ACQUISITION INNOVATION RESEARCH CENTER

Portfolio Performance Analysis and Visualization

EXECUTIVE SUMMARY AND REPORT

SEPTEMBER 2023

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EXECUTIVE SUMMARY

The objective of the research was to expand the use of portfolio-level data, analysis, and visualization of the data across Program Executive Offices (PEOs), Capabilities, and Missions to inform Integrated Acquisitions Portfolio Review (IAPR) and other portfolio decisions. The Department of Defense (DoD) needs more efficient data-driven approaches to improve analytic insights on performance and risk at program and portfolio levels. The research supports Sec. 913 (FY18 National Defense Authorization Act (NDAA)) and Sec. 801 & 836 (FY22 NDAA). Our initial efforts found significant fundamental data reporting gaps hampering multi-dimensional portfolio data management. These challenges are summarized below and detailed in the paper, "Portfolio Management Structures: System, Capability, and Mission Portfolios," published in the Naval Post Graduate School (NPS) Annual Acquisition Research Symposium (see Appendix B).

The first challenge included a lack of portfolio or program-level data fundamental for PEOs, Capabilities, and Missions. Additionally, what data are available often are classified. Because we did not have a classified contract, we were unable to review these data on this effort. Some of the authors were able to review these classified data on a different contract outside of the Acquisition Innovation Research Center (AIRC), so the lack of data sets became the focus of this research reported here.

The team collaborated with other AIRC university teams, including Virginia Tech, Georgia Tech, Purdue University, and the Steven Institute of Technology on the available data sets in an effort to ensure due diligence and collaborate effectively within the AIRC University-Affiliated Research Center (UARC). Our discovery revealed no existing standardized data structures at a portfolio or program level for capabilities or missions. Even within the existing governance structure, there is no identified standard for characterizing the programs within a PEO portfolio. The standard Office of the Secretary of Defense (OSD) Defense Acquisition Visualization Environment (DAVE) Program Number (PNO) schema is used for major programs only, and it does not give indication of what portfolio the programs are assigned. The lack of data structure across programs/research efforts within the DoD significantly inhibits analysis and visualization work. Additionally, the team found at the program level there was a lack of integrated quantitative programmatic data for cost, schedule, and performance risk. The data was created in many cases within the cost-estimating efforts for major acquisitions, but was not available for access through any database structure nor aligned to any portfolio.

The team explored with several current OSD and Service personnel what their goal was for portfolio analysis, which can be summarized as "are the services robustly funding the programs." The concept of "robustness" implies overcoming adverse conditions, which would be within the risk management domain in program management. The team looked at utilizing Research (R) and Procurement (P) budget documents with the classic Spruill chart but quickly identified that the critical piece of data in the Spruill chart is the requirement line. How can one assess the robustness of the requirement line? That led to a discussion on quantitative risk in cost and schedule considering performance risks. The challenge was risk/uncertainty quantitative data was not available in any of the standard data systems such as DAVE, Program Management Resource Tool (PMRT), or Advance Analytics (Advana).

The team reviewed the OSD approach to portfolio management and the ongoing revision effort for DoDD 7045.20, Capability Portfolio Management. The DoD policy was focusing on the secondary functions according to Michael Porter's Value Chain concept; including the Decision Support Systems which include Requirements, Acquisition and Sustainment oversight, and Planning, Programming, Budgeting, and Execution (PPBE). The research focused on the PEO building weapons, operational capability, and conducting missions. The research team saw these as the DoD's primary functions. Thus, the team worked to set up a structural schema for portfolios along these primary functions. This evolved into the multidimensional portfolio management structure (see Figure 1).

The Multidimensional Portfolio concept alignment became the research's key focus/output. The approach allows the portfolios to be managed to cover the range of Doctrine, Organization, Training, materiel, Leadership and Education, Personnel, Facilities and Policy (DOTmLPF-P) and thus not just the PEO materiel systems view, but also the operational unit and combatant commander mission view. These portfolios can be considered "capability" portfolios, but the focus is on a different type of capability.

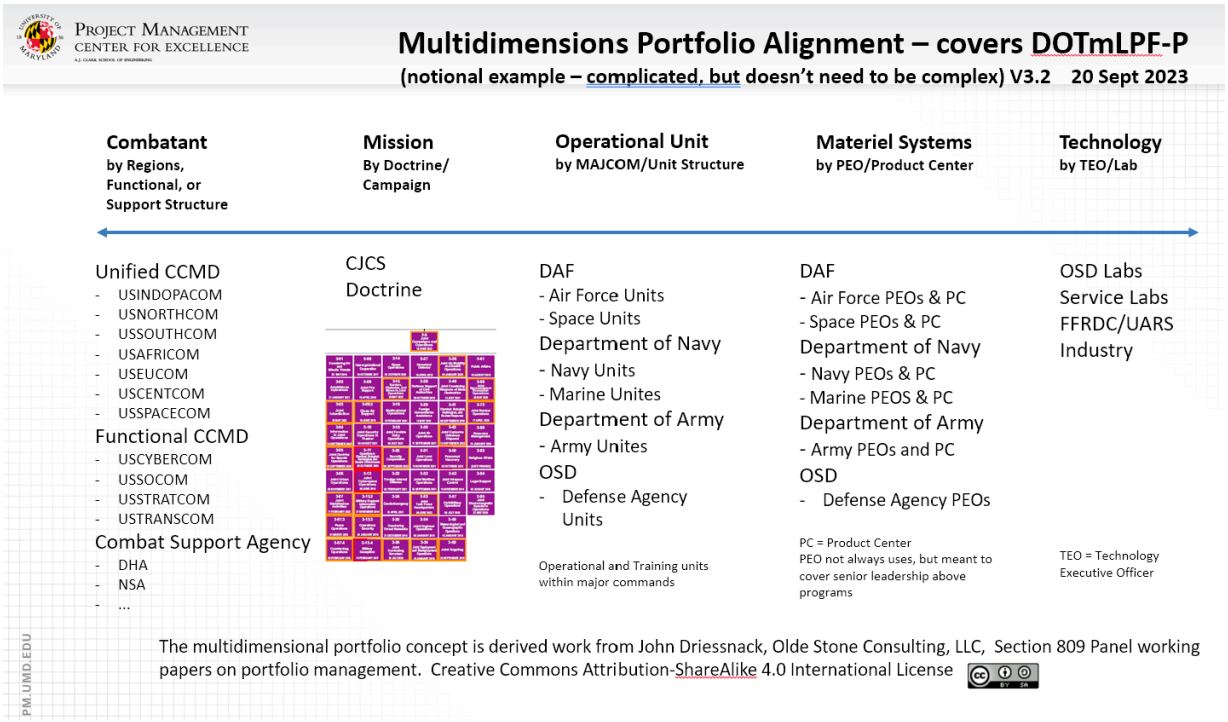

Figure 1. Multidemensional Portfolio Alignment

The predominant thought on portfolios within the industry and the federal government is on picking a portfolio structure. The DoD has arguably the largest project/program structure of portfolios in terms of PEOs within any federal government agency or industry organization. The DoD's annual expenditure is over one quarter of a trillion dollars. Therefore, the concept proposed for the DoD necessitates a structure within an overall enterprise portfolio concept.

In terms of industry best practice, it was clear that the DoD lacked the programmatic tools that could then flow data up to the portfolio level. These tools at minimum include schedule and risk management data systems from the lower-level project and program offices that can be rolled up and summarized. The summarization of data today from the original equipment manufacturer (OEM)/Prime contractors through the government program office focuses on qualitative data, making using quantitative decision tools within any portfolio structure virtually impossible. There is also no standardization in modeling missions, unit capabilities, PEOs materiel systems.

Therefore, the current systems are simply incapable of providing the needed data for portfolio-level analysis that could answer the OSD portfolio managers question: "are the services robustly funding the programs?"

As a result, the research team focused on creating a pilot program within the Department of the Air Force (DAF) Operational Imperative (OI) initiative to further explore the creation of the needed structures and utilization of project and program best and emerging practices to create data that flows into a portfolio structure. The initial tool development is focused on creating a programmatic model, what we would call model based programmatics (MBProg) using network schedule models that is challenge-informed, with challenges representing constraints, assumptions, issues, risks, and opportunities (CAIRO). The pilot effort started in September 2023 and will continue with the University of Maryland research team working under the Applied Research Laboratory for Intelligence and Security (ARLIS) in collaboration with the University of Maryland Project Management Center of Excellence.

BACKGROUND

The original project was proposed in three phases (see Figure 2). Phase 1 was 9 months which was extended to 30 September 2023 and modified to reflect the findings of the team. The research post March 2023 focused on establishing a pilot structure within the DAF on the Operational Imperatives (OI).

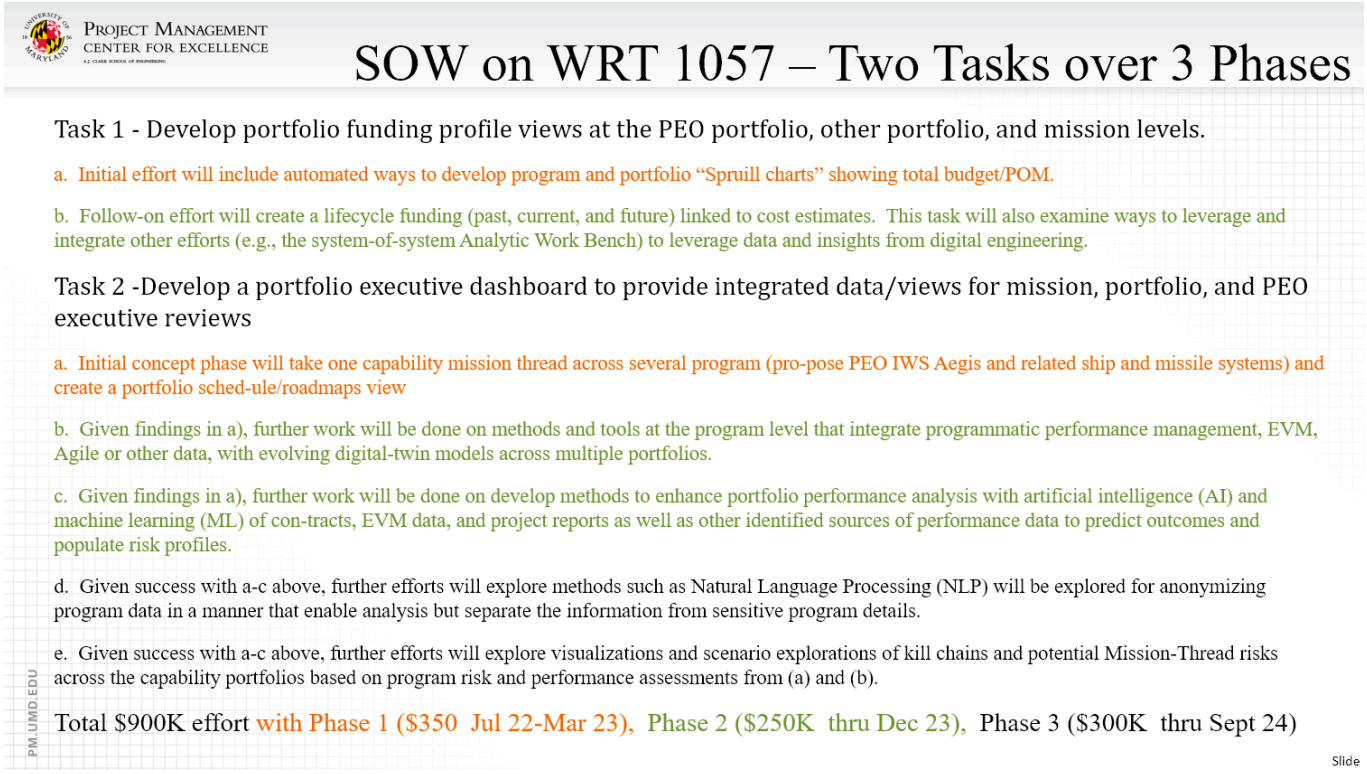

Figure 2 . Research Phases/Tasks

The team was originally focused on Tasks 1a and 2a (highlighted in Figure 2), which became impractical to execute given the lack of data. The team pivoted to create the structure for data that would meet the task's needs, which resulted in multidimensional portfolio views and expanded data set needs.

RESEARCH AND RESULTS

Details on the research and results are summarized below. Details can be found in the two published papers and a draft paper (see Appendix B). Additional information can be found in the research reviews referenced in Appendix A. Copies of those reviews are available upon request.

1.1 Industry Standard Portfolio Management

The team noted that the DoD does not implement industry standard portfolio management (see Figure 3) and characterized how the Portfolio Management (PfM) performance domains could be utilized with the department multidimensional portfolio structure (see Figure 4).

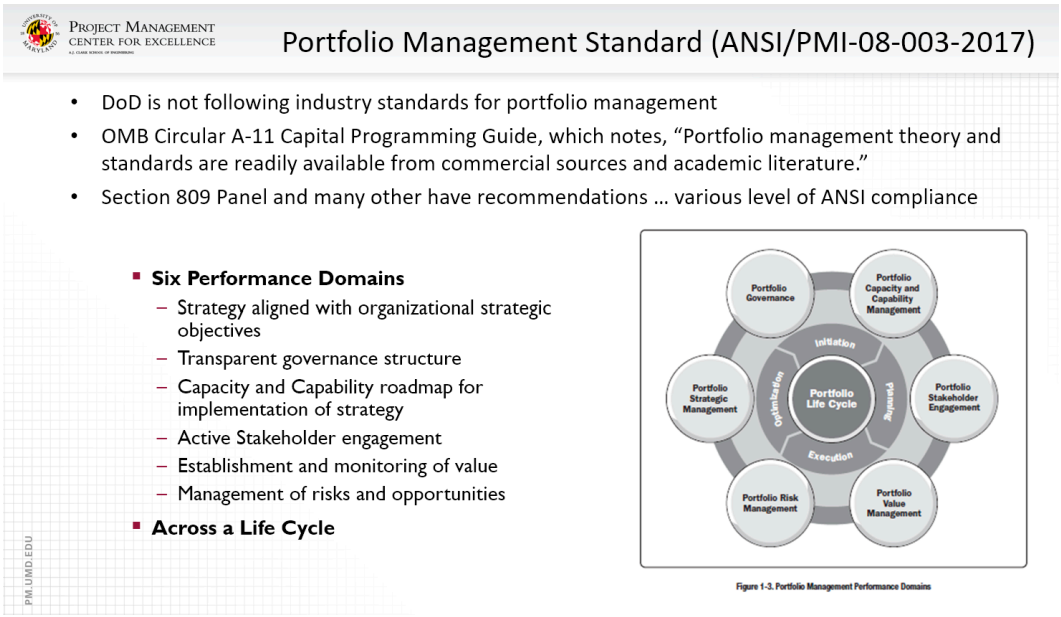

Figure 3 . Industry PfM Standard

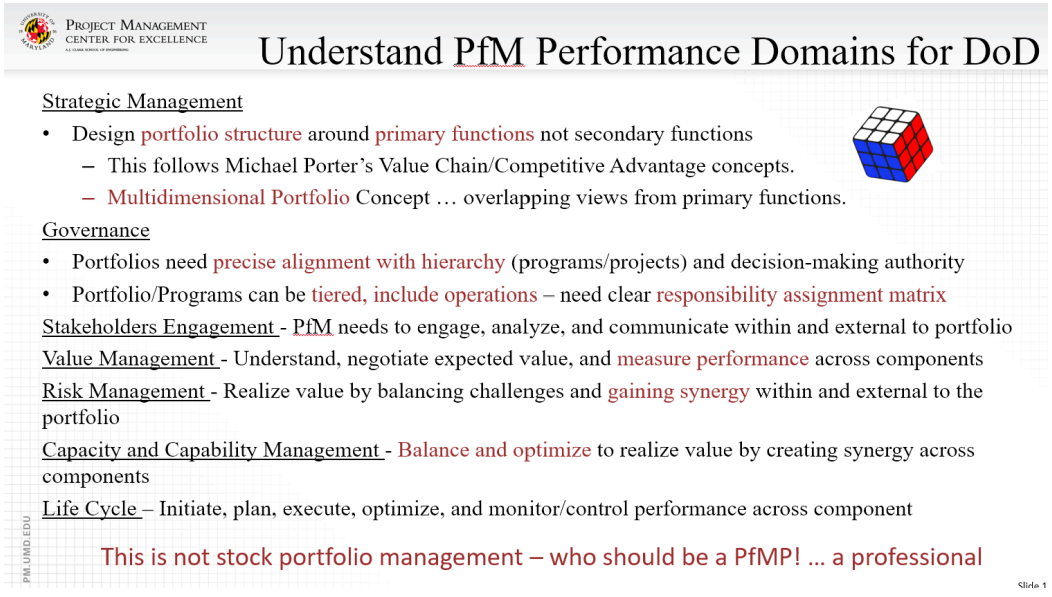

Figure 4 . PfM Performance Domains for DoD

1.2 Mission and Capability Portfolio Structure

The team identified that the current OSD capability portfolio structure did not align with the Joint Capability Areas (a structure within the office of the Chairman of the Joint Chiefs of staff (CJCS)) nor any of the Service PEO structures. The lack of alignment and desire to find a single dimension structure has inhibited the usefulness of DoDD 7045.20 Capability Portfolio Management, usefulness since it was originally published in 2008. The proposed multidimensional view focuses on the DoD Joint Doctrine Hierarchy (see Figure 5).

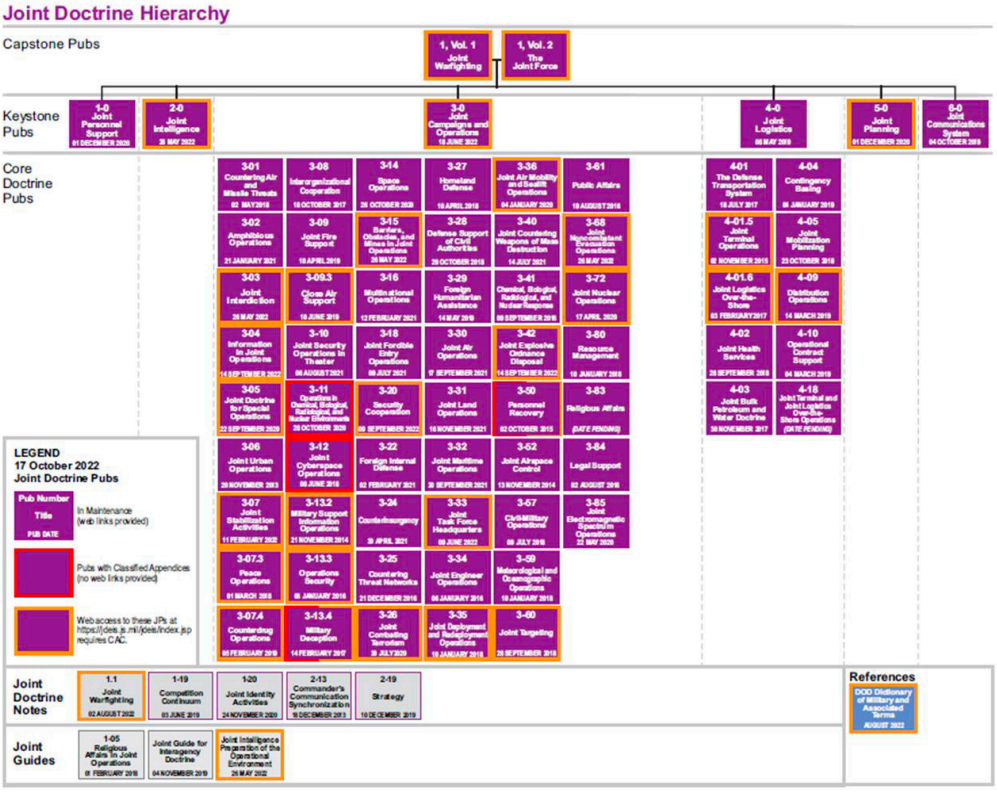

Figure 5 . Joint Doctrine Hierarchy

The team explored the uses of Universal Joint Task List (UJTL) which are used by combatant commanders to build operational plans and assign Joint Mission Essential Tasks (JMET) to Service and 4th Estate operational units. This structure can be used to connect the missions with the operational units.

1.3 Modeling Cost/Schedule/Performance and Challenges (CAIRO)

The team explored current guidance on obtaining quantitative data at the project or program level for portfolio roll up and additional modeling. Current OSD guidance on cost estimating provides clear guidance that will meet the needs, it just needs to be applied consistently at the program level whether or not the program is a major program and be done with a structure that allows integration (see Figure 6).

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Model Cost/Schedule/Performance/Challenges

- **Use OSD Cost Guide noted best practices (FICSM)**
- **Incorporate Challenges (CAIRO – constraints, assumptions, issues, risk, opportunities**
- **Conduct Schedule Risk Analysis (SRA) to enhance analysis**

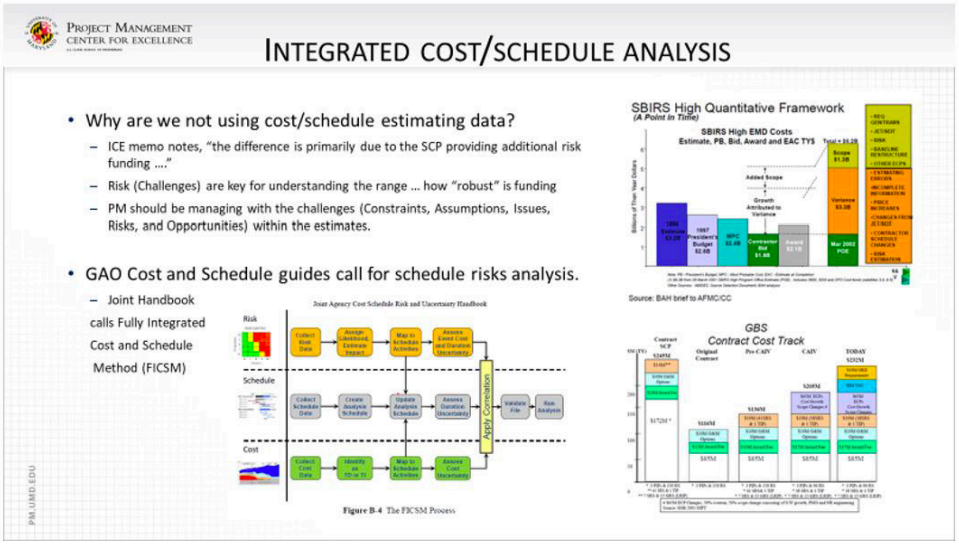

Figure 6 . Integrated Cost/Schedule Analysis

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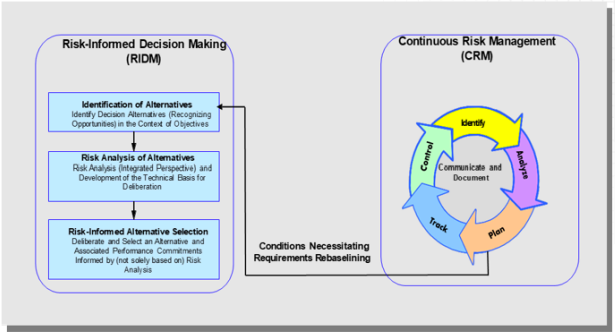
Select a Risk Management Approach

- Best Practice is NASA Risk Management Handbook, Nov 2011
- Two parts
  - RIDM
  - CRM
- DOD Risk Handbook focus on CRM
- RIDM is the key …
  - Part of Acq Strategy and setting baseline
  - What challenges are accepted



- Enterprise decisions are tradeoffs on risk … program vis mission within resources

Data structures and collection need to be informed by the needs of the portfolio management

Figure 7 . Risk Management Approach

The team also looked at best practices for risk management (see Figure 7), with emerging practices to go beyond risk to challenge management. The National Aeronautics and Space Administration's (NASA) Risk Informed Decision Making (RIDM) adds a critical decisional phase into the risk management process. The emerging practice of considering challenges, defined by Constraints, Assumptions, Issues, Risks, and Opportunities (CAIRO) allows for integration of risk drivers (constraints and assumptions) early in decision processes before baselines are set. The tracking of challenges then allows for cost and schedule to track broader areas of project/program concern, such as constraints and assumptions, to further inform decision making.

Current studies, such as the Arizona State University Integrated Project/Program Management (IP2M) Maturity and Environment Total Risk Rating (METRR) research (https://ip2m.engineering.asu.edu/) for Department of Energy demonstrated the benefits of staying within baselines focusing on good project/program performance management with risk and schedule management as key attributes.

1.4 Multidimensional Portfolio Structure

The team developed a multidimensional portfolio concept to align portfolio data across the Department's primary functions. The approach allows the portfolios to be managed to cover the DOTmLPF-P. This is not just the PEO materiel systems view, but also the operational unit and combatant commander mission view. The PEO and Technology Executive Office (TEO) are covered in separate portfolios. Note that the PEO is not just programs, but all materiel systems under the PEO/Product Center (using Air Force terms) under the DoD Total Life Cycle Systems Management approach (TLCSM). Combatant, Mission, Operational Unit, Material Systems, and Technology can be considered "capability" portfolios, but the focus is on different capability sets or dimensions.

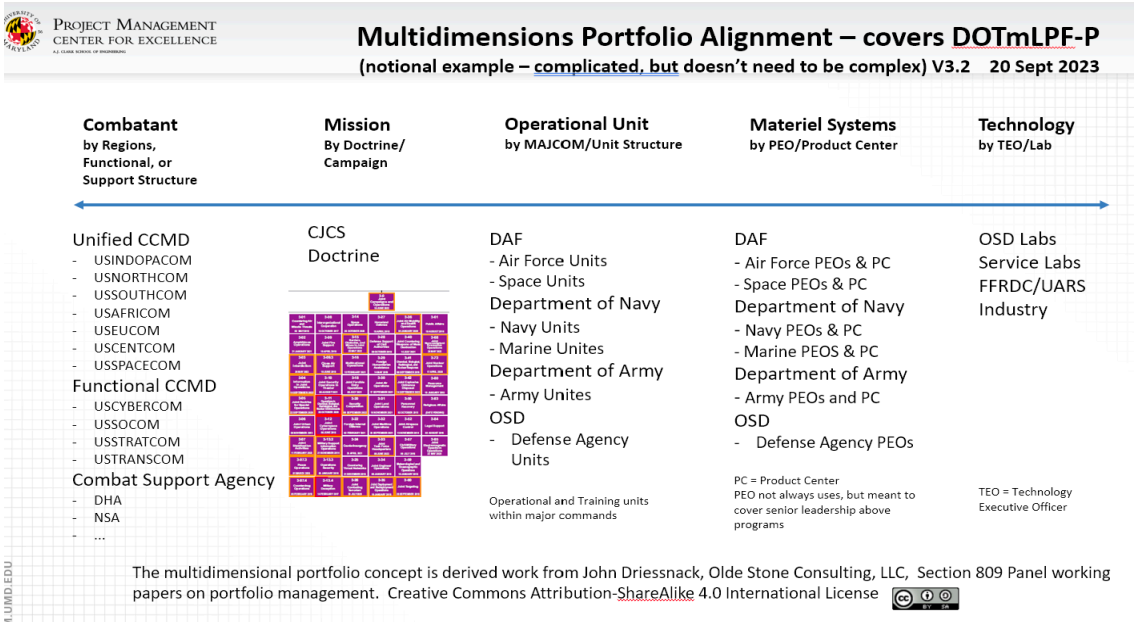


Figure 8 . Multidimensions Portfolio Alignment

As stated previously, the DoD is arguably the largest project/program structure by portfolio in terms of PEOs within any federal government agency or industry, with an annual expenditure of over a quarter trillion dollars. To-date, OSD has not been able to align to a single capability structure. The predominate thoughts on portfolios within the industry and federal government is on picking a portfolio structure that supports key decision making. For OSD, the question remains, " are the services robustly funding the programs?"

To answer this question, DoDD 7045.20 should recognize the multidimensional nature of the DoD primary functions as a capability portfolio structure that needs to be aligned under an overall enterprise portfolio structure. The enterprise portfolio would be equivalent to the Defense Management Action Group (DMAG), and would enable linking PEOs to capable Operational units needed to conduct Missions; creating a multi-dimensional view of secondary functions (e.g., The Decision Support Systems) and primary functions focused on missions.

CONCLUSIONS

The team summarized its recommendations into three areas (see Figure 9). Those include:

(1) expand quantitative performance management data,
(2) define a multidimensional system of systems for portfolios in which to collect that data, and
(3) pilot the effort to develop data and create decisional tools that can implement the designs.

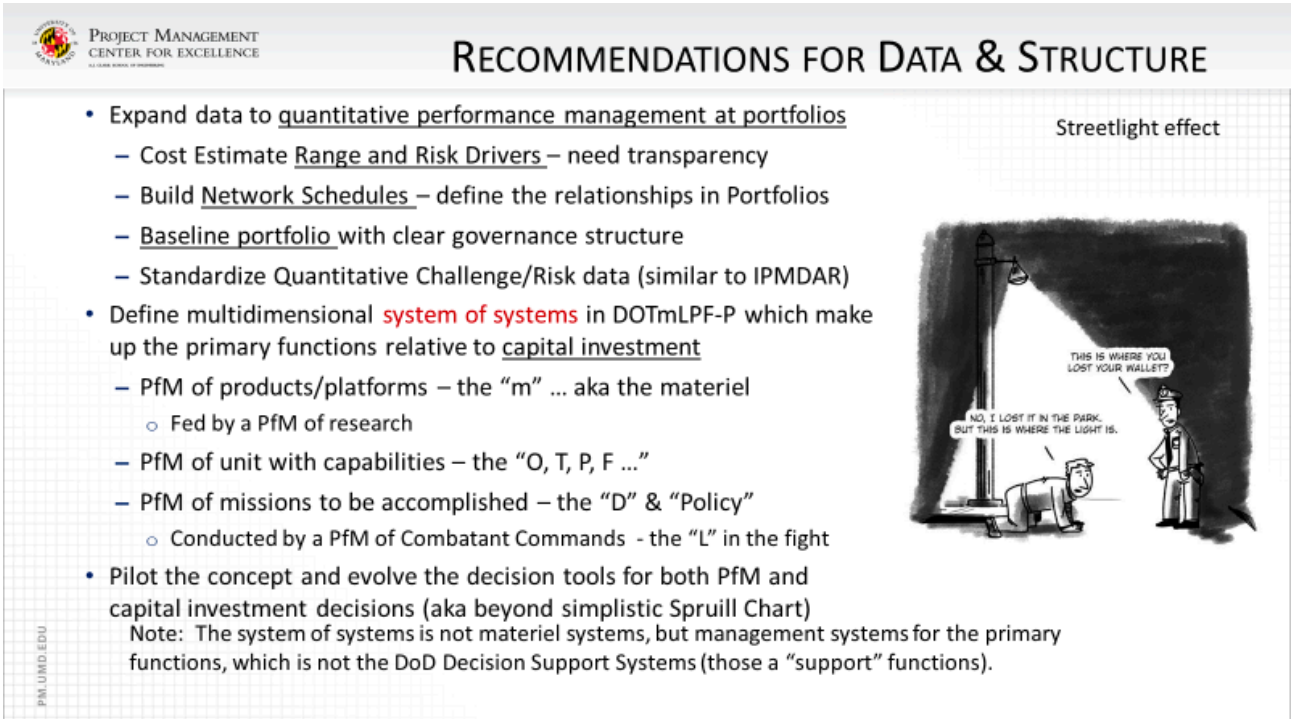


Figure 9 . Recommendations for Data Structure

The first two need to be embraced by an early adopter group of programs/portfolios that would then work with the research team to conduct the third recommendation of building the decision tools for the pilot to be successful. The proposed DAF OI Portfolio Management pilot at the writing of this report is taking this path.

APPENDIX A. RESEARCH REVIEWS SCHEDULE AND CHARTS

Below is a list of formal reviews conducted during the research period, except for the kickoff meeting in August 2022 and a review in October 2022 that focused on setting up the process. PDF copies of the review charts are provided in a separate folder.

- Review with OSD (Mr. Brian Joseph and Portfolio Managers) held on 16 December 2022
- Review with OSD (Mr. Brian Joseph and Portfolio Managers) held on 17 February 2023
- Review with Mr. David Cadman held on 22 March 2023
- Review with Mr. Mark Krzysko held on 11 May 2023
- Review with Mr. David Tremper held on 23 May 2023
- Final review held on 8 September 2023

APPENDIX B. LIST OF PUBLICATIONS RESULTED

The following are the publications related to this research task:

Portfolio Management Structures: Systems, Capabilities, and Misson Portfolios by John Driessnack and Caitlin Kenney. A copy of this paper was published at the NPS Acquisition Research Symposium in May 2023. A copy and the presentation are available at https://dair.nps.edu/handle/123456789/4850. In addition, a PDF copy of the public release version is provided in a separate folder.

Portfolio Management with the Department of Defense: A Data Challenge, by Caitlin Kenney and John Driessnack. This paper was presented at the Institute of Industrial and Systems Engineering Annual Conference in May 2023. A PDF copy of the public release version is provided in a separate folder

DoD Enterprise Portfolio Management Should Consolidate a Multidimensional Portfolio Management Structure, by John Driessnack. A PDF copy of the pre-publication version is provided in a separate folder.

Caitlin Kenney also presented a summary of the research at the University of Maryland Project Management Center of Excellence, Project Management Symposium, titled Multidimension Portfolio Management Structures: Missions, Capabilities, and Systems in April 2023. https://pmsymposium.umd.edu/pm2023/speaker/caitlin-kenney/

ACRONYMS AND ABBREVIATIONS

Advana	Advance Analytics
AI	Artificial Intelligence
AIRC	Acquisition Innovation Research Center
ARLIS	Applied Research Laboratory for Intelligence and Security
CAIRO	Constraints, Assumptions, Issues, Risks and Opportunities
DAF	Department of the Air Force
DAVE	Defense Acquisition Visualization Environment
DMAG	Defense Management Action Group
DoD	Department of Defense
IAPR	Integrated Acquisitions Portfolio Review
IP2M	Integrated Project/Program Management
IWS	Integrated Warfare Systems
JMET	Joint Mission Essential Task
MBProg	Model Based Programmatics
METRR	Maturity and Environment Total Risk Rating
ML	Machine Learning
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NPS	Naval Post Graduate School
OI	Operational Imperative
OSD	Office of Secretary of Defense
PEO	Program Executive Office
PNO	Program Number
PPBE	Planning, Programming, Budgeting, and Execution
PfM	Portfolio Management
PMRT	Program Management Resource Tool
RIDM	Risk Informed Decision Making
TEO	Technology Executive Office
TLCSM	Total Life Cycle Systems Management
UJTL	Universal Joint Task List
UARC	University-Affiliated Research Center
UMD	The University of Maryland

REFERENCES

References are noted in the papers and charts. No additional references are noted in the final report.

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