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Middle Tier Acquisition FY 2022 Budget Data Overview

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Abstract

This research uses publicly-released data from 2018 to 2021, consisting of budget submissions, program-related reporting, and contemporaneous press releases, to describe how services took the same novel authorities and developed Middle Tier Acquisitions (MTAs) with differing structures, risks, and results to date. We acknowledge the cultural and personality differences, and concentrate on the different approaches to scoping project technical uncertainty and systemic complexity to fit within MTA constraints.

Research Issue Statement: This exploratory research examines MTA data from public data including budget documentation.

Research Results Statement: This research identifies significant trends associated with MTA application to date.

Keywords: Middle Tier Acquisition, Defense acquisition, innovation

Introduction

Congress recently created Middle Tier Acquisition (MTA) programs, which provide the military services rapid prototyping and fielding pathways with new program flexibilities and an explicit schedule constraint. The services are executing multiple MTAs, resulting in a set of MTA experiments related to development, execution, and governance. This paper summarizes MTA data extracted from fiscal year (FY) 2022 budget data and explores some features of MTA execution between services.

As this is exploratory analysis, we identify inferences that may be drawn from the project distribution and resource allocations in the Department of Defense (DoD) FY 2022 budget documentation and significant trends associated with MTA distributions and resource allocations.

Background

Congress enacted MTA processes in 2016, enabling processes to prototype or field new capabilities within 2 to 5 years of approval (National Defense Authorization Act [NDAA], 2015, sec. 804). Key statutory changes enabled service acquisition executives to bypass traditional requirements and acquisition processes and establish direct-reporting program managers for these rapid acquisition programs (NDAA, 2015). By 2019, the DoD had revised over two dozen acquisition-related directives, instructions, and memoranda,[1] and introduced two new acquisition paths—rapid prototyping and rapid fielding (Lord, 2019). In 2020, the DoD brought traditional acquisition, urgent acquisition, MTAs, software, business and services acquisitions into an Agile Acquisition Framework (Lord, 2020).

DoD rapid acquisition strategies typically have limited scope and objectives, senior leadership support and oversight, and process modifications removing obstacles to faster delivery (NDAA, 2015). Tate (2016) thought such processes also included using already mature or developed systems, in modular steps, with incremental production. The MTA schedule constraint resembles earlier acquisition innovations such as information systems acquisitions that emphasized commercial products and processes (Cha et al., 2014). Williams (2005) considered that poor defense program performance resulted from systemic failures, in particular when conventional program management approaches were used for complex, uncertain, and time-constrained programs.

The Government Accountability Office (GAO) is conducting significant research and analysis related to MTAs.[2] They provide a consistent perspective of DoD acquisitions. In 2019, they reported 35 MTAs started by the services by March 2019 (Oakley, 2019). We report 85 MTAs found in the FY 2022 budget documentation in the next section, summarized in Table 1.

Table 1. Middle Tier Acquisition Data Trend

Service	GAO (2019)	GAO 2020[a]	GAO 2021[b]	FY 2022 DoD Budget[c]
Air Force	24	8	11	39
Army	8	5	5	20
Navy	3	0	1	21
Other	0	0	0	5
Total	35	13	17	85

a – MTAs reviewed in GAO-20-439 (Oakley, 2020), b – MTAs reviewed in GAO-21-222 (Oakley, 2021), c – source: https://comptroller.defense.gov/Budget-Materials/Budget2022/

The GAO 2020 and 2021 reports provide substantial information on MTAs where planned costs exceed Major Defense Acquisition Program criteria (Major Defense Acquisition Program Defined, 2021). The GAO reports provide excellent summaries of selected MTAs and in-stride assessments of GAO concerns with MTA governance and execution.

Two papers related to MTAs are in the Naval Postgraduate School Defense Acquisition Innovation Repository.[3] Riel (2020) surveyed defense acquisition professionals and found schedule speed was perceived as less important than performance or cost. We reported on interim schedule modeling simulations seeded with GAO 2020 data (Etemadi & Kamp, 2021b). We defined schedule risk as the likelihood of exceeding a planned duration and showed that the MTA schedule risk to exceed 60 months is less than 0.2 (20%), and that MTAs with budgets larger than $1 billion are more likely to exceed 60 months (Etemadi & Kamp, 2021b).

MTA projects are executed within the defense market and defined by the number of competent sellers[4] and the number of entities setting product requirements (Etemadi & Kamp, 2021a). FitzGerald et al. (2016) described market segments by products (namely military-unique, military-adapted, and commercial systems) and whether market competition was

[1] These may be found at https://www.esd.whs.mil/Directives/issuances/dodd/.
[2] MTAs are treated as an acquisition reform by the GAO (Oakley, 2019).
[3] An extensive collection of defense acquisition research (Naval Postgraduate School, 2021).
[4] This number reflects the market competition; in the DoD market there are often few competent sellers, and the market is described as an oligopoly.

constrained or viable. Chesbrough (2003) characterized corporate innovation models as open or closed, where closed innovation occurs inside the company, and open innovation includes external participation; Zoe Stanley-Lockman (2021) extends this model to DoD innovation, where traditional acquisition programs behave much like closed innovation systems. Following their reasoning, MTAs are not restricted to closed or open innovation systems, but should benefit from open innovation approaches, adaption of existing available and commercial systems, and a specific buyer setting requirements.

We used data from publicly available budget documentation. This paper summarizes the MTA projects within service and agency research, development, test, and evaluation (RDT&E) documentation and includes data for five instances of procurement funding supporting MTAs.

Findings

Table 2. FY 2022 Program Elements With One or More MTA Labels

BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG
04	43	0604033F	Hypersonics Prototyping	AF	04	52	0603619A	Landmine Warfare and Barrier - A	ARMY	04	36	0603502N	Surface and Shallow Water Mine (	NAVY
04	48	0604327F	Hard and Deeply Buried Target De	AF	04	53	0603639A	Tank and Medium Caliber Ammun	ARMY	04	58	0603635M	Marine Corps Ground Combat/Sup	NAVY
04	53	0207100F	Light Attack Armed Reconnaissanc	AF	04	60	0603801A	Aviation - Adv Dev	ARMY	04	92	0604659N	Precision Strike Weapons Develop	NAVY
04	55	0207455F	Three Dimensional Long-Range Ra	AF	04	69	0604037A	Tactical Intel Targeting Access Noc	ARMY	04	95	0605512N	MEDIUM UNMANNED SURFACE VE	NAVY
04	67	1203164F	NAVSTAR Global Positioning Syste	AF	04	72	0604113A	Future Tactical Unmanned Aircraft	ARMY	04	99	0605518N	CONVENTIONAL PROMPT STRIKE (	NAVY
04	70	1206425F	Space Situation Awareness Systen	AF	04	73	0604114A	Lower Tier Air Missile Defense (LT	ARMY					
04	74	1206760F	Protected Tactical Enterprise Servi	AF	04	81	0604403A	Future Interceptor	ARMY					
04	75	1206761F	Protected Tactical Service (PTS)	AF										
04	76	1206855F	Evolved Strategic SATCOM (ESS)	AF										
BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG
05	121	1206442F	Next Generation OPIR	AF	05	91	0604601A	Infantry Support Weapons	ARMY	05	121	0604282N	Next Generation Jammer (NGJ) In	NAVY
					05	94	0604622A	Family of Heavy Tactical Vehicles	ARMY	05	125	0604366N	Standard Missile Improvements	NAVY
					05	97	0604645A	Armored Systems Modernization (	ARMY	05	140	0604601N	Mine Development	NAVY
					05	101	0604741A	Air Defense Command, Control an	ARMY	05	160	0605215N	Mission Planning	NAVY
					05	108	0604802A	Weapons and Munitions - Eng Dev	ARMY	05	161	0605217N	Common Avionics	NAVY
					05	109	0604804A	Logistics and Engineer Equipment	ARMY	05	174	0304785N	ISR & Info Operations	NAVY
					05	113	0604818A	Army Tactical Command & Control	ARMY					
					05	132	0605042A	Tactical Network Radio Systems (L	ARMY					
					05	136	0605052A	Indirect Fire Protection Capability	ARMY					
					05	137	0605053A	Ground Robotics	ARMY					
					05	142	0605148A	Tactical Intel Targeting Access Noc	ARMY					
					05	148	0605232A	Hypersonics EMD	ARMY					
					05	153	0605625A	Manned Ground Vehicle	ARMY					
BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG
07	167	0101113F	B-52 Squadrons	AF	07	208	0203743A	155mm Self-Propelled Howitzer Ir	ARMY	07	201	0605520M	MARINE CORPS AIR DEFENSE WEA	NAVY
07	177	0102326F	Region/Sector Operation Control (	AF						07	205	0101226N	Submarine Acoustic Warfare Deve	NAVY
07	183	0207040F	Multi-Platform Electronic Warfare	AF						07	210	0204311N	Integrated Surveillance System	NAVY
07	188	0207138F	F-22A Squadrons	AF						07	221	0206313M	Marine Corps Communications Sy	NAVY
07	202	0207417F	Airborne Warning and Control Sys	AF						07	223	0206623M	Marine Corps Ground Combat/Sup	NAVY
07	205	0207431F	Combat Air Intelligence System A	AF										
07	239	0302015F	E-4B National Airborne Operation	AF										
07	240	0303131F	Minimum Essential Emergency Co	AF										
07	246	0304260F	Airborne SIGINT Enterprise	AF										
07	250	0305015F	C2 Air Operations Suite - C2 Info S	AF										
07	267	0305206F	Airborne Reconnaissance Systems	AF										
BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG	BA	Line	PE.BLI	PE.Name	ORG
08	318	0608410F	Air & Space Operations Center (A(	AF						06	191	0605873M	Marine Corps Program Wide Supp	NAVY
										06	194	0305327N	Insider Threat	NAVY

Table 2 displays RDT&E program elements (Pes) with MTA projects. The columns reflect the service (Left = Air Force, Middle = Army, Right = Navy). The rows are grouped by Budget Activity (BA). The first group (BA 04 = Advanced Technology Development) has significant activity by all services. The Army has the most activity in the second group (BA 05 = Advanced Component Development and Prototypes), but the Air Force has the largest budgeted projects in this group. The Air Force has the most in the third group (BA 07 = Operational System Development) projects. The last group includes Air Force software factory projects (BA 08 = Software and Digital Technology Pilot Programs) and two Navy projects (BA 06 = RDT&E Management Support).

Table 3. Air Force 2022 MTA Summary

BA	Line	PE.BLI	MTA.Name	GAO.21.page	MTA.Start	MTA.End	Duration	Modular	Agile	FY2020	FY2021	FY2022	Type	Type.MTA
04	43	0604033F	ARRW	121	May-18	Mar-23	58	0	1	286000	386157	238262	MSL	RP
04	48	0604327F	M-Code/EAJ Developme		Oct-20	Sep-21	11	0	0	0	2150	0	MSL	RP
04	53	0207100F	Light Attack Armed aircı		Oct-20	Sep-21	11	0	0	1982	0	0	AIR	RP
04	55	0207455F	3DELRR		Jan-20	Dec-22	35	0	1	22469	19321	0	C3I	RP
04	67	1203164F	MGUE2	133	Nov-20	Sep-25	58	0	0	308215	0	0	SPACE	RP
04	3	1203164SF	MGUE2	133	Dec-20	Sep-25	57	0	0	0	205923	281191	SPACE	RP
04	70	1206425F	Deep Space Advanced F		Jan-22	Mar-25	38	0	0	29013	0	0	SPACE	RP
04	7	1206425SF	Deep Space Advanced F		Jan-22	Mar-25	38	0	0	0	33359	123262	SPACE	RP
04	74	1206760F	PTES	137	Nov-18	Dec-21	37	0	0	101583	0	0	SPACE	RP
04	75	1206761F	PTS	139	Jun-19	Jun-26	84	1	0	154237	0	0	SPACE	RP
04	12	1206761SF	PTS	139	Sep-20	Jun-24	45	1	0	0	200178	243285	SPACE	RP
04	76	1206855F	Evolved Stra	125	Sep-20	Sep-25	60	1	0	161882	0	0	SPACE	RP
04	13	1206855SF	Evolved Stra	126	Sep-20	Sep-25	60	1	0	0	71395	160056	SPACE	RP
05	121	1206442F	OPIR	135	Oct-18	Oct-23	60	0	1	1470278	0	0	SPACE	RP
05	22	1206442SF	Next-Gen O	135	Oct-18	Oct-23	60	0	1		11128900	1137393	SPACE	RP
05	22	1206442SF	Next-Gen O	135	Oct-18	Oct-26	96	0	1	0	482013	661098	SPACE	RP
05	7	1206442SF	FORGE	131	Sep-20	Sep-24	48	1	1		498283	514577	SPACE	RP
07	34	1203001SF	Force Element Termina		Feb-19	Mar-24	61	1	1	0	156736	98979	C3I	RP
07	167	0101113F	CERP (RVP)	123	Sep-18	Apr-22	43	1	0	175359	273020	484068	AIR	RP
07	167	0101113F	CERP Rapid Physical Pro		Apr-22	Jun-25	38	1	0	0	0	0	AIR	RP
07	177	0102326F	NCR-IADS		Apr-21	Jun-22	14	0	1	0	4795	0	C3I	RP
07	183	0207040F	Spectrum Warfare Attac		Oct-22	Jan-23	3	1	0	0	0	36607	C3I	RP
07	188	0207138F	F-22 Capabi	129	Sep-18	Sep-21	36	1	1	537232	663825	647296	AIR	RP
07	188	0207138F	Sensor Systems		Jun-22	Dec-26	54	1	1	75685	260921	262972	AIR	RP
07	188	0207138F	Navigation Systems		Oct-19	Sep-26	83	1	1	5224	9000	25540	AIR	RP
07	188	0207138F	Communication System		Oct-19	Sep-26	83	1	1	0	0	131270	AIR	RP
07	202	0207417F	AWACS		Oct-19	Sep-22	35	1	1	67341	123925	171014	AIR	RP
07	239	0302015F	Survivable SHF		Oct-19	Jun-24	56	0	0	24583	3462	25581	AIR	RP
07	240	0303131F	CVR Inc 2		Jul-21	Sep-26	62	1	0	12067	22284	0	C3I	RP
07	240	0303131F	Global ASNT Inc 2		Jul-21	Jun-25	47	1	0	117	21391	19729	C3I	RP
07	246	0304260F	Common SIGINT Develo		Oct-20	Sep-22	23	0	0	85157	127832	97546	C3I	RP
07	250	0305015F	C2AOS-C2IS modificatio		Oct-19	Sep-20	11	0	1	5206	0	0	C3I	RP
07	267	0305206F	Next Generation Senso		Jan-21	Sep-22	20	1	0	17338	54841	30198	AIR	RP
08	318	0608410F	AOC.WS	119	Jul-19	Jun-24	59	1	1	0	0	186915	C3I	RP
01	57	3010F	F-15EX	127	Mar-20	Jun-23	39	0	0	621100	1367147	1334822	AIR	RF
04	20	3010F	LAA		Jul-18	Sep-22	50	0	0	30000	0	0	AIR	RP
05	32	3010F	Link-16		Jun-21	Oct-25	52	0	0	46031	153083	52702	AIR	RF
05	33	3010F	Sensor Enhancements (		Jun-20	Jun-23	36	0	0	49002	122283	196825	AIR	RF
05	38	3010F	Rapid Global Mobility		Oct-18	Sep-22	47	1	0	3617	1106	100	AIR	RP

Note that the Air Force reported three Rapid Fielding MTAs (F-15EX, Link-16, and Sensor Enhancements). The largest budget items are space-related (OPIR, F-15EX procurement, or F-22 Capability Pipeline). Some budget reporting (OPIR, for example) does not provide a project end or transition at 60 months. Note that the Air Force is planning to retire the F-22 fleet “by the 2030 timeframe” (Insinna, 2021).

Table 4. Army 2022 MTA Summary

BA	Line	PE.BLI	MTA.Name	GAO.21.page	MTA.Start	MTA.End	Duration	Modular	Agile	FY2020	FY2021	FY2022	Type	Type.MTA
04	52	0603619A	Area Denial Capability		Mar-22	Mar-25	36	1	0	0	4995	34761	GND	RP
04	53	0603639A	Advanced Armor-Piercir		Oct-18	Mar-24	65	1	0	8572	0	0	GND	RP
04	60	0603801A	FLRAA Virtual Prototype		Aug-22	Mar-24	19	1	0	0	0	102648	AIR	RP
04	69	0604037A	TITAN		Sep-21	Jun-23	21	0	0	0	0	28347	C3I	RP
04	72	0604113A	FTUAS		Sep-22	Jun-25	33	1	1	0	33758	48197	AIR	RP
04	73	0604114A	LTAMDS	161	Oct-19	Sep-22	35	0	0	364154	308805	327690	C3I	RP
05	91	0604601A	NGSW-FC program		Apr-20	Sep-21	17	1	0	14095	9782	11107	GND	RP
05	94	0604622A	Leader Follower		Oct-21	Sep-25	47	1	0	4294	10249	21918	GND	RP
05	97	0604645A	Mobile Prot	163	Dec-19	Jun-22	30	0	0	273433	123992	137256	GND	RP
05	98	0604710A	IVAS	159	Nov-19	Apr-21	17	1	1	60599	7495	4934	GND	RP
05	108	0604802A	Precision Munition (Sni		Oct-21	Sep-23	23	0	0			9275	GND	RP
05	108	0604802A	Small Caliber Ammo fo		Oct-18	Jun-23	56	0	0	17432	26483	28372	GND	RP
05	113	0604818A	Unified Network Opera		Apr-19	Jun-21	26	0	1	3499	3522	3366	C3I	RP
05	132	0605042A	Integrated Tactical Net		Jan-21	Mar-26	62	1	0	22411	9754	17762	C3I	RP
05	136	0605052A	Enduring IFPC Inc 2		Jan-21	Sep-23	32	0	0	186369	153362	233512	C3I	RP
05	137	0605053A	Small Multipurpose Eq		Jul-19	Sep-21	26	1	0	8768	28555	29448	GND	RP
05	142	0605148A	TITAN		Jul-21	Sep-24	38	0	0	0	0	28347	C3I	RP
05	148	0605232A	LRHW		Oct-22	Sep-24	23	0	0	0	0	111473	MSL	RP
05	153	0605625A	OMFV	165	Jul-21	Sep-24	38	1	0	197304	171890	225106	GND	RP
07	208	0203743A	ERCA Incren	157	Jul-19	Sep-23	50	0	1	191076	217959	213281	GND	RP

Table 5. Navy 2022 MTA Summary

BA	Line	PE.BLI	MTA.Name	GAO.21.page	MTA.Start	MTA.End	Duration	Modular	Agile	FY2020	FY2021	FY2022	Type	Type.MTA
04	36	0603502N	Medium Unmanned Su		Jul-20	Jun-27	83	1	0	22964	0	0	SHIP	RP
04	58	0603635M	Armored Reconnaissan		Jul-21	Sep-22	14	0	0	7465	17599	48563	GND	RP
04	59	0603654N	Expeditionary Diving Sy		Oct-19	Sep-25	71	1	0	911	1765	822	SHIP	RP
04	78	0604028N /	LIONFISH SUUV		Oct-19	Sep-22	35	0	0	0	4577	15881	SHIP	RP
04	92	0604659N	Convention	209	Oct-19	Jun-23	44	0	0	502435	0	0	MSL	RP
04	95	0605512N	Medium Unmanned Su		Jan-21	Sep-22	20	1	0	5200	3200	3500	SHIP	RP
04	99	0605518N	CPS prototy	209	Oct-19	Jun-23	44	0	0	0	766637	1372340	MSL	RP
05	125	0604366N	SM-2 Block IIIC		Oct-19	Sep-22	35	0	0	69180	56144	33412	MSL	RP
05	140	0604601N	Encapsulated Effector (		Oct-19	Sep-22	35	0	0	0	27000	40300	SHIP	RP
05	160	0605215N	Next Generation Naval		Oct-19	Sep-22	35	1	1	25420	35500	37606	C3I	RP
05	160	0605215N	Standardized Tester of		Oct-19	Apr-22	30	1	0	12975	14546	17772	C3I	RP
05	161	0605217N	MAGTF Agile Networkin		Jan-21	Apr-22	15	1	1	0	21133	18872	AIR	RP
05	174	0304785N	Integrated Communicat		Dec-19	Sep-22	33	1	1	8300	6095	1548	C3I	RP
06	191	0605873M	Marine Corps Wargami		May-19	Sep-22	40	0	1	11027	15000	23518	C3I	RP
06	194	0305327N	Counter Insider Threat		Oct-19	Sep-22	35	0	0	2592	2293	2581	C3I	RP
07	201	0605520M	Medium Range Interce		Jun-20	Sep-22	27	0	0	15300	52400	7800	MSL	RP
07	205	0101226N	Compact Rapid Attack V		Oct-21	Sep-26	59	0	0	0	13363	44854	C3I	RP
07	210	0204311N	Deployable Surveillanc		Oct-19	Sep-23	47	1	0	8500	26385	16592	C3I	RP
07	221	0206313M	Air Battle Management		Oct-19	Jun-22	32	1	1	6164	1290	1204	C3I	RP
07	223	0206623M	MEGFoS		Jun-20	Jun-22	24	1	1	3922	5753	12934	C3I	RP
07	223	0206623M	WSATCOM MCWS-X		Mar-21	Oct-21	7	1	1	20432	200	0	C3I	RF

Table 6. Other DoD/Agency 2022 MTA Summary

SVC	BA	Line	PE.BLI	MTA.Name	GAO.21.page	MTA.Start	MTA.End	Duration	Modular	Agile	FY2020	FY2021	FY2022	Type	Type.MTA
DOD	05	131	0604384BP	Rapid Opioid Counterm		Oct-19	Jun-22	32	1	1	13297	8417	11380	GND	RP
SOCOM	07	264	1160431BB	Weapons		Jan-20	Sep-23	44	1	0	1509	1604	1514	GND	RP
SOCOM	07	264	1160431BB	C-UAS		Mar-20	Sep-22	30	1	0	9671	5796	5195	GND	RP
SOCOM	07	264	1160431BB	Ground Organic Precisi		Oct-19	Sep-26	83	1	0	7989	2290	15963	GND	RP
SOCOM	07	268	1160483BB	SOF Combat Diving (CBD		Dec-19	Nov-25	71	1	0	2580	2161	3183	SHIP	RP

Figure 1 shows the use frequency of terms related to MTA type programs.

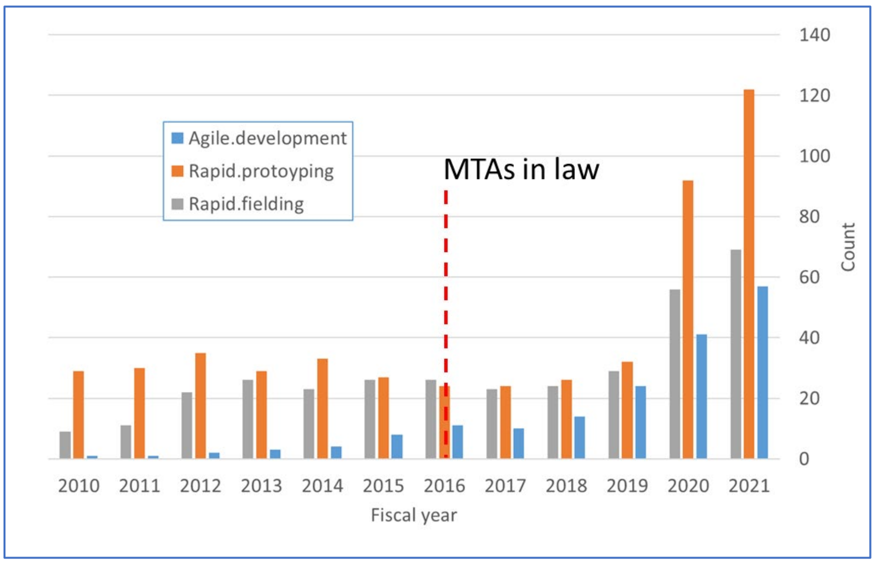

Figure 1. MTA-Related Term Use Frequency

Figure 1 includes data before FY 2022 to show the historical term usage and the delay between MTA establishment in 2016 and use.[5] The number of rapid prototyping and fielding mentions in budget documents grew in FY 2020 and FY 2021, consistent with the increasing use of MTA authorities.[6] Figure 2 shows the distribution of FY 2022 RDT&E Pes with MTA labels[7] sorted by BA and service.

[5] See GAO-19-439 (Oakley, 2019).
[6] We did not count the FY 2022 usage trends.
[7] The values in Figure 1 are term use counts and, in Figure 2, counts of MTAs.

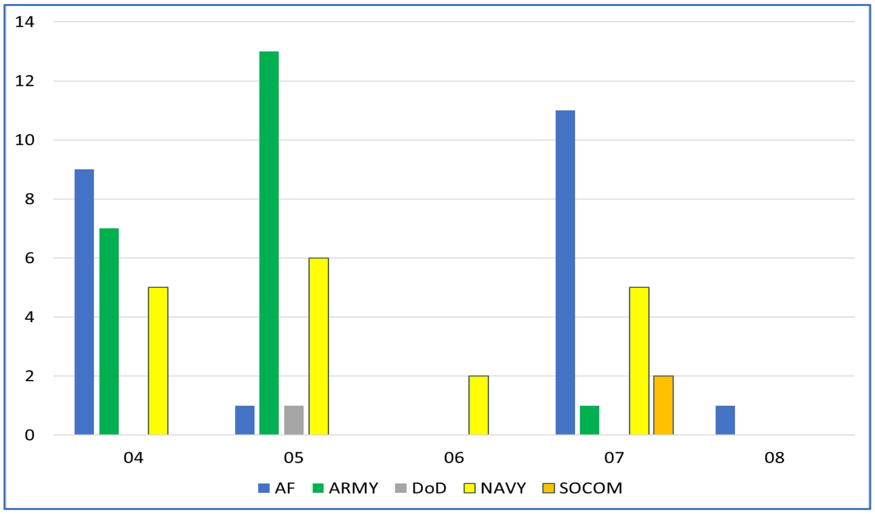

Figure 2. FY 2022 MTA Count by BA and Service

In FY 2022, the Army, Navy, and Air Force all had activity in BA 04 (Advanced Component Development and Prototypes), BA 05 (System Development and Demonstration), and BA 07 (Operational System Development). The distribution shows the Army leading new system development counts, while the Air Force was pushing both early development and operational systems. Figure 3 shows the same data sorted by service and commodity type.

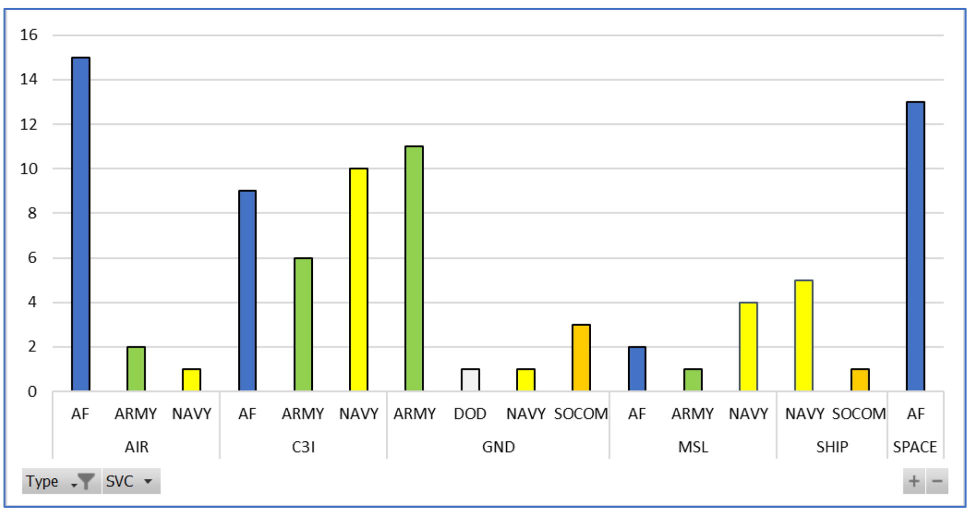

Figure 3. FY 2022 MTA Distribution by Service and Commodity Type

Figure 3 shows the Air Force emphasizing Air and space commodities, the Army emphasizing ground systems, and all three services investing in command, control, communications, and intelligence (C3I) projects. The C3I activity is consistent with use or adaptation of commercial products and processes. The Air Force activity includes projects transferred to Space Force. We present the resource allocations between FY 2020 and FY 2022 inclusive to highlight service trends. Figure 4 shows the spend for PEs with modularity labels.

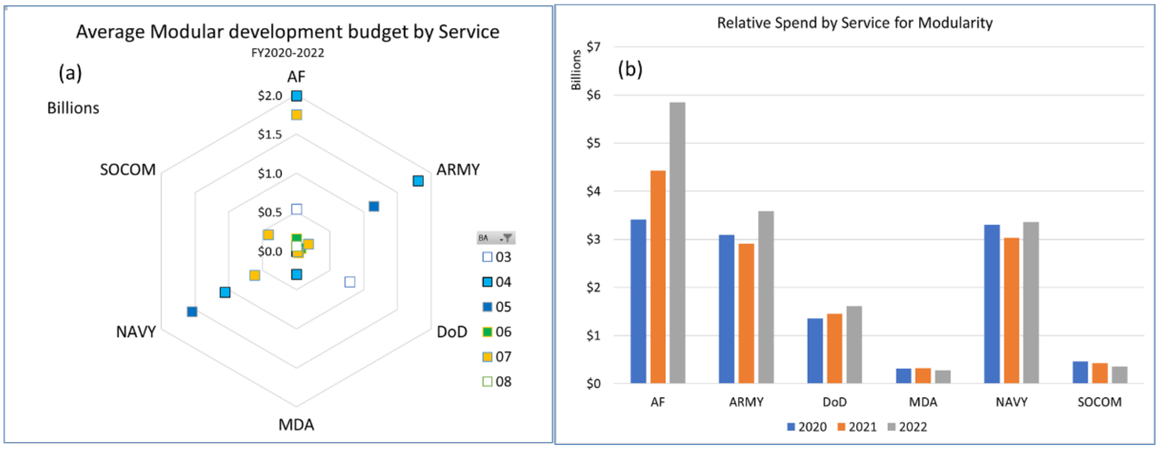

Figure 4. Resource Allocation Related to Modular Development

Figure 4a shows significant average service investment for all services related to modularity/modular development in BAs 04, 05, and 07. In Figure 4b, the Air Force shows an increasing trend, while the other services are relatively constant. Table 7 summarizes FY 2022 MTA modularity median duration and average budget median by commodity type.

Table 7. FY 2022 MTA Modularity Data Summary by Commodity Type

Type		Modular	Not Modular	Type		Modular	Not Modular
AIR	Duration	37	44.5	SHIP	Duration	71	35
	AVG budget	34171	50907		AVG budget	3304	14626
	Count	12	6		Count	4	2
C3I	Duration	35	33.5	SPACE	Duration	60	57.5
	AVG budget	13746	11690		AVG budget	77150	132555
	Count	13	12		Count	5	8
GND	Duration	36	30				
	AVG budget	11661	24542				
	Count	11	5				
MSL	Duration	*	35	Overall	Duration	43	36.5
	AVG budget	*	52912		AVG budget	13746	29514
	Count	0	7		Count	45	40

Table 7 shows the relative high cost and schedule risk of space projects. Modular MTAs have a longer median duration, but only the median average PE budgets are statistically different[8] ($\alpha = 0.1$). The ship MTA projects show long median durations due to schedule completions not being reported but shown as continuing. Modularity is being used to improve sustainment and supportability of operational or in-service systems or to create the ability to insert future upgrades to systems faster or at a lower cost or risk. Figure 5 shows the resource allocation to Agile projects.

[8] Mann-Whitney test, W-value = 1737, p-value = 0.082.

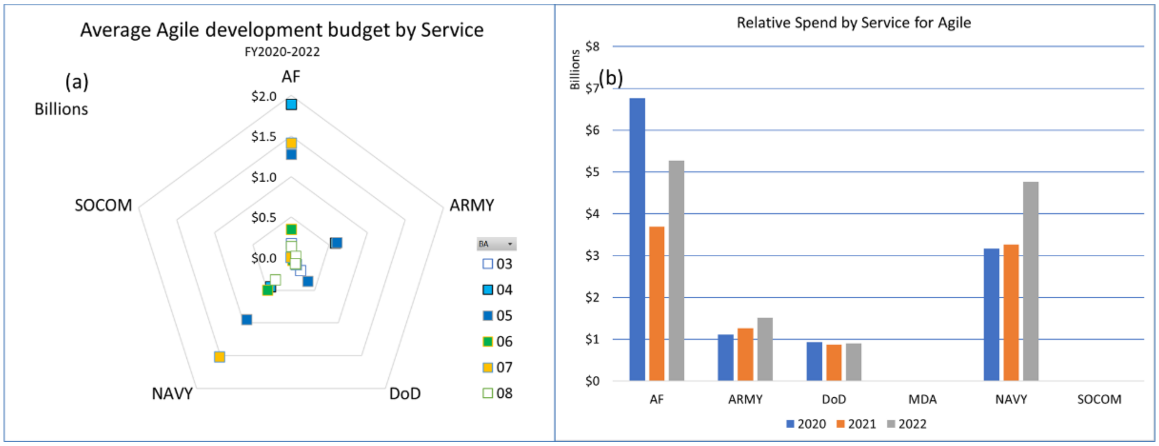

Figure 5. Resource Allocation Related to Agile Development

Figure 5 shows that the Air Force and Navy are making significant investment in Agile projects. Note that both the Navy and Air Force allocated significant BA 07 (Operational Systems Development) to PEs with Agile-related MTAs. Table 8 summarizes FY 2022 MTA Agile median duration and average budget median by commodity type.

Table 8. FY 2022 MTA Agile Data Summary by Commodity Type

Type		Agile	Not Agile	Type		Agile	Not Agile
AIR	Duration	36	39	SHIP	Duration	*	53
	AVG budget	43757	34126		AVG budget	*	5393
	Count	7	11		Count	0	6
C3I	Duration	32.5	35	SPACE	Duration	60	57
	AVG budget	7207	15098		AVG budget	498261	53961
	Count	12	13		Count	4	9
GND	Duration	32	36				
	AVG budget	24343	12154				
	Count	3	13				
MSL	Duration	58	31	Overall	Duration	35	38
	AVG budget	303473	45035		AVG budget	27318	18641
	Count	1	6		Count	27	58

Table 8 shows relatively few MTAs overall are engaged in Agile activities, with similar median durations; Agile MTAs have larger median average budgets, but the difference is not significant[9] (α = 0.1). Operational system software certification and approval processes may be reducing Agile use. Figure 6 shows the distribution of MTAs in the FY 2022 data associated with modular or Agile development.

[9] Mann-Whitney test, W-value = 1279, p-value = 0.267.

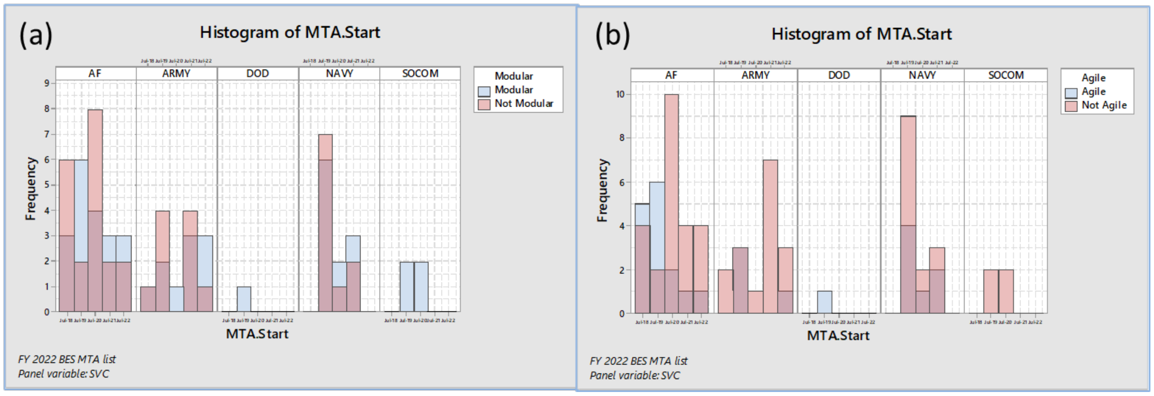

Figure 6. FY 2022 MTA Projects With Modular or Agile Labels by Start Date

Figure 6 shows marginal steady (marginal) to decreasing (Agile) use trends over time. More recent projects are more likely to not be identified as using Agile processes. Figure 7 summarizes MTA resource allocations by service.

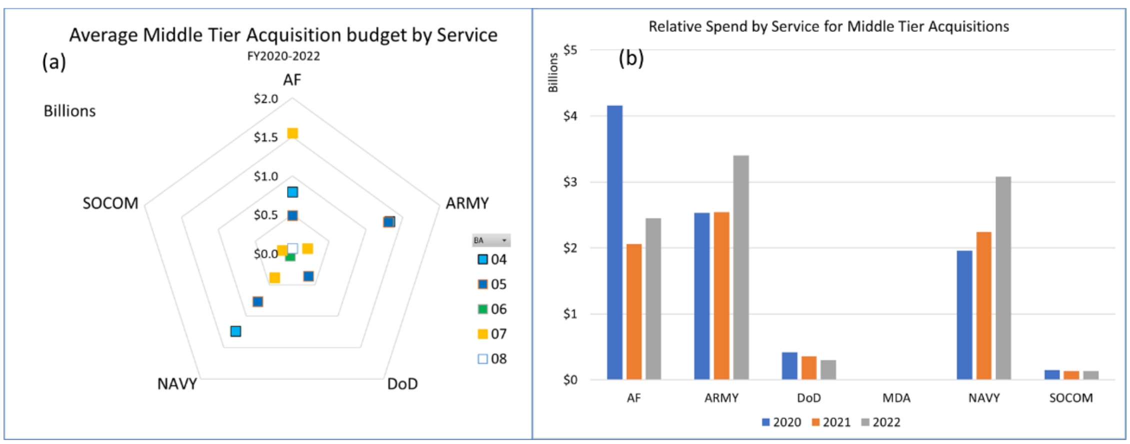

Figure 7. Resource allocation related to MTA projects.

Figure 7 shows large Air Force and Navy average investments, an initial investment surge by the Air Force, and increasing investments by the Army and Navy. The FY 2022 budgets show that MTA investment at the PE level is similar between the services. We specifically examined budget data at the MTA project level to differentiate between services. The results were that sum and average investments are statistically different[10] (α = 0.1) between services (Air Force, Army, or Navy), but not between BAs (BA 04, BA 05, BA 07).

Figure 8 shows MTA investments by commodity and type over start year at the MTA project level.

[10] Mood's Media test was used to compare medians; for sums and averages, Chi-square 0.72, p-value 0.083.

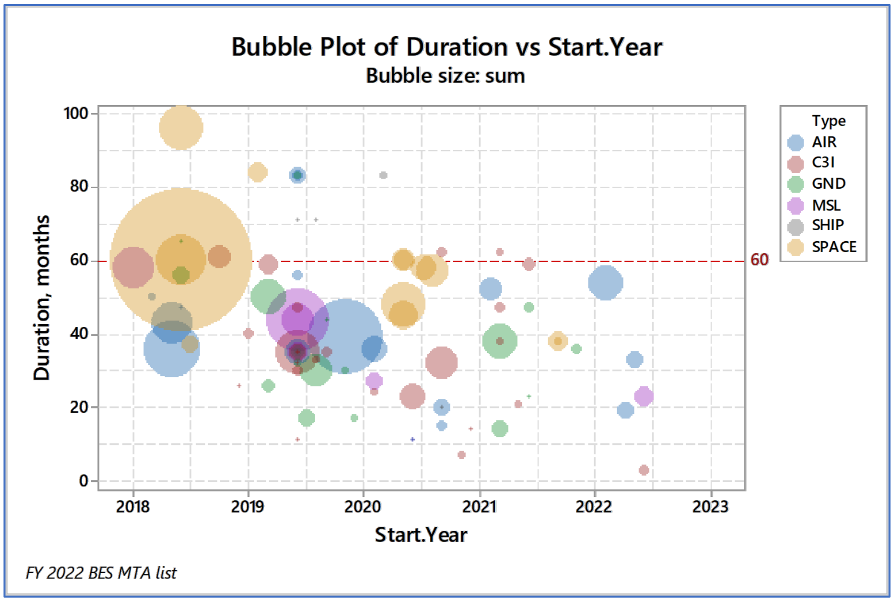

Figure 7. MTA Duration and Budget vs. Start Year

In Figure 8, a clear declining trend in large investments and longer durations is evident and confirmed by time series analysis. The conclusion is that the services are reducing project risk by focusing investments (smaller budgets and durations) and creating more programs to retire technical risks using rapid prototyping.[11] Figure 9 shows how schedules and budgets change by commodity type.

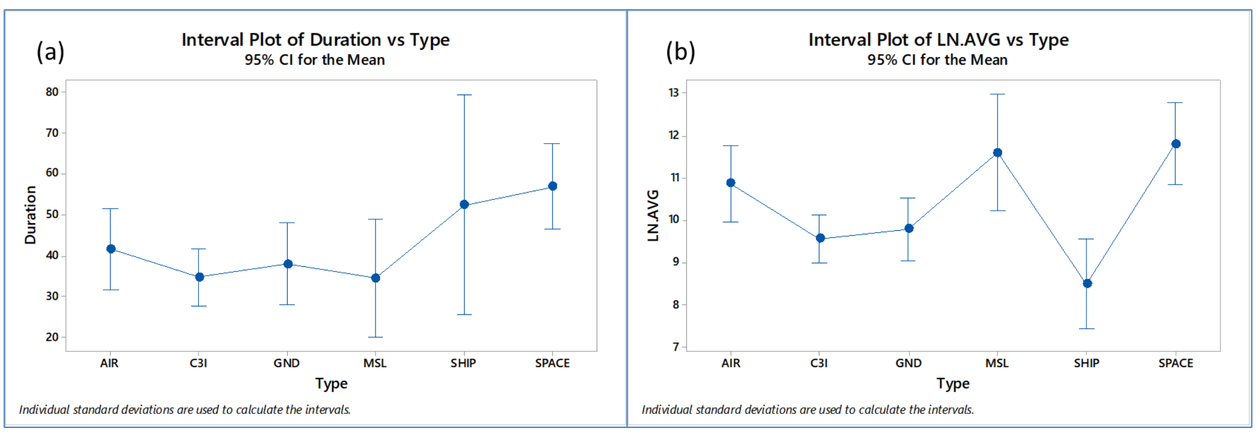

Figure 8. Schedule Duration and Budgets by Commodity Type

Three MTA projects were excluded from budget analysis to meet ANOVA assumptions. MTAs are relatively indifferent to schedule; space commodities have the highest median durations, and ship-related MTAs have the largest variance. Average budgets are in Figure 9b and presented on a natural logarithm scale. Budgets show different groupings, with ship commodities having the smallest average budgets and C3I and ground commodity types being in a middle group.

[11] Specifically, only four of 85 FY 2022 MTA projects were noted as Rapid Fielding MTAs.

Discussion

This DoD is evolving different approaches to MTAs. The Air Force was an early adopter, while the Navy was a later adopter of MTA project approaches, in part due to the different cultures and personalities noted by Riel (2020). These differences have reduced over time. Current MTA approaches generally have smaller budgets and shorter durations than earlier programs, reflecting lessons learned about the programmatic challenges associated with new acquisition approaches.

The services are employing MTA authorities to retire technical risks through rapid prototyping. A significant example of such use is the Air Force B-52 Commercial Engine Replacement Program, which is executing virtual prototype including different engine vendors and the prime integrator prior to attempting a physical prototype. A second example is the Army Integrated Visual Augmentation System, which has executed multiple physical prototypes with extensive soldier interaction at each prototype stage, resulting in rapid maturation of features and improved field reliability and performance. Both are novel prototyping approaches addressing different aspects of rapid capability development.

As previously noted, there is little research on MTAs. The FY 2022 dataset provides a detailed index for other researchers to explore MTAs and conduct detailed analyses, and for program offices to explore other creative and proven approaches to using MTAs to solve practical problems. The data used in this analysis was derived from public sources, and results and conclusions may differ if restricted or classified sources are used to replicate this work. Future research could include expanding research to include longitudinal studies of specific MTAs or MTA categories. The assessment of technical risk and system complexity affects the ability of program offices to properly scope MTA size, effort, and duration. Additional research is recommended to discover significant cost, schedule, and technical risk and complexity factors, which would be useful. Finally, research into changes in program office processes under MTA conditions would be useful to future program managers.

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