Vehicle Maintenance & Engineering

AI Predictive Maintenance Technology

What nine months of evaluating AI for Predictive Maintenance taught us

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What is Intangles

THE PLATFORM

INTANGLES™
A DIGITAL TWIN COMPANY

Manufacturer and developer of the AI predictive maintenance platform and the digital twin models. Founded 2018.

THE PARTNER

ElitePath LOGISTICS

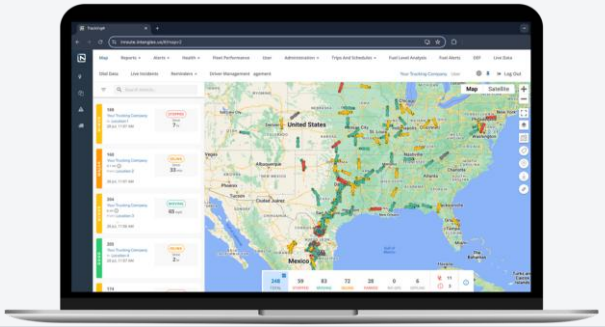
Authorized distributor and implementation partner. Installation, configuration, the bi-weekly correlation analysis and the validation review.

THE HARDWARE AND THE SOFTWARE

An on-vehicle device that passively reads the J1939 CAN network and transmits over built-in cellular — including the Dual-CAN variant that reads the second network.

The interface shows prognostic charts with per-vehicle ideal ranges, alert detail and vehicle health summaries.





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What predictive maintenance is — and is not

THE PROGRESSION

REACTIVE	PREVENTIVE	PREDICTIVE	PRESCRIPTIVE
the bus breaks, you fix it	you service on a schedule, needed or not	the bus tells you it is going to break	and the system prescribes the repair

It identifies correlations, deviations, trends and abnormalities…

WHERE THE DATA COMES FROM

The J1939 CAN network already on every bus. No new sensors, no modification to the vehicle. The device reads it passively and sends over built-in cellular. Notifications come back classified Critical, Major or Minor.

THE DIGITAL TWIN

A multi-layered, live running model of each bus. The foundational layer is a physics-based model of the powertrain; the top layer is learned from that bus's own data. "Normal" is per vehicle, not a fleet threshold.

WHAT IT IS NOT

- **Not simply a fault code reader.** The technology does provide live alerts for DTCs but that was not in scope for this pilot. The purpose was to evaluate the AI –based predictions and determine if it provided an advantage beyond the fault code.
- **Not a black box.** Every prediction is based off technician's input.
- **Not a replacement for preventive maintenance.** It tells you when your intervals are wrong.
- **Not a crystal ball.** Failures with no precursor signal cannot be predicted by anything.

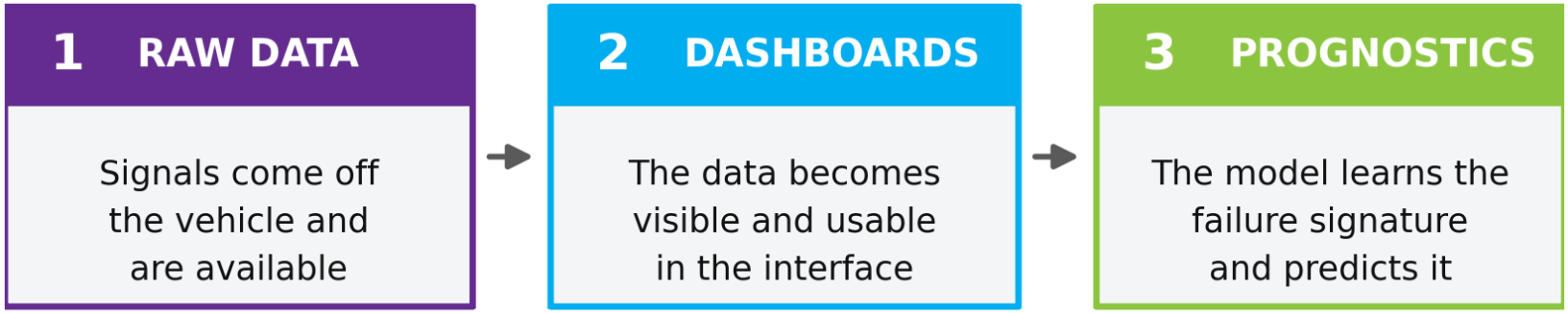


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How the pilot started — and how Metro shaped it

WE ASKED FIRST	Metro was surveyed on which failure modes hurt most — Doors and HVAC came back at the top. In December 2025 the pilot went live on 20 Division 3 CNG buses.
WHAT WE FOUND FAST	A correlation between undervoltage alerts and the BAE charging system. The signal was there; the direct view of the system producing it was not.
THE EXPANSION	20 more buses, and the newly released Dual-CAN device — so the platform could read the second CAN network and see the systems actually causing the problems.

HOW A CAPABILITY ACTUALLY GETS BUILT



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LA Metro's Request — add capabilities for…

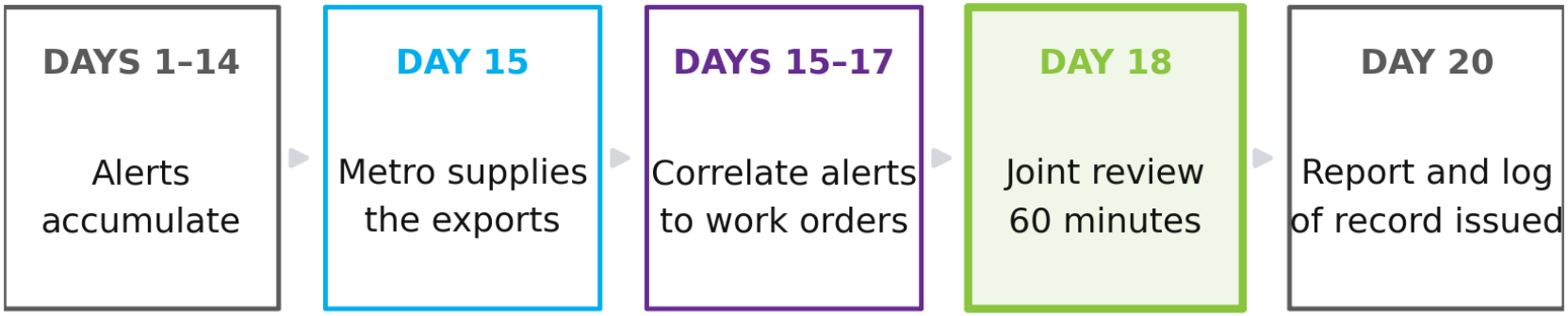
	RAW DATA	DASHBOARDS	PROGNOSTICS	
BAE charging / APS	●	◐	○	Guided repairs already adjust
Engine, coolant, air intake	●	●	●	In production
Doors	●	◐	○	Dashboards Q1 CY27
HVAC	●	◐	○	Codes Q4 CY26
CAN bus network health	◐	○	○	No date

Filled = in production · Half = in progress · Open = not started

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How we did the work

Every two weeks, for nine months



AN EPISODE

Alerts chain into a single episode that tells the story of a negative trend in that bus's health. One episode, one prediction, however many repairs it took. We count it once.

WHO DECIDES

The analysis is based on the data received. The verdict belongs to Division 3 supervision, with a validated prediction and refer it to the Technician.

TREND VS INSTANTANEOUS

A trend failure drifts measurably beforehand, and an instantaneous one does not. Our technicians make that call, and when they rule it instantaneous, we score it against the platform.

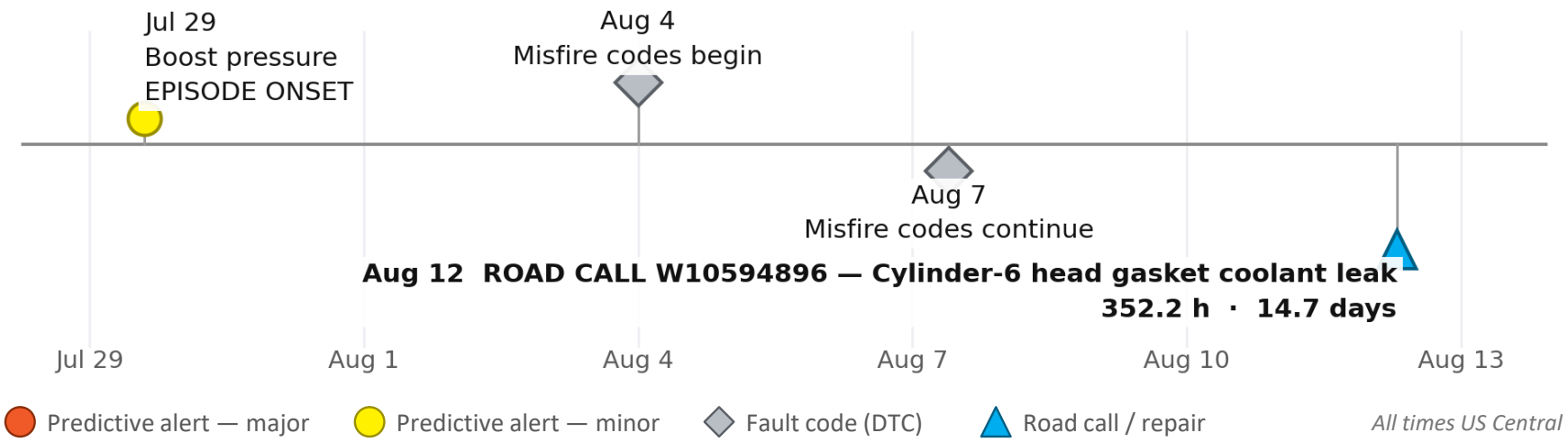
The guiding question: *"Did the technology provide enough warning to allow us to take action and prevent a road call?"*

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Example One

BUS 1913

The alert was in one system, and the failure was in another.



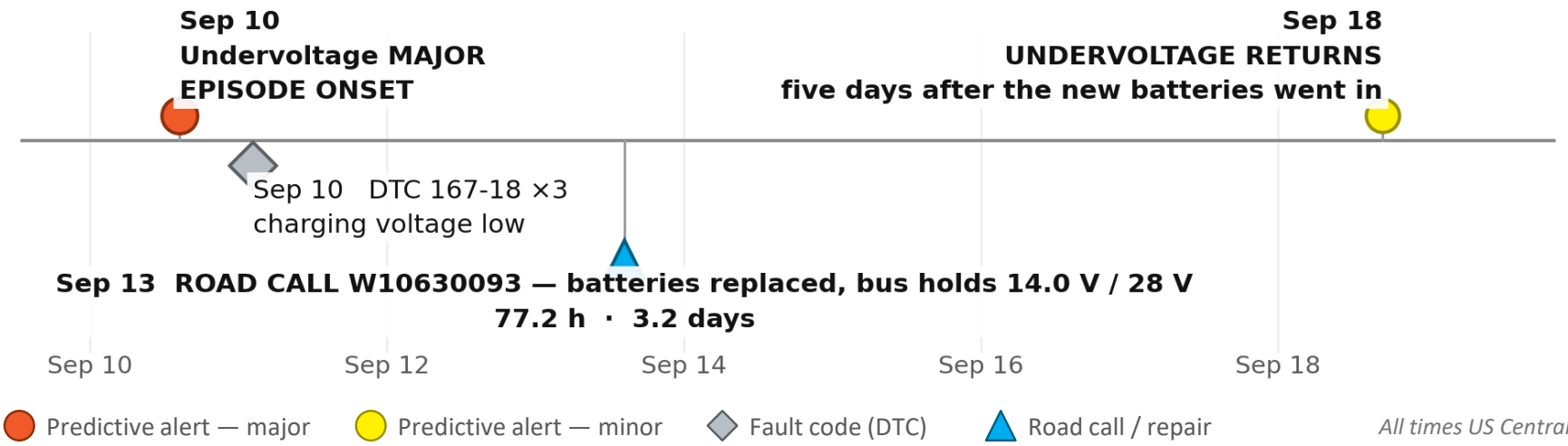
AI had a minor alert for boost pressure — misfire codes most of us always think plugs and coils are going bad. But after pulling the bus in we found a bad thermostat and a coolant leak. We replaced both. Once we placed the notes in AI this alert will now tell us this type of episode can be related to a coolant leak.
Now the system knows what was learned and we can prevent prior road calls from this alert.

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Example Two

BUS 1593 ·

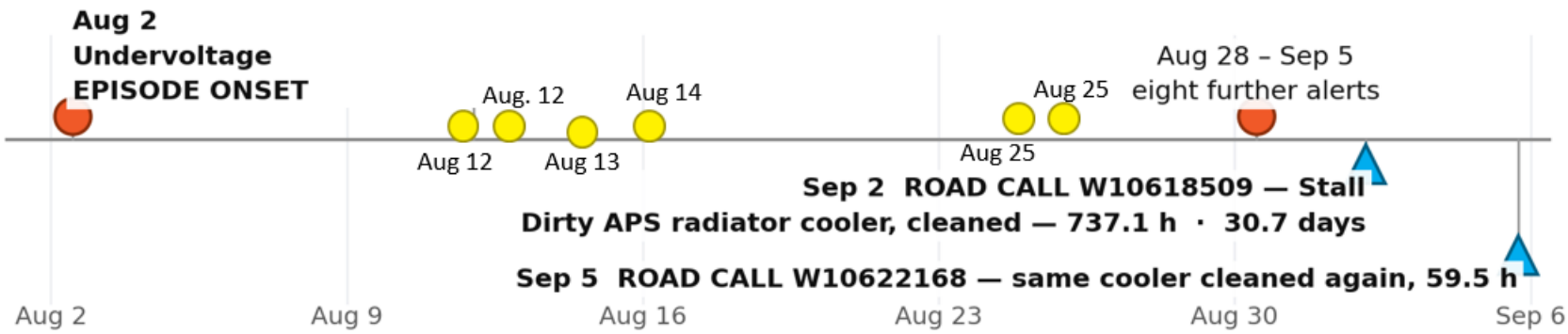
The repair was correct. We where not done.



The repair was completed but the diagnosis was incomplete. This taught us something new. Even though the bus was repaired we still had some fine tuning. The platform kept watching and told us we had not finished. We brought the bus back in at found out the alternator needed to be changed.

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Example Three

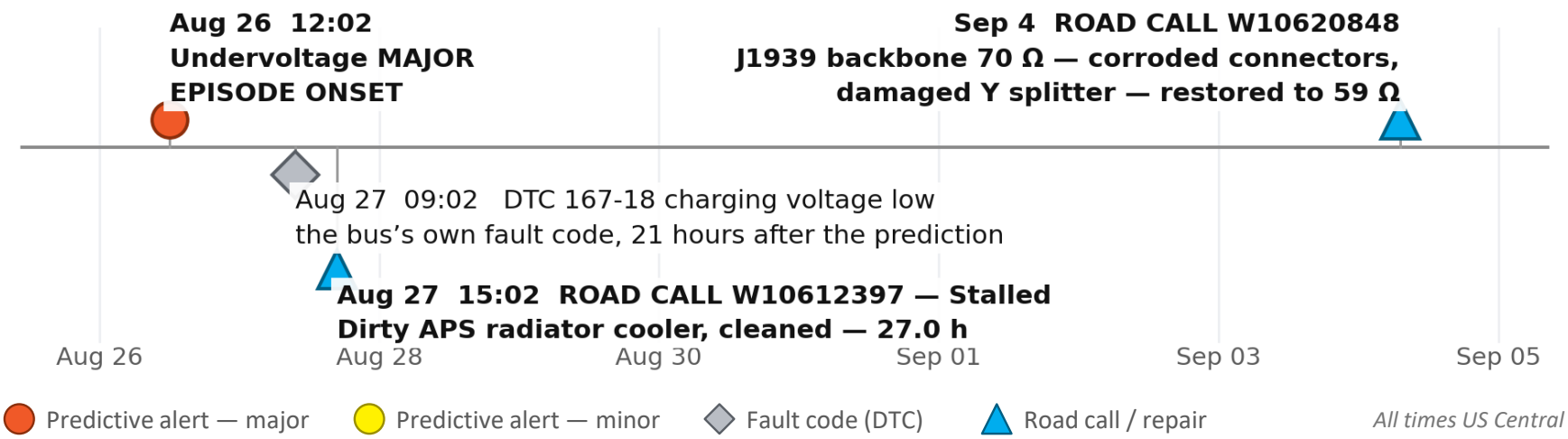


Predictive alert — major Predictive alert — minor Fault code (DTC) Road call / repair *All times US Central*

Eight buses over two months had a clogged APS radiator's cooler.
Note: we currently have a preventive maintenance interval every six thousand miles— AI did not just predict failures; it found a cleaning interval issue. So we thought. After further research the radiators were not cleaned on time.

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Example Four



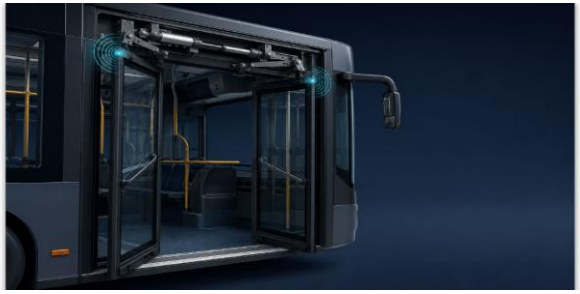
One was a cooling obstruction the another was corrosion in the network wiring. Four J1939 corrosion repairs in twelve days. We now have a campaign in motion.

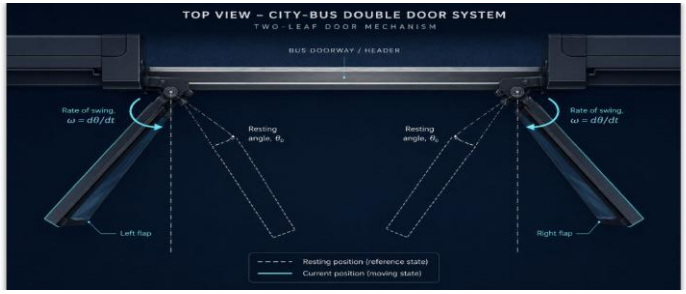
Ai just didn't predict failures it creates patterns by analyzing the data in the network to see common repairs. This accrues when we update the notes with the cause and the effect.

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What is being worked on next

DOORS — THE FAILURE MODE METRO NAMED FIRST, AND THE ONE FURTHEST ALONG





HOW THE DOOR MODEL WORKS

Every open and close is timed, counted, and tracked per door. The trigger is drift against that door's own 30-day baseline — a door 9% slower than last month is degrading.

A FIRST SIGNAL ALREADY

Bus 1916 produced twenty-six door position-drift codes in 27 hours, and a work order was raised proactively. No door road call followed. If that stands, it is the first door prediction on this fleet.

Service the door on its wear, not on the calendar.

HVAC

Suction, discharge and duct temperature are already in the interface. Fault codes Q4 CY2026, dashboards Q1 CY2027.

CAN BUS HEALTH

On the roadmap. No date, and we are not going to invent one.

THE GAP WE KNOW ABOUT

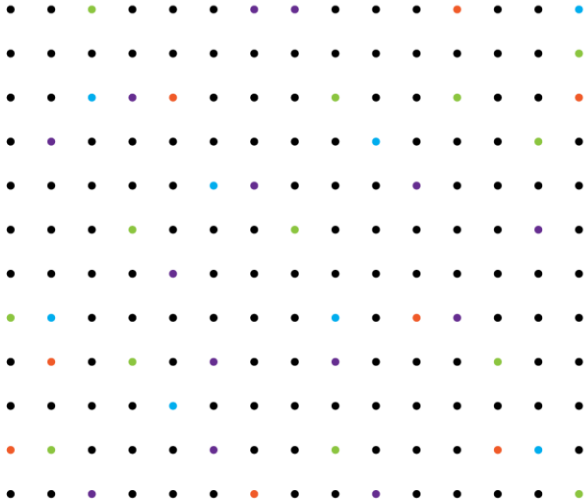
25 of 40 buses have no direct view of the BAE charging system — yet undervoltage is 86% of alert volume.

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Thank you

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