BEYOND CRUISE CONTROL

Key Benefits
- *Easier system integration*
- *Simpler design process*
- *Simpler vendor interface validation*
- *Improved maintenance and proactive measures*
- *Easier installation and removal of nodes*

LONWORKS® NETWORKS KEEP ACELA ZIPPING ALONG

Zooming up and down the U.S. Northeast Corridor at speeds of up to 150 mph, the glistening Acela trains from Amtrak were originally projected to shrink the Boston-to-Washington rail trip from about eight to six hours. Amtrak hoped Acela would revolutionize U.S. rail travel and save the company. To pull it off, Amtrak invested $800 million in 20 trainsets from manufacturing consortium Bombardier/ALSTHOM, which relies on the LONWORKS® platform, developed by Echelon, to oversee critical train systems.

One Acela trainset is made of two power cars and six coaches. The train holds 260 coach and 44 first-class passengers and offers features such as a very smooth ride, more comfortable and adjustable seating, electrical outlets, and conference tables. Acela's goal was to attract businesspeople seeking an alternative to the discomfort of car and air travel. Its goal, however, came with many challenges.

Making a Successful Bullet— Orchestrating the Systems

To begin with, Bombardier, the Canadian manufacturer, had to ensure safe and optimal operation at high speeds, maximize train uptime, and enhance communication with passengers. Next, even though Amtrak installed new rails, Bombardier had to run high-speed trains on lower-speed rail paths. This meant adapting to railway turns not designed for high speed. So Bombardier used technology that tilts the car as it goes

through a turn to compensate for lateral acceleration, thus keeping passengers unaffected.

According to Alain Poirier, project engineer at Bombardier for the Acela trains: "You wouldn't be able to walk inside the train unless you had the tilting. As well as tilting, each car uses another 15 to 20 systems that require constant monitoring and periodic maintenance, such as braking, doors, HVAC, speed sensing, speed limitation, fire, integrated truck surveillance, low-voltage battery charging, and more."

For example, the Amtrak ACSES system enforces speed limitations at specific points on the track.

"If you have a curve or tunnel where you want to limit the speed, there is a transponder on the track, installed by Amtrak. We have an on-board system that detects those transponders," explains Poirier. "With so many systems, Bombardier required an efficient, very reliable monitoring network for Acela crews. While designing the network, Bombardier also needed to simplify communication specifications to its many train systems vendors.".

Having used the LONWORKS platform extensively on other projects and feeling it was the right fit, Bombardier again chose LONWORKS solutions to meet the Acela requirements.

LONWORKS Networks Drive the Acela Nerve Center

As the scenery hurtles toward Acela, the engineer and assistant rely on a LONWORKS monitoring network for the train. They continually consult two LCD screens showing speed, pre-departure tests, brake gauges, and alarms. They also have a third screen with a schematic of the train and options that give the status of any system in any part of the train to any level of detail desired. Using a keypad, the crew can activate menus to obtain instantaneous information, critical for safe and efficient operation. In addition, using the LONWORKS network, the crew can control air dampers on the train, such as when entering a tunnel.

Controller
Vibration detection
Sensor
Vibration prevention with an electric actuator
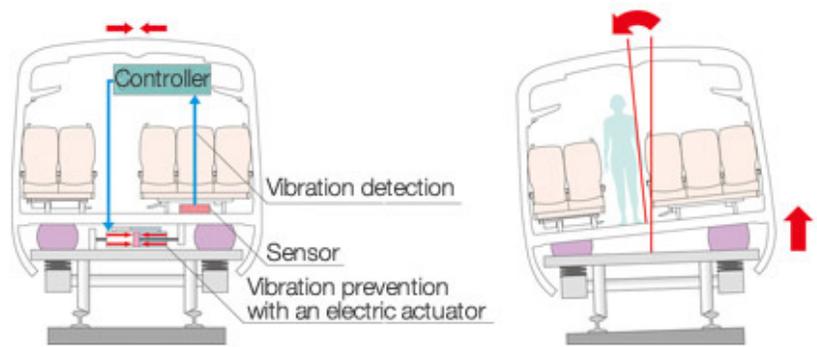
Because all systems are monitored by the LONWORKS platform, access to maintenance information is exceptional. Poirier explains: "Maintenance information generated in each car is sent to the central monitoring system within the car and also wayside. The maintenance facility can have access to the train information—online—even when the train is running. They can prepare for the train arrival and get the spare parts to get the train up and running again."

Maintenance and operations are not the only ways that LONWORKS touches passengers on Acela. Before boarding the train, passengers read the external LC display signs on the side of every car, which provide basic train information such as the destination. Once aboard, passengers can refer to general information LCD displays for messages from the crew. Lastly, if passengers are curious about their progress on the journey, they can look at another LCD display in their car. All signs in all cars use information provided by LONWORKS networks and can be controlled from the crew office in the Café car using a LCD display with a keypad.

Each system/node on each car, such as brakes, a screen, or a keypad, sends information and receives requests via the LONWORKS system. Each node connects to the Car Monitoring Unit PC (CMU) within its car via an Echelon FTT-10A Free Topology Transceiver interface over twisted pair to another FTT-10A in the CMU.

Within the CMU, these signals—based on the LonTalk® protocol—are processed by the LONWORKS MIP DPS software and used by the Bombardier Car Network Manager (CNM) software, which translates them into an inter-car protocol. Next, the CMU sends this protocol over the Bombardier inter-car communication network that connects all cars and their CMUs. This protocol is then received and processed by other CMUs to be translated back into LonTalk using the CNMs and MIP DPS software. These messages are finally sent to their intended nodes.

LONWORKS Networks are Right on Track
Besides meeting the requirements for a powerful monitoring system and reducing wiring costs, the LONWORKS system gives excellent integration benefits to Bombardier.

"The big interest in LONWORKS is the ease of integration for the different equipment supplied by vendors," Poirier says. "You just have to define the parameters you want the system to send or to listen to, and then you can bind those variables as you wish. This can evolve during the course of the project. You can change very easily without having to go back to the supplier, which is a great benefit in terms of cost and time.

"Furthermore, LONWORKS simplified and expedited the design process. You limit the risk because you don't have to make a decision too early in the project. You know that you will need some information, but you do not have to know exactly who (which node) will be using that information. If you were using another standard approach, you would have to know exactly who is using what at the beginning of the project. This is very hard when you have 20 different nodes and maybe 12 suppliers: This is a nightmare."

Amtrak, too, will see many LONWORKS benefits over time. Poirier predicts a reduction in maintenance costs and easier fixes.

"Through the Car Network Manager software we developed, you can do live installation," he explains. "If you remove a piece of equipment and you install a new one, it will automatically be installed in the car network management tool. If a system fails, then you can just unpower it and put a new one in. It will be installed on the network, and—boom—you're ready to go again. This is a great benefit."

Poirier points out that Bombardier plans to continue using LONWORKS for other projects, as does Bombardier's client, Amtrak. Amtrak made plans to roll the program out nationwide and spent $10 billion over 10 years to create 10 high-speed rail corridors in 28 states. As travelers and crew enjoy the grace and comfort of the new Acela trains, the crew will have something else to appreciate—LONWORKS.