ACQUISITION INNOVATION RESEARCH CENTER

Summary of DoD PPBE Reform Research Findings and Recommendations

EXECUTIVE SUMMARY AND REPORT

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ABSTRACT

This report provides a consolidated executive summary of the research performed for the Commission on Planning, Programming, Budgeting and Execution (PPBE) Reform, highlighting the research team's findings and recommendations. The chapters summarize the literature review and research tasks, providing summaries from separate task reports. In addition, at the end of the document, we provide a consolidated list of findings in Table 9.1, a consolidated recommendations list in Table 9.2, a list of suggestions for additional research in Table 9.3, and a consolidated list of acronyms and abbreviations.

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CONSOLIDATED ACRONYMS AND ABBREVIATIONS

Source	Acronym	Meaning
Task 3: Lit Review & J-Books	**2D/3D**	2-Dimensional/3-Dimensional
Task 3: J-Books	**5G**	Fifth Generation
Tasks 1&2	**A**	Army
Task 3: J-Books	**A&AS**	Advisory and Assistance Services
Tasks 1&2	**AAF**	Adaptive Acquisition Framework
Tasks 1&2	**AAPML**	Army Acquisition Program Master List
Task 3: J-Books	**ABADS**	Airbase Air Defense Systems
Task 3: J-Books	**ABMS**	Advanced Battle Management System
Tasks 1&2 & 3: J-Books	**ACAT**	Acquisition Category
Task 3: J-Books	**ACD&P**	Advanced Component Development & Prototypes
Task 3: Lit Review	**ACDB**	Advanced Capabilities and Deterrence Board
Task 6	**ACWP**	Actual Cost of Work Performed
Task 3: Lit Review	**ADCP**	Advanced Capability and Deterrence Panel
Task 3: Lit Review	**ADD**	Attention-Deficit Disorder
Task 3: J-Books	**ADS**	Air Defense Sectors
Task 3: J-Books	**AEN**	Airborne Edge Node
All tasks	**AF**	Air Force
Task 3: Lit Review	**AFWERX**	Air Force Work Project
Tasks 3: Lit Review, J-Books & 4	**AI**	Artificial Intelligence
Task 3: J-Books	**AI/ML**	Artificial Intelligence/Machine Learning
Tasks 1&2, 3: Lit Review, 4 & 6	**AIRC**	Acquisition Innovation Research Center
Tasks 1&2	**AIS**	Automated Information System
Task 4	**ALOC**	Air Lines of Communications
Tasks 1&2	**AoS**	Acquisition of Services
Task 3: Lit Review	**APB**	Acquisition Program Baseline
Task 3: J-Books	**API(s)**	Application Program Interface(s)
Tasks 1&2	**APUC**	Acquisition Procurement Unit Cost
Task 3: J-Books	**ASE**	Architecture and Systems Engineering
Task 3: Lit Review	**ATR**	Above Threshold Reprogramming

Source	Acronym	Meaning
Task 3: J-Books	**BA**	Budget Activity
Task 3: Lit Review	**BA-8**	Budget Activity Eight
Tasks 1&2 and 3: Lit Review	**BLI(s)**	Budget Line Item(s)
Task 3: J-Books	**BMC2**	battle management, command, and control
Tasks 3: Lit Review & 4	**BTR**	Below Threshold Reprogramming
Task 3: J-Books	**C2**	Command and Control
Task 3: J-Books	**C3BM**	Command, Control, Communication and Battle Management
Task 3: J-Books	**C5ISRT**	Command and Control, Communications, Computers, Cyber, Intelligence, Surveillance, Reconnaissance, Targeting
Tasks 1, 2, 3: Lit Review & 4	**CAE**	Component Acquisition Executive
Task 3: J-Books	**CAO**	Chief Architect Office
Task 3: Lit Review	**CAPE**	Cost Assessment and Program Evaluation
Task 3: J-Books	**CBC2**	Cloud-Based Command and Control
Tasks 1&2	**CBDP**	Chemical and Biological Defense Program
Tasks 1&2 & 4	**CCDR(s)**	Combatant Commander(s)
Tasks 1, 3:Lit Review & 4	**CCMD**	Combatant Command
Task 3: Lit Review	**CCMND**	Combatant Command
Tasks 3: Lit Review, J-Books & 4	**CDAO**	Chief Digital and Artificial Intelligence Office(r)
Task 3: J-Books	**CDL EA**	Common Data Link Executive Agent
Task 3: J-Books	**CDS**	Cross Domain Solutions
Task 3: Lit Review	**CEB**	Chief of Naval Operations Executive Board
Task 2	**CFR**	Code of Federal Regulations
Tasks 3: Lit Review, J-Books & 4	**CFT**	Cross Functional Team
Task 3: J-Books	**CI/CD**	continuous integration/continuous delivery
Tasks 1&2	**CJCS**	Chairman of the Joint Chiefs of Staff
Tasks 1&2	**CNGB**	Chief, National Guard Bureau
Task 3: J-Books	**CoA(s)**	Course(s) of Action
Tasks 3: Lit Review & J-Books	**COCOM(s)**	Combatant Command(s)
Tasks 3: J-Books & 4	**CONUS**	Continental U.S.
Task 3: J-Books	**CR**	Capability Release
Tasks 4, 5 & 6	**CR**	Continuing Resolution

Source	Acronym	Meaning
Task 6	**CRS**	Congressional Research Service
Tasks 1&2	**CYBER**	United States Cyber Command
Tasks 1&2 & 3: Lit Review	**DA**	Decision Authority
Tasks 1&2 & 4	**DAE**	Defense Acquisition Executive
Tasks 1&2	**DAES**	Defense Acquisition Executive Summary
Tasks 1&2, 3: J-Books & 4	**DAF**	Department of the Air Force
Tasks 1&2	**DAMIR**	Defense Acquisition Management Information Retrieval
Tasks 1&2 & 4	**DAS**	Defense Acquisition System
Task 4	**DASN**	Deputy Assistant Secretary of the Navy
Tasks 4 & 6	**DAU**	Defense Acquisition University
Tasks 1&2	**DAVE**	Defense Acquisition Visibility Environment
Task 4	**DAWDA**	Department of Defense Acquisition Workforce Development Account
Task 4	**DAWDF**	Department of Defense Acquisition Workforce Development Fund
Task 3: J-Books	**DBMN**	Distributable Battle Management Node
Tasks 1&2	**DBS**	Defense Business System
Task 6	**DC**	District of Columbia
Tasks 1&2	**DCAA**	Defense Contract Audit Agency
Tasks 1&2 & 4	**DCMA**	Defense Contract Management Agency
Tasks 1&2	**DCSA**	Defense Counterintelligence and Security Agency
Tasks 3: Lit Review & 4	**DCTC**	Defense Civilian Training Corps
Task 3: Lit Review	**DDS**	Defense Digital Service
Task 3: J-Books	**DE**	Digital Engineering
Task 3: Lit Review	**DeFi**	Decentralized Finance Allocation
Tasks 3: Lit Review & 4	**DEPSECDEF**	Deputy Secretary of Defense
Task 3: Lit Review	**DeRA**	Decentralized Resource Allocation
Tasks 1&2	**DHRA**	DoD Human Resources Activity
Task 3: J-Books	**DI**	Digital Infrastructure
Tasks 1&2	**DISA**	Defense Information Systems Agency
Task 3: Lit Review	**DIU**	Defense Innovation Unit
Tasks 1&2 & 4	**DLA**	Defense Logistics Agency
Task 3: Lit Review	**DMAG**	Defense Management Action Group

Source	Acronym	Meaning
All Tasks	**DoD**	Department of Defense
Task 4	**DoDD**	DoD Directive
Tasks 1&2	**DON**	Department of the Navy
Tasks 1&2, 3: Lit Review, 4 & 5	**DPG**	Defense Planning Guidance
Tasks 1&2	**DSCA**	Defense Security Cooperation Agency
Task 3: Lit Review	**DSD**	Deputy Secretary of Defense
Tasks 1&2	**DTRA**	Defense Threat Reduction Agency
Task 3: Lit Review	**EDI**	European Deterrence Initiative
Tasks 1&2	**EMD**	Engineering and Manufacturing Development
Tasks, 3: Lit Review & 6	**EVM**	Earned-Value Management
Task 6	**Exp.**	Expenditures
Task 3: J-Books	**F-15E/EX**	F-15E Strike Eagle
Task 3: J-Books	**F2T2EA**	find, fix, track, target, engage, and assess
Task 3: Lit Review	**FAR**	Federal Acquisition Regulations
Task 3: Lit Review	**FERC**	Federal Energy Regulatory Commission
Tasks 3: Lit Review & J-Books	**FFRDC**	Federally Funded Research and Development Center
Task 5	**FM**	Field Manual
Tasks 1&2 & 3: Lit Review	**FMR**	Financial Management Regulation
Task 6	**FPDS**	Federal Procurement Data System
Tasks 3: J-Books & 6	**FY**	Fiscal Year
Tasks 3: Lit Review & 4	**FYDP**	Future Years Defense Program
Tasks 1&2, 3: Lit Review & 6	**GAO**	Government Accountability Office
Task 5	**GDP**	Gross Domestic Product
Task 5	**GPRA**	Government Performance and Review Act
Tasks 3: Lit Review & 5	**GTA**	General Transfer Authority
Task 5	**HR**	Human Resources
Tasks 3: Lit Review & J-Books	**ID/IQ**	Indefinite Delivery/Indefinite Quantity
Task 3: Lit Review	**IMP**	Integrated Master Plan
Task 3: Lit Review	**IMS**	Integrated Master Schedule
Task 3: Lit Review	**IP**	Intellectual Property
Task 3: Lit Review	**IPL**	Integrated Priority List

Source	Acronym	Meaning
Task 4	**IPT**	Integrated Product Team
Task 3: J-Books	**IR**	Information Repository
Task 4	**IR&D**	Internal Research and Development
Tasks 3: Lit Review & J-Books	**JADC2**	Joint All Domain Command and Control
Task 3: Lit Review	**JAIC**	Joint Artificial Intelligence Center
Tasks 1&2 & 3: J-Books	**J-Books**	Justification Books
Tasks 1&2, 3: Lit Review & 4	**JCIDS**	Joint Capabilities Integration and Development System
Task 3: J-Books	**JCM**	Joint Communications Marketplace
Task 3: J-Books	**JCO**	Joint Concept of Operations
Task 4	**JEONS**	Joint Emerging Operational Needs Statement
Tasks 1&2, 3: Lit Review & 4	**JROC**	Joint Requirements Oversight Council
Task 3: J-Books	**JSON**	JavaScript Object Notation
Tasks 1&2	**JSPS**	Joint Strategic Planning System
Task 3: J-Books	**JTNC**	Joint Tactical Networking Center
Task 4	**JUON(s)**	Joint Urgent Operational Need(s)
Task 3: J-Books	**KC-46/KC-46A**	USAF "Pegasus" Multirole Air Refueling Tanker
Task 3: J-Books & 4	**LLM(s)**	Large Language Model(s)
Task 3: J-Books	**LOE**	Level of Effort
Task 3: Lit Review	**LPTA**	Lowest Price Technically Acceptable
Task 4	**LRASM**	Long-Range Anti-Ship Missile
Task 6	**MABP**	Months After Budget Passed
Tasks 3: J-Books & 4	**MAJCOM(s)**	Major Commands
Task 3: J-Books	**MA-MLS**	Multiple-Award, Multi-Level Security
Tasks 1&2	**MCA**	Major Capability Acquisition
Tasks 1&2	**MDA**	Missile Defense Agency
Task 3: J-Books	**MDA**	Mission Domain Architectures
Task 4	**MDA**	Milestone Decision Authority
Tasks 1&2, 3: Lit Review & 4	**MDAP(s)**	Major Defense Acquisition Program(s)
Task 6	**MILCON**	Military Construction
Task 3: J-Books	**MITs**	Mission Integration Team
Tasks 3: J-Books & 4	**ML**	Machine Learning

Source	Acronym	Meaning
Task 4	**MRL**	Manufacturing Readiness Level
Tasks 1&2, 3: Lit Review & 4	**MTA**	Middle Tier of Acquisition
Task 3: J-Books	**MVCR**	Minimum Viable Capability Release
Task 3: J-Books	**MVP**	Minimum Viable Product
Tasks 1&2	**N**	Navy
Task 3: J-Books	**N&NC**	NORAD and USNORTHCOM
Task 3: J-Books	**NATO**	North Atlantic Treaty Organization
Task 3: Lit Review	**NCSC**	National Counterintelligence and Security Center
Task 3: Lit Review & J-Books	**NDAA(s)**	National Defense Authorization Acts
Task 3: Lit Review	**NDIA**	National Defense Industrial Association
Task 3: Lit Review	**NDS**	National Defense Strategy
Tasks 3: J-Books & 4	**NLP**	Natural Language Processing
Task 4	**NMS**	National Military Strategy
Task 3: J-Books	**NORAD**	North American Aerospace Defense Command
Task 5	**NPM**	New Public Management
Task 3: Lit Review	**NSCAI**	National Security Commission on Artificial Intelligence
Task 4	**NSS**	National Security Strategy
Tasks 3: Lit Review & 6	**O&M**	Operations and Maintenance
Task 6	**Obl.**	obligations
Task 3: Lit Review & J-Books	**OCO**	Overseas Contingency Operations
Task 3: J-Books	**OCONUS**	Outside the Continental U.S.
Task 3: J-Books	**OCR**	Optical Character Recognition
Task 3: J-Books	**OCS**	Open Communications Standards
Task 3: Lit Review	**ODNI**	Office of the Director of National Intelligence
Task 3: J-Books	**OGC**	Other Government Costs
Tasks 3: Lit Review, 4 & 5	**OMB**	Office of Management and Budget
Task 3: Lit Review	**OR**	Operations Research
Task 3: J-Books	**ORT**	Operational Response Team
Tasks 1&2, 3: Lit Review & 5	**OSD**	Office of the Secretary of Defense
Task 3: Lit Review	**OSD R&E**	Office of the Secretary of Defense Research and Engineering
Task 3: Lit Review	**OTA**	Other Transaction Authority

Source	Acronym	Meaning
Tasks 3: Lit Review & 6	**OUSD**	Office of the Under Secretary of Defense
Task 6	**OUSD(A&S)**	Office of the Under Secretary of Defense for Acquisition and Sustainment
Task 6	**OUSD(R&E)**	Office of the Under Secretary of Defense for Research and Engineering
Task 3: J-Books	**PADS**	Pacific Air Defense Sector
Task 3: Lit Review	**PAF**	Philippine Air Force
Task 6	**PALT**	Procurement Administrative Lead Time (sometimes also defined as Procurement Action Lead Time)
Task 5	**PART**	Program Rating Assessment Tool
Tasks 1&2	**PAUC**	Program Acquisition Unit Cost
Task 3: J-Books	**PB**	President's Budget
Task 3: J-Books	**PDF**	Portable Document Format
Task 3: Lit Review	**PDI**	Pacific Deterrence Initiative
Tasks 1&2, 3: Lit Review & J-Book	**PE**	Program Element
Tasks 1&2, & 4	**PEO**	Program Executive Office
Tasks 3: Lit Review & J-Books	**PEO(s)**	Program Executive Officer(s)
Task 4	**pLEO**	Proliferated Low Earth Orbit
Tasks 1&2, 3: Lit Review, 4 & 5	**PM**	Program Manager
Tasks 1&2	**PMRT**	Air Force Data Access and Program Management Resource Tools
Tasks 3: Lit Review & 4	**POM**	Program Objective Memorandum
Task 5	**PPB**	Planning, Programming, and Budgeting
All Tasks	**PPBE**	Planning, Programming, Budgeting, and Execution
Tasks 1&2	**PPBES**	Planning, Programming, Budgeting, and Execution System
Tasks 3: Lit Review & 5	**PPBS**	Planning, Programming, and Budgeting System
Task 6	**PROC**	Procurement
Tasks 3: Lit Review & 4	**QDA**	Qualitative Data Analysis
Tasks 1&2	**QDR**	Quadrennial Defense Review
Tasks 3: Lit Review, 4, 5 & 6	**R&D**	Research and Development
Task 3: Lit Review	**RA**	Reference Architecture
Tasks 3: J-Books, & 4	**RCO**	Rapid Capabilities Office

Source	Acronym	Meaning
Tasks 1&2	**RDAIS**	Navy ASN(RD&A) Information System
All Tasks	**RDT&E**	Research, Development, Test, and Evaluation
Task 3: Lit Review	**ROI**	Return on Investment
Tasks 3: Lit Review, J-Books & 4	**S&T**	Science and Technology
Tasks 3: Lit Review, J-Books & 4	**SAE(s)**	Service Acquisition Executive(s) (Officials)
Task 3: J-Books	**SAP**	Special Access Program
Tasks 1&2 and 3: J-Books	**SAR(s)**	Selected Acquisition Report(s)
Tasks 3: J-Books & 4	**SBIR**	Small Business Innovation Research
Task 3: J-Books	**SCM**	Security Cryptographic Module
Tasks 1&2, 3: Lit Review & 4	**SDA**	Space Development Agency
Task 3: J-Books	**SD-WAN**	Software Defined Wide Area Networking
Task 3: J-Books	**SecAF**	Secretary of the Air Force
Tasks 1&2	**SecDef**	Secretary of Defense
Task 3: Lit Review	**SECDEF**	Secretary of Defense
Task 3 & 6	**SERC**	Systems Engineering Research Center
Task 3: Lit Review	**SETA**	Systems Engineering Technical Assistance
Task 3: Lit Review	**SME(s)**	Subject Matter Expert(s)
Task 3: Lit Review	**SNCOs**	Senior Non-Commissioned Officers
Tasks 1&2	**SOCOM**	United States Special Operations Command
Tasks 1&2	**SSA**	Support for Strategic Analysis
Task 4	**SSEB**	Source Selection Evaluation Board
Task 3: Lit Review	**STEM**	Science, Technology, Engineering, and Math
Task 3: J-Books	**STTR**	Small Business Technology Transfer
Task 3: J-Books	**SW**	Software
Tasks 1&2	**SWP**	Software Acquisition Pathway
Task 4	**SYSCOM**	Systems Command
Task 3: Lit Review	**T&E**	Testing and Evaluation
Task 3: J-Books	**TDNE**	Tactical Data Network Enterprise
Tasks 1&2	**TJS**	The Joint Staff
Task 3: J-Books	**TOC**	Tactical Operations Centers
Task 3: J-Books	**TOC FoS**	TOC Family of Systems

Source	Acronym	Meaning
Task 4	**TRL**	Technology Readiness Level
Task 3: J-Books	**TS/SCI**	Top Secret/Sensitive Compartmented Information
Task 6	**U.S.**	United States
Task 6	**UARC**	University-Affiliated Research Center
Tasks 1&2	**UCA**	Urgent Capability Acquisition
Task 3: J-Books	**UI/UX**	User Interface/User Experience
Tasks 1&2	**URC**	Unit Cost Report
Task 3: J-Books	**US/U.S.**	United States
Task 3: J-Books	**USAF**	U.S. Air Force
Task 2	**USC**	United States Code
Task 6	**USD(A&S)**	Under Secretary of Defense for Acquisition and Sustainment
Tasks 3: Lit Review & 6	**USD(R&E)**	Under Secretary of Defense for Research and Engineering
Task 3: J-Books	**USG**	U.S. Government
Task 3: J-Books	**USNORTHCOM**	U.S. Northern Command
Task 3: J-Books	**USSF**	U.S. Space Force
Task 3: Lit Review	**VCJCS**	Vice Chairman of the Joint Chiefs of Staff
Task 4	**VoD**	Valley of Death
Task 3: J-Books	**WOC**	Wing Operations Centers
Task 3: Lit Review	**WSARA**	Weapon Systems Acquisition Reform Act
Tasks 3: Lit Review & J-Books	**XML**	Extensible Markup Language

1. LITERATURE REVIEW

This report provides the results of a Department of Defense (DoD) Planning, Programming, Budgeting, and Execution (PPBE) based literature search and review. The search identified a list of 146 sources (not including the 809 Panel recommendations and the National Security Commission on Artificial Intelligence). The research team looked at those recommendations, however since we had sufficient sources to review and analyze we elected to not invest any time in analyzing those recommendations. Of the 146 sources, ten (10) of these were identified as being primarily historical in nature, leaving 136 reports, podcasts, and articles of which the majority were published after January of 2021. After a concerted effort to "divide and conquer" to carefully review these sources, we decided to prioritize approximately half based on a quick review of the contents of the remaining articles as most pertinent. The full list of 136 reports and articles is available in Appendix A of the report.

Our effort to extract PPBE improvement recommendations resulted in 262 of which some were simply observations or suggestions. The full list of 262 is found in Appendix B and includes a reference number to the source in Appendix A, a summary of the recommendations for brevity if warranted (however just copying the recommendation from the source was our preferred approach), and an actionability assessment of the recommendation. This assessment was reviewed by team members to determine if "the recommendation is understood and well-defined," noting that in some cases these recommendations may have already been implemented. This is understandable given that a number of these recommendations are dated. Hence, the reader should take this observation into context. This assessment left 222 recommendations for further analysis.

The results of qualitative data analysis suggest that a significant fraction (almost half) of the Pentagon's problems can be self-corrected. We considered this to be our first finding despite the potential for the data to be biased towards familiarity with the PPBE process as most of the authors appeared to have backgrounds on the DoD side of these processes. Yet, there were several recommendations suggesting actions that can be unilaterally taken by Congress and several more in collaboration with the DoD to enact legislation in support of obtaining a responsive-agile PPBE process.

The Qualitative Data Analysis (QDA) also found several proposed actions to foster trust and transparency through modernized business systems, using, for example, real-time data analytics. As a result, we have included in the report two views of a reference architecture (RA) that once refined and agreed to by the stakeholders or by statute, should help achieve the desired result.

We also observed that the 809 Panel's Portfolio Management and Budgeting recommendation, Buy/Use Commercial Technology, and Flexibility (under Budgeting) were significantly repeated themes. Further, we observed a significant workforce theme including training and retention, among others.

It is worth noting that a concerted effort to cross check the recommendations found in the literature against existing and ongoing DoD initiatives has not been attempted. However, we are aware of initiatives such as the new Defense Civilian Training Corps (DCTC) among others that should be considered as satisfying several of the literature's recommendations.

2. CASE STUDIES ON PPBE SUPPORT OF PROGRAMS AND ORGANIZATIONS

The PPBE Commission requested six case studies that assessed how the PPBE process supports joint efforts, capability and platform lifecycles, and technology transition from developmental phase to production.

The George Mason University research team examined the following cases:

- U.S. Navy Program Executive Office Unmanned and Small Combatants: Large Unmanned Surface Vessel (LUSV) and Medium Unmanned Surface Vehicle (MUSV);
- U.S. Air Force Program Executive Office Fighters and Advanced Aircraft Directorate: Collaborative Combat Aircraft (CCA);
- U.S. Army Program Executive Office Ground Combat Systems: Robotic Combat Vehicle (RCV);
- The Space Development Agency (SDA);
- Tactical Intelligence Targeting Access Node (TITAN); and
- Joint Rapid Acquisition Cell (JRAC).

Overall, the case study findings highlight challenges associated with rapidly iterating and deploying software and/or commercial technology capabilities to support warfighter requirements. In particular, the PPBE process struggles when:

- Funding the rapid development and deployment of new capabilities to meet operational needs;
- The need for fiscal flexibility is greatest, usually during the year of execution; and
- Adjusting to rapidly evolving programs and needs.

These challenges can be overcome, however. The cases demonstrate that successful development and progress can be made when:

- Strong senior leadership drives prioritization;
- The broadness of Program Elements (PEs) enables flexibility in program execution;
- Agile approaches such as Middle Tier of Acquisition (MTA) enable programs to evolve and adapt with the least disruption; and
- Congressional engagements are regular and candid.

CASE STUDY FINDINGS

Each case is unique and offers some insight into potential areas of concern regarding technology transition in the PPBE process. Those specific findings are summarized below.

U.S. Navy Program Executive Office Unmanned and Small Combatants:
Large Unmanned Surface Vessel (LUSV) and Medium Unmanned Surface Vehicle (MUSV)

- PPBE process can be difficult to navigate in several ways, including:
  - » Congressional marks with prejudice;
  - » continuing resolutions;
  - » reprogramming threshold limit;
  - » lack of management reserve;
- One size-fits-all PPBE process does not work well for new technology programs with no significant cost or development history; and
- J-books can be problematic for projects with many interrelated parts because they appear as an "à la carte" menu.

U.S. Air Force Program Executive Office Fighters and Advanced Aircraft Directorate:
Collaborative Combat Aircraft (CCA)

- CCA benefited significantly from close coordination with other government agencies (Navy, DARPA, SCO, cost estimators "living with CAPE") as well as industry vendors;
- PPBE outcomes sometimes conflict with Air Force strategy;
- Budget structure that provides flexibility helps navigate the PPBE process; and
- Leadership prioritization is a critical factor for programmatic success.

U.S. Army Program Executive Office Ground Combat Systems:
Robotic Combat Vehicle (RCV)

- PPBE processes are not optimal, but also not a significant hurdle to operations or strategy;
- More frequent interactions with Congressional staff would help to communicate evolving program status and associated budget;
- There is a need for flexibility in PPBE process to address agile acquisition; and
- Having all lines of effort in a single program element is helpful.

The Space Development Agency (SDA)

- SDA's use of the MTA pathway and the agile, iterative incorporation of commercial technologies are central to rapid product delivery;
- Due to SDA's mandate to rapidly deliver capabilities, budget requests must be made before requirements are finalized—programming occurs before planning;
- PE consolidation gives SDA flexibility for program success, while external stakeholders who seek to impact the program prefer a divided PE structure; and
- Building and launching SDA tranches can be challenging to manage in existing budgetary categories.

Tactical Intelligence Targeting Access Node (TITAN)

- TITAN's use of the MOSA approach and MTA pathway have led to rapid prototyping and program success;
- TITAN prototyping efforts have benefited programmatically and technologically from being a continuation of previous Army research efforts and funding lines; and
- The shift of program funding from Procurement to RDT&E, accomplished with effective stakeholder alignment, ensured appropriate investment was made in prototyping, which has been important to program success.

Joint Rapid Acquisition Cell (JRAC)

- Difficulty transitioning JRAC efforts into Service programs highlights the challenges of developing and deploying urgently needed capabilities to support operational needs via the Services' respective PPBE processes; and
- Phasing out Overseas Contingency Operations funding has made it increasingly difficult to secure funding to fill urgent capability gaps, especially JUONs and JEONs.

TOPICS FOR FURTHER RESEARCH

The George Mason University team identified several promising ideas for consideration in follow-on research efforts that DoD might sponsor.

1. Research, analyze, and make recommendations vis-à-vis Combatant Command PPBE authorities concerning the validation of requirements, program and budget proposals, and expenditure of funds. This study will be a detailed examination of what authorities exist in general as well as for specific COCOMs, and the COCOMs' relation to the PPBE roles and responsibilities of the Services and Defense Agencies. Likewise, this study will explore the role of OSD, the Joint Staff, the Services, Defense Agencies, and Congress in the actions and products of the PPBE process relative to Combatant Command requirements and advocacy. Recommendations will be included.

- Research, analyze, and make recommendations regarding options for duplicating the SDA model in the Department of the Army, the Department of the Navy, the Missile Defense Agency, or Special Operations Command. Explain in detail the authorities, organization, and practices that are relevant and their first-order and second-order consequences.

3. ASSESSMENTS OF PPBE BY PROGRAM SIZE, ACQUISITION PATHWAY, AND STATUTORY/POLICY BASIS

The George Mason University team conducted research on PPBE processes to address the three specific subtasks outlined below.

PPBE BY PROGRAM SIZE

The PPBE Commission requested an assessment of whether the PPBE process should be the same for programs that breach the Major Defense Acquisition Program (MDAP) threshold (10 USC 4201), Major Systems threshold (10 USC 2302d), and non-major systems, and make recommendations.

Numerous statutes, regulations, policies, and practices have developed around the PPBE process since its introduction in the 1960s. Following are the conclusions from a threefold analysis of Major Defense Acquisition Program (MDAP) and Major Systems thresholds, acquisition pathways such as the Software Pathway and Middle Tier Acquisition (MTA), and the legal foundations that drive PPBE.

After assessing the different Acquisition Categories utilized by DoD, there is insufficient evidence to suggest that the PPBE process should not be the same for programs that breach the MDAP threshold, Major Systems threshold, and non-major systems. The characteristics identified during this assessment suggest that acquisition categories share similarities and differences *across* categories and that programs *within* acquisition categories share similarities and differences resulting in acquisition categories that are likely to be meaningfully correlated. Thus, any difference in PPBE process is likely to result in a similar effect across Acquisition Categories.

RECOMMENDATIONS

Recommendation: An alternate categorization of programs, such as by operational need and/or mission (particularly those likely to experience immediate and difficult-to-predict needs), is a prime candidate for slight modifications to PPBE. Another potential categorization of programs for slight modifications to PPBE is the type of program such as hardware versus software or varying levels within these types of physical versus non-physical systems. Therefore, agencies within DoD that require significant flexibility due to their operational needs/mission should minimize the number of Program Elements (PEs) used in the budget request to allow for a broad range of potential uses of funds and thus generating limited need for reprogramming and maximizing flexibility when operational need and/or mission create a need for such increased flexibility.

PPBE BY ACQUISITION PATHWAY

The PPBE Commission requested an evaluation of how DoD uses acquisition pathways such as the Software Pathway and MTA within the PPBE process and make recommendations.

The examination of the use of acquisition pathways by DoD identified meaningful variation across the Military Departments and Agencies. MTA and Major Capability Acquisition (MCA) are the most utilized pathways across the DoD while the other four acquisition pathways are used rather minimally. Acquisition pathway usage is unique to each Military Department and Agency as the distribution of pathways are quite different for each Military Department and Agency. Even with significant differences in pathway usage, the general observation of a heavy focus on MTA and MCA with limited use of the other pathways is observed across most Military Departments and Agencies.

RECOMMENDATIONS

Recommendation: Budget justification documents, particularly for RDT&E, are overly complex, convoluted, and lack standardization across and within Military Departments and Agencies. These issues decrease transparency and potentially impede effective oversight and management. The following recommendations can help to improve the justification books.

#1: DoD should require acquisition pathways to be explicitly identified in the budget justification books as part of the Acquisition Strategy (Section D of Exhibit R-2a) as well as prescribe the specific components of acquisition, management, and contracting strategies to be provided – such as contract type, and competition type (full and open or sole source).

#2: DoD should work to ensure that appropriate detail is presented, when applicable, such that the requested level of detail including milestones, approvals, and events are presented. This recommendation is to ensure conformity to the existing guidance and consistency across and within Military Departments and Agencies extends to Exhibit R-4a (Schedule Detail).

#3: DoD should consider reorganizing (and possibly a complete overhaul of) the use of the PE and Project structure to better align with the DAS to enhance the ability to track and manage across PPBE and DAS. At present, the program structure used in PPBE is not a simple one-to-one mapping to the program structure used in DAS. Consistency and conformity will likely improve communication across government and within different parts of DoD workforce to improve oversight and management.

PPBE FOUNDATIONS: STATUTORY, REGULATORY, OR POLICY

The PPBE Commission requested analysis of the legal foundations that drive PPBE as well as the creation of a matrix outlining how PPBE components are directed, whether by statue, regulation, policy, or practice.

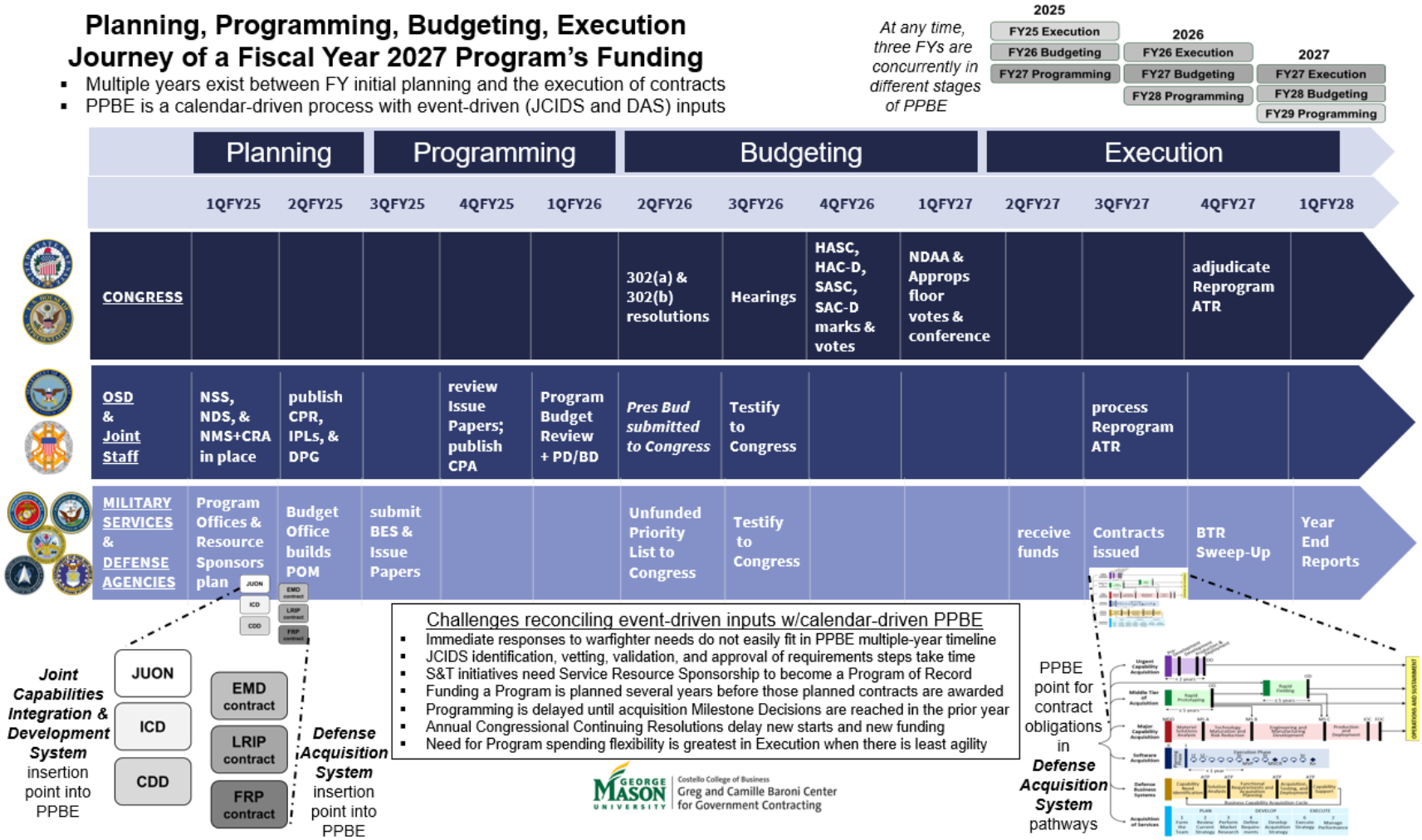
The PPBE process serves as a foundational framework for resource allocation within the DoD and individual military branches. PPBE is directed by a combination of statutory guidelines from sections of 2 USC, 10 USC, 31 USC, and 50 USC as well as DoD policies, CJCS policies, and Senate and House rules. The primary tasks/activities that constitute the Planning, Budgeting, and Execution phases of PPBE are principally directed by statute. In contrast, the tasks/activities that constitute the Programming phase of PPBE are directed by policy. Identifying how specific tasks/activities are directed is important when recommending PPBE reforms. Reforms aimed at tasks/activities directed by statute will require Congressional action and may be more difficult to affect while reforms aimed at tasks/activities directed by statute may be less difficult to affect requiring only DoD action. Table 3.1 summarizes how PPBE is directed (the PPBE Matrix) of phase, task/activity with the statutory, regulatory with policy and rules foundations for PPBE.

Table 3.1. How is PPBE Directed? (The PPBE Matrix)

Phase	Task/Activity	Statutory	Regulatory	OSD and JS Policy	Senate and House Rules
Planning	Chairman's Risk Assessment (CRA)	10 USC 153(b)(3)(B)		CJCSI 8501.01B [Enclosure A(1)(c)(7)]	
Planning	Chairman's Program Recommendation (CPR)	10 USC 153(a)(7)(A)		DoDD 7045.14 [Enclosure 2(10)(a)]; CJCSI 8501.01B [Enclosure A(1)(c)(5)	
Planning	National Military Strategy (NMS)	10 USC 153(b)(3)(A); 10 USC 153(b)(4)		CJCSI 8501.01B [Enclosure A(1)(a)(1)]	
Planning	National Security Strategy (NSS)	50 USC 3043(a)			
Planning	National Defense Strategy (NDS)	10 USC 113(g)(1)			
Planning	OMB Fiscal Guidance	31 USC 503(a)(2)		OMB Circular A-11	
Planning	Integrated Priority Lists (IPL)	10 USC 153(c)		CJCSI 8501.01 [Enclosure 2(b)(2)]	
Planning	Defense Planning Guidance (DPG)	10 USC 113(g)(2)		DoDD 7045.14 [Enclosure 2(2)(b)] and [Enclosure 4(1)(b)]	
Programming	Program Objective Memorandum (POM)			DoD 7000.14-R Volume 2A, Chapter 1 and Chapter 3	
Programming	Program Review			DoDD 7045.14 [Enclosure 2(3)(b)] and [Enclosure 4(2)(a)(2)	
Programming	Chairman's Program Assessment (CPA)	10 USC 153(a)(4)		DoDD 7045.14 [Enclosure 2(10)(a)]; CJCSI 8501.01B [Enclosure A(1)(c)(6)	
Programming	Issue Papers			CJCSI 8501.01B [Enclosure A(1)(c)(3)]; [Enclosure A(2)(b)(1)]; [Enclosure A(3)(b)(3)]; [Enclosure A(4)(a)(5)]	
Programming	Program Resource Manager's Group (PRMG)			DoDD 7045.14 (4)(b)(1)	
Programming	Deputy's Management Action Group (DMAG)			DoDD 7045.14 (4)(b)(1)	
Programming	OMB Pass-Back	31 USC 503(c)(4)		OMB Circular A-11	
Programming	Program Decisions		CFR 48 FAR/DFAR	DoDD 7045.14 [Enclosure 2(3)(a)(3)] and [Enclosure 4(2)(a)(2)]	
Programming	FYPD Update	10 USC 221(a)-(e); 10 USC 222(a)-(c)		DoDD 7045.14 [Enclosure 2(3)(a)(4)] and [Enclosure 4(2)(d)]	
Budgeting	Budget Estimate Submission (BES)	10 USC 2203		Dod 7000.14-R Volume 2A, Chapter 1 and Volume 2B, Chapter 5; DoDD 7045.14 [Enclosure 4(2)(b)(1)]	
Budgeting	Program Budget Review	10 USC 192(b)		DoDD 7045.14 [Enclosure 2(1)(a)] and [Enclosure 4(2)(b)(2)	
Budgeting	Budget Decision			DoDD 7045.14 [Enclosure 2(1)(c)] and [Enclosure 4(2)(b)(2)	
Budgeting	FYDP Update	10 USC 221(a)-(e); 10 USC 222(a)-(c)		DoDD 7045.14 [Enclosure 2(3)(a)(4)] and [Enclosure 4(2)(d)]	
Budgeting	Budget Submission to OMB	31 USC 1104(e)		DoD 7000.14-R Volumne 2A, Chapter 1; DoDD 7045.14 [Enclosure 2(1)(d)]; OMB Circular A-11	
Budgeting	President's Budget Request	31 USC 1105(a)			
Budgeting	Unfunded Priority List	10 USC 222(a)-(e)			
Budgeting	302(a) and 302(b)	2 USC 632(a) and 2 USC 633(a)-(b)			
Budgeting	Hearings and Staffer Days			DoDD 7045.14 [Enclosure 2(1)(e)]	Senate Rule XXVI; House Jefferson Manual XI and XIII
Budgeting	Marks and Deliberations	2 USC 636(a)-(d)			Senate Rule XXVI; House Jefferson Manual XI
Budgeting	Conference	2 USC 636(a)-(d)			Senate Rule XXVIII & XXVI; House Jefferson Manual XLVI, XLIV, XLV
Budgeting	NDAA	2 USC 639(a)			
Budgeting	Appropriations	2 USC 639(a)			House Rule X; Senate Rules XXV and XVI
Execution	Apportionment	31 USC 1512(b) and 31 USC 1513(c)		DoD 7000.14-R Volume 3, Chapter 2; OMB Circular A-11	
Execution	Midyear Review			OMB Circular A-11	
Execution	Transfer of Funds/Reprogramming	10 USC 2214(a)-(d)		DoD 7000.14-R Volume 3, Chapter 2	
Execution	Closeout			OMB Circular A-11	
Execution	Expired status for appropriations	31 USC 1553(a)		DoD 7000.14-R Volume 6A, Chapter 4	
Execution	Appropriation closed/canceled	31 USC 1552(a)-(b)		DoD 7000.14-R Volume 6A, Chapter 4	
Execution	Outstanding obligation adjustment	31 USC 1553(b)		DoD 7000.14-R Volume 6A, Chapter 4	

Additionally, Figure 3-1 provides a summary "placemat" that illustrates the PPBE process elements and timelines. This figure portrays the PPBE journey of the FY 2027 Program's Funding. The figure shows the steps taken by principal stakeholders through the PPBE process across successive calendar years in support of a particular FY's run.

Figure 3-1. PPBE Process Placemat



RECOMMENDATIONS FOR FUTURE RESEARCH RELATED TO CHAPTERS 2 AND 3

GMU identified several promising ideas for consideration in follow-on research efforts that DoD might sponsor.

1. Research, quantify, and analyze the probability of particular programmatic factors being correlated to Congressional marks. Examine the size of Congressional marks to RDT&E BA 4-5 Program Elements with over a dozen Projects compared to such Program Elements with a single Project. Compare the Army, Navy, and Air Force justification books, and for Fiscal Years 2014-2023. Analyze the data utilizing statistical techniques, including regression analysis, to determine the probability and correlation of Congressional action, and the extent of that Congressional action, in relation to Program Elements with many projects and those with one project. Based upon the results of the analysis, propose recommendations.

2. In reference to Military Service Justification Book standardization, explore a comprehensive methodology to objectively calculate, vet, and approve a defense program's risk/reward determination. This exploration will include the development of a numerical risk metric representing the probability of programmatic (technological, fielding, and integration) success as well as a reward metric representing the potential impact of achieving military preparedness and superiority. The end result will be to propose a new standard Exhibit to be submitted to Congress with the PB submission based upon the novel risk/reward metric.

4. J-BOOK KEY WORD SEARCH ASSOCIATION

When the yearly President's Budget (PB) is submitted to Congress for authorization and appropriations, the Department of Defense (DoD) Comptroller submits several Budget Documents, also called "Justification Books" or "J-Books." These are detailed documents that justify the budgetary requests for specific programs, projects, or activities within the DoD. These documents, currently provided only in PDF format, are individually submitted by each of the military services and the various agencies. Each service and agency submitting their own requests results in disjointed information that can be hard to read and follow.

Further, the Section 809 panel[1] recommendations include that the DoD implement a portfolio-based capability framework (see Section 809 Panel link in the references under the Volume 3 tab, Recommendations 36-39). This recommendation and our intent to make these documents easier to read for all personnel drives the following research question: *Can the existing J-Books be restructured to facilitate a portfolio view and allow the utilization of Artificial Intelligence/Machine Learning (AI/ML) techniques including Large Language Models (LLMs) to answer questions about DoD spending without changing the existing layout and document delivery approach?*

This is the first of two reports to address our results from the investigation of two initial exploratory research approaches. It is an initial proof-of-concept approach that uses a key word search across multiple J-Books to extract the content associated with the key word. For the purposes of this proof-of-concept demonstration, we chose to simply extract the sentences associated with the key word "JADC2" (Joint All Domain Command and Control).[2] JADC2 was chosen as this DoD strategy spans multiple service's Research, Development, Test & Evaluation (RDT&E) J-Book volumes. Subsequent (2nd and 3rd tier) associated acronyms were then extracted using a ChatGPT query of the initial results.

The research documented in this report is rudimentary and is meant to only provide an initial proof-of-concept. A more advanced capability would not only extract all the information associated with the region of the J-Books document but also provide historical analysis across the fiscal years (FY) and budgetary materials, including each FY's National Defense Authorization Act (NDAA). We were able to successfully extract tables from PDF files after putting them through Adobe's® optical character recognition (OCR) algorithm. Hence, we were able to associate cost data across the fiscal years as documented in the FY24 J-Book files. Further, we successfully integrated an LLM (ChatGPT) to provide summaries of the sections of each document and used it to demonstrate simple text queries into a MongoDB. Overall, we feel the results of this initial research are promising and adequately demonstrate the merit of the approach.

The research team proposes the following recommendations:

- **Discontinue the use of images of tables in budget documents:** While using optical character recognition (OCR) is a viable approach for our demonstration purposes, it is known to introduce errors during the conversion process. The services should stop providing PDF files with embedded images of tables.

[1] For information about the Section 809 Panel statute and what it was empowered to do, see *FY 2016 National Defense Authorization Act (Public Law 114-92)*. The link is provided in the reference section at the end of this report.

[2] For information about JADC2, download and read the DoD's *SUMMARY OF THE JOINT ALL-DOMAIN COMMAND & CONTROL (JADC2) STRATEGY* document. The link is provided in the reference section at the end of this report.

- **Provide data in XML[3] or JSON[4] formats:** Although we have described a process for converting PDF documents into either XML or JSON structured data formats, we believe the user would benefit from at least one of these machine-readable formats being provided by the services and the comptroller in addition to the PDF documents.[5, 6]

- **Provide reference tools for parsing and visualizing the data:** In addition to machine-readable XML or JSON, reference tools for parsing and visualization can provide a baseline context for the development of more advanced capabilities.

[3] Online descriptions on what the XML (Extensible Markup Language) format is can be found at: https://www.w3schools.com/xml/default.asp, and https://en.wikipedia.org/wiki/XML.

[4] Online descriptions on what the JSON (JavaScript Object Notation) format is can be found at: https://www.w3schools.com/js/js_json.asp, and https://en.wikipedia.org/wiki/JSON.

[5] This recommendation is consistent with Title LVII, the Financial Data Transparency Act in the FY23 National Defense Authorization Act (https://www.govinfo.gov/content/pkg/PLAW-117publ263/pdf/PLAW-117publ263.pdf).

[6] Requirements for providing budget materials in machine readable format can also be traced to: https://obamawhitehouse.archives.gov/the-press-office/2013/05/09/executive-order-making-open-and-machine-readable-new-default-government-, https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf, and https://comptroller.defense.gov/Portals/45/documents/fmr/Volume_02b.pdf.

5. J-BOOK PE SUMMARIZATION USING CHATGPT

When the yearly President's Budget (PB) is submitted to Congress for authorization and appropriations, the Department of Defense (DoD) Comptroller submits several Budget Documents, also called "Justification Books" or "J-Books." These are detailed documents that justify the budgetary requests for specific programs, projects, or activities within the DoD. These documents, currently provided only in PDF format, are individually submitted by each of the military services and the various agencies. Each service and agency submitting their own requests results in disjointed information that can be hard to read.

Further, the Section 809 panel[7] recommendations include that the DoD implement a portfolio-based capability framework (see Section 809 Panel link in the references under the Volume 3 tab, Recommendations 36-39). This recommendation and our intent to make these documents easier to read for all personnel drives the following research question: *Can the existing J-Books be restructured to facilitate a portfolio view and allow the utilization of Artificial Intelligence/Machine Learning (AI/ML) techniques including Large Language Models (LLMs) or "Generative AI"[8] to answer questions about DoD spending without changing the existing layout and document delivery approach?*

This is the second of two reports to address our results from the investigation of two initial exploratory research approaches. It is an initial proof-of-concept approach that uses a key word search across multiple J-Books to extract the content associated with the key word. For the purposes of this proof-of-concept demonstration, we chose to simply extract the sentences associated with the key word "JADC2" (Joint All Domain Command and Control).[9] JADC2 was chosen as this DoD strategy spans multiple service's Research, Development, Test & Evaluation (RDT&E) J-Book volumes. Subsequent (2nd and 3rd tier) associated acronyms were then extracted using a ChatGPT query of the initial results.

The research documented in this report was intended to determine if ChatGPT could support analysis of the large volume of budget materials found in the DoD Comptroller's J-Books documents in support of our larger proof-of-concept to reorganize these documents into a portfolio. We found that, while continuously improving, LLMs such as ChatGPT were not up to the challenge of analyzing the large volume of information we have in our budgetary materials. Overall, however, we were able to integrate the ChatGPT LLM into our prototype implementation and successfully used it to analyze smaller samples of data. Thus, we feel our results from this initial research are promising and adequately demonstrate the merit of the approach.

Additional strategies for future research include semantic network analysis, trend analysis, resource allocation modeling, temporal modeling, and operational implications assessment, and offering a holistic approach to dissecting and comprehending a program's dynamics. These methods can provide deep insight into inter-service synergy, technological integration, resource allocation, and operational implications.

Ultimately, this research empowers the DoD and Congress to an alternative approach to understand the complexities and interdependencies of these programs, how they can begin to associate programs into portfolios, and contribute to a more comprehensive understanding. Such insights enhance the capabilities and effectiveness of military programs and inform more efficient resource allocation, bolstering the overall decision-making processes. This research can significantly influence program development and implementation, ultimately advancing national defense and military strategies.

[7] For information about the Section 809 Panel statute and what it was empowered to do, see *FY 2016 National Defense Authorization Act (Public Law 114-92)*. The link is provided in the reference section at the end of this report.

[8] We use LLM or LLMs as the general "generative AI" term in this report.

[9] For information about JADC2, download and read the DoD's *SUMMARY OF THE JOINT ALL-DOMAIN COMMAND & CONTROL (JADC2) STRATEGY* document. The link is provided in the reference section at the end of this report.

We believe a follow-on effort should attempt to characterize the various ChatGPT PDF reader plugins, updates to ChatGPT-4, and other LLMs to determine if they can be trained/tuned to provide summarizations that directly align with congressional staff needs. Further, using a specifically trained LLM from the Chief Digital and Artificial Intelligence Office (CDAO) could also be a future research step.

The team recommends the following for future research:

- **Fund further research into LLM support of Budgetary Analysis:** Noting that Advana[10] has implemented the "GAMECHANGER"[11] capability, and a blog indicates that at least one tool vendor may have resolved the issues noted in this report[12], further research should assess various LLMs and confirm that an LLM can be trained on the DoD's corpus of data. The goal is to confirm that a ChatGPT text-based query interface can reliably support and enhance analysts with their tasks.

- **Fund further efforts to reorganize budget documents:** Providing portfolio-like budget views from AI/ML reorganizations without having to make drastic changes to the existing documentation format used by the various services would simply add a processing step to the existing delivery flow. Once completed, these results can support collaborative decisions on what changes and additions should be promulgated to the services to fully enact a portfolio management approach that includes a portfolio budget view during the accumulation of the data.

[10] Advana is the Department of Defense's (DoD's) enterprise-wide, multi-domain data, analytics, and artificial intelligence (AI) platform that provides military and civilian decision makers, analysts, and builders with unprecedented access to enterprise tools and capabilities—all in a scalable, reliable, and secure environment.

[11] For additional information on GAMECHANGER, see for example, https://www.dia.mil/News-Features/Articles/Article-View/Article/2926343/gamechanger-where-policy-meets-ai/

[12] A blog (https://c3.ai/c3-generative-ai-getting-the-most-out-of-enterprise-data/) from Graham Neubig, Associate Professor of Computer Science, Carnegie Mellon University, indicates that many of the issues identified here have been resolved by at least one LLM vendor.

6. PPBE INTERFACES WITH REQUIREMENTS AND ACQUISITION

The PPBE system, in its present state, is struggling to adapt to changing geopolitical developments, technological advancements, and the necessary agility required to uphold the nation's competitive edge. This challenge is compounded by escalating global threats and the rapid advancement of adversaries' military capabilities. The AIRC formed an Integration Research Panel to support the PPBE Reform Commission focusing on the challenges and opportunities in integrating the requirements, acquisition, and PPBE systems within the DoD. Keeping decisions from these three systems synchronized is problematic since the requirements and acquisition systems operate on an event-driven basis with associated flexibility, while the PPBE system follows a rigid, calendar-driven approach. The panel received not-for-attribution inputs from 50 leaders in DoD, industry, and academia and documented these as well as three use case examples in the first portion of a final report. The remainder of this chapter summarizes findings and recommendations based on the panel's assessment.

6.1 INTEGRATION PROBLEMS IN THE DOD

We found that key challenges are faced by each of the three core functions:

- The primary goal of the **PPBE process** is to align resources with strategic priorities. However, problems often arise when translating strategic objectives into actionable budgets and resource allocation plans given the increasing tempo of operational and strategic changes driven by ever more rapid technological growth. These issues often result in misaligned funding priorities, wasted resources, and delays in critical projects.

- The **DoD requirements process, Joint Capabilities Integration and Development System (JCIDS)** is responsible for defining what capabilities are needed to meet national security objectives. The development of requirements involves input from various stakeholders, including combatant commanders, acquisition professionals, and technologists. Integration problems occur when requirements are not effectively communicated, are not sufficiently developed in a timely manner, or when requirements are not supported by technology or aligned with available resources and budget constraints, leading to unrealistic demands.

- The **DoD acquisition process** is responsible for procuring and delivering the capabilities described by the requirements process. Integration problems in this phase often manifest as cost overruns, schedule delays, and unmet performance expectations. The lack of synchronized communication among acquisition teams, requirements officers, and budgeting personnel can result in significant inefficiencies. Resolving integration issues typically falls to the acquisition Program Executive Officer (PEO) or Program Manager (PM).

The effectiveness of the three decision support systems hinges on their capacity to integrate in a way that ensures the delivery of the right capabilities at the right time. Consequently, enhancing integration and synchronization among these systems is of paramount importance to DoD. Our panel examined the seams and integration problems among these three systems. Our findings and recommendations are summarized as follows:

PPBE / ACQUISITION SEAM

PPBE is calendar-driven, while Acquisition is requirements- and activity-driven. Changes in deliverables and events (e.g., test results) often require execution year flexibility, but existing processes require senior intervention and heroic efforts to accommodate changes that were not programmed years in advance (e.g., transitioning the Long-Range Anti-Ship Missile (LRASM) from a successful prototype to a program of record). PEOs have limited ability to adjust resources within their portfolios, even though Congress has authorized new acquisition authorities to enable flexibility and speed. This inhibits acquisition agility and hinders our ability to keep pace with new technology, especially commercial technologies available now to competitors and adversaries. Programs with incremental/spiral development and modular open architecture strategies (e.g., Space Development Agency (SDA)) are better able to accommodate PPBE changes by incorporating upgrades to later iterations. The changes recommended by the PPBE Reform Commission will go a long way toward providing the needed flexibility. To develop additional recommendations, the panel reviewed issues in time-based synchronization, availability of data to support decisions, pulling important technologies across the "Valley of Death," and establishing transparency and trust. These are documented in the full report and form the basis for the following recommendations.

RECOMMENDATIONS

- We endorse the Commission's Interim Report recommendations that will provide much needed flexibility, especially the recommendations on:
  - » Colors of money (a different approach)
  - » Modify thresholds for Below Threshold Reprogrammings (BTRs)
  - » Modify internal DoD reprogramming requirements
  - » Modify availability of appropriations
  - » Mitigate problems caused by Continuing Resolutions
  - » RDT&E Budget Activities consolidation
  - » Transform the budget structure
  - » Systematic review and consolidation of budget line items
  - » Improve understanding of private sector practices
- To build more flexibility in developing, producing, and sustaining warfighting capabilities, DoD should structure the Program Objective Memorandum (POM) and budget to group resources for like-capabilities into PEO-managed portfolios with tradeoff authority while including appropriate controls.
- To reduce the time for integration from a PPBE perspective, DoD should define clear roles and responsibility (who can say "yes," and more importantly, limiting who can say "no" to approvals) and avoid the drive for consensus through staff action by elevating issues to decision makers in a timely manner. For example, on the acquisition side, it is recognized that the top line for every program is a prioritization function that comes out of a larger PPBE process. Once that top line decision is made, the policy should clearly state that:

  - only the PEO has approval authority over the PM from program perspectives; all others are advisory to the PM and PEO but cannot nonconcur;
  - only the Component Acquisition Executive (CAE) has approval authority over the PEO; all others are advisory to the PM and PEO but cannot nonconcur;
  - only the Defense Acquisition Executive (DAE) has approval authority over the CAE; all others are advisory to the PM and PEO but cannot nonconcur;
  - the Milestone Decision Authority (MDA) is the main stopping point for approvals up the acquisition chain-of-command; the policy clearly states that "For MDAPs, it is DoD policy to budget to the DCAPE ICE unless an alternative estimate is specifically approved by the MDA"—thus, no others have an ability to say "no"; and
  - those above the MDA in the acquisition chain-of-command can intervene in oversight, but this should be minimized.

- DoD should link the concept of affordability in PPBE (DoDD 7045.14, Enclosure 3) to the affordability analysis called for and defined in the acquisition community (DoDI 5000.85, Section 3, and underlying processes). Affordability analysis results should be provided with all JCIDS requirements validations.

- To improve transparency and information sharing, DoD should prioritize implementation of information technology systems that are intuitive for building transparency and trust, including developing capabilities to use large language models (LLMs), natural language processing (NLP), and machine learning (ML) to make PPBE (including justification books) more timely, accurate, accessible, and transparent for authorized users. There are nascent capabilities in Advana, and other AIRC research for the Commission explored how these evolving capabilities could be applied to improve information sharing and cognizance (especially from portfolio and mission views), but continued R&D is recommended for this promising approach.

- If more aggressive PPBE reform is possible, the DPG could specify that tradeoffs in funding validated requirements be within a major funding category (RDT&E/Procurement, Personnel, and Operations and Maintenance) rather than across these categories to ensure that the investment accounts (future capability) are not used to fund current capability.

REQUIREMENTS / PPBE SEAM

There is a major disconnect between the formal DoD requirements process and the PPBE process at every level below the Defense Planning Guidance (DPG). Given that every materiel product is generated by requirements, this represents a critical failure. The Joint Requirements Oversight Council (JROC) validates Combatant Command (CCMD) and Service requirements but has little or no influence over PPBE priorities, which are set in the programming processes. Combatant Commanders (CCDRs) feel that their priorities are subordinate to Service priorities with no forum for resolution. Industry is expected to invest in production capacity but faces risk due to unknown DoD production requirements. Integrating the DoD Requirements process more effectively with PPBE and Acquisition will require increased use of Cross Functional Teams (CFTs), more CCMD influence on resources, more emphasis on affordability analyses, and professional development in the requirements community.

RECOMMENDATIONS

- DoD should empower the JROC to assign a validated CCMD Joint Emerging Operational Need Statement (JEONS) to a Service or Agency as a "must fund" priority, with the Deputy Secretary of Defense (DEPSECDEF) visibility of the resulting resource decisions. Require that CCMDs prioritize their requirements as part of the JROC requirements validation process, and that requirement lists be matched to and reconciled with Service Budget requests in the PPBE process by DEPSECDEF.

- The Joint Staff and DoD should give CCDR-provided scenarios, exercise, and wargaming results weight equal to that given to the Military Services and Joint Staff inputs as the basis for the annual Capability Gap Analysis of the Future Years Defense Program (FYDP).

- DoD should provide Service affordability analysis along with requirements that are reviewed and approved by the JROC. This will provide the JROC with the Service's sense of priorities and affordability with respect to the materiel item in question. Affordability analysis is required at Milestone A and thus is available for CDD validation (see DoDI 5000.85).

- To provide Industry more visibility into DoD requirements, especially with respect to production capacity, DoD should include in budget justification documents provided publicly with the President's budget request both a threshold [minimum] and an objective [stretch goal] level for annual procurement quantities. DoD acquisition programs should reflect these requirements with contract options to the objective level and termination liability clauses applicable below the threshold level. In addition, DoD should provide cleared defense contractors with controlled access to validated mission needs and requirements statements (at the CUI and classified levels) to help with industry's planning for Internal Research and Development (IR&D), staffing, and infrastructure investments and investment hedges.

- DoD should provide Industry (along with Congress) data and information from the President's Budget justification books in structured machine-readable formats. (This will also facilitate improved data analytics and portfolio views discussed in other AIRC reports to the PPBE Commission.)

- DoD should give investments in staffing, training, and career development of the Joint Staff and Military Service requirements community higher PPBE priority, as has been done successfully in Defense Acquisition Workforce improvement investments. This would:

  - » Professionalize the requirements generation, determination, validation, and management process. Develop entry- and mid-career training programs along with career-enhancing recognition for those who successfully participate in the process to improve collaborative decision processes among the user, PPBE, and acquisition communities.
  - » Establish a DoD Requirements Workforce Development Account (DRWDA) analogous to the DoD Acquisition Workforce Development Account (DAWDA) and the similar funds (DAWDFs) for the three military departments.
  - » Fund a segment of the Defense Civilian Training Corps (DCTC) focused on requirements management for training and orientation of undergraduates as an improved civilian pipeline into the Requirements Community (generally) and the interface with PPBE.

REQUIREMENTS / ACQUISITION SEAM

We recognize that this seam is outside the scope of the PPBE Reform Commission, however it represents a key failure point through decades of "reforms" because each element was treated as a silo, with little understanding of the secondary consequences of decisions across the seam. We found that integration needs improvement and are providing recommendations for future consideration. The current JCIDS process is widely criticized as too slow and bureaucratic to keep pace with technology or threats and is based on a waterfall model rather than the highly iterative and collaborative agile development process used in industry. Successful programs have used CFTs for collaboration and iteration among requirement developers and system engineers, often with user representatives embedded in the program office (e.g., B-21) to better balance documenting needs and requirements with deliverables to yield more timely delivery of operationally relevant capabilities. In light of acquisition reform and PPBE reform initiatives, we found that reform of the requirements process is needed to achieve the agility DoD and Congress demand. A key theme in improving this seam is a focus on organizational roles and responsibilities.

RECOMMENDATIONS

- We agree with the current Senate version of the FY 2024 NDAA direction to reform the DoD requirements system. We recommend starting now on such reforms, to include:
  - » Forming a JS-led CFT with OSD and Service stakeholders to reform the system, specifically the boundary between Requirements (JCIDS) and Acquisition (Defense Acquisition System (DAS)).
  - » Developing a more agile, collaborative, and iterative process for the integration and transition of requirements to the systems engineering process.
  - » Developing a capability needs and requirements framework and pathways that are aligned to the Department's Adaptive Acquisition Framework pathways, and that include aligning the Department's science and technology (S&T) processes to emphasize products that address capability requirements.
  - » Developing a process to rapidly validate the military utility of commercial solutions to meet capability needs or opportunities.
  - » Developing a mission engineering approach for defining enduring requirements in a set of capability portfolios, with a set of mission impact measures that capability deliveries must seek to continuously improve.
  - » Assessing best practices to ensure that the requirements process for software, artificial intelligence, data, and related capability areas enable a more rapid, dynamic, and iterative approach than used for hardware systems.
- In addition, we recommend that the reforms of the DoD Requirements process include designating a single organization or entity directly responsible for overseeing and driving the development of joint capabilities.

TOPICS FOR FURTHER RESEARCH

The panel identified several promising ideas and potential recommendations that require more research or prototyping before they can be finalized. We offer these for consideration in follow-on efforts that DoD might sponsor.

PPBE / ACQUISITION SEAM

- Existing technology can be used for a rapid prototype of an LLM-enabled approach to J-books. Commercial offerings allow DoD to select whatever LLM is best suited (and replace it when something better is available), use controlled DoD data sources for training the model, guarantee factual accuracy and citable sources without risk of hallucinations, and demonstrate the utility of the system in responding to complex natural language queries. We believe a spiral prototype interacting with users can validate key aspects of the system well within a year. We recommend such a prototype be considered for SBIR funding or other source of FY 2024 funds.

- Budget execution reviews could move from calendar-based Comptroller sweeps of unobligated funds to acquisition managers setting an event-based obligation schedule for each program when funds are appropriated, and DoD and Service Comptrollers measuring obligation status against these schedules. Congress could maintain oversight through a data management infrastructure that permits near real-time monitoring of execution status. Needed research includes further investigation of historical obligation patterns on acquisition programs compared to the normal linear execution model.

- Given that sustainment costs historically exceed procurement costs, more emphasis and visibility is warranted on sustainability concerns as a factor of total program cost during development. One idea is to fence investment funds for reducing lifecycle (sustainment) costs, perhaps by designating them as RDT&E BA 7 and allowing them to be used in early development to reduce future sustainment costs (as if the system already existed and we were working to address sustainment issues). Further study is needed to get stakeholder views and apply reliability growth models and cost models to assess the potential effects of such a recommendation.

REQUIREMENTS / PPBE SEAM

- DoD could ask the geographic CCMDs to propose regional equivalents to the European Deterrence Initiative (a good example) for consideration in future planning and programming. The CCMDs and associated Service funding lines would have to prioritize within available dollars and then engage in the program and budget review processes for additional resources, if required. The CCMDs should use the capability in the Services/Agencies to execute the funds for the CCMD priorities rather than duplicate program offices, contracting, etc. That gives the CCMDs more flexibility than waiting till the end of the POM to see how their IPLs stacked up for funding. It also incentivizes the Services for meeting CCMD IPL requirements with increased funding. If a more radical approach is possible, geographic CCMDs might be given substantial control over funds for Joint emerging needs. Research is needed to develop a method of cross-CCMD coordination to avoid duplication of capability development efforts, to get stakeholder views, and to provide cost estimates. A CFT with CCMD, Service, OSD, and JS representation would be needed.

- To better inform Industry on production capacity planning, DoD could provide access to Defense Contract Management Agency (DCMA) and Defense Logistics Agency (DLA) supply chain insights to better recognize, plan, and fund for supply chain risks and production capacity issues on highest priority, cross-program parts, and end-of-life procurement needs. This would need further research regarding protection of proprietary interests and analysis of the differences between production and sustainment supply chains.

For more details on the methodology, findings, and recommendations, refer to the full report.

7. A BUDGET THEORETICAL PERSPECTIVE ON PPBE REFORM

Budget theory and historical lessons offer insights into the basic structure of the DoD's PPBE process and possible ways to reform PPBE to improve DoD innovation and adaptability.

First, for reforms to be successful, *decision-makers' ability and willingness* to utilize administrative flexibilities need to be enhanced. This includes addressing the risk of non-prudent use of administrative discretion and low risk tolerance.

Second, budget participants need to be involved in the design and implementation stages of PPBE reforms that relax restrictions. Also, when delegating PPBE decisions, *clearly defined goals, authorities, and responsibilities* are needed to convey senior leadership intent and hold delegates accountable. A potentially important starting point for moving toward additional clarity in goals is to assess the need to add further detail to the Defense Planning Guidance (DPG).

Third, benefits hinge on several conditions that need to be addressed in ways where policy makers and DoD officials do not allow the perfect to get in the way of the good. This includes *addressing the sheer complexity* of the defense budget when seeking to optimize and adjust at each stage of PPBE.

Finally, there are three fundamental budgeting formats: outcomes, inputs, and tasks. *Outcome-based budgeting generally used in PPBE still appears to be the desired format* given the defense budget exists solely to improve national security.[13] Portfolio- and mission-based budgeting aligns well with the intent of outcome-based budgeting and thus is supported by budget theory.

The other two formats focus more on fiscal responsibility/control and efficiency/managerial control, respectively, which may not optimally result in defense mission results. Some portions of the DoD budget are actually input- or task/activity-based, which are not explicitly tied to agency outcomes but rather intermediaries that can lead to outcomes. This further supports changes that better align budget elements with mission outcomes.

WILLINGNESS TO UTILIZE ADMINISTRATIVE FLEXIBILITIES

Decision-makers in the DoD need to be able and willing to use new budgeting or reprogramming authorities in recommended reforms. Decision-makers (especially at lower levels) need to be sufficiently trained and incentivized to properly use these authorities. Moreover, the frequency of changes in PPBE statutes, regulations, policy, and guidance aggravates training deficiencies in both staff and leadership. Finally, public servants tend to be overly risk-averse because of disincentives and the threats of personal punishments (e.g., many decision-makers take out professional liability insurance because they are worried that a mistake may lead to personal financial penalties).

[13] Outcome-based programming is called "program budgeting" in the literature—not to be confused with "acquisition programs".

RECOMMENDATIONS

- **Batch PPBE reforms:** Consider introducing discipline in the frequency of reforms by batching them so they only become effective periodically (say, every 3–4 years).
- **Improve PPBE training:** Explore ways to streamline processes for requesting above-threshold reprogramming.
- **Align incentives:** Conduct further applications of frameworks to align incentives and culture them with prudent decision-making.[14]
- **Balance accountability:** Conduct applied research to (a) assess and summarize the frequency with which DoD officials are held personally financially liable for mistakes made in good faith without intent of breaking a law, and (b) develop recommendations on how to balance actual with perceived liabilities—possibly to include better training on the actual risks and engagement with the Department of Justice to clarify when the Government will stand behind civil servants who are conducting their job. If risks are significant, the research may consider whether changes to law would be prudent to indemnify public servants from financial penalties for mistakes when operating in good faith in their areas of responsibility and authority.

DECENTRALIZING SOME PPBE AUTHORITIES

Delegation of decisions is possible (e.g., similar to Commander's Intent), but this must come with mechanisms to hold lower-level decision-makers accountable for aligning to senior leader guidance.

RECOMMENDATIONS

- **Develop improved ways to define PPBE goals:** This may include additional details in the DPG but also developing additional actionable goals during execution to inform actions, such as reprogramming and making tradeoffs between expending funds on problems in development versus buying down future sustainment costs through improved designs.
- **Delegate more PPBE decisions:** Explore ways to shift decision authority down from senior DoD leaders by providing clearly defined goals along with PPBE authorities and responsibilities to reduce managerial restrictions by increasing accountability for results.
- **Delegate below-threshold reprogramming to PEOs:** Along with ideas to raise reprogramming thresholds, consider delegating below-threshold reprogramming authorities (e.g., to program executive officers [PEOs]) rather than requiring significant reviews and higher-level approvals.

[14] See Girth et al., 2002, for approaches on aligning incentives. Incentives for Motivating Workforce Agility and Innovation - The Acquisition Innovation Research Center (acqirc.org)

ABILITY TO UTILIZE ADMINISTRATIVE BUDGET FLEXIBILITIES

The intent of PPBE is to consider all alternative means to accomplish established objectives, but PPBE is too large and complicated to predict the results of, or even consider, all options every budget cycle, resulting in slow PPBE and less-desirable coping mechanisms. This includes *incrementalism* (using last year's budget as the bulk basis for the next year's budget, which is more aligned with line-item budgeting focused on inputs) and *satisficing* (using simpler structures that are acceptable but not necessarily optimal).

RECOMMENDATION

- **Develop computational top-down budgeting:** Continue developing portfolio and mission-engineering decision processes. Explore computational and AI approaches that can build budgets from top-down guidance and portfolio/mission reviews.

BUDGETING FORMAT

Outcome-based budgeting generally used in PPBE still appears to be the best format, but more can be done to structure DoD budgets around outcomes instead of inputs and tasks/activities.

RECOMMENDATIONS

- **Keep PPBE budget formats focused on outcomes:** Retain PPBE's basic theoretical underpinning of outcome-based program elements.
- **Continue development of portfolio- and mission-based budgeting:** Strengthen PPBE's focus on outcomes (over inputs and tasks) by ensuring that budget documents clearly describe the connection between acquisition programs and other tasks/activity line items and agency outcomes. Moving to budget elements that are outcomes (e.g., by mission or portfolio) also align and should be explored to the degree that leadership intent, equities, and control (both by Congress and DoD leaders) are retained to a satisfactory level.
- **Restructure DoD budget elements that are input- or task-oriented:** With the basic format in mind, it would be useful to conduct a review of the entire current DoD budget to identify those that are formatted around inputs or tasks/activities and develop alternative outcome-based formats to replace them, improving both the focus on mission and stakeholder understanding of the need for these elements and their funding levels.

8. DOD OBLIGATION AND EXPENDITURE RATES: MORE REALISTIC BENCHMARKS AND THE EFFECTS OF CONTINUING RESOLUTIONS AND OTHER EVENTS ON OBLIGATION RATES

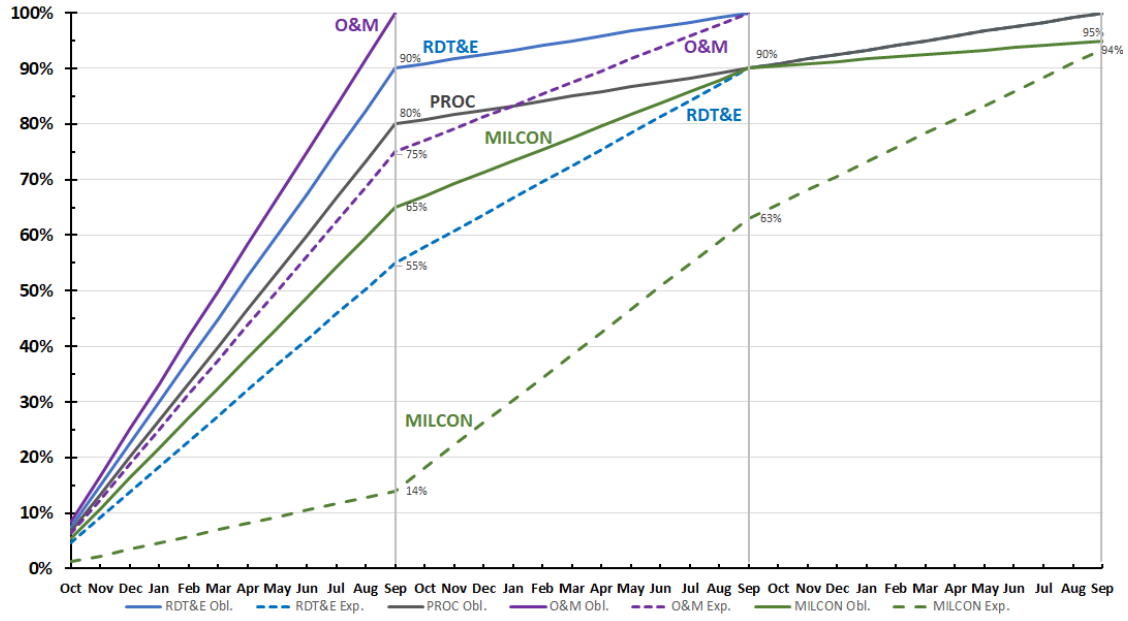
What gets measured gets managed – even when it's pointless to measure and manage it, and even if it harms the purpose of the organization to do so.

Peter Drucker

A common management tool for overseeing program execution is to use benchmarks to compare against the actual obligation rates of funds and their final expenditures (outlays or disbursements). The Department of Defense (DoD) uses linear benchmarks for each category of funding (see Figure 8-1). Such benchmarks can help identify programs and activities that may have issues in spending funds within the year(s) of availability and thus may be candidates for further review to have portions of their budgets reprogrammed for critical priorities that emerged in the year of execution.

This paper assesses these benchmarks through quantitative analysis of DoD obligation and expenditures over time, earned-value management (EVM) data on contractor execution rates, and a review of existing theory and qualitative data from experts. It also assesses the statistical effects of delayed full fiscal year (FY) appropriations associated with continuing resolutions (CRs), calendar-month effects (e.g., at the start and end of the FY), and time trends on DoD obligation rates. These analyses provide new insights into the realism of DoD obligation and expenditure benchmarks, leading to recommendations for improving these benchmarks.

Figure 8-1. Current Comptroller Obligations and Expenditures Rule-of-Thumb Benchmarks



SOURCE: Under Secretary of Defense (Comptroller), as reported in Tomasini (2017).

NOTES: The dashed lines are the obligation (Obl.) benchmarks over time, and the solid lines are the associated expenditure (Exp.) benchmarks over time. The O&M benchmark curves rise the fastest, followed by RDT&E and PROC. Tomasini (2017) reports that Procurement expenditures are "N/A." Exp. = expenditures; MILCON = Military Construction; O&M = Operation and Maintenance; Obl. = obligations; PROC = Procurement; RDT&E = Research, Development, Test, and Evaluation.

OBLIGATION RATES: EFFECTS OF CONTINUING RESOLUTIONS AND OTHER EVENTS

One concern often raised related to the PPBE process is the potential effect of continuing resolutions (CRs) on spending in the DoD. Statistical analysis of DoD obligation rates for Research, Development, Test, and Evaluation (RDT&E), Procurement (PROC), Operation and Maintenance (O&M), Military Personnel (MILPERS), Military Construction (MILCON) found the following (see Table 8-8.1 and Table 8-8.2):

- Obligation rates are higher in the two to six months after the full budget is passed (MAB)—i.e., once managers know their authorized spending. Thus, CRs delay a portion of funding into later in the FY.
- S&T and Management Support within RDT&E have a significantly lower obligation rate during CR months that other types of funding did not exhibit.
- Obligation rates are often lower the first October in the spending cycle, possibly reflecting assertions in the literature that it takes time to delegate spending authorization to program managers.
- Obligation rates are often higher the first March in the spending cycle (i.e., the month before the midyear spending reviews).
- Obligation rates for some types of funding are higher in September.
- While each category of funding has a general underlying linear trend, MILPERS obligations are linear with slight upward trend.
- RDT&E and Procurement dollars obligate the first year on a fairly linear basis but then inflect to a reduced, curved basis. Thus, obligations are modeled well by linear models with these variate effects.
- Military Construction (MILCON) shows a significant upward curve in the first year rather than the straight line in the benchmark but becomes fairly linear afterwards. Also, a significant fraction of MILCON obligations occurs after year 3, which is not in alignment with the benchmark targets.

These statistical models align somewhat with linear obligation rate targets set by the DoD Comptroller and are compatible with anecdotal assertions that when told to obligate, programs do. This does not account for any changes in DoD priorities given new threats or technological opportunities since the budgets were first drafted early in the PPBE process, but when told to spend or risk losing their funds, individuals across the DoD appear to do so to a large extent.

Table 8-8.1. Contributions of CRs and Other Variables Affecting RDT&E Obligation Rates: S&T, Development, and Management Support (FY 2011–2023 Appropriations)

		1st Year of Availability				2nd Year of Availability			
		Combined	S&T	DEV	Mgt	Combined	S&T	DEV	Mgt
Avg. Base		5.9%	6.4%	6.0%	6.3%	1.7%	2.3%	1.6%	2.5%
Add CR Effects	CR		-1.0%		-1.4%				
	1 MAB		-1.6%						
	2 MAB	4.3%		3.0%	2.1%				
	3 MAB	6.3%	4.8%	7.1%	2.1%				
	4 MAB	3.7%	4.3%	4.8%					
	5 MAB		1.5%						
	6 MAB		1.8%						
Add Calendar Month Effects	Oct.	-2.3%	-3.5%	-1.9%				0.40%	-0.63%
	Nov.		-1.1%			0.91%		0.52%	
	Mar.	2.3%	1.6%	1.7%					0.68%
	Sept.		2.4%		2.9%	1.0%	1.3%	0.84%	1.3%
Time Trend	Time (mo.)					-0.10%	-0.15%	-0.10%	-0.10%
Adj. R2		63%	84%	60%	42%	32%	48%	50%	33%

MAB = month after budget is passed; CR = month under a continuing resolution (the months before 1 MAB); BA = Budget Activity; S&T = Science and Technology (BA-1, BA-2, and BA-3 combined); DEV = development (BA-4, BA-5, and BA-7 combined); Mgt = Management [Support] (BA-6); mo. = month; Oct. = October; Nov. = November; Jan. = January; Mar. = March; Aug. = August; Sept. = September.

Table 8-8.2. Contributions of CRs and Other Variables Affecting Obligation Rates (FY 2011–2023 Appropriations)

			RDT&E (combined)		PROC		O&M	MILPERS
			1st Year	2nd Year	1st Year	2nd–3rd Years		
Average Base	Monthly Rate	*Base rate:*	5.9%	1.7%	5.0%	2.0%	7.5%	7.9%
CR Effects	1st MAB	*If true, add:*					1.2%	
	2nd MAB	*If true, add:*	4.3%		1.8%		2.4%	
	3rd MAB	*If true, add:*	6.3%		4.6%		2.4%	
	4th MAB	*If true, add:*	3.7%		2.2%		1.6%	
Calendar Month Effects	October	*If true, add:*	−2.3%		−3.6%		−1.1%	
	November	*If true, add:*		0.9%		0.6%	−0.8%	
	December	*If true, add:*				0.9%		
	March	*If true, add:*	2.3%		2.6%	0.4%		
	July	*If true, add:*					2.4%	
	August	*If true, add:*					−1.8%	
	September	*If true, add:*		1.0%	4.6%	1.4%	4.1%	0.4%
Time Trend	Time (month)	*If true, add:*		−0.1%		−0.1%		0.1%

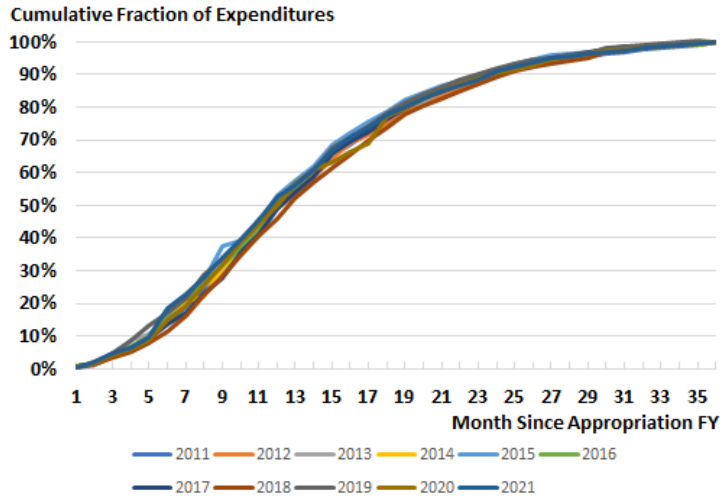
MAB = month after budget is passed.

EXPENDITURE RATES

Analysis of DoD data show that RDT&E, Procurement, and O&M expenditures follow an S-curve shape rather than the linear profiles in the DoD's benchmarks. This aligns with over 50 years of data and theory in the literature.[15]

While the S-curve for RDT&E meets the 12- and 24-month targets of 55% and 90%, respectively, the average 6-month value of 15.5% is well below the benchmark of 27.5% (see Figure 8-2). Thus, the DoD's linear RDT&E benchmark poorly informs the midyear execution review for RDT&E. RDT&E, O&M, and MILCON expenditure differences between actuals over the last decade and the current linear benchmarks can be as large as $10 billion, $23 billion, and $3 billion, respectively.

Figure 8-2. Cumulative RDT&E Expenditures by Month After Appropriation (FY 2011–2021 Appropriations)



NOTE: Month 1 is October of the FY in which the appropriations were made.

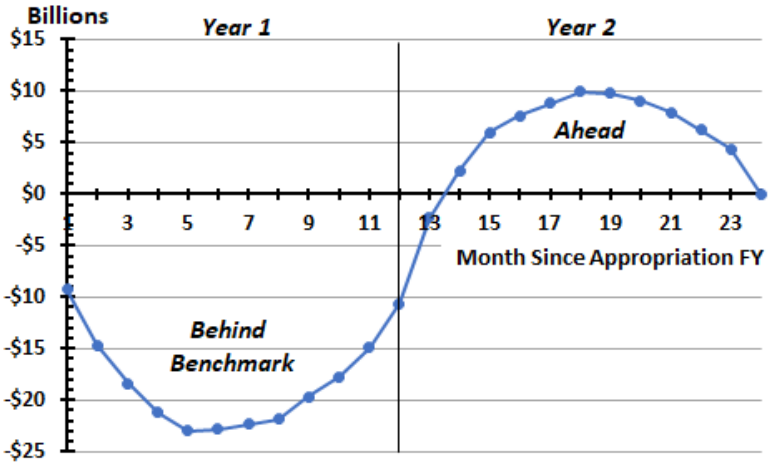
ALIGNING OBLIGATION AND EXPENDITURE BENCHMARKS WITH THEORY AND DATA

This paper reached the following conclusions based on the review of theory and analysis of available data.

At the least, benchmarks should be adjusted to reflect realities evident in recent years. DoD obligation and expenditure data consistently show statistically significant differences between average actuals and simple linear benchmarks. If benchmarks are not adjusted, then benchmarks are less effective at identifying potential issues. When average (normal) actuals are behind the benchmark, then too many programs may be undergoing subsequent deep-dive performance reviews. Likewise, when average actuals are above the benchmarks, then too few programs may be undergoing subsequent deep-dive performance reviews. Thus, these are indicators that updating benchmarks may improve the effectiveness and efficiency of performance reviews by helping to focus better on programs that may be behind. For example, Figure 8-3 shows that O&M expenditures are, on average, as much as $23 billion below benchmarks in months 5–6 (right before mid-year reviews) and as much as $10 billion over benchmarks by month 18. This indicates potentially significant inefficiencies given limited oversight resources.

[15] See, for example, Norden, 1970; Watkins, 1082; Lee, Hogue, and Gallagher, 1993; Lee, Hogue, and Hoffman, 1993; Gallagher and Lee, 1996; Davis, 2008; Behn, 2008; Davis et al., 2009; Burgess et al., 2014; Brown et al., 2015; Schiavoni, 2019.

Figure 8-3. Dollar Difference Between Average Cumulative O&M Expenditures and Current Benchmark (FY 2011–2022 Appropriations)



The best shape of obligation benchmark curves ultimately comes down to intent and theory. While the data in Chapter 2 show that managers in the DoD tend to obligate at rates that generally align with current linear obligation benchmarks, there are good reasons to reconsider these profiles. First, even with pressures to obligate on a straight line, actual data show startup delays as well as reductions due to CR effects. Also, RDT&E inherently involves engineering uncertainty and surprises, so it may be more effective for the DoD and the country to target more obligations in the second year than in the first. In addition, shifting more obligation targets for RDT&E and Procurement into the second year would give DoD managers more time to make investments when needed (earlier or later), negotiate better deals (e.g., prices, intellectual property rights, and deliverables), and fully assess contractors' execution, subcontracting, and supply-chain plans and risks.

Benchmarks should be adjusted for CR and financial-management realities. Regardless of the basic shape of the benchmarks, the statistical analysis in Chapter 2 shows real-world effects that should be considered for RDT&E, Procurement, and O&M. CRs result in obligation bumps after full budgets are passed as well as reductions during CRs for S&T and Management Support. Obligation rates in the first month (October of the first year) are lower than the current benchmarks (probably from the time it takes for the financial management system to allocate spending authority to program managers). These CR effects introduce some level of S-curve patterns into actual obligation rates.

S-curves for obligation benchmarks may be beneficial for RDT&E, PROC, and O&M. While actual obligations have underlying linear bases, shifting to an S-curve profile for obligations would allow more time for improved performance and deals, addressing the points above.

Benchmarks can be useful but require additional due diligence. When combined with further due diligence, benchmarks can help the DoD and Congress identify funds that could be reprogrammed to address higher-priority threats and needs that emerge during the spending periods. The combined effects of these benefits can improve DoD mission outcomes by identifying badly needed resources. However, the emphasis here is on proper use and due diligence to ensure a balance between the benefits and issues. The use of benchmarks alone does not provide insight into the practical realities and issues in execution. Anecdotes indicate that DoD and Congressional leadership do not rely solely on benchmarks to identify from whom to take money for new urgent priorities that arise during the year of execution. However, other anecdotal evidence indicates that program managers believe otherwise, adding to the concern that these managers may prioritize spending to benchmarks over more prudent uses of financial resources, leading to undesirable or unforeseen negative side effects.

Avoid unforeseen negative consequences from managing to benchmarks. Finally, metrics drive behavior. This concern is well documented in the literature[16] and also can be seen in the increased obligation rates in March immediately before the midyear reviews that identify programs spending below the benchmark rates for potential budget reprogramming to other programs and needs. While management metrics can be useful tools for insight, management pressures will drive behavior to the exclusion of other factors. Forcing people to spend to a curve will get spending to that curve whether or not that spending results in the best use of taxpayer dollars and the best results for national security. This axiom also applies to other potential uses of these benchmarks, such as adjusting Office of Management and Budget (OMB) apportionments based on changes in benchmarks.

SUGGESTIONS FOR FUTURE RESEARCH

These analyses highlighted the following areas for suggested future research that are summarized in Chapter 4 of the full paper, which may lead to additional recommendations:

- Piloting modified benchmarks.
- Identifying expenditure benchmark profiles for Procurement.
- Assess obligation and expenditure rates at the account level within each category.
- Assess sources of obligation and expenditure data errors.

RECOMMENDATIONS

Based on these observations, we recommend that the DoD Comptroller consider modifying their benchmarks. Four optional variants are discussed in the report. The preferred option includes adding additional S-curve ramp-up elements on top of historical obligation behaviors and recommends replacing linear expenditure profiles with historical S-curve profiles. Table 8-8.3 summarizes our recommendations.

Table 8-8.5 and Table 8-8.6 show the recommended Option 1 benchmarks for the first three years of availability. These benchmarks include S-curves added to the beginning of historical averages for obligations; expenditure benchmarks reflect recent historical patterns.

In addition to aligning expenditure benchmarks to actual data and theoretical objectives, such changes could help eliminate the negative side effects cited in theory and the literature that program managers may seek expenditures prematurely just to meet comptroller benchmarks at the expense of other program and department objectives of prudent use of the resources (see, for example, Marsalis, 2022; Commission on PPBE Reform, 2023, p. 33). Slight delays in switching to S-curves with their lower initial expenditure benchmarks should give program managers more time to get good deals for the program, the DoD, and taxpayers rather than having to rush negotiations and contracting to meet somewhat arbitrary benchmarks or risk losing their funding.

There would be some cultural and process adjustments for both Congress and DoD (and Industry) to adjusting the obligation and expenditure benchmark profiles over time, but the benefits could be improved performance given the financial resources provided by Congress and the taxpayers to the DoD. In the end, keep in mind the following insightful quote.

[16] See, for example, National Research Council, 2005; Behn, 2008.

Tell me how you measure me, and I will tell you how I will behave.
If you measure me in an illogical way…do not complain about illogical behavior.
Eliyahu Moshe Goldratt

Table 8-8.3. Recommendations for Improving Obligation and Expenditure Benchmarks

Obligations	Expenditures
• Reduce obligation benchmarks for the first 1–2 months for RDT&E, PROC, and O&M to reflect process delays in allocating spending authorities. • Consider changing benchmarks to S-curves instead of straight lines. • Consider allowing more time in benchmarks for later spending to give time to get better negotiated deals and address surprises.	• Change benchmarks to S-curves for RDT&E, PROC, and O&M. • At a minimum, if the benchmarks are not changed to S-curves, consider: » Reducing expenditure benchmarks for the first 3 months. » Changing benchmark shapes to straight lines across all years for multi-year funds rather than front-loading in the first year. • Add predictive metrics to identify more likely spending shortfalls.
• Explore switching to plan-based benchmarks instead of fixed benchmark curves, using Advana to collect plans from program offices. • Ensure proper due diligence along with spending relative to benchmarks before taking program funds. • Use needs, plans, and priorities for budgeting—not just spending. • Avoid overly enforcing benchmarks and other metrics. Keep these as information tools. • To avoid slowing down DoD acquisition, do not use obligation and expenditure benchmarks as a guide to OMB apportionments—instead inform apportionments based on the distribution data of recent actual obligations and expenditures. • Pilot these changes before pursuing more aggressive shifts to lower benchmarks in earlier years to understand better the effects (if any) on changes in unobligated and unexpended funds at the end of normal availability.	

Table 8-8.4. Recommended Benchmarks: Benchmarks Options: Elements and Ranking

	Obligations		Expenditures	RDT&E	Rank
	Base Shape	***Variables***			
Option 1	S-curves on historic	CR, MAB, Calendar, and Time Effects	Historic (S-curved)	Separate S&T, DEV, Mgt	1 (Preferred)
Option 2	S-curves on historic			Combined	2
Option 3	Historic (linear base)			Separate S&T, DEV, Mgt	2
Option 4	Historic (linear base)			Combined	3
Option 5	As-is (arbitrary lines)	None	As-is (arbitrary lines)	Combined	4

Table 8-8.5. Option 1 Separate RDT&E Benchmarks: S-Curved Obligation and Historical Expenditure Curves

		S&T (BAs 1, 2, 3)				Development (BAs 4, 5, 7)			Management (BA-6)			
Year	Month	Obs.			Exp.	Obs.		Exp.	Obs.			Exp.
			Add if in CR	*Add after CRs*			*Add after CRs*			*Add if in CR*	*Add after CRs*	
1st	Oct	1.1%	*-1.04%*		0.52%	1.1%		0.36%	1.1%	*-1.42%*		0.69%
	Nov	3.9%	*-2.08%*		1.6%	3.9%		1.2%	3.9%	*-2.84%*		2.8%
	Dec	8.3%	*-3.12%*	*1st MAB: -1.6%*	3.2%	8.3%	*1st MAB: 0%*	3.5%	8.3%	*-4.27%*	*1st MAB: 0%*	5.7%
	Jan	15.1%	*-4.16%*	*2nd MAB: -1.6%*	5.1%	15.1%	*2nd MAB: 3.0%*	6.0%	15.1%	*-5.69%*	*2nd MAB: 2.1%*	8.9%
	Feb	22.7%	*-5.20%*	*3rd MAB: 3.3%*	7.3%	22.7%	*3rd MAB: 10.1%*	9.4%	22.7%	*-7.11%*	*3rd on: 4.2%*	12.4%
	Mar	31.5%	*-6.24%*	*4th MAB: 7.5%*	10.5%	31.5%	*4th on: 14.9%*	14.9%	31.5%	*-8.53%*		16.5%
	Apr	40.5%	*-7.28%*	*5th MAB: 9.0%*	14.3%	40.5%		19.6%	40.5%	*-9.96%*		21.9%
	May	48.5%	*-8.32%*	*6th on: 10.8%*	18.4%	47.9%		25.6%	50.0%	*-11.38%*		26.7%
	Jun	54.9%	*		22.9%	53.9%		31.3%	56.4%	*		32.0%
	Jul	61.3%	*		27.7%	59.9%		38.3%	62.7%	*		36.9%
	Aug	67.8%	*		33.3%	65.9%		43.8%	69.0%	*		42.3%
	Sep	76.6%	*		39.6%	71.9%		50.7%	76.9%	*		47.9%
2nd	Oct	85.1%			44.8%	88.8%		56.4%	78.4%			52.6%
	Nov	87.0%			49.4%	90.7%		60.7%	80.7%			55.8%
	Dec	88.9%			54.3%	92.0%		67.1%	82.9%			59.0%
	Jan	90.5%			58.9%	93.2%		70.7%	85.0%			62.2%
	Feb	92.1%			63.4%	94.3%		74.1%	86.9%			65.1%
	Mar	93.4%			68.9%	95.3%		78.9%	89.5%			68.9%
	Apr	94.7%			72.8%	96.2%		81.7%	91.3%			71.7%
	May	95.8%			76.4%	97.0%		84.2%	93.0%			74.0%
	Jun	96.7%			79.5%	97.7%		86.3%	94.5%			76.5%
	Jul	97.5%			82.4%	98.3%		88.2%	96.0%			79.0%
	Aug	98.2%			84.8%	98.8%		89.9%	97.4%			81.2%
	Sep	100.0%			87.7%	100.0%		91.8%	100.0%			84.2%
3rd	Oct				89.5%			93.1%				86.2%
	Nov				91.0%			94.2%				87.9%
	Dec				92.4%			95.4%				89.6%
	Jan				93.6%			96.1%				91.3%
	Feb				94.6%			96.7%				92.6%
	Mar				95.9%			97.7%				94.4%
	Apr				96.8%			98.3%				95.6%
	May				97.5%			98.6%				96.6%
	Jun				98.2%			99.1%				97.6%
	Jul				98.8%			99.4%				98.5%
	Aug				99.4%			99.8%				99.3%
	Sep				100.0%			100.0%				100.0%

* The data included no CRs extending past May, but it may make sense to continue adding -1.04% (for S&T) or -1.42% (for Mgt.) for each month under a CR from June–Sept, or adjust based on the size of any full-year CR budget for the BA(s).

SOURCE: Authors' analysis of FYs 2013, 2014, 2017–2023 DoD obligations and expenditures data.

NOTES: Any cumulative CR and MAB effects for the 2nd and subsequent years are already added to the cumulative monthly benchmark values shown. Our sample only included CRs through May, so we only included the CR effects through May in the table. There were no significant reductions during CR months for RDT&E development (BAs 4, 5, 7). MAB = month after full budget is passed. If there were at least 10 working days in the month that the final budget (appropriation) was passed, then the 1st MAB is the month of passage, else the following calendar month is the 1st MAB. For example, for FY 2014, passage was on 1/17/2014 with at least 10 working days in January, so 1 MAB was January. However, in FY 2015, passage was on 12/16/2014, so with the end-of-year holidays we used January instead of December as the 1 MAB. Thus, if the final budget was passed in mid-December, then the 1st MAB would be January and the S&T obligation benchmarks for December would be 8.3% - 3.12% = 5.18% and the January benchmark would be 15.1% - 1.6% = 13.5%.

Table 8-8.6. Option 1–2 PROC, O&M, and MILCON Benchmarks: Obligation S-Curves and Historical Expenditure Patterns: 1st–3rd Years of Availability

		Procurement			O&M			MILCON	
Year	Month	Obs.		Exp.	Obs.		Exp.	Obs.	Exp.
			Add after CRs			*Add after CRs*			
First	Oct	0.55%		0.43%	3.0%		1.9%	0.60%	0.00%
	Nov	1.6%		1.0%	6.0%		5.6%	1.0%	0.11%
	Dec	3.6%	1st MAB: 0.0%	1.9%	11.0%	1st MAB: 1.2%	10.0%	1.6%	0.34%
	Jan	5.8%	2nd MAB: 1.8%	3.7%	19.0%	2nd MAB: 3.6%	15.0%	3.3%	0.31%
	Feb	9.3%	3rd MAB: 6.5%	5.0%	30.0%	3rd MAB: 6.0%	20.4%	5.9%	0.50%
	Mar	13.8%	4th on: 8.7%	7.2%	41.0%	4th on: 7.7%	26.7%	8.9%	0.76%
	Apr	18.3%		8.7%	52.0%		33.1%	11.3%	0.99%
	May	23.3%		10.6%	60.5%		39.5%	15.8%	1.1%
	Jun	28.8%		13.0%	69.3%		46.7%	22.9%	1.6%
	Jul	34.2%		15.5%	76.9%		53.8%	27.6%	2.1%
	Aug	39.6%		18.4%	84.7%		61.3%	33.9%	2.7%
	Sep	45.7%		21.8%	92.3%		69.2%	47.4%	3.9%
Second	Oct	59.1%		23.9%			75.4%	49.1%	4.6%
	Nov	63.2%		26.6%			79.5%	50.8%	5.5%
	Dec	68.3%		30.2%			83.2%	53.1%	6.7%
	Jan	72.1%		32.9%			86.0%	55.1%	7.9%
	Feb	75.3%		35.4%			88.7%	56.3%	9.3%
	Mar	78.9%		38.8%			91.3%	57.9%	10.6%
	Apr	81.6%		41.4%			93.3%	59.7%	12.4%
	May	84.0%		43.5%			94.9%	61.1%	14.4%
	Jun	86.2%		46.6%			96.5%	62.8%	16.8%
	Jul	88.0%		48.8%			97.7%	64.3%	19.3%
	Aug	89.8%		51.2%			98.9%	67.1%	21.7%
	Sep	91.7%		54.1%			100.0%	70.8%	24.6%
Third	Oct	93.1%		56.3%				71.4%	27.2%
	Nov	94.2%		59.0%				72.7%	29.2%
	Dec	95.2%		61.6%				73.7%	31.5%
	Jan	96.0%		63.3%				74.7%	33.7%
	Feb	96.6%		65.0%				75.7%	35.8%
	Mar	97.4%		68.2%				76.5%	37.5%
	Apr	98.0%		70.3%				77.2%	40.1%
	May	98.4%		72.1%				77.9%	42.2%
	Jun	99.0%		74.1%				78.8%	44.4%
	Jul	99.3%		75.8%				79.8%	46.6%
	Aug	99.6%		77.6%				80.5%	48.9%
	Sep	100.0%		79.6%				82.9%	51.3%

SOURCE: Authors' analysis of FY 2011–2023 DoD obligations and expenditures data.

NOTE: Years 4–6 of availability for Procurement and MILCON, are the same as in Table 8.7 below. Any cumulative CR and MAB effects for the 2nd and subsequent years are already added to the cumulative monthly benchmark values shown. MAB = month after full budget is passed. If there were at least 10 working days in the month that the final budget (appropriation) was passed, then the 1st MAB is the month of passage, else the following calendar month is the 1st MAB. For example, for FY 2014, passage was on 1/17/2014 with at least 10 working days in January, so 1 MAB was January. However, in FY 2015, passage was on 12/16/2014, so with the end-of-year holidays we used January instead of December as the 1 MAB. Thus, if the final budget was passed in mid-December, then the 1st MAB would be January and the Procurement obligation benchmarks for January–June that year would be 5.8%, 11.1%, 20.3%, 27.0%, 32.0%, and 37.5%, respectively.

Table 8.7. Options 1–4 PROC and MILCON Benchmarks (continued): 4th–6th Years of Availability

Year	Month	Procurement Exp.	MILCON Obs.	MILCON Exp.
Fourth	Oct	80.8%	83.0%	53.4%
	Nov	82.7%	83.6%	55.3%
	Dec	84.4%	84.5%	56.9%
	Jan	85.3%	85.2%	58.4%
	Feb	86.3%	85.7%	59.7%
	Mar	88.1%	86.4%	61.7%
	Apr	89.3%	87.1%	63.2%
	May	90.2%	87.6%	64.6%
	Jun	91.3%	88.2%	66.2%
Fifth	Jul	92.1%	88.5%	67.6%
	Aug	92.9%	88.9%	68.9%
	Sep	93.8%	89.9%	70.2%
	Oct	94.2%	89.9%	71.4%
	Nov	95.2%	90.6%	72.4%
	Dec	96.0%	90.8%	73.6%
	Jan	96.3%	91.0%	74.6%
	Feb	96.7%	91.2%	75.5%
	Mar	97.6%	91.8%	76.5%
	Apr	98.0%	92.2%	77.7%
	May	98.5%	93.0%	78.4%
	Jun	99.0%	93.6%	79.3%
	Jul	99.3%	95.2%	80.2%
	Aug	99.6%	96.4%	81.1%
	Sep	100.0%	100.0%	82.1%
Sixth	Oct			82.3%
	Nov			83.1%
	Dec			83.7%
	Jan			84.3%
	Feb			84.8%
	Mar			85.7%
	Apr			86.4%
	May			87.1%
	Jun			87.8%
	Jul			88.4%
	Aug			89.2%
	Sep			90.0%

SOURCE: Authors' analysis of FY 2011–2023 DoD obligations and expenditures data.

NOTE: This table illustrates the benchmarks for the years after those shown in Table 8 8.6. Any cumulative CR and MAB effects for the 2nd and subsequent years are already added to the cumulative monthly benchmark values shown. Tables for other options are included in the body of the report.

9. CONSOLIDATED LISTS OF FINDINGS AND RECOMMENDATIONS

Table 9.1 lists the findings and conclusions across all tasks. Table 9.2 (starting on p. 55) lists the recommendations across all tasks. Finally, Table 9.3 (starting on p. 64) lists our suggestions for future research.

Table 9.1 Findings and Conclusions

#	Source Task:	Findings:
F.1	Task 1	Overall, the case study findings highlight challenges associated with rapidly iterating and deploying software and/or commercial technology capabilities to support warfighter requirements. In particular, the PPBE process struggles when: • Funding the rapid development and deployment of new capabilities to meet operational needs; • The need for fiscal flexibility is greatest, usually during the year of execution; and • Adjusting to rapidly evolving programs and needs.
F.2	Task 1	The cases demonstrate that successful development and progress can be made when: • Strong senior leadership drives prioritization; • The broadness of Program Elements (PEs) enables flexibility in program execution; • Agile approaches such as Middle Tier of Acquisition enable programs to evolve and adapt with the least disruption; and • Congressional engagements are regular and candid.
F.3	Task 1	PPBE process can be difficult to navigate in several ways, including: • Congressional marks with prejudice • continuing resolutions • reprogramming threshold limit • lack of management reserve
F.4	Task 1	One size-fits-all PPBE process does not work well for new technology programs with no significant cost or development history.
F.5	Task 1	J-books can be problematic for projects with many interrelated parts because they appear as an “à la carte” menu.
F.6	Task 1	CCA benefited significantly from close coordination with other government agencies (Navy, DARPA, SCO, cost estimators “living with CAPE”) as well as industry vendors.
F.7	Task 1	PPBE sometimes conflicts with Air Force strategy.
F.8	Task 1	Budget structure that provides flexibility helps navigate the PPBE process.
F.9	Task 1	Leadership prioritization is a critical factor for programmatic success.
F.10	Task 1	PPBE processes are not optimal, but also not a significant hurdle to operations or strategy.

#	Source Task:	Findings:
F.11	Task 1	More frequent interactions with Congressional staff would help to communicate evolving program status and associated budget.
F.12	Task 1	There is a need for flexibility in PPBE process to address agile acquisition.
F.13	Task 1	Having all lines of effort in a single program element is helpful.
F.14	Task 1	Space Development Agency (SDA)'s use of the MTA pathway and the agile, iterative incorporation of commercial technologies are central to its rapid product delivery.
F.15	Task 1	Due to SDA's mandate to rapidly deliver capabilities, budget requests must be made before requirements are finalized—programming must occur before planning.
F.16	Task 1	PE consolidation gives SDA flexibility for program success, while external stakeholders who seek to impact the program prefer a divided PE structure.
F.17	Task 1	Building and launching SDA tranches can be challenging to manage in existing budgetary categories.
F.18	Task 1	TITAN's use of the MOSA approach and MTA pathway have led to rapid prototyping and program success.
F.19	Task 1	TITAN prototyping efforts have benefited programmatically and technologically from being a continuation of previous Army research efforts and funding lines.
F.20	Task 1	The shift of program funding from Procurement to RDT&E, accomplished with effective stakeholder alignment, ensured appropriate investment was made in prototyping, which has been important to program success.
F.21	Task 1	Difficulty transitioning JRAC efforts into Service programs highlights the challenges of developing and deploying urgently needed capabilities to support operational needs via the Services' respective PPBE processes.
F.22	Task 1	Phasing out Overseas Contingency Operations funding has made it increasingly difficult to secure funding to fill urgent capability gaps, especially JUONs and JEONs.
F.23	Task 3: Literature Review	Qualitative Data Analysis (QDA) suggests that a significant fraction (almost half) of the Pentagon's PPBE problems can be self-corrected.
F.24	Task 3: Literature Review	Several recommendations in the literature suggest unilateral actions that can be taken by Congress and several that are in collaboration with the DoD to enact legislation in support of obtaining a responsive-agile PPBE process.
F.25	Task 3: Literature Review	Several literature-proposed actions were identified that were focused on building trust and enhancing transparency through modernized business systems, using, for example, real-time data analytics. As a result, AIRC included two different reference architecture (RA) views of models and data flow in a modern digital engineering environment. These views are for reference to support further discussions on the topic.

#	Source Task:	Findings:
F.26	Task 3: J-Books AI/ ML Proof-of-Concept	None of the J-Book documents from the services were provided in a machine-readable format such as XML or JSON.
F.27	Task 3: J-Books AI/ ML Proof-of-Concept	The Army and Navy J-Book documents contained images of Tables requiring the researchers to use Adobe Acrobat's Optical Character Recognition (OCR) to process these documents in order to support Python pattern matching scripts.
F.28	Task 3: J-Books AI/ ML Proof-of-Concept	ChatGPT's LLM (as of the early fall of 2023) was unable to ingest the full volume of data required to reorganize these volumes into portfolio views. However, ChatGPT's LLM was able to satisfactorily summarize and support the analysis of smaller data sets, consisting of OCR'ed PDF documents with ~20 pages of text in tables.
F.29	Task 4	The primary goal of the PPBE process is to align resources with strategic priorities. However, problems often arise when translating strategic objectives into actionable budgets and resource allocation plans given the increasing tempo of operational and strategic changes driven by ever more rapid technological growth. These issues often result in misaligned funding priorities, wasted resources, and delays in critical projects. The DoD requirements process, Joint Capabilities Integration and Development System (JCIDS) is responsible for defining what capabilities are needed to meet national security objectives. The development of requirements involves input from various stakeholders, including combatant commanders, acquisition professionals, and technologists. Integration problems occur when requirements are not effectively communicated, are not sufficiently developed in a timely manner, or when requirements are not supported by technology or aligned with available resources and budget constraints, leading to unrealistic demands.
F.30	Task 4	The DoD acquisition process is responsible for procuring and delivering the capabilities described by the requirements process. Integration problems in this phase often manifest as cost overruns, schedule delays, and unmet performance expectations. The lack of synchronized communication among acquisition teams, requirements officers, and budgeting personnel can result in significant inefficiencies. Resolving integration issues typically falls to the acquisition Program Executive Officer (PEO) or Program Manager (PM).

#	Source Task:	Findings:
F.31	Task 6	**Continuing Resolutions (CRs) and other events affect obligation rates:**
		• Obligation rates are higher in the 2nd–4th months after the full budget is passed (i.e., once managers know their authorized spending). Thus, CRs delay this bump into later in the FY.
		• Obligation rates are lower the first October in the spending cycle, reflecting time needed to delegate spending authorization down to program managers.
		• Obligation rates are higher the first March in the spending cycle (which is the month before the midyear spending reviews).
		• Obligation rates are higher in September—but not for RDT&E's first year of obligating.
		• Subsequent-year RDT&E and PROC obligation rates are higher near the year-end holidays.
		• Multiyear dollars obligate the first year on a linear basis, then inflect to a reduced, curved basis. Thus, obligations are modeled well by linear models with these variate effects.
F.32	Task 6	***Obligations*** - **It takes time for subordinate organizations to receive funds, delaying obligations.** While the benchmarks expect obligations to begin on October 1, it takes 30–45 days or more for program offices and agencies to receive their obligation authorities in the DoD financial management system (Marsalis, 2022). This is true of all types of funds, including O&M. Thus, obligation benchmarks that begin in October are limited to those offices and organizations that receive faster obligations and thus may be unrealistic generally.
F.33	Task 6	***Obligations*** - **Time needed to issue contract awards further delays obligations.** If the obligation is on a contract (versus, say, DoD personnel), it takes time to issue a contract award.
F.34	Task 6	***Obligations*** - **Operating under CRs can also delay obligations.** As mentioned earlier, while there is no general slowing of actual obligations during a CR, statistical analysis found a one-time statistically significant increase three months after a final budget is passed (see Anton and Buettner, forthcoming). Tremaine and Seligman (2013) also published survey data from 229 responding DoD personnel indicating that CRs can delay obligations. Thus, there is quantitative and qualitative evidence supporting an adjustment in obligation benchmarks due to CRs.
F.35	Task 6	***Expenditures*** - **Analysis of DoD data show that RDT&E, Procurement, and O&M expenditures follow an S-curve shape rather than the linear profiles in the DoD's benchmarks.** While the S-curve for RDT&E meets the 12- and 24-month targets of 55% and 90%, respectively, the average 6-month value of 15.5% is well below the benchmark of 27.5%. Thus, the DoD's linear RDT&E benchmark poorly informs the midyear execution review for RDT&E.

#	Source Task:	Findings:
F.36	Task 6	***Expenditures*** - **Expenditure benchmarks should reflect slow rises at the start of the FY.** As discussed above, obligations for a FY often do not trickle down to program offices by October 1. Thus, obligation benchmarks should show a delay in the first quarter of a FY. In turn, this delay also results in a delay in expenditures in the first quarter of a FY.
F.37	Task 6	**Obligation and expenditure benchmarks should be based on theory and data.**
		• The best shape of obligation benchmark curves ultimately comes down to intent and theory.
		• Benchmarks should be adjusted for CR and financial-management realities.
		• S-curves for obligation benchmarks may be beneficial for RDT&E, PROC, and O&M.
		• Actual expenditure and execution data consistently show S-curves for contract-based work (RDT&E, PROC, and O&M).
		• Benchmarks can be useful but require additional due diligence.
		• Unforeseen negative consequences need to be avoided from overly managing to benchmarks.

Table 9.2 Recommendations

#	Task	Recommendations
R.1	Task 2	**Provide PE Simplification/Consolidation for Operational or Mission Need Programs:** An alternate categorization of programs, such as by operational need and/or mission (particularly those likely to experience immediate and difficult-to-predict needs), is a prime candidate for slight modifications to PPBE. Another potential categorization of programs for slight modifications to PPBE is the type of program such as hardware versus software or varying levels within these types of physical versus non-physical systems. Therefore, agencies within DoD that require significant flexibility due to their operational needs/mission should minimize the number of Program Elements (PEs) used in the budget request to allow for a broad range of potential uses of funds and thus generating limited need for reprogramming and maximizing flexibility when operational need and/or mission create a need for such increased flexibility.
R.2	Task 2	**Recommendations for the RDT&E J-Books:** Budget justification documents, particularly for RDT&E, are overly complex, convoluted, and lack standardization across and within Military Departments and Agencies. These issues decrease transparency and potentially impede effective oversight and management. The following three recommendations (#R.2.1 - R.2.3) can help to improve the justification books.
R.2.1	Task 2	**Require Explicit Acq. Pathway Identification in J-Books:** DoD should require acquisition pathways to be explicitly identified in the budget justification books as part of the Acquisition Strategy (Section D of Exhibit R-2a) as well as prescribe the specific components of acquisition, management, and contracting strategies to be provided – such as contract type, and competition type (full and open or sole source).
R.2.2	Task 2	**Need Strategy to Ensure Consistent Level of Detail for Acq. Pathway DA Events:** DoD should work to ensure that appropriate detail is presented, when applicable, such that the requested level of detail including milestones, approvals, and events are presented. This recommendation is to ensure conformity to the existing guidance and consistency across and within Military Departments and Agencies extends to Exhibit R-4a (Schedule Detail).
R.2.3	Task 2	**Reorganize PE and Project Structure to align with the DAS:** DoD should consider reorganizing (and possibly a complete overhaul of) the use of the PE and Project structure to better align with the Defense Acquisition System (DAS) to enhance the ability to track and manage across PPBE and DAS. At present, the program structure used in PPBE is not a simple one-to-one mapping to the program structure used in DAS. Consistency and confinity will likely improve communication across government and within different parts of the DoD workforce to improve oversight and management.
R.3	Task 3	**Discontinue the use of images of tables in budget documents:** While using optical character recognition (OCR) is a viable approach for our demonstration purposes, it is known to introduce errors during the conversion process. The services should stop providing PDF files with embedded images of tables.

#	Task	Recommendations
R.4	Task 3	**Provide data in XML or JSON formats:** Although we have described a process for converting PDF documents into either XML or JSON structured data formats, we believe the user would benefit from at least one of these machine-readable formats being provided by the services and the comptroller in addition to the PDF documents.
R.5	Task 3	**Provide reference tools for parsing and visualizing the data:** In addition to machine-readable XML or JSON, reference tools for parsing and visualization can provide a baseline context for the development of more advanced capabilities.
R.6	Task 4	**Acquisition Seam - Executive Panel Endorsements:** Executive Panel endorsed the Commission's Interim Report recommendations that will provide much needed flexibility, especially the recommendations on: • Colors of money (a different approach) • Modify thresholds for Below Threshold Reprogrammings (BTRs) • Modify internal DoD reprogramming requirements • Modify availability of appropriations • Mitigate problems caused by Continuing Resolutions • RDT&E Budget Activities consolidation • Transform the budget structure • Systematic review and consolidation of budget line items • Improve understanding of private sector practices
R.7	Task 4	**Acquisition Seam - POM Structured into Resource Groupings:** To build more flexibility in developing, producing, and sustaining warfighting capabilities, DoD should structure the Program Objective Memorandum (POM) and budget to group resources for like-capabilities into PEO-managed portfolios with tradeoff authority while including appropriate controls.

#	Task	Recommendations
R.8	Task 4	**Acquisition Seam - Speedup Integration by Revising Concurrence Process:** To reduce the time for integration from a PPBE perspective, DoD should define clear roles and responsibility (who can say "yes," and more importantly, limiting who can say "no" to approvals) and avoid the drive for consensus through staff action by elevating issues to decision makers in a timely manner. For example, on the acquisition side, it is recognized that the top line for every program is a prioritization function that comes out of a larger PPBE process. Once that top line decision is made, the policy should clearly state that: • only the PEO has approval authority over the PM from program perspectives; all others are advisory to the PM and PEO but cannot nonconcur; • only the Component Acquisition Executive (CAE) has approval authority over the PEO; all others are advisory to the PM and PEO but cannot nonconcur; • only the Defense Acquisition Executive (DAE) has approval authority over the CAE; all others are advisory to the PM and PEO but cannot nonconcur; • the Milestone Decision Authority (MDA) is the main stopping point for approvals up the acquisition chain-of-command; the policy clearly states that "For MDAPs, it is DoD policy to budget to the DCAPE ICE unless an alternative estimate is specifically approved by the MDA"—thus, no others have an ability to say "no"; and • those above the MDA in the acquisition chain-of-command can intervene in oversight, but this should be minimized.
R.9	Task 4	**Acquisition Seam - Link Affordability to Analysis:** DoD should link the concept of affordability in PPBE (DoDD 7045.14, Enclosure 3) to the affordability analysis called for and defined in the acquisition community (DoDI 5000.85, Section 3, and underlying processes). Affordability analysis results should be provided with all JCIDS requirements validations.
R.10	Task 4	**Acquisition Seam - Prioritize Information Technology System Implementation:** To improve transparency and information sharing, DoD should prioritize implementation of information technology systems that are intuitive for building transparency and trust, including developing capabilities to use large language models (LLMs), natural language processing (NLP), and machine learning (ML) to make PPBE (including justification books) more timely, accurate, accessible, and transparent for authorized users. There are nascent capabilities in Advana, and other AIRC research for the Commission explored how these evolving capabilities could be applied to improve information sharing and cognizance (especially from portfolio and mission views), but continued R&D is recommended for this promising approach.
R.11	Task 4	**Acquisition Seam - Limit Validated Requirements Funding to Major Categories:** If more aggressive PPBE reform is possible, the DPG could specify that tradeoffs in funding validated requirements be within a major funding category (RDT&E/ Procurement, Personnel, and Operations & Maintenance) rather than across these categories to ensure that the investment accounts (future capability) are not used to fund current capability.

#	Task	Recommendations
R.12	Task 4	**Requirements Seam - Empower JROC to assign JEONS as "must fund" priorities:** DoD should empower the JROC to assign a validated CCMD Joint Emerging Operational Need Statement (JEONS) to a Service or Agency as a "must fund" priority, with the Deputy Secretary of Defense (DEPSECDEF) visibility of the resulting resource decisions. Require that CCMDs prioritize their requirements as part of the JROC requirements validation process, and that requirement lists be matched to and reconciled with Service Budget requests in the PPBE process by DEPSECDEF.
R.13	Task 4	**Requirements Seam - Give CCDR-provided Scenarios Equal Weight:** The Joint Staff and DoD should give CCDR-provided scenarios, exercise, and wargaming results weight equal to that given to the Military Services and Joint Staff inputs as the basis for the annual Capability Gap Analysis of the Future Years Defense Program (FYDP).
R.14	Task 4	**Requirements Seam - Provide Service Affordability Analysis with Requirements:** DoD should provide Service affordability analysis along with requirements that are reviewed and approved by the JROC. This will provide the JROC with the Service's sense of priorities and affordability with respect to the materiel item in question. Affordability analysis is required at Milestone A and thus is available for CDD validation (see DoDI 5000.85).
R.15	Task 4	**Requirements Seam - Provide Industry Visibility into DoD Requirements:** To provide Industry more visibility into DoD requirements, especially with respect to production capacity, DoD should include in budget justification documents provided publicly with the President's budget request both a threshold [minimum] and an objective [stretch goal] level for annual procurement quantities. DoD acquisition programs should reflect these requirements with contract options to the objective level and termination liability clauses applicable below the threshold level. In addition, DoD should provide cleared defense contractors with controlled access to validated mission needs and requirements statements (at the CUI and classified levels) to help with industry's planning for Internal Research and Development (IR&D), staffing, and infrastructure investments and investment hedges.
R.16	Task 4	**Requirements Seam - Provide J-Books in Structured Machine-Readable Formats:** DoD should provide Industry (along with Congress) data and information from the President's Budget justification books in structured machine-readable formats. (This will also facilitate improved data analytics and portfolio views discussed in other AIRC reports to the PPBE Commission.) [Comment: Similar to recommendation R.10 from task 3.]

#	Task	Recommendations
R.17	Task 4	**Requirements Seam - Invest in Requirements Community Training as a PPBE Priority:** DoD should give investments in staffing, training, and career development of the Joint Staff and Military Service requirements community higher PPBE priority, as has been done successfully in Defense Acquisition Workforce improvement investments. This would: • Professionalize the requirements generation, determination, validation, and management process. Develop entry- and mid-career training programs along with career-enhancing recognition for those who successfully participate in the process to improve collaborative decision processes among the user, PPBE, and acquisition communities. • Establish a DoD Requirements Workforce Development Account (DRWDA) analogous to the DoD Acquisition Workforce Development Account (DAWDA) and the similar funds (DAWDFs) for the three military departments. • Fund a segment of the Defense Civilian Training Corps (DCTC) focused on requirements management for training and orientation of undergraduates as an improved civilian pipeline into the Requirements Community (generally) and the interface with PPBE.
R.18	Task 4	**Req. & Acq. Seam - Concur with FY24 DoD Requirements Process Modernization:** We agree with the FY 2024 NDAA section 811 direction to modernize the defense requirements process. We recommend starting now on such reforms, to include: • Forming a JS-led Cross Functional Teams (CFTs) with OSD and Service stakeholders to reform the system, specifically the boundary between Requirements (JCIDS) and Acquisition (Defense Acquisition System (DAS)). • Developing a more agile, collaborative, and iterative process for the integration and transition of requirements to the systems engineering process. • Developing a capability needs and requirements framework and pathways that are aligned to the Department's Adaptive Acquisition Framework pathways, and that include aligning the Department's science and technology (S&T) processes to emphasize products that address capability requirements. • Developing a process to rapidly validate the military utility of commercial solutions to meet capability needs or opportunities. • Developing a mission engineering approach for defining enduring requirements in a set of capability portfolios, with a set of mission impact measures that capability deliveries must seek to continuously improve. • Assessing best practices to ensure that the requirements process for software, artificial intelligence, data, and related capability areas enable a more rapid, dynamic, and iterative approach than used for hardware systems.
R.19	Task 4	**Req. & Acq. Seam - Assigning a Single Organization for Joint Requirements:** We recommend that the reforms of the DoD Requirements process include designating a single organization or entity directly responsible for overseeing and driving the development of joint capabilities.
R.20	Task 5	**Batch PPBE reforms:** Consider introducing discipline in the frequency of reforms by batching them so they only become effective periodically (say, every 3–4 years).

#	Task	Recommendations
R.21	Task 5	**Improve PPBE training:** Explore ways to streamline processes for requesting above-threshold reprogramming.
R.22	Task 5	**Align incentives:** Conduct further applications of frameworks to align incentives and culture them with prudent decision-making. (See Girth et al., 2002, for approaches on aligning incentives. Incentives for Motivating Workforce Agility and Innovation - The Acquisition Innovation Research Center (acqirc.org): https://acqirc.org/publications/research/incubator/2022-incentives-for-motivating-workforce-agility-and-innovation/)
R.23	Task 5	**Balance accountability:** Conduct applied research to (a) assess and summarize the frequency with which DoD officials are held personally financially liable for mistakes made in good faith without intent of breaking a law, and (b) develop recommendations on how to balance actual with perceived liabilities—possibly to include better training on the actual risks and engagement with the Department of Justice to clarify when the Government will stand behind civil servants who are conducting their job. If risks are significant, the research may consider whether changes to law would be prudent to indemnify public servants from financial penalties for mistakes when operating in good faith in their areas of responsibility and authority.
R.24	Task 5	**Develop improved ways to define PPBE goals:** This may include additional details in the DPG but also developing additional actionable goals during execution to inform actions, such as reprogramming and making tradeoffs between expending funds on problems in development versus buying down future sustainment costs through improved designs.
R.25	Task 5	**Delegate more PPBE decisions:** Explore ways to shift decision authority down from senior DoD leaders by providing clearly defined goals along with PPBE authorities and responsibilities to reduce managerial restrictions by increasing accountability for results.
R.26	Task 5	**Delegate below-threshold reprogramming to PEOs:** Along with ideas to raise reprogramming thresholds, consider delegating below-threshold reprogramming authorities (e.g., to program executive officers [PEOs]) rather than requiring significant reviews and higher-level approvals.
R.27	Task 5	**Develop computational top-down budgeting:** Continue developing portfolio and mission-engineering decision processes. Explore computational and AI approaches that can build budgets from top-down guidance and portfolio/mission reviews.
R.28	Task 5	**Keep PPBE budget formats focused on outcomes:** Retain PPBE's basic theoretical underpinning of outcome-based program elements.
R.29	Task 5	**Continue development of portfolio- and mission-based budgeting:** Strengthen PPBE's focus on outcomes (over inputs and tasks) by ensuring that budget documents clearly describe the connection between acquisition programs and other tasks/activity line items and agency outcomes. Moving to budget elements that are outcomes (e.g., by mission or portfolio) also align and should be explored to the degree that leadership intent, equities, and control (both by Congress and DoD leaders) are retained to a satisfactory level.

#	Task	Recommendations
R.30	Task 5	**Restructure DoD budget elements that are input- or task-oriented:** With the basic format in mind, it would be useful to conduct a review of the entire current DoD budget to identify those that are formatted around inputs or tasks/activities and develop alternative outcome-based formats to replace them, improving both the focus on mission and stakeholder understanding of the need for these elements and their funding levels.
R.31	Task 6	***Obligations* - Reduce obligation benchmarks for the first 1–2 months for RDT&E, PROC, and O&M to reflect process delays in allocating spending authorities.** Given it takes at least 1–2 months for budget authorities to work their way down to program offices and agencies, obligation for October–November (and probably December) should be lower (if not zero). An S-curve would accomplish this objective, as would a delay in the linear benchmarks
R.32	Task 6	***Obligations* - Consider changing benchmarks to S-curves instead of straight lines.** In addition to delays from the time needed to allocate funding authority to programs and agencies, the significant times involved in PALT (as well as preparatory and approval activities before submitting solicitation requests before that), the benchmarks should reflect a start-up growth period similar to that seen in the EVM execution data. PALT has less of an effect on existing contracts, but they still involve work (and thus time). We do not have actual data on the combined effect of these delays, but the same management theory accompanying EVM data indicates that S-curves (e.g., Weibull [including Rayleigh] and Beta Distributions) would be reasonable (better) benchmarks. While the actual obligation profiles in Chapter 2 show that the DoD can meet linear benchmarks, an S-curve would allow for less time pressures when ramping up a program while driving for high obligation rates in the middle period.
R.33	Task 6	***Obligations* - Consider allowing more time in benchmarks for later spending to give time to get better deals and address surprises**. For funds such as RDT&E, Procurement, and MILCON, it may make better sense to target more obligations in later years rather than in earlier years. This would give programs more time to negotiate better deals and negotiations with contractors and address unforeseen issues in research and development (R&D).
R.34	Task 6	***Expenditures* - Change benchmarks to S-curves for RDT&E, PROC, and O&M.** Comptroller expenditure benchmark curves should reflect the decades of extensive data and analysis of business theory and actual expenditure profiles since the 1970s and even earlier, changing to S-curves (e.g., Weibull [including Rayleigh] and Beta Distributions). MILCON already has such a profile, but RDT&E, Procurement, and O&M benchmark profiles should be adjusted accordingly. This aligns with the recommendations in Marsalis (2002) for RDT&E benchmarks. An S-curve would correctly align the midyear review benchmark to the actual average of 15.5% rather than the misleading target of 27.5%. O&M's S-curve should reflect the mixed realities of linear staff expenditures and S-curve contractor execution.

#	Task	Recommendations
R.35	Task 6	**At a minimum, if the benchmarks are not changed to S-curves, consider:** • **Reducing expenditure benchmarks for the first three months.** Given it takes about 1–3 months for budget authorities to work their way down to program offices, and then time for the contractor to ramp up activities on new efforts, expenditures for October–November (and probably December) should be reduced, with the benchmark curve rising first in January. • **Changing benchmark shapes to straight lines across all years for multi-year funds rather than front-loading in the first year.** At a minimum, if the benchmarks are not changed to S-curves, consider straight line benchmarks across all the years—not higher in the first year with reductions in subsequent years. This would only make sense, however, for incrementally funded multi-year contracts. Ideally, however, benchmarks would seek lower expenditures in the first year—not higher.
R.36	Task 6	***Expenditures* - Add predictive metrics to identify more likely spending shortfalls.** The DoD should use available EVM data on RDT&E contracts to inform predictive measures of actual expenditures. For example, the National Defense Industrial Association (NDIA) published a very useful Guide to Managing Programs Using Predictive Measures (NDIA, 2017). Some of those predictive measures help forecast when a contractor is falling behind in execution and thus may not fully execute and invoice the obligated funds in the allowable period. In such cases and with further due diligence to validate whether the contractor will not complete performance in time, the DoD could repurpose those resources (either on other program needs or reprogrammed to other high-priority needs).
R.37	Task 6	***Obligations and Expenditures* - Explore switching to plan-based benchmarks instead of fixed benchmark curves, using Advana to collect plans from program offices.** Pattern-based benchmarks could be replaced with dynamic benchmarks based on a program's actual expenditure plan that reflects the timing and realities of program, negotiations, supply-chain realities, and other factors known best by the program manager and the prime contractor (Tremaine and Seligman, 2013; Anton, 2022). Again, Advana is in a position to begin serving this need
R.38	Task 6	***Obligations and Expenditures* - Ensure proper due diligence along with spending relative to benchmarks before taking program funds.** While these notional benchmark curves may be useful filters to identify programs that may be falling behind, continued use of additional due diligence is necessary to understand each situation and avoid causing damage to programs that are actually managing well. Yes, identifying new funds in the year of execution for critical, new needs is important, but notional benchmarks alone are blind to the actual realities ongoing in programs. Anecdotes indicate that DoD and Congressional leadership do not simply rely on benchmarks for whom to take money for new urgent priorities that arise during the year of execution, but other anecdotes indicate that program managers believe otherwise, adding to the following concern of unforeseen negative side effects.
R.39	Task 6	***Obligations and Expenditures* - Use needs, plans, and priorities for budgeting—not just spending.** As a corollary to the concerns raised with the incentives associated with obligation and expenditure benchmarks—that of spending one's budget to ensure that next year's budget is not cut. As with these benchmarks used for management oversight and potential reprogramming, not spending out one's budget (or having one's budget reduced in the spending period) is a useful but not sufficient data point for setting subsequent budget levels. Budgeting should always be needs based, and spending alone is not sufficient to establish need.

#	Task	Recommendations
R.40	Task 6	***Obligations and Expenditures*** **- Avoid overly enforcing benchmarks and other metrics. Keep these as information tools.** ally, management training and execution should continually caution against managing closely to benchmarks and other metrics. They should remain as informative but not strongly enforced.
R.41	Task 6	***Obligations and Expenditures*** **- Do not use Benchmarks to Guide OMB apportionments.** To avoid slowing down DoD acquisition, do not use obligation and expenditure benchmarks as a guide to OMB apportionments—instead inform apportionments based on the distribution data of recent actual obligations and expenditures.
R.42	Task 6	***Obligations and Expenditures*** **- Pilot changes before aggressive shifts.** Pilot these changes before pursuing more aggressive shifts to lower benchmarks in earlier years to understand better the effects (if any) on changes in unobligated and unexpended funds at the end of normal availability.

Table 9.3 Suggestions for Future Research

#	Task:	**Research Recommendation Title:** Explanation
FR.1	Tasks 1 & 2	**Research CCMND PPBE Authorities:** Research, analyze, and make recommendations vis-à-vis Combatant Command PPBE authorities concerning the validation of requirements, program and budget proposals, and expenditure of funds. This study will be a detailed examination of what authorities exist in general as well as for specific COCOMs, and the COCOMs' relation to the PPBE roles and responsibilities of the Services and Defense Agencies. Likewise, this study will explore the role of OSD, the Joint Staff, the Services, Defense Agencies, and Congress in the actions and products of the PPBE process relative to Combatant Command requirements and advocacy. Recommendations will be included.
FR.2	Tasks 1 & 2	**Investigate Duplicating the SDA Model Across Services:** Research, analyze, and make recommendations regarding options for duplicating the SDA model in the Department of the Army, the Department of the Navy, the Missile Defense Agency, or Special Operations Command. Explain in detail the authorities, organization, and practices that are relevant and their first-order and second-order consequences.
FR.3	Tasks 1 & 2	**Research the probability of factors being correlated to Congressional marks:** Research, quantify, and analyze the probability of particular programmatic factors being correlated to Congressional marks. Examine the size of Congressional marks to RDT&E BA 4-5 Program Elements with over a dozen Projects compared to such Program Elements with a single Project. Compare the Army, Navy, and Air Force justification books, and for Fiscal Years 2014-2023. Analyze the data utilizing statistical techniques, including regression analysis, to determine the probability and correlation of Congressional action, and the extent of that Congressional action, in relation to Program Elements with many projects and those with one project. Based upon the results of the analysis, propose recommendations.
FR.4	Tasks 1 & 2	**Investigate J-Book Standardization:** Military Service Justification Book standardization, explore a comprehensive methodology to objectively calculate, vet, and approve a defense program's risk/reward determination. This exploration will include the development of a numerical risk metric representing the probability of programmatic (technological, fielding, and integration) success as well as a reward metric representing the potential impact of achieving military preparedness and superiority. The end result will be to propose a new standard Exhibit to be submitted to Congress with the PB submission based upon the novel risk/reward metric.

#	Task:	**Research Recommendation Title:** Explanation
FR.7	Task 3	**Research LLM Use on DoD Budget Materials:** Noting that Advana has implemented the "GAMECHANGER" capability, and a blog indicates that at least one tool vendor may have resolved the issues noted in this report , further research to assess various LLMs and confirm that an LLM can be trained on the DoD's corpus of data. The goal is to confirm that a ChatGPT text-based query interface can reliably support and enhance analysts with their tasks.
FR.8	Task 3	**Fund further efforts to reorganize budget documents:** Providing portfolio-like budget views from AI/ML reorganizations without having to make drastic changes to the existing documentation format used by the various services would simply add a processing step to the existing delivery flow. Once completed, these results can support collaborative decisions on what changes and additions should be promulgated to the services to fully enact a portfolio management approach that includes a portfolio budget view during the accumulation of the data.
FR.9	Task 4	**Prototype an LLM-enabled J-Books Approach:** Existing technology can be used for a rapid prototype of an LLM-enabled approach to J-books. Commercial offerings allow DoD to select whatever LLM is best suited (and replace it when something better is available), use controlled DoD data sources for training the model, guarantee factual accuracy and citable sources without risk of hallucinations, and demonstrate the utility of the system in responding to complex natural language queries. We believe a spiral prototype interacting with users can validate key aspects of the system well within a year. We recommend such a prototype be considered for SBIR funding or other source of FY 2024 funds. [An initial prototype is being accomplished under this contract under Task 3. This is an endorsement from the Executive Panel on the direction of this research.]
FR.10	Task 4	**Event-based Obligation Schedule for Programs:** Budget execution reviews could move from calendar-based Comptroller sweeps of unobligated funds to acquisition managers setting an event-based obligation schedule for each program when funds are appropriated, and DoD and Service Comptrollers measuring obligation status against these schedules. Congress could maintain oversight through a data management infrastructure that permits near real-time monitoring of execution status. Needed research includes further investigation of historical obligation patterns on acquisition programs compared to the normal linear execution model.

#	Task:	Research Recommendation Title: Explanation
FR.11	Task 4	**Investigate Approaches to Emphasize Sustainment Costs:** Given that sustainment costs historically exceed procurement costs, more emphasis and visibility is warranted on sustainability concerns as a factor of total program cost during development. One idea is to fence investment funds for reducing lifecycle (sustainment) costs, perhaps by designating them as RDT&E BA 7 and allowing them to be used in early development to reduce future sustainment costs (as if the system already existed and we were working to address sustainment issues). Further study is needed to get stakeholder views and apply reliability growth models and cost models to assess the potential effects of such a recommendation.
FR.12	Task 4	**Investigate CCMD Equivalents to EDI for Future Planning & Programming:** DoD could ask the geographic CCMDs to propose regional equivalents to the European Deterrence Initiative (EDI) (a good example) for consideration in future planning and programming. The CCMDs and associated Service funding lines would have to prioritize within available dollars and then engage in the program and budget review processes for additional resources, if required. The CCMDs should use the capability in the Services/ Agencies to execute the funds for the CCMD priorities rather than duplicate program offices, contracting, etc. That gives the CCMDs more flexibility than waiting to the end of the POM to see how their IPLs stacked up for funding. It also incentivizes the Services for meeting CCMD IPL requirements with increased funding. If a more radical approach is possible, geographic CCMDs might be given substantial control over funds for Joint emerging needs. Research is needed to develop a method of cross-CCMD coordination to avoid duplication of capability development efforts, to get stakeholder views, and to provide cost estimates. A CFT with CCMD, Service, OSD, and JS representation would be needed.
FR.13	Task 4	**Investigate Industry Involvement in Production Capacity Planning:** To better inform Industry on production capacity planning, DoD could provide access to Defense Contract Management Agency (DCMA) and Defense Logistics Agency (DLA) supply chain insights to better recognize, plan, and fund for supply chain risks and production capacity issues on highest priority, cross-program parts, and end-of-life procurement needs. This would need further research regarding protection of proprietary interests and analysis of the differences between production and sustainment supply chains.
FR.14	Task 6	**Future research based on the analysis of Obs & Expenditures data** (which may lead to additional recommendations): • Piloting modified benchmarks. • Identifying expenditure benchmark profiles for Procurement. • Assess obligation and expenditure rates at the account level within each category. • Assess sources of obligation and expenditure data errors.