

CTA Innovation Studio Update

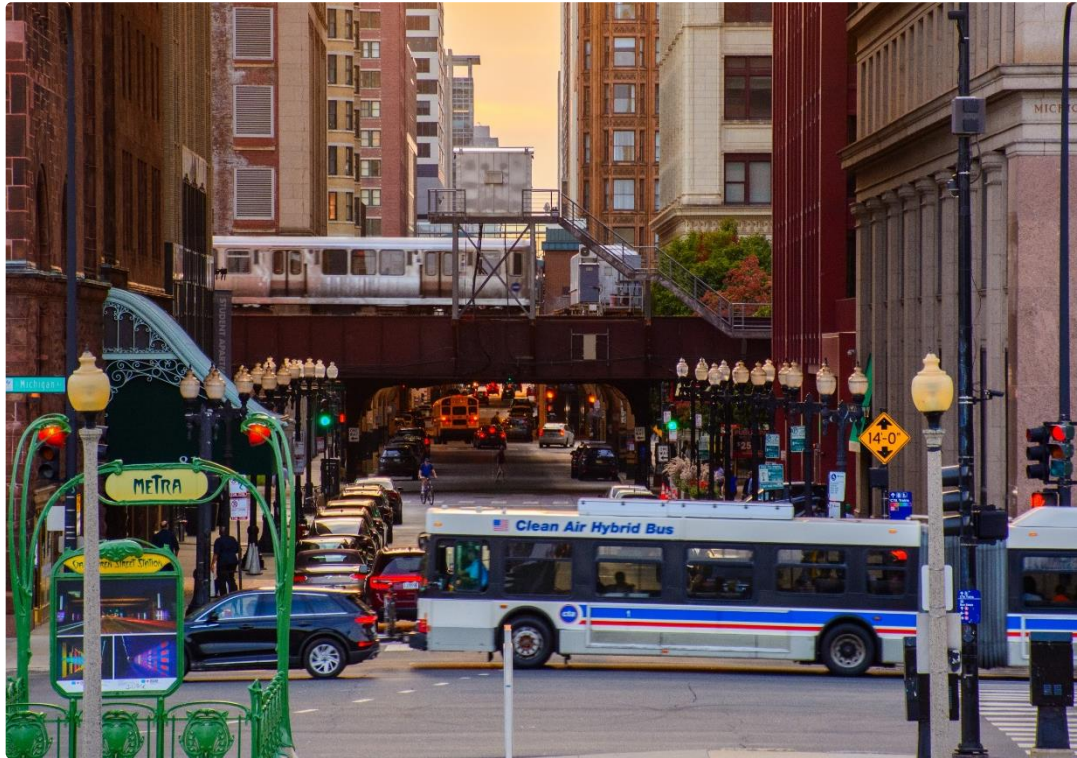
Sandbox Carbon Proposal to use Activated Carbon Filters on Railcars

January 2025



Chicago Transit Authority

Improving Air Quality and CTA Passenger Experience



How can CTA mitigate the impact to customers of smoking on vehicles?

Innovation Studio problem statement launched June 2025, seeking solutions to help mitigate the smell and harmful particles associated with secondhand smoke and other unpleasant odors. CTA sought solutions that are:

- Low Maintenance
- Able to be installed with little workforce effort
- Able to perform in a variety of outdoor weather conditions

Pilot Proposal

Staff recommends approval of a Smoking Mitigation pilot with Sandbox Carbon:

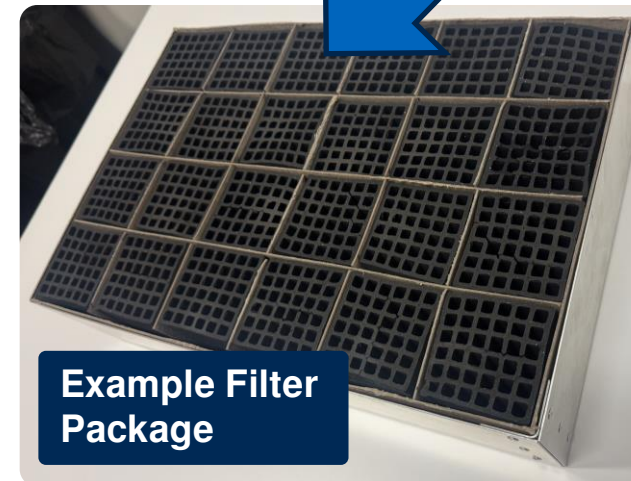
- CTA received 9 proposals to this Innovation Studio problem statement.
- Sandbox Carbon demonstrated an innovative way to integrate activated carbon filters into the existing HVAC system on railcars with an advanced sensor kit to monitor filter performance.
- CTA is seeking board approval for a \$65,075.24 pilot on 8 railcars lasting 1 year.



Sandbox Carbon Pilot Overview

CTA will install Sandbox Carbon's activated carbon filters on eight 5000-series railcars (red line or green line)

- Filters will be installed in the return air ducts, which pull air from the cabin for the HVAC system
- A protective metal grate covers the filter and return duct to prevent debris from entering
- CTA will also install two sensors in the pilot railcars to monitor common byproducts of odors
- Sensors will monitor air flowing through HVAC system



Defining Success with Metrics and Internal Stakeholders

Stakeholders involved in project implementation and evaluation

Safety

Planning and
Innovation

Rail Equipment
Engineering

Metrics to evaluate pilot performance



Odor reduction time

Number of minutes it takes for Volatile Organic Compound (VOC) levels to return to baseline following a cigarette smoking event



Customer Perception of Odor

Number of minutes after a cigarette smoking event that customers can perceive the smell.



Duration between filter changes

Number of days filters can meet odor reduction targets before needing to be changed



Time to change filters

Number of minutes it takes CTA personnel to change filters



Air circulation reduction

Impact of filters on air circulation in the railcar HVAC system

Appendix

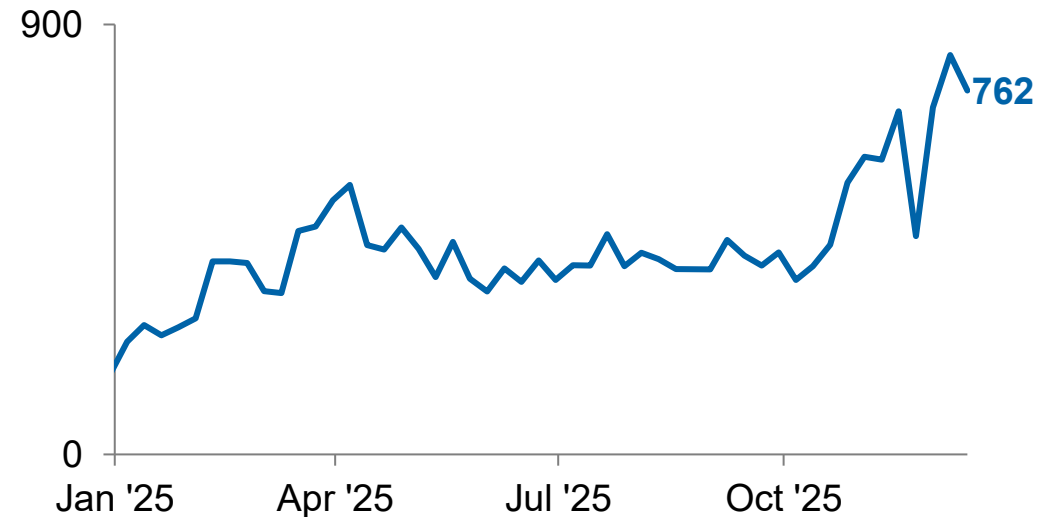


Chicago Transit Authority

Cleanliness and Smell Complaints at CTA

- Smoke is a top customer complaint
- Cleanliness on CTA trains received the lowest customer satisfaction rating on the Spring 2025 Customer Survey with only 41% of respondents reporting satisfaction. 89% of dissatisfied respondents indicated that their dissatisfaction with train cleanliness was due to unpleasant smells.
- CTA has increased resources to address smoking complaints including on board announcements regarding 'no smoking' and completion of 59 no smoking missions since April 2025 led by CPD and CTA security resources that alone resulted in 586 citations.
- However, various smells linger on railcars and degrade the passenger experience

Weekly Complaints of Smoking on Trains to CTA Chatbot



Railcar Environment is Challenging for Integration

CTA's railcars leave little room for integration of new, post-production/retrofit solutions, the solution chosen for the pilot needed to:

- **Address Odors:** Most standard HVAC filters do not filter Volatile Organic Compounds (VOCs), the particles responsible for smells and some harmful effects
- **Avoid damaging the existing HVAC system:** Replacing existing filters with a HEPA filter could have damaged the blower motor and reduced airflow below requirements
- **Be Resistant to Vandalism:** Solutions protruding into passenger areas of the railcar reduce passenger capacity and are more vulnerable to vandalism

Sandbox Carbon addressed these issues

- ✓ **Mitigates Odors**
Filters made entirely of activated carbon ensure the solution addresses odors
- ✓ **Little Impact to Airflow**
Sandbox Carbon's activated carbon filter design and manufacturing process, backed by airflow simulations and practical tests, ensure no damage to HVAC
- ✓ **Resistant to Vandalism**
Filters integrated into existing return air ducts with protective covers limit vandalism potential and ensure no impact to passenger capacity

Sandbox's sensor proposal for monitoring performance was the most advanced of all vendor responses, with sensors directly measuring specific combustion byproducts.

Sandbox Carbon Pilot Milestones and Deliverables

Hardware and Software Deliverables

Hardware

- A custom extrusion die used for manufacturing the activated carbon filters
- 70 Filter Enclosures and 170 Filters (enough for 8 railcars, and additional spares)
- 8 Instrumentation Kits, each including a Data Logger, Smoke and Odor Sensors, and other components

Software

- Cloud Storage for storing Smoke/Odor sensor data for analysis

Pilot Timeline

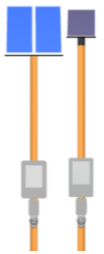
- Sandbox Carbon estimates 2 months for initial design and first manufacturing order
- Sensors installed on railcars will collect data for an initial 2 months without filters to determine a baseline level of pollutants
- Sensors will collect data with filters for 10 months to determine filter effectiveness and longevity
 - Filters will be replaced every 60 days alongside standard maintenance
- Pilot hardware installed on vehicle for 12 months

E-Paper Bus Stop Signs – Progress Update

Customer Experience – Real-Time Info at Bus Stops

- Executed contracts, totaling \$110,000, for pilots with Global Display Solutions (GDS) and Papercast in January 2025 to provide 20 e-paper bus stop signs
- Signs installed at 16 of 17 planned locations
- All signs include text-to-speech buttons which will read upcoming arrivals

Global Display Solutions

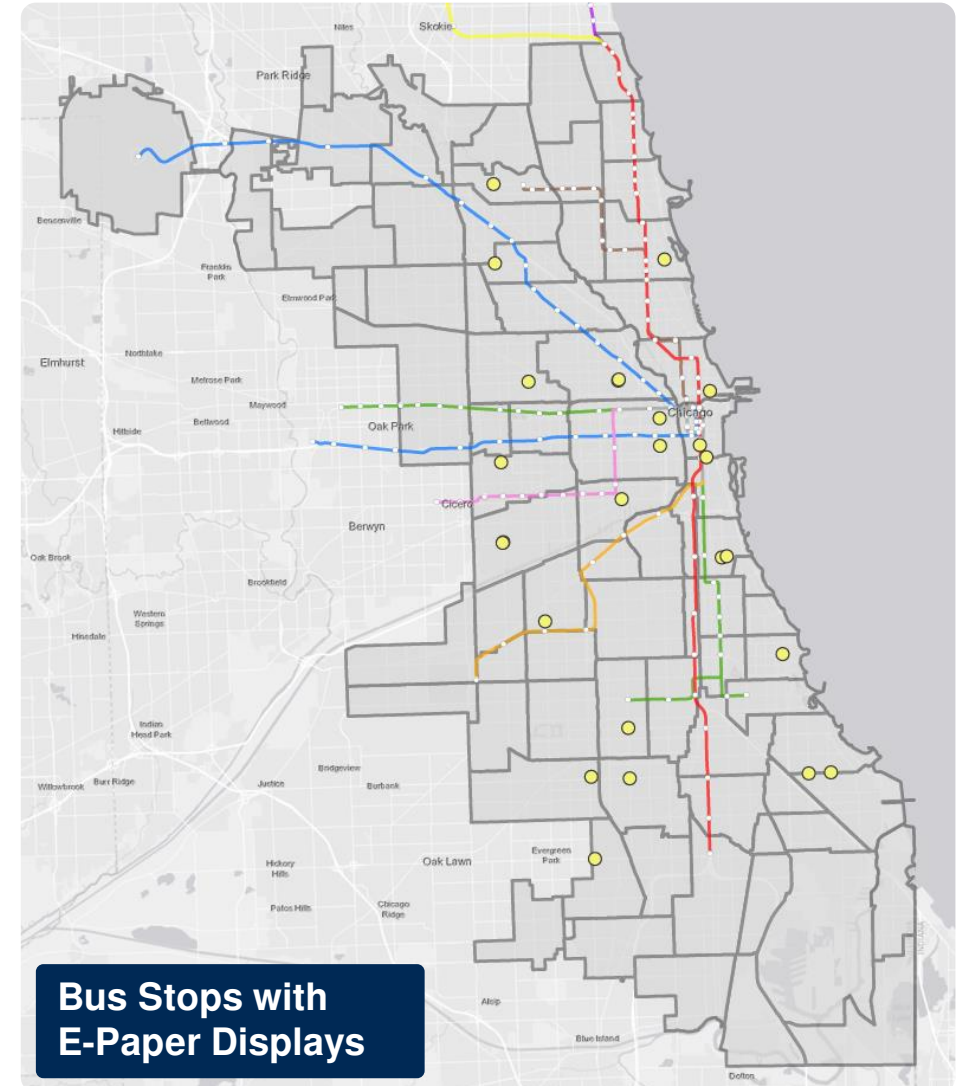


- 5 Flex Displays (13”), Requiring > 4 hours sun exposure
- 5 Low-Power (13”), Requiring >1 hour sun exposure

Papercast



- 5 Large Displays (23”), Requiring > 4 hours sun exposure
- 5 Battery-Powered (13”), Battery life lasting 3-5 years.

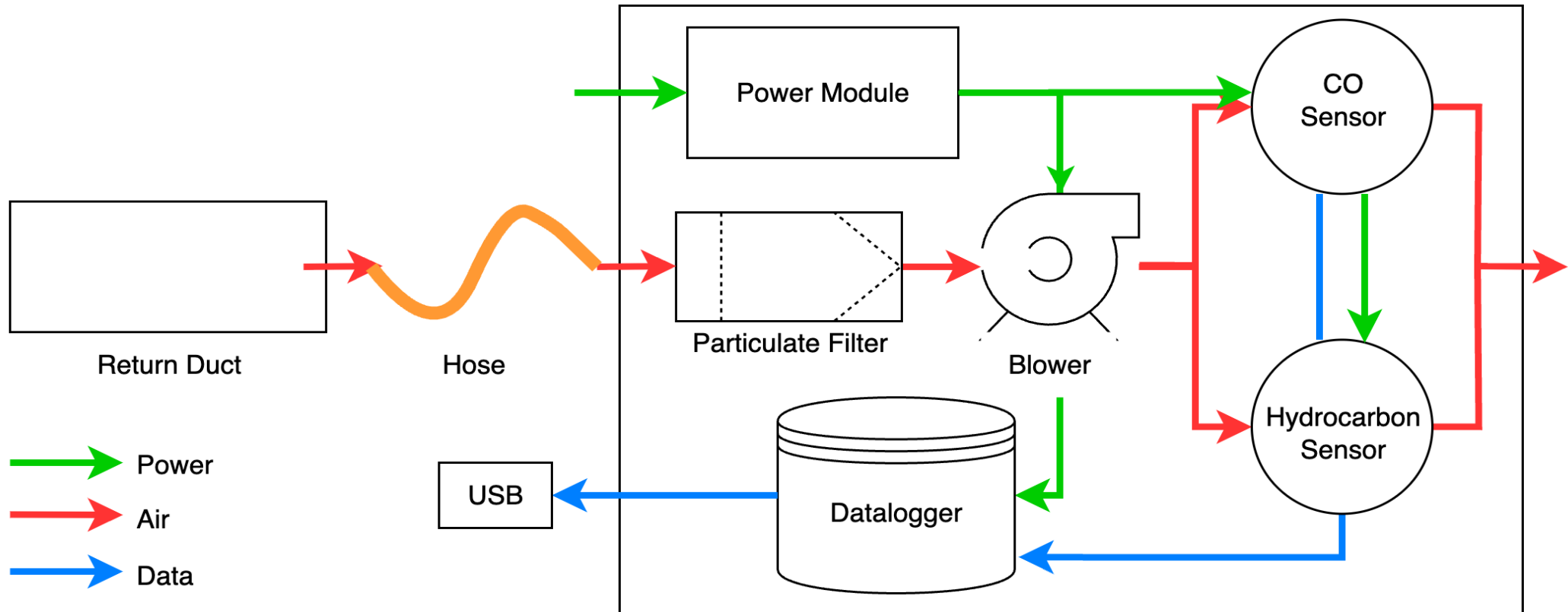


What is Innovation Studio?

- The Innovation Studio program allows CTA to pilot solutions and new technologies for some of the agency's biggest challenges
- Problem statement format allows CTA to learn about solutions we may not have otherwise been aware of, especially in the changing technological ecosystem
- After pilots are concluded, CTA to evaluate whether to pursue larger system-wide solution
- Since program initiation in late 2023, released three problem statements, resulting in three in progress pilots to date



Sandbox Carbon Pilot System Architecture



Existing Pilot Updates



2024 Innovation Studio Problem Statements



Customer Experience

How can CTA expand real-time arrival and alert signage to bus stops?



Two Digital Signage Pilots

- Text to speech functionality
- Devices installed at 16 of 17 planned stops throughout city



Safety

How can CTA automatically detect people or large objects on the tracks to enable swift intervention?



- Camera-based system with STV/Derq installed at two stations collecting data
- Sensonic fiber-optic system installed along 1-mile of track, vendor working on calibration



Process

How can CTA automatically monitor the condition of physical assets at bus stops or their use over time?



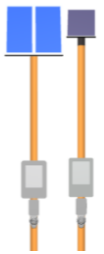
- No-cost pilot leveraging bus camera video anticipated to kick off in January 2026

E-Paper Bus Stop Signs – Progress Update

Customer Experience – Real-Time Info at Bus Stops

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- Signs installed at 16 of 17 planned locations
- All signs include text-to-speech buttons which will read upcoming arrivals
- Initial customer feedback indicates that e-paper signs are very well received

Global Display Solutions

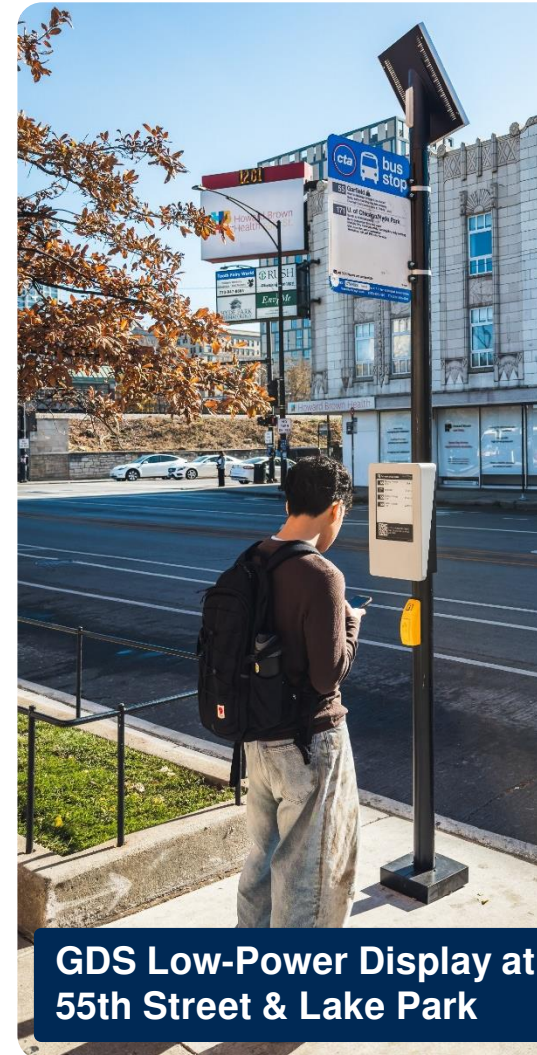


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GDS Low-Power Display at 55th Street & Lake Park



ROW Intrusion Detection Pilots – Status Update

- STV/Derq camera-based system installed at Cicero (Blue) and Ashland (Green/Pink)
 - Conducted system test using a crash test dummy and trash can liner to provide training data and determine accuracy of identifying intrusions.
 - System has successfully observed multiple ROW intrusions at these stations
- Sensonic fiberoptic sensing equipment installed between Racine and Illinois Medical District, undergoing vendor calibration

