_Media_and_PA_Troops_History”[Marine_Corps_Media_and_PA]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Media_and_PA_Troops_History”[Inherently_Joint_Media_and_PA]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service]_Budget.Avg_Annual_Personnel_Cost_per_Person	Ghosted Convert er, user-defined	Annual cost per service member, annually	140000 ¹⁵⁰
[Service]_Media_and_PA_Function_Expenditure	Stock	Each Service’s total Media and PA Function Expenditure ¹⁵¹	Joint: 0*140000 Army: 5245*140000 Air Force: 6769*140000 Navy: 3804*140000 Marine Corps: 1597*140000 Inherently Joint: 0*140000
[Service]_Media_and_PA_Expenditure	Outflow	Each Service’s annual Media and PA Function expenditure	HISTORY(“[Service]_Media_and_PA_Function_Expenditure,” TIME)

¹⁵⁰ Harper, “Pentagon Personnel Costs at Historic High.”

¹⁵¹ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, “Pentagon Personnel Costs at Historic High.”

7. Machine Operator and Production Function Capacity and Expenditure

The “Machine Operator and Production Capacity and Expenditure” Function module, shown in Figure 24, simulates allocation of each Service’s manpower and expenditure toward its Service-based Machine Operator needs, as well as its allocation of Service-based Machine Operator job specialty personnel to the Joint Force Machine Operator Function combat capability requirement, ultimately fielding the Joint Machine Operator Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This element also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Machine Operator personnel provided to the Joint Force Machine Operator Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 16 describes each element within the module.

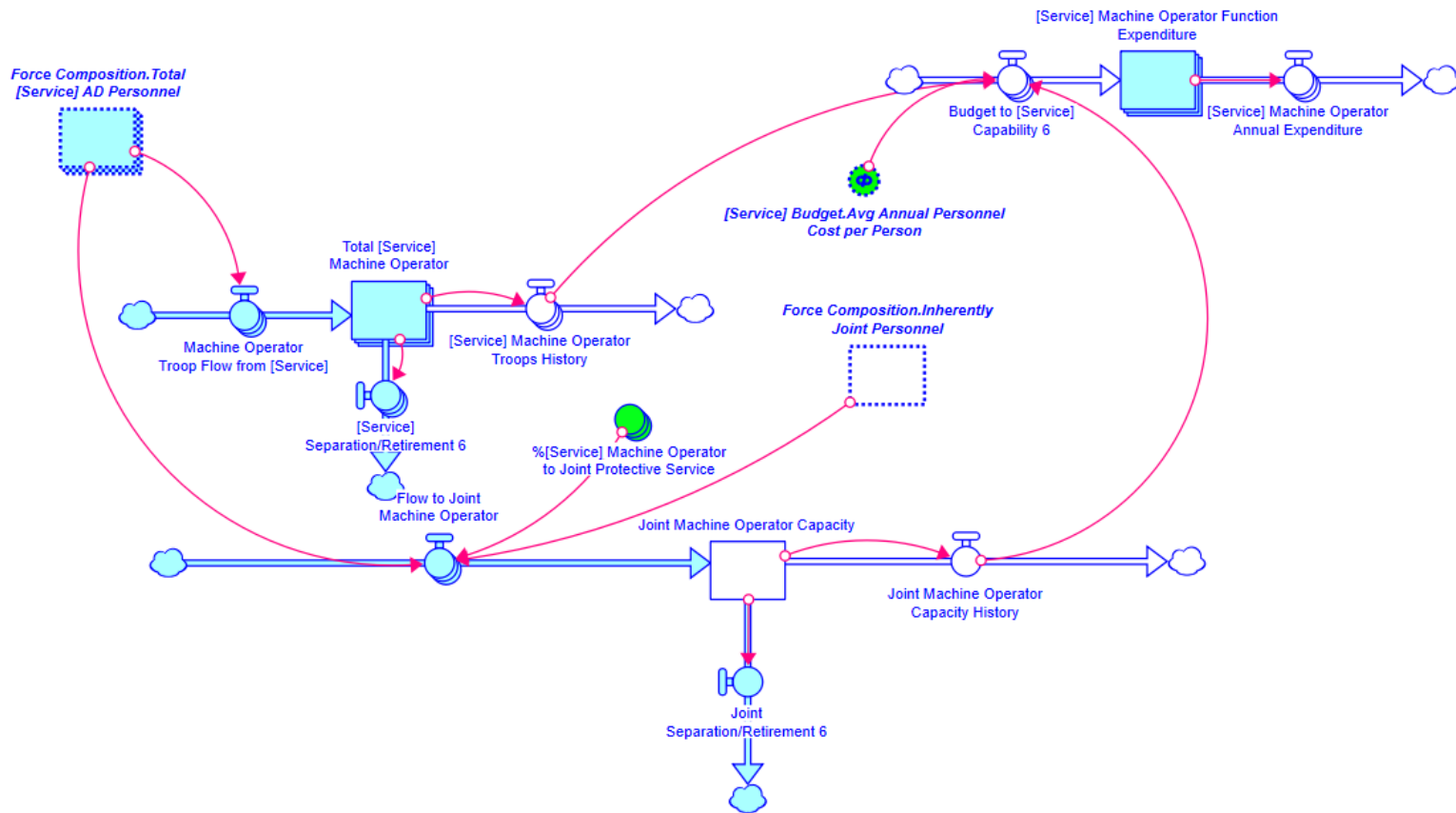


Figure 24. Machine Operator and Production Function Capacity and Expenditure Module.¹⁵²

¹⁵² Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 16. Description of Machine Operator and Production Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁵³	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Machine Operator Troop Flow from [Service]	Inflow	The flow of Machine Operator Personnel as a percentage from the Services based on CY22 data ¹⁵⁴	Army: .009*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .02*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .03*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .01*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .02*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Machine Operator	Stock	Initialized number of Machine Operator Personnel by Service based on CY22 data ¹⁵⁵	Army: 4153 Air Force: 6695 Navy: 9402 Marine Corps: 2399 Inherently Joint: 0
[Service] Separation/Retirement 6	Outflow	Expected Separations and Retirements by	.14*"Total_[Service]_Machine_Operator" ¹⁵⁶

¹⁵³ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁵⁴ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁵⁵ U.S. Bureau of Labor Statistics.

¹⁵⁶ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		Service calculated as a percentage from average annual total	
[Service] Machine Operator Troops History	Outflow	Annual total number of Service-produced Machine Operator Personnel	HISTORY("Total_[Service]_Machine_Operator," TIME)
Flow to Joint Machine Operator	Outflow	Flow of allocated Service Machine Operator Personnel to Joint Machine Operator Capacity	<p>Army: $.009 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Army}] * \text{"\%}[Service]_Machine_Operator_to_Joint_Protective_Service"} * [\text{Army}_ \%_to_Joint_Function]$</p> <p>Air Force: $.02 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Air_Force}] * \text{"\%}[Service]_Machine_Operator_to_Joint_Protective_Service"} * [\text{Air_Force}_ \%_to_Joint_Function]$</p> <p>Navy: $.03 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Navy}] * \text{"\%}[Service]_Machine_Operator_to_Joint_Protective_Service"} * [\text{Navy}_ \%_to_Joint_Function]$</p> <p>Marine Corps: $.01 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Marine_Corps}] * \text{"\%}[Service]_Machine_Operator_to_Joint_Protective_Service"} * [\text{Marine_Corps}_ \%_to_Joint_Function]$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{"\%}[Service]_Machine_Operator_to_Joint_Protective_Service"} * [\text{Inherently_Joint}_ \%_to_Joint_Function]$</p>
%[Service] Machine Operator to Joint Machine Operator	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Machine Operator Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition.	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0

Element Name	Type	Description	Formula
Inherently Joint Personnel			
Joint Machine Operator Capacity	Stock	Number of Joint Machine Operator Personnel	Initialized at 0
Joint Separation/Retirement 6	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Machine_Operator_Capacity ¹⁵⁷
Joint Machine Operator Capacity History	Outflow	Annual total number of Joint Machine Operator Personnel	HISTORY(Joint_Machine_Operator_Capacity, TIME)
Budget to [Service] Capability 6	Inflow	Calculation of how much Services pay for Machine Operator capability	<p>Joint: Joint_Machine_Operator_Capacity_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Machine_Operator_Troops_History”[Army_Machine_Operators]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Machine_Operator_Troops_History”[Air_Force_Machine_Operators]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Machine_Operator_Troops_History”[Navy_Machine_Operators]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Machine_Operator_Troops_History”[Marine_Corps_Machine_Operators]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>

¹⁵⁷ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
			Inherently Joint: “[Service]_Machine_Operator_Troops_History”[Inherently_Joint_Machine_Operators]* “[Service]_Budget”.Avg Annual Personnel Cost per Person
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹⁵⁸
[Service] Machine Operator Function Expenditure	Stock	Each Service’s total Machine Operator Function Expenditure ¹⁵⁹	Joint: 0*140000 Army: 4153*140000 Air Force: 6695*140000 Navy: 9402*140000 Marine Corps: 2399*140000 Inherently Joint: 0*140000
[Service] Machine Operator Expenditure	Outflow	Each Service’s annual Machine Operator Function expenditure	HISTORY(“[Service]_Machine_Operator_Function_Expenditure,” TIME)

¹⁵⁸ Harper, “Pentagon Personnel Costs at Historic High.”

¹⁵⁹ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, “Pentagon Personnel Costs at Historic High.”

8. Human Resources Function Capacity and Expenditure

The “Human Resources Capacity and Expenditure” Function module, shown in Figure 25, simulates allocation of each Service’s manpower and expenditure toward its Service-based Human Resources needs, as well as its allocation of Service-based Human Resources job specialty personnel to the Joint Force Human Resources Function combat capability requirement, ultimately fielding the Joint Human Resources Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Human Resources personnel provided to the Joint Force Human Resources Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 17 describes each element within the module.

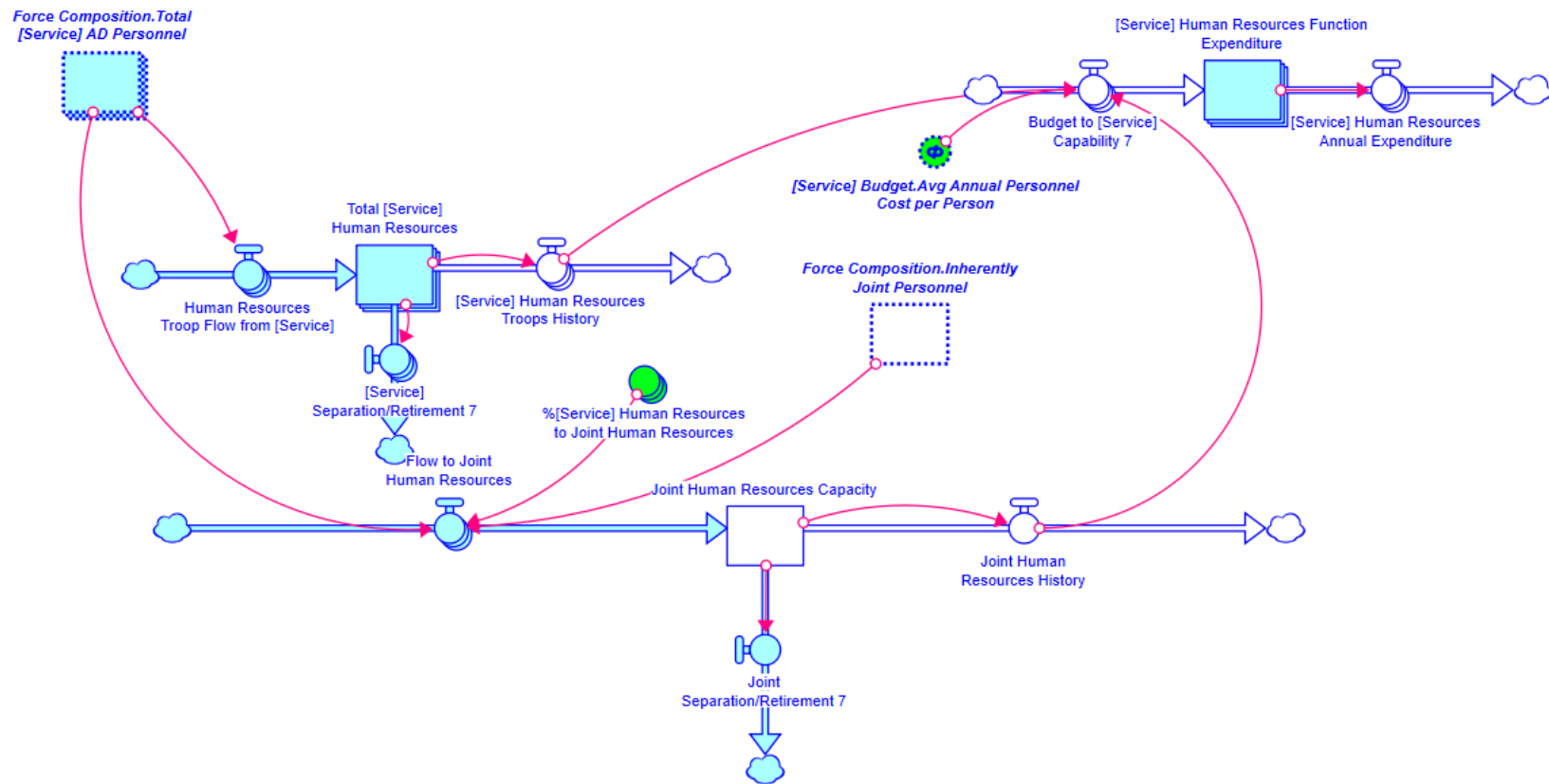


Figure 25. Human Resources Function Capacity and Expenditure Module.¹⁶⁰

¹⁶⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 17. Description of Human Resources Function Capacity and Budget Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁶¹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Human Resources Troop Flow from [Service]	Inflow	The flow of Human Resources Personnel as a percentage from the Services based on CY22 data ¹⁶²	Army: .03*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .03*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .02*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .01*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .02*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Human Resources	Stock	Initialized number of Human Resources Personnel by Service based on CY22 data ¹⁶³	Army: 15174 Air Force: 8426 Navy: 5308 Marine Corps: 2328 Inherently Joint: 0

¹⁶¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁶² U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁶³ U.S. Bureau of Labor Statistics.

Element Name	Type	Description	Formula
[Service] Separation/ Retirement 7	Outflow	Expected Separations and Retirements by Service calculated as a percentage from average annual total	.14*"Total_[Service]_Human_Resources" ¹⁶⁴
[Service] Human Resources Troops History	Outflow	Annual total number of Service-produced Human Resources Personnel	HISTORY("Total_[Service]_Human_Resources," TIME)
Flow to Joint Human Resources	Outflow	Flow of allocated Service Human Resources Personnel to Joint Human Resources Capacity	<p>Army: .03 *Force_Composition."Total_[Service]_AD_Personnel"[Army]* "[%Service]_Human_Resources_to_Joint_Human_Resources"[Army_%_to_Joint_Function]</p> <p>Air Force: .03 *Force_Composition."Total_[Service]_AD_Personnel"[Air_Force]* "[%Service]_Human_Resources_to_Joint_Human_Resources"[Air_Force_%_to_Joint_Function]</p> <p>Navy: .02 *Force_Composition."Total_[Service]_AD_Personnel"[Navy]* "[%Service]_Human_Resources_to_Joint_Human_Resources"[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .01 *Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps]* "[%Service]_Human_Resources_to_Joint_Human_Resources"[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* "[%Service]_Human_Resources_to_Joint_Human_Resources"[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Human Resources to	Ghosted Input as Selector	Selectable percent of Service,	Army: 0.1 Air Force: 0.1 Navy: 0.1

¹⁶⁴ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
Joint Human Resources		initialized at 10% as a starting assumption Human Resources Personnel allocated to Joint Capacity	Marine Corps: 0.1 Inherently Joint: 0.1
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Human Resources Capacity	Stock	Number of Joint Human Resources Personnel	Initialized at 0
Joint Separation/Retirement 7	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Human_Resources_Capacity ¹⁶⁵
Joint Human Resources Capacity History	Outflow	Annual total number of Joint Human Resources Personnel	HISTORY(Joint_Human_Resources_Capacity, TIME)
Budget to [Service] Capability 7	Inflow	Calculation how much Services pay for Human Resources capability	Joint: Joint_Human_Resources_History* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person Army:

¹⁶⁵ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
			<p>“[Service]_Human_Resources_Troops_History”[Army_Human_Resources_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Human_Resources_Troops_History”[Air_Force_Human_Resources_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Human_Resources_Troops_History”[Navy_Human_Resources_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Human_Resources_Troops_History”[Marine_Corps_Human_Resources_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Human_Resources_Troops_History”[Inherently_Joint_Human_Resources_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹⁶⁶
[Service] Human Resources Function Expenditure	Stock	Each Service’s total Human Resources Function Expenditure ¹⁶⁷	Joint: 0*140000 Army: 15174*140000 Air Force: 8426*140000 Navy: 5308*140000 Marine Corps: 2328*140000 Inherently Joint: 0*140000
[Service] Human Resources Expenditure	Outflow	Each Service’s annual Human Resources Function expenditure	HISTORY(“[Service]_Human_Resources_Function_Expenditure,” TIME)

¹⁶⁶ Harper, “Pentagon Personnel Costs at Historic High.”

¹⁶⁷ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, “Pentagon Personnel Costs at Historic High.”

9. Healthcare Function Capacity and Expenditure

The “Healthcare Capacity and Expenditure” Function module, shown in Figure 26, simulates allocation of each Service’s manpower and budget to its Service-based Healthcare needs, as well as its allocation of Service-based personnel to the Joint Force Healthcare Function combat capability requirement, ultimately fielding the Joint Healthcare Capability and Capacity. Separations and retirements are accounted for in both the Services and the Joint force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Healthcare personnel to the Joint Force Healthcare Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 18 describes each element within the module.

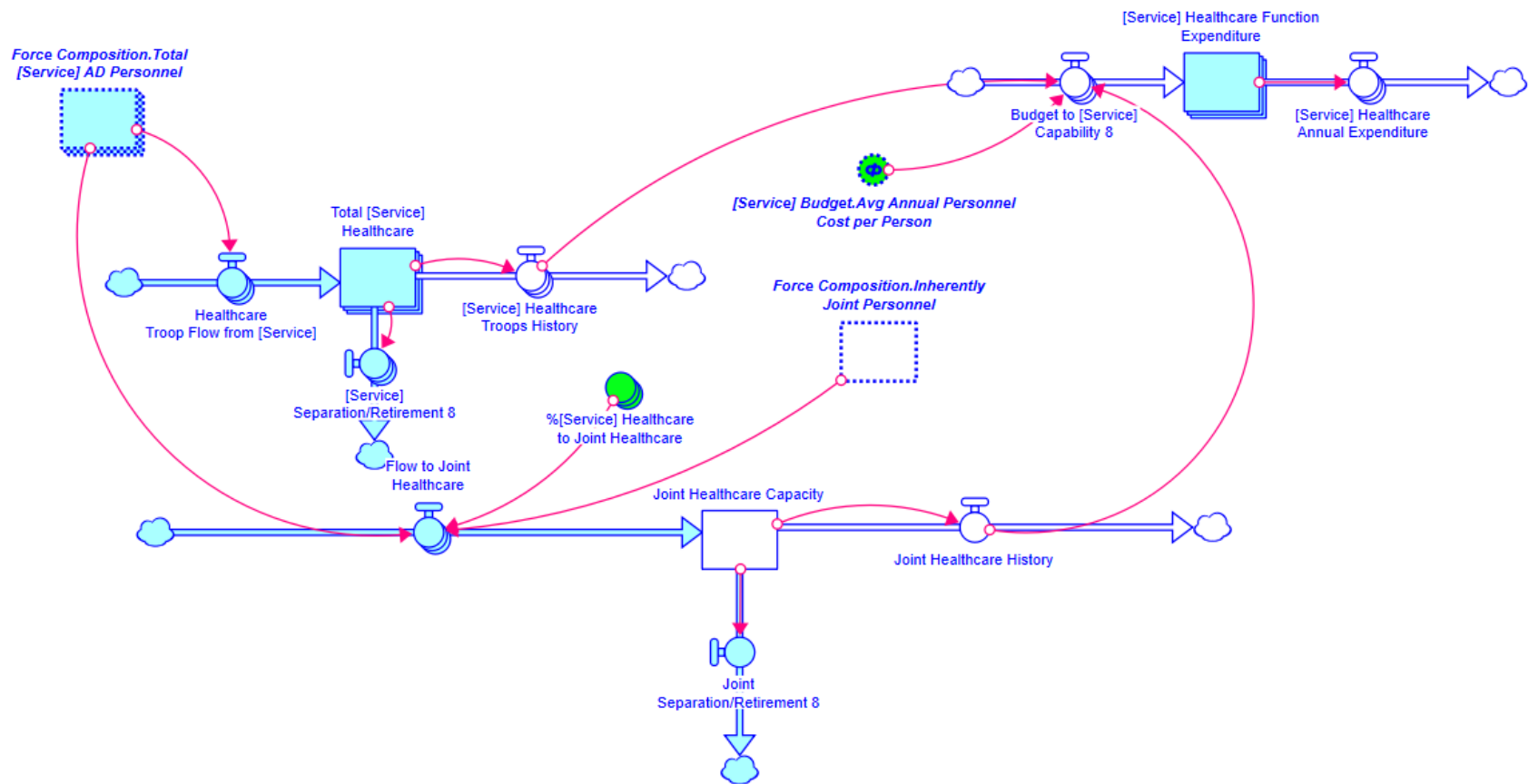


Figure 26. Healthcare Function Capacity and Expenditure Module.¹⁶⁸

¹⁶⁸ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 18. Description of Healthcare Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁶⁹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Healthcare Troop Flow from [Service]	Inflow	The flow of Healthcare Personnel as a percentage from the Services based on CY22 data ¹⁷⁰	Army: .05*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .04*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .07*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: 0*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .05*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Healthcare	Stock	Initialized number of Healthcare Personnel by Service based on CY22 data ¹⁷¹	Army: 25960 Air Force: 14881 Navy: 23932 Marine Corps: 0 Inherently Joint: 0 (model requirement)

¹⁶⁹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁷⁰ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁷¹ U.S. Bureau of Labor Statistics.

Element Name	Type	Description	Formula
[Service] Separation/ Retirement 8	Outflow	Expected Separations and Retirements by Service calculated as a percentage from average annual total	.14*"Total_[Service]_Healthcare" ¹⁷²
[Service] Healthcare Troops History	Outflow	Annual total number of Service-produced Healthcare Personnel	HISTORY("Total_[Service]_Healthcare," TIME)
Flow to Joint Healthcare	Outflow	Flow of allocated Service Healthcare Personnel to Joint Healthcare Capacity	<p>Army: .05 *Force_Composition."Total_[Service]_AD_Personnel"[Army]* "[%Service]_Healthcare_to_Joint_Healthcare"[Army_%_to_Joint_Function]</p> <p>Air Force: .04 *Force_Composition."Total_[Service]_AD_Personnel"[Air_Force]* "[%Service]_Healthcare_to_Joint_Healthcare"[Air_Force_%_to_Joint_Function]</p> <p>Navy: .07 *Force_Composition."Total_[Service]_AD_Personnel"[Navy]* "[%Service]_Healthcare_to_Joint_Healthcare"[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .0 *Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps]* "[%Service]_Healthcare_to_Joint_Healthcare"[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* "[%Service]_Healthcare_to_Joint_Healthcare"[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Healthcare to Joint Healthcare	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Healthcare Personnel allocated to Joint Capacity	Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1
Force Composition.	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0

¹⁷² U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
Inherently Joint Personnel			
Joint Healthcare Capacity	Stock	Number of Joint Healthcare Personnel	Initialized at 0
Joint Separation/Retirement 8	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Healthcare_Capacity ¹⁷³
Joint Healthcare Capacity History	Outflow	Annual total number of Joint Healthcare Personnel	HISTORY(Joint_Healthcare_Capacity, TIME)
Budget to [Service] Capability 8	Inflow	Calculation of how much Services pay for Healthcare capability	<p>Joint: Joint_Healthcare_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Healthcare_Troops_History”[Army_Healthcare]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Healthcare_Troops_History”[Air_Force_Healthcare]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Healthcare_Troops_History”[Navy_Healthcare]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Healthcare_Troops_History”[Marine_Corps_Healthcare]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Healthcare_Troops_History”[Inherently_Joint_Healthcare]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>

¹⁷³ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ¹⁷⁴
[Service] Healthcare Function Expenditure	Stock	Each Service's total Healthcare Function Expenditure ¹⁷⁵	Joint: 0*140000 Army: 25960*140000 Air Force: 14881*140000 Navy: 23932*140000 Marine Corps: 0*140000 Inherently Joint: 0*140000
[Service] Healthcare Expenditure	Outflow	Each Service's annual Healthcare Function expenditure	HISTORY("[Service]_Healthcare_Function_Expenditure," TIME)

¹⁷⁴ Harper, "Pentagon Personnel Costs at Historic High."

¹⁷⁵ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

10. Engineering Science and Technical Function Capacity and Expenditure

The “Engineering Science and Technical Capacity and Expenditure” Function module, shown in Figure 27, simulates allocation of each Service’s manpower and expenditure toward its Service-based Engineering needs, as well as its allocation of Service-based Engineering job specialty personnel to the Joint Force Engineering Function combat capability requirement, ultimately fielding the Joint Engineering Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Engineering personnel provided to the Joint Force Engineering Function to explore effects of increasing contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 19 describes each element within the module.

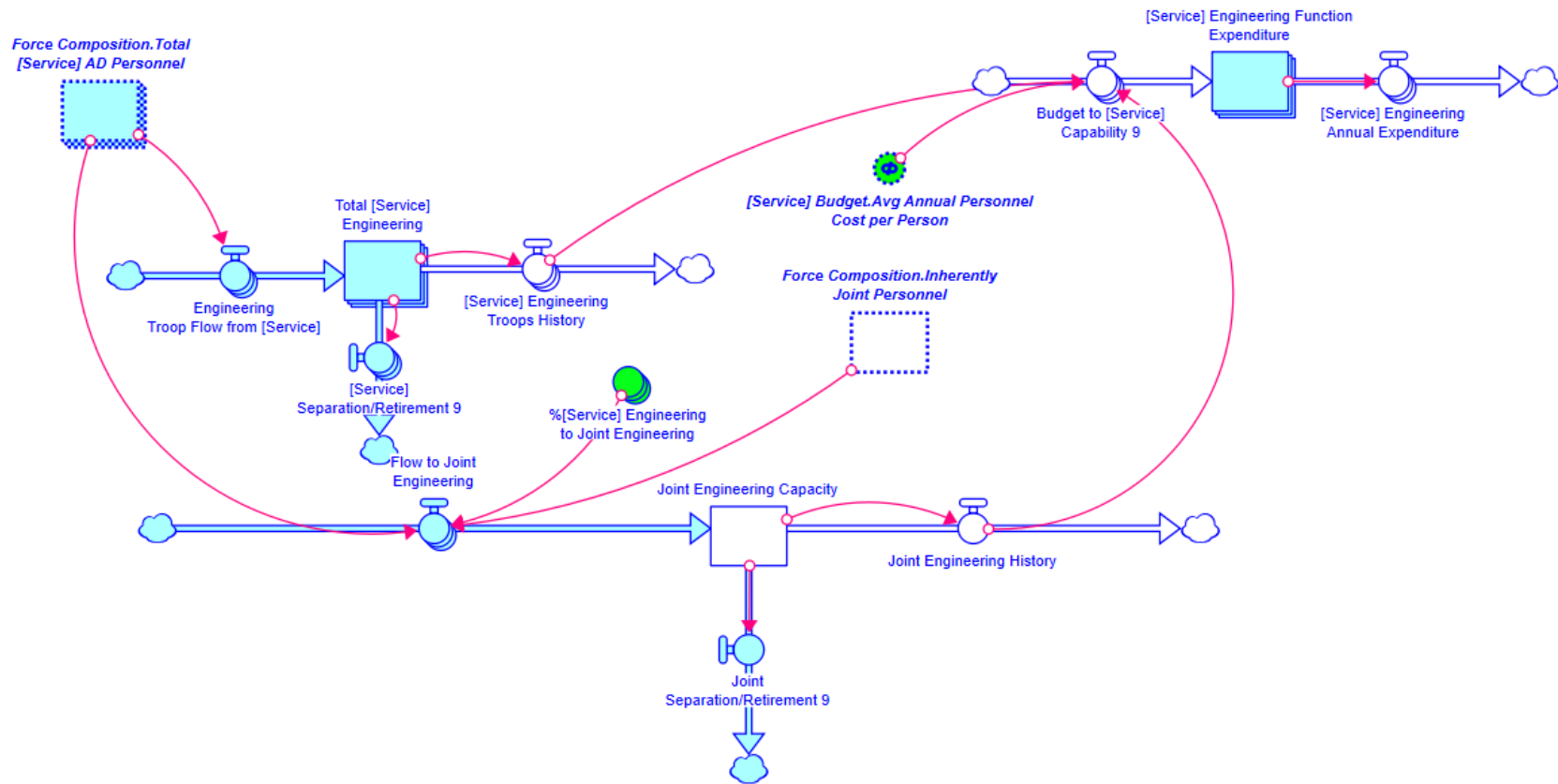


Figure 27. Engineering Science and Technical Function Capacity and Expenditure Module.¹⁷⁶

¹⁷⁶ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final”

Table 19. Description of Engineering Science and Technical Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁷⁷	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Engineering Troop Flow from [Service]	Inflow	The flow of Engineering Personnel as a percentage from the Services based on CY22 data ¹⁷⁸	Army: .09*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .17*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .14*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .16*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .14*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Engineering	Stock	Initialized number of Engineering Personnel by Service based on CY22 data ¹⁷⁹	Army: 42788 Air Force: 55595 Navy: 46653 Marine Corps: 28067 Inherently Joint: 0
[Service] Separation/Retirement 9	Outflow	Expected Separations and Retirements by Service	.14*"Total_[Service]_Engineering" ¹⁸⁰

¹⁷⁷ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁷⁸ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁷⁹ U.S. Bureau of Labor Statistics.

¹⁸⁰ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		calculated as a percentage from average annual total	
[Service] Engineering Troops History	Outflow	Annual total number of Service-produced Engineering Personnel	HISTORY("Total_[Service]_Engineering," TIME)
Flow to Joint Engineering	Outflow	Flow of allocated Service Engineering Personnel to Joint Engineering Capacity	<p>Army: $.09 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{[Army]\%_to_Joint_Function}$</p> <p>Air Force: $.17 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{[Air_Force]\%_to_Joint_Function}$</p> <p>Navy: $.14 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{[Navy]\%_to_Joint_Function}$</p> <p>Marine Corps: $.16 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * \text{[Marine_Corps]\%_to_Joint_Function}$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{[Inherently_Joint_]\%_to_Joint_Function}$</p>
%[Service] Engineering to Joint Engineering	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Engineering Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Engineering Capacity	Stock	Number of Joint Engineering Personnel	Initialized at 0

Element Name	Type	Description	Formula
Joint Separation/Retirement 9	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Engineering_Capacity ¹⁸¹
Joint Engineering Capacity History	Outflow	Annual total number of Joint Engineering Personnel	HISTORY(Joint_Engineering_Capacity, TIME)
Budget to [Service] Capability 9	Inflow	Calculation of how much Services pay for Engineering capability	<p>Joint: Joint_Engineering_History* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: "[Service]_Engineering_Troops_History"[Army_Engineering_Troops]* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: "[Service]_Engineering_Troops_History"[Air_Force_Engineering_Troops]* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: "[Service]_Engineering_Troops_History"[Navy_Engineering_Troops]* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: "[Service]_Engineering_Troops_History"[Marine_Corps_Engineering_Troops]* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: Joint_Engineering_History* "[Service]_Budget".Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg	Ghosted Converter,	Annual cost per service member, annually	140000 ¹⁸²

¹⁸¹ U.S. Department of Labor, "Transition Assistance Program."

¹⁸² Harper, "Pentagon Personnel Costs at Historic High."

Element Name	Type	Description	Formula
Annual Personnel Cost per Person	user-defined		
[Service] Engineering Function Expenditure	Stock	Each Service's total Engineering Function Expenditure ¹⁸³	Joint: 0*140000 Army: 42788*140000 Air Force: 55595*140000 Navy: 46653*140000 Marine Corps: 28067*140000 Inherently Joint: 0*140000
[Service] Engineering Expenditure	Outflow	Each Service's annual Engineering Function expenditure	HISTORY("[Service]_Engineering_Function_Expenditure," TIME)

¹⁸³ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

11. Electronic and Electrical Equipment Repair Function Capacity and Expenditure

The “Electronic and Electrical Equipment Repair Capacity and Expenditure” Function module, shown in Figure 28, simulates allocation of each Service’s manpower and expenditure toward its Service-based Electrical needs, as well as its allocation of Service-based Electrical job specialty personnel to the Joint Force Electrical Function combat capability requirement, ultimately fielding the Joint Electrical Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Electrical personnel provided to the Joint Force Electrical Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 20 describes each element within the module.

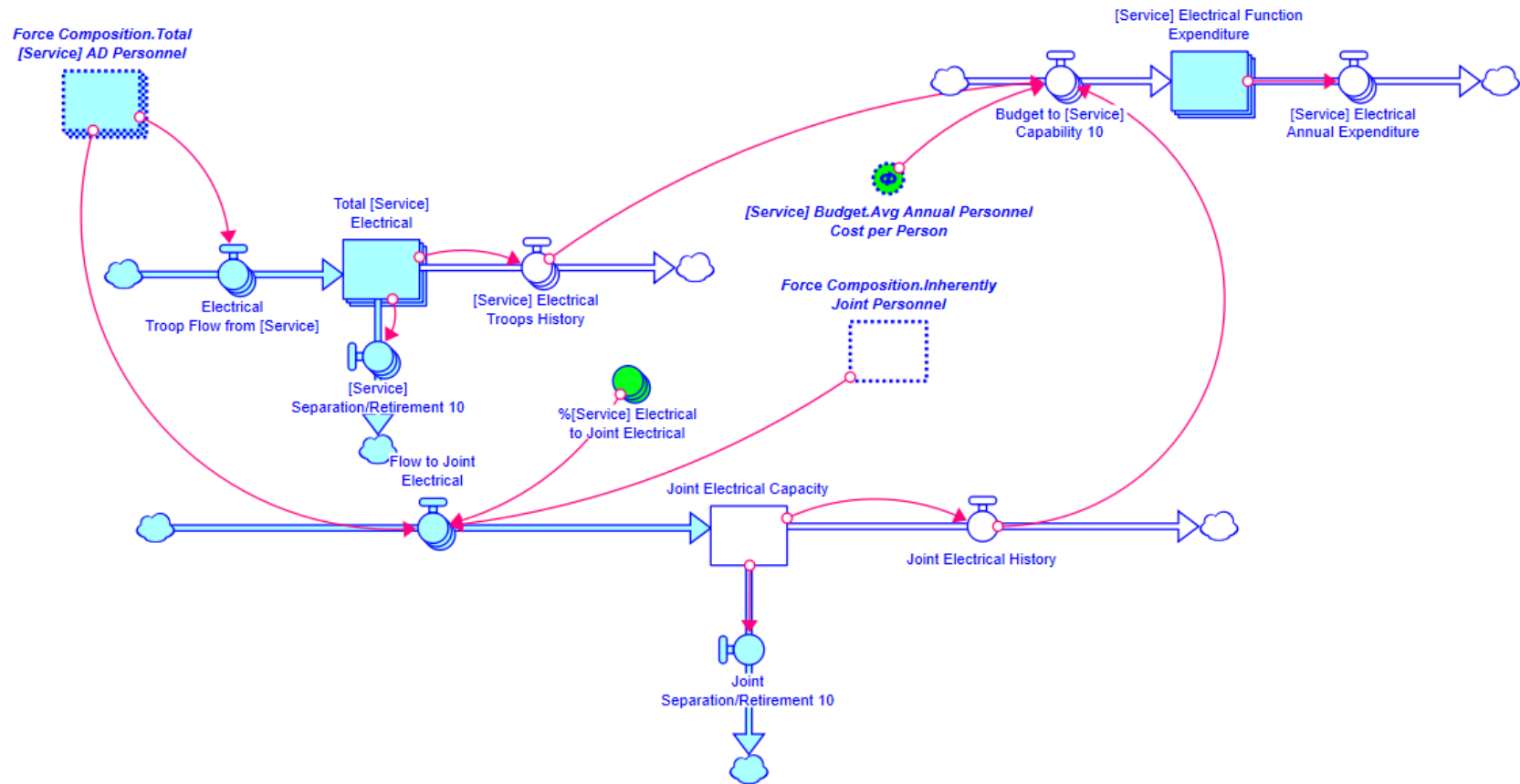


Figure 28. Electronic and Electrical Equipment Repair Function Capacity and Expenditure Module.¹⁸⁴

¹⁸⁴ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 20. Description of Electronic and Electrical Equipment Repair Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁸⁵	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Electrical Troop Flow from [Service]	Inflow	The flow of Electrical Personnel as a percentage from the Services based on CY22 data ¹⁸⁶	Army: .06*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .09*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .15*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .08*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .10*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Electrical	Stock	Initialized number of Electrical Personnel by Service based on CY22 data ¹⁸⁷	Army: 28934 Air Force: 28552 Navy: 50455 Marine Corps: 14333 Inherently Joint: 0

¹⁸⁵ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁸⁶ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁸⁷ U.S. Bureau of Labor Statistics.

Element Name	Type	Description	Formula
[Service] Separation/ Retirement 10	Outflow	Expected Separations and Retirements by Service calculated as a percentage from average annual total	.14*[Total_[Service]_Electrical] 188
[Service] Electrical Troops History	Outflow	Annual total number of Service-produced Electrical Personnel	HISTORY("Total_[Service]_Electrical," TIME)
Flow to Joint Electrical	Outflow	Flow of allocated Service Electrical Personnel to Joint Electrical Capacity	<p>Army: .06 *Force_Composition."Total_[Service]_AD_Personnel"[Army]* "%[Service]_Electrical_to_Joint_Electrical"[Army_%_to_Joint_Function]</p> <p>Air Force: .09 *Force_Composition."Total_[Service]_AD_Personnel"[Air_Force]* "%[Service]_Electrical_to_Joint_Electrical"[Air_Force_%_to_Joint_Function]</p> <p>Navy: .15 *Force_Composition."Total_[Service]_AD_Personnel"[Navy]* "%[Service]_Electrical_to_Joint_Electrical"[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .08 *Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps]* "%[Service]_Electrical_to_Joint_Electrical"[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* "%[Service]_Electrical_to_Joint_Electrical"[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Electrical to Joint Electrical	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Electrical Personnel allocated to Joint Capacity	Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0

188 U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
Joint Electrical Capacity	Stock	Number of Joint Electrical Personnel	Initialized at 0
Joint Separation/Retirement 10	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Electrical_Capacity ¹⁸⁹
Joint Electrical Capacity History	Outflow	Annual total number of Joint Electrical Personnel	HISTORY(Joint_Electrical_Capacity, TIME)
Budget to [Service] Capability 10	Inflow	Calculation how much Services pay for Electrical capability	<p>Joint: Joint_Electrical_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Electrical_Troops_History”[Army_Electrical_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Electrical_Troops_History”[Air_Force_Electrical_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Electrical_Troops_History”[Navy_Electrical_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Electrical_Troops_History”[Marine_Corps_Electrical_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Electrical_Troops_History”[Inherently_Joint_Electrical_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg	Ghosted Convert	Annual cost per service member, annually	140000 ¹⁹⁰

¹⁸⁹ U.S. Department of Labor, “Transition Assistance Program.”

¹⁹⁰ Harper, “Pentagon Personnel Costs at Historic High.”

Element Name	Type	Description	Formula
Annual Personnel Cost per Person	er, user-defined		
[Service] Electrical Function Expenditure	Stock	Each Service's total Electrical Function Expenditure ¹⁹¹	Joint: 0*140000 Army: 28934*140000 Air Force: 28552*140000 Navy: 50455*140000 Marine Corps: 14333*140000 Inherently Joint: 0*140000
[Service] Electrical Expenditure	Outflow	Each Service's annual Electrical Function expenditure	HISTORY("[Service]_Electrical_Function_Expenditure," TIME)

¹⁹¹ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

12. Construction Function Capacity and Expenditures

The “Construction Capacity and Expenditure” Function module, shown in Figure 29, simulates allocation of each Service’s manpower and expenditure toward its Service-based Construction needs, as well as its allocation of Service-based Construction job specialty personnel to the Joint Force Construction Function combat capability requirement, ultimately fielding the Joint Construction Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Construction personnel provided to the Joint Force Construction Function to explore effects of contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 21 describes each element within the module.

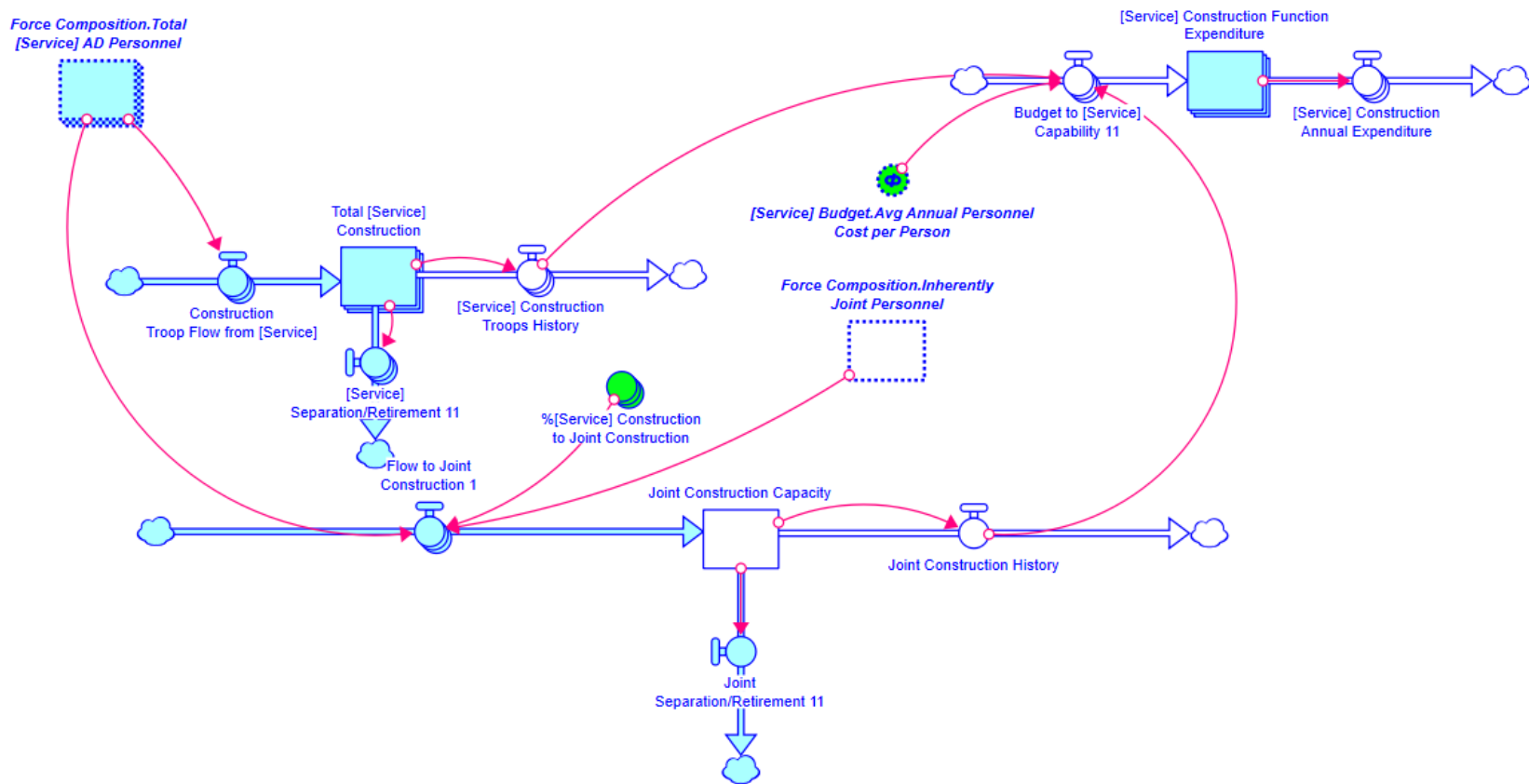


Figure 29. Construction Function Capacity and Expenditure Module.¹⁹²

¹⁹² Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 21. Description of Construction Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ¹⁹³	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Construction Troop Flow from [Service]	Inflow	The flow of Construction Personnel as a percentage from the Services based on CY22 data ¹⁹⁴	Army: .03*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .02*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .01*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .03*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .02*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Construction	Stock	Initialized number of Construction Personnel by Service based on CY22 data ¹⁹⁵	Army: 14353 Air Force: 4991 Navy: 3849 Marine Corps: 6119 Inherently Joint: 0
[Service] Separation/Retirement 11	Outflow	Expected Separations and Retirements by Service	.14*"Total_[Service]_Construction" ¹⁹⁶

¹⁹³ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

¹⁹⁴ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

¹⁹⁵ U.S. Bureau of Labor Statistics.

¹⁹⁶ U.S. Department of Labor, "Transition Assistance Program."

Element Name	Type	Description	Formula
		calculated as a percentage from average annual total	
[Service] Construction Troops History	Outflow	Annual total number of Service-produced Construction Personnel	HISTORY("Total_[Service]_Construction," TIME)
Flow to Joint Construction	Outflow	Flow of allocated Service Construction Personnel to Joint Construction Capacity	<p>Army: $.03 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Army}] * \text{"\%}[Service]_Construction_to_Joint_Construction"} * [\text{Army}_\%_to_Joint_Function]$</p> <p>Air Force: $.02 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Air_Force}] * \text{"\%}[Service]_Construction_to_Joint_Construction"} * [\text{Air_Force}_\%_to_Joint_Function]$</p> <p>Navy: $.01 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Navy}] * \text{"\%}[Service]_Construction_to_Joint_Construction"} * [\text{Navy}_\%_to_Joint_Function]$</p> <p>Marine Corps: $.03 * \text{Force_Composition} * \text{Total_}[Service]_AD_Personnel * [\text{Marine_Corps}] * \text{"\%}[Service]_Construction_to_Joint_Construction"} * [\text{Marine_Corps}_\%_to_Joint_Function]$</p> <p>Inherently Joint: $\text{Force_Composition} * \text{Inherently_Joint_Personnel} * \text{"\%}[Service]_Construction_to_Joint_Construction"} * [\text{Inherently_Joint}_\%_to_Joint_Function]$</p>
%[Service] Construction to Joint Construction	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting assumption Construction Personnel allocated to Joint Capacity	<p>Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1 Inherently Joint: 0.1</p>
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Construction Capacity	Stock	Number of Joint Construction Personnel	Initialized at 0

Element Name	Type	Description	Formula
Joint Separation/Retirement 11	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Construction_Capacity ¹⁹⁷
Joint Construction Capacity History	Outflow	Annual total number of Joint Construction Personnel	HISTORY(Joint_Construction_Capacity, TIME)
Budget to [Service] Capability 11	Inflow	Calculation how much Services pay for Construction capability	<p>Joint: Joint_Construction_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Army: “[Service]_Construction_Troops_History”[Army_Construction_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Air Force: “[Service]_Construction_Troops_History”[Air_Force_Construction_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Navy: “[Service]_Construction_Troops_History”[Navy_Construction_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Construction_Troops_History”[Marine_Corps_Construction_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Construction_Troops_History”[Inherently_Joint_Construction_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg	Ghosted Convert	Annual cost per service member, annually	140000 ¹⁹⁸

¹⁹⁷ U.S. Department of Labor, “Transition Assistance Program.”

¹⁹⁸ Harper, “Pentagon Personnel Costs at Historic High.”

Element Name	Type	Description	Formula
Annual Personnel Cost per Person	er, user-defined		
[Service] Construction Function Expenditure	Stock	Each Service's total Construction Function Expenditure ¹⁹⁹	Joint: 0*140000 Army: 14353*140000 Air Force: 4991*140000 Navy: 3849*140000 Marine Corps: 6119*140000 Inherently Joint: 0*140000
[Service] Construction Expenditure	Outflow	Each Service's annual Construction Function expenditure	HISTORY("[Service]_Construction_Function_Expenditure," TIME)

¹⁹⁹ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, "Pentagon Personnel Costs at Historic High."

13. Combat Specialty Function Capacity and Expenditure

The “Combat Specialty Capacity and Expenditure” Function module, shown in Figure 30, simulates allocation of each Service’s manpower and expenditure toward its Service-based Combat Specialty needs, as well as its allocation of Service-based Combat Specialty job specialty personnel to the Joint Force Combat Specialty Function combat capability requirement, ultimately fielding the Joint Combat Specialty Capability and Capacity required by the Combatant Commands. Separations and retirements are accounted for in both the Services and the Joint Force. This module also contains a link to a User Interface (colored in GREEN) enabling the selection of the percentage of Service-based Combat Specialty personnel provided to the Joint Force Combat Specialty Function to explore effects of increasing contributions to the Joint Force. The elements of this module are arrayed by Service to visually declutter the model. Table 22 describes each element within the module.

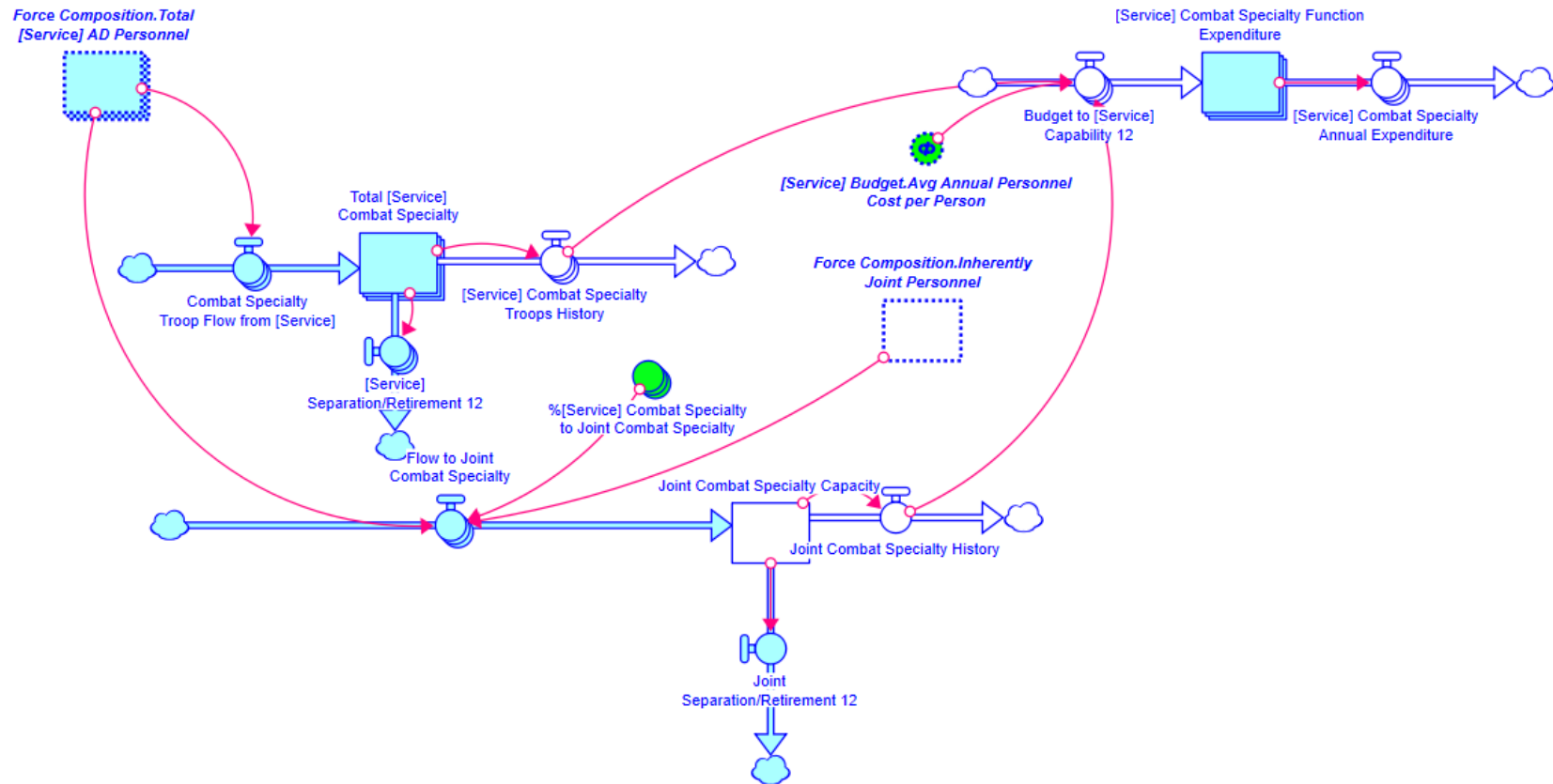


Figure 30. Combat Specialty Function Capacity and Expenditure Module.²⁰⁰

²⁰⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 22. Description of Combat Specialty Function Capacity and Expenditure Module Elements

Element Name	Type	Description	Formula
Force Composition. Total [Service] AD Personnel	Ghosted Stock as Input	DOD force size by Service, initialization values from FY23 budget request ²⁰¹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Combat Specialty Troop Flow from [Service]	Inflow	The flow of Combat Specialty Personnel as a percentage from the Services based on CY22 data ²⁰²	Army: .23*Force_Composition."Total_[Service]_AD_Personnel"[Army] Air Force: .002*Force_Composition."Total_[Service]_AD_Personnel"[Air_Force] Navy: .03*Force_Composition."Total_[Service]_AD_Personnel"[Navy] Marine Corps: .22*Force_Composition."Total_[Service]_AD_Personnel"[Marine_Corps] Inherently Joint: .12*Force_Composition."Total_[Service]_AD_Personnel"[Inherently_Joint]
Total [Service] Combat Specialty	Stock	Initialized number of Combat Specialty Personnel by Service based on CY22 data ²⁰³	Army: 111710 Air Force: 911 Navy: 9155 Marine Corps: 39021 Inherently Joint: 0

²⁰¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²⁰² U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*.

²⁰³ U.S. Bureau of Labor Statistics.

Element Name	Type	Description	Formula
[Service] Separation/ Retirementv12	Outflow	Expected Separations and Retirements by Service calculated as a percentage from average annual total	.14*Total_[Service]_Combat_Specialty” ²⁰⁴
[Service] Combat Specialty Troops History	Outflow	Annual total number of Service-produced Combat Specialty Personnel	HISTORY(“Total_[Service]_Combat_Specialty,” TIME)
Flow to Joint Combat Specialty	Outflow	Flow of allocated Service Combat Specialty Personnel to Joint Combat Specialty Capacity	<p>Army: .03 *Force_Composition.”Total_[Service]_AD_Personnel”[Army]* “[Service]_Combat_Specialty_to_Joint_Combat_Specialty”[Army_%_to_Joint_Function]</p> <p>Air Force: .02 *Force_Composition.”Total_[Service]_AD_Personnel”[Air_Force]* “[Service]_Combat_Specialty_to_Joint_Combat_Specialty”[Air_Force_%_to_Joint_Function]</p> <p>Navy: .01 *Force_Composition.”Total_[Service]_AD_Personnel”[Navy]* “[Service]_Combat_Specialty_to_Joint_Combat_Specialty”[Navy_%_to_Joint_Function]</p> <p>Marine Corps: .03 *Force_Composition.”Total_[Service]_AD_Personnel”[Marine_Corps]* “[Service]_Combat_Specialty_to_Joint_Combat_Specialty”[Marine_Corps_%_to_Joint_Function]</p> <p>Inherently Joint: Force_Composition.Inherently_Joint_Personnel* “[Service]_Combat_Specialty_to_Joint_Combat_Specialty”[Inherently_Joint_%_to_Joint_Function]</p>
%[Service] Combat Specialty to	Ghosted Input as Selector	Selectable percent of Service, initialized at 10% as a starting	Army: 0.1 Air Force: 0.1 Navy: 0.1 Marine Corps: 0.1

²⁰⁴ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
Joint Combat Specialty		assumption Combat Specialty Personnel allocated to Joint Capacity	Inherently Joint: 0.1
Force Composition. Inherently Joint Personnel	Ghosted stock as input	Number of converted Inherently Joint Personnel	Initialized at 0
Joint Combat Specialty Capacity	Stock	Number of Joint Combat Specialty Personnel	Initialized at 0
Joint Separation/Retirement 12	Outflow	Expected Separations and Retirements from Joint Capacity calculated as a percentage from average annual total	.14*Joint_Combat_Specialty_Capacity ²⁰⁵
Joint Combat Specialty Capacity History	Outflow	Annual total number of Joint Combat Specialty Personnel	HISTORY(Joint_Combat_Specialty_Capacity, TIME)
Budget to [Service] Capability 12	Inflow	Calculation how much Services pay for Combat Specialty capability	Joint: Joint_Combat_Specialty_History* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person Army: “[Service]_Combat_Specialty_Troops_History”[Army_Combat_Specialty_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person Air Force: “[Service]_Combat_Specialty_Troops_History”[Air_Force_Combat_Specialty_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person

²⁰⁵ U.S. Department of Labor, “Transition Assistance Program.”

Element Name	Type	Description	Formula
			<p>Navy: “[Service]_Combat_Specialty_Troops_History”[Navy_Combat_Specialty_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Marine Corps: “[Service]_Combat_Specialty_Troops_History”[Marine_Corps_Combat_Specialty_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p> <p>Inherently Joint: “[Service]_Combat_Specialty_Troops_History”[Inherently_Joint_Combat_Specialty_Troops]* “[Service]_Budget”.Avg_Annual_Personnel_Cost_per_Person</p>
[Service] Budget.Avg Annual Personnel Cost per Person	Ghosted Converter, user-defined	Annual cost per service member, annually	140000 ²⁰⁶
[Service] Combat Specialty Function Expenditure	Stock	Each Service’s total Combat Specialty Function Expenditure ²⁰⁷	Joint: 0*140000 Army: 111710*140000 Air Force: 911*140000 Navy: 9155*140000 Marine Corps: 39021*140000 Inherently Joint: 0*140000
[Service] Combat Specialty Expenditure	Outflow	Each Service’s annual Combat Specialty Function expenditure	HISTORY(“[Service]_Combat_Specialty_Function_Expenditure,” TIME)

²⁰⁶ Harper, “Pentagon Personnel Costs at Historic High.”

²⁰⁷ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook: Military Careers*; Harper, “Pentagon Personnel Costs at Historic High.”

E. MODEL STRUCTURE: “TIER 2” JOINT CAPABILITIES MODULE

“Tier 2” Capabilities are complex domain-specific and multi-domain Capabilities requiring close integration from individual Tier 1 Functional Capabilities and Capacities. In other words, Tier 2 Capabilities are Joint Capabilities requiring support from specific job specialties within each Service across multiple Functions to create an integrated Joint Capability. Tier 2 Capability simulations are contained in the “Joint Capabilities” module, using the Joint Capability for Long Range Precision Fires as an example. Figure 31 depicts the Tier 2 Capability “Long Range Precision Fires,” and Table 23 describes each element within the Long Range Precision Fires module. In this simplified example, each Service contributes five specialty career fields (known as either Military Occupational Specialty [MOS], Air Force Specialty Codes [AFSC], or Navy Enlisted Codes [NEC]) labeled as “Contributors” in differing quantity to the overall Joint Capability. The five types of Service Contributors are Intelligence Personnel, Targeteers, Air Traffic Control (ATC), Approval Authorities, and Gunners/Shooters, which flow through a Queue and into a Joint Long Range Precision Fires Capability Personnel Requirement. Currently, each input converter assumes a static percentage allocation of Service-based personnel towards the Joint Capability requirement and the desired percentage is selectable in the User Interface. Simulations are dependent on the SWITCH position to “Start Conversion from Services to Joint Force” to model differences between manning the Joint Capability under the DOD “as it currently exists” and “as it could be” based on a new force structure. IF the SWITCH to “Start Conversion from Services to Joint Force” is ON, the Average Annual Cost per Servicemember rheostat is active and will forecast a selectable personnel cost, which completes a feedback loop into the [Service] Module and shows effects to DOD Budget, Inherently Joint Budget, Appropriations Budgets, and Tier 1 Functional Capacity and Budget expenditure. The new Inherently Joint structure embedded within the Joint Capability accounts for reductions in personnel requirements due to streamlining Functions based on the elimination of Service “overhead” currently used to sustain Service-specific Functions redundant to Joint Functional Capability requirements. Each Service’s Contributors module receives feedback from the “Force Composition” module, reflecting changes in the force structure and size based on percent GDP allocation to the DOD (both

in times of peace and armed conflict based on the position of the “Activate Combat Funding” SWITCH), and whether the force is undergoing modification to the Inherently Joint Force structure (based on the position of SWITCH to “Start Conversion from Services to Joint Force”).

Additional and more robust models will be required for other Joint Capabilities such as Special Operations and Joint Forcible Entry Operations in the future iterations. This Joint Capability is a simplified example for conceptual and illustrative purposes, selecting generalized example job specialties easily compared between Services. This example does not include material or budget modeling parameters, which are recommended for inclusion in future versions of the “Functionally Aligned Service-Agnostic U.S. Military” stock and flow model.

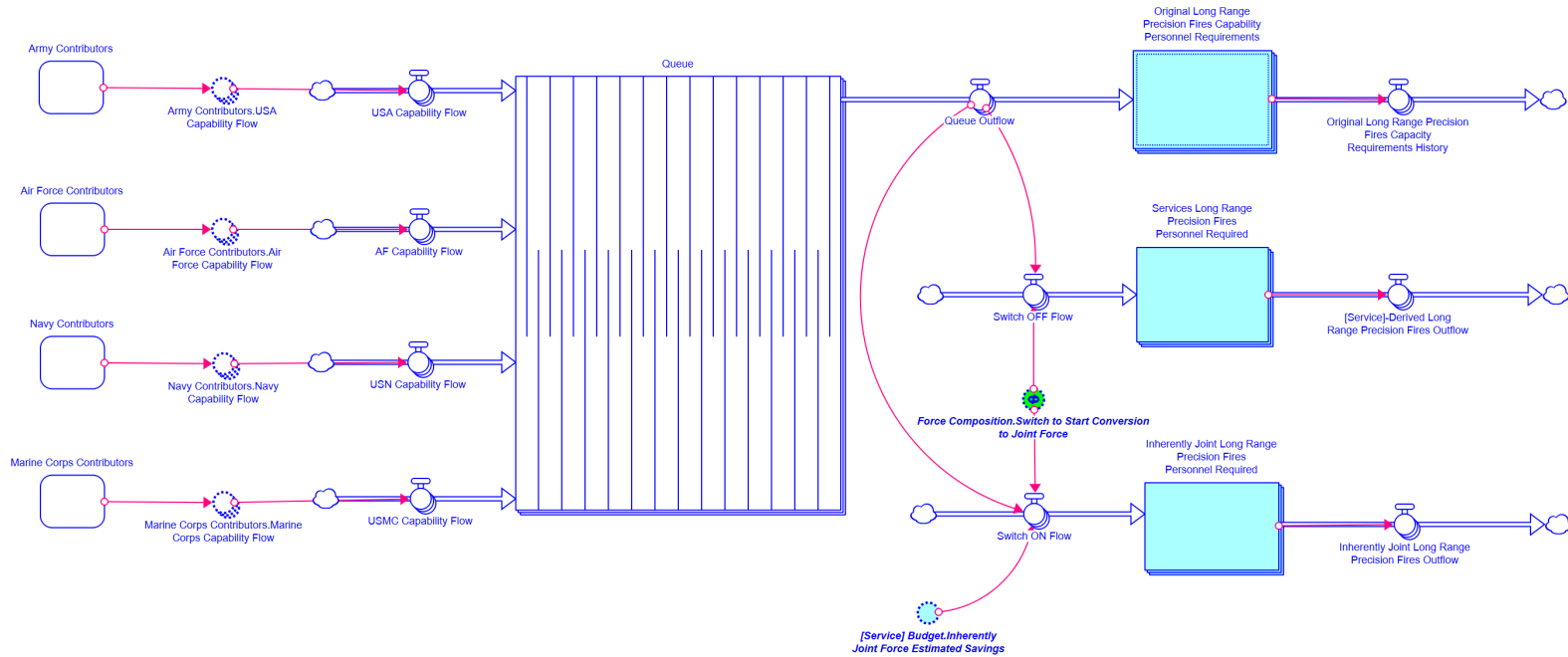


Figure 31. Joint Capability for Long Range Precision Fires Module.²⁰⁸

²⁰⁸ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 23. Description of Joint Capability for Long Range Precision Fires Module

Element Name	Type	Description	Formula
Army Contributors	Module	Grouping of military occupational specialties the Army supplies towards Long Range Precision Fires capability	See next section
Army Contributors. USA Capability Flow	Ghosted inflow	The flow of Army military occupational specialties towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Army_Targeteers"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army]) ELSE ("%Army_Targeteers"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Gunners/Shooters"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Gunners/Shooters"*Force_Composition.Inherently_Joint_Personnel</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Approval_Authorities"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Approval_Authorities"*Force_Composition.Inherently_Joint_Personnel</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Intelligence_Personnel"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Intelligence_Personnel"*Force_Composition.Inherently_Joint_Personnel</p> <p>Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_ATC"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_ATC"*Force_Composition.Inherently_Joint_Personnel</p>
USA Capability Flow	Inflow	Model mechanism to move Army	<p>Targeteers: Army_Contributors.USA_Capability_Flow [Targeteers]</p>

Element Name	Type	Description	Formula
		Capability flow to the Queue	<p>Gunners: Army_Contributors.USA_Capability_Flow [Gunners]</p> <p>Approval Authorities: Army_Contributors.USA_Capability_Flow [Approval_Authorities]</p> <p>Intelligence Analysts: Army_Contributors.USA_Capability_Flow [Intelligence_Analysts]</p> <p>Flight Path Deconfliction: Army_Contributors.USA_Capability_Flow [Flight_Path_Deconfliction_Personnel]</p>
Air Force Contributors	Module	Grouping of Air Force Specialty Codes the Air Force supplies towards Long Range Precision Fires capability	See subsequent sections
Air Force Contributors. Air Force Capability Flow	Ghosted inflow	The flow of Air Force specialty codes towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Air_Force_Targeteers"*Force_Composition."Original_[Service]_AD_Personnel_Estimated" [Air_Force]) ELSE ("%Air_Force_Targeteers"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Air_Force_Gunners/ Shooters"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Air_Force]) ELSE ("%Air_Force_Gunners/Shooters"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Air_Force_Approval_Authorities"*Force_Composition."Original_[Service]_AD_Personnel_Estimated" [Air_Force]) ELSE ("%Air_Force_Approval_Authorities" *Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts:</p>

Element Name	Type	Description	Formula
			<p>IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Air_Force_Intelligence_Personnel"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Air_Force]) ELSE ("%Air_Force_Intelligence_Personnel"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction Personnel: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Air_Force_ATC"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Air_Force]) ELSE ("%Air_Force_ATC"*Force_Composition.Inherently_Joint_Personnel)</p>
AF Capability Flow	Inflow	Model mechanism to move Air Force Capability flow to the Queue	<p>Targeteers: Air_Force_Contributors.Air_Force_Capability_Flow [Targeteers]</p> <p>Gunners: Air_Force_Contributors.Air_Force_Capability_Flow [Gunners]</p> <p>Approval Authorities: Air_Force_Contributors.Air_Force_Capability_Flow [Approval_Authorities]</p> <p>Intelligence Analysis: Air_Force_Contributors.Air_Force_Capability_Flow [Intelligence_Analysts]</p> <p>Flight Path Deconfliction Personnel: Air_Force_Contributors.Air_Force_Capability_Flow [Flight_Path_Deconfliction_Personnel]</p>
Navy Contributors	Module	Grouping of Navy Enlisted Codes the Navy supplies towards Long Range Precision Fires capability	See subsequent sections
Navy Contributors. Navy Capability Flow	Ghosted inflow	The flow of Navy Enlisted Codes towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Navy_Targeteers"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Navy]) ELSE ("%Navy_Targeteers"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners:</p>

Element Name	Type	Description	Formula
			<p>IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Gunners/Shooters”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Navy]) ELSE (“%Navy_Gunners/Shooters”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Approval_Authorities”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Navy]) ELSE (“%Navy_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Intelligence_Personnel”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Navy]) ELSE (“%Navy_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_ATC”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Navy]) ELSE (“%Navy_ATC”*Force_Composition.Inherently_Joint_Personnel)</p>
USN Capability Flow	Inflow	Model mechanism to move Navy Capability flow to the Queue	<p>Targeteers: Navy_Contributors.Navy_Capability_Flow [Targeteers]</p> <p>Gunners: Navy_Contributors.Navy_Capability_Flow [Gunners]</p> <p>Approval Authorities: Navy_Contributors.Navy_Capability_Flow [Approval_Authorities]</p> <p>Intelligence Analysts: Navy_Contributors.Navy_Capability_Flow [Intelligence_Analysts]</p> <p>Flight Path Deconfliction: Navy_Contributors.Navy_Capability_Flow [Flight_Path_Deconfliction_Personnel]</p>
Marine Corps Contributors	Module	Grouping of military occupational	See subsequent sections

Element Name	Type	Description	Formula
		specialties the Marine Corps supplies towards Long Range Precision Fires capability	
Marine Corps Contributors. USMC Capability Flow	Ghosted inflow	The flow of Marine Corps military occupational specialties towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_Targeteers”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (”%USMC_Targeteers”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (”%USMC_Gunners/Shooters”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (”%USMC_Gunners/Shooters”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (”%USMC_Approval_Authorities”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (”%USMC_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (”%USMC_Intelligence_Personnel”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (”%USMC_Intelligence_Personnel”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (”%USMC_ATC”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (”%USMC_ATC”*Force_Composition.Inherently_Joint_Personnel)</p>
USMC Capability Flow	Inflow	Model mechanism to move Marine Corps Capability	<p>Targeteers: Marine_Corps_Contributors.Marine_Corps_Capability_Flow [Targeteers]</p> <p>Gunners:</p>

Element Name	Type	Description	Formula
		flow to the Queue	<p>Marine_Corps_Contributors.Marine_Corps_Capability_Flow [Gunners]</p> <p>Approval Authorities: Marine_Corps_Contributors.Marine_Corps_Capability_Flow [Approval_Authorities]</p> <p>Intelligence Analysts: Marine_Corps_Contributors.Marine_Corps_Capability_Flow [Intelligence_Analysts]</p> <p>Flight Path Deconfliction: Marine_Corps_Contributors.Marine_Corps_Capability_Flow [Flight_Path_Deconfliction_Personnel]</p>
Queue	Stock modeling multiple inflows	Accepts inflows from Army, Air Force, Navy and Marine Corps contributors to Long Range Precision Fires	Initialized value at 0
Queue Outflow	Outflow	Annual outflow from the Queue	N/A
Original Long Range Precision Fires Capability Personnel Requirements	Stock	Initial value of Service-allocated personnel to fill the Long Range Precision Fires Capability	0
Original Long Range Precision Fires Capacity Requirements History	Outflow	Annual Service-allocated personnel to fill the Long Range Precision Fires Capability	HISTORY(Original_Long_Range_Precision_Fires_Capability_Personnel_Requirements, TIME)
Switch OFF Flow	Inflow	Flow from the Services to the Long Range Precision Fires capability when the “Switch to	IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN Queue_Outflow ELSE 0

Element Name	Type	Description	Formula
		Start Conversion to Joint Force” is OFF	
Services Long Range Precision Fires Personnel Required	Stock	Initial number of personnel the Services allocate to Long Range Precision Fires Capability	0
[Service]-Derived Long Range Precision Fires Outflow	Outflow	Annual number of personnel the Services allocate to Long Range Precision Fires capability	HISTORY(Services_Long_Range_Precision_Fires_Personnel_Required, TIME)
Force Composition. Switch to Start Conversion to Joint Force	Ghosted Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)
Switch ON Flow	Inflow	Flow from the Inherently Joint Force to the Long Range Precision Fires capability when the “Switch to Start Conversion to Joint Force” is ON	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Queue_Outflow [Targeteers] – (“[Service]_Budget”.Inherently_Joint_Force_Estimated_Savings * Queue_Outflow [Targeteers]) ELSE 0</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Queue_Outflow [Gunners] – (“[Service]_Budget”.Inherently_Joint_Force_Estimated_Savings * Queue_Outflow [Gunners]) ELSE 0</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Queue_Outflow [Approval_Authorities] – (“[Service]_Budget”.Inherently_Joint_Force_Estimated_Savings * Queue_Outflow [Approval_Authorities]) ELSE 0</p>

Element Name	Type	Description	Formula
			<p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force > 0 THEN Queue_Outflow [Intelligence_Analysts] – (“[Service]_Budget”.Inherently_Joint_Force_Estimated_Savings * Queue_Outflow [Intelligence_Analysts]) ELSE 0</p> <p>Flight Path Deconfliction Personnel: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force >0 THEN Queue_Outflow [Flight_Path_Deconfliction_Personnel] – (“[Service]_Budget”.Inherently_Joint_Force_Estimated_Savings * Queue_Outflow [Flight_Path_Deconfliction_Personnel]) ELSE 0</p>
Joint Long Range Precision Fires Personnel Required	Stock	Initial number of personnel the Inherently Joint Force allocates to the Long Range Precision Fires capability	0
Inherently Joint Long Range Precision Fires Outflow	Outflow	The annual number of personnel the Inherently Joint Force allocates to the Long Range Precision Fires capability	HISTORY(Joint_Long_Range_Precision_Fires_Personnel_Required, TIME)
[Service] Budget. Inherently Joint Force Estimated Savings	Ghosted Converter	Static percentage estimated savings when DOD is converted to Inherently Joint Force	.10

Table 24 describes elements common to all Service Contributors. Figure 32 and Table 25 describe each element within the Army Contributors module. Figure 33 and Table 26 describe each element within the Air Force Contributors module. Figure 34 and Table 27 describe each element within the Navy Contributors module. Figure 35 and Table 28 describe each element within the Marine Corps Contributors module.

Table 24. Common Elements to Service Contributors Modules

Element Name	Type	Description	Formula
Force Composition. Original [Service] AD Personnel Estimated	Ghosted Stock as input	DOD force size by Service, initialization values based on FY23 request ²⁰⁹	Army: 473000 Air Force: 323400 Navy: 346300 Marine Corps: 177000 Inherently Joint: 1 (model requirement)
Force Composition. Switch to Start Conversion to Joint Force	Ghosted Switch, ON or OFF	Inject conversion of personnel from traditional Service-based structure to Inherently Joint Force	ON (1) or OFF (0)
Force Composition. Inherently Joint Personnel	Ghosted Stock	Initialization value for Inherently Joint Personnel	0

²⁰⁹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

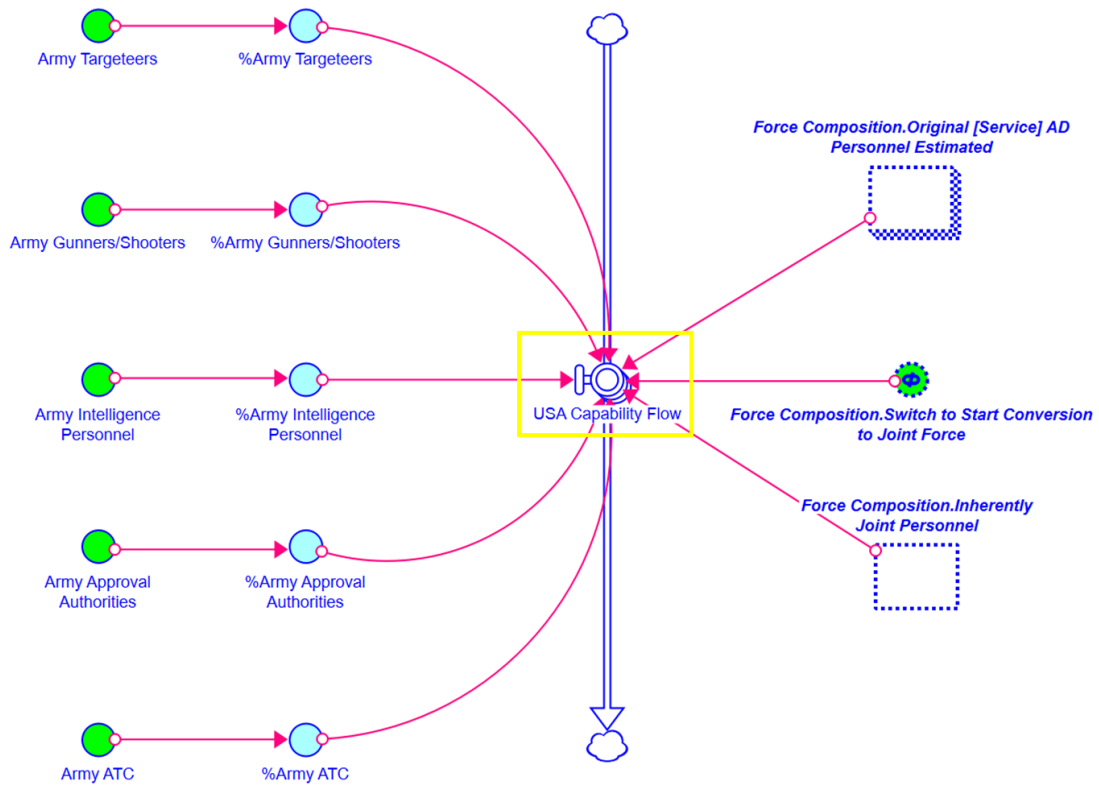


Figure 32. Army Contributors Module.²¹⁰

²¹⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 25. Description of Army Contributors Module

Element Name	Type	Description	Formula
Army Targeteers	Converter, user-defined	Number of targeteers in the Army	700 (notional)
%Army Targeteers	Converter	Percentage of total Army AD force allocated to targeteers based off FY23 force size ²¹¹	Army_Targeteers/473000
Army Gunners/ Shooters	Converter, user-defined	Number of personnel employing long range precision fires in the Army	200 (notional)
%Army Gunners/ Shooters	Converter	Percentage of total Army AD force allocated to employing Long Range Precision Fires based off FY23 force size ²¹²	“Army_Gunners/Shooters”/473000

²¹¹ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²¹² Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
Army Intelligence Personnel	Converter, user-defined	Number of intelligence personnel in the Army	23171 (notional)
%Army Intelligence Personnel	Converter	Percentage of Army AD force allocated to intelligence based off FY23 force size ²¹³	Army_Intelligence_Personnel/473000
Army Approval Authorities	Converter, user-defined	Number of personnel designated with approval authority to employ Long Range Precision Fires	15 (notional)
%Army Approval Authorities	Converter	Percentage of Army AD force designated with approval authority to employ Long Range Precision Fires based off FY23 force size ²¹⁴	Army_Approval_Authorities/473000

²¹³ Office of the Under Secretary of Defense (Comptroller), A-4.

²¹⁴ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
Army ATC	Converter, user-defined	Number of personnel performing Air Traffic Control functions	1500 (notional)
%Army ATC	Converter	Percentage of Army AD force performing Air Traffic Control functions based off FY23 force size ²¹⁵	Army_ATC/473000
USA Capability Flow	Outflow	The flow of Army military occupational specialties towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN ("%Army_Targeteers"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army]) ELSE ("%Army_Targeteers"*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Gunners/Shooters"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Gunners/Shooters"*Force_Composition.Inherently_Joint_Personnel</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Approval_Authorities"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Approval_Authorities"*Force_Composition.Inherently_Joint_Personnel</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN "%Army_Intelligence_Personnel"*Force_Composition."Original_[Service]_AD_Personnel_Estimated"[Army] ELSE "%Army_Intelligence_Personnel"*Force_Composition.Inherently_Joint_Personnel</p>

²¹⁵ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
			Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force < 1 THEN “%Army_ATC” * Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Army] ELSE “%Army_ATC” * Force_Composition.Inherently_Joint_Personnel

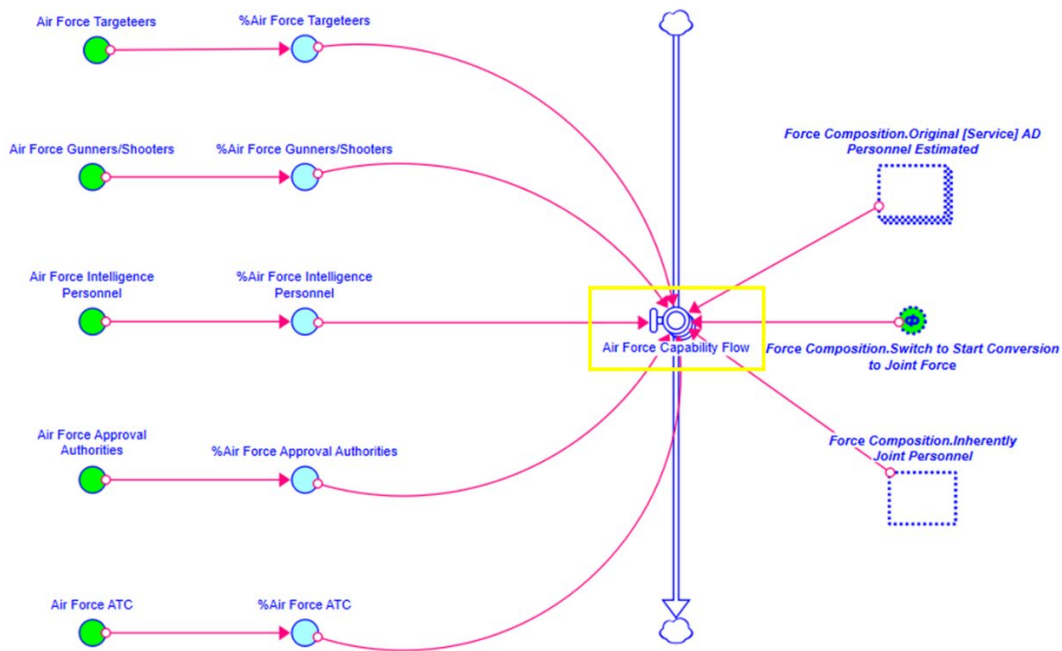


Figure 33. Air Force Contributors Module.²¹⁶

²¹⁶ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 26. Description of Air Force Contributors Module

Element Name	Type	Description	Formula
Air Force Targeteers	Converter, user-defined	Number of targeteers in the Air Force ²¹⁷	3158
%Air Force Targeteers	Converter	Percentage of total Air Force AD force allocated to targeteers based off FY23 force size ²¹⁸	Air_Force_Targeteers/323400
Air Force Gunners/ Shooters	Converter, user-defined	Number of personnel employing long range precision fires in the Air Force ²¹⁹	1758
% Air Force Gunners/ Shooters	Converter	Percentage of total Air Force AD force allocated to employing Long Range Precision Fires based off FY23 force size ²²⁰	“Air_Force_Gunners/Shooters”/323400
Air Force Intelligence Personnel	Converter, user-defined	Number of intelligence personnel in the Air Force ²²¹	3260

²¹⁷ “1N1X1 – Geospatial Intelligence (GEOINT) AFSC,” Forever Wingman, accessed November 26, 2023, https://foreverwingman.com/career_fields/1n1x1-geospatial-intelligence-geoint/.

²¹⁸ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²¹⁹ “2M0X1 – Missile and Space Systems Electronic Maintenance AFSC,” Forever Wingman, accessed November 26, 2023, https://foreverwingman.com/career_fields/2m0x1-missile-and-space-systems-electronic-maintenance/; “2M0X2 – Missile and Space Systems Maintenance AFSC,” Forever Wingman, April 2021, https://foreverwingman.com/career_fields/2m0x2-missile-and-space-systems-maintenance/; “2M0X3 – Missile and Space Facilities AFSC,” Forever Wingman, April 2021, https://foreverwingman.com/career_fields/2m0x3-missile-and-space-facilities/.

²²⁰ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²²¹ “1N0X1 – Operations Intelligence AFSC,” Forever Wingman, July 2021, https://foreverwingman.com/career_fields/1n0x1-operations-intelligence/.

Element Name	Type	Description	Formula
% Air Force Intelligence Personnel	Converter	Percentage of Air Force AD force allocated to intelligence based off FY23 force size ²²²	Air_Force_Intelligence_Personnel/323400
Air Force Approval Authorities	Converter, user-defined	Number of personnel designated with approval authority to employ Long Range Precision Fires	10 (notional)
%Air Force Approval Authorities	Converter	Percentage of Air Force AD force designated with approval authority to employ Long Range Precision Fires based off FY23 force size ²²³	Air_Force_Approval_Authorities/323400
Air Force ATC	Converter, user-defined	Number of personnel performing Air Traffic Control functions ²²⁴	3362
%Air Force ATC	Converter	Percentage of Air Force AD force performing Air Traffic Control functions based off FY23 force size ²²⁵	Air_Force_ATC/323400
Air Force Capability Flow	Outflow	The flow of Air Force specialty codes towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Air_Force_Targeteers”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Air_Force]) ELSE (“%Air_Force_Targeteers” *Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Air_Force_Gunners/ Shooters”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Air_Force]) ELSE “%Air_Force_Gunners/</p>

²²² Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²²³ Office of the Under Secretary of Defense (Comptroller), A-4.

²²⁴ “1C1X1 – Air Traffic Control AFSC,” Forever Wingman, July 2021, https://foreverwingman.com/career_fields/1c1x1-air-traffic-control/.

²²⁵ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

Element Name	Type	Description	Formula
			<p>Shooters” *Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Air_Force_Approval_Authorities”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Air_Force]) ELSE (“%Air_Force_Approval_Authorities” *Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Air_Force_Intelligence_Personnel”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Air_Force]) ELSE “%Air_Force_Intelligence_Personnel” *Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction Personnel: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Air_Force_ATC”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Air_Force]) ELSE (“%Air_Force_ATC” *Force_Composition.Inherently_Joint_Personnel)</p>

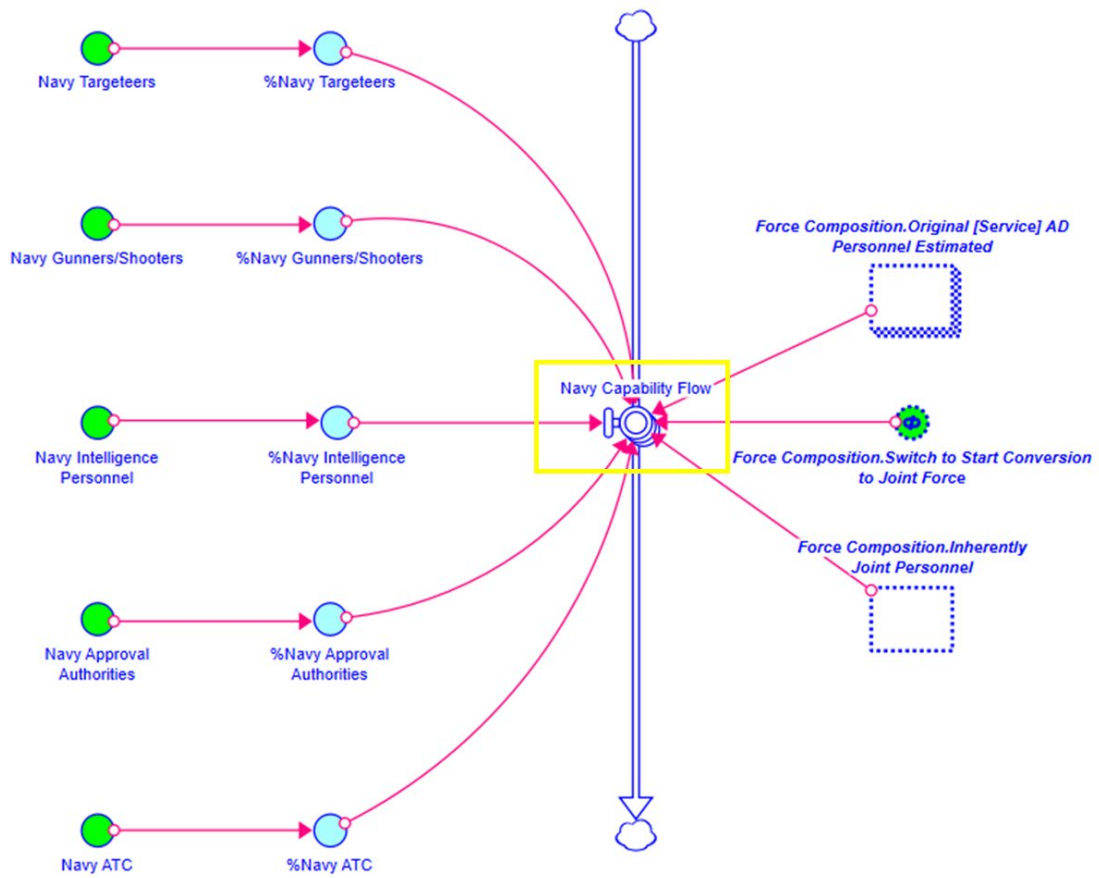


Figure 34. Navy Contributors Module.²²⁶

²²⁶ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 27. Description Navy Contributors Module

Element Name	Type	Description	Formula
Navy Targeteers	Converter, user-defined	Number of targeteers in the Navy	500 (notional)
%Navy Targeteers	Converter	Percentage of total Navy AD force allocated to targeteers based off FY23 force size ²²⁷	Navy_Targeteers/346300
Navy Gunners/ Shooters	Converter, user-defined	Number of personnel employing long range precision fires in the Navy	100 (notional)
% Navy Gunners/ Shooters	Converter	Percentage of total Navy AD force allocated to employing Long Range Precision Fires based off FY23 force size ²²⁸	“Navy_Gunners/Shooters”/346300

²²⁷ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

²²⁸ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
Navy Intelligence Personnel	Converter, user-defined	Number of intelligence personnel in the Navy	21100 (notional)
% Navy Intelligence Personnel	Converter	Percentage of Navy AD force allocated to intelligence based off FY23 force size ²²⁹	Navy_Intelligence_Personnel/346300
Navy Approval Authorities	Converter, user-defined	Number of personnel designated with approval authority to employ Long Range Precision Fires	12 (notional)
%Navy Approval Authorities	Converter	Percentage of Navy AD force designated with approval authority to employ Long Range Precision Fires based off FY23 force size ²³⁰	Navy_Approval_Authorities/346300

²²⁹ Office of the Under Secretary of Defense (Comptroller), A-4.

²³⁰ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
Navy ATC	Converter, user-defined	Number of personnel performing Air Traffic Control functions	2000 (notional)
%Navy ATC	Converter	Percentage of Navy AD force performing Air Traffic Control functions based off FY23 force size ²³¹	Navy_ATC/346300
Navy Capability Flow	Outflow	The flow of Navy enlisted codes towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Targeteers”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Navy]) ELSE (“%Navy_Targeteers”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Gunners/Shooters”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Navy]) ELSE (“%Navy_Gunners/Shooters”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Approval_Authorities”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Navy]) ELSE (“%Navy_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts:</p>

²³¹ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
			<p>IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_Intelligence_Personnel”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Navy]) ELSE (“%Navy_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%Navy_ATC”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Navy]) ELSE (“%Navy_ATC”*Force_Composition.Inherently_Joint_Personnel)</p>

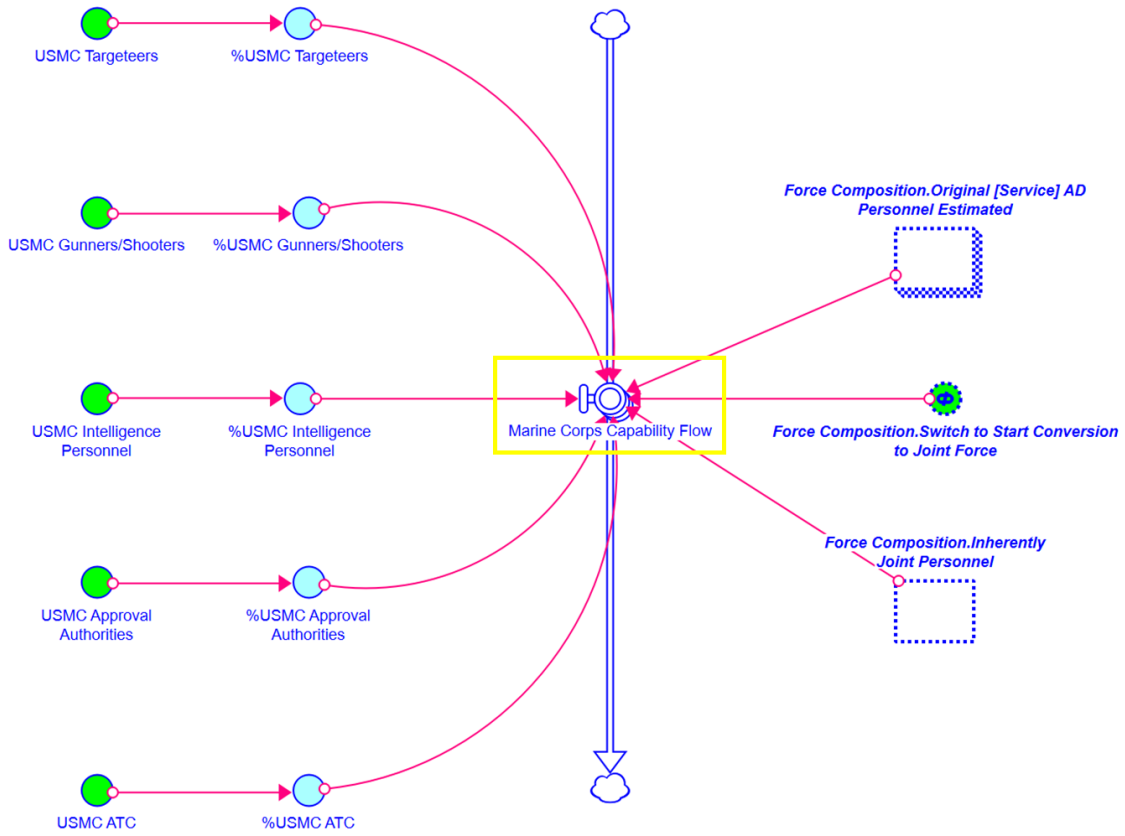


Figure 35. Marine Corps Contributors Module.²³²

²³² Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”

Table 28. Description of Marine Corps Contributors Module

Element Name	Type	Description	Formula
Marine Corps Targeteers	Converter, user-defined	Number of targeteers in the Marine Corps	167 (notional)
%Marine Corps Targeteers	Converter	Percentage of total Marine Corps AD force allocated to targeteers based off FY23 force size ²³³	USMC_Targeteers/177000
Marine Corps Gunners/ Shooters	Converter, user-defined	Number of personnel employing long range precision fires in the Marine Corps	20 (notional)
%Marine Corps Gunners/ Shooters	Converter	Percentage of total Marine Corps AD force allocated to employing Long Range Precision Fires based	“USMC_Gunners/Shooters”/177000

²³³ Office of the Under Secretary of Defense (Comptroller), *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*, A-4.

Element Name	Type	Description	Formula
		off FY23 force size ²³⁴	
Marine Corps Intelligence Personnel	Converter, user-defined	Number of intelligence personnel in the Marine Corps	5511 (notional)
% Marine Corps Intelligence Personnel	Converter	Percentage of Army AD force allocated to intelligence based off FY23 force size ²³⁵	USMC_Intelligence_Personnel/177000
Marine Corps Approval Authorities	Converter, user-defined	Number of personnel designated with approval authority to employ Long Range Precision Fires	4 (notional)
%Marine Corps Approval Authorities	Converter	Percentage of Marine Corps AD force designated with approval authority to employ Long Range Precision	USMC_Approval_Authorities/177000

²³⁴ Office of the Under Secretary of Defense (Comptroller), A-4.

²³⁵ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
		Fires based off FY23 force size ²³⁶	
Marine Corps ATC	Converter, user-defined	Number of personnel performing Air Traffic Control functions	801 (notional)
%Marine Corps ATC	Converter	Percentage of Marine Corps AD force performing Air Traffic Control functions based off FY23 force size ²³⁷	USMC_ATC/177000
Marine Corps Capability Flow	Outflow	The flow of Marine Corps military occupational specialties towards Long Range Precision Fires capability	<p>Targeteers: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_Targeteers”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (“%USMC_Targeteers”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Gunners: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_Gunners/Shooters”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated”[Marine_Corps]) ELSE (“%USMC_Gunners/Shooters”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Approval Authorities:</p>

²³⁶ Office of the Under Secretary of Defense (Comptroller), A-4.

²³⁷ Office of the Under Secretary of Defense (Comptroller), A-4.

Element Name	Type	Description	Formula
			<p>IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_Approval_Authorities”*Force_Composition.”Original_[Service]_AD_Personnel_Estim ated”[Marine_Corps]) ELSE (“%USMC_Approval_Authorities”*Force_Composition.Inherently_Joint_Personnel)</p> <p>Intelligence Analysts: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_Intelligence_Personnel”*Force_Composition.”Original_[Service]_AD_Personnel_ Estimated”[Marine_Corps]) ELSE (“%USMC_Intelligence_Personnel” *Force_Composition.Inherently_Joint_Personnel)</p> <p>Flight Path Deconfliction: IF Force_Composition.Switch_to_Start_Conversion_to_Joint_Force <1 THEN (“%USMC_ATC”*Force_Composition.”Original_[Service]_AD_Personnel_Estimated” [Marine_Corps]) ELSE (“%USMC_ATC”*Force_Composition.Inherently_Joint_Personnel)</p>

F. MODEL STRUCTURE: USER INTERFACE

The “Functionally Aligned Service-Agnostic U.S. Military” model is set to simulate a time horizon of 70 years, which depicts two periods of armed conflict and their cumulative effects on manpower and budget requirements. This model also includes several user-defined variables manipulated via SWITCH activation or rheostat selection on the User Interface. The available user-selectable variables are broken into three groupings: 1) Funding Variables, 2) Manpower Variables, and 3) Functional Variables.

1. Funding Variables

Funding Variables, located on User Interface Page 1, include 1) an ON/OFF SWITCH to determine whether a higher percent GDP is allocated to support combat operations; and 2) a rheostat to specify what percentage of GDP is allocated to fund combat operations. When the SWITCH “Activate Combat Funding” is in the OFF position, the percent GDP allocated to the Defense Budget is randomized within a historical range of -3.5% (periods of economic decline) to 7.0% (periods of economic boom). When the SWITCH is set to ON, the model illustrates the effects of increased percent GDP allocation to the Defense Budget in the event of major armed conflict starting in five years and enduring for a period of 10 years. This armed conflict cycle recurs 30 years later to model cumulative effects of multiple wars over time, matching the historical trend the U.S. enters a significant armed conflict on a 40-year cycle. The selectable rheostat titled “Percent GDP allocated to Combat Funding” allows the user to manually change the percent GDP allocation to the Defense Budget during the periods armed conflict. While historical average shows the United States typically allocates 3.1% GDP to the DOD (FY23 was 5.5% GDP), World War I combat funding increased to 20% GDP and World War II funding increased to 41% GDP; this variable is initialized at 20% GDP.²³⁸ Figure 36 depicts these options.

²³⁸ U.S. Government Spending, “US Government Defense Spending History with Charts.”

2. Manpower Variables

Manpower Variables, located on User Interface Page 1, include 1) an ON/OFF SWITCH titled “Switch to ON to Start Conversion from Services to Joint Force” specifying whether the model is run “as the system exists” with a Service-centric force structure (SWITCH OFF), or if the U.S. military is modeled “as the system could be” converted to an Inherently Joint Force (SWITCH ON); a selectable conversion rate to transfer Service personnel into their Inherently Joint billets (similar to United States Air Force members transferring to the United States Space Force, and initialized at 10% per year); and an “Average Annual Cost per Service Member” rheostat enabling personnel cost forecasting based on increasing personnel cost trends. In the “Service Budget” module, this variable only functions when the SWITCH to “Start Conversion from Services to Joint Force” is ON. In the “Functional Capacity and Expenditures” module this variable is accounted for regardless of SWITCH to “Start Conversion from Services to Joint Force” position. Due to global pandemic ramifications to worldwide and domestic economies, personnel costs are higher than average and are initialized at \$140,000 per service member annually.²³⁹ Figure 36 depicts these options.

3. Functional Variables

Functional Variables, located on User Interface Page 2, are selectable rheostat manipulation of the percentage of personnel the Services provide to the Joint Combatant Command capacity requirement for each of the modeled 13 Tier 1 “Functional Capacity and Expenditures” modules. This value is initialized at 1% from all Services to each of the 13 Joint Functions until refined data is obtained. Figure 37 depicts these options.

²³⁹ Harper, “Pentagon Personnel Costs at Historic High.”



KEY PARAMETER VALUES USED IN THE MODEL

Funding Variables

Activate Combat Funding
(Increase Percent GDP Allocated
to DoD for Combat Operations)



Percent GDP allocated to
Combat Funding

Run
Simulation

Manpower Variables

Switch to ON to Start
Conversion from Services to
Joint Force



Conversion Rate to Inherently
Joint Force (Annual)



Average Annual Cost per
Service Member (FY23 USD)

← BACK

Figure 36. User Interface Page 1 with Available User-Defined Variables.²⁴⁰

²⁴⁰ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”



KEY PARAMETER VALUES USED IN THE MODEL

Functional Variables

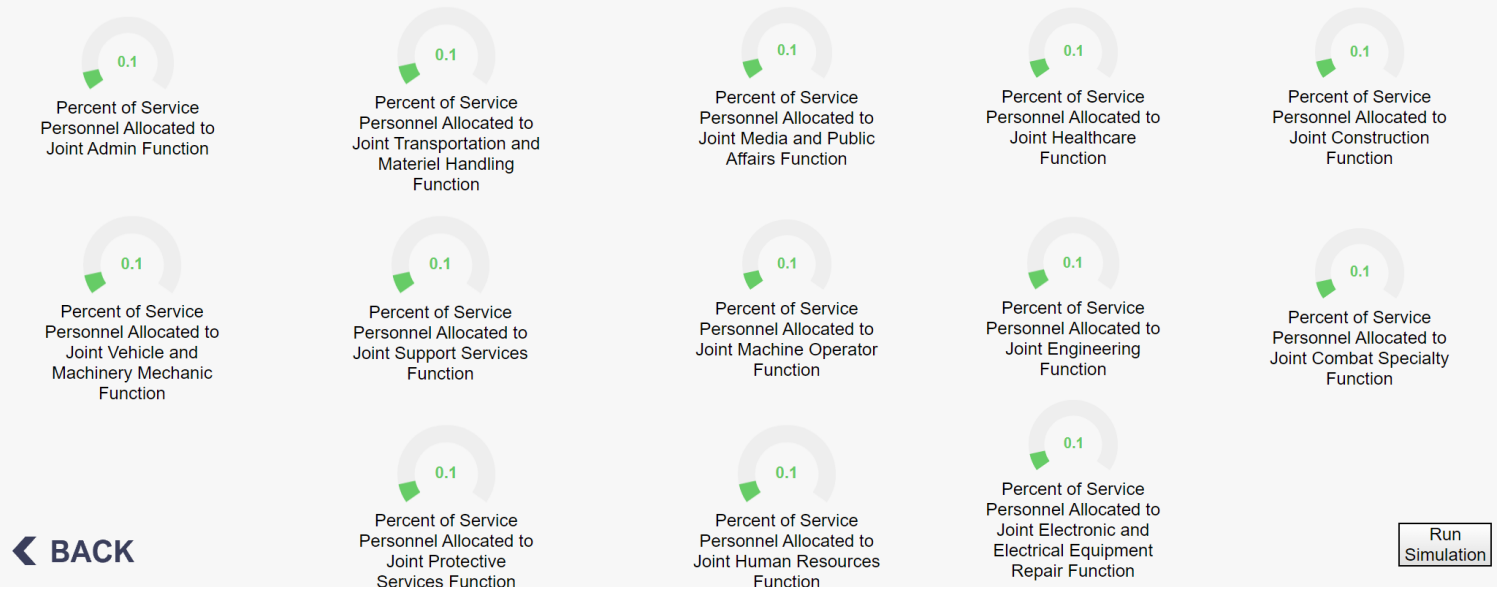


Figure 37. User Interface Page 2 with Available User-Defined Variables.²⁴¹

²⁴¹ Source: Skogsberg-Karnowski.

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V. VARIABLE MANIPULATION AND ANALYSIS

For purposes of analysis, three major conditions were simulated. Condition 1 is the DOD “as it currently exists” using a Service-centric force structure with no periods of armed conflict throughout the 70-year duration of the model. Condition 2 is the DOD “as it currently exists” using a Service-centric force structure while inducing two periods of significant armed conflict on the 40-year life cycle. Condition 3 simulates the DOD “as it could be” using an Inherently Joint force structure combined with inducing two periods of significant armed conflict on the 40-year life cycle. Condition 1 can be considered the “peacetime baseline” control, whereas Condition 2 and 3’s differing force structures during periods of wartime are illustrative of the effects of projected economic factors and force structure on the DOD budget.

A. CONDITION 1: SERVICE-CENTRIC PEACETIME OPERATIONS

Condition 1 set the User Interface variables to not include Combat Funding or a transition to an Inherently Joint Force, an average personnel cost of \$140,000 per year, and retained the default settings at 10% allocation of each Service’s Functional personnel towards the Joint Function (for example, 10% of the Army’s Administrative personnel are presented to the Joint Administrative Function as dictated by notional Combatant Command’s capacity requirements).²⁴² Figure 38 and Figure 39 depict these settings on the User Interface.

²⁴² Harper, “Pentagon Personnel Costs at Historic High.”

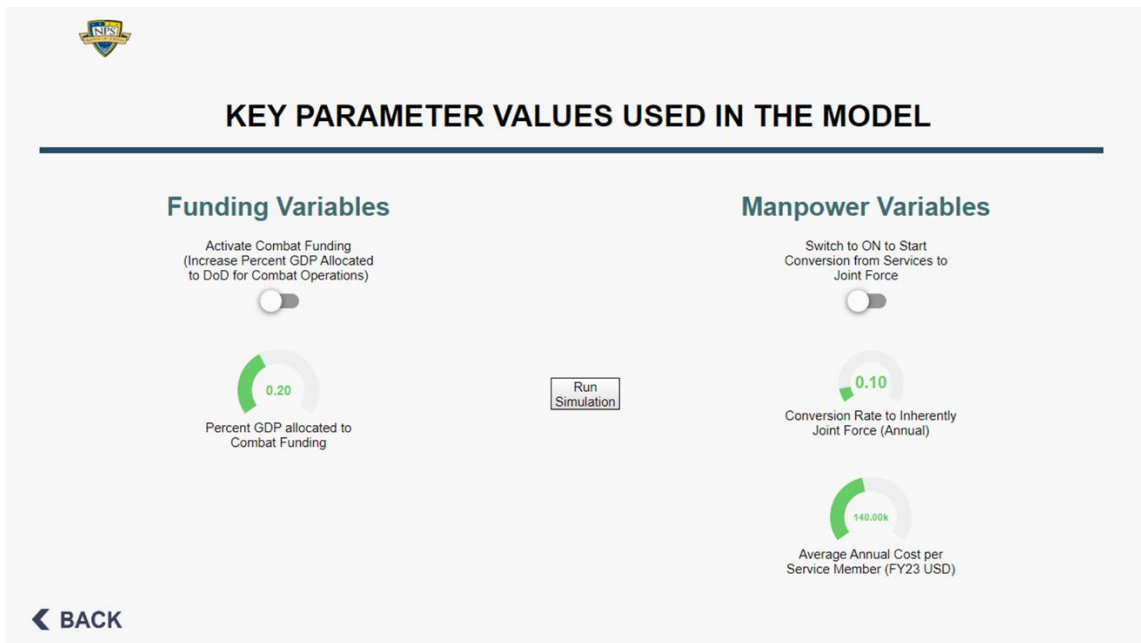


Figure 38. Condition 1 User Interface Page 1.²⁴³

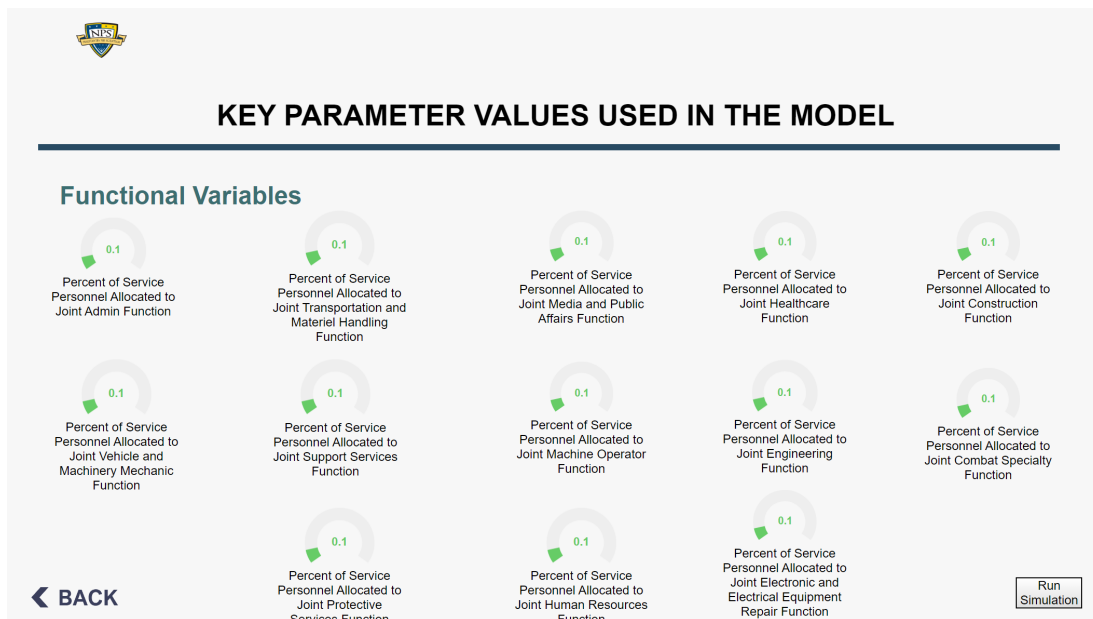


Figure 39. Condition 1 User Interface Page 2.²⁴⁴

²⁴³ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final”

²⁴⁴ Source: Skogsberg-Karnowski.

1. Budgets

As a baseline, Condition 1 simulation data illustrates a few points to carry forward into the other two simulations. The first is that while the GDP growth rate can, and will, fluctuate year-to-year, the overall trend is percent GDP growth over an extended timeline. By logical extension, this also produces a generally-increasing trend in overall DOD Budget (Figure 40), and subsequent increasing trend in Service Budgets and their associated individual Appropriations Budgets (Figure 41 through Figure 45).

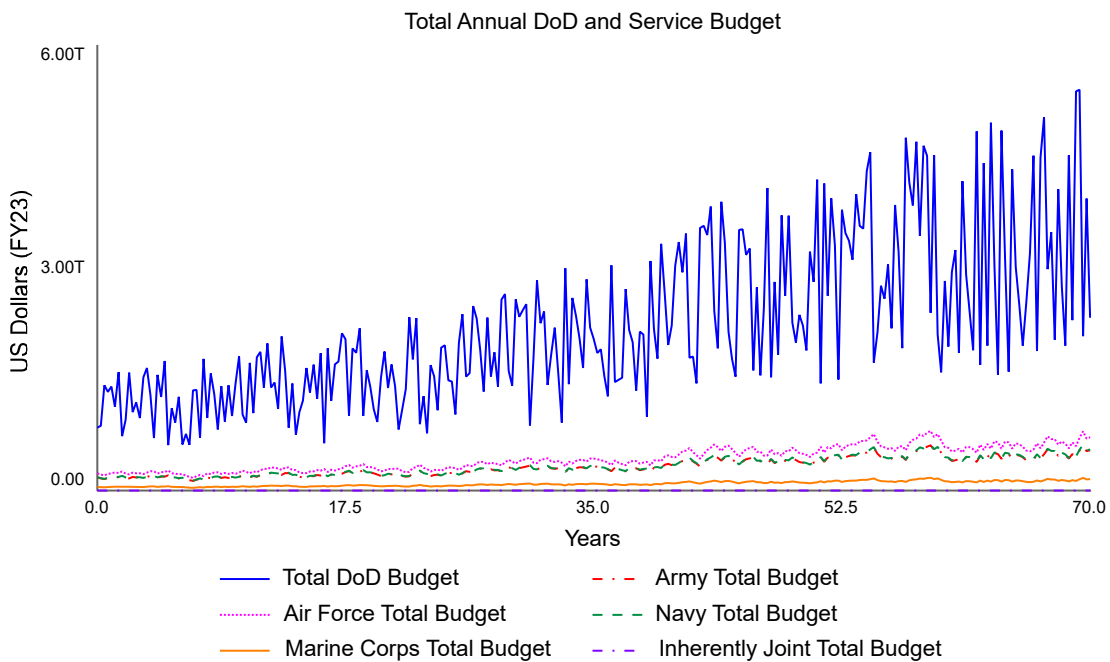


Figure 40. Condition 1 Annual Total DOD and Service Budgets.²⁴⁵

²⁴⁵ Source: Skogsberg-Karnowski.

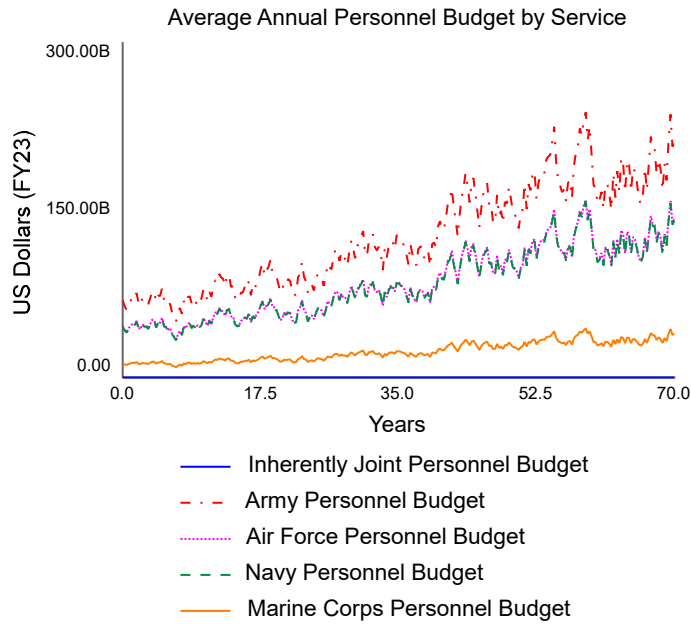


Figure 41. Condition 1 Annual Personnel Budget by Service.²⁴⁶

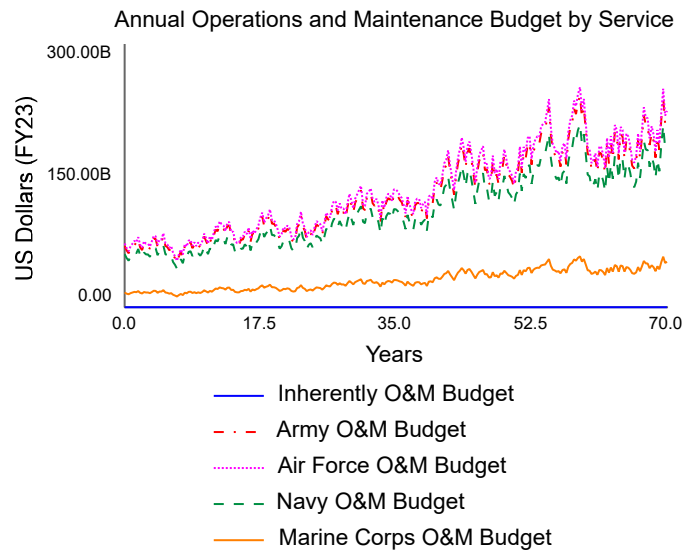


Figure 42. Condition 1 Annual Operations and Maintenance Budget by Service.²⁴⁷

²⁴⁶ Source: Skogsberg-Karnowski.

²⁴⁷ Source: Skogsberg-Karnowski.

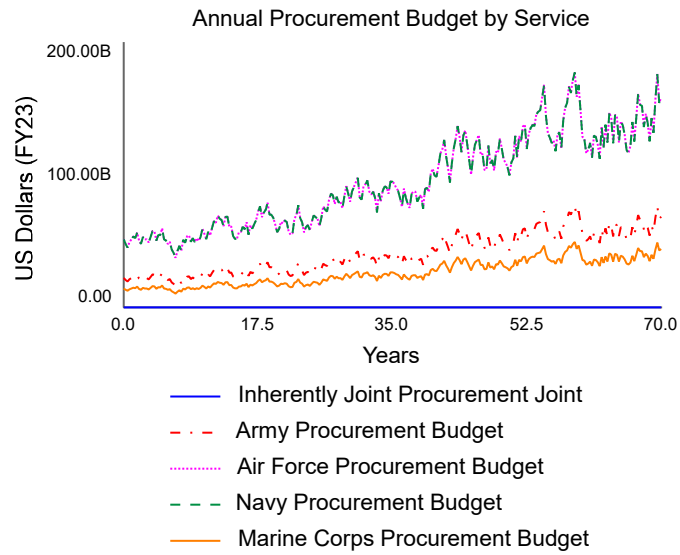


Figure 43. Condition 1 Annual Procurement Budget by Service.²⁴⁸

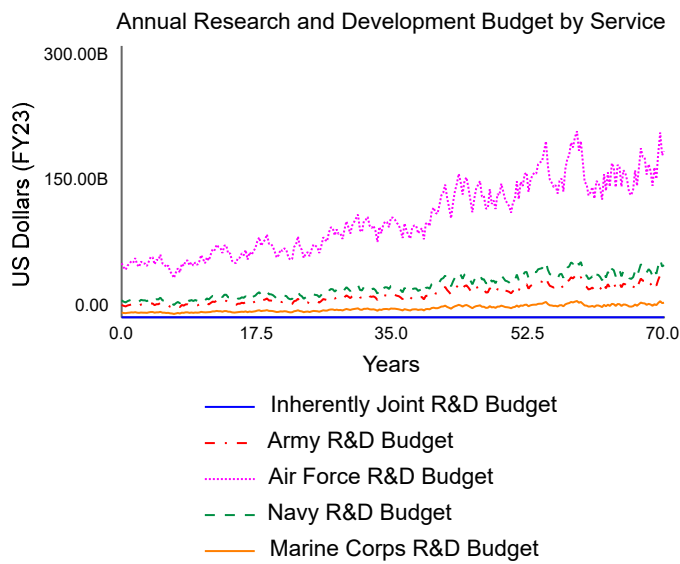


Figure 44. Condition 1 Annual Research and Development Budget by Service.²⁴⁹

²⁴⁸ Source: Skogsberg-Karnowski.

²⁴⁹ Source: Skogsberg-Karnowski.

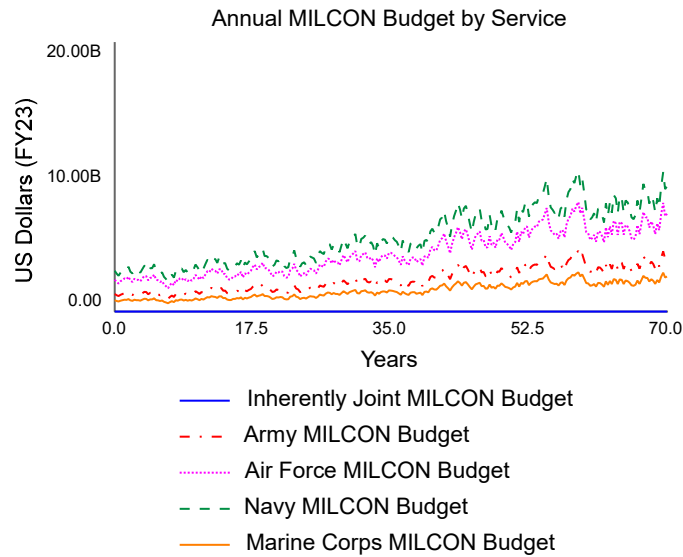


Figure 45. Condition 1 Annual Military Construction Budget by Service.²⁵⁰

2. Force Composition

The second point to consider is the link between DOD Budget and active duty force size. As a general trendline, as annual percent GDP increases so does the DOD Total Budget, which in turn increases active duty force size. Therefore, as GDP is expected to continually increase over a long time horizon, the active duty force size will also increase over time. The active duty force size over a 70-year period is shown in Figure 46.

²⁵⁰ Source: Skogsberg-Karnowski.

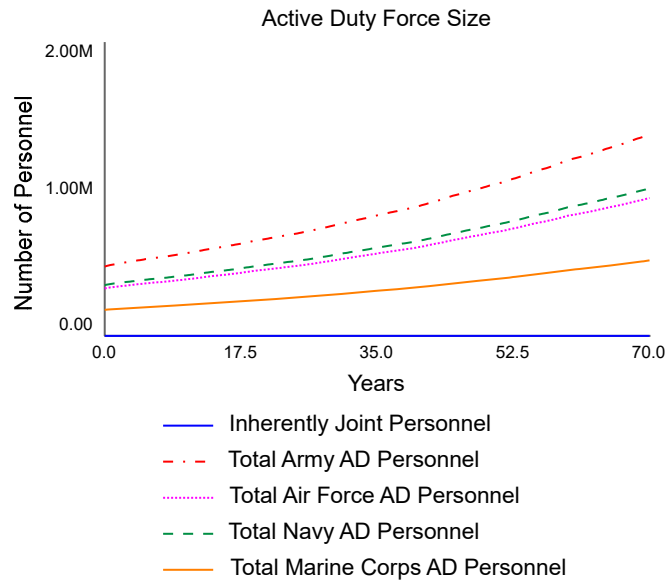


Figure 46. Condition 1 Annual Active Duty Force Size.²⁵¹

3. Tier 1 Function Capacity and Expenditures

The third conclusion is as each Service’s active duty force size increases, so too does the expense of executing each of the 13 Functions (Administrative, Vehicle and Machinery Mechanic, Transportation and Material Handling, Support Services, Protective Services, Media and Public Affairs, Machine Operator and Production, Human Resources, Healthcare, Engineering Science and Technical Capacity, Electronic and Electrical Equipment Repair, Construction, and Combat Specialty). The cost of executing each Function is dependent on the number of personnel each Service dedicates to the Function, and on the average annual expense of each person. Therefore, the annual expenditure on the Function is tied to how many people are required to execute the Function. Furthermore, as the Joint Force executing under Geographic Combatant Commands only requires a limited percentage of the total Service-based capacity, the Joint expenditure on the Function is significantly smaller. As the U.S. military presents its combat forces in a Joint construct via the Combatant Commands, there may be unrealized savings by maintaining redundant Service capabilities outside what the Combatant Commands are employing.

²⁵¹ Source: Skogsberg-Karnowski.

Figure 47 through Figure 59 depict each Function's annual required personnel capacity and its required annual expenditure over a 70-year period.

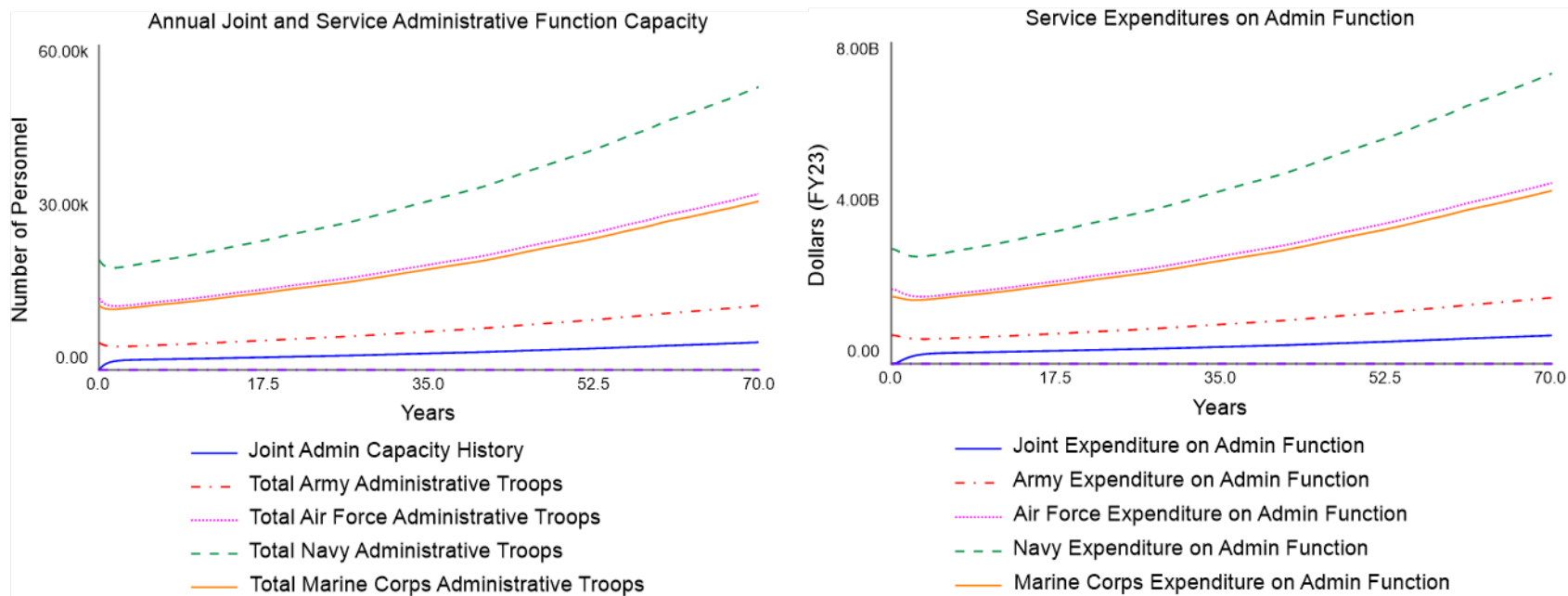


Figure 47. Condition 1 Annual Administrative Function Capacity and Expenditure.²⁵²

²⁵² Source: Skogsberg-Karnowski.

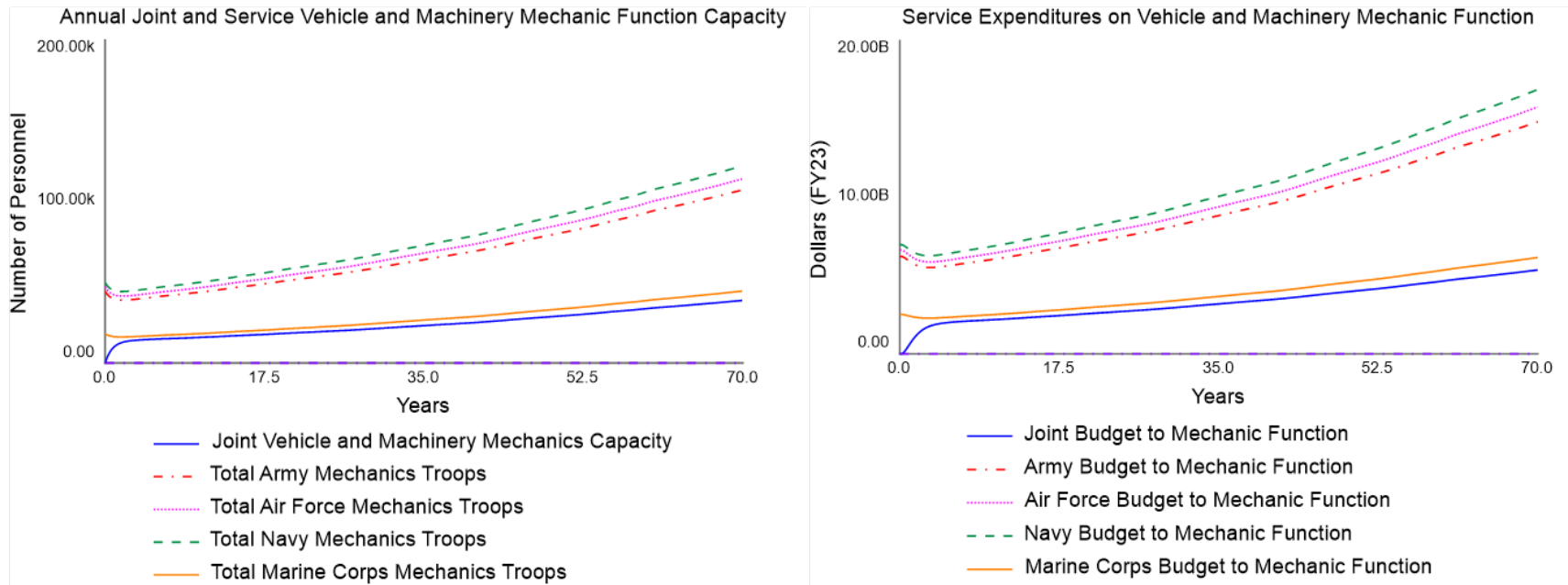


Figure 48. Condition 1 Annual Vehicle and Machinery Mechanic Function Capacity and Expenditure.²⁵³

²⁵³ Source: Skogsberg-Karnowski.

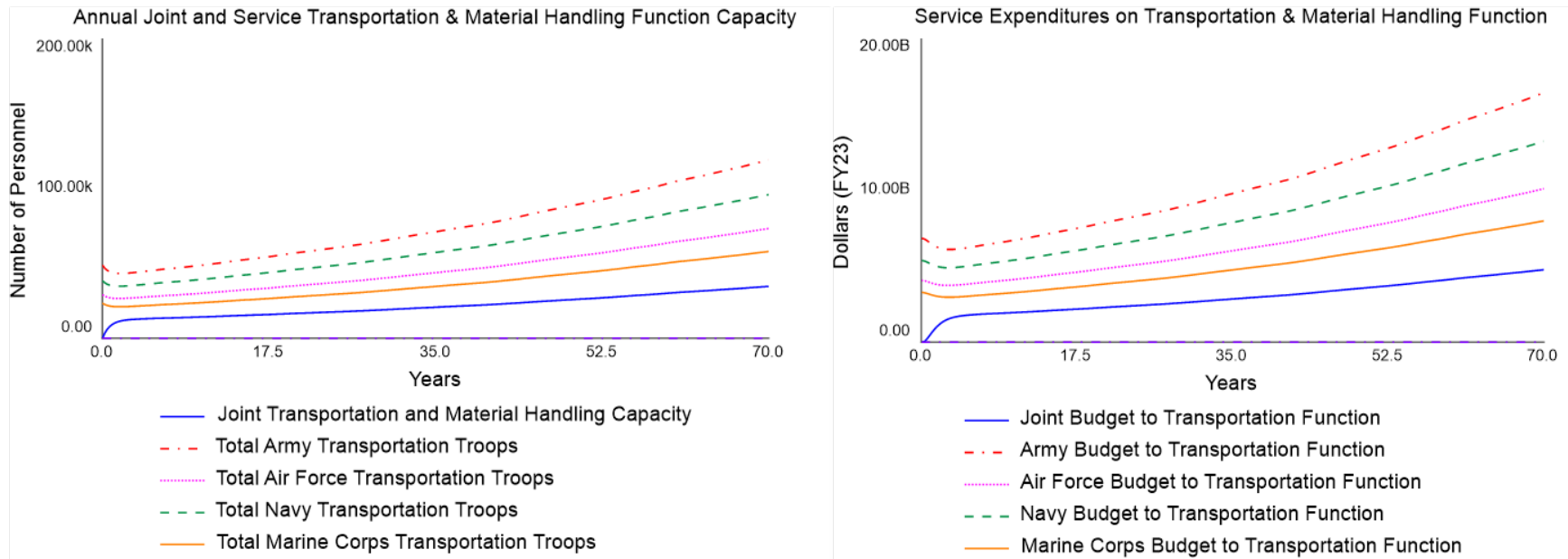


Figure 49. Condition 1 Annual Transportation and Material Function Capacity and Expenditure.²⁵⁴

²⁵⁴ Source: Skogsberg-Karnowski.

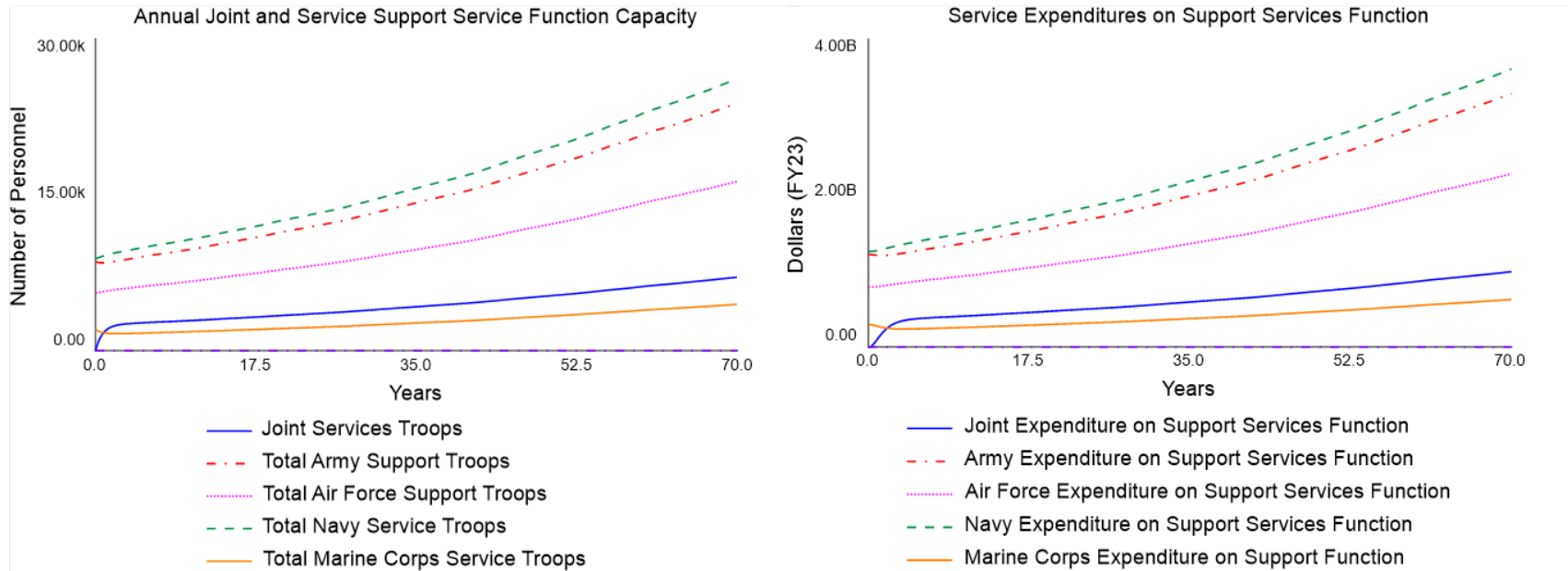


Figure 50. Condition 1 Annual Support Service Function Capacity and Expenditure.²⁵⁵

²⁵⁵ Source: Skogsberg-Karnowski.

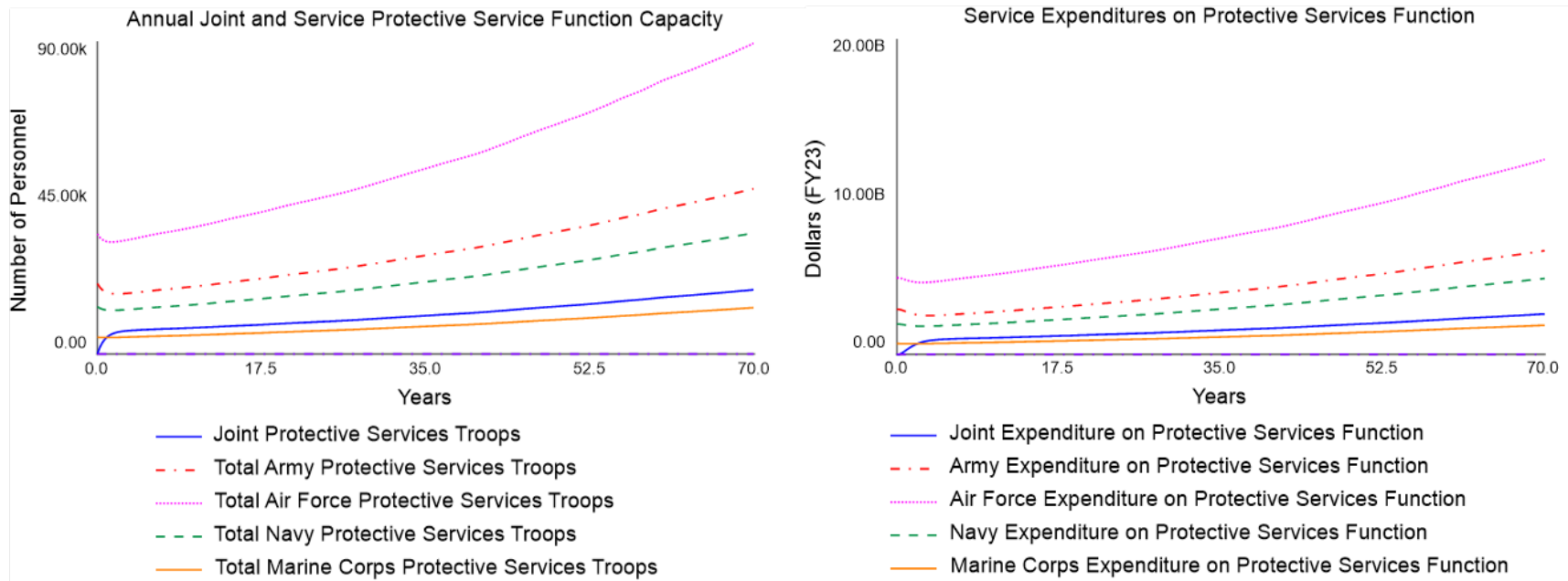


Figure 51. Condition 1 Annual Protective Service Function Capacity and Expenditure.²⁵⁶

²⁵⁶ Source: Skogsberg-Karnowski.

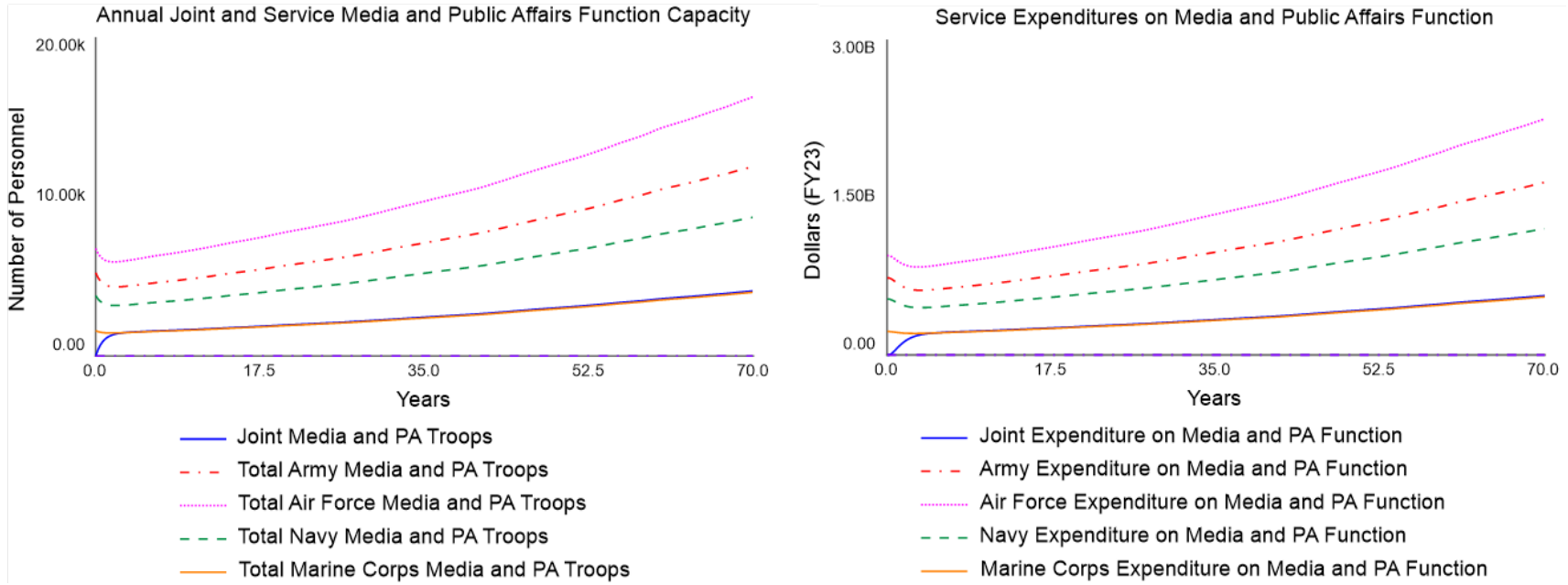


Figure 52. Condition 1 Annual Media and Public Affairs Function Capacity and Expenditure.²⁵⁷

²⁵⁷ Source: Skogsberg-Karnowski.

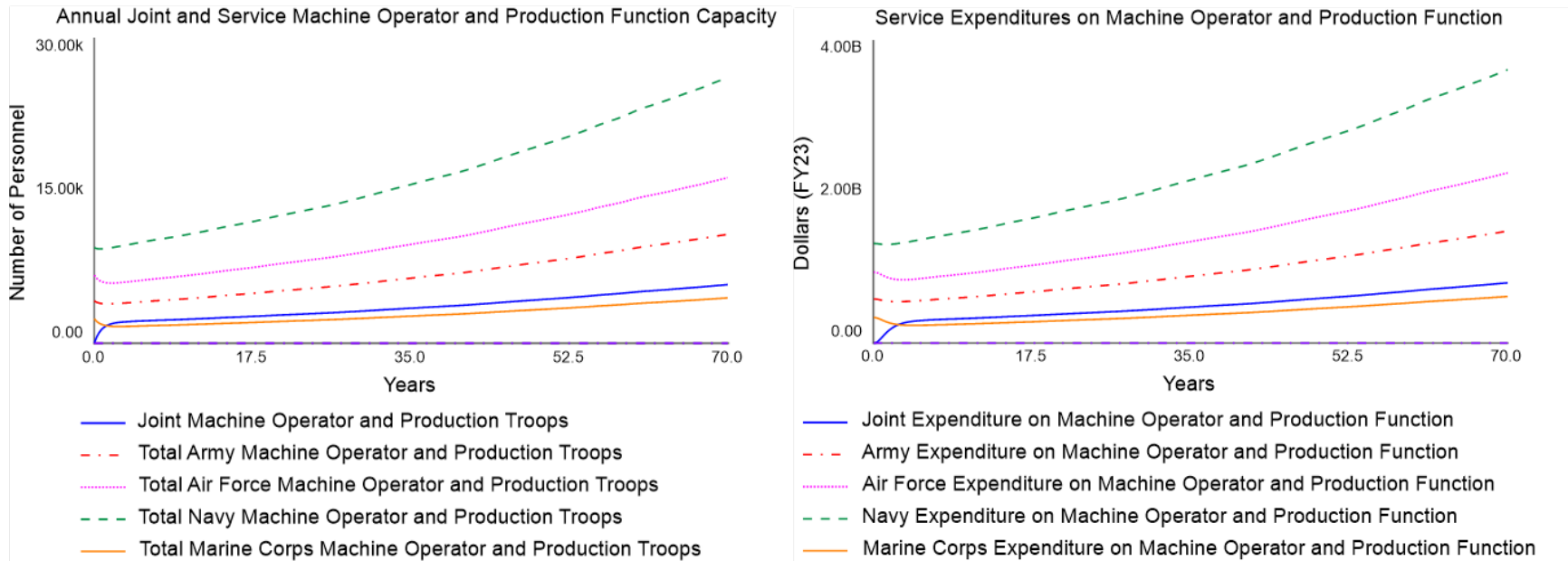


Figure 53. Condition 1 Annual Machine Operator and Production Function Capacity and Expenditure.²⁵⁸

²⁵⁸ Source: Skogsberg-Karnowski.

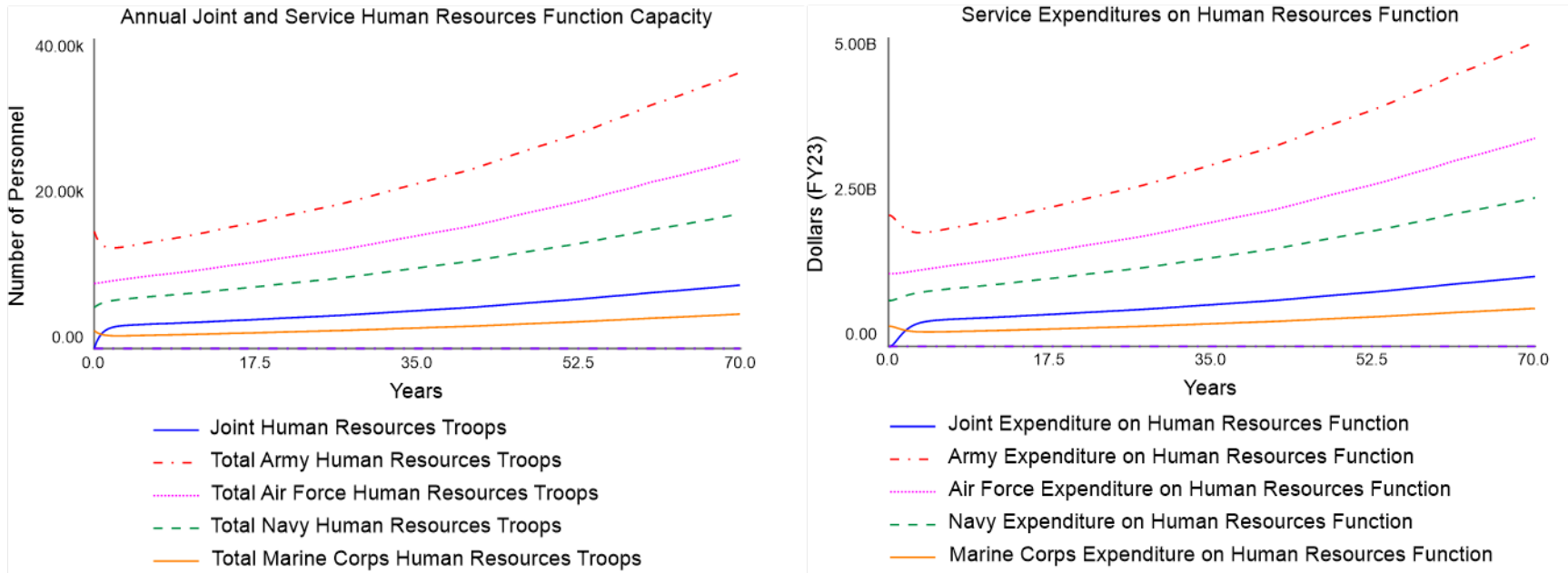


Figure 54. Condition 1 Annual Human Resources Function Capacity and Expenditure.²⁵⁹

²⁵⁹ Source: Skogsberg-Karnowski.

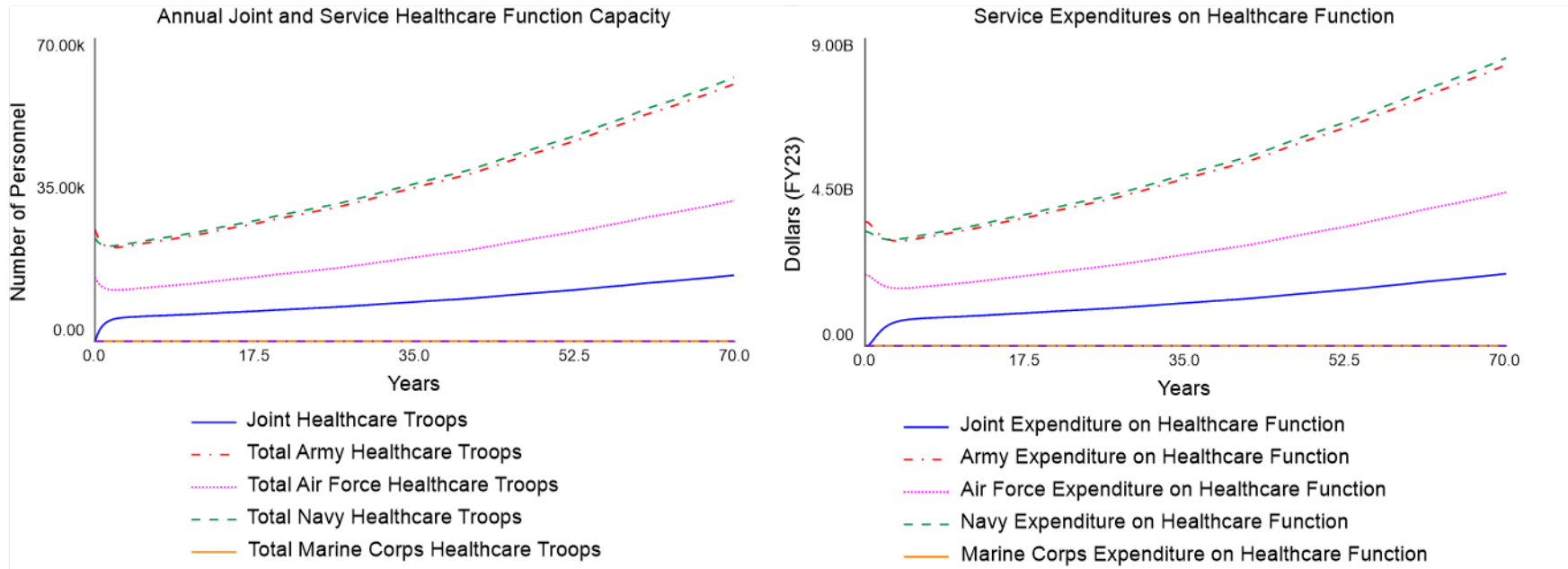


Figure 55. Condition 1 Annual Healthcare Function Capacity and Expenditure.²⁶⁰

²⁶⁰ Source: Skogsberg-Karnowski.

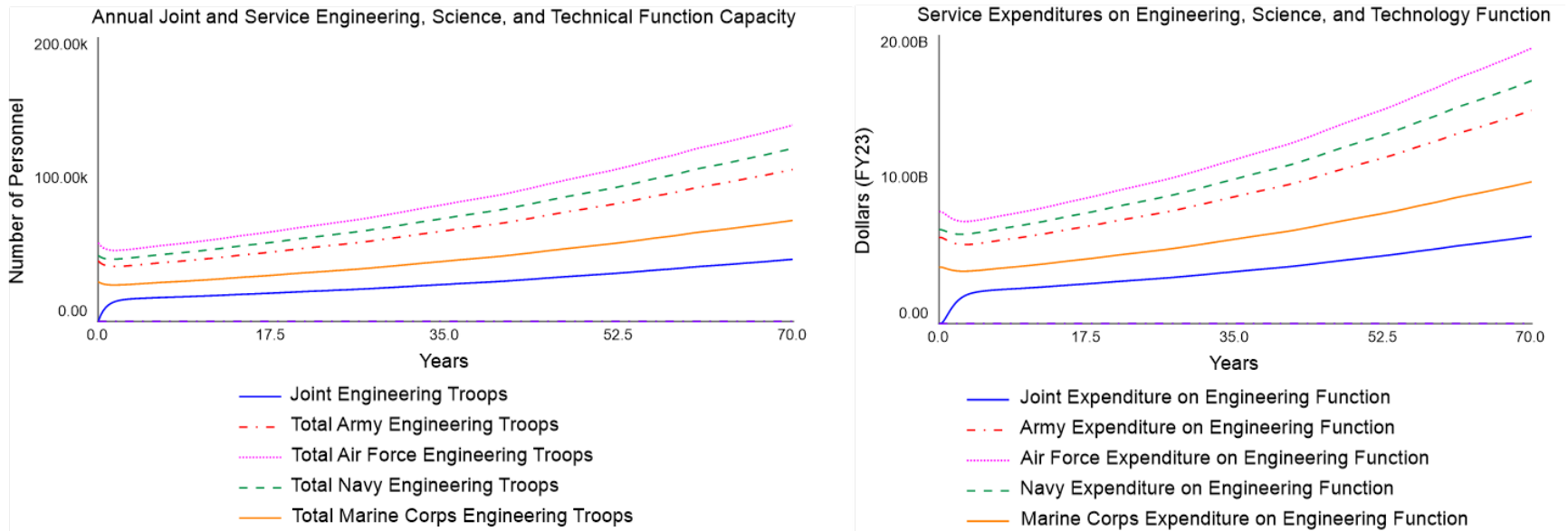


Figure 56. Condition 1 Annual Engineering, Science, and Technical Function Capacity and Expenditure.²⁶¹

²⁶¹ Source: Skogsberg-Karnowski.

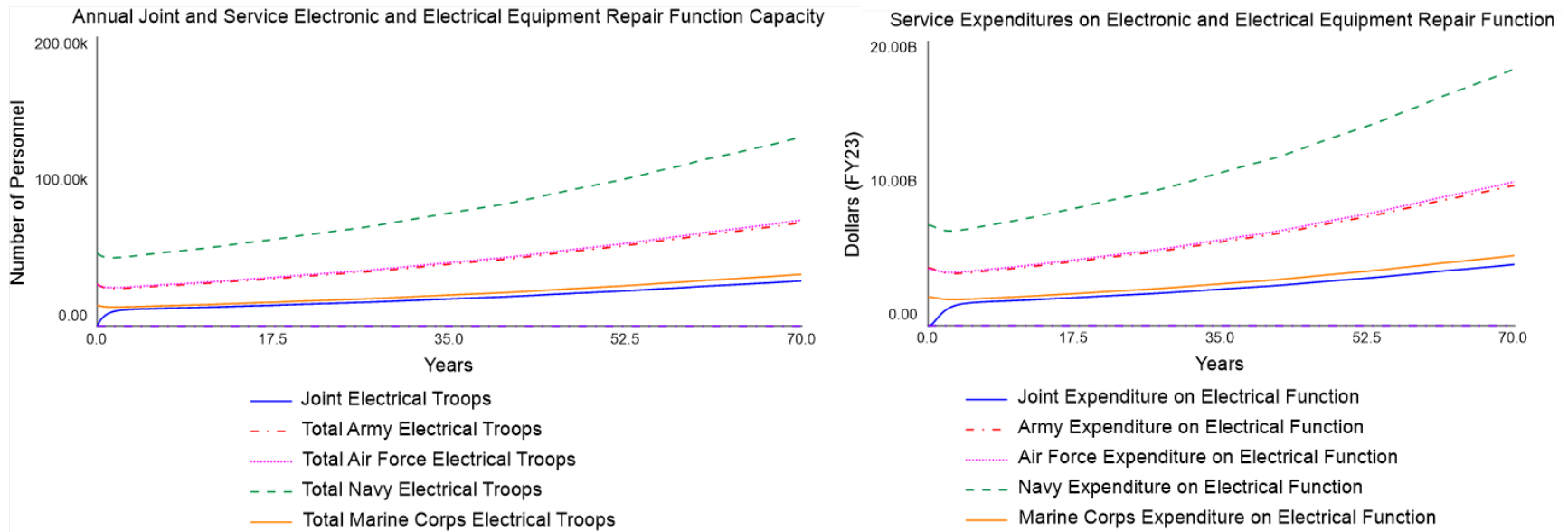


Figure 57. Condition 1 Annual Electronic and Electrical Equipment Repair Function Capacity and Expenditure.²⁶²

²⁶² Source: Skogsberg-Karnowski.

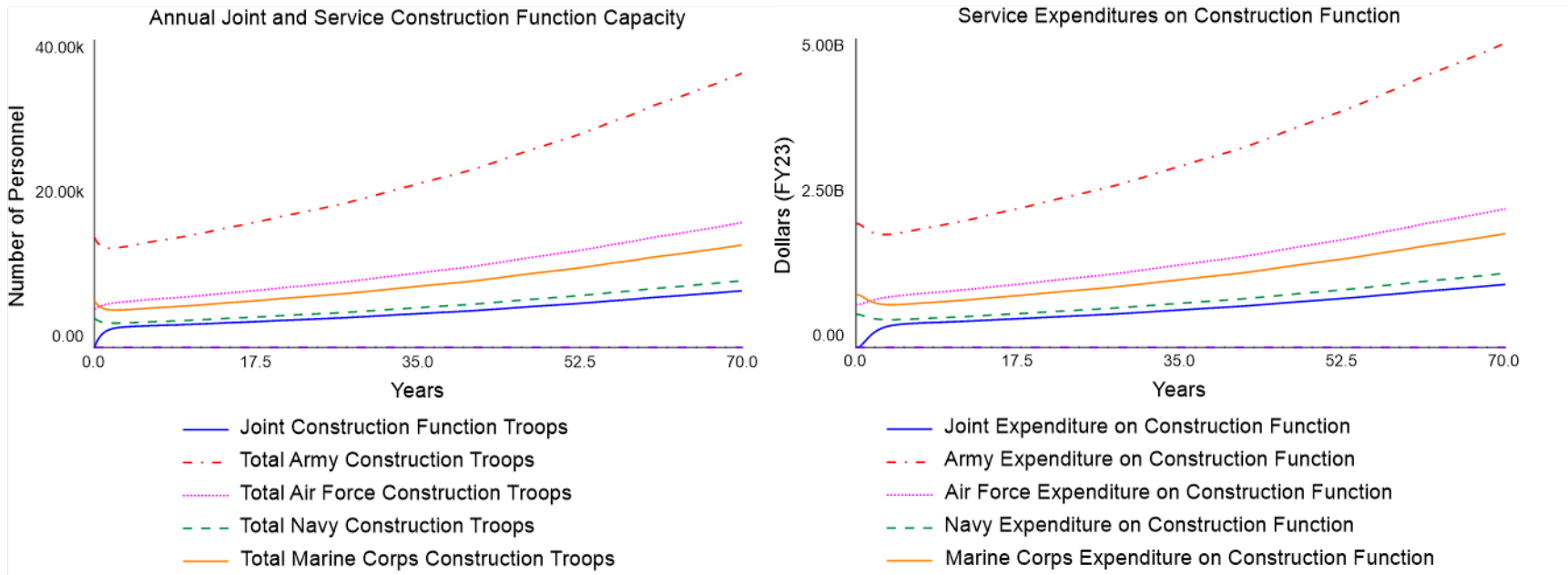


Figure 58. Condition 1 Annual Construction Function Capacity and Expenditure.²⁶³

²⁶³ Source: Skogsberg-Karnowski.

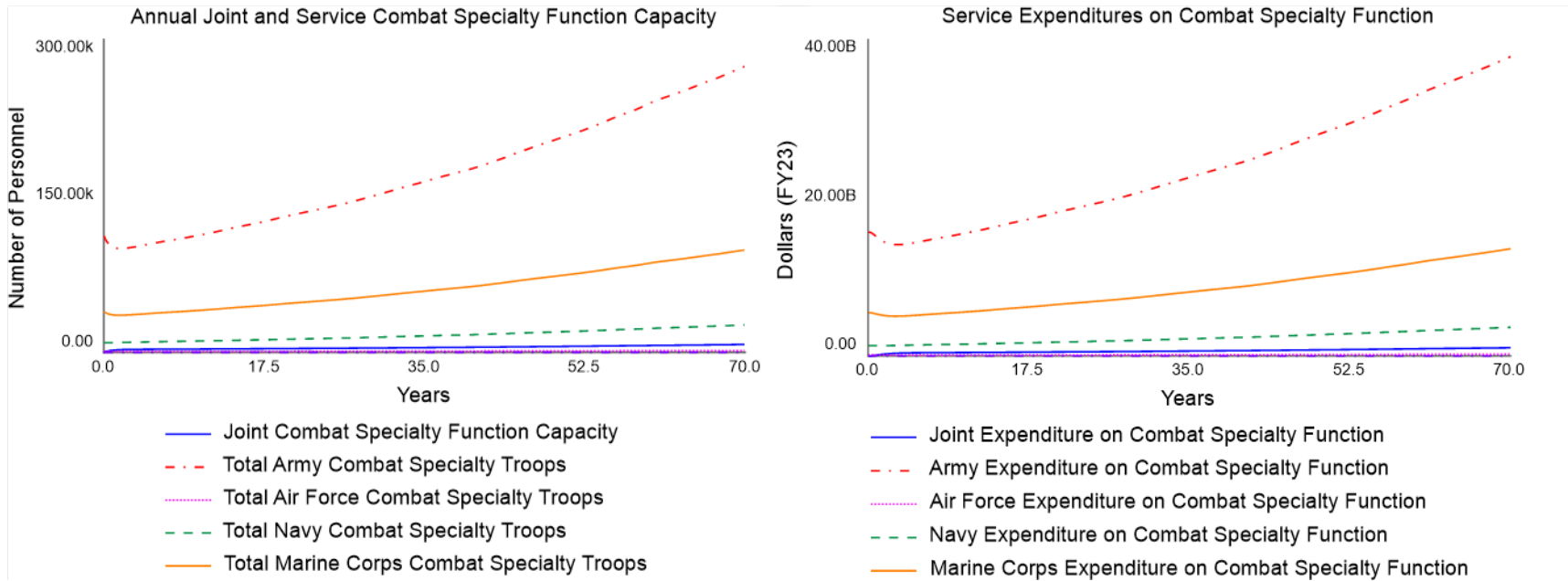


Figure 59. Condition 1 Annual Combat Specialty Function Capacity and Expenditure.²⁶⁴

²⁶⁴ Source: Skogsberg-Karnowski.

4. Tier 2 Capability Capacity

Figure 60 depicts a Tier 2 Capability, Long Range Precision Fires, which requires contributors (Targeteers, Intelligence Analysts, Approval Authorities, ATC, and Gunners/ Shooters) to provide a Joint Capability. Under Condition 1 parameters, increased funding correlates to increased required capacity of each contributor function to support the larger overall force size (where each contributor function is the sum of each of the Service’s contribution).

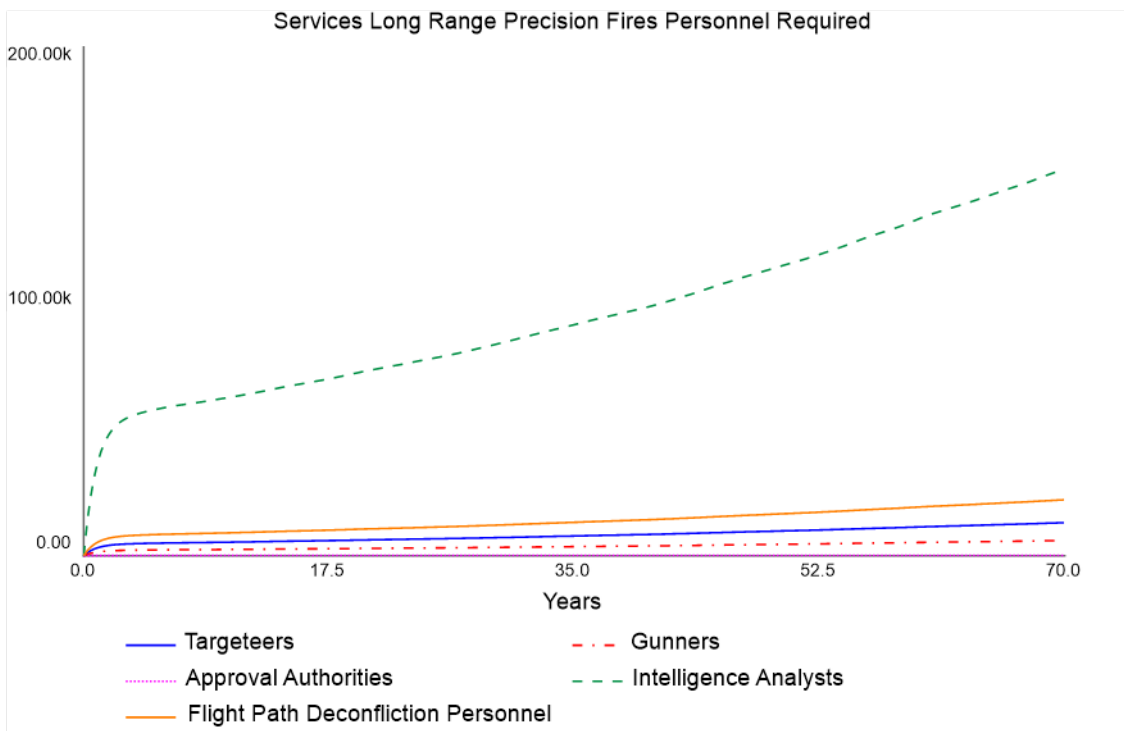


Figure 60. Condition 1 Annual Long Range Precision Fires Personnel Requirements by Contributor Function.²⁶⁵

B. CONDITION 2: SERVICE-CENTRIC WARTIME OPERATIONS

Condition 2 set the User Interface variables to include Combat Funding increases in percent GDP allocation to 20% based on historical precedence but does not transition to

²⁶⁵ Source: Skogsberg-Karnowski.

an Inherently Joint Force, an average annual personnel cost of \$140,000, and retained the default settings at 10% allocation of each Service’s Functional personnel towards the Joint Function (for example, 10% of the Army’s Administrative personnel are presented to the Joint Administrative Function as dictated by notional Combatant Command’s capacity requirements).²⁶⁶ Figure 61 and Figure 62 depict these settings on the User Interface.

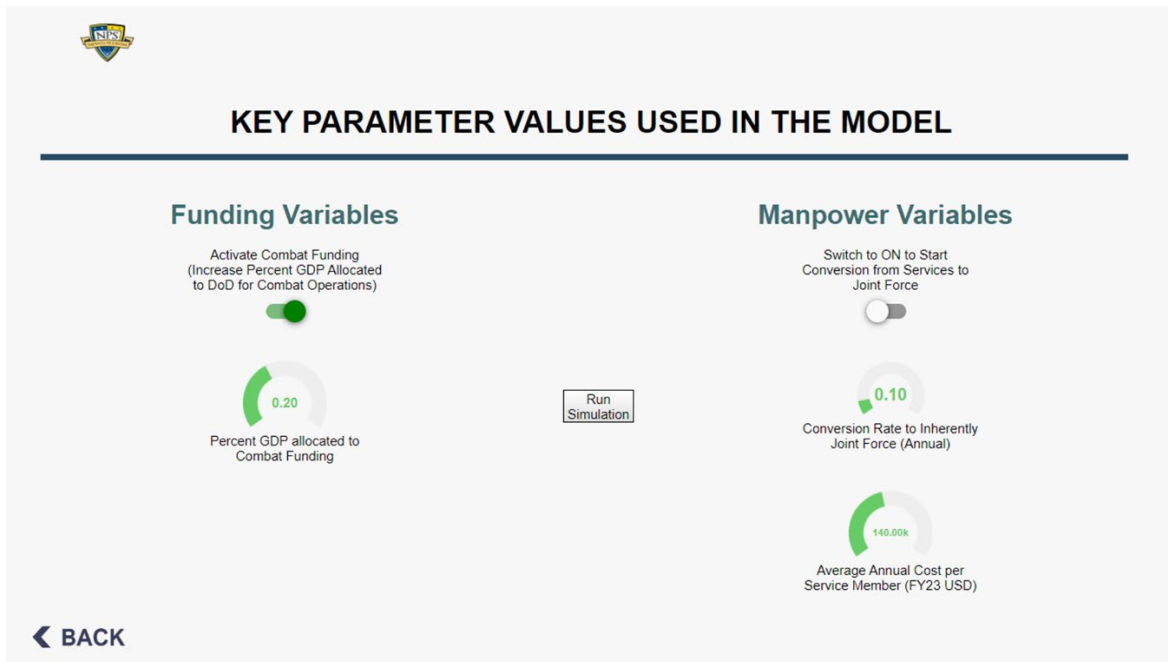


Figure 61. Condition 2 User Interface Page 1.²⁶⁷

²⁶⁶ U.S. Government Spending, “US Government Defense Spending History with Charts”; Harper, “Pentagon Personnel Costs at Historic High.”

²⁶⁷ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”



KEY PARAMETER VALUES USED IN THE MODEL

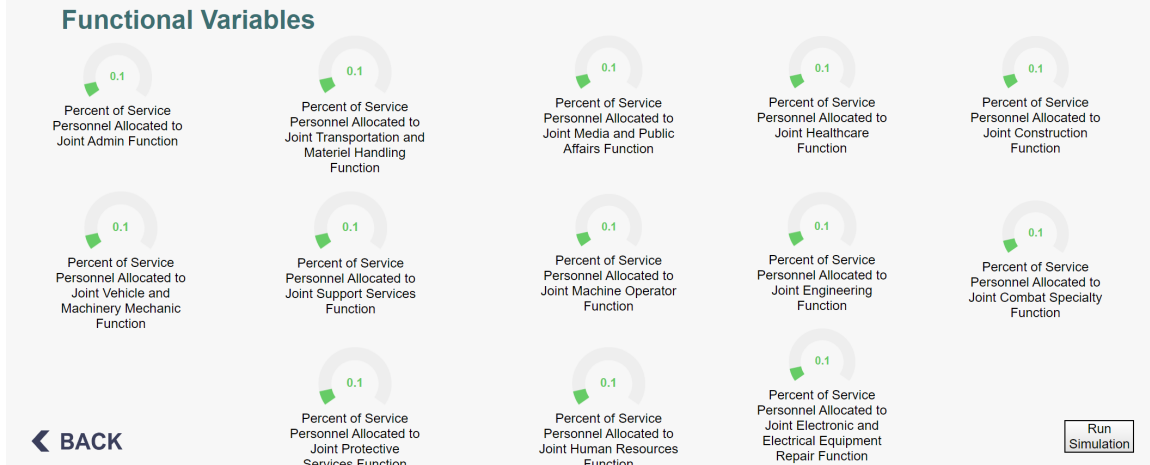


Figure 62. Condition 2 User Interface Page 2.²⁶⁸

1. Budgets

As seen with Condition 1, Condition 2 also exhibits an increasing trendline in Total Annual DOD and Service Budgets over time, as well as the associated Service Appropriations Budgets. There is an obvious difference, however, in budget magnitudes between years 5–15 and 45–55 due to the two periods of simulated armed conflict and increased percent GDP allocation. During the height of the first conflict, at approximately year 15, the projected DOD spending is \$7.28 trillion, compared to \$1.32 trillion had the U.S. not gone to war. Startlingly, the projected DOD spending during the second war, at approximately year 55, exceeds \$16 trillion in FY23 USD as compared to Condition 1 peacetime Total DOD Budget of \$3.53 trillion at the same time period. The difference in magnitude between Condition 1 and Condition 2 across periods of multiple armed conflicts is non-linear—the monetary expense of waging the second war are far higher than the first. See Figure 63 through Figure 68 for Condition 2 budgetary data.

²⁶⁸ Source: Skogsberg-Karnowski.

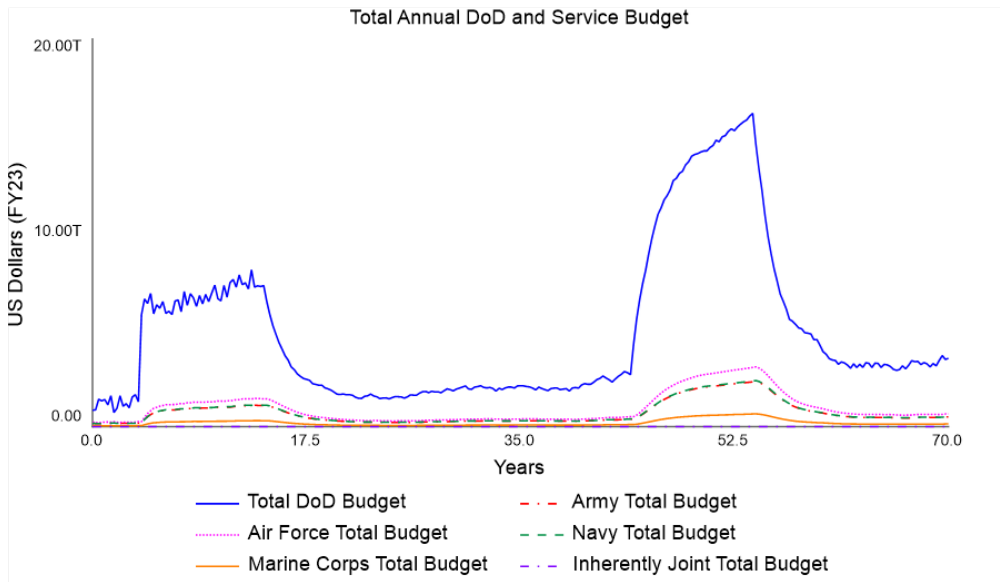


Figure 63. Condition 2 Annual Total DOD and Service Budgets.²⁶⁹

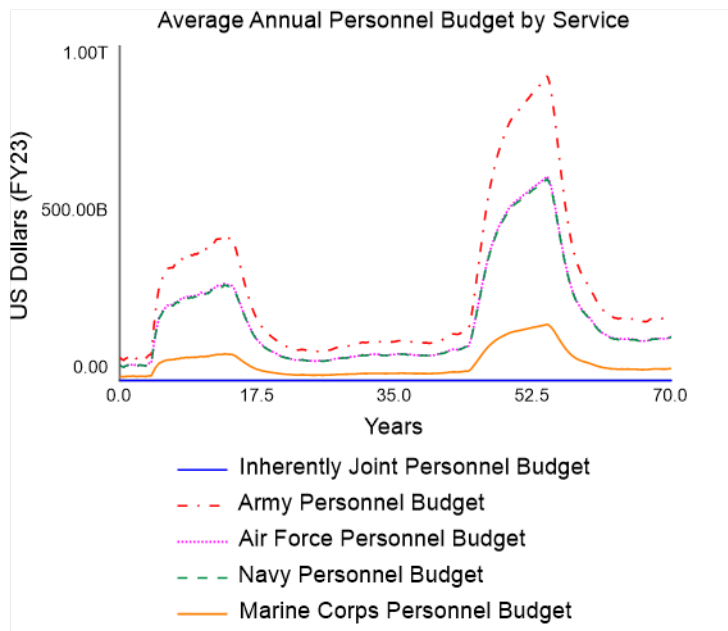


Figure 64. Condition 2 Annual Personnel Budget by Service.²⁷⁰

²⁶⁹ Source: Skogsberg-Karnowski.

²⁷⁰ Source: Skogsberg-Karnowski.

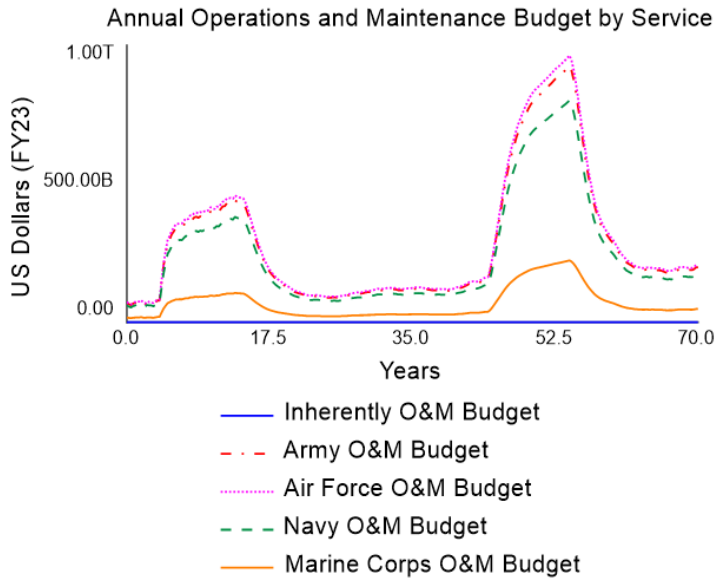


Figure 65. Condition 2 Annual Operations and Maintenance Budget by Service.²⁷¹

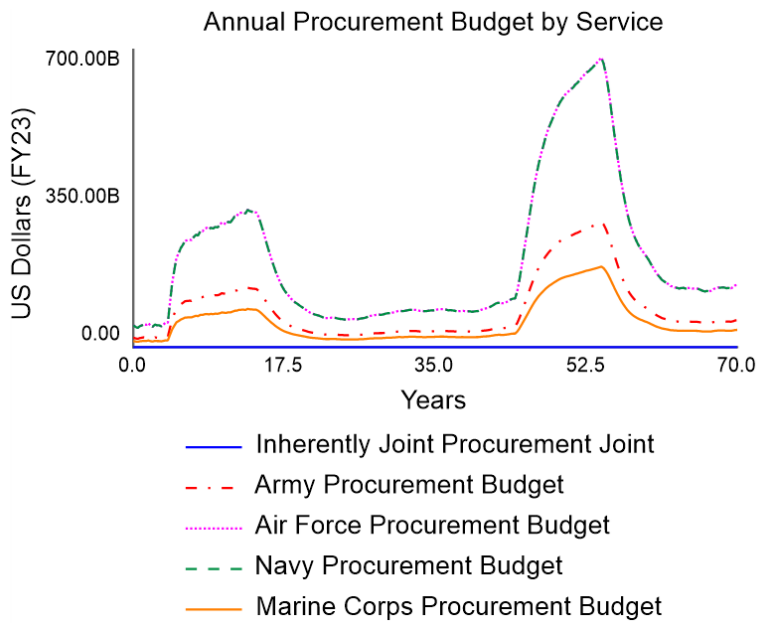


Figure 66. Condition 2 Annual Procurement Budget by Service.²⁷²

²⁷¹ Source: Skogsberg-Karnowski.

²⁷² Source: Skogsberg-Karnowski.

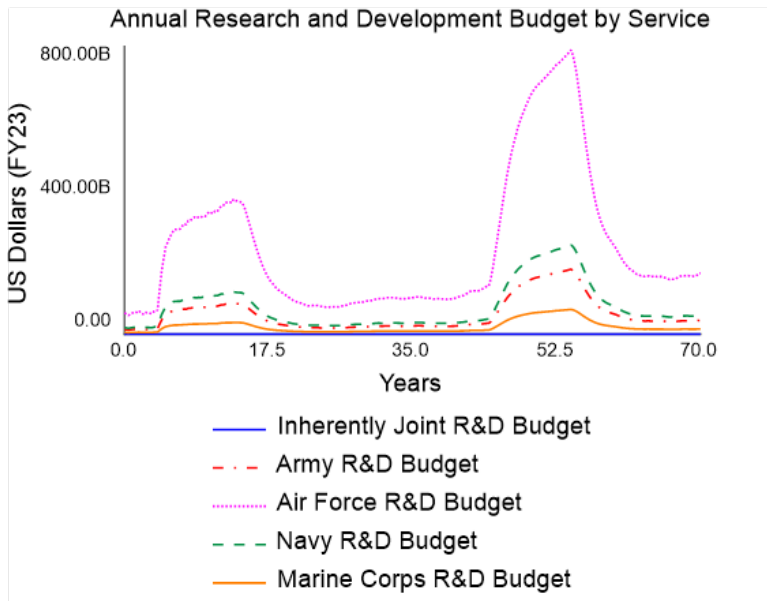


Figure 67. Condition 2 Annual Research and Development Budget by Service.²⁷³

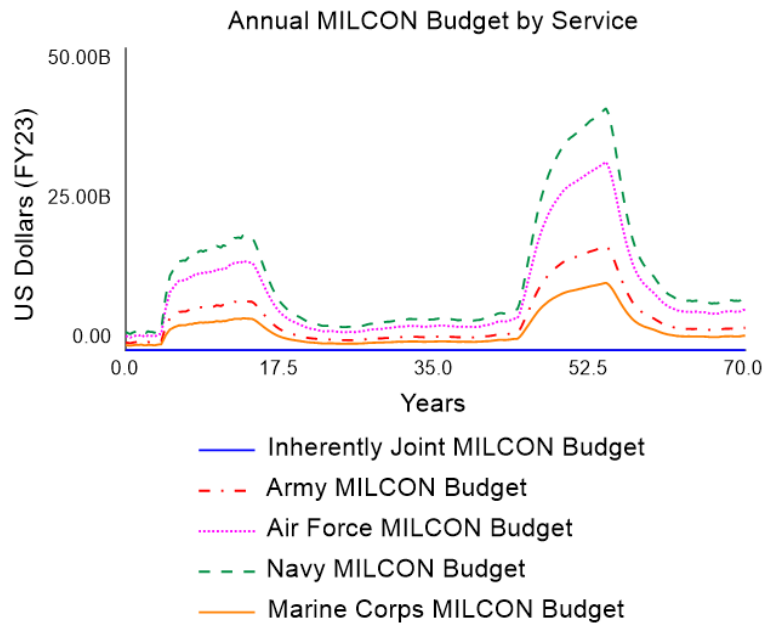


Figure 68. Condition 2 Annual Military Construction Budget by Service.²⁷⁴

²⁷³ Source: Skogsberg-Karnowski.

²⁷⁴ Source: Skogsberg-Karnowski.

2. Force Composition

Regarding force composition, the active duty force size exhibits an overall growth trend commensurate with increased DOD funding. As compared to Condition 1, Condition 2 active duty force size experiences rapid growth to a peak at approximately year 15 and year 55 due to war (see Figure 69). For comparative purposes, the force size of Condition 2 at year 15 is approximately 2.98 million active duty personnel, whereas Condition 1 is 1.70 million; and the force size of Condition 2 at year 55 is approximately 10.77 million as compared to approximately 3.12 million in Condition 1. The difference in magnitude between Condition 1 and Condition 2 is again non-linear—the monetary and manpower expenses of waging the second war are far higher than the first.

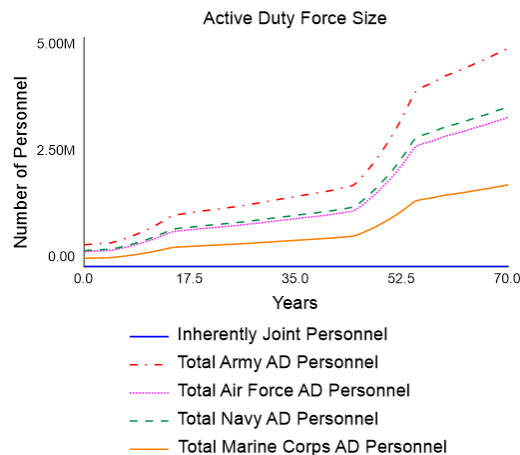


Figure 69. Condition 2 Annual Active Duty Force Size.²⁷⁵

3. Tier 1 Function Capacity and Expenditures

The Functional Capacity and Expenditures trendlines experience similar magnitude changes due to increased funding and personnel in wartime, as is predictable. The difference between Condition 1 and Condition 2 capacity and expenses is non-linear and increases rapidly in the second conflict period as compared to the first. See Figure 70 through Figure 82.

²⁷⁵ Source: Skogsberg-Karnowski.

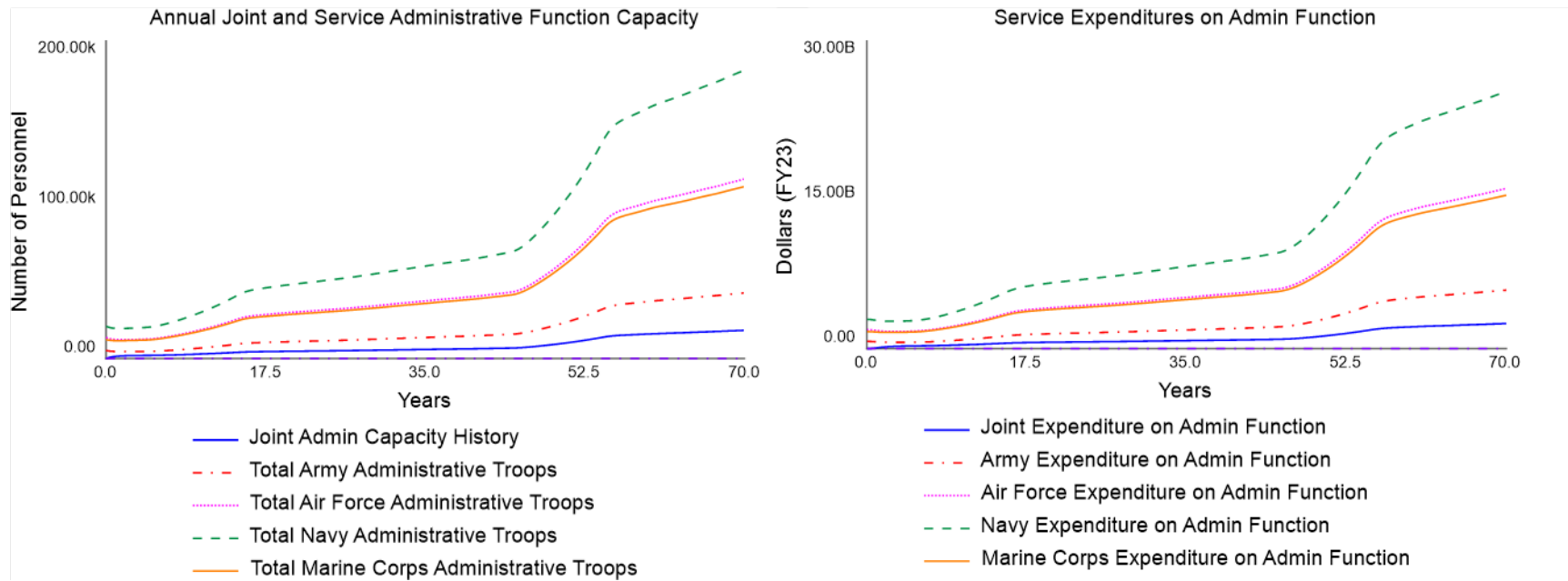


Figure 70. Condition 2 Annual Administrative Function Capacity and Expenditure.²⁷⁶

²⁷⁶ Source: Skogsberg-Karnowski.

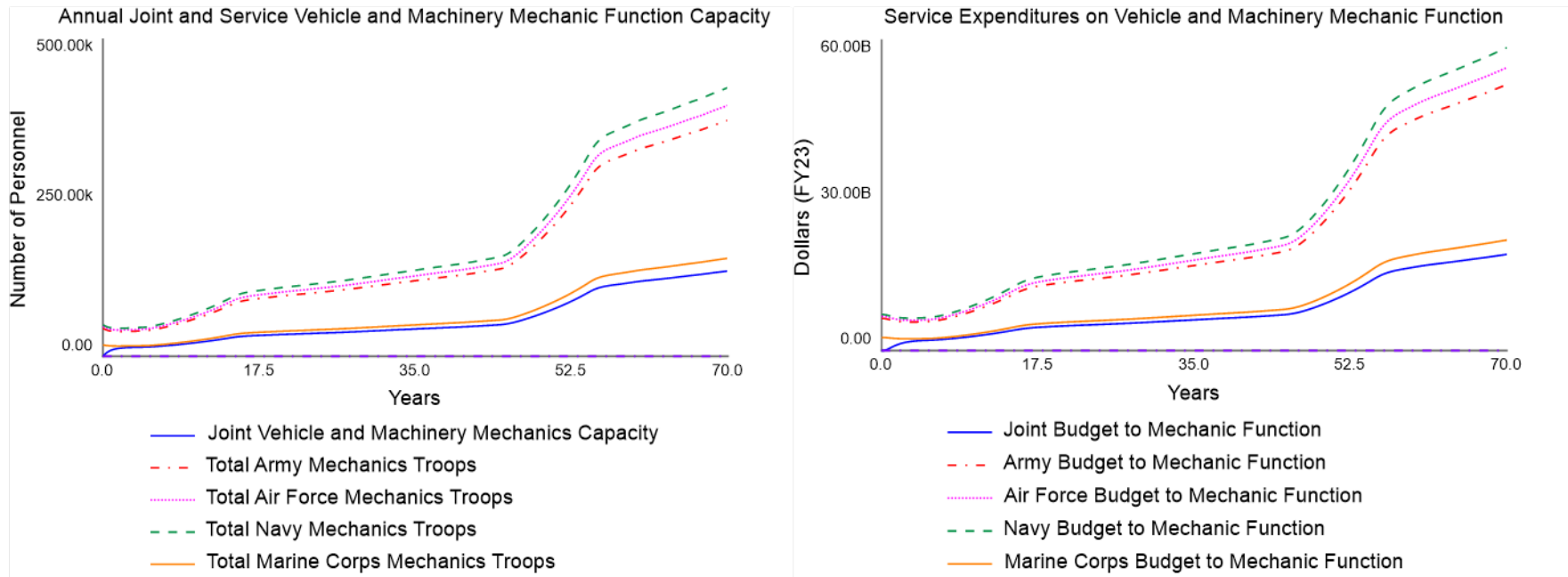


Figure 71. Condition 2 Annual Vehicle and Machinery Mechanic Function Capacity and Expenditure.²⁷⁷

²⁷⁷ Source: Skogsberg-Karnowski.

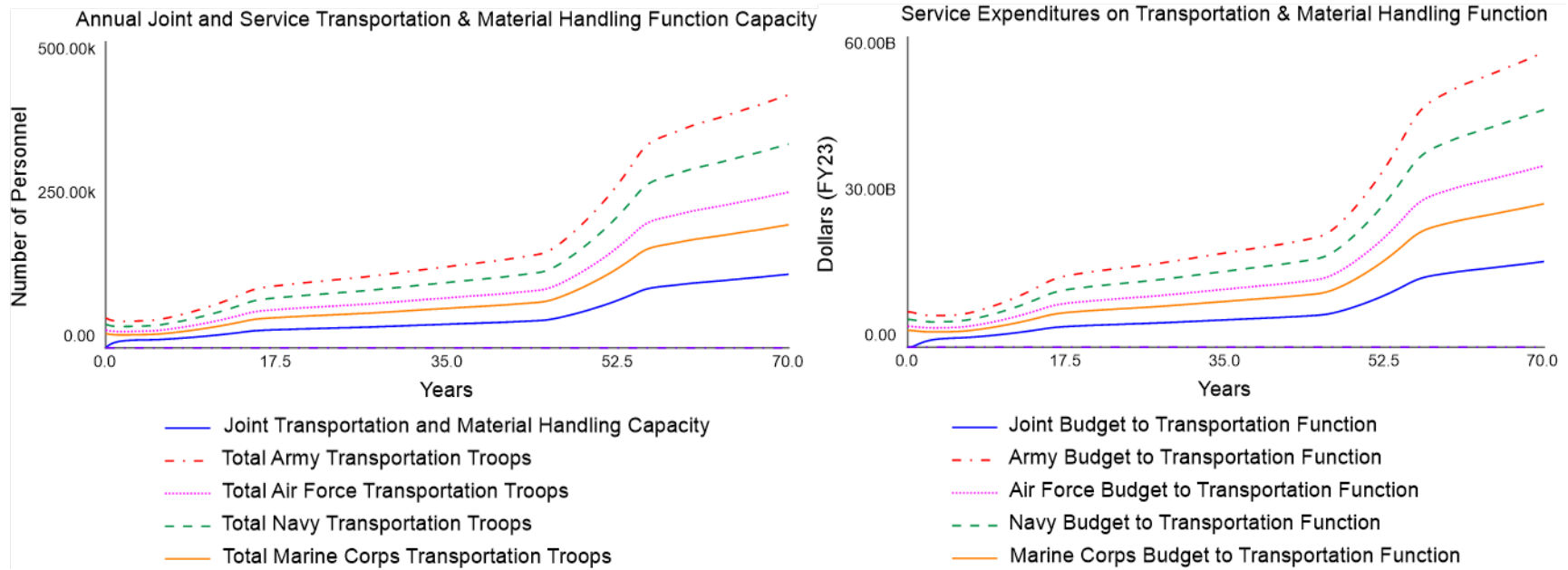


Figure 72. Condition 2 Annual Transportation and Material Function Capacity and Expenditure.²⁷⁸

²⁷⁸ Source: Skogsberg-Karnowski.

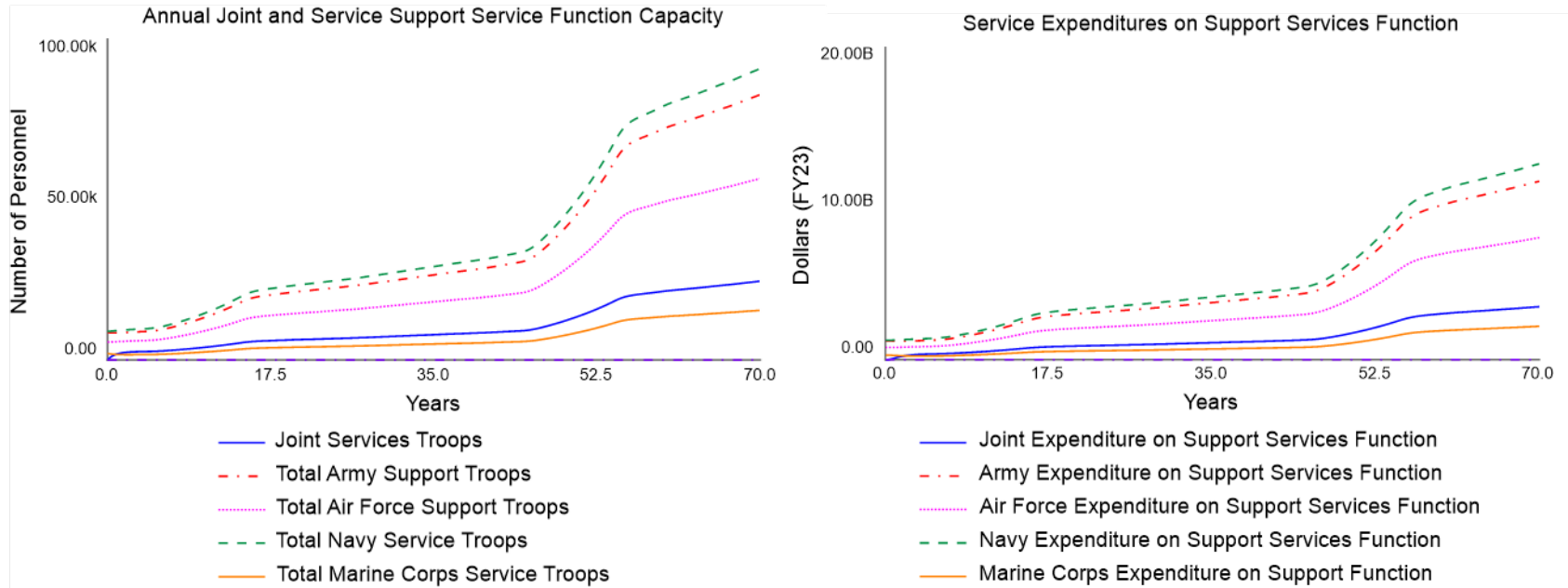


Figure 73. Condition 2 Annual Support Service Function Capacity and Expenditure.²⁷⁹

²⁷⁹ Source: Skogsberg-Karnowski.

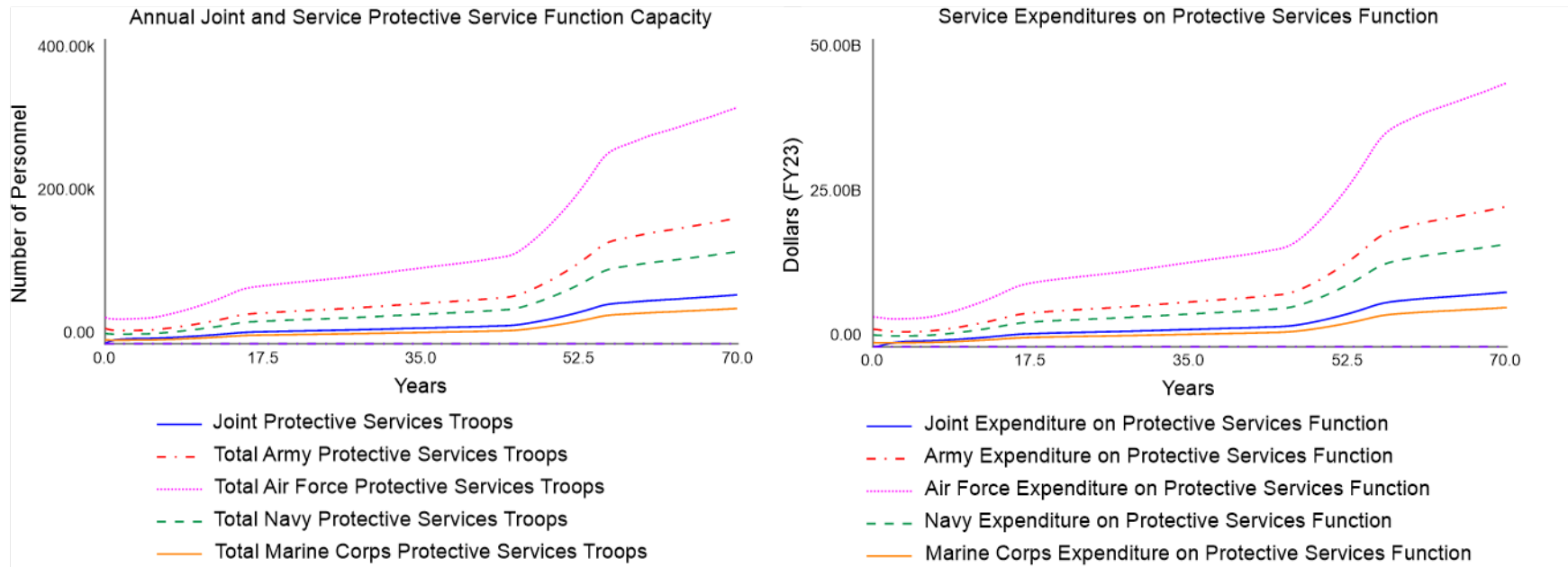


Figure 74. Condition 2 Annual Protective Service Function Capacity and Expenditure.²⁸⁰

²⁸⁰ Source: Skogsberg-Karnowski.

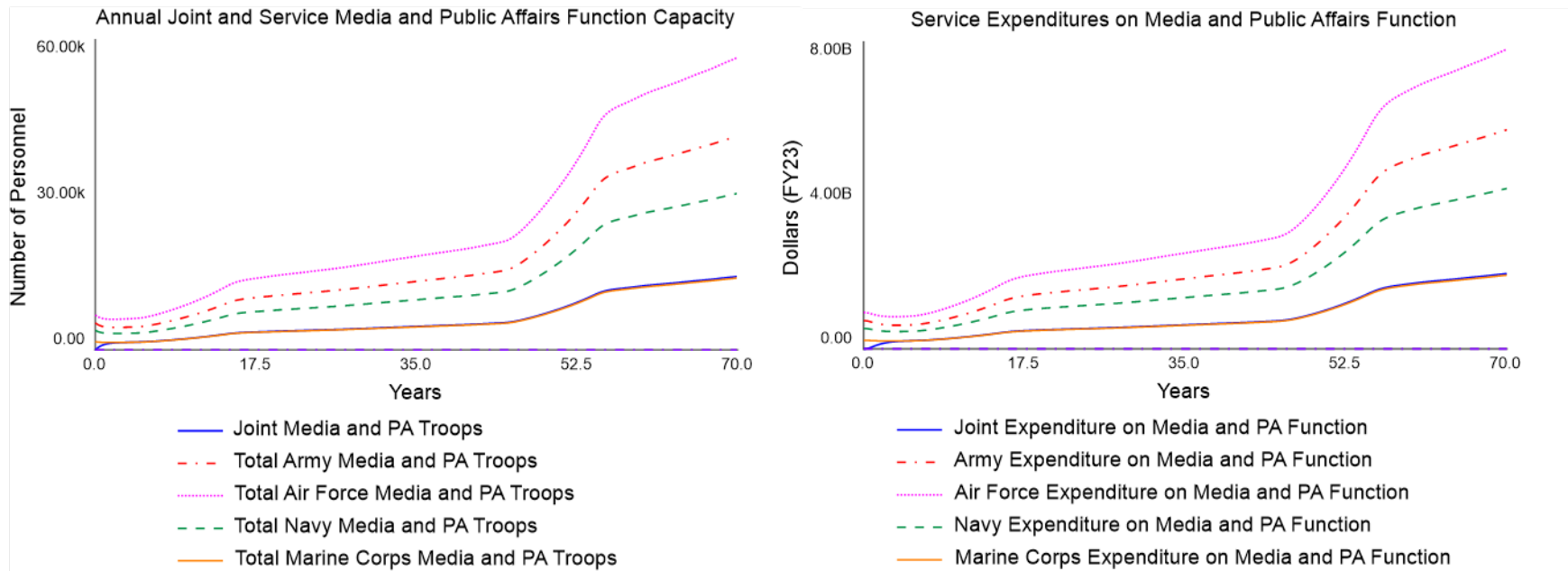


Figure 75. Condition 2 Annual Media and Public Affairs Function Capacity and Expenditure.²⁸¹

²⁸¹ Source: Skogsberg-Karnowski.

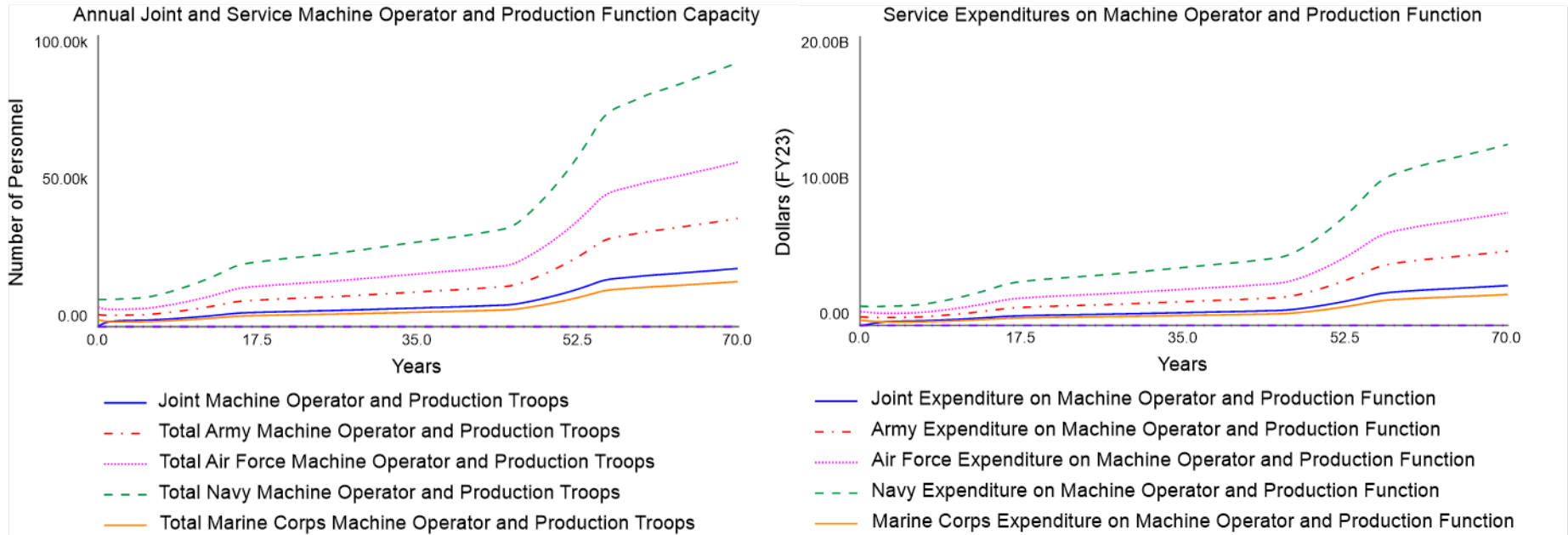


Figure 76. Condition 2 Annual Machine Operator and Production Function Capacity and Expenditure.²⁸²

²⁸² Source: Skogsberg-Karnowski.

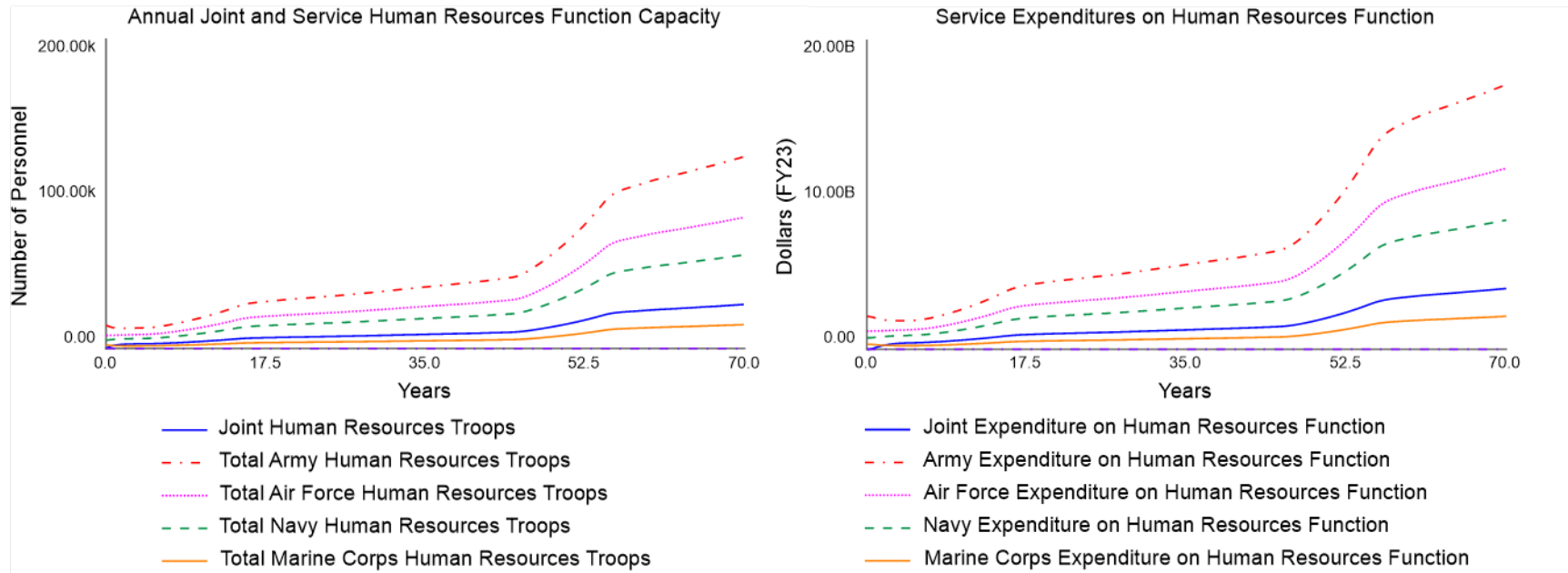


Figure 77. Condition 2 Annual Human Resources Function Capacity and Expenditure.²⁸³

²⁸³ Source: Skogsberg-Karnowski.

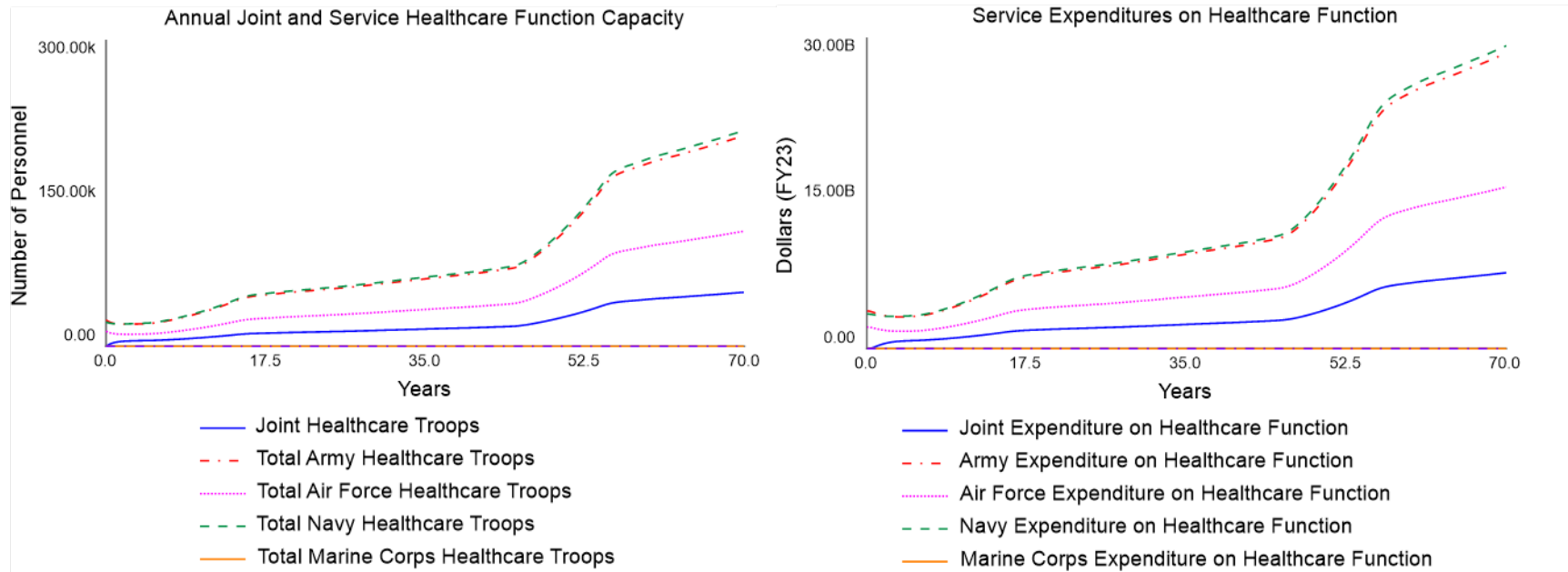


Figure 78. Condition 2 Annual Healthcare Function Capacity and Expenditure.²⁸⁴

²⁸⁴ Source: Skogsberg-Karnowski.

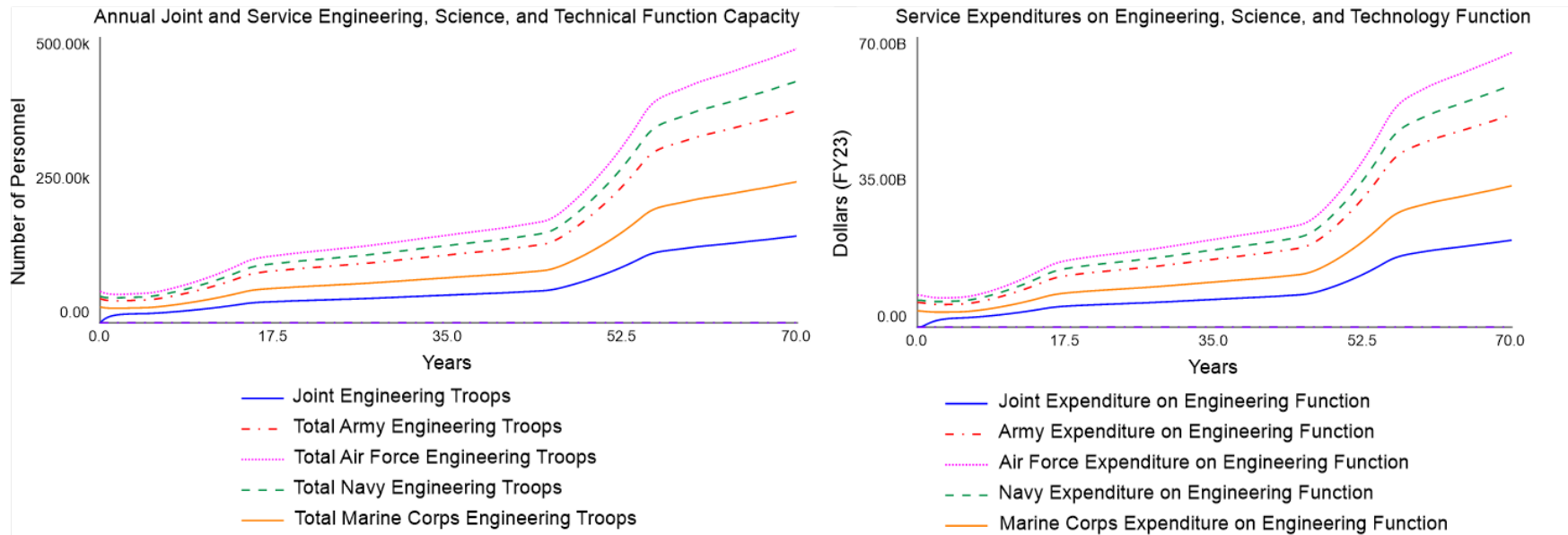


Figure 79. Condition 2 Annual Engineering, Science, and Technical Function Capacity and Expenditure.²⁸⁵

²⁸⁵ Source: Skogsberg-Karnowski.

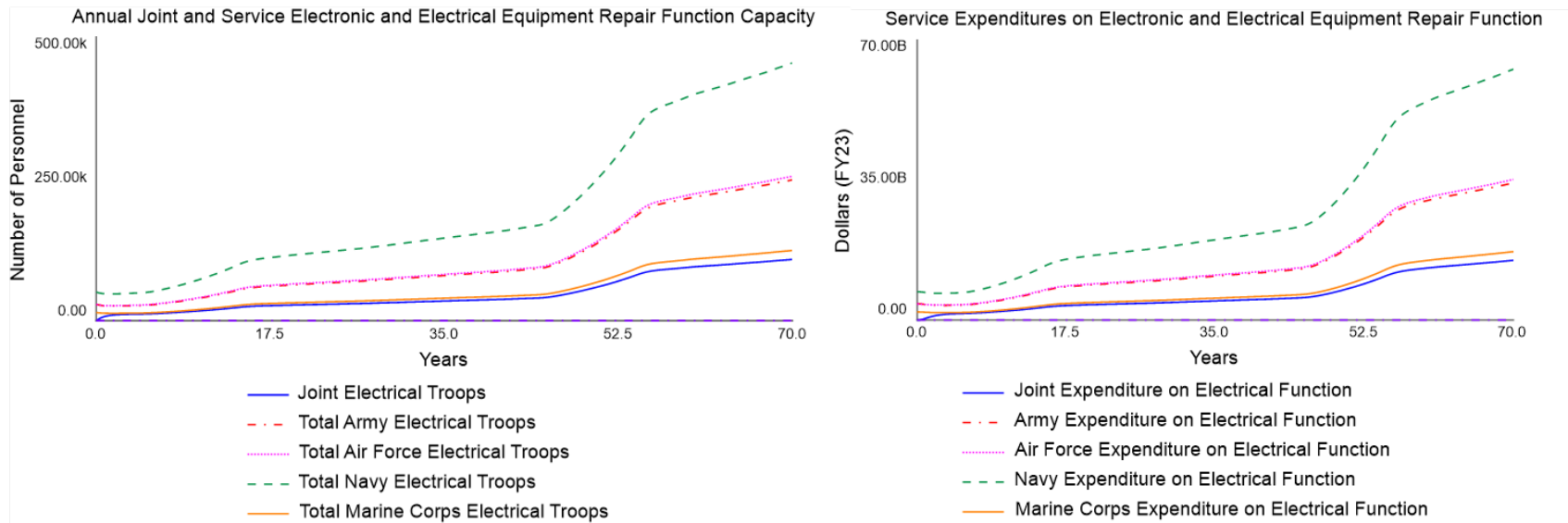


Figure 80. Condition 2 Annual Electronic and Electrical Equipment Repair Function Capacity and Expenditure.²⁸⁶

²⁸⁶ Source: Skogsberg-Karnowski.

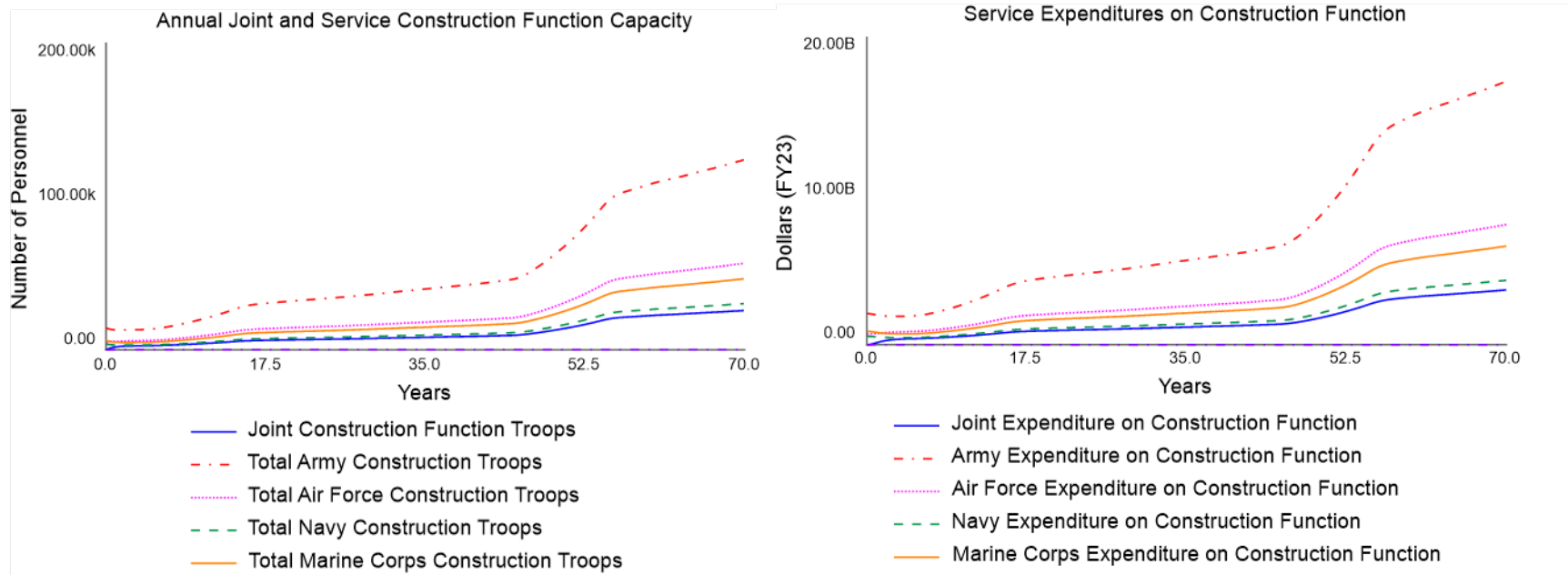


Figure 81. Condition 2 Annual Construction Function Capacity and Expenditure.²⁸⁷

²⁸⁷ Source: Skogsberg-Karnowski.

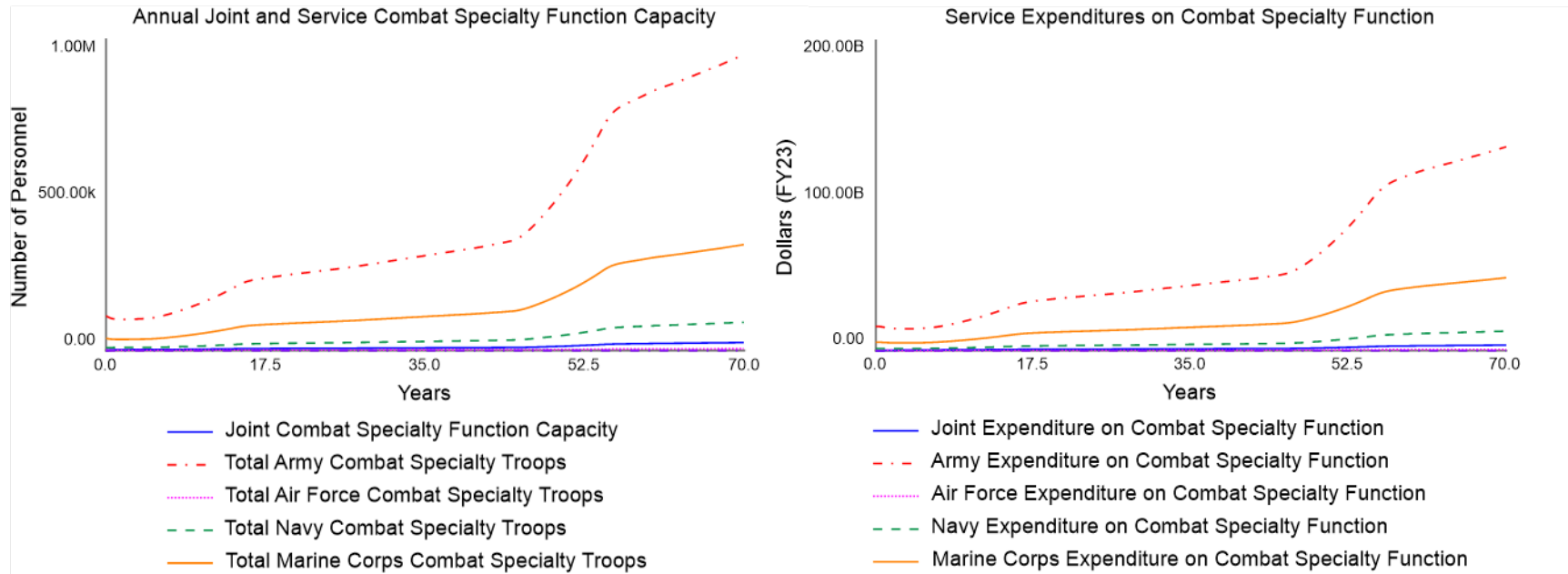


Figure 82. Condition 2 Annual Combat Specialty Function Capacity and Expenditure.²⁸⁸

²⁸⁸ Source: Skogsberg-Karnowski.

4. Tier 2 Capability Capacity

Figure 83 depicts a Tier 2 Capability, “Joint Capability for Long Range Precision Fires,” which requires Contributors (Targeteers, Intelligence Analysts, Approval Authorities, ATC, and Gunners/Shooters) to provide a Joint Capability. Under Condition 2 parameters, significantly increased Combat Funding results in a larger overall active duty force size, which in turn increases required capacity of each Contributor Function to support the larger overall force size (where each Contributor Function is the sum of each of the Service’s contribution).

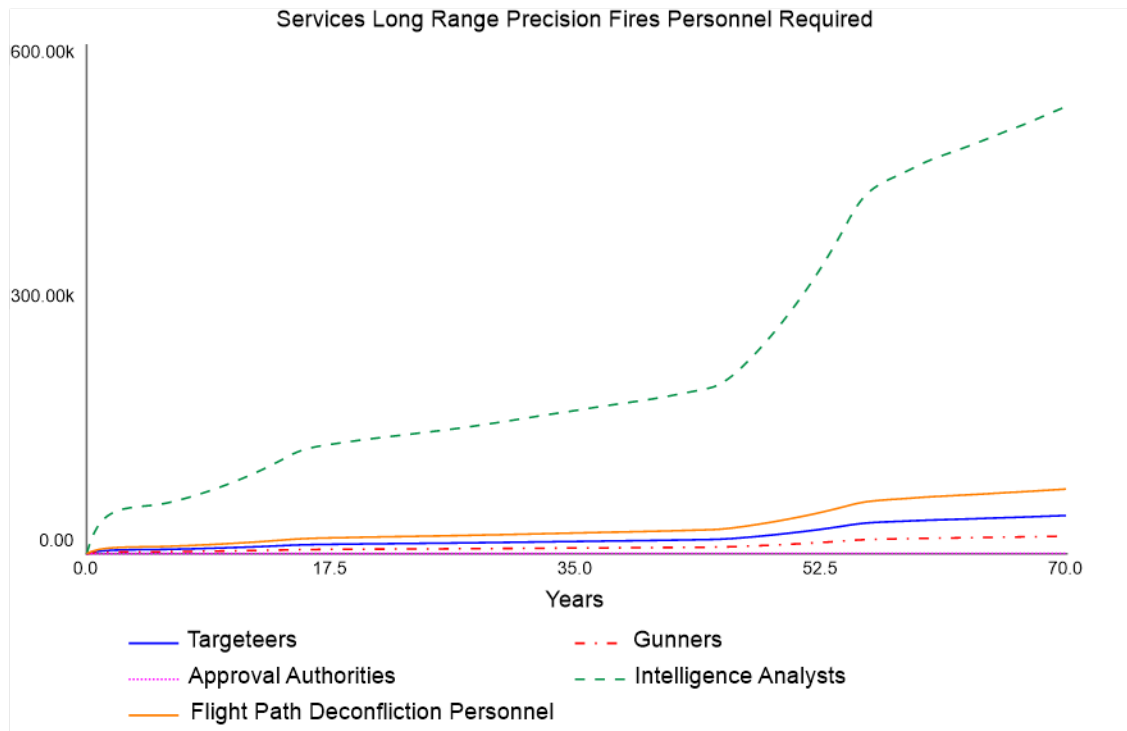


Figure 83. Condition 2 Annual Joint Capability for Long Range Precision Fires Personnel Requirements by Contributor Function.²⁸⁹

²⁸⁹ Source: Skogsberg-Karnowski.

C. CONDITION 3: FUNCTIONALLY ALIGNED WARTIME OPERATIONS

Condition 3 set the User Interface variables to include Combat Funding increases in percent GDP allocation to 20% based on historical precedence, and an average annual personnel cost of \$140,000. This simulation enabled the transition to an Inherently Joint Force, set the “Annual Conversion Rate to Inherently Joint Force” at 10%, and retained the default settings at 10% allocation of the Inherently Joint Functional personnel towards the notional Combatant Command’s capacity requirements.²⁹⁰ Figure 84 and Figure 85 depict these settings on the User Interface.

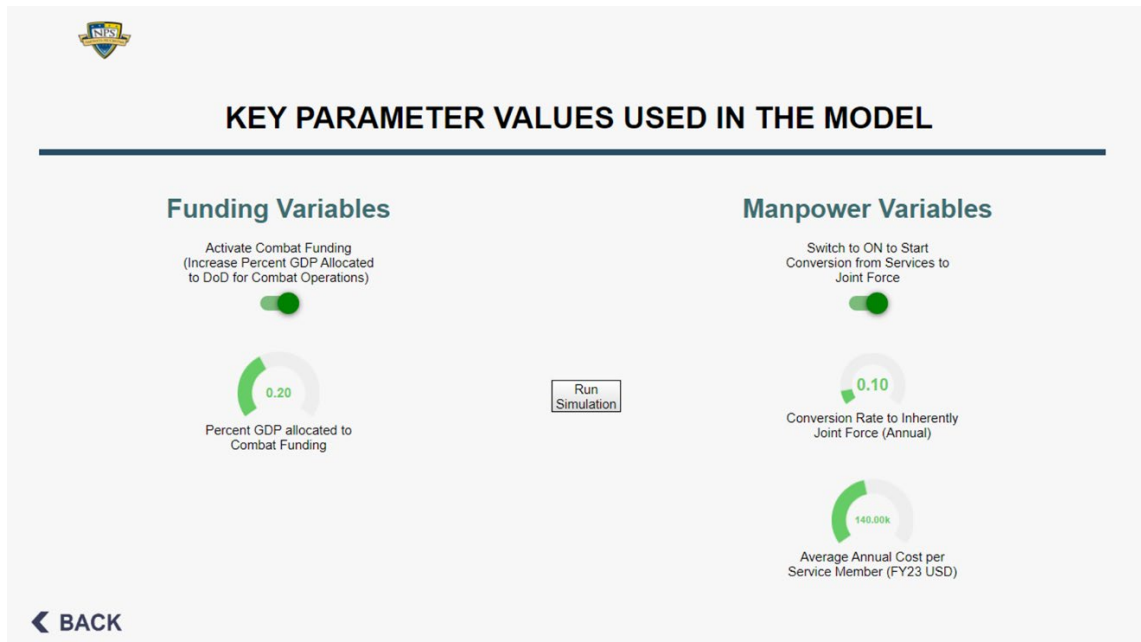


Figure 84. Condition 3 User Interface Page 1.²⁹¹

²⁹⁰ U.S. Government Spending, “US Government Defense Spending History with Charts”; Harper, “Pentagon Personnel Costs at Historic High.”

²⁹¹ Source: Skogsberg-Karnowski, “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final.”



KEY PARAMETER VALUES USED IN THE MODEL

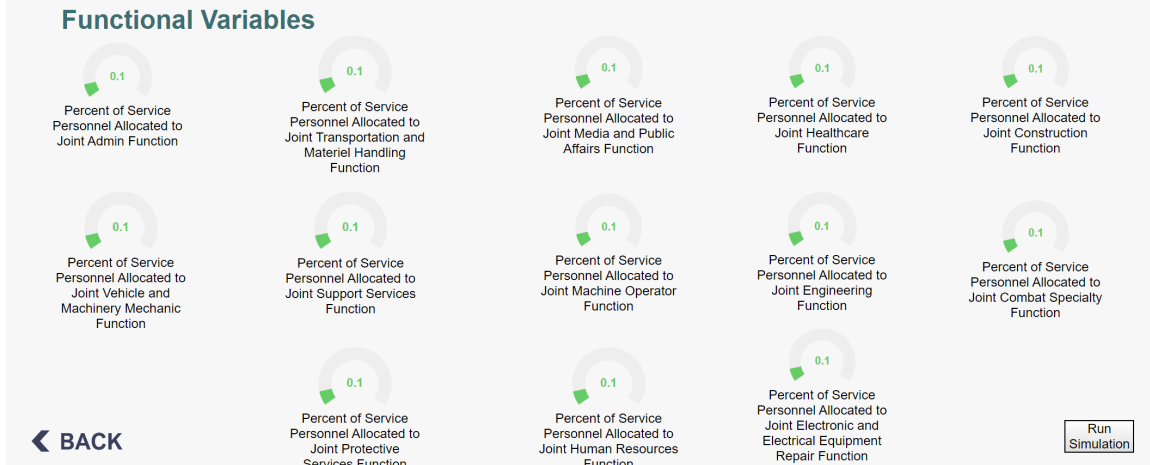


Figure 85. Condition 3 User Interface Page 2.²⁹²

1. Budgets

Comparing Condition 3 to Condition 2 highlights possible money and manpower savings across the DOD if an Inherently Joint force structure is implemented. Figure 86 depicts the Total Annual DOD Budget (which includes all defense-wide activities not specifically tied to a Service under Condition 2 parameters), the sum of the Service Budgets modeled in Condition 2, and the Inherently Joint Budget modeled in Condition 3. Like Condition 2, the monetary and manpower expenses in the second period of armed conflict are of higher magnitude than the first conflict, supporting a non-linear trend over time. More impactful is the comparison between the sum of the Service Budgets and the Inherently Joint Budget over the 70-year period; the Inherently Joint force construct could save a total of \$24.35 trillion USD in FY23 money, or an average of \$347.88 billion USD annually. Keeping in mind cost-savings are realized at an increasingly greater magnitude as time progresses, the potential savings are approximately half of the total of FY23's requested Service Budgets, repeated annually. Reducing overhead associated with

²⁹² Source: Skogsberg-Karnowski.

redundancies in maintaining duplicative Service Functionality by a modest 10% results in a significantly higher reduction in budget.

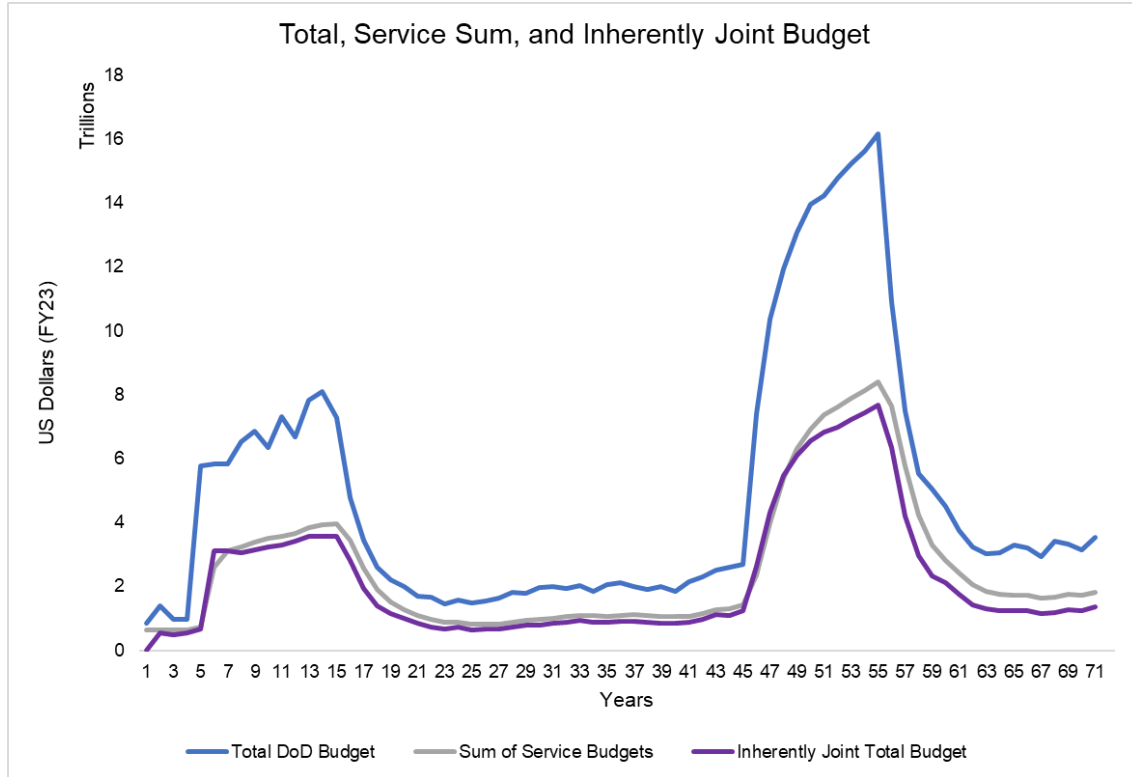


Figure 86. Condition 3 Inherently Joint Budget vs. Condition 2 Service Budget Sum and Total DOD Budget, Annual

The Appropriations Budgets in Condition 3 reflect reductions to appropriations expenditures as the total Inherently Joint Budget is lower. Figure 87 through Figure 91 depict each of the five Appropriations Budgets as a comparison between the sum of the Service appropriations in Condition 2 against the Inherently Joint appropriations budgets.

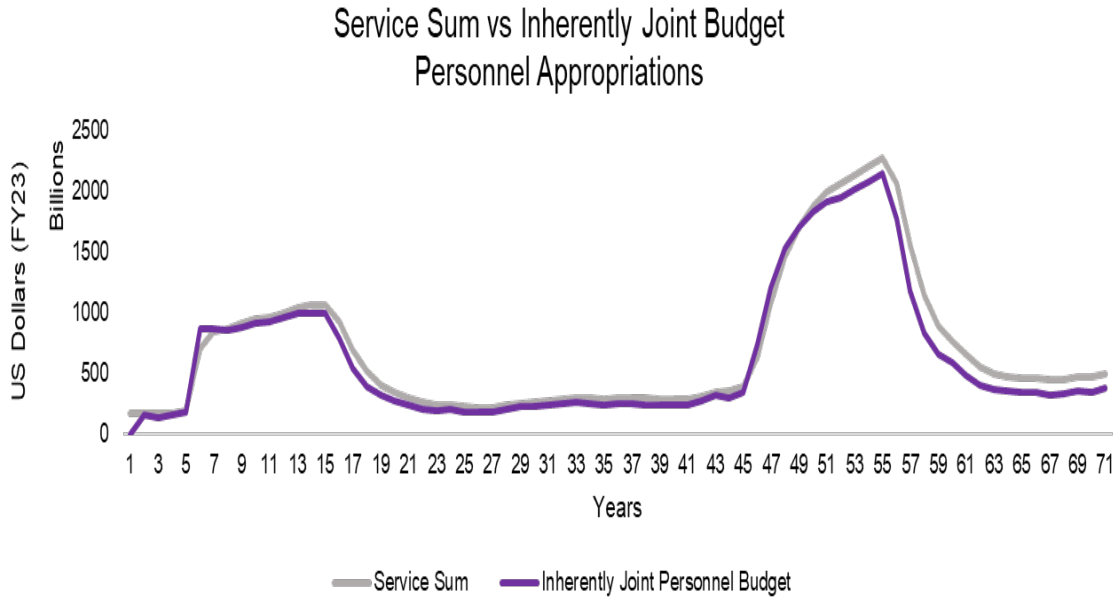


Figure 87. Condition 3 Inherently Joint Personnel Budget vs. Condition 2 Service Budget Sum, Annual

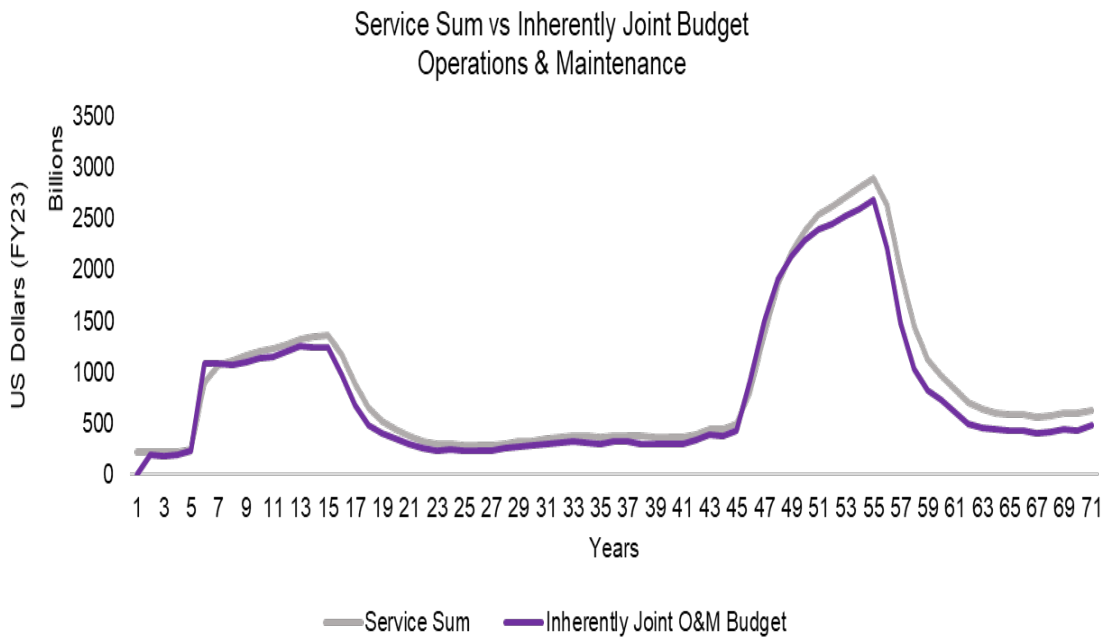


Figure 88. Condition 3 Inherently Joint Operations and Maintenance Budget vs. Condition 2 Service Budget Sum, Annual

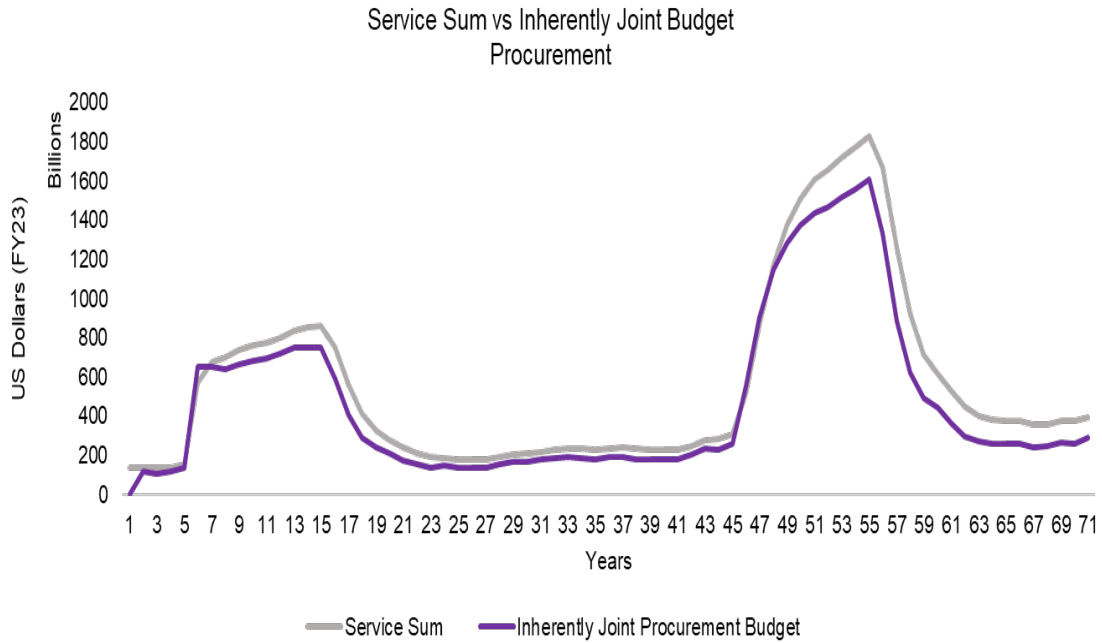


Figure 89. Condition 3 Inherently Joint Procurement Budget vs. Condition 2 Service Budget Sum, Annual

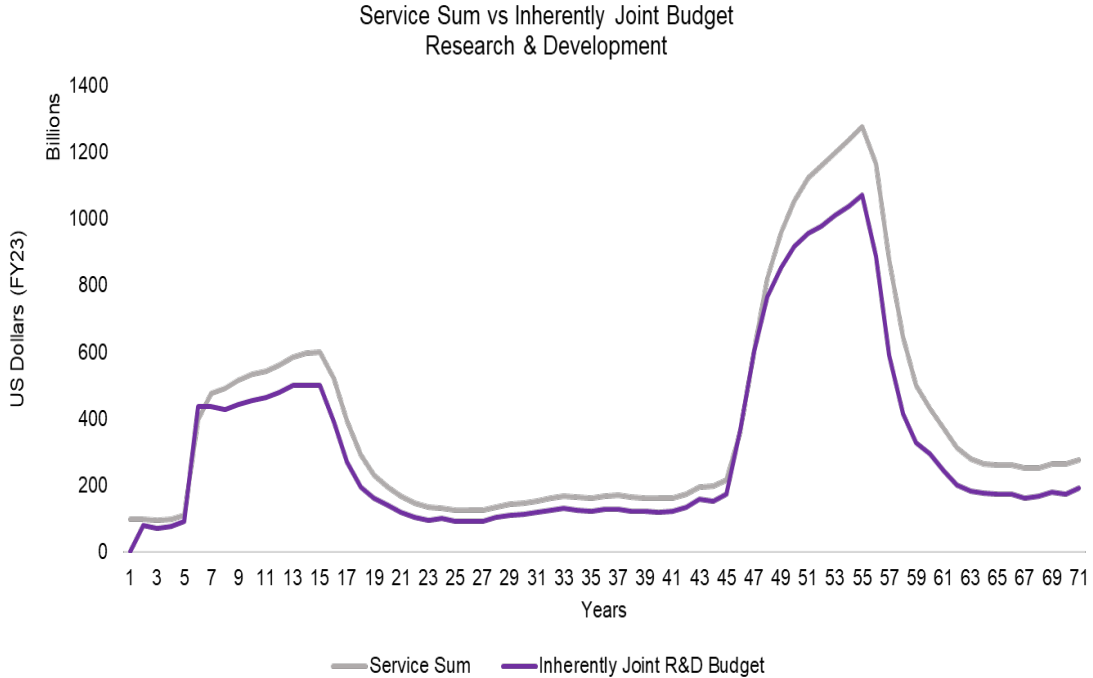


Figure 90. Condition 3 Inherently Joint Research and Development Budget vs. Condition 2 Service Budget Sum, Annual

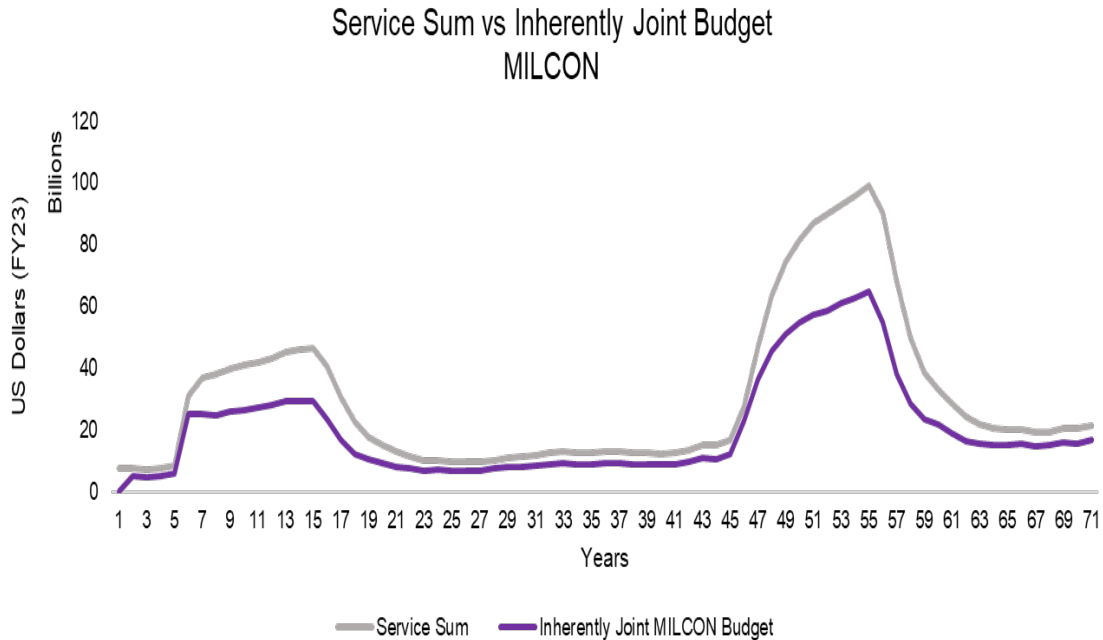


Figure 91. Condition 3 Inherently Joint Military Construction Budget vs. Condition 2 Service Budget Sum, Annual

2. Force Composition

When assessing force composition, depicted in Figure 92, the number of Service personnel decreases to zero as 10% are converted annually to an Inherently Joint Force. The overall total active duty force continues to grow commensurate with percent increase of GDP and subsequent increases to the DOD Budget while Service personnel are converted to Inherently Joint personnel. Peaks in manning are visible at the height of each conflict, with year 15 seeing approximately 298 thousand Inherently Joint personnel, and year 55 forecasting approximately 1.02 million due to reductions made by reducing overhead requirements. Comparatively, Condition 2 predicted approximately 3.12 million at year 15 and approximately 10.8 million at year 55. Figure 93 is a comparison of forecasted Condition 3 Inherently Joint personnel versus the sum of Condition 2 Service personnel, making clear the magnitude of personnel savings over time with an Inherently Joint force structure. This realignment might decrease the need for a projected 13-million active duty force size across all Services at the drawdown from the second war to a forecasted 1.3 million-personnel Service-agnostic and Inherently Joint Force at the same

time period. As with budget requirements, manpower savings are realized at an increasingly greater magnitude as time progresses.

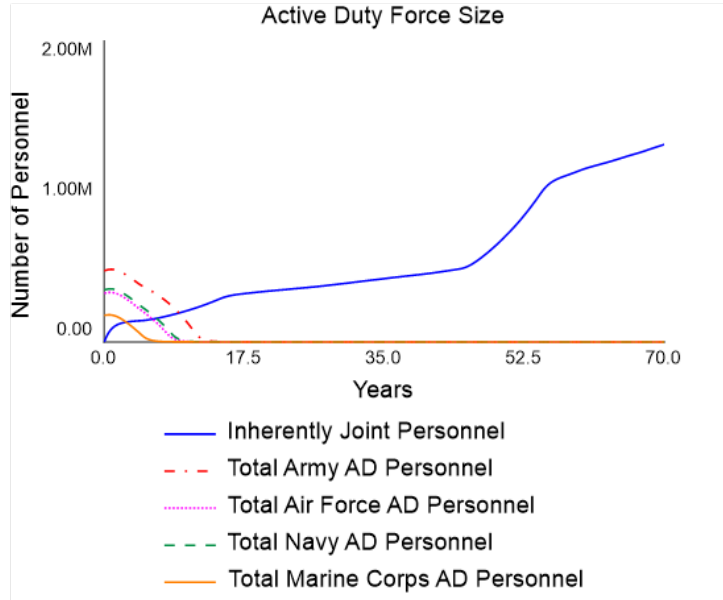


Figure 92. Condition 3 Annual Active Duty Force Size.²⁹³

²⁹³ Source: Skogsberg-Karnowski.

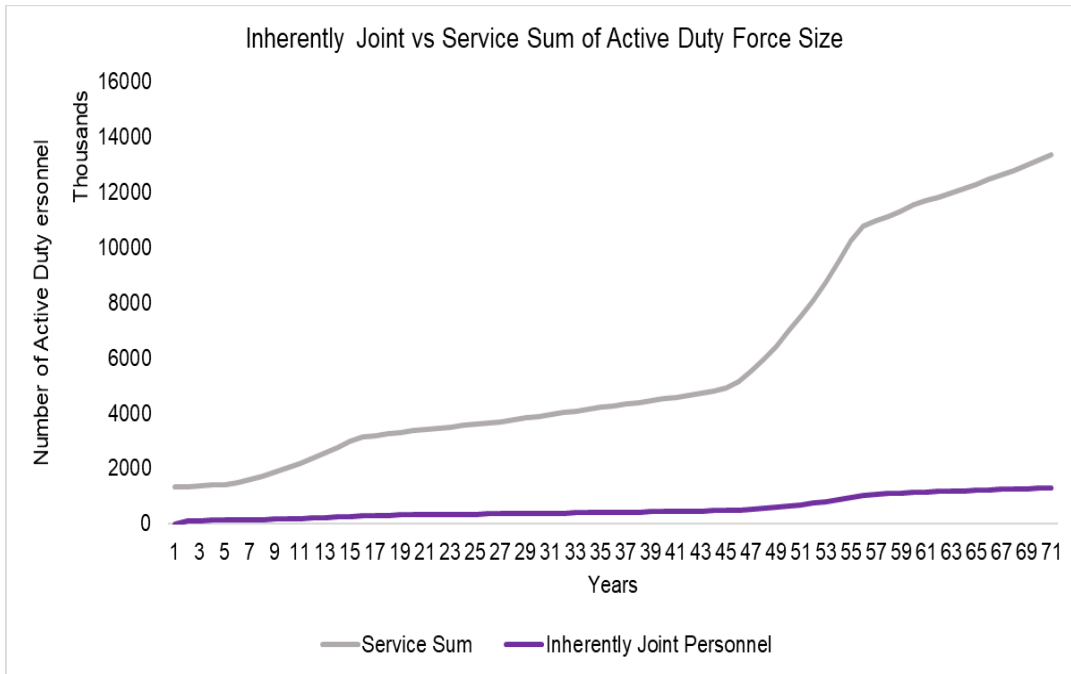


Figure 93. Condition 3 Inherently Joint Active Duty Force Size vs. Condition 2 Service Active Duty Force Size Sum, Annual

3. Tier 1 Function Capacity and Expenditures

The Functional Capacity and Expenditures trendlines depict the same Service drawdown as the Inherently Joint Force is established, and the Inherently Joint trend line continues to echo the peaks created by the increased Combat Funding. Figure 94 through Figure 106 depict each Function’s annual required personnel capacity and its require annual expenditure over a 70-year period.

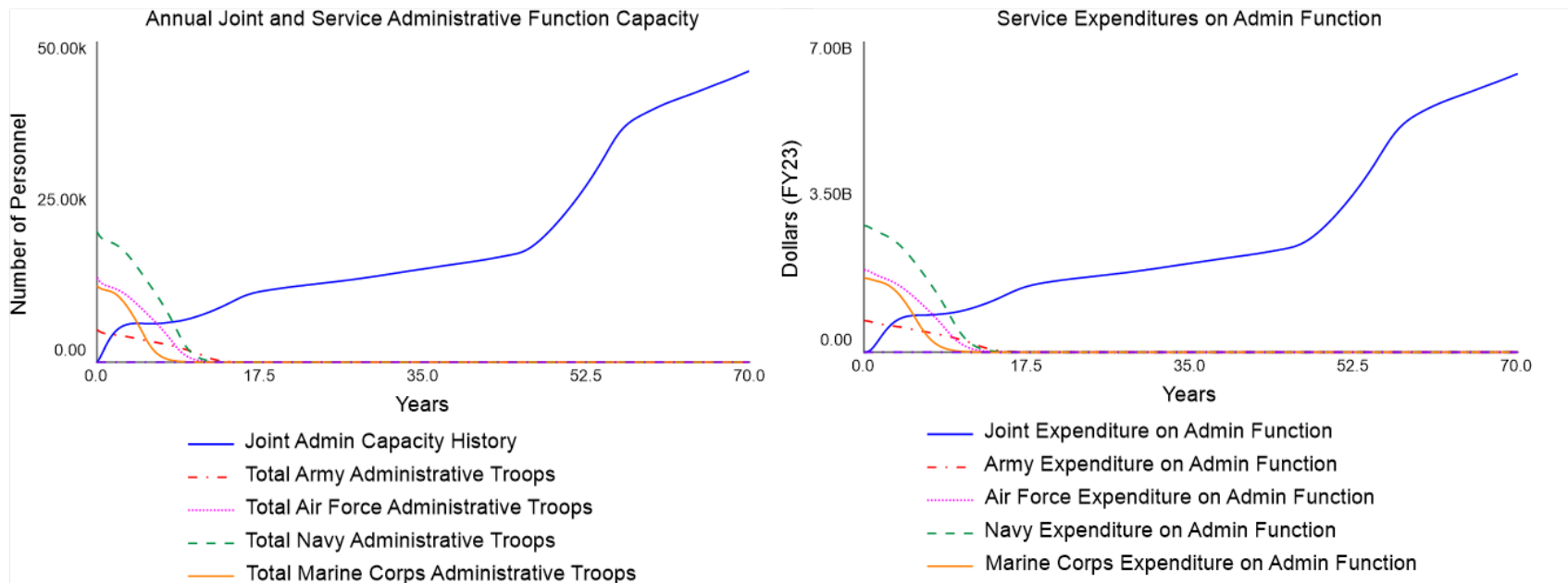


Figure 94. Condition 3 Annual Inherently Joint Administrative Function Capacity and Expenditure.²⁹⁴

²⁹⁴ Source: Skogsberg-Karnowski.

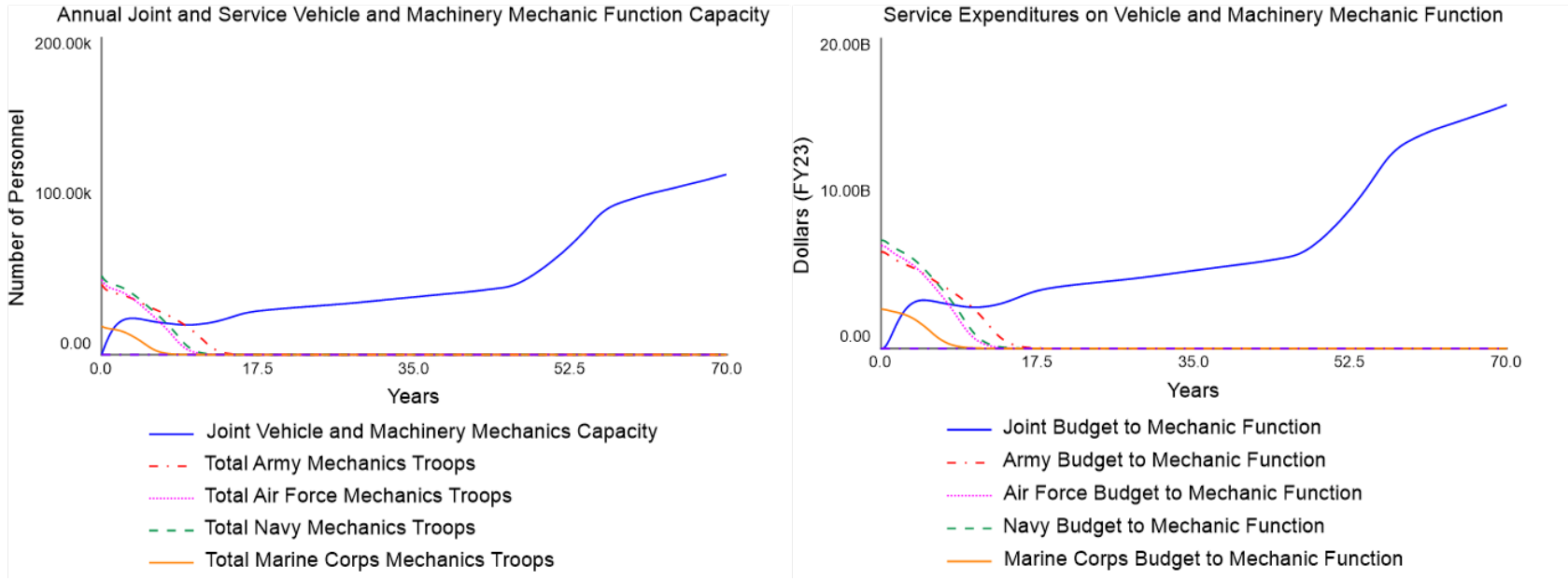


Figure 95. Condition 3 Annual Inherently Joint Vehicle and Machinery Mechanic Function Capacity and Expenditure.²⁹⁵

²⁹⁵ Source: Skogsberg-Karnowski.

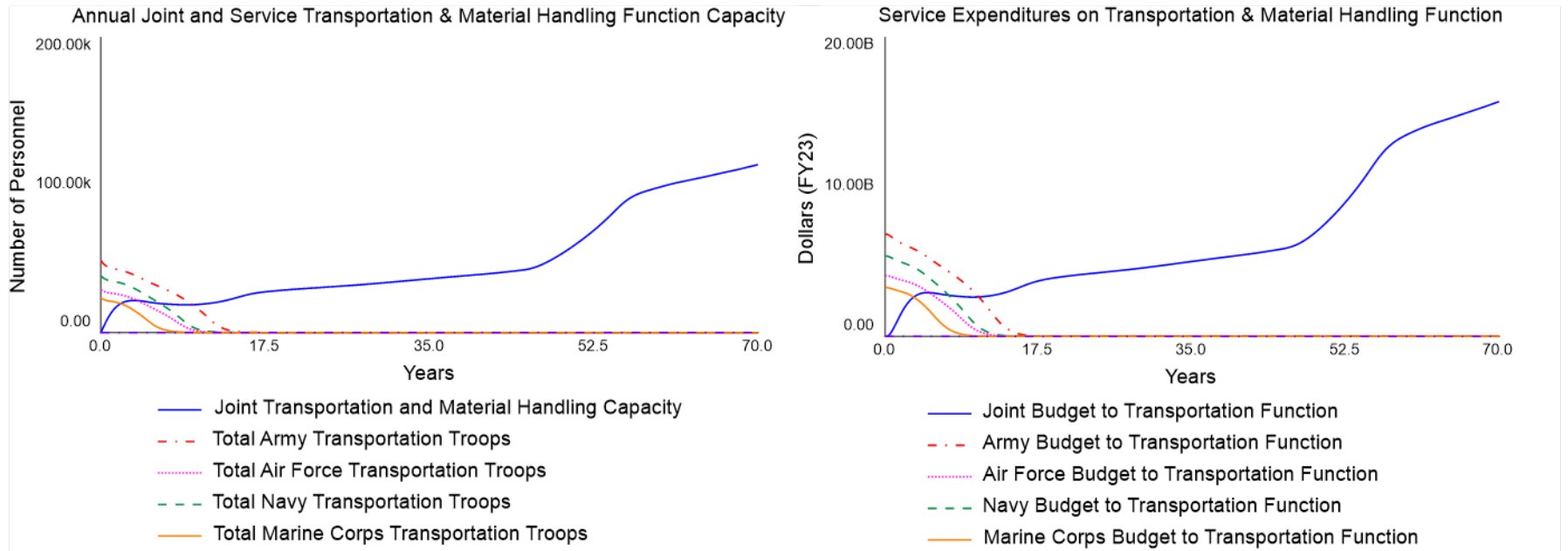


Figure 96. Condition 3 Annual Inherently Joint Transportation and Material Function Capacity and Expenditure.²⁹⁶

²⁹⁶ Source: Skogsberg-Karnowski.

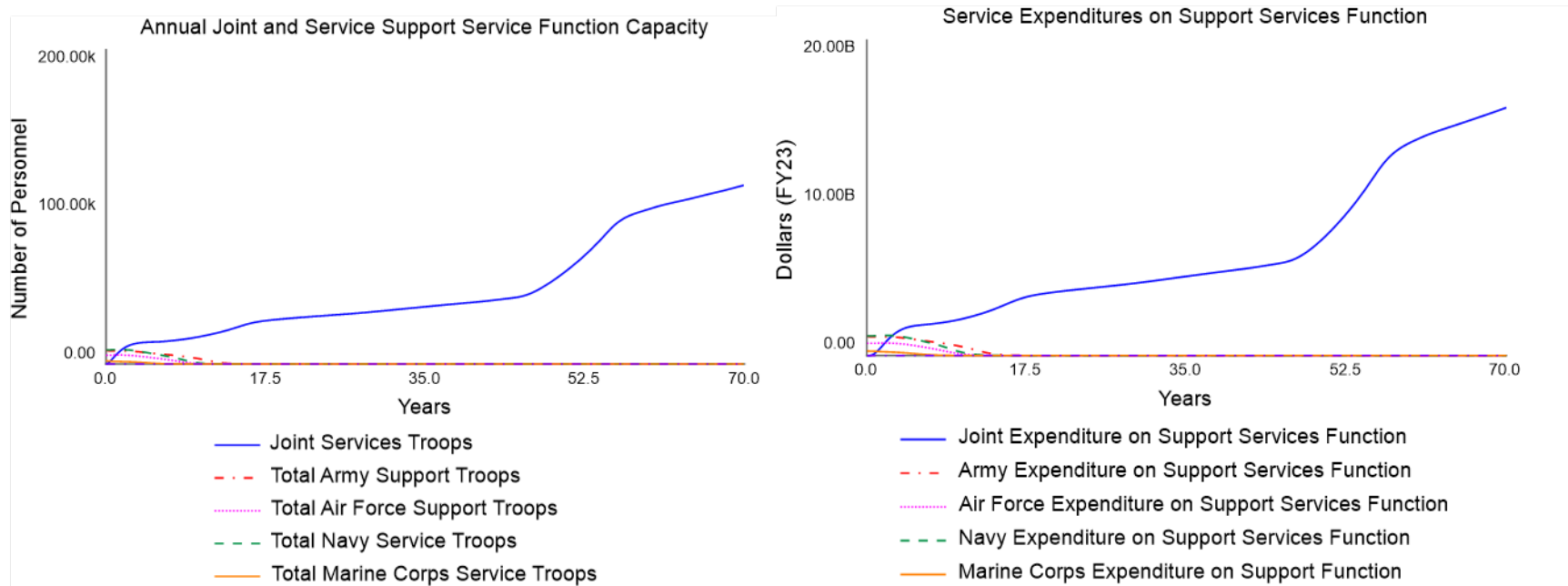


Figure 97. Condition 3 Annual Inherently Joint Support Service Function Capacity and Expenditure.²⁹⁷

²⁹⁷ Source: Skogsberg-Karnowski.

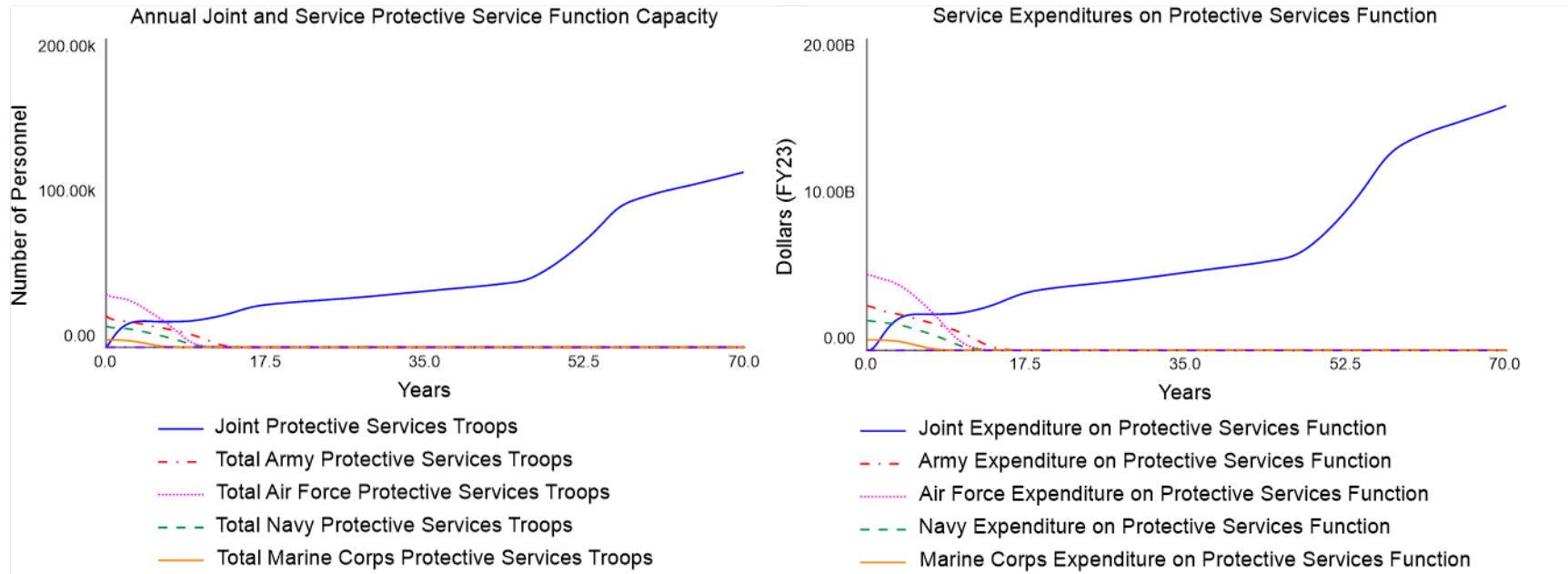


Figure 98. Condition 3 Annual Inherently Joint Protective Service Function Capacity and Expenditure.²⁹⁸

²⁹⁸ Source: Skogsberg-Karnowski.

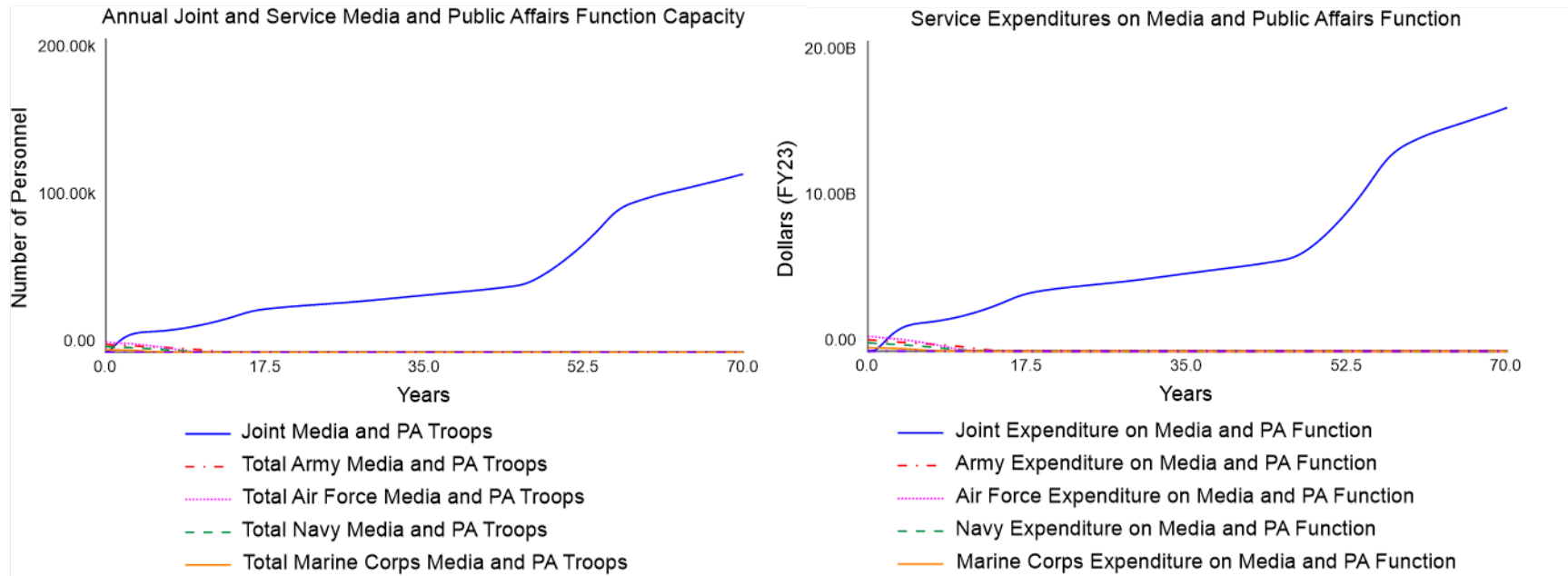


Figure 99. Condition 3 Annual Inherently Joint Media and Public Affairs Function Capacity and Expenditure.²⁹⁹

²⁹⁹ Source: Skogsberg-Karnowski.

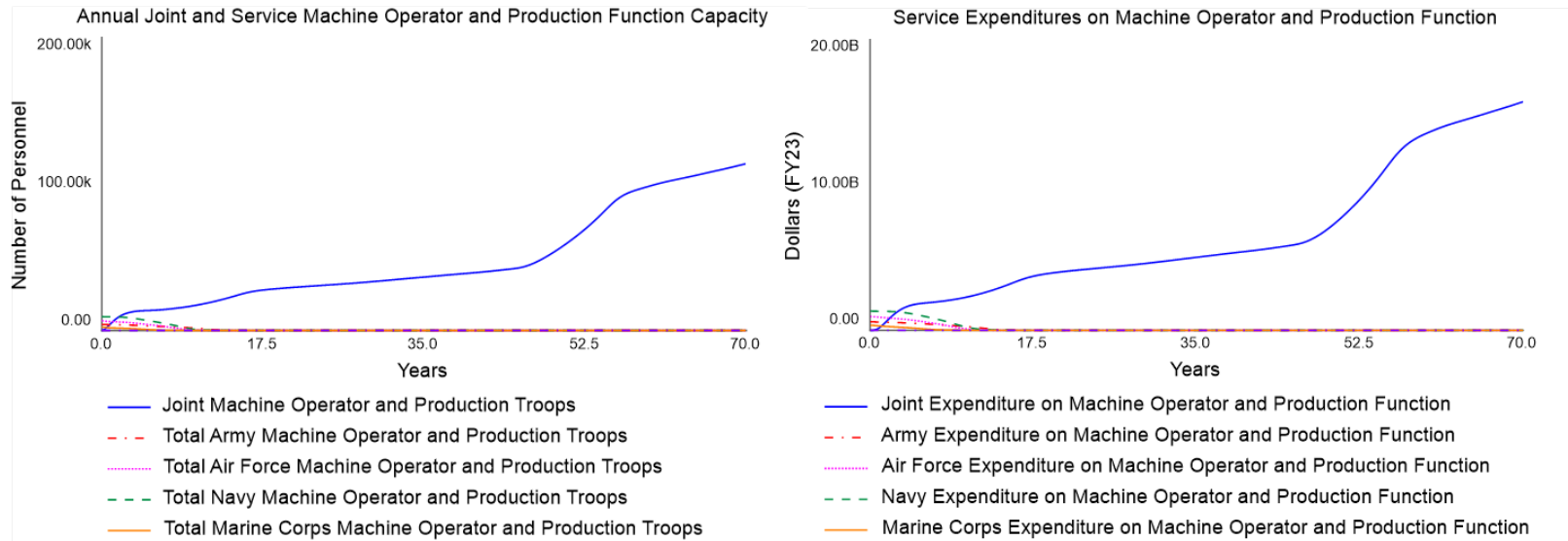


Figure 100. Condition 3 Annual Inherently Joint Machine Operator and Production Function Capacity and Expenditure.³⁰⁰

³⁰⁰ Source: Skogsberg-Karnowski.

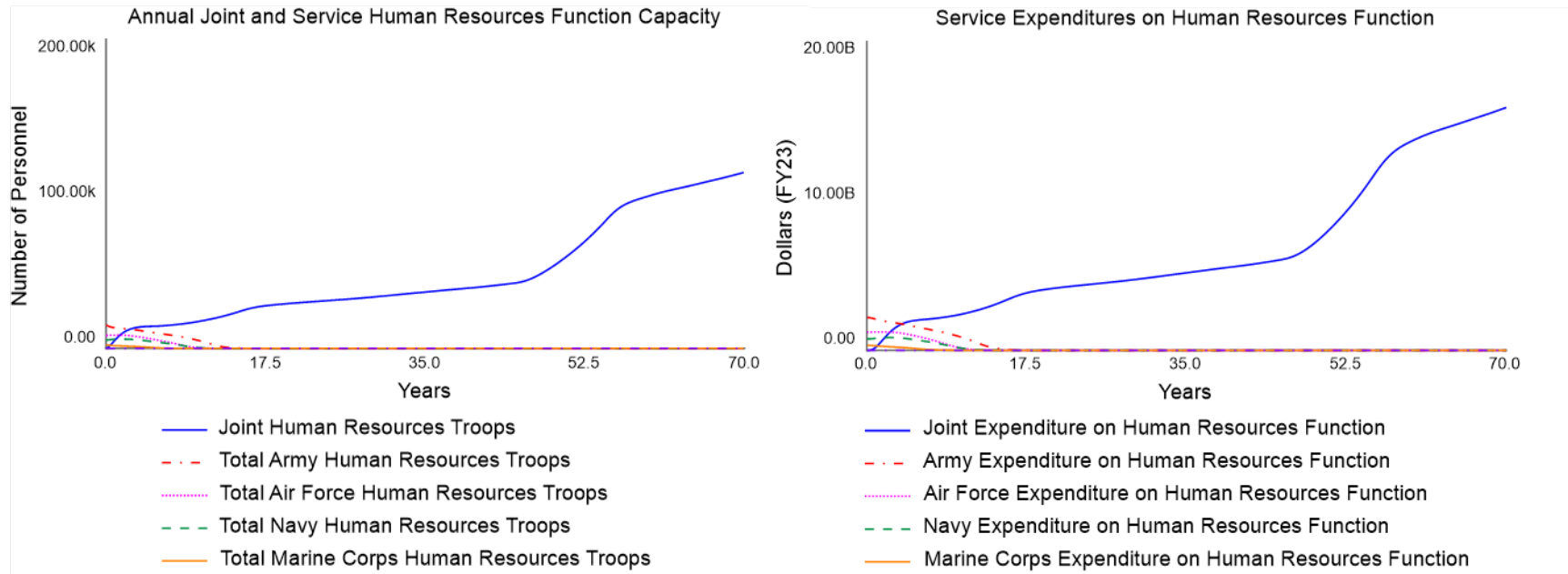


Figure 101. Condition 3 Annual Inherently Joint Human Resources Function Capacity and Expenditure.³⁰¹

³⁰¹ Source: Skogsberg-Karnowski.

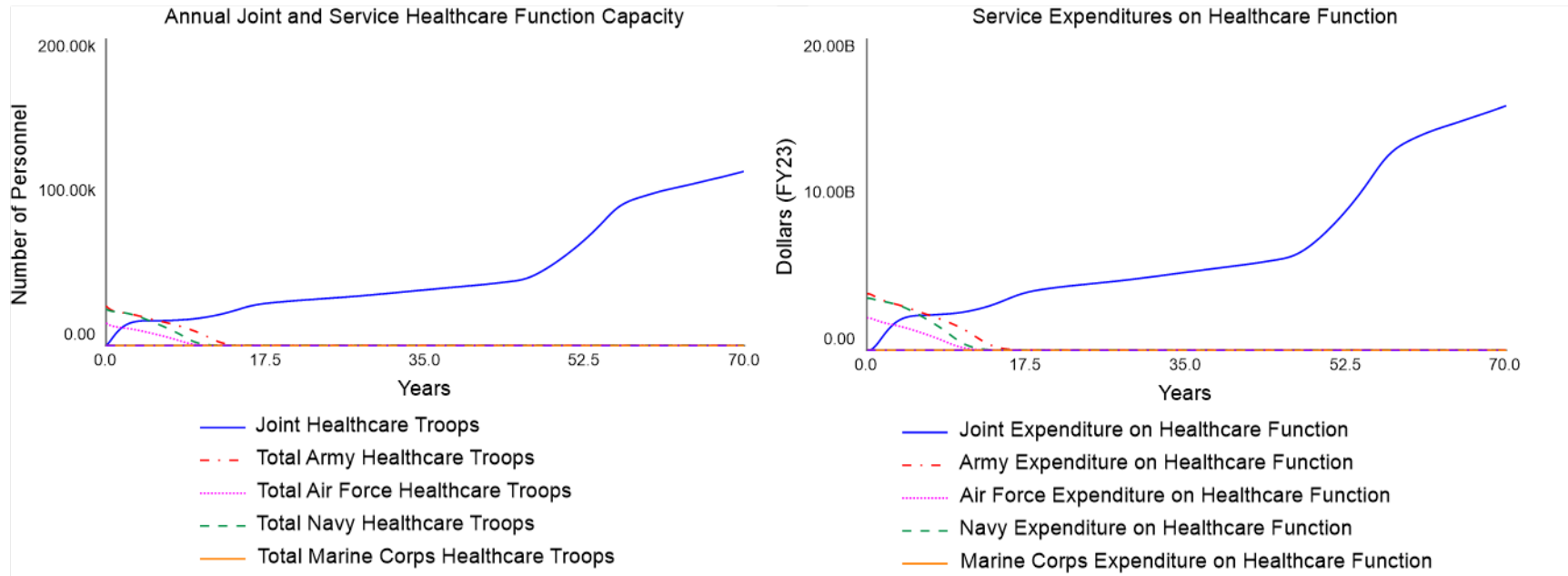


Figure 102. Condition 3 Annual Inherently Joint Healthcare Function Capacity and Expenditure.³⁰²

³⁰² Source: Skogsberg-Karnowski.

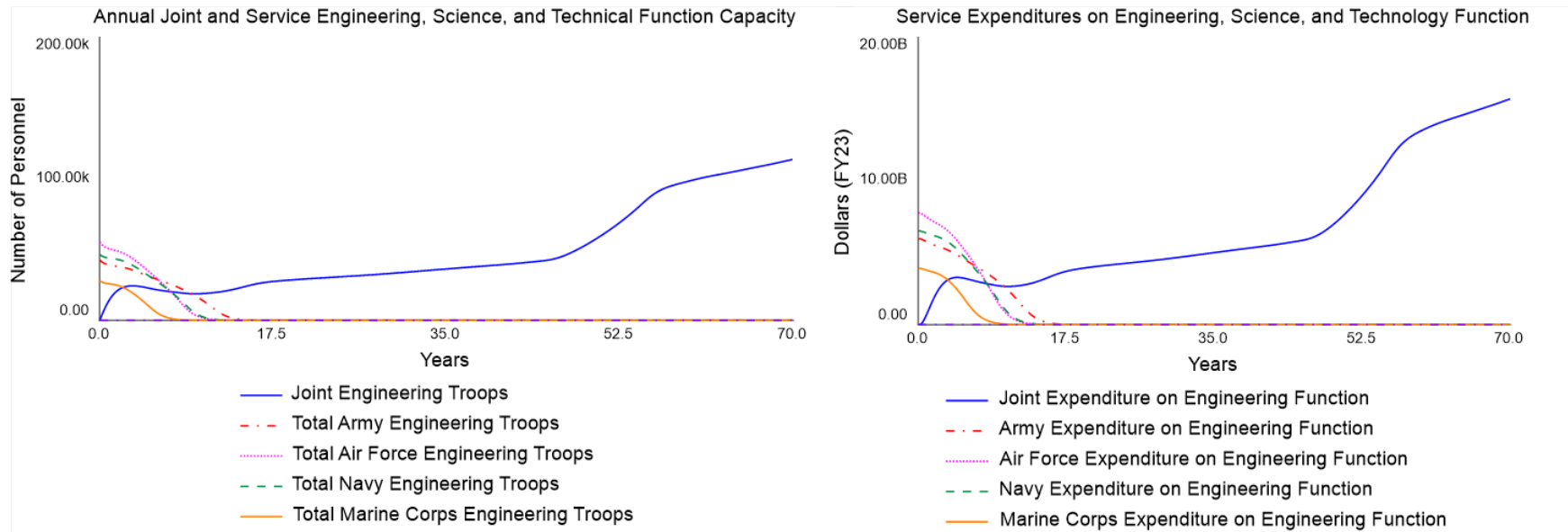


Figure 103. Condition 3 Annual Inherently Joint Engineering, Science, and Technical Function Capacity and Expenditure.³⁰³

³⁰³ Source: Skogsberg-Karnowski.

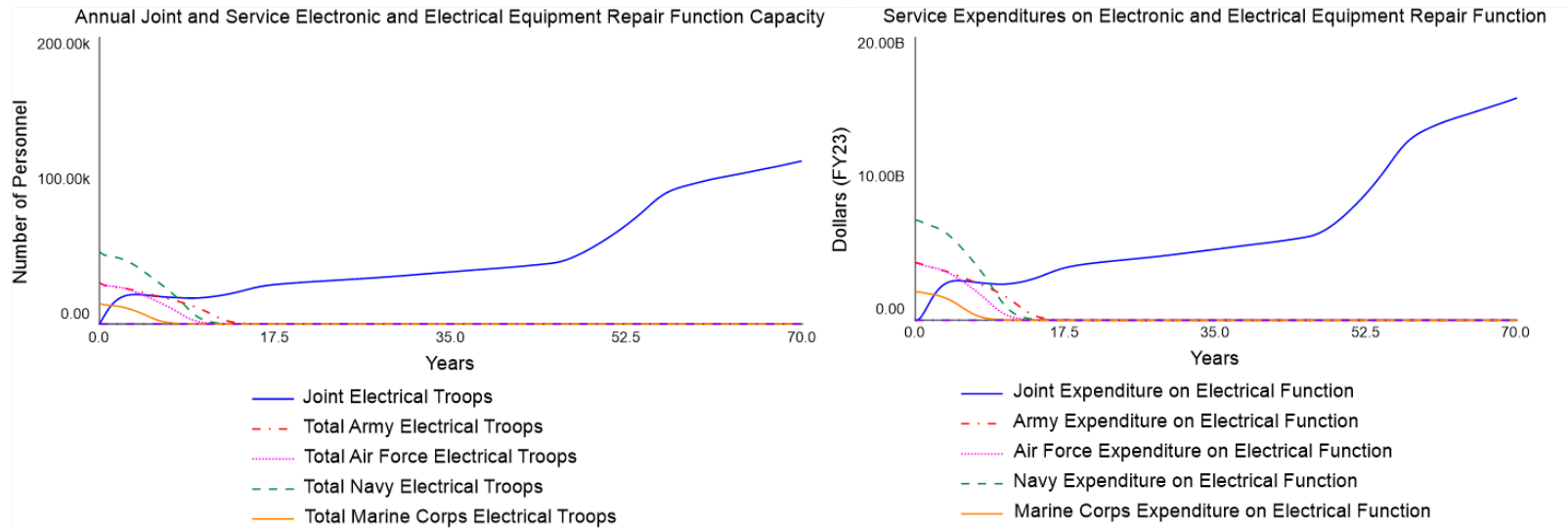


Figure 104. Condition 3 Annual Inherently Joint Electronic and Electrical Equipment Repair Function Capacity and Expenditure.³⁰⁴

³⁰⁴ Source: Skogsberg-Karnowski.

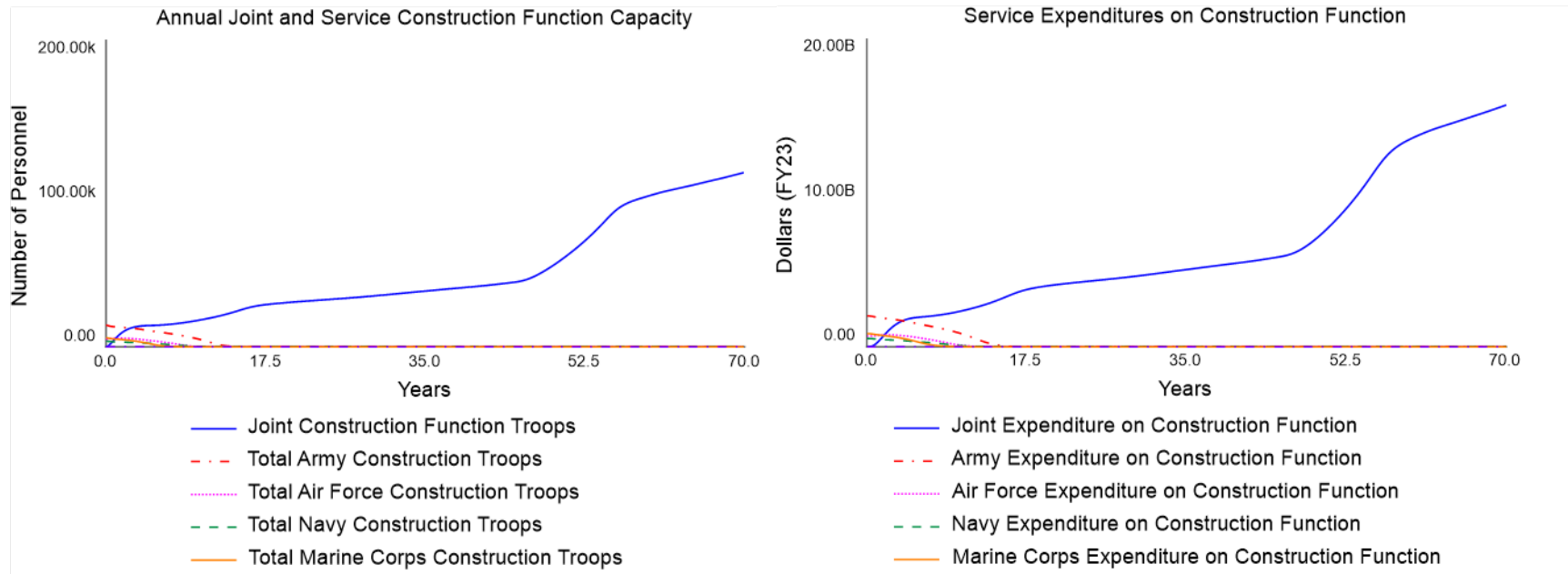


Figure 105. Condition 3 Annual Inherently Joint Construction Function Capacity and Expenditure.³⁰⁵

³⁰⁵ Source: Skogsberg-Karnowski.

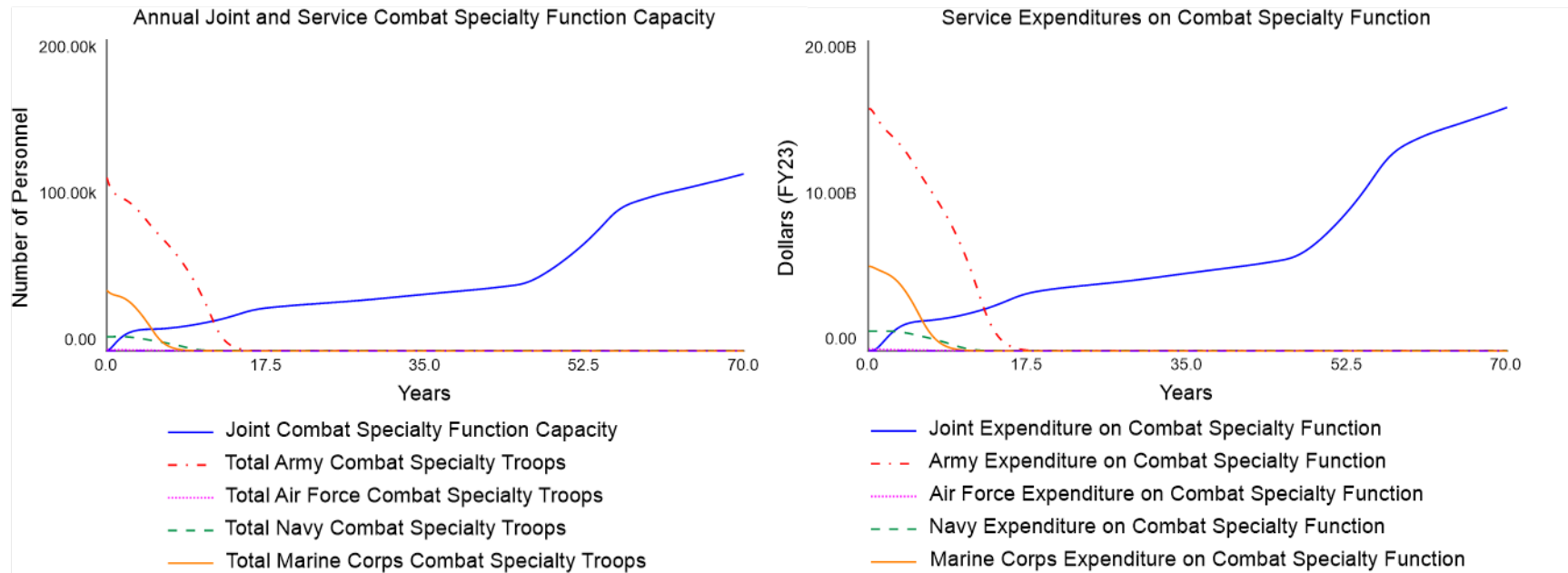


Figure 106. Condition 3 Annual Inherently Joint Combat Specialty Function Capacity and Expenditure.³⁰⁶

³⁰⁶ Source: Skogsberg-Karnowski.

4. Tier 2 Capability Capacity

Figure 107 depicts a simplified Tier 2 Capability, “Joint Capability for Long Range Precision Fires,” which requires Contributors (Targeteers, Intelligence Analysts, Approval Authorities, ATC, and Gunners/Shooters) to provide an Inherently Joint Capability. Under Condition 3 parameters, a significantly reduced number of personnel are required to support the Combatant Commander’s capability capacity requirement due to the overall smaller force structure. Assuming the Inherently Joint Force requires a 10% reduction in what the individual Services would have provided towards the Joint Capacity, at the 70-year mark the Inherently Joint Force requires approximately one-fifth the amount of personnel the larger Service-centric force requires due to non-linear interactions over time.

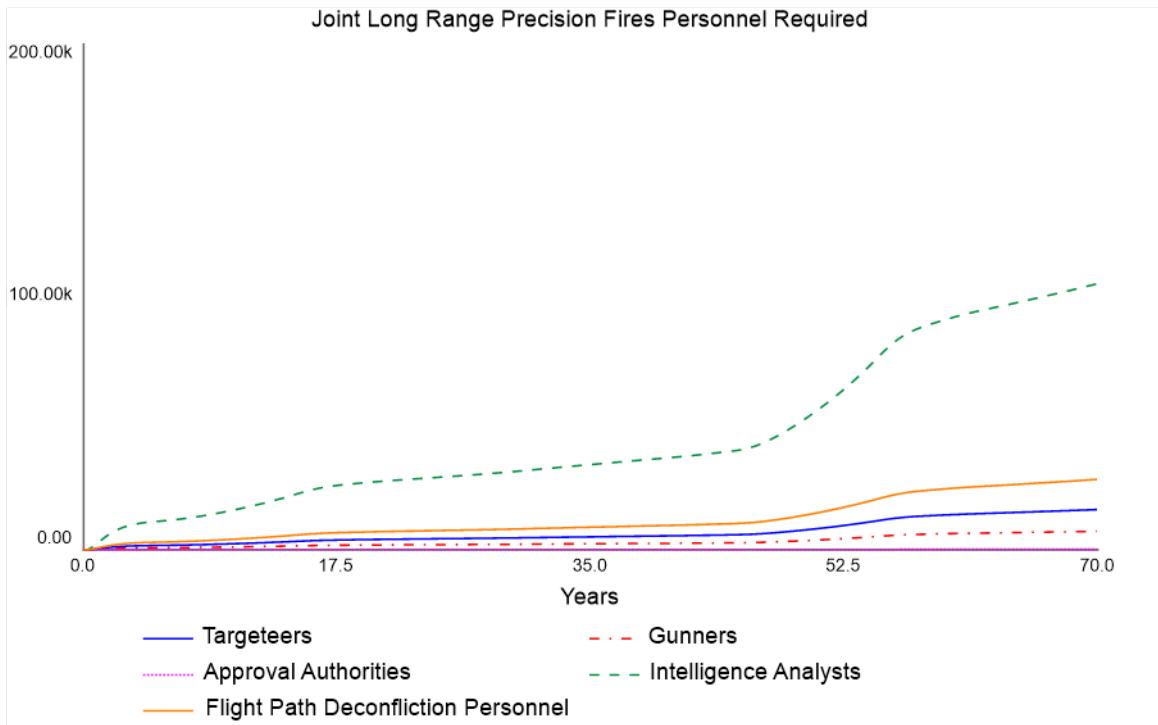


Figure 107. Condition 3 Annual Joint Capability for Long Range Precision Fires Personnel Requirements by Contributor Function.³⁰⁷

³⁰⁷ Source: Skogsberg-Karnowski.

D. ANALYSIS CONCLUSIONS

Systems dynamics modeling revealed a non-linear relationship for both manpower and budget requirements over time, emphasizing changes in force structure implemented in the short-term yield significant savings in budget and manpower over the long-term. This non-linear effect is magnified during periods of simulated armed conflict, where large increases in combat-related funding typically occur.

Assuming the U.S. enters two wars over the next 70-year period, this research found:

1. Adopting a Functionally Aligned, Service-agnostic force structure with a modest 10% reduction in overhead prior to the first war could potentially save a total of \$24.35 trillion USD in FY23 money after the second war, or an average of \$347.88 billion USD annually. Cost-savings are realized at an increasingly greater magnitude as time progresses.
2. This realignment and 10% reduction in manpower might decrease the need for a projected 13-million active duty force size across all Services at the drawdown from the second war to a forecasted 1.3 million-personnel Service-agnostic and Inherently Joint Force at the same time period. Manpower savings are realized at an increasingly greater magnitude as time progresses. As an example, a simplified simulation of the Joint Capability for Long Range Precision Fires personnel requirement results in a decrease to one-fifth of the required Service-based personnel when forces are converted to an Inherently Joint force structure over the entirety of the modeled timeline.

This research also identified the following trends:

3. There is a strong link between the percent of gross domestic product (GDP) growth, Total DOD Budget, and Total Force Size. Changes in economic conditions have a downstream effect on defense spending, and changes to force structure affect budget requirements upstream.

4. As each Service's active duty force size increases, so too does the expense of executing assigned Functions. Furthermore, as the Joint Force operating in support of Combatant Commands only requires a limited percentage of the total Service-based capacity, the Joint expenditure on the function is significantly smaller. Since the U.S. military presents its combat forces in a Service-supplied Joint construct via the Combatant Commands, there may be unrealized savings by maintaining redundant Service capabilities outside what the Combatant Commands are employing.
5. Budget requirements experience non-linear growth over time. This effect is magnified during periods of war when the U.S. typically allocates higher funding towards combat operations. Therefore, the monetary expenses of waging a second war are far higher than the first over time.
6. Manpower requirements experience non-linear growth over time. This effect is magnified during periods of war when the U.S. typically grows its force size. Therefore, the manpower requirements of waging a second war are far higher than the first over time.
7. Non-linear increases in both budget and manpower requirements forecasted across multiple periods of conflict illustrate a short-term conflict, estimated to begin five years from now as perhaps speculated with the PRC, inflicts a monetary and personnel cost that may be unsustainable or intolerable when effects are forecasted into the "next war."

VI. ACKNOWLEDGEMENT OF COUNTERARGUMENTS

Of the three Strategic Options presented in Chapter III, this research analyzed the most aggressive reorganization of the Department of Defense. This admittedly invites a host of counterarguments. A few are addressed in short form below.

1. Congressional Budget Office’s Interactive Force Structure Tool. The Congressional Budget Office maintains a database and associated tool to “show the change in total [DOD] funding and personnel needed for a particular force, or to show the change in total [DOD] forces and personnel associated with a particular budget target,” organized by major combat units.³⁰⁸ This tool lacks the capability to redesign a force structure into a new organization such as an Inherently Joint Force.
2. Implementation Timeline. A DOD restructuring of this magnitude is expected to take between 7–22 years, and is admittedly a herculean effort. However, historical precedence suggests the U.S. will enter two wars in the next 70 years, and as the simulations show, the cost of waging the second war far outweigh the first. In the simulation, the expected “peacetime period” between wars, when the U.S. historically conducts its major DOD structural reforms, begins at year 16 and lasts through year 45. The DOD could realistically be reorganized into a Functionally Aligned Service-Agnostic force prior to the second war.
3. Friction and Failure During Transition. Most organizations expectedly experience friction and a short-term decrease in performance while reorganizing. To mitigate the negative effects of reorganization, it is suggested the DOD reorganize in a phased approach, where Tier 1 Functions reorganize first and then apply lessons learned to more complex Tier 2 Capabilities.

³⁰⁸ Congressional Budget Office, “CBO’s Interactive Force Structure Tool,” Congressional Budget Office,” accessed May 22, 2023, <https://www.cbo.gov/force-structure-tool>.

4. Institutional Inertia and the Power of the Services. The Services are the most powerful entities in the DOD, and will advocate for institutional preservation.³⁰⁹ This is acknowledged as a significant hurdle in garnering support for structure reform away from a Service-centric model. However, this staunch institutional inertia is also one of the strongest examples of how Service culture is hindering advancement. The military has repeatedly exhibited slow progress in implementing changes due to Service culture and traditions, especially when the change creates a new military Service or devalues currently dominant military systems.³¹⁰ The Functionally Aligned Service-Agnostic approach fundamentally challenges organizational assumptions that domain dominance is the most effective and efficient DOD alignment.
5. Services Have Desirable Qualities. This research does not assert there are no good qualities associated with a traditional Service culture. It is suggested that heritage, expertise, lessons learned, and proven tactics, techniques and procedures could be integrated from Service personnel and Functions into their new Inherently Joint Functional alignment. This process already occurs as old capabilities are retired and new technology and processes replace them.

³⁰⁹ Zimmerman et al., *Movement and Maneuver*, 184; Locher, “Has It Worked,” 54.

³¹⁰ Mahnken and FitzSimonds, “Revolutionary Ambivalence,” 113.

VII. RECOMMENDATIONS FOR FUTURE RESEARCH

Based on these findings, systems dynamics modeling should continue investigating potential means and benefits associated with implementing a Functionally Aligned Service-Agnostic U.S. Military force structure. Specifically, the following additional modeling is recommended:

1. Incorporate DELAYS in modeling. Historical evidence suggests a strong correlation between percent GDP changes and percent total GDP allocated to the Defense Budget, but a lagging indicator is usually present between the two. Therefore, DELAYS should be incorporated between percent GDP changes and percent total GDP allocation to the Defense Budget for a duration of one year.
2. There are several places across modules where the Services are assumed to contribute the same percentage of their force size to a Joint Function or Joint Capability. This assumption should be updated with representative numbers from the Combatant Commands' current requirements.
3. The Average Annual Cost per Servicemember variable does not provide feedback to the DOD Budget with the "Start Conversion from Services to Joint Force" SWITCH set to OFF. This should be rectified to better estimate the impact of increasing personnel costs in all simulation conditions.
4. More robust modeling of complex Joint Capabilities like the "Joint Capability for Long Range Precision Fires" module is needed, including the complete range of job specialties from each of the Services as well as the means for analyzing associated expenditures. Suggested Joint Capabilities include Special Operations and Joint Forcible Entry Operations.

5. Materiel requirements should be incorporated into future iterations of this model. Ideally, every Function and Capability should be modeled with four total variables: time, money, personnel, and materiel requirements.
6. Include Total Force and all Services in future iterations. This model was bounded to the active duty forces of four Services. The National Guard, Reserve Command, Space Force, Coast Guard and government service employees and contractors contribute significant capability, and associated costs, and were not accounted for in this research.
7. Model the Combatant Command's employment of Joint Capability and the interactions between the Services and the Combatant Commanders.
8. Three Strategic Approaches to addressing redundancies and inefficiencies were introduced in Chapter III (Domain Alignment, Functional Alignment, and a Hybrid). This model could be modified to simulate the Hybrid approach and realign only those capabilities with high commonality among each Service.
9. This research assumes an Inherently Joint Force will continue to be employed via the existing Combatant Command Joint structure. An alternative avenue could be introduced to analyze the potential benefits of restructuring the Combatant Commands and how they use forces provided by the Services.

VIII. CONCLUDING THOUGHTS

While work remains in future iterations of this Functionally Aligned Service-Agnostic U.S. Military stock and flow model, initial results suggest realigning the Department of Defense towards an Inherently Joint Force provides significant budget and manpower savings over time due to non-linear relationships in system behavior. Potential savings are magnified when simulated over multiple periods of conflict. The short-term budgetary and manpower costs of a war started in the next five years, perhaps as speculated with the PRC, inflicts a monetary and personnel cost which may be unsustainable or intolerable when effects are forecasted into the “next war” while still operating with the current DOD force structure. Systems dynamics modeling, and the results from this research, are valuable decision support tools to aid senior leaders in analyzing potential courses of action to restructure the DOD in a way commensurate with deterring and defeating future threats while facing significant budgetary constraints.

Narrowing military capability gaps between the United States and the PRC, the expense of high-end technology to maintain or regain military superiority and credible deterrence, and extended programmatic development timelines all contribute to the urgent need to reduce redundancies and increase efficiencies within the DOD. The DOD is not evolving fast enough to meet current and future threats, and the force structure is a significant hindrance.³¹¹ Therefore, the DOD must heavily scrutinize its Service-centric model which supports and encourages resource guarding and institutional inertia—two major contributors to redundancies and inefficiencies. Beyond cost-savings, a Functionally Aligned, Service-agnostic force structure has the potential to overcome common resource guarding tendencies, upset the institutional inertia stymying rapid, significant reform, and organize a more streamlined, lethal force better able to compete in the new strategic

³¹¹ David Vergun, “DOD Must Field Capabilities Faster, Hicks Says,” *DOD News*, August 31, 2022, <https://www.defense.gov/News/News-Stories/Article/Article/3146087/dod-must-field-capabilities-faster-hicks-says/>.

landscape. Strategic competitors are closing the gap with the U.S.³¹² As “we cannot continue to mortgage our future by being wedded to the technology of the past,” the DOD should not be wedded to a service-centric joint force construct as it devises competitive plans and strategies to maintain a superior standing in the world arena.³¹³

³¹² Jim Garamone, “Military Must Continue Progress to Deter Competitors,” *DOD News*, September 11, 2020, <https://www.defense.gov/News/News-Stories/Article/Article/2345179/military-must-continue-progress-to-deter-competitors/#:~:text=The%20U.S.%20military%20has%20seen,Deputy%20Defense%20Secretary%20David%20L>.

³¹³ Milley, testimony on *FY23 Department of Defense Budget Hearing I*, 7.

APPENDIX A: DATA SOURCES

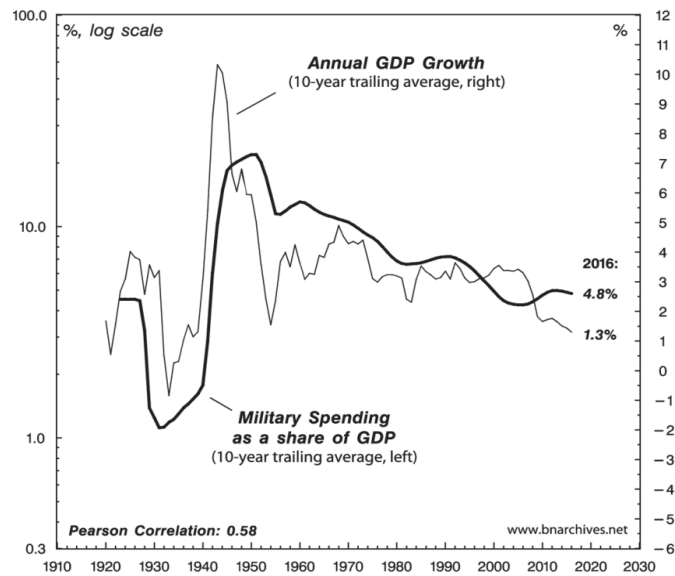


Figure 108. Historical Military Spending as a Share of GDP.³¹⁴

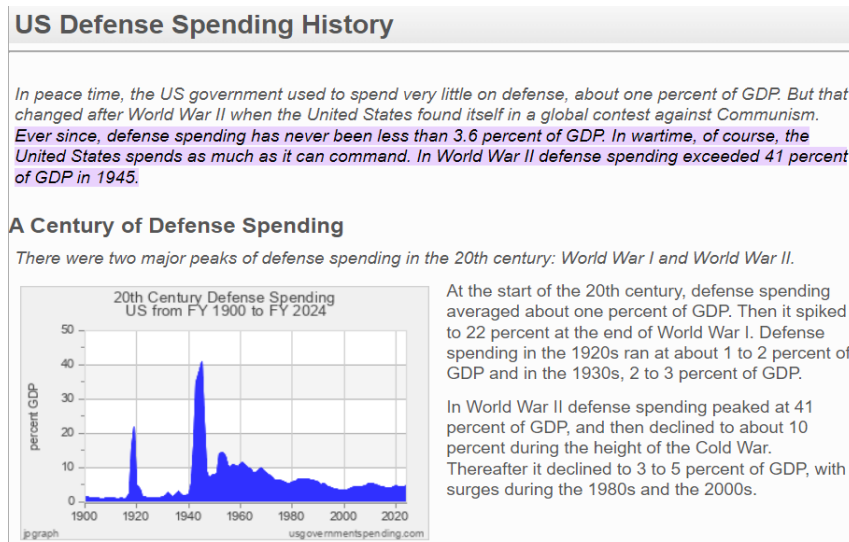


Figure 109. Historical Defense Spending as Percent GDP.³¹⁵

³¹⁴ Source: Shimshon Bichler and Jonathan Nitzan, “Arms and Oil in the Middle East: A Biography of Research,” *Rethinking Marxism* 30, no. 3 (July 3, 2018): 428, <https://doi.org/10.1080/08935696.2018.1534436>.

³¹⁵ Source: U.S. Government Spending, “US Government Defense Spending History with Charts.”

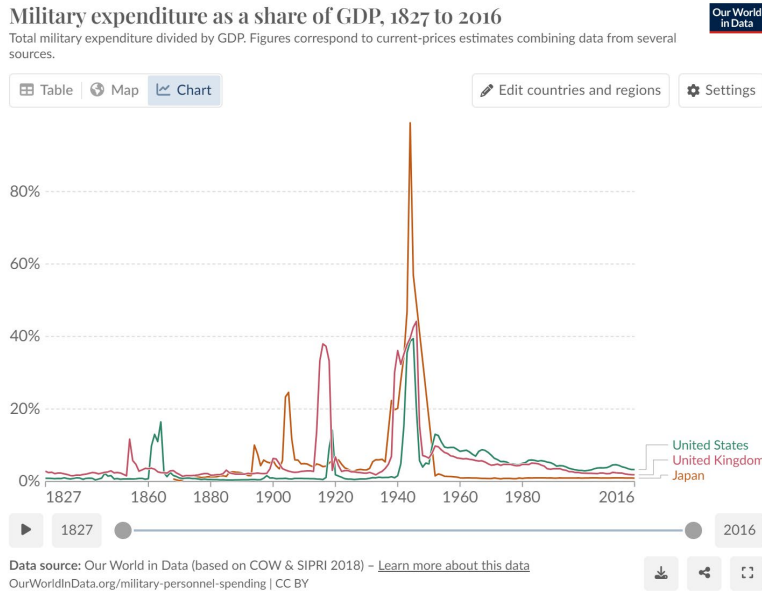


Figure 110. Military Expenditure as a Share of GDP, 1827–2016.³¹⁶

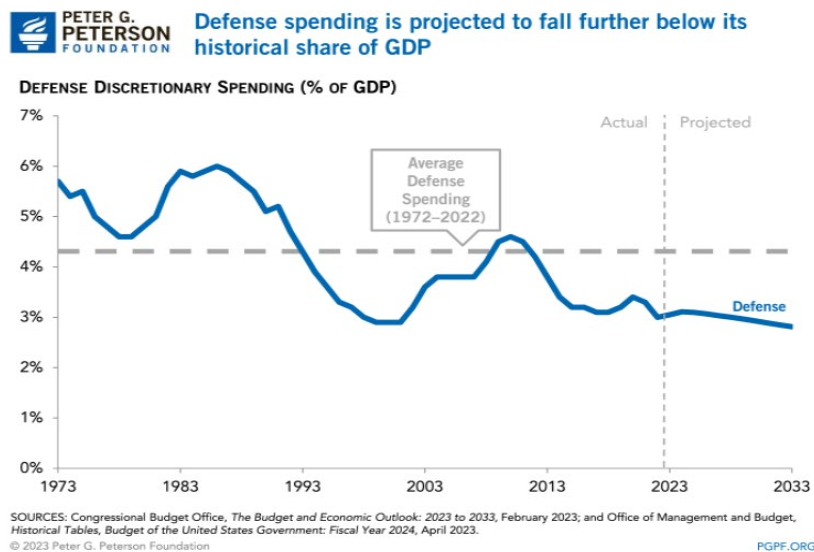


Figure 111. Projection of Defense Spending as a Percentage of GDP.³¹⁷

³¹⁶ Source: Esteban Ortiz-Ospina, “Long-Run Trends in Military Spending and Personnel: Four Key Facts from New Data,” Our World in Data, April 22, 2018, <https://ourworldindata.org/military-long-run-spending-perspective>.

³¹⁷ Source: Peter G. Peterson Foundation, “The United States Spends More on Defense than the Next 10 Countries Combined.”

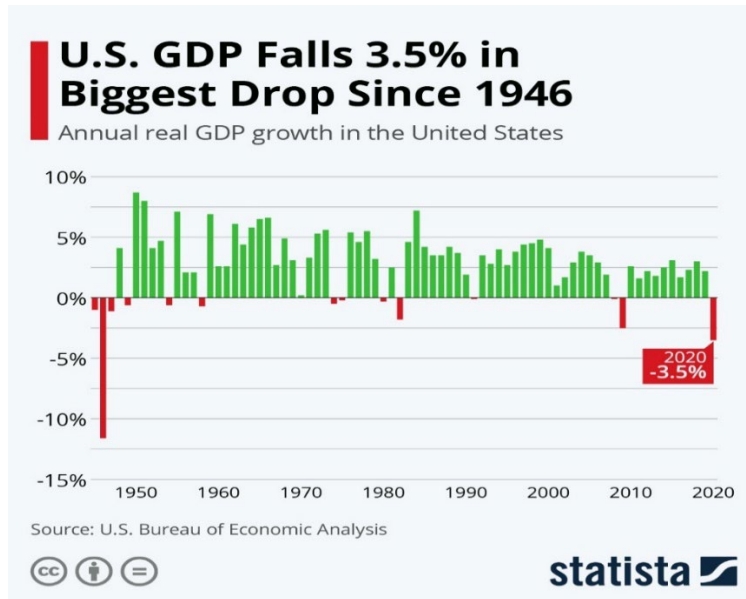


Figure 112. U.S. GDP Historical Trend.³¹⁸

Budget plan of the United States armed forces for the fiscal year of 2023, by military department and appropriation title
(in million U.S. dollars)

Appropriation title	Department of the Navy	Department of the Army	Department of the Air Force	Defense Wide
Military personnel	58,484	69,073	46,326	0
Operation and maintenance	77,705	70,241	73,096	87,845
Procurement	63,458	22,344	51,704	5,905
Research and development	24,079	13,710	59,954	32,355
Military construction	3,889	1,310	2,368	2,630
Family housing	706	606	588	57
Revolving funds	-	30	80	1,313
Total	230,848	177,315	234,116	130,104

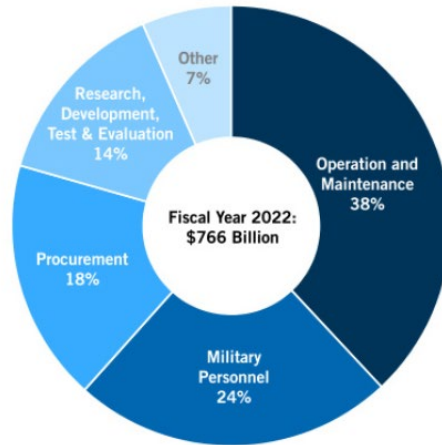
Showing entries 1 to 8 (8 entries in total)

Figure 113. Budget Plan by Department and Appropriations Title FY23.³¹⁹

³¹⁸ Source: Felix Richter, “Infographic: U.S. GDP Falls 3.5% in Biggest Drop Since 1946,” Statista Daily Data, January 29, 2021, <https://www.statista.com/chart/24056/annual-real-gdp-growth-in-the-united-states>.

³¹⁹ Source: “Budget Plan of the U.S. Armed Forces by Department and Appropriation FY2023,” Statista, n.d., <https://www.statista.com/statistics/239280/budget-plan-of-the-us-armed-forces-by-department-and-appropriation/>.

Defense spending covers a wide range of activities



SOURCE: Office of Management and Budget, *Public Budget Database, Budget of the United States Government: Fiscal Year 2024*, March 2023.
NOTES: Numbers may not sum to 100 percent due to rounding. The data presented above are for mandatory and discretionary defense spending. All Other Defense Spending includes military construction; family housing; atomic energy defense activities; defense-related activities; and other smaller miscellaneous outlays.
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Figure 114. FY24 Defense Spending Activities.³²⁰

³²⁰ Source: Peter G. Peterson Foundation, “The United States Spends More on Defense than the Next 10 Countries Combined.”

APPENDIX B: JOINT FUNCTIONS

Table 29. Active Duty Enlisted Personnel by Occupational Group and Branch CY22.³²¹

Enlisted	Army	Air Force	Space Force	Coast Guard	Marine Corps	Navy	Total enlisted personnel in each occupational group
Occupational group							
Administrative	5,073	13,253	—	—	11,933	20,393	50,652
Combat Specialty	111,710	911	—	—	39,021	9,155	160,797
Construction	14,353	4,991	—	—	6,119	3,849	29,312
Electronic and Electrical Equipment Repair	28,934	28,552	4	—	14,333	50,455	122,278
Engineering, Science, and Technical	42,788	55,595	124	—	28,067	46,653	173,227
Healthcare	25,960	14,881	1	—	—	23,932	64,774
Human Resource Development	15,174	8,426	9	—	2,328	5,308	31,245
Machine Operator and Production	4,153	6,695	—	—	2,399	9,402	22,649
Media and Public Affairs	5,345	6,769	—	—	1,597	3,804	17,515
Protective Service	20,382	34,700	—	—	4,872	13,686	73,640
Support Service	8,574	5,553	—	—	2,058	8,861	25,046
Transportation and Material Handling	48,865	29,098	—	—	23,428	38,445	136,836
Vehicle and Machinery Mechanic	44,481	47,360	2	—	18,042	49,821	159,706
Non-occupation or unspecified coded personnel	650	5,161	2,733	—	0	932	9,476
Total enlisted personnel for each military branch and Coast Guard	373,442	261,945	2,873	31,560	154,197	284,696	1,077,153

SOURCE: U.S. Department of Defense, Defense Manpower Data Center

Table 30. Active Duty Officer Personnel by Occupational Group and Branch CY22.³²²

Officer	Army	Air Force	Space Force	Coast Guard	Marine Corps	Navy	Total officer personnel in each occupational group
Occupational group							
Combat Specialty	22,081	3,692	45	—	4,643	6,303	36,764
Engineering, Science, and Technical	24,750	13,773	2,653	—	5,113	11,315	57,604
Executive, Administrative, and Managerial	13,601	6,942	757	—	2,684	6,732	30,716
Healthcare	10,828	9,333	—	—	none	7,690	27,851
Human Resource Development	3,104	1,665	—	—	812	3,436	9,029
Media and Public Affairs	341	353	—	—	335	259	1,288
Protective Service	3,273	1,104	—	—	385	1,232	5,994
Support Service	1,749	828	—	—	39	1,040	3,656
Transportation	10,576	23,032	21	—	7,085	10,079	50,793
Non-occupation or unspecified coded personnel	2,427	221	8	—	966	7,608	11,230
Total officer personnel for each military branch and Coast Guard	92,730	60,943	3,496	8,648	22,062	55,694	234,925

SOURCE: U.S. Department of Defense, Defense Manpower Data Center

³²¹ Source: U.S. Bureau of Labor Statistics, “Military Careers.”

³²² Source: U.S. Bureau of Labor Statistics.

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LIST OF REFERENCES

- Adamsky, Dima. *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the U.S., and Israel*. Redwood City: Stanford University Press, 2010.
- Aksom, Herman. “A Theory of Institutional Inertia – Organizational Change and Practice Variation.” Master’s thesis, University of Jyväskylä, Finland, 2021.
https://www.researchgate.net/publication/351774271_A_theory_of_institutional_inertia_I_Organizational_change_and_practice_variation.
- Bichler, Shimshon, and Jonathan Nitzan. “Arms and Oil in the Middle East: A Biography of Research.” *Rethinking Marxism* 30, no. 3 (July 3, 2018): 418–40.
<https://doi.org/10.1080/08935696.2018.1534436>.
- Builder, Carl H. *The Masks of War: American Military Styles in Strategy and Analysis*. Santa Monica, CA: RAND, 1989.
- Congressional Budget Office. “CBO’s Interactive Force Structure Tool.” Congressional Budget Office. <https://www.cbo.gov/force-structure-tool>.
- Congressional Budget Office. *The U.S. Military’s Force Structure: A Primer, 2021 Update*. Washington, DC: Congressional Budget Office, 2021.
- Cote, Catherine. “Growth Mindset vs. Fixed Mindset: What’s the Difference?” *Harvard Business School Online: Business Insights* (blog), March 10, 2022.
<https://online.hbs.edu/blog/post/growth-mindset-vs-fixed-mindset>.
- Cronk, Terri M. “DOD Innovation Speed Must Increase to Modernize.” *DOD News*, August 7, 2020. <https://www.defense.gov/News/News-Stories/Article/Article/2305705/dod-innovation-speed-must-increase-to-modernize/>.
- Directorate for Organizational Policy and Decision Support. *Organization and Management of the Department of Defense; Resource Guide v3.2*. Washington, DC: Department of Defense, March 2019. <https://irp.fas.org/agency/dod/org-man.pdf>.
- Department of Labor. “Transition Assistance Program.” Accessed September 11, 2023.
<http://www.dol.gov/agencies/vets/programs/tap>.

- Eilon, Lindsey, and Jack Lyon. *White Paper: Evolution of Department of Defense Directive 5100.01 "Functions of the Department of Defense and Its Major Components."* Washington, DC: Office of the Secretary of Defense, 2014. <https://dml.armywarcollege.edu/wp-content/uploads/2022/12/DOD-CMO-White-Paper-Evolution-of-5100.01-2020-Update.pdf>
- FiscalData. "Fiscal Data Explains Federal Spending." Accessed November 27, 2023. <https://fiscaldata.treasury.gov/americas-finance-guide/federal-spending/>.
- Forever Wingman. "1C1X1 – Air Traffic Control AFSC." July 2021. https://foreverwingman.com/career_fields/1c1x1-air-traffic-control/.
- Forever Wingman. "1N0X1 – Operations Intelligence AFSC." July 2021. https://foreverwingman.com/career_fields/1n0x1-operations-intelligence/.
- Forever Wingman. "1N1X1 – Geospatial Intelligence (GEOINT) AFSC." Accessed November 26, 2023. https://foreverwingman.com/career_fields/1n1x1-geospatial-intelligence-geoint/.
- Forever Wingman. "2M0X1 – Missile and Space Systems Electronic Maintenance AFSC." Accessed November 26, 2023. https://foreverwingman.com/career_fields/2m0x1-missile-and-space-systems-electronic-maintenance/.
- Forever Wingman. "2M0X2 – Missile and Space Systems Maintenance AFSC." Forever Wingman, April 2021. https://foreverwingman.com/career_fields/2m0x2-missile-and-space-systems-maintenance/.
- Forever Wingman. "2M0X3 – Missile and Space Facilities AFSC." Forever Wingman, April 2021. https://foreverwingman.com/career_fields/2m0x3-missile-and-space-facilities/.
- Garamone, Jim. "Military Must Continue Progress to Deter Competitors." *DOD News*, September 11, 2020. <https://www.defense.gov/News/News-Stories/Article/Article/2345179/military-must-continue-progress-to-deter-competitors/#:~:text=The%20U.S.%20military%20has%20seen,Deputy%20Defense%20Secretary%20David%20L.>
- Grady, John. "Lawmakers Argue U.S. Must Divest Legacy Systems to Keep Up With China's Technology Growth." *USNI News* (blog), November 2, 2020. <https://news.usni.org/2020/11/02/lawmakers-argue-u-s-must-divest-legacy-systems-to-keep-up-with-chinas-technology-growth>.
- Harper, Jon. "Pentagon Personnel Costs at Historic High." *National Defense*, October 19, 2021. <https://www.nationaldefensemagazine.org/articles/2021/10/19/pentagon-personnel-costs-at-historic-high>.

- Hoehn, John R. *Joint All-Domain Command and Control*. CRS Report No. IF11493. Washington, DC: Congressional Research Service, 2022. <https://sgp.fas.org/crs/natsec/IF11493.pdf>.
- Holland, John H. "Complex Adaptive Systems." *Daedalus* 121, no. 1, (1992): 17–30. <http://www.jstor.org/stable/20025416>.
- International Crisis Group. *Competing Visions of International Order in the South China Sea*. Asia Report, no. 315. Brussels, Belgium: International Crisis Group. November 2021. <https://www.crisisgroup.org/asia/north-east-asia/china/315-competing-visions-international-order-south-china-sea>.
- ISEE Systems. "Creating a Variable Alias (Ghost)." Accessed November 20, 2023. https://www.iseesystems.com/resources/help/v2/Content/03-BuildingModels/Creating_variable_aliases.htm.
- ISEE Systems. "Data Builtins," n.d. https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Overview_Builtins.htm.
- ISEE Systems. "Delay Builtins," n.d. https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Delay_builtins.htm#SMTH1.
- ISEE Systems. "Statistical Builtins," n.d. https://www.iseesystems.com/resources/help/v1-2/Content/08-Reference/07-Builtins/Statistical_builtins.htm#RANDOM.
- ISEE Systems. "Stella Software Online Help," 2023. <https://www.iseesystems.com/resources/help/v3/>.
- ISEE Systems. "Test Input Builtins," n.d. https://www.iseesystems.com/resources/help/v2/Content/08-Reference/07-Builtins/Test_input_builtins.htm.
- Joint Air Power Competence Centre, "All-Domain Operations in a Combined Environment," September 2021. <https://www.japcc.org/flyers/all-domain-operations-in-a-combined-environment/>.
- Joint Chiefs of Staff. *Joint Task Force Headquarters*, JP 3-33. Washington, DC: Joint Chiefs of Staff, 2018. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_33.pdf.
- Kitfield, James. *Prodigal Soldiers: How the Generation of Officers Born of Vietnam Revolutionized the American Style of War*. New York: Simon & Schuster, 1995.
- Koda, Yoji. *China's Blue Water Navy Strategy and Its Implications*. Washington, DC: Center for New American Studies, March 2017. <https://www.cnas.org/publications/reports/chinas-blue-water-navy-strategy-and-its-implications>.

- Lamb, Richard. “This Is What Special Ops Learned 40 Years Ago from Operation Eagle Claw.” *Military Times*, April 24, 2020, <https://www.militarytimes.com/opinion/commentary/2020/04/24/this-is-what-special-ops-learned-40-years-ago-from-operation-eagle-claw/>.
- Locher, James R. “Has It Worked?: The Goldwater-Nichols Reorganization Act.” *Naval War College Review* 54, no. 4 (2001): 95–115. <http://www.jstor.org/stable/26393873>.
- Mahnken, Thomas G., and James R. FitzSimonds. “Revolutionary Ambivalence: Understanding Officer Attitudes Toward Transformation.” *International Security* 28, no. 2 (2003): 112–48. <http://www.jstor.org/stable/4137470>.
- Meadows, Donella H. *Thinking in Systems: A Primer*. London: Earthscan, 2009.
- Mueller, Julia. “Progressives Propose Bill to Slash Defense Budget by \$100 Billion.” Text. *The Hill* (blog), February 22, 2023. <https://thehill.com/policy/defense/3869625-progressives-propose-bill-to-slash-defense-budget-by-100-billion/>.
- Office of the Under Secretary of Defense (Comptroller). *Defense Budget Overview: United States Department of Defense Fiscal Year 2023 Budget Request*. Washington, DC: Office of the Secretary of Defense, April 2022. https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2023/FY2023_Budget_Request_Overview_Book.pdf.
- O’Rourke, Ronald. *Renewed Great Power Competition: Implications for Defense—Issues for Congress*. CRS Report No. R43838. Washington, DC: Congressional Research Service, 2019. <https://congressional-proquest-com.libproxy.nps.edu/congressional/result/congressional/congdocumentview?accountid=12702&groupid=100340&parmId=1857F633F54>.
- Osborn, Kris. “Pentagon Crafts New ‘Joint Warfighting’ Concept.” *Warrior Maven: Center for Military Modernization*, August 22, 2021. <https://warriormaven.com/history/integrated-deterrence-space-force>.
- Ortiz-Ospina. “Long-Run Trends in Military Spending and Personnel: Four Key Facts from New Data.” *Our World in Data*, April 22, 2018. <https://ourworldindata.org/military-long-run-spending-perspective>.
- Performance.gov. “Department of Defense,” Accessed December 8, 2023. <https://trumpadministration.archives.performance.gov/defense/#:~:text=The%20Department%20of%20Defense%20is,is%20the%20nation’s%20largest%20employer..>
- Peter G. Peterson Foundation. “The Fiscal & Economic Challenge,” 2023, <https://www.pgpf.org/the-fiscal-and-economic-challenge>.

- Peter G. Peterson Foundation. “The United States Spends More on Defense than the Next 10 Countries Combined,” April, 2024. <https://www.pgpf.org/blog/2023/04/the-united-states-spends-more-on-defense-than-the-next-10-countries-combined>.
- Porter, Wayne, and Mark Mykleby. “Rethinking America’s Joint Force: Strength and Credibility in a Constrained Fiscal Environment.” *American Foreign Policy Interests* 34, no. 2 (March 2012): 57–68. <https://doi.org/10.1080/10803920.2012.666148>.
- Richter, Felix. “Infographic: U.S. GDP Falls 3.5% in Biggest Drop Since 1946,” Statista, January 29, 2021. <https://www.statista.com/chart/24056/annual-real-gdp-growth-in-the-united-states>.
- Skogsberg-Karnowski, Sarah. “Causal Loop Diagram,” Unpublished model data, September 10, 2023.
- Skogsberg-Karnowski, Sarah. “Functionally Aligned Service-Agnostic U.S. Military_Skogsberg-Karnowski_Final,” Unpublished model data, December 3, 2023.
- Skogsberg-Karnowski, Sarah. “Skogsberg-Karnowski_DA4481 Assignment 3,” Unpublished graduate report, September 14, 2023.
- Statista. “Budget Plan of the U.S. Armed Forces by Department and Appropriation FY2023,” n.d. <https://www.statista.com/statistics/239280/budget-plan-of-the-us-armed-forces-by-department-and-appropriation/>.
- Sterman, John D. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Jeffrey J. Shelstad, 2000. <https://www.tandfonline.com/doi/full/10.1057/palgrave.jors.2601336>.
- Swanson, J. “Business Dynamics—Systems Thinking and Modeling for a Complex World.” *Journal of the Operational Research Society* 53, no. 4 (April 2002): 472–73. <https://doi.org/10.1057/palgrave.jors.2601336>.
- Tirpak, John. “Kendall: Beijing Totally Restructured Its Military to Beat the US.” *Air & Space Forces Magazine*, January 17, 2023. <https://www.airandspaceforces.com/kendall-beijing-totally-restructured-military-to-beat-us/>.
- Trading Economics. “United States GDP Growth Rate,” n.d. <https://tradingeconomics.com/united-states/gdp-growth>.
- United States Joint Staff Joint Force Development (J7) – Future Force Development. *Cross-Domain Synergy in Joint Operations Planner’s Guide*. Washington, DC: Joint Chiefs of Staff, 2016. https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/cross_domain_planning_guide.pdf?ver=2017-12-28-161956-230.

- United States Senate Committee on Appropriations. “Defense Fiscal Year 2024 Appropriations Bill,” July 27, 2023. <https://www.appropriations.senate.gov/news/majority/bill-summary-defense-fiscal-year-2024-appropriations-bill>.
- U.S. Bureau of Labor Statistics. *Occupational Outlook Handbook: Military Careers*. Washington, DC: U.S. Bureau of Labor Statistics, n.d. <https://www.bls.gov/ooh/military/military-careers.htm>.
- U.S. Government Spending. “US Government Defense Spending History with Charts.” Accessed September 4, 2023. https://www.usgovernmentspending.com/defense_spending_history.
- USA Spending. “Government Spending Explorer,” n.d. <https://usaspending.gov/explorer>.
- Vergun, David. “DOD Must Field Capabilities Faster, Hicks Says.” *DOD News*, August 31, 2022. <https://www.defense.gov/News/News-Stories/Article/Article/3146087/dod-must-field-capabilities-faster-hicks-says/#:~:text=In%20the%20face%20of%20the,Deputy%20Defense%20Secretary%20Kathleen%20H>.
- White House. “2022 National Defense Strategy.” White House, 2022. <https://media.defense.gov/2022/Mar/28/2002964702/-1/-1/1/nds-fact-sheet.pdf>.
- White House. *Military and Security Developments Involving the People’s Republic of China – 2020: Annual Report to Congress*. Washington, DC: White House, 2020. <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-dod-china-military-power-report-final.pdf>.
- YCharts. “US Real GDP.” YCharts. n.d. https://ycharts.com/indicators/us_real_gdp.
- Zimmerman, S., Kimberly Jackson, Natasha Lander, Colin Roberts, Dan Madden, and Rebeca Orrie. *Movement and Maneuver: Culture and the Competition for Influence Among the U.S. Military Services*. Santa Monica, CA: RAND Corporation, 2019. <https://doi.org/10.7249/RR2270>.

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