

AUTOMATED TRANSIT BUS MAINTENANCE AND YARD OPERATIONS DEMONSTRATION PROJECT

CapMetro

CAPMETRO YARD AUTOMATION RESEARCH & DEPLOYMENT (YARD) PROGRAM

CAPITAL METROPOLITAN AUTHORITY (CAPMETRO)

IN PARTNERSHIP WITH PERRONE ROBOTICS, CLEVER DEVICES, TEXAS A&M TRANSPORTATION INSTITUTE, AND WSP



U.S. Department of Transportation
Federal Transit Administration

PROJECT SUMMARY

Automation Level(s): 4

On June 8, 2023, the Federal Transit Administration (FTA) announced the award of \$6.5 million to six projects to further the research in transit automation technologies aiming to improve safety and efficiency in bus service and yard operations. The FTA selected the Capital Metropolitan Authority (CapMetro) to participate in advancing transit bus automation research through Level 4 automation demonstrations within an active bus yard.

Building upon the Strategic Transit Automation Research (STAR) Plan, CapMetro intends to identify potential benefits and efficiencies of automating a Battery Electric Bus (BEB) fleet through the YARD demonstration program. The FTA Automated Transit Bus Maintenance and Yard Operations Demonstration Program is one of several research initiatives under the multi-year FTA's STAR program. The demonstration will be the first of its kind in North America, further cementing CapMetro's role as an industry leader in transit innovation.

The FTA Grant Program includes \$1.5 million to fund projects dedicated to transit bus and transit worker efficiency and safety in bus yards. The FTA identified the following activities for the demonstration: engineering tasks leading to the demonstration of Automated Driving Systems (ADS) use cases including FTA requirements, architecture, and design developments, equipment installation and integration, and pre-demonstration testing. CapMetro will provide the following deliverables as part of a successful Phase I:

- Physical deployment of two Level 4 electric automated vehicle demonstrations – one with a cutaway shuttle bus and the second, a retrofitted heavy-duty BEB from CapMetro's existing fleet.
- A workforce assessment of how bus yard automation may impact existing roles and create demand for new positions at CapMetro.
- Developing software requirements and schematic design for the first automated bus yard dispatch system that can remotely engage and direct automated BEBs simultaneously.
- Complying with all reporting requirements directed by the FTA.

The heavy-duty BEB vehicle automation demonstrations will highlight four specific use cases during Phase I of the Yard Program including parking and recall, bus wash, precision-docking, and automated charging. These use cases were selected due to the potential operational and safety benefits of automating current daily yard maneuvers. The CapMetro Project Team comprises transit automation Subject Matter Experts (SMEs) that possess unique industry-leading experience deploying and testing three of the four selected use cases (parking and recall, precision-docking, and automated charging) with a 40 ft. heavy-duty Level 4 BEB. The Phase I demonstration will include retrofitting an existing BEB from CapMetro's fleet with Perrone Robotics' TONY automation kit. A key differentiator of the automated bus yard deployment will include testing the feasibility of autonomous BEB charging with an overhead pantograph dispenser that will be installed at the North Ops bus yard.

PROJECT GOALS

The fundamental goals of CapMetro's ADS YARD Program include:

- Testing and assessing the potential future benefits and challenges of automated battery electric buses through routine bus yard maneuvers.
- Collaborating with CapMetro frontline staff to better understand the potential workforce impacts.
- Determining the long-term viability of fleet-wide bus yard automation for current and future CapMetro bus depots
- Sharing lessons-learned from the AV demonstrations with CapMetro stakeholders and industry partners to improve and inform future requirements of fleet automation solutions.

PROPOSED SCOPE OF WORK

Below are the project assumptions guiding the Phase I delivery of the CapMetro YARD Program:

- Retrofitting a BEB from the existing fleet to safely perform the required maneuvers without the assistance from a driver.
- Collaborating with stakeholders to complete a workforce analysis, including a comprehensive short- and long-term assessment of the impacts of vehicle automation, thereby enabling CapMetro to proactively plan for future workforce needs.
- Completing all project requirements within the stated 12-month timeframe, including a summary report to the FTA, ultimately positioning the industry to consider fleetwide testing of bus yard automation through a second funding phase.

VEHICLE INFORMATION

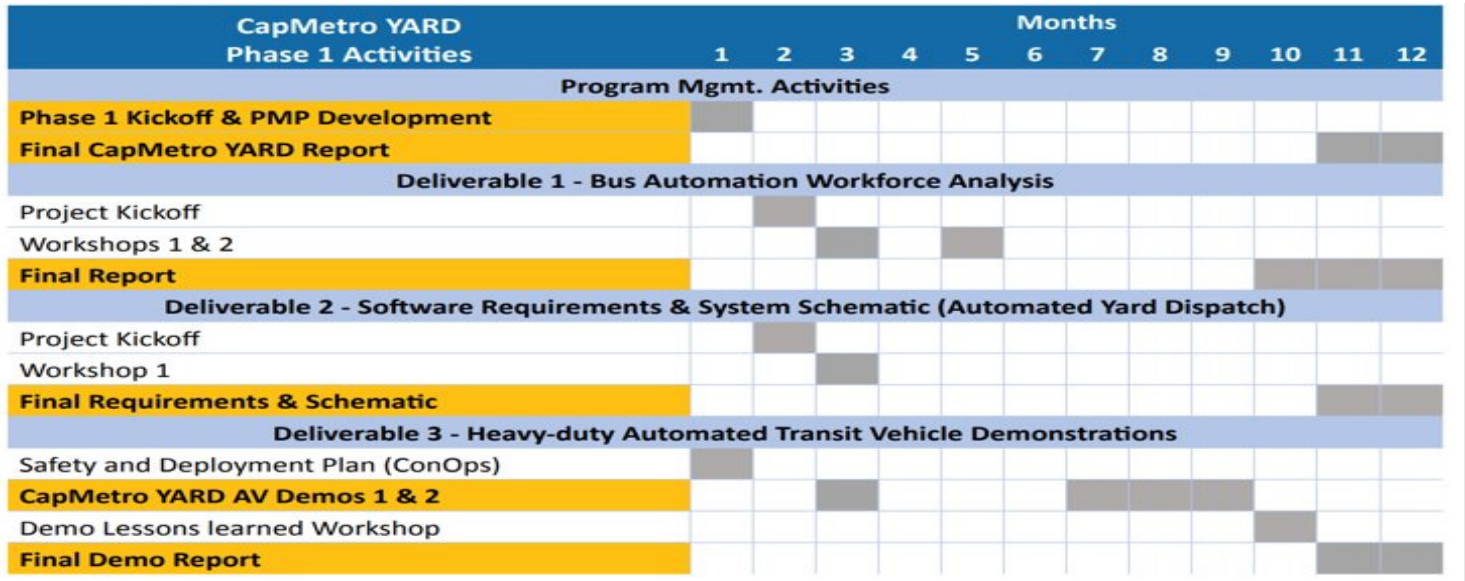
This project anticipates using a GreenPower AV Star Cutaway Bus and a New Flyer XHE 40-Foot Excelsior Bus. Both vehicles will be equipped with an ADS provided by Perrone Robotics.

DATA COLLECTION, MANAGEMENT, & SHARING

Data Management Plan (DMP): documenting information flow between existing systems of record at CapMetro and systems new to the project. The DMP will encompass information such as the type of data collected, data structure, data schema, data volume, variety, and calibration, ultimately supporting a data analytics system for reporting KPIs. CapMetro will participate in the Community of Projects to share information and will share the final report and data.

PROJECT STATUS & SCHEDULE

The CapMetro Project Team anticipates this work beginning in September 2023 and completing it in December 2024.



BUDGET

The total project cost is estimated at \$1,261,800, with \$949,500 awarded by the FTA and \$237,300 in local matching funds, and \$75,000 in In-Kind matching funds.

| FTA Funding | Non-Federal Cost Share | Total Amount |
|-------------|------------------------|--------------|
| \$949,500 | \$312,300 | \$1,261,800 |