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MONTEREY, CALIFORNIA

JOINT APPLIED PROJECT REPORT

PROGRAM MANAGER PREPARATION
AND ACQUISITION OUTCOMES

September 2021

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PROGRAM MANAGER PREPARATION AND ACQUISITION OUTCOMES

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	acquisition category
DAMIR	Defense Acquisition Management Informational Retrieval
DAU	Defense Acquisition University
DAWIA	Defense Acquisition Workforce Improvement Act
DOD	Department of Defense
MDAP	major defense acquisition programs
MAPL	Military Acquisition Position List
OSD	Office of the Secretary of Defense
PM	program manger
PMI	Project Management Institute

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I. INTRODUCTION

According to retired General Colin Powell, “There is no secret to success. It is the result of preparation, hard work, and learning from failure” (BrainyQuote, n.d.). The Defense Acquisition System is no different. In an ever-evolving, fast-paced world, technologies are constantly changing, and the American warfighter deserves the best equipment to protect and defend the nation. However, the American taxpayers also deserve to have their hard-earned dollars spent effectively. There are many reported instances of failed programs that wasted time and money while providing zero capability for the warfighter. For instance, Rodriguez (2014) lists the “Top 10 Failed Defense Programs of the Revolution of Military Affairs Era” that cost American taxpayers \$52.7B and provided zero capabilities for the warfighter. Articles pointing out failures in the acquisition system cause outrage among American taxpayers.

Even though these programs failed to provide new capabilities to the warfighter, some may argue that the expense of such failed programs is worth their costs. For one, though these programs ultimately failed to directly provide increased capability to the warfighter, some argue that they often still increased knowledge and advanced technologies. Furthermore, some would point out that the costs of such programs spread out over several years represent a small proportion of the overall Department of Defense budget, which has been over \$633B annually since 2008 (Macrotrends, n.d.).

In the Defense Acquisition system, the program manager (PM) is the individual who must deliver the best for the warfighter while maintaining cost, schedule, and performance outcomes that maximize the taxpayer dollar. The PM is the sole individual responsible for running a military acquisition program from inception to disposal. Throughout a program’s life cycle, there are multiple PMs making decisions to ensure that superior capabilities are in the hands of the U.S. servicemen and women. To do this, a PM must prepare, work hard, and learn from failures.

Each branch has its acquisition command and own way of preparing PMs. Does the difference in PM preparation result in better acquisition outcomes? Is one of the branches’

PM preparations better than all of the rest? The goal of this research is to determine any differences in PM preparation between the United States Air Force, Army, Navy, and Marine Corps and how these impact cost and schedule outcomes. The hypothesis is that one branch has a different way to train PMs which produces superior results. This will be determined by comparing PM preparation and analyzing differences. This will be followed by examining acquisition statistics to determine if one branch outperforms the others in cost and schedule performance.

II. METHOD

A. PREPARATIONAL PROCESS

Each branch has its unique process of preparing PMs. Research of open source information provided the bulk of the data on preparational processes. Acquisition professionals from each branch provided additional clarifying information to ensure the accuracy of the preparational processes. Commonalities and differences in each branch's PM preparational process were then identified and compared.

B. ACQUISITION OUTCOMES

Acquisition outcomes are measured by the triple constraint of program management. The triple constraint consists of performance, cost, and schedule. Performance entails that the acquired weapon system achieves the results required by the end-users. This is determined by performance specifications meeting and exceeding threshold objectives. Essentially, the end-user lists requirements, performance specifications are generated, and the degree to which the item meets or exceeds the specifications dictates the performance. However, in military acquisitions, the only true measure of performance is how the weapons system performs in combat. This makes capturing and analyzing performance data difficult, and no reports could be found. Therefore, the performance constraint was not able to be analyzed.

The cost constraint views how well a program stays on budget. Each program uses cost estimation to establish a baseline budget for the program. A program executing funding under or on the baseline budget demonstrates how well it performs in the cost constraint. This study looks at the cost constraint performance in percentages. Positive numbers indicate a percentage cost growth; meanwhile, negative numbers show a program running under budget. The formula to calculate cost growth is $(\text{program cost} - \text{baseline cost}) / (\text{baseline cost})$. For instance, a \$100M program that displays a 10 would be \$10M over budget, whereas a -10 would be \$10M under budget. The lower the number, the better a program performs against the cost constraint.

The schedule constraint outlines the timeline to complete events eventually leading to the fielding of equipment. The schedule sets a timeframe in which actions must be completed. Being on or ahead of schedule allows warfighters to receive the equipment they need on time. This study shows how well programs perform against their baseline schedule in percentages. Positive numbers indicate a percentage schedule growth or getting equipment to the warfighter later than projected. Meanwhile, negative numbers show capabilities being fielded faster than projected. The formula for calculating schedule growth remains the same as cost growth. The lower the number, the better a program performs against the schedule constraint.

C. SELECTED ACQUISITION REPORT (SAR)

To determine the services' cost and schedule performance, SARs datasets were used. SARs are mandated under 10 U.S. Code 2432 to be submitted quarterly for major defense acquisition programs (MDAP) (Unit Cost Reports, 1983). Statutory law, 10 U.S. Code 2432 defines an MDAP as an “acquisition program that is not highly sensitive classified program (as determined by the Secretary of Defense) and that is designated by the Secretary of Defense as a major defense acquisition program” (Unit Cost Reports, 1983). MDAPs are Acquisition Category (ACAT) I programs. Since 10 U.S. Code 2432 was written, the dollar threshold has been adjusted for MDAPs. MDAP thresholds are currently programs that have an “eventual total expenditure for research, development, and test and evaluation of more than \$525 million” or a total procurement cost of \$3.065 billion in fiscal year 2020 constant dollars (Department of Defense [DOD], 2020, Appendix 3A). Special interest programs as also designated as ACAT I (DOD, 2020).

A SAR captures a myriad of data that is outlined in 10 U.S. Code 2432. Part of that data includes cost and schedule percentage growth (Unit Cost Reports, 1983). Defense Acquisition Management Informational Retrieval (DAMIR) combines SARs and provides multiple types of reports. One such report provides cost and schedule growth and can be easily filtered by branch. DAMIR reports from December 2017, 2018, and 2019 captured SAR cost and schedule growth data for multiple programs. An additional report also provided the PMs from each SAR program. These reports are

Microsoft Excel documents and easily filtered. The SAR data was used from DAMIR reports to identify programs managed by uniformed personnel, filter programs by branch, and capture cost and schedule growth.

D. GOAL

To compare differences in the PM preparation between and branches and analyze their programs' cost and schedule growth. If a measurable difference can be determined, a correlation can be made between PM preparation and acquisition outcomes. In order to do this, SAR datasets from December 2017, 2018, and 2019 were analyzed to see changes in cost and schedule over the three years. The data sets were filtered to eliminate programs supervised by civilians. Only programs overseen by military service members were analyzed for this study, as the civilian preparation process could be different from the component in which they are serving.

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III. PREPARATIONAL PROCESS

A. HISTORY

The Defense Acquisition Workforce Improvement Act (DAWIA) of 1990, which was sponsored by former U.S. Representative Nicholas Mavroules, set preparational and experience requirements for acquisition professionals. DAWIA set the groundwork for ensuring an educated Defense Acquisition Corps. The act tasked the DOD with establishing training for military and civilian PMs, and with implementing the Defense Acquisition University (DAU) (Defense Acquisition Workforce Act [DAWIA], 1990). The DOD established the DAU and component functional leaders who are responsible to oversee certification standards and provide input for curriculums (Department of Defense [DOD] (2019). DAU curriculums were established for multiple acquisition career fields to include program management. Military Departments also must ensure that sufficient billets are available for junior officers to provide viable careers paths for advancement in the acquisition field (DOD, 2019).

B. PROGRAM MANAGER PREPARATION REQUIREMENTS

The DAWIA codified that to become an acquisition workforce member an individual must be the rank of O-4; major in the Air Force, Army, and Marine Corps, or Lieutenant Commander in the Navy (DAWIA, 1990). However, the acquisition corps has been abolished (National Defense Authorization Act [NDAA], 2019). DAWIA also required the Secretary of Defense to established critical acquisition positions to be filled by O-4 or higher (DAWIA, 1990). PMs of MDAPs and significant non-MDAPS fill some of these critical acquisition positions.

Working in conjunction with functional leaders from each component, the DAU established a curriculum for three different DAWIA certification levels for program management though the DAU does not certify an individual because they have completed the prerequisite course. Certification in each level depends upon the Component Acquisition Executive (Department of Defense [DOD], 2005). DAU PM level requirements can be satisfied through online classes or component instruction, but also

must include real-world experience. Table 1 shows the requirements for each DAWIA certification level for PMs. This includes the DAU-required classes, hours to complete the classes, and level of experience. However, as mentioned before DOD components can satisfy these requirements by their own methods. For instance, the Naval Postgraduate School Program Management curriculum meets the DAWIA level II certification.

For DAWIA Program Management Level I, DAU requires the courses listed below with one year of acquisition experience with cost, schedule, and performance responsibilities (Defense Acquisition University [DAU], n.d.). Level II requires two years of the same responsibilities and additional classes (DAU, n.d.). The requirements for Level III certification build upon Level I and II, but experience drives the Level III certification. Level III involves four years in program management with cost, schedule, and performance responsibilities. At least 2 of the 4 years need to be in a program office for system development and acquisition or similar organization (DAU, n.d.). Table 1 identifies the basic qualifications to obtain DAWIA certification. Each military department can deviate for the DAU curriculum to fit their needs.

Table 1. DAU Level 1, 2, and 3 PM Training. Adapted from DAU (n.d.).

Level 1			
Required Courses	Course Name	Aproximate Hours to Completion	Training Type
ACQ 1010	Fundamentals of Systems Acquisition Management	13	Online
ENG 101	Fundamentals of Systems Engineering	12	Online
CLB 007	Cost Analysis	4	Online
CLV 016	Introduction to Earned Value Management	1	Online
	Total Hours	30	Online
1 year of acquisition experience with cost, schedule, and performance responsibilities			
Level 2			
ACQ 202	ACQ 202 Intermediate Systems Acquisition, Part A	19	Online
ACQ 203	Intermediate Systems Acquisition, Part B (R)	4 days	Instructor led
PMT 2520	Program Management Tools Course, Part I	15	Online
PMT257V	Program Management Tools Course, Part II	5 days	Instructor led
CON 121	Contract Planning	11	Online
CON 124	Contract Execution	9	Online
CON 127	Contract Management	8	Online
EVM 101	Fundamentals of Earned Value Management	10	Online
ISA 1011	Basic Information Systems Acquisition	10	Online
	Total Hours	9 class day and 82 hours online	
2 years of acquisition experience with cost, schedule, and performance responsibilities			
Level 3			
ACQ 315	Understanding Industry (R)	4.5 days	Instructor led
BCF 110	Fundamentals of Business Financial Management	22	Online
ENG 201	Applied Systems Engineering in Defense Acquisition, Part I	9	Online
EVM 263	Principles of Schedule Management ®	3 days	Instructor led
LOG 104	Reliability, Availability, and Maintainability (RAM)	6	Online
PMT 3550	Program Management Office Course, Part A	13	Online
PMT 360	Program Management Office Course, Part B (R)	18.5 days	Instructor led
	Total Hours	26 days and 50 hours	
	Overall Total	35 days in class 162 hours online	

In addition to the DAWIA certification levels, statutory requirements for experience are in place for PMs. PMs of MDAPs are required to have 8 years of acquisition experience (Defense Acquisition Workforce, 1990). Deputy PMs of MDAPS and PMs of significant non-MDAPs are required to have 6 years of acquisition experience (Defense Acquisition Workforce, 1990).. All three of the above mentioned PM positions are required to have at least 2 years of experience in a program office of similar organizations (Defense Acquisition Workforce, 1990). Deputy PMs of non-MDAPs are required to have 4 years of acquisition experience. (Defense Acquisition Workforce, 1990).

There are multiple pathways to becoming a uniformed PM across the armed forces, as each branch is required to have acquisition-coded billets. These billets satisfy the DAU experience level requirements. This essentially leads to each PM having a different experience and pathway in becoming a PM. General pathways for each component are described below.

C. PROGRAM MANAGER PREPARATION REQUIREMENTS BY BRANCH

1. The United States Air Force

The Air Force provides a few different pathways to become a PM. Acquisition officers can come from the Air Force Academy or ROTC. Acquisitions will be the lieutenant's primary military occupational specialty. After a three-week course in acquisition fundamentals, lieutenants can go straight into acquisitions. Some choose to take an operational tour first and then come back to acquisitions; meanwhile, others embed with industry to learn program management and then return to acquisitions. The Air Force is the only branch that provides rotational assignments (Sullivan, 2018). Rotational assignments was identified as a leading practice in the development of PMs (Sullivan, 2018).

2. United States Army

All acquisition positions are documented in the Army's Military Acquisition Position List (MAPL). Officers must serve in a billet listed on the MAPL to become a PM. Once placed into an acquisition position, the officer has a 24-month grace period to earn their DAU Level II certification.

An officer can complete the DAU training for program management though most active-duty officers attend the Army Acquisition Center of Excellence (AACOE) for their Level I & II certifications in program management or contracting. AACOE conveys DAU equivalencies. To obtain Level III certification the officer must attend DAU classes to complete their certification.

To be eligible to become a PM "only major or above who meet the following requirements may be considered for Acquisition Corps membership: 24 semesters of business credit; at least 4 years of experience in an acquisition position; and DAWIA Level II certification in at least one area of concentration" United States Army Acquisition Support Center, n.d., para. 7).

A business degree is not required as any baccalaureate degree is acceptable. However, officers with science, technology, engineering, and mathematics degrees are more highly sought after today followed by those with business degrees. To get the

requisite four years of experience, the officer must have a job assigned on the MAPL though a business type degree can count as one of the four required years.

All officers will have a master's degree before entering the Acquisition Corps or will attend one of two schools offering an advanced degree in acquisition-specific training. The two schools are the Naval Postgraduate School in Monterey, California, and the University of Alabama in Huntsville. The Army has a relatively new 18-month program partnering with the University of Alabama in Huntsville and DAU, whereby an officer can gain a master of science degree with a concentration in systems engineering. The effort of the two schools is to convey Level III training upfront when the officer starts their acquisition careers. However, the Level II requirement is for acquisition corps membership.

3. United States Navy and Marine Corps

As part of their PM preparation, Navy and Marine Corps officer must have a billet that is acquisition coded. Once in a coded billet, the officer must achieve DAU Level II certification. The Navy offers acquisition corps master's degree programs for both Navy and Marine Corps officers, but those are not required to become a PM. An officer only needs to be an O-4 or higher and complete an acquisition coded billet and DAU Level II certification.

D. COMMONALITIES

DAWIA required that the DOD set up the DAU. DAU established requirements for certification levels which include real-world experience. Each component acquisition executive certifies the PMs. On paper, the preparation to become a PM in each component appears the same.

E. DIFFERENCES

The Air Force prepares PMs in two ways that are different to the other branches. First, the Air Force assigns officers to rotational assignments in acquisition billets. Second, commissioned officers can go directly into acquisitions. Additionally, the Army has the requirement that a PM must have a master's degree, and it provides an opportunity for

acquisition degrees from NPS or the University of Alabama in Huntsville. Finally, each acquisition coded billet provides a different experience for each PM.

IV. ACQUISITION OUTCOMES

A. RESULTS

The DAMIR reports were filtered to ensure that PMs from the studied programs were uniformed officers. The reports were sorted by components and the percentage of cost and schedule growth for 2017–2019 was captured. The DAMIR reports listed 22 Air Force, 13 Army, 6 Marine Corps, and 28 Navy ACAT I programs. Table 2 shows the cost and schedule growth of these programs. Table 3 shows a ranking system displaying the branches’ performance with an average score. The results show that the Air Force outperformed all services

Table 2. Service Cost and Schedule Performance 2017–2019. Adapted from SARS (2021)

Component	Program	Cost 17	Schedule 17	Cost 18	Schedule 18	Cost 19	Schedule 19
AIR FORCE	AEHF	-22.86	--	-23.57	--	-24.24	--
AIR FORCE	APT	--	--	0.27	0.00	0.23	-17.65
AIR FORCE	B-2 DMS-M	3.06	8.70	13.69	8.70	-5.96	47.83
AIR FORCE	B61 Mod 12 LEP TKA	-14.99	--	-1.03	--	-5.53	--
AIR FORCE	EPS	--	--	--	--	-2.69	--
AIR FORCE	F-15 EPAWSS	-40.41	1.47	-35.13	--	0.00	--
AIR FORCE	F-22 Inc 3.2B Mod	-0.17	1.39	-3.44	1.39	-3.55	2.78
AIR FORCE	FAB-T-CAPT	2.89	--	-4.06	--	3.85	--
AIR FORCE	FAB-T-FAT-T FET	-5.08	--	-4.14	--	--	--
AIR FORCE	GPS III	-4.24	--	-7.71	--	-7.83	--
AIR FORCE	GPS IIIF	--	--	0.00	--	-0.67	--
AIR FORCE	HC/MC-130 Recap	-6.62	--	-7.46	--	-10.54	--
AIR FORCE	ICBM Fuze Mod	0.61	0.00	-0.76	0.00	6.28	13.45
AIR FORCE	JASSM	0.74	--	0.00	0.00	117.83	--
AIR FORCE	KC-46A	-1.22	23.08	0.00	0.00	-0.86	51.28
AIR FORCE	MGUE Inc 1	-6.51	--	-5.53	--	-8.54	--
AIR FORCE	NSSL	-17.46	0.00	-11.53	0.00	-9.11	0.00
AIR FORCE	PNVC Integrator	--	--	--	--	--	--
AIR FORCE	SBIRS High	-10.78	--	-14.37	--	-15.81	--
AIR FORCE	SDB II	4.15	41.67	4.75	51.39	4.88	58.33
AIR FORCE	VC-25B	--	--	-2.33	--	-1.95	--
AIR FORCE	WGS	--	--	19.13	4.26	19.12	4.26
	Average	-7.43	10.90	-4.16	7.30	2.74	20.04
Component	Program	Cost 17	Schedule 17	Cost 18	Schedule 18	Cost 19	Schedule 19
ARMY	AH-64E New Build	-23.34	--	-6.18	--	-3.51	--
ARMY	AH-64E Remanufacture	6.98	6.02	7.54	6.02	6.41	6.02
ARMY	CH-47F Block II	-0.58	0.00	19.13	87.50	-0.58	0.00
ARMY	CIRCM	-0.35	2.82	0.11	2.82	0.00	2.82
ARMY	GMLRS/GMLRS AW	148.17	-4.30	132.29	-4.30	88.81	-4.30
ARMY	HMS	13.00	188.24	15.00	188.24	19.79	188.24
ARMY	IAMD	22.85	85.00	21.46	85.00	25.16	85.00
ARMY	ITEP	--	--	--	--	-0.01	0.00
ARMY	JAGM	-2.72	15.79	0.00	0.00	-4.74	15.79
ARMY	MQ-1C Gray Eagle	-4.70	6.98	-0.92	6.98	-2.76	6.98
ARMY	PAC-3 MSE	35.71	--	0.25	--	-1.44	--
ARMY	PIM	1.93	--	26.88	--	30.32	--
ARMY	UH-60M Black Hawk	-2.30	--	-0.96	--	-1.15	--
	Average	16.22	37.57	17.88	46.53	12.02	33.39

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Component	Program	Cost 17	Schedule 17	Cost 18	Schedule 18	Cost 19	Schedule 19
MARINE CORPS	ACV FoV	-6.98	0.00	-0.41	0.00	147.88	1.75
MARINE CORPS	CH-53K	-0.22	41.18	0.95	58.82	0.48	58.82
MARINE CORPS	DDG 1000	7.65	37.60	7.90	52.00	10.80	52.00
MARINE CORPS	H-1 Upgrades	-3.54	2.90	-2.02	2.90	-3.61	2.90
MARINE CORPS	V-22	5.61	1.20	-1.57	1.20	-1.59	1.20
MARINE CORPS	VH-92A	-4.37	-1.32	-4.83	1.32	0.20	6.58
	Average	-0.31	13.59	0.00	19.37	25.70	20.54
Component	Program	Cost 17	Schedule 17	Cost 18	Schedule 18	Cost 19	Schedule 19
NAVY	AAG	0.13	0.00	7.31	0.00	-11.76	-0.98
NAVY	AARGM-ER			0.00	0.00	-2.18	0.00
NAVY	AGM-88E AARGM	-0.26	28.24	0.11	28.24	0.00	28.24
NAVY	AIM-9X Blk II	-5.30	--	0.74	--	-2.93	--
NAVY	AMDR	-5.45	2.46	-1.45	7.38	0.87	6.56
NAVY	BMDS	--	--	--	--	--	--
NAVY	CEC	2.72	0.00	-0.09	0.00	2.35	0.00
NAVY	CVN 78	57.36	31.39	51.36	35.77	-3.18	51.09
NAVY	DDG 51	9.55	34.15	13.96	34.15	12.03	34.15
NAVY	E-2D AHE	2.56	-0.73	-0.37	-0.73	1.52	-0.73
NAVY	IDECM	-34.57	--	-4.27	--	-2.92	--
NAVY	IRST	-0.58	0.00	0.00	0.00	-2.35	0.00
NAVY	JPALS	-0.28	0.00	-6.61	0.00	-0.74	3.92
NAVY	KC-130J	0.14	--	11.60	--	-0.55	--
NAVY	LCS	-43.31	8.57	-39.35	8.57	-40.14	8.57
NAVY	LCS MM	-13.02	25.00	-0.13	--	1.66	--
NAVY	LPD 17	-0.55	10.94	-0.16	10.94	-0.72	10.94
NAVY	MIDS	4.55	--	8.44	--	11.10	--
NAVY	MQ-25	--	--	-14.45	0.00	-10.77	0.00
NAVY	MQ-4C Triton	-0.59	67.39	2.54	69.57	8.48	86.96
NAVY	MQ-8 Fire Scout	2.58	--	9.14	--	8.04	--
NAVY	NGJ Mid-Band	4.69	16.67	1.38	16.67	-0.74	16.67
NAVY	OASuW Inc 1 (LRASM)	19.50	--	-8.45	--	13.18	--
NAVY	P-8A	2.58	3.64	2.80	3.64	4.28	3.64
NAVY	SM-6	-16.96	50.67	9.21	50.67	5.58	50.67
NAVY	SSBN 826	-1.06	3.73	-1.13	3.73	-0.49	3.73
NAVY	SSN 774	-1.23	6.45	-2.85	6.45	-0.45	6.45
NAVY	Trident II Missile	0.12	4.05	0.81	4.05	1.16	4.05
	Average	-0.67	15.40	1.48	13.96	-0.36	15.70

Table 3. Component Cost and Schedule Performance Averages and Rankings

Component	% Cost Growth 2017	% Schedule Growth 2017	% Cost Growth 2018	% Schedule Growth 2018	% Cost Growth 2019	% Schedule Growth 2019	Average Score	Rankings
AIR FORCE	-7.43	10.90	-4.16	7.30	2.74	20.04	1.33	1
ARMY	16.22	37.57	17.88	46.53	12.02	33.39	3.83	2
MARINE CORPS	-0.31	13.59	0.00	19.37	25.70	20.54	2.83	3
NAVY	-0.67	15.40	1.48	13.96	-0.36	15.70	2	4

B. ANALYSIS

Each component's averages were calculated using the information from the December 2017, 2018, and 2019 DAMIR reports for cost and schedule growth. A negative number in cost growth shows that a program is staying under budget. Meanwhile, a positive number in cost growth shows that a program is over budget. The same is true for schedule growth. A positive number indicates a program is behind schedule, and a negative number that a program is ahead of schedule.

Each branch of service was analyzed by the cost and schedule growth of their programs. The percentage cost and schedule growth of each program was averaged to get an aggregate total for years 2017–2019 by service components. For instance, the Marine Corps has six SARs for 2017–2019. To calculate the average total for cost growth in 2017, each program percentage was added up and divided by six, which was -.31. This means that the Marine Corps experienced a cost growth from the baseline estimates of all six programs by -.31 percent. This demonstrates that the Marine Corps stayed just under budget for 2017. Consequently, in 2019 the Marine Corps' average cost growth was 25.70. This demonstrates a cost growth of 25.70 percent over the baseline budgets of the six programs.

The branches were then compared to each other for analysis. For example, the schedule percentage growth average for the components in 2017 was: Air Force 10.90%, the Army 37. %, Marine Corps 13.59%, and Navy 15.40%. In this example, the Air Force had the lowest average schedule growth ranking them at number one in this category. Meanwhile, the Marine Corps was second, Navy third, and Army fourth. Each service received a score corresponding to their ranking. The lowest score received a one and the highest score receiving a four. The scores for 2017–2019 were averaged to show which branch performed the best in cost and schedule growth. The Air Force was ranked first in four categories and second in two. Out of the six categories the Air Force received eight points, which divided by six gave them the best average at 1.33. The Navy averaged a 2.0 ranking them second, followed by the Marine Corps at 2.83, and finally the Army at 3.83. According to the results, the Air Force outperformed the other branches in cost and schedule growth or 2017–2019.

C. CORRELATION BETWEEN PREPARATION AND ACQUISITION OUTCOMES

Every branch of service has the same requirement to become a PM due to DAWIA. Those requirements are DAU-required classes or equivalency certified by the Component Acquisition Executive (DOD Directive 5000.52), and years of experience required for each level. The main difference in the services PM preparation revolves around DAU equivalencies and how experience is gained. The Army requires PMs to have a master's

degree, and the Navy offers acquisition degrees at the Naval Postgraduate School. The Air Force, Navy, and Marine Corps do not require advanced degrees to become PMs. The Air Force allows its officers to go directly into acquisitions and provides rotational assignments to bolster their experience, which is the main difference between Air Force PM preparation and the other services. Thus, the main factor in this study is that the experience gained in the Air Force's preparational process seems to correlate to better acquisition outcomes. The best method to prepare PMs for success encompasses early exposure and rotational assignment in acquisitions.

D. LIMITATIONS

Admittedly there are weaknesses in this study. One consideration is the number of programs for each component. More programs to divide by could have led to have skewed the results. For instance, in the sample there were 28 Navy programs and only 6 Marine programs. More Navy programs could have had higher cost growth than Marine programs, but the average cost growth would be less due to being divided by 28 vice 6. However, the same would apply to programs running under budget. The sure number of programs could have skewed the data in favor of one service. Though this limitation had a negligible effect for this dataset.

The accuracy or non-reporting of cost and schedule growth, as signified by the blanks in Table 2, could have skewed scores. In those cases, it is difficult to conclude whether the program did not experience a change due to good management, were too early in the development so that no baseline had been established to compare against, or another reason. Another drawback to the dataset was the ability to ascertain if program cost and schedule growth was due to an increase in quantity changes. According to the DOD (Department of Defense [DOD], 2019) quantity and scope changes account for cost increases however, with revised indices 16 of 20 programs are equal to or under their current baseline costs. Additionally, 60 of 84 SARs reporting captured the same (DOD, 2019). The changes during program life cycles could affect the accuracy of the averages. Though according to the report on SARs for 2018, quantity changes were captured in revised indices and resulted in a majority of programs being on or under their baselines.

Again, this limitation could have impacted averages, but seems to have little effect on the dataset.

Another argument that can be made is that the some branches may have better cost and schedule estimators, which enables them to perform better in cost and schedule, and is not indicative of a PMs ability. However, it is still the responsibility of the program management office led by the PM to submit the cost analysis requirement description to the program executive office for approval (Department of Defense [DOD], 2015). This means that the PM has the ultimate responsibility of providing cost estimates.

Finally, the most significant limitation in determining how well the branches perform in cost and schedule involves ACAT categories. The SARs reported in the chart are ACAT I programs. The RAND Corporation identified “that about 92 percent of all programs are non-MDAPs not subject to centralized OSD oversight or existing Nunn-McCurdy reporting and control requirements” (Arena et al., 2013). These programs are managed by each military department and they have their monitoring systems (Arena et al., 2013). If the programs not subject to OSD oversite were all reported, the results of this study may have been different.

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V. RECOMMENDATION

A. UNIFORM STANDARDS

It is clear from the study, that there is no uniform process in which to become a PM in the military. The United States Air Force, Army, Marine Corps, and Navy all have similar pathways to becoming a PM. Those similar preparational paths are the results of DAWIA and DAU certification levels. The DAU has an established curriculum. However, there are DAU equivalences established by each component. Since each component can have equivalencies outside of the DAU courses, there is really no way to guarantee uniform educational standards.

A former PM argues for the professionalization of the acquisition workforce by the use of accredited education such as that provided by the Project Management Institute (PMI) (Mortlock, 2020). He contends that PMI has three certification levels and that each level fits into the DAWIA PM levels (Mortlock, 2020). This is a compelling argument to the need of a more standardized process of developing PMs. The private sector holds PMI certifications in high esteem. The American National Standards Institute certified PMI's practices as an American National Standard in (Holtzman, 1999). However, it has been identified that the PMI certifications would likely not meet the complexities of managing DOD programs (Karnes, (2021). For instance, the Project Management Professional (PMP) exam outline lists three domains: people, process, and the business environment with a total of 35 tasks (Project Management Institute, 2020). The questions on the exam breakdown into the following percentages and tasks: 42% people covering 14 tasks, 50% process contributing to 17 tasks, and 8% business environment with 4 tasks. Meanwhile, the DOD program management competencies number 70. The competencies are listed in Table 4

Table 4. Program Management Competency Units and Competencies.
Source: MacStravic (2016).

Program Management Competency Units and Competencies (August 30, 2016)

Acquisition Management		Technical Management
Capability Integration Planning	Program Execution	Engineering Management
Requirements Management (Mgmt)	Risk/Opportunity Mgmt	Technical Planning
Acquisition Program Strategic Planning	Program Planning	Requirements Decomposition
Business Case Development	Teaming	Technical Assessment
Acquisition Law and Policy	Program Oversight	Decision Analysis
Acquisition Policy and Best Practice	Resource Mgmt	Configuration Mgmt
Contractual Laws, Regulations, and Obligations	Technology Mgmt	Technical Data Mgmt
Financial Mgmt Laws, Directives, and Policies	Services Acquisition	Interface Mgmt
Program Support Laws, Directives, and Policies	Business Management	Defense Business Systems
Technical and Engineering Laws, Directives and Policies	Contract Management	DBS Certification
Information Technology Laws, Policy, Best Practices	Market Research	DBS Acquisition Approach Preparation
International Acquisition and Exportability	Pre-Solicitation Planning and Execution	Test and Evaluation Mgmt
International Cooperative Programs	Source Selection and Negotiations	Test Planning
Sales and Transfers	Contract Administration	Test Execution
Technology Security and Foreign Disclosure	Contract Closeout	Manufacturing Mgmt
Defense Exportability Integration	Financial Mgmt	Manufacturing Planning and Transition
	Financial Planning	Manufacturing Shutdown
Stakeholder Mgmt	Programming	Product Support Mgmt
Political Savvy	Budget Formulation	Product Support Planning
External Situational Awareness	Budget Execution	Product Support Mgmt
Media Relationships	Cost estimates	Supply Chain Mgmt
Executive Leadership		
Foundational Competencies	Leading Change	Results Driven
Interpersonal Skills	Creativity & Innovation	Accountability
Integrity / Honesty	Vision	Decisiveness
Communicate Effectively	Flexibility	Entrepreneurship
Continual Learning	Resilience	Customer Service
Public Service Motivation	Leading People	Problem Solving
Technical Credibility	Conflict Management	
Building Coalitions	Leveraging Diversity	
Influencing / Negotiating	Developing Others	
Partnering	Team Building	

It is clear from the competencies listed in Table 4 that PMI certifications will not meet the preparational requirements of DOD PMs. It would be very difficult for a commercial standard to meet the unique needs of the DOD. However, PMI or another commercial certification could be used as a supplement to DOD PM preparation. The DOD should establish a uniform curriculum to prepare PMs. One such curriculum is in place and available through the Naval Postgraduate School Masters of Science in Program Management. DOD components could send PMs through this curriculum or establish their own curriculums based upon the Naval Postgraduate School's Program Management model. This would create a uniform standard across the branches that meets the unique educational requirements of DOD PMs.

B. EXPERIENCE

Experience is a huge factor in developing in any profession. Teachers are required to complete student teaching before becoming full time educators. Doctors complete residency before practicing medicine on their own. Also, many trades require apprentices before an individual can become a certified professional. DOD acquisition professionals are no different. In order to be a member of the original acquisition corps, a uniformed service member had to be an O-4 (DAWIA, 1990). This means a military member served around 8 years before being eligible to become an acquisition corps member. Recently the acquisition corps was terminated via public law that is to take effect in December 2021 (NDAA, 2019). This could be a step in the right direction as it may allow for junior military personnel to enter the acquisition community earlier and gain more experience. The experience requirement to be PMs of MDAPs still remain in statutory law, but allowing perspective PMs to gain acquisition experience earlier could lead to better program management of DOD programs.

In addition to early exposure to acquisition billets, the branches need to establish a primary military occupational specialty MOS for military officers. The Air Force is the only branch in this study that allows officers to start off in an acquisition military occupational specialty. In addition to direct entry into acquisition, the Air Force provides cross-flow experience in which an officer leaves their primary MOS to serve in a different

community (Horine, 2011). One officer who started off as an Acquisition Manager went into Intelligence for a few years before returning to acquisitions. Through this experience, he was able to get closer to the end user, understand their needs, and acquire systems that better fit the desired capabilities of the warfighter (Horine, 2011). This make more sense than having officers enter into acquisition fields later in their careers and then still having to demonstrate primary MOS credibility by returning to billets in their MOS to remain competitive for promotion.

C. CONCLUSION

Experiences seems to be the biggest factor in program management preparation that impacts cost and schedule performance. This can be correlated to the fact the Air Force provides officers early entrance into the acquisition field and rotates them through billets. The Air Force performed the best out of all the branches in this study. Meanwhile, the Army is the only branch that requires PMs to have master's degrees, yet the Army performed the worst in cost and schedule over the period from 2017–2019. However, this study does have limitations as over 90 percent of active programs are non-MDAP and not reportable on SARs. Looking into the cost and schedule performance of those programs would provide further insight into how to prepare PMs.

A recommendation for DOD components to consider would be to open up acquisition positions to junior military officers. This recommendation is backed by an OSD study of PMs in which a need was identified for early and more aggressive career experience, with their recommendation to designate military officers into acquisition earlier (DOD Study of Program Manager Training and Experience, August 21, 2014). Embedding junior officers in deployable units who liaison directly with program management offices would give the junior officers the perspective of the warfighter and their needs. After experiencing time in a deployable unit, the junior officer could then rotate through billets in the program offices to gain experience or embed with industry. This type of preparation is similar to the Air Force's existing cross-flow program and should be adopted by the Army, Navy, and Marine Corps. The valuable experienced gleaned would

provide better program management of defense acquisition programs in the future by safeguarding taxpayer dollars and acquiring needed capabilities for the warfighter.

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