Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy											Date: May 2021	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0205632N *I MK-48 ADCAP*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	254.038	69.800	70.542	114.492	-	114.492	-	-	-	-	-	-
0366: *MK 48 ADCAP*	254.038	69.800	70.542	114.492	-	114.492	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Increase in FY22 funding supports TI-2 hardware and software development updates to prototype baseline, supporting transition of SCO developed technologies to the Navy heavyweight torpedo program. This includes system engineering, hardware/software prototype design updates, material procurements, with associated laboratory and in-water prototype testing. Additionally, the increased funding in FY22 supports MK 48 MOD 8 (APB6/TI-1) G&C material procurements by the contractor for Proof-of-Design, and APB 6 software builds in support of Test and Evaluation.

MK-48 ADCAP (Advanced Capability) Research, Development, Test and Evaluation (RDT&E) program executes incremental development of weapon performance improvements in two development product areas: (1) Advanced Processor Builds (APBs), and (2) Torpedo Technology Insertions (TIs). This Program Element (0205632N/0366) is tied to development programs that leverage a joint United States/Australia Armaments Cooperative Project (ACP) and develop MK-48 ADCAP technologies developed by the Office of Naval Research (ONR), and the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO).

Torpedo APB development testing, and implementation process is being utilized to address shallow water as a critical operating area to counter third world diesel electric submarines and near-peer adversaries. In water testing, in conjunction with laboratory simulation efforts, has shown that significant performance improvements can be made by implementing changes to weapon tactics and software algorithms. The TAPB program also leverages the RAN joint torpedo program and technologies developed by ONR and SCO in the areas of torpedo broadband signal processing, tactics processing, and alertment.

Torpedo Technology Insertions (TIs) will provide for significant torpedo hardware improvements and upgrades, including the transition and testing of advanced technologies from the R&D community. This approach will incorporate developmental testing of transitioning technologies from ONR and SCO for ADCAP upgrades in the areas of torpedo sensors, weapon propulsion, weapon/platform connectivity, and improved fusing. These efforts will continue torpedo development investment at a lower cost and shorter term than traditional torpedo programs.

The MK 48 MOD 8 (APB6/TI-1) Heavyweight Torpedo (HWT) program is an significant upgrade to the MK 48 MOD 7 HWT which will consist of an operational software upgrade referred to as APB 6 and a hardware upgrade referred to as TI-1. TI-1 will include a Guidance and Control (G&C) section upgrade, and an Improved Post Launch Communications System (IPLCS). IPLCS will replace the existing copper guidance wire with fiber optics. These improvements are needed for performance in the presence of advanced countermeasures, shallow water, low Doppler targets, Very Shallow Water (VSW), to improve fuzing, and Anti Surface Warfare (ASuW) performance. TI-1 will also include features from three ONR Future Naval Capabilities (FNC) programs.

MK48 MOD 9 (APB7/TI-2) represents significant improvements to the MK 48 MOD 7 and MOD 8 heavyweight torpedo (HWT), providing extended range and advance sensing capabilities against surface and subsurface targets. MK48 MOD 8 (APB6/TI-1) and MK48 MOD 9 (APB7/TI-2) provide two distinctly different capabilities and

are operationally intended for different mission sets. These improvements consist of the APB7 software upgrade and Technology Insertion 2 (TI-2) hardware upgrade which provides advanced sensing, processing, and propulsion technologies developed under OSD SCO and ONR FNC research and development programs.

APB5 software upgrades achieved early fielding in May 2019, and are currently in operational testing for MK-48 ADCAP torpedoes to field the full capability in FY21.

APB5+ software upgrades are currently in process for MK-48 ADCAP torpedoes. APB5+ enhancements are required to address Combat Control System (CCS)/MK48 pre and post launch interface limitations which prevent full utilization by ship's crew.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	72.265	110.349	121.877	-	121.877
Current President's Budget	69.800	70.542	114.492	-	114.492
Total Adjustments	-2.465	-39.807	-7.385	-	-7.385
• Congressional General Reductions	-	-0.492			
• Congressional Directed Reductions	-	-39.315			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.465	0.000			
• Program Adjustments	0.000	0.000	-5.489	-	-5.489
• Rate/Misc Adjustments	0.000	0.000	-1.896	-	-1.896

Change Summary Explanation

The program was reduced in FY22 by $5.489M to account for the availability of prior year funding.

Increase in FY22 funding supports TI-2 hardware and software development updates to prototype baseline, supporting transition of SCO developed technologies to the Navy heavyweight torpedo program. This includes system engineering, hardware/software prototype design updates, material procurements, with associated laboratory and in-water prototype testing. Additionally, the increased funding in FY22 to support MK 48 MOD 8 (APB6/TI-1) G&C material procurements by the contractor for Proof-of-Design, and APB 6 software builds in support of Test and Evaluation.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy											Date: May 2021	
Appropriation/Budget Activity 1319 / 7					R-1 Program Element (Number/Name) PE 0205632N / *MK-48 ADCAP*				Project (Number/Name) 0366 / *MK 48 ADCAP*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
0366: *MK 48 ADCAP*	254.038	69.800	70.542	114.492	-	114.492	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

MK-48 ADCAP (Advanced Capability) Research, Development, Test and Evaluation (RDT&E) program executes incremental development of weapon performance improvements in two development product areas: (1) Advanced Processor Builds (APBs), and (2) Torpedo Technology Insertions (TIs). This Program Element (0205632N/0366) is tied to development programs that leverage a joint United States/Australia Armaments Cooperative Project (ACP) and develop MK-48 ADCAP technologies developed by the Office of Naval Research (ONR), and the Office of the Secretary of Defense (OSD) Strategic Capabilities Office (SCO).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: TORPEDO APB / TEST & EVALUATION	69.800	70.542	114.492	0.000	114.492
Articles:	-	-	-	-	-
FY 2021 Plans:					
APB5 - Complete Operational Testing (OT)					
Continue APB6 Software development					
Continue TI-1 Hardware development					
Continue APB6 Modeling & Simulation development					
APB6 - Conduct CDR					
TI-1 - Conduct CDR APB5+ - Conduct OTRR					
APB5+ - Begin Operational Testing (OT)					
APB5+ - Conduct Modeling & Simulation testing					
APB5+ - Complete Operational Testing (OT)					
APB5+ - Complete Initial Operational Capability (IOC)					
APB7 - software prototype development and builds					
Prototype combat system software development					
APB7/TI-2 - Modeling and Simulation.					
APB7/TI-2 - In-water Test Events and SCEPS Demonstration					
FY 2022 Base Plans:					
Continue APB6 Software development					
Continue TI-1 Hardware development					
Continue APB6 Modeling & Simulation development					
Continue APB-7 Software prototype development					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
initiate TI-2 - Hardware prototype development APB7/TI-2 - Modeling and Simulation. APB7/TI-2 - Conduct System Requirements Review(SRR). Continue in-water prototype testing. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase in FY22 funding supports TI-2 hardware and software development updates to prototype baseline, supporting transition of SCO developed technologies to the Navy heavyweight torpedo program. This includes system engineering, hardware/software prototype design updates, material procurements, with associated laboratory and in-water prototype testing. Additionally, the increased funding in FY22 to support MK 48 MOD 8 (APB6/TI-1) G&C material procurements by the contractor for Proof-of-Design, and APB 6 software builds in support of Test and Evaluation.					
Accomplishments/Planned Programs Subtotals	69.800	70.542	114.492	0.000	114.492

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• WPN/3225: *MK-48 Torpedo ADCAP Mods*	39.508	55.699	35.680	-	35.680	-	-	-	-	-	-
• WPN/3117: *MK-48 Torpedo*	130.000	276.844	159.107	-	159.107	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

Continue to incrementally develop technology to pace the threats to be integrated into the production baseline. A competitive contract for TI-1 hardware development was awarded in FY 2019. The development contract includes a LRIP options to procure kits to be used for OT. FRP hardware will be used to upgrade the entire inventory of MK48 MOD 7 to MOD 8.

The MK 48 MOD 9 (APB7/TI-2) acquisition strategy is to fund the Penn State University Applied Research Laboratory to complete prototype builds and testing from the OSD SCO program and implement design refinements for industry builds. Competitive industry manufacturing contract awards are planned starting in FY23 for developmental and operational test units.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development - APB 5 / 5+	WR	NUWC NPT : Newport RI	48.016	2.594	Nov 2019	1.401	Nov 2020	0.000		-		0.000	-	-	-
Software Development - APB 6	WR	NUWC NPT : Newport RI	35.222	17.799	Nov 2019	19.580	Nov 2020	20.691	Nov 2021	-		20.691	-	-	-
Software Development - APB 6	WR	NUWC KPT : Keyport WA	0.000	0.000		0.505	Nov 2020	0.400	Nov 2021	-		0.400	-	-	-
Software Development - APB 6	WR	ARL / PSU : State College PA	0.000	0.000		0.000		2.450	Nov 2021	-		2.450	-	-	-
Hardware Development - TI-1	WR	NUWC NPT : Newport RI	27.213	4.163	Nov 2019	0.919	Nov 2020	2.900	Nov 2021	-		2.900	-	-	-
Hardware Development - TI-1	C/CPIF	Progeny : Manassas, VA	5.071	25.080	Dec 2019	12.427	Jan 2021	29.330	Jan 2022	-		29.330	-	-	-
Hardware Development - TI-1 IPLCS	C/CPFF	Harris Corp. : Melbourne, FL	5.549	5.462	Nov 2019	5.124	Nov 2020	4.000	Nov 2021	-		4.000	-	-	-
Hardware Development - IM	WR	Indian Head : Indian Head, MD	2.086	0.450	Nov 2019	0.340	Oct 2020	0.450	Nov 2021	-		0.450	-	-	-
Software Development - APB 7	C/CPFF	ARL / PSU : State College PA	0.000	0.000		0.000		2.840	Nov 2021	-		2.840	-	-	-
Software Development - APB 7	WR	NUWC NPT : Newport RI	0.000	0.000		0.000	Dec 2020	4.670	Nov 2021	-		4.670	-	-	-
Hardware Development - TI-2	C/CPFF	ARL / PSU : State College PA	0.000	0.000		8.584	Nov 2020	20.918	Dec 2021	-		20.918	-	-	-
Hardware Development - TI-2	WR	NUWC NPT : Newport RI	0.000	0.000		1.170	Nov 2020	4.325	Nov 2021	-		4.325	-	-	-
Hardware Development - TI-2	WR	NSWC, IH : Indian Head, MD	0.000	0.000		1.252	Nov 2020	3.160	Nov 2021	-		3.160	-	-	-
		Subtotal	123.157	55.548		51.302		96.134		-		96.134	-	-	N/A

Remarks

- Decreased funding in FY22 for APB 5/ APB 5+ due completion of Operational Testing.
- Increased funding in FY22 for APB 6 to support increased software development.
- Decreased funding in FY22 for IPCS is due to reduced material procurement requirements by the contractor in FY22.
- Increased funding in FY22 for TI-1 to support increased material procurement requirements by the contractor in FY22.
- Increased funding in FY22 for APB 7 to support software prototype development, as well as the shift in TAPB from APB 6 to APB 7.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 0205632N / *MK-48 ADCAP*	Project (Number/Name) 0366 / *MK 48 ADCAP*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
- Increased funding in FY22 for TI-2 hardware development updates to SCO prototype baseline, supporting transition to industry and the fleet. This includes system engineering, hardware/software prototype design updates, material procurements, with associated laboratory and in-water prototype testing.															

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development - APB 5/APB5+	WR	NUWC NPT : Newport RI	38.273	2.200	Oct 2019	1.744	Nov 2020	0.000		-		0.000	-	-	-
Software Development - APB 6	WR	NUWC NPT : Newport RI	2.740	1.652	Oct 2019	3.073	Nov 2020	4.200	Nov 2021	-		4.200	-	-	-
Software Development - APB 6	WR	NUWC KPT : Keyport WA	1.852	0.435	Oct 2019	0.666	Nov 2020	3.210	Nov 2021	-		3.210	-	-	-
Software Development - APB 6	C/CPFF	ARL / PSU : State College PA	0.000	0.000		0.000		0.048	Dec 2021	-		0.048	-	-	-
Hardware Development - TI-1 IPLCS	C/CPFF	ARL / PSU : State College PA	0.000	0.000		0.600	Nov 2020	0.600	Nov 2021	-		0.600	-	-	-
		Subtotal	42.865	4.287		6.083		8.058		-		8.058	-	-	N/A

Remarks

- Decreased funding in FY22 due the IOC and fielding of APB 5+.
- Increased funding in FY22 for APB 6 software development

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation - APB 5/5+	WR	NUWC NPT : Newport RI	27.271	3.370	Oct 2019	4.429	Oct 2020	0.000		-		0.000	-	-	-
Test & Evaluation - APB 5/5+	WR	NUWC KPT : Keyport WA	37.790	4.160	Oct 2019	3.803	Oct 2020	0.000		-		0.000	-	-	-
Test & Evaluation - APB 5/5+	WR	OPTEVFOR : Norfolk VA	12.826	0.515	May 2020	0.364	Dec 2020	0.000		-		0.000	-	-	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 0205632N / *MK-48 ADCAP*	Project (Number/Name) 0366 / *MK 48 ADCAP*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test & Evaluation - APB 6	C/CPFF	ARL / PSU : State College PA	2.383	1.344	Oct 2019	0.000	Nov 2020	0.000		-		0.000	-	-	-
Test & Evaluation - APB 6	WR	NUWC KPT : Keyport WA	0.000	0.000		1.373	Nov 2020	1.350	Nov 2021	-		1.350	-	-	-
Test & Evaluation - APB 6	WR	NUWC NPT : Newport RI	0.000	0.000		1.984	Nov 2020	0.290	Nov 2021	-		0.290	-	-	-
Test & Evaluation - APB 6	WR	OPTEVFOR : Norfolk VA	0.000	0.000		0.000		0.546	Dec 2021	-		0.546	-	-	-
Test & Evaluation - TI-1	WR	NUWC NPT : Newport RI	0.000	0.000		0.000		0.715	Nov 2021	-		0.715	-	-	-
Test & Evaluation - TI-1	WR	NUWC KPT : Keyport WA	0.000	0.000		0.143	Nov 2020	0.715	Nov 2021	-		0.715	-	-	-
Test & Evaluation - TI-2	WR	NUWC KPT : Keyport WA	0.000	0.000		0.484	Nov 2020	6.093	Nov 2021	-		6.093	-	-	-
		Subtotal	80.270	9.389		12.580		9.709		-		9.709	-	-	N/A

Remarks

- Decreased funding in FY22 as Test and Evaluation shifts from APB5+ to TI-1/APB6.
- Increased funding in FY22 for TI-2 to support in-water prototype testing.

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	C/CPFF	Serco : Mclean VA	6.347	0.526	Dec 2019	0.542	Dec 2020	0.556	Nov 2021	-		0.556	-	-	-
Travel	WR	NAVSEA : Washington DC	1.399	0.050	Dec 2019	0.035	Dec 2020	0.035	Nov 2021	-		0.035	-	-	-
		Subtotal	7.746	0.576		0.577		0.591		-		0.591	-	-	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	254.038	69.800		70.542		114.492		-		114.492	-	-	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 0205632N / *MK-48 ADCAP*	Project (Number/Name) 0366 / *MK 48 ADCAP*	

	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

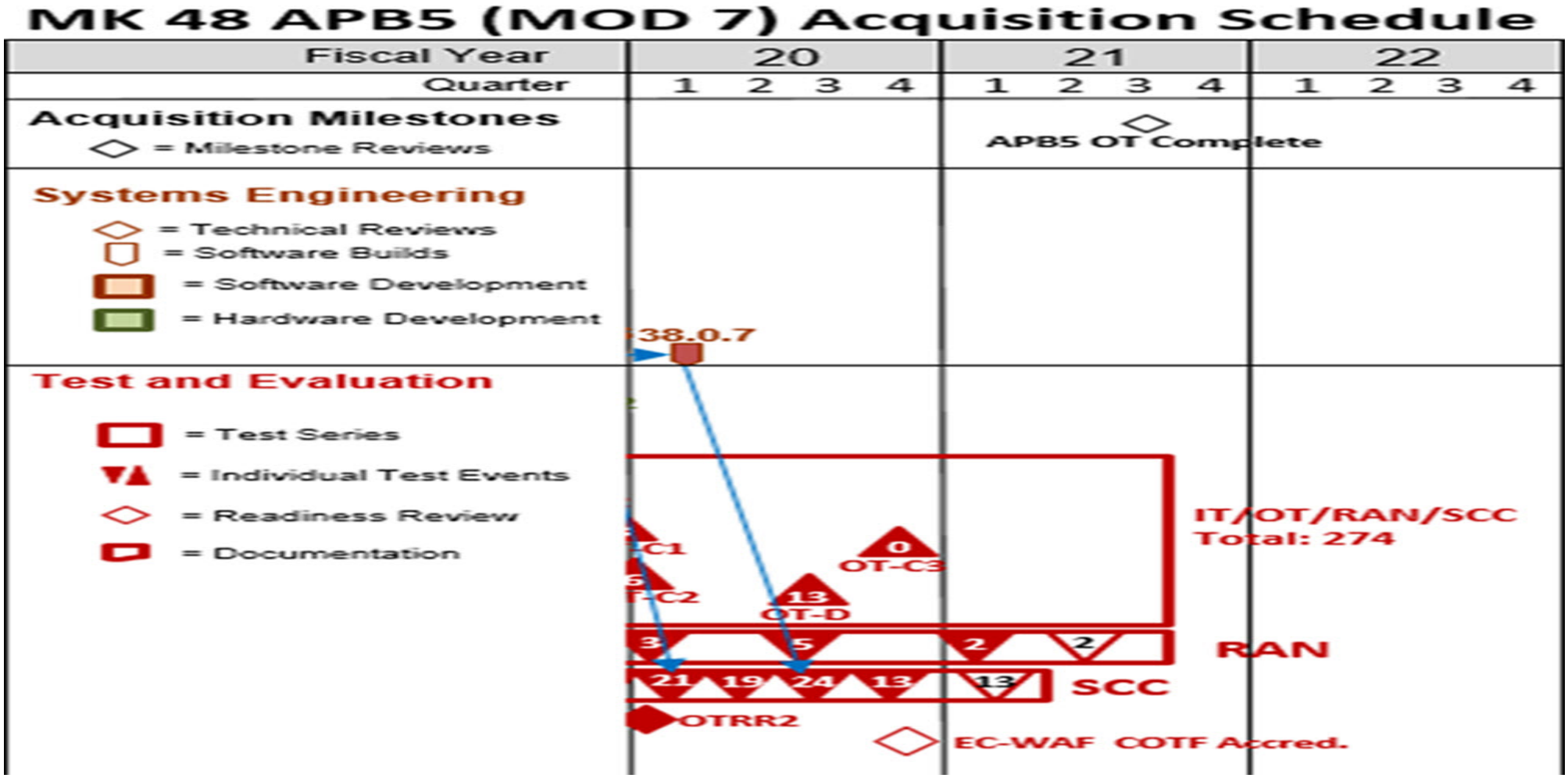

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

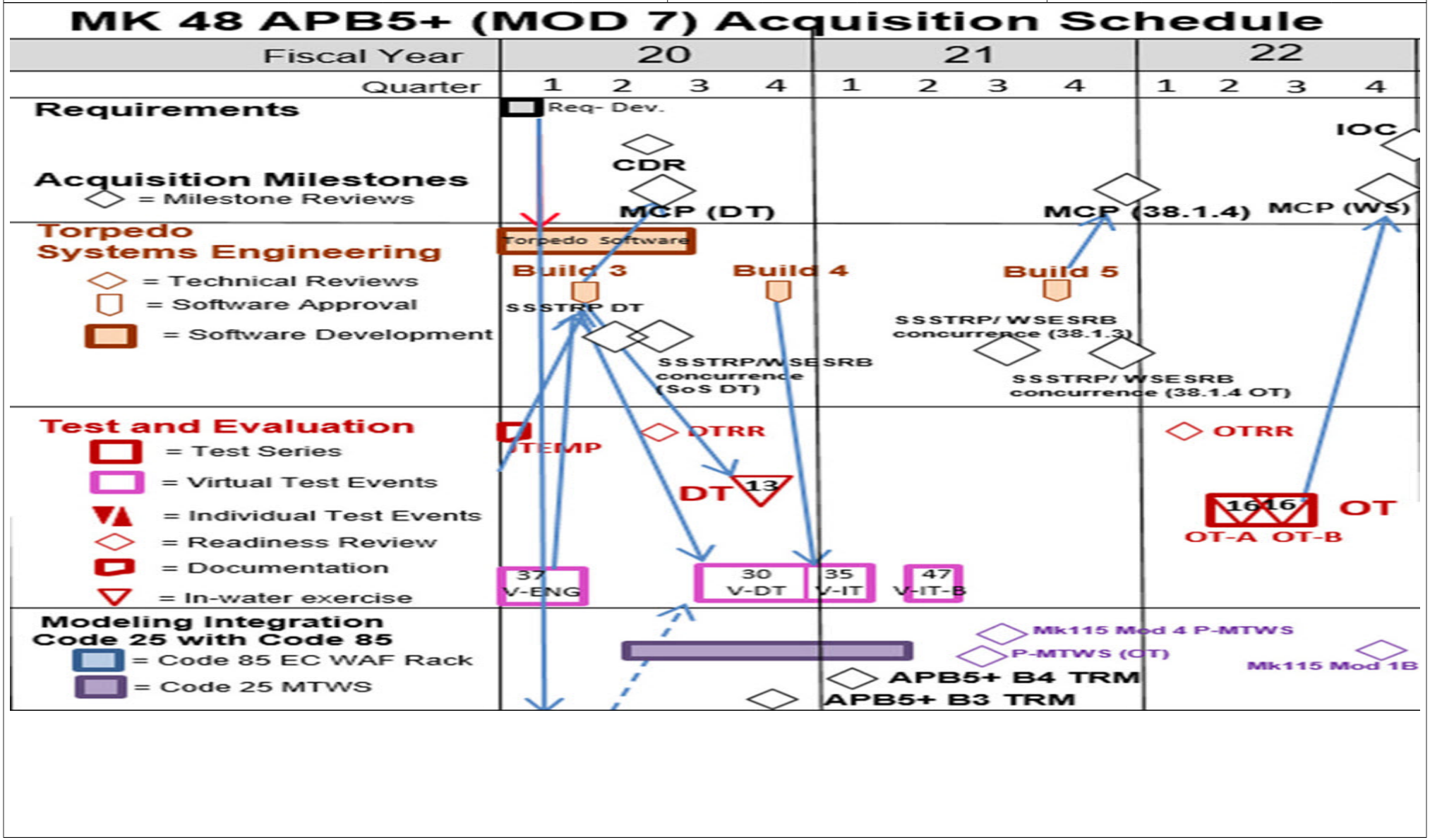

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

MK 48 APB6/TI-1 (MOD 8) Acquisition

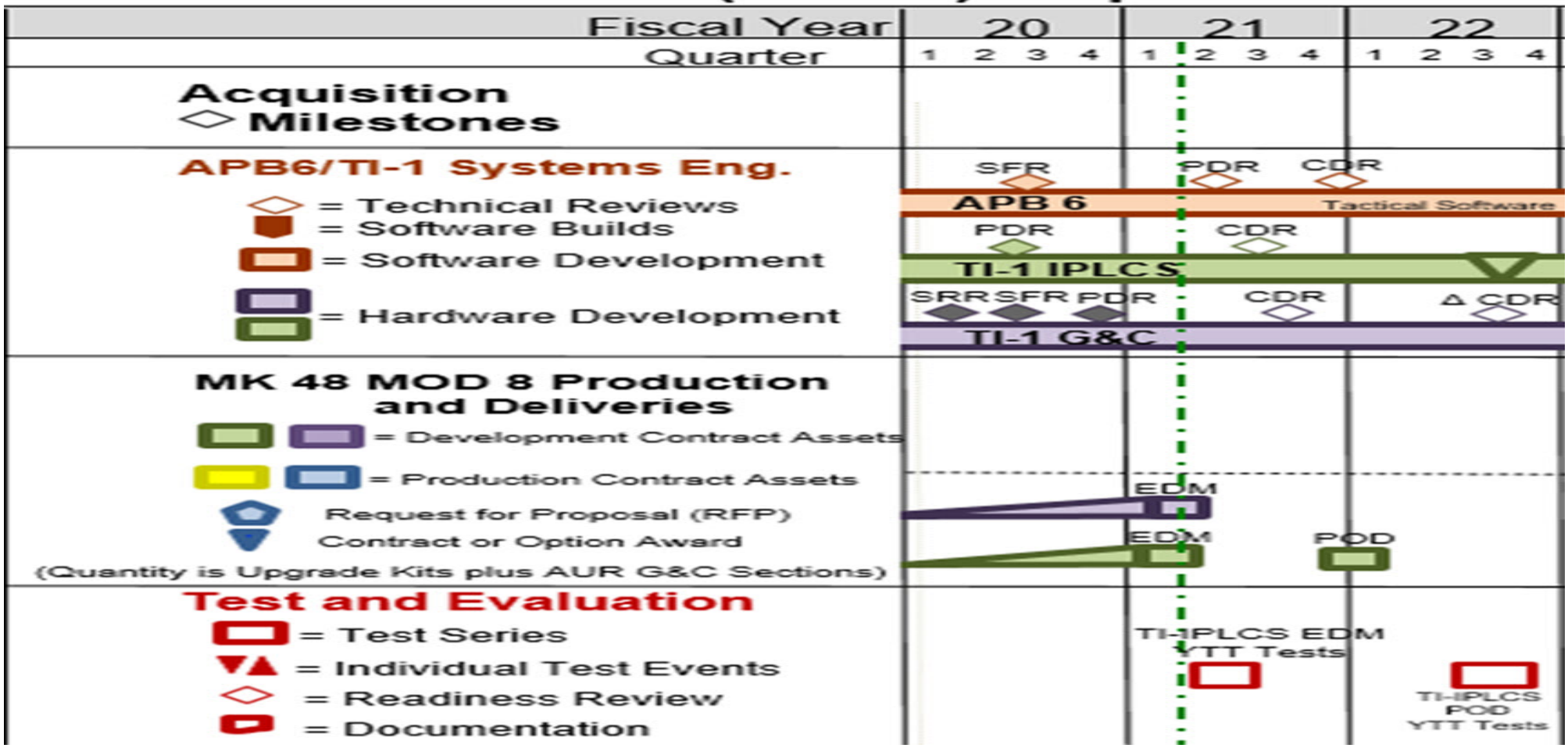

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

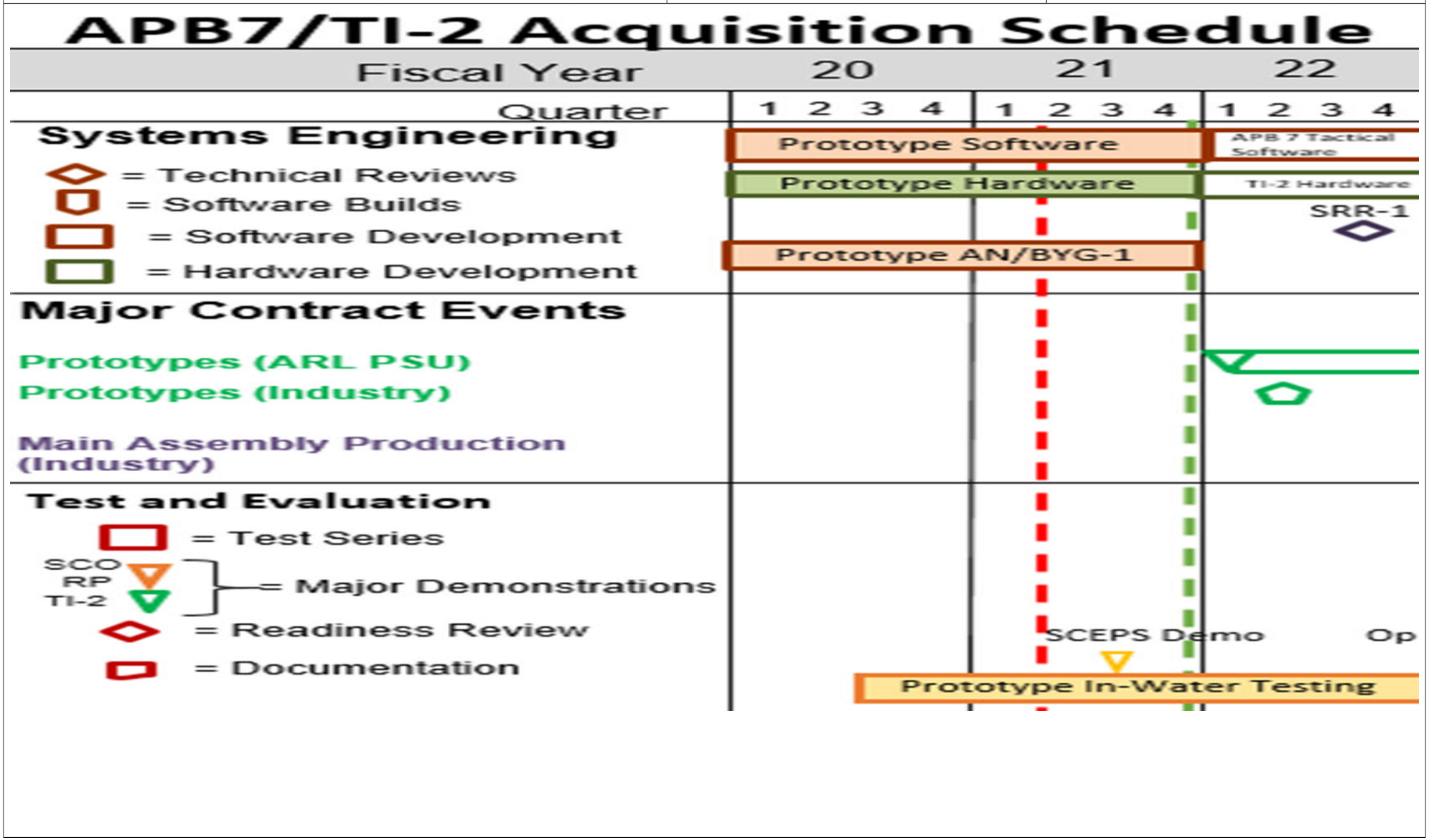

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0205632N / *MK-48 ADCAP*	**Project (Number/Name)** 0366 / *MK 48 ADCAP*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 0366				
APB 5 Development: APB 5 Operation Test (OT)	4	2018	3	2021
APB 5+ Development: APB 5+-1 Developmental Test (DT)	3	2020	4	2020
APB 5+ Development: APB 5+ Operation Test (IT/OT)	4	2020	3	2022
APB 5+ Development: APB 5+ IOC	4	2022	4	2022
APB 6 Software / TI-1 Hardware Development: APB 6 Development	1	2018	4	2022
APB 6 Software / TI-1 Hardware Development: TI-1 Development	4	2019	4	2022
APB7 / TI-2 Development: APB7 / TI-2 Prototype Testing and Demonstration	1	2021	4	2022
APB7 / TI-2 Development: APB 7 Software Development and Engineering Tests - continues through 2nd QTR FY27	1	2022	4	2022
APB7 / TI-2 Development: TI-2 Hardware Development and Engineering Tests - continues through 2nd QTR FY27	1	2022	4	2022