Massachusetts Bay Transit Authority

Boston, MA

Government

Photo courtesy of Crescendo AV, May 2012

Crestron-powered Operations center helps Boston area commuter rail system deal effectively with emergencies

Background

It happens all the time. High winds bring trees and other debris down on railroad tracks, and commuter trains from San Bernardino to the Bronx must slow down or stop. There's a danger of accidents, including derailments and collisions, so railroads must be ready to react to any emergency, from crossing accidents to terrorist attacks.

In the Boston area, the Massachusetts Bay Transportation Authority (MBTA) is ready for any emergency, recently completing a new Operations Control Center (OCC) that brings together almost ten years of effort to improve railway monitoring and communications systems.

At the heart of the OCC is a 9-screen video wall powered by a Crestron DigitalMedia™ network and Crestron control. The video wall allows managers and engineers to view a wealth of data from the trains and video from the news, allowing them to make quick and accurate decisions in any emergency.

Building the OCC

According to Matt Spicer, co-owner of Warwick, RI-based Crescendo AV, the idea of building the operations center goes back to September 11, 2001, when federal government officials asked the MBTA to shut down the railroad in response to the attacks on the World Trade Center and the Pentagon. "They had a request to shut down the whole system and call back all of their trains," he explains. "The problem was, though, that they relied on the local cell phone network to communicate with drivers and conductors, and the cell network had been overloaded and shut down. They had no way to reach the trains."

Photos courtesy of Crescendo AV, May 2012

In the wake of the tragedy, which, fortunately, did not cause any danger to MBTA passengers, the agency applied for and received federal funding to build an emergency communications network. This network includes five key technologies.

1. There are GPS systems on all the trains constantly sending data to the railroad, making it possible to plot train locations in real-time on a map of the MBTA system.
2. Electronics in each locomotive stream data on the performance of key systems – including engine functioning, speed, even heating and air conditioning in the cars – alerting network operators to possible problems and allowing them to take preventative action.
3. Front-facing cameras now installed on all trains which allow operators to see what drivers see as they travel down the tracks. In case of an accident, the system automatically sends the railroad a video clip showing what happened right before the event occurred.
4. Cameras mounted in each station allow operators to view passengers boarding in real-time and review any incidents that may have taken place on the platforms.
5. A private wireless network, provided by Verizon®, carries all train-to-train and train-to-railroad voice and data communications. Since this network is completely separate from Verizon's public network, it is far less subject to outages.

Should there be any kind of emergency, all of this data can be accessed instantly in the OCC by railroad managers and engineers, who gather to make decisions, provide information to their trains and coordinate all communications with emergency crews and the public.

Inside the OCC

Spicer says that, when funding was secured to build the OCC, the MBTA turned to Crescendo AV, whom they had worked with on other projects. "They knew they needed an easy to way to see and hear all of their data, video and audio sources, but they left it up to us to design an efficient way to do so."

Spicer says he turned to Joe Sullivan, co-owner of Crescendo, to design a reliable system that would be extremely easy to use. "The last thing you want in an emergency is to be fumbling with controls that you might not have used for a while."

> " These components were built to work together, and we knew from experience that they work very reliably. We also knew that Crestron would help us quickly should we run into a problem that we couldn't solve on our own."
>
> **Matt Spicer,** Co-Owner, Crescendo AV

In the OCC, feeds from each of the data and video streams come into eight computer workstations, each of which outputs to the DM® 16X16 switcher. There's an additional ninth video feed from an HD cable television receiver, which allows operators to monitor broadcast and cable news services and share their output within the OCC.

For display, Crescendo used nine 40" LCD monitors mounted in tilting wall mounts to form a video wall, plus a ceiling-mounted projector. The displays have video wall processing built in, allowing them to show separate or combined images. A simple interface on a Crestron touch screen provides control of how each source is viewed.

Photo courtesy of Crescendo AV, May 2012

The touch screen interface features a replica of the video wall. The operator can select a source and choose where he or she wants it displayed, including on a projector, on a four-screen block of the video wall, on all nine screens, or on some combination of the projector and the video wall. An additional icon restores the video wall to its default configuration.

The Crestron processor also controls a wireless keyboard and mouse, automatically routing their control to whatever computer is displayed on the projector. Audio, delivered by two amplifiers to two pairs of in-wall speakers, is also normally played from the source displayed on the projector. In this way, a single technician can easily control all nine computer or video sources.

Sullivan says he looked at several possibilities, but found that a Crestron-based system would be the most reliable and the most economical for this application.

"We knew we wanted it to be all-digital to keep video quality high, and also because we didn't want to mess around with transmitters, receivers or scan converters. Distances were short, so we could carry all signals with three to six foot HDMI® cables, and the DigitalMedia™ technology allowed us to plug the HDMI cables directly into the switcher."

Sullivan says the DM switcher has the additional advantage of being card-based, so should there be a problem, at most they would lose one channel. "There's a lot of redundancy built into this system, even a redundant power supply," he explains. Spicer adds that all of the computer functions could have been handled by one high-end computer workstation, but he and Sullivan suggested that MBTA buy standard HP mini-towers instead. "It would be very hard for this entire system to go down, and even if one card or one computer does fail, we can easily swap it out."

The Crestron switcher also made it easy to control the wireless keyboard and mouse, since DigitalMedia includes a USB channel that can be switched together with HDMI.

Once they decided on the Crestron switcher, Spicer says it was a no-brainer to pair it with Crestron controls. "These components were built to work together, and we knew from experience that they work very reliably. We also knew that Crestron would help us quickly should we run into a problem that we couldn't solve on our own."

Fortunately, there has only been one emergency since the system opened, and that was when two trees blew down across the tracks during a severe storm. "The system worked perfectly," Spicer says. "They were able to locate the trains immediately, ask the drivers to stop and then back up to points where they could be switched to other tracks. Because they could see at a glance the locations of all the trains coming up behind them, they were able to ask them to stop or slow in turn until they had the first trains switched safely."

Though emergencies are few, the OCC is used daily for other applications. Customer service representatives can ask trains running behind schedule to speed up if necessary and to shorten times in stations if needed. Since they're able to monitor the locations of all their trains and view passenger boarding from the OCC, they can do so without compromising safety. Customer service has also developed a digital signage system that uses the GPS data to notify passengers when trains are getting close to stations, that has helped improve safety while streamlining boarding.