Results in Brief

OIG 21-01
November 16, 2020

Audit of the Replacement of WMATA's Remote Terminal Units

Why We Did This Review

While conducting the *Washington Metropolitan Area Transit Authority's (WMATA) Cybersecurity over Rail Industrial Control Systems (ICS)* audit, OIG found WMATA had three projects to replace obsolete and unreliable Remote Terminal Units. These projects were initiated to decrease equipment failures, improve system functionality, and provide reliable service to customers.

[redacted]

The objective of this audit was to determine whether the RTU replacement project was efficient, economical, and provided the required solution.

What We Found

WMATA had not established an overall Remote Terminal Unit (RTU) replacement project, or fully integrated and coordinated the activity. WMATA did not complete several critical Project Lifecycle Management (PLM) processes, such as: a business needs assessment, risk assessment, and project plan. The Information Technology (IT) Department had documented its RTU replacement processes, while Office of Automatic Train Control Systems (ATCS) and Office of Power (PWRS) had not yet fully documented project requirements. These conditions occurred because: (1) the lack of an enterprise-wide ICS/SCADA modernization plan, (2) organizational fragmentation, (3) inadequate oversight controls, (4) lack of agreed upon solutions, and (5) not fully following the PLM process.

The lack of an integrated and fully coordinated enterprise-wide RTU replacement project put individual project components at risk. The issues raised by OIG prompted management to conclude the interim IT RTU replacement project was infeasible. The interim IT RTU replacement project was subsequently cancelled thus increasing cost efficiency by putting $62.9 million of funds to better use. Management estimated the need for $39.3 million to complete the RTU replacement project, leaving $23.6 million (in savings) for other purposes.

Further, without an integrated and coordinated enterprise-wide RTU project, the individual RTU projects may not be optimal regarding outcomes. Issues at the RTU enterprise project level have not been resolved including an enterprise architecture, integrated requirements, and [redacted] There is confusion among stakeholders as to the various RTU project scopes and gaps in how the projects will be pieced together. In addition, the separate projects may result in conflicting technical requirements and [redacted] and [redacted] Streamlining the RTU replacement project would create efficiencies and economies as well as solidify architecture and technical requirements. [redacted]

Management's Response

WMATA management generally concurred with the findings and recommendations made in this report (refer to Appendix B). WMATA has taken significant action to adjust the RTU replacement project and provided details on a consolidated approach to complete the project. OIG considers management's comments responsive to the recommendations and corrective actions, taken or planned, should correct the deficiencies identified in the report.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ABBREVIATION	DESCRIPTION
AIM	Advanced Information Management
ATCS	Office of Automatic Train Control Systems
EVP CAPD	Executive Vice President, Capital Delivery
EVP IBOP	Executive Vice President and Chief Internal Business Operations
EVP SPPM	Executive Vice President, Strategy, Planning and Program Management
ICS	Industrial Control Systems
OT	Operational Technology
PLM	Project Lifecycle Management
PLNT	Office of Plant Maintenance
PWRS	Office of Power Systems Engineering
ROCC	Rail Operations Control Center
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
TCR	Train Control Room

BACKGROUND

[redacted]

[redacted]

[redacted]

Organizations

ATCS is in the Engineering Department under the Office of Capital Program Delivery (CAPD). This office is responsible for the design and control of the ATC system, including technical oversight of maintenance, repair and replacements. Large-scale renewal/replacement efforts, such as the referenced project to replace TCR and associated wayside equipment, are directed by ATCS. [redacted]

[redacted]

PWRS is also in the Engineering Department under the CAPD. PWRS is responsible for the control of the SCADA system standards, design criteria and specifications, as well as the SCADA system design in collaboration with Maintenance of Way Engineering SCADA team. PWRS provides real-time web based diagnostic remote monitoring for a range [redacted]

The Office of Systems and Software is one of the units within the IT Department, under Internal Business Operations. This office is responsible for the development, configuration, implementation, upgrades, and operation of all WMATA applications, including transit systems. The AIM system is managed and maintained by this office. IT controls the integration with AIM, requiring collaboration on how devices connect to the system.

The Office of Capital Programming is under the Department of Strategy, Planning and Program Management (SPPM). This office plans, develops, and prioritizes Metro's capital program through planning and prioritization, project evaluation and accountability and portfolio reporting.

RTU Projects
WMATA had three projects to replace outdated RTUs.

- ATCS Project - In July 2018, the ATCS initiated a four-year project to replace all ATC equipment within 25 TCRs, including 25 RTUs housed in these rooms at a projected budget of $64.8 million. Specifically, the TCR equipment upgrade includes the replacement of track circuits, vital relays, non-vital relays, train-to-wayside communications, station support circuits, automatic route selection at interlocking, RTUs and other equipment as required. The remaining train control rooms' equipment and their respective RTUs will be upgraded in future phases as needed. Some of the equipment is 15 to 45 years old and is no longer supported by the original manufacturer. Eventually, equipment in the rest of the TCRs except for the Silver Line will be upgraded with their respective RTUs.

- IT Department Project - In June 2019, the IT Department initiated a five-year project to replace outdated and unreliable RTUs. The IT RTU replacement project original scope involved installing 97 new RTUs in the TCRs to allow the Office of Plant Maintenance (PLNT), PWRS, and ATCS equipment and systems to send data to [redacted] The projected budget is $64.2 million. During the audit, the IT RTU replacement project scope shifted to the implementation of an interim solution that would replace some of the old RTUs.

- PWRS Project - Between November 2012 and August 2019, PWRS completed or scheduled for completion the installation of 109 RTUs out of a total of 340 RTUs. They are replacing them in traction power substations and tie breaker stations for an estimated cost of over $14.6 million. Refer to Diagram 1 on the next page for an overview of WMATA's RTU architecture, including visual displays of the projects.

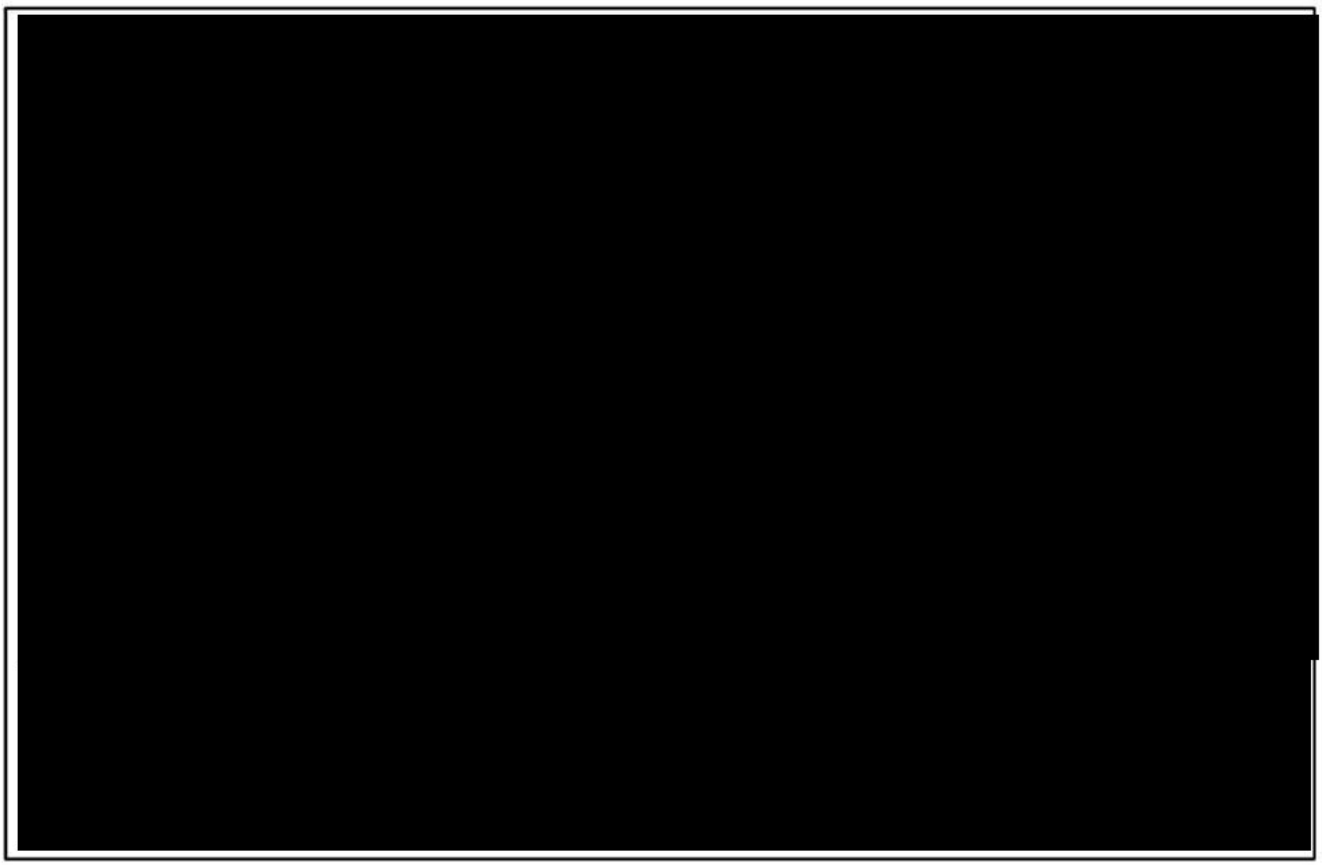

Diagram 1 – Overview of Proposed Metro Rail SCADA/RTU Architecture

Fiber Optic Project

The Ancillary Fiber Optic communications project will install fiber optic cable throughout WMATA facilities, tunnels, and train control systems at a projected cost of $170 million. The Network Communication Systems office is responsible for the implementation of the fiber optic cable project. Additionally, the successful implementation of various projects [redacted] Although OT officials have determined the need to connect their equipment and facilities with fiber optics to facilitate reliable transmission, the IT RTU replacement project does not fulfill this need.

AUDIT OBJECTIVE AND RESULTS

Audit Objective

The audit objective was to determine whether the RTU replacement project was efficient, economical, and provided the required solution.

Audit Results

WMATA's RTU Replacement Project Has Not Been Fully Integrated or Coordinated

WMATA has not established an overall RTU replacement project, or fully integrated and coordinated the activity. WMATA did not complete several critical PLM processes, such as a business needs assessment, risk assessment, and project plan. The IT Department had documented its RTU replacement processes, while ATCS and PWRS had not yet fully documented project requirements. See Chart 1 showing gaps in the PLM processes for each project.

Chart 1 - Completed PLM Stages and Associated Documents for the RTU Replacement Project

	Overall	Project Level		
PLM Stages and Associated Documents	Enterprise RTUs Project Documents	ATCS Documents	PWRS Documents	IT Documents
Assessment and Authorize				
• Project Charter	N	N	N	Y
• Business Needs	N	Y	Y	Y
• Cost Estimates	N	Y	Y	Y
• Risk Assessment	N	N	N	N
• Gain Formal Approval	N	Y	N	Y
• Communication Plan	N	N	N	N
Plan and Define				
• Project Management Plan	N	N	N	Y
• Analysis of Alternatives[4]	N	N	N	N
• Current and Future Business Process	N	N	N	N
• Requirements Management Plan	N	N	N	Y
• Requirements Specifications Document	N	N	N	Y

N - document does not exist or process was inadequate; Y - the document exists and the process was adequate.

[4]Analysis of Alternatives component was not specifically covered as part of a PLM stage. The Transit Cooperative Research Program (TCRP), *State of Good Repair: Prioritizing the Rehabilitation and Replacement of Existing Capital Assets and Evaluating the Implications for Transit, Report 157* states that transit agencies should have a policy in place for evaluating project alternatives.

Compliance Assessment to the PLM Stages

Assess and Authorize Stage

1. **Project Charter:** WMATA did not have an enterprise-wide RTU project charter which would include budgets, key stakeholders, and a high-level project scope and approach. At the individual project level, the IT Department was the only group to develop a charter, but it was not integrated with the other Operational Technology (OT)[5] projects. Thus, an overall business plan initiation process was not performed to include the OT components to allow project managers and key stakeholders to agree on a reasoned business case, perform an integrated cost and scope estimation, and conduct a preliminary risk assessment prior to formal approval.

2. **Business Needs:** An integrated business needs and justification requiring a technical solution was not prepared for the overall RTU replacement project. Business needs assessments were performed for each individual project. The IT RTU project documentation indicated that the IT Department was replacing 97 RTUs in the TCRs. However, during the audit, the IT RTU replacement project scope shifted to an interim solution that would replace some of the old RTUs.

3. **Cost Estimates:** Cost estimates for the overall project were not developed at an enterprise-wide level. At the individual project level, cost estimates and scope were performed under separate budgets for the IT Department ($64.2 million), ATCS ($64.8 million for 25 stations), and PWRS ($14.6 million), which totaled $143.6 million. The IT Department has hired a contractor to prepare an IT RTU implementation strategy as well as a statement of work for procurement and installation of the RTUs at a cost of $6.9 million.

4. **Risk Assessments**: An overall enterprise-wide risk assessment of WMATA SCADA/RTU infrastructure was not conducted. Thus, enterprise level risks such as compatibility of RTUs, [redacted], ownership, and inventory of assets were not holistically assessed. The IT RTU consultant had developed some risk attributes in its IT charter but did not conduct a full risk assessment. None of the OT offices performed a risk assessment.

5. **Gain Formal Approval**[6]: There was no enterprise-wide level steering committee comprising both IT and OT leadership teams to review and approve the proposed RTU replacement budgets and scope. For instance, the IT RTU replacement budget for equipment totaling over $37 million was approved only by senior IT management, excluding the approval of OT senior management. The PLM provides a set of deliverables within each stage. Each stage should be reviewed and approved by business owners prior to continuing to the next stage. The lack of review may result in the project's technical components not aligning with the project goals and objectives.

6. **Communication Plan:** Communication on the overall RTU replacement project has not been effective. There is no forum or form of communication to discuss the enterprise-wide RTU project holistically. At the individual project level, communication has been a challenge. For instance, ATCS and PWRS officials indicated their involvement and understanding of the IT project are minimal since they do not have clear information on what is involved in the IT RTU replacement project. Similarly, ATCS and PWRS have not communicated their individual project details to IT.

[5]The Operational Technology groups include ATCS, PWRS, and PLNT.

[6]The EVP - SPPM has developed a new business case and approval process for capital projects for the 2021 budget. This office is conducting a business case analysis on the Fiber Optics project which will include examining RTUs.

Plan and Define Stage

7. **Project Management Plan**: WMATA did not have a project plan for the overall RTU replacement project. An overall project plan would assist in the integration and coordination of the individual projects. WMATA did not know how many RTUs it needed on an enterprise-wide basis. An inventory of RTUs totaled 449, not including PLNT which did not have a total count. With the exception of the IT Department, OT groups had not documented respective RTU projects. PLNT officials indicated there are 1 or 2 RTUs in each station but could not confirm the number of RTUs.

8. **Current and Future Business Processes**: Current and future business processes were not defined for the RTU replacement project on an enterprise-wide basis. The IT Department has developed some "existing," "interim," and "future" RTU diagrams specific to interfaces such as the AIM system, traction power interface, and RTU data architecture. However, there is no enterprise architecture depicting the integration of all functional RTUs across WMATA.

9. **Requirements Management Plans**: An overall requirements management plan was not developed to trace enterprise-wide RTU requirements throughout the life cycle of the project and to ensure that build, testing, and implementation activities continue to align with the initial requirements. Except for the IT Department, individual project level requirements management plans had not been prepared by the OT offices.

10. **Requirement Specifications Document**: WMATA has not developed an enterprise-wide requirement specifications document for the overall RTU replacement solution. This document defines and validates the business solution in more detail regarding inputs, processes, and outputs. At the individual project level, there are various technical solutions. ATCS has an existing RTU solution on the Silver Line, while the IT Department is working to aggregate information before it connects to AIM. In addition, overall security requirements and design of a security architecture were not spelled out for the project on an enterprise basis.

What Is Required

- *WMATA's Project Lifecycle Management (PLM) Process & Deliverables* provides a guide that standardizes the stages of projects occurring throughout the enterprise. The end-to-end PLM framework also allows IT management and stakeholders to manage projects from 'cradle to grave' while maintaining the flexibility to manage how each project is tailored to specific needs based on project size, complexity, scope, and duration. Documentation exists to ensure objectives are met, explain product functionality, unify project related information, and allow for discussing all significant questions that arise between stakeholders and developers. See Appendix C for a full description of the stages.

- A Transit Cooperative Research Program, *State of Good Repair: Prioritizing the Rehabilitation and Replacement of Existing Capital Assets and Evaluating the Implications for Transit*, *Report 157* states that transit agencies should have a policy in place for evaluating project alternatives. The PLM and the Transit Cooperative Research Program cite leading project management practices for transit agencies and are appropriate to large scale rehabilitation projects.

- ATCS uses its ATC-400, a *Systems Configuration Management Plan Instructions and Procedures Manual* to document their project implementations and field distribution. ATCS and PWRS do not follow any specific project lifecycle management standards.

- *WMATA Manual of Design Criteria, Section 25 re: Automatic Train Control (ATC)* includes all functional and design criteria for train control systems for the WMATA Metrorail Transit System.

Why This Occurred

There are several causes for the projects not being fully integrated or coordinated:

- *Holistic Approach to Modernizing ICS/SCADA Needed* – WMATA had not developed an enterprise-wide level strategic plan that includes critical stakeholders. They also had not conducted a risk assessment as a guide to ensure safety during the replacement of RTUs.

- *Organizational Fragmentation* – The OT offices have historically been independent of IT. These groups have several initiatives addressing the RTU replacement. However, the IT Department was given a more active role in rail operational technology projects that integrate with the AIM system. Since these offices have historically had different roles, full and open communications of projects was a challenge.

- *Inadequate Oversight Controls* – WMATA did not have oversight controls, such as a senior executive steering committee or technical architecture oversight committee, focusing across projects to ensure project integration.

- *Lack of an Agreed Solution* – Various RTU replacement solutions for individual projects were in progress, but not an overall RTU enterprise-wide solution. Rail and the OT groups discourage interim solutions and referred to them as a waste of resources.

- *PLM process Not Fully Followed* – There is no WMATA-wide policy requiring OT projects to follow the PLM stages including senior management approval after every stage.

Why This Is Important

The lack of an integrated and fully coordinated enterprise-wide RTU replacement project put individual project components at risk. The issues raised by OIG prompted management to conclude the interim IT RTU replacement project was infeasible as it would take almost the same amount of time as the permanent solution. The interim IT RTU replacement project was subsequently cancelled thus increasing cost efficiency by putting $62.9 million of funds to better use.[7] Management estimated the need for $39.3 million to complete the RTU replacement project, leaving $23.6 million (in savings) for other purposes. The IT RTU replacement project funds are as follows (see Table 1).

[7]Funds Put to Better Use – Funds that could be used more efficiently by implementing a recommended action.

Table 1: IT RTU Replacement Project Funds

	Description	Funds	Fund Category
1.	Projected cost of the interim IT RTU Project	$64,200,000	
2.	Funds Spent	-$1,300,000	
3.	Unspent funds for the interim IT RTU Project	$62,900,000	Funds Put to Better Use
4.	Proposed cost of alternative RTU replacement project using repurposed funds (per Management)	-$39,300,000	
5.	Estimated funds to be used for other purposes	$23,600,000	

Further, without an integrated and coordinated enterprise-wide RTU replacement project, the individual RTU projects may not be optimal in regard to outcomes. Issues at the RTU enterprise project level have not been resolved including an enterprise architecture, integrated requirements, and [redacted]. There is confusion among stakeholders as to the various RTU project scopes and gaps in how the projects will be pieced together. In addition, the separate projects may result in conflicting technical requirements [redacted].[8] Streamlining the RTU replacement project would create efficiencies and economies as well as solidify architecture and technical requirements. This in turn may expedite the project and lessen the risk of serious service interruptions or train accidents due to decreased visibility over the rail system.

Recommendations

We recommend the General Manager/Chief Executive Officer:

1. Revise the scope of the project to eliminate the interim IT RTU replacement project and put the $62.9 million to better use. (Action: EVP CAPD, EVP IBOP and EVP SPPM)

2. Review the IT RTU replacement contract to determine how it can be leveraged to address a permanent solution. (Action: EVP CAPD and EVP IBOP)

3. Complete the enterprise-wide architecture analysis and develop corresponding requirements for the overall RTU replacement project to ensure the implementation of the required solution. (Action: EVP CAPD, EVP SPPM and EVP IBOP)

4. Develop and implement a long-term ICS/SCADA modernization strategic plan with an associated safety risk assessment which would include RTU replacement and train control systems upgrade. (Action: EVP CAPD and EVP IBOP)

[redacted]
Control Systems that do not integrate or comply with industry specifications.

5. Develop oversight controls such as an executive steering committee or technical architecture oversight committee across projects to oversee the implementation of RTUs enterprise-wide. (Action: EVP CAPD and EVP IBOP)

6. Implement controls that require critical stakeholders and process owners to sign off on key deliverables and project stages. (Action: EVP CAPD and EVP IBOP)

7. Develop an enterprise-wide project management communication plan to improve collaboration of key stakeholders. (Action: EVP CAPD and EVP IBOP)

8. Implement security controls across the RTU enterprise-wide project. (Action: EVP CAPD and EVP IBOP)

9. Prioritize and implement the Ancillary Fiber Optic Communications project [redacted] etc., and replace RTUs and the Data Transmission System with fiber cables, as necessary. (Action: EVP SPPM, EVP CAPD and EVP IBOP)

SUMMARY OF MANAGEMENT'S RESPONSE

WMATA management generally concurred with the findings and recommendations made in this report. WMATA has taken significant action to adjust the RTU replacement project by cancelling the interim IT RTU project, allowing $62.9 million of funds to be put to better use, and providing details on a consolidated approach to complete the RTU project. WMATA agreed to all the recommendations including to: (1) develop an enterprise-wide, integrated strategy and modernization plan for industrial control systems/SCADA to include the RTU replacement project; (2) complete the permanent future state high-level SCADA architecture; (3) integrate the RTU replacement project with the permanent fiber optics communication project; (4) put additional oversight and security controls and processes in place; and (5) develop a robust communication plan to coordinate the project across the organization. Management agreed to complete all the recommendations by December 2021. Management's comments, in their entirety, are provided in Appendix B.

OIG considers management's comments responsive to the recommendations and corrective actions, taken or planned, should correct the deficiencies identified in the report.

Appendix A

OBJECTIVE, SCOPE, AND METHODOLOGY

Objective

The audit objective was to determine whether the RTU replacement project was efficient, economical, and provided the required solution.[9]

Scope

This is the second audit in a series of reviews under the audit of *WMATA's Cybersecurity over Rail Industrial Control Systems (ICS).* The scope included the RTU replacement project involving the IT Department and several OT offices.

Methodology

To address the audit objective, OIG:

1. Reviewed relevant documents, including WMATA's *Project Lifecycle Management Process & Deliverables* guidance.

2. Interviewed WMATA staff from the Offices of ATCS, PWRS and PLNT, Systems and Software, IT Infrastructure and Operations, and Capital Programming.

3. Reviewed internal controls over operations technology and IT projects.

4. Reviewed best practices for designing, procuring, developing and implementing train management, control and monitoring systems.

5. Examined Request for Proposals' Statements of Work and Technical Specifications for the IT RTU replacement project, ATCS train control room upgrade, and the PWRS project.

We did not rely on computer generated data to accomplish our objective.

We conducted this performance audit from June 2019 to October 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

[9]This objective was more specific than the original objective of assessing controls over the RTU replacement project.

Appendix B

MANAGEMENT'S RESPONSE

M E M O R A N D U M

SUBJECT: WMATA Management Response to *Audit of the Replacement of WMATA's Remote Terminal Units* (OIG 21-01)

DATE: November 16, 2020

FROM: Laura Mason, EVP, CAPD — Laura Mason E023773 WMATA — Digitally signed by Laura Mason E023773 WMATA Date: 2020.11.16 11:36:59 -05'00'

John Kuo, EVP, IBOP — John Kuo E023756 WMATA

Thomas Webster, EVP, SPPM — Thomas J Webster — Digitally signed by Thomas J Webster Date: 2020.11.16 14:40:08 -05'00'

THRU: GM/CEO – Paul J. Wiedefeld

TO: OIG – Geoffrey A. Cherrington

This memo provides management's response to the OIG report *Audit of the Replacement of WMATA's Remote Terminal Units* (OIG 21-01). Metro appreciates OIG's attention to this critical program. The retirement of outdated communications technology, especially one that connects between multiple systems, is a complex challenge and one that takes significant investment of resources to mature to implementation. Metro generally agrees with the findings and recommendations by OIG and responds to each recommendation below.

Prior to detailing our responses to the recommendations, Metro would like to add further context on the outlook for the program as the audit report reflects a snapshot in time of a program that is still under development. Although the time taken to develop the program was longer than expected, it did not result in any duplicate capital installations or any imminent risk that duplication would occur.

Washington Metropolitan Area Transit Authority

Due to the number of systems affected by this change and the significant advancements in technology since our existing system was developed, it is more appropriate to recognize this effort as a program of projects to modernize our communications and controls system rather than a project to replace a device. Metro agrees that a long-term modernization strategic plan for the data communication system, inclusive of these RTUs, is appropriate, and work is underway to develop such a strategy, which will address many of the concerns identified in the report.

In addition, Metro acknowledges and would like to highlight that its approach to RTU renewal has changed over the past year, in parallel with the completion of the audit by OIG. Initially, the RTU replacement project included the development of an interim solution to replace RTUs not expected to last until the migration to a new architecture was completed, as completion is dependent on

multiple other equipment renewal programs. Now, in 2020, with the benefit of dedicated funding and improved capital program coordination, we are following a more comprehensive approach to retire the old Data Transmission System (DTS), inclusive of the existing RTUs, and implement a more modern system architecture, resulting in holistic changes to program scope, project management and budgeting.

Program Costs

Under this plan, work will be required at mu**ltiple locations – train control rooms,** traction power substations and AC room**s – and these locations** will also be hosting major equipment replacement programs also made possible by dedicated funding. The new RTUs will be integrated into these larger equipment renewal projects managed by each functional team.

This change in approach – from a single project managed by IT to elements included in multiple projects managed by various groups **– requires a change in** budget treatment. The unified RTU replacement line item identified in Table 1 is being discontinued, and new RTU units will become project cost elements in separate SOGR projects. The discontinuation of the IT line item in the capital program should not be interpreted as a net cost savings or elimination of the work. The savings referenced in Table 1 are based on efficiencies gained from the acceleration of the larger equipment renewal projects and installation of a new fiber network, which eliminates the need to develop a temporary/interim replacement of the old RTU device (within the existing DTS) and move more quickly to the new architecture.

Capital Programming

Metro has developed a new capital programming process to standardize investment identification, approval processes and to ensure more disciplined project management. In addition, functional and organizational changes, including the September 2019 reorganization that created the Strategy, Planning & Program Management (SPPM) and Capital Delivery (CAPD) departments, have been implemented to better ensure strategic investment planning and coordinated project execution. Many of these recent enhancements happened after the initiation of the RTU replacement project.

As part of the improved capital programming process, in Fall of 2019, it became clear that a fully developed plan was not yet available for RTU replacement. For this reason, future funding for RTU replacement was placed on hold as outlined Metr**o's** December 2019 *Program of Projects.* The action to place additional work on hold was taken before the capital programming team became aware of the

OIG audit and effectively assured that significant capital funds would not be provided until a revised plan was in place (funding to develop the plan continued).

Please note that due to the significant financial challenges currently facing Metro, the future pace of investment in these systems continues to be subject to funding availability though it is a high priority for the agency due to the safety and operational implications.

Response to Recommendations

1. *Revise the scope of the project to eliminate the interim IT RTU replacement project and put the $62.9 million to better use. (Action: EVP CAPD, EVP SPPM, and EVP IBOP).*
   Response: *CAPD, SPPM and IBOP will revise the scope to focus resources on the migration to the new distributed architecture, eliminating the interim solution. CAPD, in collaboration with IBOP, is developing the comprehensive program of work required to complete the migration and will advise SPPM on programming changes necessary for incorporation into the overall capital program in FY22. This action will be complete by June 2021.*

2. *Review the IT RTU replacement contract to determine how it can be leveraged to address a permanent solution. (Action: EVP CAPD and EVP IBOP)*
   Response: *CAPD and IBOP will review the contract to determine if/how it can be leveraged to address the permanent solution, including the need to develop comprehensive program strategy documents, including scope definitions for the associated projects and clarification of the interfaces. This action will be complete by August 2021.*

3. *Complete the enterprise-wide architecture analysis and develop corresponding requirements for the overall RTU replacement project to ensure the implementation of the required solution. (Action: EVP CAPD, EVP SPPM and EVP IBOP)*
   Response: *Metro will complete the permanent future state high-level SCADA architecture. Metro will finalize the details and document the long-term plan (as noted in Recommendation 4). In addition, Metro (CAPD, SPPM, and IBOP) will develop the corresponding requirements for overall RTU replacement by October 2021.*

4. *Develop and implement a long-term ICS/SCADA modernization strategic plan with an associated safety risk assessment which would include RTU replacement and train control systems upgrade. (Action: EVP CAPD and EVP IBOP)*
   ***Response:** CAPD and IBOP will develop the long-term ICS/SCADA modernization strategic plan by June 2021.*

5. *Develop oversight controls such as an executive steering committee or technical architecture oversight committee across projects to oversee the implementation of RTUs enterprise-wide. (Action: EVP CAPD, EVP SPPM, and EVP IBOP).*
   ***Response:** CAPD, SPPM, and IBOP will establish an executive steering committee by December 2020.*

6. *Implement controls that require critical stakeholders and process owners to sign off on key deliverables and project stages. (Action: EVP CAPD, EVP SPPM and EVP IBOP)*
   ***Response:** The controls outlined above currently exist throughout the organization and will be aligned to create clarity and instill accountability. This action will be addressed by December 2021.*

7. *Develop an enterprise-wide project management communication plan to improve collaboration of key stakeholders. (Action: EVP CAPD and EVP IBOP)*
   ***Response:** CAPD and IBOP will formalize the plan as part of the ICS/SCADA modernization strategic plan. The communication plan will be established by June 2021.*

8. *Implement security controls across the RTU enterprise-wide project. (Action: EVP CAPD and EVP IBOP)*
   ***Response:** Security controls are already **included in Metro's processes and** will be included within the ICS/SCADA modernization strategic plan. This action will be implemented by CAPD and IBOP by June 2021.*

9. *Prioritize and implement the Ancillary Fiber Optic Communications project to provide fiber optic connectivity to RTUs in facilities, train control rooms, substations, etc., and replace RTUs and the Data Transmission System with fiber cables, as necessary. (Action: EVP SPPM, EVP CAPD and EVP IBOP)*

Response: *Metro will prioritize this investment through the capital program development process managed by SPPM and implementation planning by CAPD. This action will begin immediately, and the plan and programming requirements will be completed by August 2021.*

cc: **MARC – Elizabeth** Sullivan, VP

Appendix C

WMATA's Project Lifecycle Management Process

A Summary of WMATA's PLM Process Stages

PLM Stages	Description
Stage 1: Assess and Authorize	1. A preliminary assessment is conducted to ensure that the business need is consistent and aligns with WMATA IT goals. 2. A Project Charter is prepared including key stakeholders. 3. Cost estimates are prepared, and high-level analysis and preliminary risk assessments are performed to establish the business case for proceeding forward in the lifecycle. 4. Enterprise level steering committee to review and approve the projects.
Stage 2: Plan and Define	1. The Project Manager collaborates with the Program Manager, other impacted business and technical groups to create the Project Management Plan. 2. Specific plans for management and governance of the project are established and documented to guide on-going project execution and control. 3. Business requirements are developed, analyzed, and decomposed into functional and non-functional requirements in a requirements specification document. 4. Current state architecture is defined, a test strategy is outlined, and a project transition plan is initiated.
Stage 3: Design and Build	1. This stage seeks to develop detailed specifications that emphasize the physical solution to the customer's information technology needs. 2. Define current and future business processes. 3. Documented requirements are further refined and allocated into system design specifications suitable for implementation within the constraints of the physical environment. 4. Prepare a requirement management plan(s) and requirement specifications document.
Stage 4: Test and Validate	1. This stage determines whether the solution developed, and unit tested during the Design and Build stage is ready for implementation. 2. Formal testing is performed to uncover errors and bugs that will need to be resolved. 3. System integration, regression, and user acceptance are performed. 4. A Test Readiness Review will also occur to ensure all preparations have been made before testing procedures commence.
Stage 5: Deploy and Transition	The project is deployed into production dependent on Go/No Go decision. The final system must be formally authorized before use in production.
Stage 6: Sustain and Monitor	The deployed solution operates in the full-scale production environment for sustained use, maintenance support, and performance monitoring.
Stage 7: Disposal	1. The operation of a solution is formally retired or disposed of based on determinations made during the Sustain and Monitor stage and in accordance with WMATA needs and standards. 2. Proper preservation of the data processed by the solution as necessary.

Appendix D

TO REPORT FRAUD WASTE OR ABUSE

Please Contact:

Email: hotline@wmataoig.gov

Telephone: 1-888-234-2374

Address: WMATA
Office of Inspector General
Hotline Program
500 L'Enfant Plaza S.W., Suite 800
Washington, D.C. 20024