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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Office of the Secretary Of Defense **Date:** March 2023

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide I BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604016D8Z I <i>Department of Defense Corrosion Program</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	150.547	3.168	3.166	3.185	-	3.185	3.215	3.210	3.210	3.279	Continuing	Continuing
015: <i>Corrosion Protection Projects</i>	150.547	3.168	3.166	3.185	-	3.185	3.215	3.210	3.210	3.279	Continuing	Continuing

Note

New Start (Y/N): No

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) initiated the Corrosion Program in 2003 in response to 10 U.S.C. 2228, requiring the Secretary of Defense to accomplish a number of actions including the implementation of a corrosion prevention/mitigation strategic plan for DoD equipment and infrastructure. The DoD Corrosion Prevention and Control Strategy was revised and signed in January 2021.

Corrosion continues to be a significant contributor to maintenance costs for DoD equipment and facilities. The average annual cost of corrosion by Service and Major Weapon System Platform between 2004 and 2020 was greater than \$16 billion, and between 16% and 25% of all maintenance costs are attributable to corrosion, depending on the type of system. GAO reports 18-678 and 21-101SP analyzed the DoD aviation weapon system segment where corrosion was specifically attributed to the reduced reliability and maintainability of 33% of the systems. Four of the systems were noted in both reports.

Additionally, GAO-20-296, *Defense Nuclear Enterprise Faces Sustainment Challenges*, the Air Force attributes corrosion as a degrading factor on at least 3 weapon systems. In GAO-22-105032, the Navy allocates a 6% minimum growth factor for corrosion repairs in its annual shipyard work estimates, resulting in part due to deferred corrosion maintenance. Corrosion remains a direct contributor to reduced system availability.

The overall strategic goal of the DoD Corrosion Program is to demonstrate the ability to improve military readiness through the implementation of targeted and effective material and nonmaterial solutions that reduce the corrosion impacts on availability and affordability of DoD weapon systems and infrastructure. This goal can be achieved by focusing RDT&E efforts into two categories: Research Studies and Technology Development and Implementation. Technology development and implementation includes demonstrating and validating mature technologies and advanced research on technologies aimed at reducing cost and increasing availability of DoD weapon systems and facilities.

Demonstration/validation projects are specific corrosion prevention/mitigation efforts funded by the CPO with the objective of developing, testing, qualifying, and implementing new technologies. A number of low-risk, high-payoff technologies promise to vastly improve the service life, significantly reduce the maintenance costs, and improve the availability and safety of weapon systems and facilities essential to maintain support for the warfighter. A total of 85 projects have been completed including a follow-on assessment of their return-on-investment estimates. The overall return on investment as estimated by the Military Departments is approximately 17:1.

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Advanced research includes Test and Evaluation projects, research studies, and research performed by academic institutions to include the Armed Forces' Academies. The primary objectives are: (1) generate products that contribute to the scientific understanding of material degradation and protection mechanisms, (2) explore the feasibility of technologies or processes for future demonstration/implementation projects, (3) generate knowledge products that contribute to ability to make data-driven decisions to prioritize corrosion prevention investments. Research areas include:

- Improved and validated data analytics and predictive modeling
- Accelerated corrosion test method development
- Improved surface treatments and coatings
- New materials and materials processing techniques

B. Program Change Summary (\$ in Millions)	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024 Base</u>	<u>FY 2024 OCO</u>	<u>FY 2024 Total</u>
Previous President's Budget	3.241	3.166	3.185	-	3.185
Current President's Budget	3.168	3.166	3.185	-	3.185
Total Adjustments	-0.073	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	-0.073	-	-	-	-

Change Summary Explanation

No funding change for FY 2024.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Office of the Secretary Of Defense										Date: March 2023		
Appropriation/Budget Activity 0400 / 4					R-1 Program Element (Number/Name) PE 0604016D8Z / Department of Defense Corrosion Program				Project (Number/Name) 015 / Corrosion Protection Projects			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
015: Corrosion Protection Projects	150.547	3.168	3.166	3.185	-	3.185	3.215	3.210	3.210	3.279	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

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Corrosion continues to be a significant contributor to maintenance costs for DoD equipment and facilities. GAO reports 18-678 and 21-101SP analyzed the DoD aviation weapon system segment, corrosion was specifically attributed to the reduced reliability and maintainability of 33% of the systems. Four of the systems were noted in both reports.

Additionally, GAO-20-296, Defense Nuclear Enterprise Faces Sustainment Challenges, the Air Force attributes corrosion as a degrading factor on at least 3 weapon systems. In GAO-22-105032, the Navy allocates a 6% minimum growth factor for corrosion repairs in its annual shipyard work estimates, resulting in part due to deferred corrosion maintenance.

The overall strategic goal of the DoD Corrosion Program is to demonstrate the ability to improve military readiness through the implementation of targeted and effective material and nonmaterial solutions that reduce the corrosion impacts on availability and affordability of DoD weapon systems and infrastructure. This goal can be achieved by focusing RDT&E efforts into two categories: Research Studies and Technology Development and Implementation. Technology development and implementation includes demonstrating and validating mature technologies and advanced research on technologies aimed at reducing cost and increasing availability of DoD weapon systems and facilities.

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Advanced research includes Test and Evaluation projects, research studies, and research performed by academic institutions to include the Armed Forces' Academies. The primary objectives are: (1) generate products that contribute to the scientific understanding of material degradation and protection mechanisms, (2) explore the feasibility of technologies or processes for future demonstration/implementation projects, (3) generate knowledge products that contribute to ability to make data-driven decisions to prioritize corrosion prevention investments. Research areas include:

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Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604016D8Z / <i>Department of Defense Corrosion Program</i>	Project (Number/Name) 015 / <i>Corrosion Protection Projects</i>
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- Improved and validated data analytics and predictive modeling
- Accelerated corrosion test method development
- Improved surface treatments and coatings
- New materials and materials processing techniques

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

	FY 2022	FY 2023	FY 2024
<p>Title: Corrosion Prevention and Control Projects and Activities</p> <p>Description: Corrosion prevention and control projects and activities are conducted in support of the support of the strategic plan to reduce the impact of corrosion on the cost and availability of DoD equipment and facilities. FY 2020 RDT&E Projects still in-progress include:</p> <ul style="list-style-type: none"> •Zinc-rich Aerosol Products for Touch-up Painting of Steel Substrates – Increased efficiency of maintenance processes •Improved Surface Preparation and Coatings for Corrosion Control of Aluminum Substrates – Extending intervals between coating applications •Pressure Sensitive Adhesive Appliques for Quick Field Repair of Topcoat Damage – Improved field-level maintenance •Weld-Through Coatings for Prevention of Crevice Corrosion in Skip-Welded Joints – Service life extension for ground vehicles <p>Support for advanced research in the areas of improving the accuracy of the algorithm for extracting corrosion information from maintenance data, aircraft structural repair using additive manufacturing, optimizing aircraft washdown intervals, corrosion sensor development, analytical corrosion prediction methods, mitigation of biologically induced corrosion, and prediction of environmentally assisted cracking was continued.</p> <p>FY 2021 RDT&E Projects still in-progress include:</p> <ul style="list-style-type: none"> •Environmentally Friendly Coating Assessment for Non-Immersed Marine Environment for structures located in coastal environments. --Successfully Completed in FY 2022 will be implemented in facilities criteria updates. •Gentoo Coating Application to HH-60G Tail Landing Gear Yoke to reduce corrosion inspection requirements and improve the durability of the yoke between inspection cycles; improving HH-60 readiness. •Improved Landing Gear Durability for F/A-18E/F Super Hornet evaluating the application of multiple corrosion prevention technologies to improve the landing gear system to improve readiness and reduce cost. •Ship Class Topside Corrosion Control Configuration (CT3C) Implementation multiple corrosion prevention technologies to improve the improve ship operational sustainment and reduce cost <p>--Technologies will be implemented on 2 demonstration ships in FY 2023</p> <ul style="list-style-type: none"> •Property-driven determination of acceptable criteria in MIL-DTL-46027 (weldable aluminum armor) for enhanced sustainability and readiness to evaluate the corrosion susceptibility characteristics and impact due desensitization of aluminum alloys. <p>--Successfully completed.</p>	3.168	3.166	3.185

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>•Evaluating aerospace applications for Zn-Ni coatings as an alternative to Cd coatings to improve corrosion performance while reducing environmental and human safety impacts. --Effort has expanded the implementation of Zn-Ni on multiple components processed at NAVAIR Depots, reducing the overall Cd usage while improving corrosion protection.</p> <p>Activities executed included:</p> <ul style="list-style-type: none"> • Delivery of corrosion control and coatings training to field- and depot-level workforce provided over 22 different CPC training courses to over 800 DoD workforce personnel • Posted CLM 038 Computer Based CPC Overview Training on DAU for the DAWIA Certified workforce professionals • Expanded scope of Cost of Corrosion data for Navy Surface Ships <p>-- Identified the top 10 corrosion drivers and top 10 maintenance labor drivers</p> <ul style="list-style-type: none"> • Supported the technical revisions to corrosion-related military specifications <p>FY 2023 Plans:</p> <ul style="list-style-type: none"> •Year 3 increment funding for FY 2021 long term Corrosion Demonstration/Validation Projects •Initiate FY 2023 Demonstration and Implementation Project process and/or Initiate a CPC Test and Evaluation project or studies, Quarter 3. •Develop a corrosion dashboard concept for Navy Surface Ships Corrosion Metrics. <p>FY 2024 Plans:</p> <p>Fund year 3 of 3 for the following projects:</p> <ul style="list-style-type: none"> •Gentoo Coating Application to HH-60G Tail Landing Gear Yoke to reduce corrosion inspection requirements and improve the durability of the yoke between inspection cycles; improving HH-60 readiness. (note: project delayed due to COVID restriction limitations) <p>Fund year 4 for the following projects:</p> <ul style="list-style-type: none"> •Improved Landing Gear Durability for F/A-18E/F Super Hornet evaluating the application of multiple corrosion prevention technologies to improve the landing gear system to improve readiness and reduce cost. •Ship Class Topside Corrosion Control Configuration (CT3C) Implementation multiple corrosion prevention technologies to improve the improve ship operational sustainment and reduce cost <p>Initiate FY 2024 Demonstration and Implementation Project process and/or Initiate a CPC Test and Evaluation project or studies.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
No significant change.			
Accomplishments/Planned Programs Subtotals	3.168	3.166	3.185

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Office of the Secretary Of Defense **Date:** March 2023

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604016D8Z / Department of Defense Corrosion Program	Project (Number/Name) 015 / Corrosion Protection Projects
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Product Development (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Corrosion Policy and Oversight	MIPR	Various (Army, Navy, Air Force) : Various	120.019	0.492	Oct 2022	1.427	Oct 2023	1.629	Oct 2024	0.000		1.629	Continuing	Continuing	-
Subtotal			120.019	0.492		1.427		1.629		0.000		1.629	Continuing	Continuing	N/A

Support (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Research Studies	C/FFP	Various : Various	2.402	1.142	Sep 2022	0.100	Sep 2023	0.100	Sep 2024	0.000		0.100	Continuing	Continuing	-
Technical Support	MIPR	Various (Army, Navy, Air Force) : Various	0.325	0.158	Jun 2022	0.158	Jun 2023	0.158	Jun 2024	0.000		0.158	Continuing	Continuing	-
Technical Support	Option/FFP	Leidos, Inc. : Virginia	0.496	-		-		0.000		0.000		0.000	Continuing	Continuing	-
Technical Support	C/FFP	Excet Inc. : Maryland	0.210	0.221	Jun 2022	0.210	Jun 2023	0.210	Jun 2024	0.000		0.210	Continuing	Continuing	-
Research Studies	MIPR	Various (Army, Navy, Air Force) : Various	-	-		0.292	Mar 2023	0.200	Oct 2024	-		0.200	Continuing	Continuing	-
Subtotal			3.433	1.521		0.760		0.668		0.000		0.668	Continuing	Continuing	N/A

Test and Evaluation (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Critical Compatibility Testing - COVID19 (FY20 Congressional-Add)	MIPR	Various (Army, Navy, Air Force) : Various	2.691	-		-		-		-		-	Continuing	Continuing	-
Subtotal			2.691	-		-		-		-		-	Continuing	Continuing	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Office of the Secretary Of Defense **Date:** March 2023

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Management Services (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Corrosion Policy and Oversight	C/FFP	Logistics Management Institute : McLean, VA	23.194	0.956	Feb 2022	0.791	Feb 2023	0.686	Feb 2024	0.000		0.686	Continuing	Continuing	-
Corrosion Policy and Oversight	Option/FFP	LMI : McLean, VA	1.023	-		-		0.000		0.000		0.000	Continuing	Continuing	-
SBIR/STTR Funding	Allot	OSD : Virginia	0.123	0.120	Jun 2022	0.046	Jun 2023	0.123	Jun 2024	0.000		0.123	Continuing	Continuing	-
USD(A&S) Management Reserve	Allot	USD(A&S) : Virginia	0.064	0.064	Jun 2022	0.064	Jun 2023	0.064	Jun 2024	0.000		0.064	Continuing	Continuing	-
Corrosion Policy and Oversight Mgmt Services	Allot	Corrosion Policy and Oversight : Alexandria, VA	-	0.015	Oct 2022	0.015	Oct 2023	0.015	Oct 2024	0.000		0.015	Continuing	Continuing	-
Senior Leadership Directive	Allot	OSD : Virginia	-	0.000		0.063	Feb 2023	0.000		0.000		0.000	Continuing	Continuing	-
Subtotal			24.404	1.155		0.979		0.888		0.000		0.888	Continuing	Continuing	N/A

	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	150.547	3.168	3.166	3.185	0.000	3.185	Continuing	Continuing	N/A

Remarks
N/A

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Exhibit R-4, RDT&E Schedule Profile: PB 2024 Office of the Secretary Of Defense **Date:** March 2023

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604016D8Z / Department of Defense Corrosion Program	Project (Number/Name) 015 / Corrosion Protection Projects
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	FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Corrosion Protection Projects																								
Zinc-rich aerosol products for touch-up painting of steel substrates																								
Improved surface preparation and coatings for corrosion control of aluminum substrates																								
Pressure sensitive adhesive appliques for quick field repair of topcoat damage																								
Weld-through coatings for prevention of crevice corrosion in skip-welded joints																								
Improving the accuracy of the algorithm for extracting corrosion information from maintenance data																								
Aircraft structural repair using additive manufacturing																								
Optimizing aircraft washdown intervals																								
Corrosion sensor development																								
Analytical corrosion prediction methods																								
Mitigation of biologically induced corrosion																								
Prediction of environmentally assisted cracking																								
Gentoo Coating Application to HH-60G Tail Landing Gear Yoke																								
Environmentally Friendly Coating Assessment for Non-Immersed Marine Environment																								
Improved Landing Gear Durability for F/A-18E/F Super Hornet																								
Ship Class Topside Corrosion Control Configuration (CT3C) Implementation																								

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Exhibit R-4A, RDT&E Schedule Details: PB 2024 Office of the Secretary Of Defense		Date: March 2023
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604016D8Z / <i>Department of Defense Corrosion Program</i>	Project (Number/Name) 015 / <i>Corrosion Protection Projects</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Corrosion Policy and Oversight				
Zinc-rich aerosol products for touch-up painting of steel substrates	3	2020	4	2021
Improved surface preparation and coatings for corrosion control of aluminum substrates	3	2020	4	2021
Pressure sensitive adhesive appliques for quick field repair of topcoat damage	3	2020	4	2021
Weld-through coatings for prevention of crevice corrosion in skip-welded joints	3	2020	4	2021
Implementation of Zinc-Nickel (1Z-C17 +Zn-Ni) Electroplating as an Alternative to Cadmium (extended)	3	2016	4	2023
Gentoo™ Coating Application to HH-60G Tail Landing Gear Yoke	2	2021	1	2023
Improved Landing Gear Durability for F/A-18E/F Super Hornet	2	2021	4	2024
Ship Class Topside Corrosion Control Configuration (CT3C) Implementation	2	2021	4	2024
Environmentally Friendly Coating Assessment for Non-Immersed Marine Environment	2	2021	4	2022
Aircraft structural repair using additive manufacturing	4	2018	1	2023
Optimizing aircraft washdown intervals	4	2018	1	2021
Corrosion sensor development	4	2018	4	2020
Analytical corrosion prediction methods	4	2018	1	2023
Mitigation of biologically induced corrosion	4	2018	1	2023
Prediction of environmentally assisted cracking	4	2018	1	2022