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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy **Date:** April 2022

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 6: RDT&E Management Support</i>	R-1 Program Element (Number/Name) PE 0604759N / <i>Major T&E Investment</i>
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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	0.000	104.170	96.617	95.316	-	95.316	76.954	76.517	73.859	75.296	Continuing	Continuing
2195: <i>T & E Investment</i>	0.000	84.862	84.617	95.316	-	95.316	76.954	76.517	73.859	75.296	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	19.308	12.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	31.308

A. Mission Description and Budget Item Justification

This project corrects major deficiencies, improves Test & Evaluation (T&E) capabilities, and increases T&E support effectiveness at Navy Major Range and Test Facility Base ranges and facilities. The T&E Investment project improves, modernizes and adds new test capabilities at the following test facilities: the Naval Undersea Warfare Center Division Newport Atlantic Undersea Test and Evaluation Center, Andros Island, Bahamas; the Nanoose and Dabob ranges of the Naval Undersea Warfare Center Division Keyport, Keyport, WA; the Sea Range, Land Ranges, Target Operations, Ordnance T&E Facility, Test Wing Pacific located at the Naval Air Warfare Center Weapons Division, Point Mugu, CA and China Lake, CA; and the Atlantic Test Range, Air Combat Environment T&E Facility, Electromagnetic Environmental Effects, Air Vehicle Modification and Instrumentation facility, Test Wing Atlantic, Target Operations, and the Propulsion Systems Evaluation Facility located at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD and the test and evaluation capabilities located at the Pacific Missile Range Facility, Kauai, HI.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under RESEARCH, DEVELOPMENT, TEST and EVALUATION MANAGEMENT SUPPORT because it supports efforts directed toward sustaining or modernizing installations or operations required for general research, development, test and evaluation.

B. Program Change Summary (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	105.195	84.617	0.000	-	0.000
Current President's Budget	104.170	96.617	95.316	-	95.316
Total Adjustments	-1.025	12.000	95.316	-	95.316
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	12.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.025	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
• Adjustments to Budget Year	-	-	95.316	-	95.316

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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

Congressional Add: *Undersea range modernization*

Congressional Add: *Integrated Sensor Effectiveness Test*

Congressional Add: *Lab and test range upgrades- targets*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2021	FY 2022
	9.654	0.000
	9.654	0.000
	0.000	12.000
Congressional Add Subtotals for Project: 9999	19.308	12.000
Congressional Add Totals for all Projects	19.308	12.000

Change Summary Explanation

FY 2023 funding request was reduced by \$2.420 million to account for the availability of prior year execution balances.

Schedule: Not applicable.

Technical: Not applicable.

 FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

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Appropriation/Budget Activity 1319 / 6					R-1 Program Element (Number/Name) PE 0604759N / Major T&E Investment				Project (Number/Name) 2195 / T & E Investment			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
2195: T & E Investment	0.000	84.862	84.617	95.316	-	95.316	76.954	76.517	73.859	75.296	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project corrects major deficiencies, improves Test & Evaluation (T&E) capabilities, and increases T&E support effectiveness at Navy Major Range and Test Facility Base ranges and facilities. The T&E Investment project improves, modernizes and adds new test capabilities at the following test facilities: the Naval Undersea Warfare Center Division Newport Atlantic Undersea Test and Evaluation Center (AUTEC), Andros Island, Bahamas; the Nanoose and Dabob ranges of the Naval Undersea Warfare Center Division Keyport, Keyport, WA; the Sea Range, Land Ranges, Target Operations, Ordnance T&E Facility, Test Wing Pacific located at the Naval Air Warfare Center Weapons Division, Point Mugu, CA and China Lake, CA; and the Atlantic Test Range, Air Combat Environment T&E Facility, Electromagnetic Environmental Effects, Air Vehicle Modification and Instrumentation facility, Test Wing Atlantic, Target Operations, and the Propulsion Systems Evaluation Facility located at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD and the test and evaluation capabilities located at the Pacific Missile Range Facility, Kauai, HI.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: UNDERSEA RANGE INVESTMENTS	33.137	25.498	32.962	0.000	32.962
Articles:	-	-	-	-	-
Description: This effort funds the modernization, upgrades, and new test and evaluation capabilities required at the Navy's Major Range Test Facility Base undersea ranges, to include AUTEC, Andros Island, Bahamas and the Nanoose and Dabob ranges of the Naval Undersea Warfare Center Division Keyport, Keyport, WA.					
FY 2022 Plans:					
- Continue the minor upgrade and modernization of test capabilities at AUTEC, Nanoose and Dabob.					
- Continue replacement of underwater cables to hydrophone arrays at Nanoose and Dabob.					
- Continue upgrade to acoustic acquisition systems and replace the acoustic signal processing systems at Nanoose and Dabob.					
- Continue replacement of the acoustic signal processing system at AUTEC.					
- Continue replacement of the array structures at Nanoose and Dabob.					
- Complete modernization of range data management system at Nanoose and Dabob.					
- Complete replacement of the shore electronics interface to the hydrophone system at AUTEC.					
- Initiate replacement of the hydrophone tracking system at AUTEC.					
- Initiate replacement of the tracking display system at AUTEC.					
- Initiate modernization of acoustic tracking and beamforming capability at Nanoose and Dabob.					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
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<ul style="list-style-type: none"> - Initiate replacement of radio communication system at Nanoose and Dabob. - Initiate replacement of universal winch fiber optic at Nanoose and Dabob. - Initiate real time tracking software upgrade at Nanoose and Dabob. <p>FY 2023 Base Plans:</p> <ul style="list-style-type: none"> - Complete upgrade to acoustic acquisition systems and replace the acoustic signal processing systems at Nanoose and Dabob. - Complete replacement of the acoustic signal processing system at AUTEK. - Complete modernization of acoustic tracking and beamforming capability at Nanoose and Dabob. - Complete replacement of radio communication system at Nanoose and Dabob. - Continue the minor upgrade and modernization of test capabilities at AUTEK, Nanoose and Dabob. - Continue replacement of underwater cables to hydrophone arrays at Nanoose and Dabob. - Continue replacement of the array structures at Nanoose and Dabob. - Continue replacement of the hydrophone tracking system at AUTEK. - Continue replacement of the tracking display system at AUTEK. - Continue replacement of universal winch fiber optic at Nanoose and Dabob. - Continue real time tracking software upgrade at Nanoose and Dabob. <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding increase from FY 2022 to FY 2023 due to starting the production phase of the hydrophone replacement system at AUTEK.</p>					
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Title: OPEN AIR RANGE INVESTMENTS	32.409	41.854	35.680	0.000	35.680
Articles:	-	-	-	-	-
<p>Description: This effort funds the modernization and upgrades of existing capabilities and the development of new T&E capabilities required at the Navy's Major Range Test Facility Base open air ranges at the Naval Air Warfare Center Aircraft Division (NAWCAD), Patuxent River, MD, Naval Air Warfare Center Weapons Division (NAWCWD), Point Mugu, CA and China Lake, CA and Pacific Missile Range Facility (PMRF), Kauai, HI.</p> <p>FY 2022 Plans:</p> <ul style="list-style-type: none"> - Continue the minor upgrade and modernization of test capabilities at NAWCAD, NAWCWD and PMRF. - Continue procurement of Range Support Aircraft. - Continue the development and integration of Telemetry equipment on the Range Support Aircraft. 					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<ul style="list-style-type: none"> - Continue the imaging radar transmitter modernization at PMRF. - Continue optical tracking mount replacement at PMRF. - Continue tracking pedestal modernization at NAWCAD. - Continue imaging radar modernization at NAWCAD. - Continue software modifications to increase air warfare battleshaping capabilities at NAWCWD. - Continue mobile radio replacement at NAWCWD. - Complete the development of Environmental Impact Statements at NAWCAD. - Complete the integration of optics equipment on the Range Support Aircraft. - Complete cyber security upgrades to critical range instrumentation and networks at NAWCWD. - Complete remotely operated tracking radar modernization at NAWCWD. - Continue telemetry recorder replacement at PMRF. - Complete telemetry processor modernization at NAWCAD. - Complete optical sensor modernization at PMRF. - Initiate and complete phase 1 fiber replacement at NAWCWD South Range. - Initiate upgrades to telemetry collection and processing capabilities at NAWCWD. - Initiate upgrades to telemetry collection and processing capabilities at PMRF. <p>FY 2023 Base Plans:</p> <ul style="list-style-type: none"> - Complete the imaging radar transmitter modernization at PMRF. - Complete tracking pedestal modernization at NAWCAD. - Complete imaging radar modernization at NAWCAD. - Continue the minor upgrade and modernization of test capabilities at NAWCAD, NAWCWD and PMRF. - Continue procurement of Range Support Aircraft. - Continue the development and integration of Telemetry equipment on the Range Support Aircraft. - Continue optical tracking mount replacement at PMRF. - Continue software modifications to increase air warfare battleshaping capabilities at NAWCWD. - Continue mobile radio replacement at NAWCWD. - Complete telemetry recorder replacement at PMRF. - Continue upgrades to telemetry collection and processing capabilities at NAWCWD. - Continue upgrades to telemetry collection and processing capabilities at PMRF. <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Funding decrease from FY 2022 to FY 2023 due to the completion of multiple projects including remotely operated tracking radar modernization, telemetry recorder replacement, optical sensor modernization, and optics integration on range support aircraft.					

Title: TEST FACILITIES INVESTMENTS	19.316	17.265	26.674	0.000	26.674
Articles:	-	-	-	-	-

Description: This effort funds the modernization and upgrades of existing capabilities and the development of new Test & Evaluation capabilities required at the Navy's Major Range Test Facility Base ground test facilities at NAWCAD, Patuxent River, MD, and NAWCWD, Point Mugu, CA and China Lake, CA.

FY 2022 Plans:

- Continue the minor upgrade and modernization of test capabilities at NAWCAD and NAWCWD and the upgrade to general instrumentation and equipment.
- Continue the modernization of the insensitive munitions test arena at NAWCWD. Tasks include renovating and modernizing the control room, refurbishing the test pads and cable paths to the test arena and replacing associated cabling between the test pad and control room at the Ordnance test facility.
- Continue ordnance test arena at NAWCWD by replacing conduits, cabling, firing control system and data collection system.
- Continue helicopter drive system upgrade by aligning test stand and replacing loading and instrumentation at NAWCAD.
- Initiate modernization of environmental test chambers at NAWCWD.
- Initiate modernization of the electromagnetic radiation test area at NAWCAD.
- Initiate development of direct drive electromagnetic pulse test capability at NAWCAD.
- Initiate development of an integrated fire control test environment at NAWCAD.

Modeling and Simulation:

- Continue multi-domain testbed improvements and integration using best practices, open interfaces and ensure persistent connectivity to enhance integrated Live Virtual Constructive (LVC) capability across Department of the Navy test and evaluation labs, facilities and ranges.
- Continue update of Naval modeling and simulation environment to implement improved electronic warfare modeling effects, propagation and interactions. Improve fidelity and accuracy of the Electronic Warfare (EW) interactions and environmental effects (including Radio Frequency, Electro-Optical and Infrared (RF/EO/IR) .

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>Testing will include virtual and hardware-in-the-loop facilities and ranges to create coherent Live, Virtual, and Constructive (LVC) EW evaluation environments.</p> <ul style="list-style-type: none"> - Continue to develop architecture to integrate emerging threat intelligence products for both classified software, virtual and low-cost hardware representations. Task will improve and integrate Integrated Threat Analysis Simulation Environment (ITASE) to meet Navy requirements. Task will integrate classified mixed hardware / software threat emulations into a real-time LVC environment. Threat will be available through innovative repository/cloud solutions. - Continue updates to Family of Simulation models to account for offensive and defensive cyber effects in the battlespace. Integrate automated intelligence and machine learning models with the Next Generation Threat System (NGTS) environment then assess the improvements available to both test and training. - Complete advanced immersive visualization of battlespace and red/blue interactions. Demonstrate immersive visualization model suite, which added complex Electronic Warfare (EW) effects, to evaluate the level of improvement over the traditional tools. Analyze visualization areas still requiring refinement and develop implementation plan. - Initiate development of high fidelity blue-on-red and red-on-blue jamming technique models and simulations including blue-on-blue EMI that are realistic and observed across all systems. Provide a means to test and train in degraded and denied environments for Communications, Global Positioning System (GPS), Link, and Radar modes. - Initiate integration of multi-domain reference interoperability emulators, low fidelity capability assessment tools and battlespace suites in labs and testbeds designed to allow platforms to assess performance early in system development. - Initiate developing scalable and reusable M&S environments for experimenting and testing with new concepts and warfighting capabilities across Doctrine, Organization, Training, Materiel, Leadership, Personnel and Facilities (DOTMLPF) spectrum. Task includes development of M&S capabilities in order to support T&E requirements associated with subsurface environment capabilities, undersea sensors, data fusion capabilities, and measuring the effectiveness of Counter-Intelligence Surveillance, Reconnaissance and Targeting (C-ISRT), Cyber and Electronic Warfare effects in near real time supporting Electromagnetic Maneuver Warfare (EMW) 					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>and Integrated Fires (IF) (e.g., Military Deception/Operational Deception (MILDEC/OPDEC), Computer Network Attack (CNA), Computer Network Exploitation (CNE), and active / passive Electronic Attack (EA).</p> <ul style="list-style-type: none"> - Initiate development of Next Generation M&S Space capability for users across the Test and Evaluation labs, facilities and ranges including LVC, Analysis, Tactics, Techniques and Procedures (TTP) planning, Testing, Training, and Fleet Design activities. - Initiate enhancement of modeling behaviors (e.g. evasion rules and environment data from blue and red torpedoes) to support assessment of autonomous behaviors in a warfighting environment, improve decision making via mining of simulation / LVC big datasets, uncover hidden patterns, reveal trends, and understand SoS interactions. - Initiate advanced improvements of intelligent models to realistically represent the Battlespace as well as analyze and assess Modeling and Simulation (M&S) environments. Simulate intelligent enemy agent tactics to provide realistic OPFOR for T&E. <p><i>FY 2023 Base Plans:</i></p> <ul style="list-style-type: none"> - Continue the minor upgrade and modernization of test capabilities at NAWCAD and NAWCWD and the upgrade to general instrumentation and equipment. - Continue the modernization of the insensitive munitions test arena at NAWCWD. Tasks include renovating and modernizing the control room, refurbishing the test pads and cable paths to the test arena and replacing associated cabling between the test pad and control room at the Ordnance test facility. - Continue the modernization of the ordnance test arena at NAWCWD by replacing conduits, cabling, firing control system and data collection system. - Continue helicopter drive system upgrade by aligning test stand and replacing loading and instrumentation at NAWCAD. - Continue modernization of environmental test chambers at NAWCWD. - Continue modernization of the electromagnetic radiation test area at NAWCAD. - Continue development of direct drive electromagnetic pulse test capability at NAWCAD. - Continue development of an integrated fire control test environment at NAWCAD. <p>Modeling and Simulation:</p> <ul style="list-style-type: none"> - Complete development of high fidelity blue-on-red and red-on-blue jamming technique models and simulations including blue-on-blue EMI that are realistic and observed across all systems. Provide a means to test and train 					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>in degraded and denied environments for Communications, Global Positioning System (GPS), Link, and Radar modes.</p> <ul style="list-style-type: none"> - Complete integration of multi-domain reference interoperability emulators, low fidelity capability assessment tools and battlespace suites in labs and testbeds designed to allow platforms to assess performance early in system development. - Complete developing scalable and reusable M&S environments for experimenting and testing with new concepts and warfighting capabilities across Doctrine, Organization, Training, Materiel, Leadership, Personnel and Facilities (DOTMLPF) spectrum. Task includes development of M&S capabilities in order to support T&E requirements associated with subsurface environment capabilities, undersea sensors, data fusion capabilities, and measuring the effectiveness of Counter-Intelligence Surveillance, Reconnaissance and Targeting (C-ISRT), Cyber and Electronic Warfare effects in near real time supporting Electromagnetic Maneuver Warfare (EMW) and Integrated Fires (IF) (e.g., Military Deception/Operational Deception (MILDEC/OPDEC), Computer Network Attack (CNA), Computer Network Exploitation (CNE), and active / passive Electronic Attack (EA). - Complete development of Next Generation M&S Space capability for users across the Test and Evaluation labs, facilities and ranges including LVC, Analysis, Tactics, Techniques and Procedures (TTP) planning, Testing, Training, and Fleet Design activities. - Complete enhancement of modeling behaviors (e.g. evasion rules and environment data from blue and red torpedoes) to support assessment of autonomous behaviors in a warfighting environment, improve decision making via mining of simulation / LVC big datasets, uncover hidden patterns, reveal trends, and understand SoS interactions. - Complete advanced improvements of intelligent models to realistically represent the Battlespace as well as analyze and assess Modeling and Simulation (M&S) environments. Simulate intelligent enemy agent tactics to provide realistic OPFOR for T&E. - Complete multi-domain testbed improvements and integration using best practices, open interfaces and ensure persistent connectivity to enhance integrated Live Virtual Constructive (LVC) capability across Department of the Navy test and evaluation labs, facilities and ranges. 					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>- Continue update of Naval modeling and simulation environment to implement improved electronic warfare modeling effects, propagation and interactions. Improve fidelity and accuracy of the Electronic Warfare (EW) interactions and environmental effects (including Radio Frequency, Electro-Optical and Infrared (RF/EO/IR). Testing will include virtual and hardware-in-the-loop facilities and ranges to create coherent Live, Virtual, and Constructive (LVC) EW evaluation environments.</p> <p>- Continue to develop architecture to integrate emerging threat intelligence products for both classified software, virtual and low-cost hardware representations. Task will improve and integrate Integrated Threat Analysis Simulation Environment (ITASE) to meet Navy requirements. Task will integrate classified mixed hardware / software threat emulations into a real-time LVC environment. Threat will be available through innovative repository/cloud solutions.</p> <p>- Complete updates to Family of Simulation models to account for offensive and defensive cyber effects in the battlespace. Integrate automated intelligence and machine learning models with the Next Generation Threat System (NGTS) environment then assess the improvements available to both test and training.</p> <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding increase from FY 2022 to FY 2023 due to major material purchases for multiple projects including the helicopter drive system upgrade, the environmental test chambers, the electromagnetic radiation test area, the direct drive electromagnetic pulse test capability, and the integrated fire control test environment.</p>					
Accomplishments/Planned Programs Subtotals	84.862	84.617	95.316	0.000	95.316

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
9999: Congressional Adds	0.000	19.308	12.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	31.308
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Add

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022
Congressional Add: Undersea range modernization FY 2021 Accomplishments: Initiate and complete efforts to support Undersea ranges. Modernize the systems and equipment at the Undersea Ranges. FY 2022 Plans: N/A	9.654	0.000
Congressional Add: Integrated Sensor Effectiveness Test FY 2021 Accomplishments: Initiate engineering and management efforts for the Integrated Sensor Effectiveness Test requirements. Support Electronic Warfare Integrated Reprogramming Database (EWIRDB) Software Operational, Maintenance, and Enhancement Support on the Automated Virtual Information Production Support System (AVIPSS). Modernize the data gathering systems and equipment at the ranges. FY 2022 Plans: N/A	9.654	0.000
Congressional Add: Lab and test range upgrades- targets FY 2021 Accomplishments: N/A FY 2022 Plans: Initiate replacement of the hydrophone tracking system at AUTEK.	0.000	12.000
Congressional Adds Subtotals	19.308	12.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not required for Congressional Adds