Metropolitan Transportation Authority
State of New York

Request For Expression of Interest (RFEI)

Instrumenting Revenue Cars for Automated Right of Way Monitoring

Vendor Questions Due date : April 8, 2025 at 4:00PM
Email Questions to Howard.Hall@mtahq.org

MTA Response to Vendor Questions Due: April 12, 2025 at 4:00PM

RFEI Responses Due: April 18, 2025 at 4:00 PM
Email Responses to Howard.Hall@mtahq.org

Request for Expressions of Interest: Instrumenting Revenue Cars for Automated Right of Way Monitoring

Background: The Metropolitan Transportation Authority (MTA) operates the largest public transit network in North America, serving millions of passengers daily across New York City. As part of its ongoing modernization efforts, the Department of Subways ("Subways") is exploring opportunities to instrument its passenger trains "revenue trains" with sensors and other data collection devices to generate an automated and timely data source for right of way monitoring, including track conditions, power systems, and other critical assets. The goal is to leverage this data to better predict, identify and remediate issues, reducing delays and enhancing system reliability.

Currently, information on track conditions is provided by both specialized Track Geometry Cars (TGCs) and manual inspections performed by Track Inspectors. The TGCs are equipped with a variety of sensors, including high-resolution video cameras, ultrasonic sensors, thermal imaging devices, and lasers (See Appendix A for list of sensors). These tools are used to identify track geometry issues, rail wear, encroachments, loose or missing hardware, and other defects. Manual inspections complement the TGC runs by bringing Track personnel into the field to identify and remediate issues.

Instrumenting revenue trains holds the promise of complementing our current approach with additional high-frequency data. This can enable faster detection of defects, helping to prevent structural issues and downstream impacts such as signal malfunctions that could lead to delays. By retrofitting revenue cars with commodity hardware, the MTA aims to create a continuous and scalable condition monitoring system that supplements our traditional inspection methods, enabling earlier detection and proactive maintenance.

What Are We Trying to Do Better?

1. **Quicker Detection**: By instrumenting revenue cars, Subways seeks to more quickly identify and remediate track issues. Continuous data collection will enable identifying and remediating issues—e.g., replacing a rail or securing a loose manhole cover – as quickly as possible.
2. **AI-enabled maintenance**: Subways aims to leverage AI and analytics to uncover upstream conditions that contribute to downstream failures. For example, one of the most common causes of subway delays is signaling equipment malfunctions. These can be caused by upstream issues, such as excess vibration or track misalignment, that can be mitigated through targeted track repairs. Advanced analytics will help prioritize these fixes to reduce subway delays.

Principles: Guiding principles for this effort include:

1. **Continuous Data Collection**: Deploying additional sensor technology on revenue trains to gather real-time track condition data that can lead to actionable analysis
2. **Advanced data analysis**: Implementing algorithms to detect anomalies and prioritize issues based on severity. MTA also aims to use AI[i] to analyze right of way conditions in conjunction with asset performance, for instance, to identify the types of issues or clusters of issues that may cause future subway delays. The system should account for the fact that defects, even when classified under the same severity level, may vary in urgency and required response. The data is intended to supplement the ongoing TGC and manual inspections.
3. **High frequency processing**: Ensuring collected data is available for review and action on the same day or the next day.
4. **Modular Architecture**: Supporting an adaptable framework that allows multiple vendors to contribute different analytical capabilities. The MTA's ultimate goal is to establish an open architecture capable of accommodating a variety of sensor hardware from different manufacturers, as well as diverse analytical solutions from various firms.
5. **Integration with MTA Systems**: Ensuring interoperability and compatibility with existing infrastructure, including Enterprise Asset Management (EAM) platforms which contain information about assets and their reliability, and Geographic Information System (GIS) tools.
    a. Raw/Processed Programmatic Data Access:
        i. In order to support this analysis internally and to integrate this data with other analytics at MTA, data needs to be accessible in a machine readable format and using an endpoint that can be accessed in an automated fashion. All data collected by the system is subject to access by the MTA in this fashion.
        ii. Data from the system should be made available to the MTA programmatically. Possible forms of data access:
            1. API
            2. Database Access
            3. Cloud object storage access
            4. Batch delivery over SFTP
            5. Raw data from the devices should be available no later than next day
            6. Processed data (detections) should be available no later than next day

Questions for Firms Expressing Interest: MTA is seeking information from firms with expertise in sensor deployment, data collection, and/or AI/ML-driven (Artificial Intelligence/Machine Learning) analytics. The information gathered through this Request for Expressions of Interest (RFEI) will help MTA assess available solutions and inform potential future solicitations. The scope is not limited to track inspections but also encompasses monitoring of other assets. Interested firms should respond to the following:

1. **Technical Approach**:

    - What technologies and methodologies would you propose for sensor placement, data transmission, and AI/ML-based analysis?
    - How would you handle challenges such as underground connectivity, GPS limitations, and data processing at scale? Outdoor areas are also exposed to the elements.
    - What measures would you implement to minimize false negatives in defect detection? False positives?
    - What approaches would you take to analyze understand what track conditions may lead to delays?

- What MTA data sources would you require to effectively build and train defect detection models? Please describe how you would integrate real-world rail defect data, historical maintenance records, or other available sources into your analysis. The MTA has granular data sources available that can be provided upon further engagement.
- While not a requirement, please indicate if your solution incorporates technologies such as Multimodal Generative AI, real-time data streaming, and/or petabyte-scale, fully managed data warehouses for massive data storage and analysis.

2. **Implementation Strategy**:
   - What would be your approach to piloting, scaling, and fully deploying these approaches?
   - How would you coordinate with MTA for hardware installation and ongoing system maintenance?
   - What cybersecurity and data privacy measures would you incorporate, and how would you align them with MTA's existing cyber and data requirements?
3. **Experience and Qualifications**:
   - Describe your firm's expertise in AI/ML, sensor technology, and/or transit infrastructure monitoring. We are looking for vendors with prior experience in railroad environments, particularly in detecting and analyzing rail defects.

   - Provide examples of similar projects you have completed, including details on:

     - Clients and their environments (ideally other rail operators)
     - Implemented technologies and processes
     - Outcomes achieved

   - Provide key personnel profiles and their relevant experience.

Process Overview: To ensure flexibility and avoid premature commitments, MTA will follow a structured evaluation and exploration process:

1. **Market Exploration**: This RFEI is being issued to gauge interest and identify firms with relevant experience and technical capabilities.
2. **Vendor Shortlisting**: Based on responses, MTA will identify at its sole discretion firms with suitable qualifications for further discussions.
3. **Technical Consultations**: Any selected firms will be invited for detailed discussions to explore technical feasibility, system integration, and deployment strategies. Selected firms may be asked to submit more detailed proposals including expected outcomes, and cost estimates.
4. **Evaluation and Next Steps**: Informed by responses through this RFEI process will evaluate whether and how to proceed to pursue this opportunity.

Submission Instructions: Submissions should be limited to 10 pages, with resumes and supplementary materials provided as appendices.

As noted above, MTA reserves the right to request further discussions with selected firms based on their responses

Appendix A

Sensors onboard TGC

Sensor	Utilization	Software	Hardware
Thermal Imaging	Detect hotspots	I R Video Software	FLIR Camera
Ultrasound	Rail Flaw Detection (cracks)	DAPCO RTS400	DAPCO RTS400
Geometry Swords	Rail Geometry	Plasser Onboard/offboard	Plasser Onboard/offboard
Geometry laser	3rd rail geometry, rail wear, flangeway	Plasser Onboard/offboard	Plasser Onboard/offboard
Riegl Laser	Clearance, crosscut	Plasser Onboard/offboard	Plasser Onboard/offboard
Cameras/video feed	Track Defects • Right of Way Video • Track Components Video • Rail Side View Video • Third Rail Video • Trip Arm Video	BvSys Onboard/offboard	BvSys Onboard/offboard

MTA Cybersecurity Terms & Conditions along with requirements

MTA Cybersecurity Terms and Conditio

[i] All data generated during this RFEI or any subsequent procurement as a result of this RFEI is the property of the MTA and may not be used to train any AI service or tool without the MTA's explicit written consent.