

### BACKGROUND

Nuclear power plants use Uranium fuel to generate heat, which drives turbines to generate electricity. US nuclear plants shut down every 18 months to replace depleted fuel rods with fresh ones. During the refueling, technicians use wired and wireless communications equipment to coordinate their activities. Wireless gear is particularly important to high efficiency. There are at least two particular circumstances that make this application quite different from most other situations where intercom equipment gets used.

- During refueling, the reactor is shut down and revenue loss is on the order of one million dollars per day. Any investment in equipment that saves time is welcome.
- Equipment that has been used inside the so-called containment area is considered radioactive and can never come out again. Therefore, equipment can never be sent for service.

In addition, the use of multichannel audio through the containment wall saves having to compromise the building integrity.

### ROLE OF RTS

Two decades ago, Nuclear Operating Companies (NOCs) used walkie-talkie equipment to communicate during refueling. Walkie-talkie is simplex only, meaning the channel can be used by one person, and everyone else needs to be listening, not broadcasting. That is why people say “over”: I am releasing the channel now. With walkie-talkies, refueling typically took between 60 and 90 days.

In the 1990s, NOCs started using UHF-based equipment from RTS. This product family is designated BTR followed by a number. BTRs allow full-duplex communication. Four belt packs communicate to one base station, and base stations can be interconnected. This allows for much more integrated and efficient communications. Refueling time was cut to between 30 and 40 days. The equipment pays for itself! Two models are big-sellers with NOCs: The BTR-800 (shown in Figure 3) and the BTR-80N, a narrowband version of the BTR-800.



Figure 1. Cooling towers at a nuclear power plant



Figure 2. Two service technicians during a refueling operation. They can now communicate without shouting!



Figure 3. BTR-800 with four belt packs

# NETWORK DIAGRAM

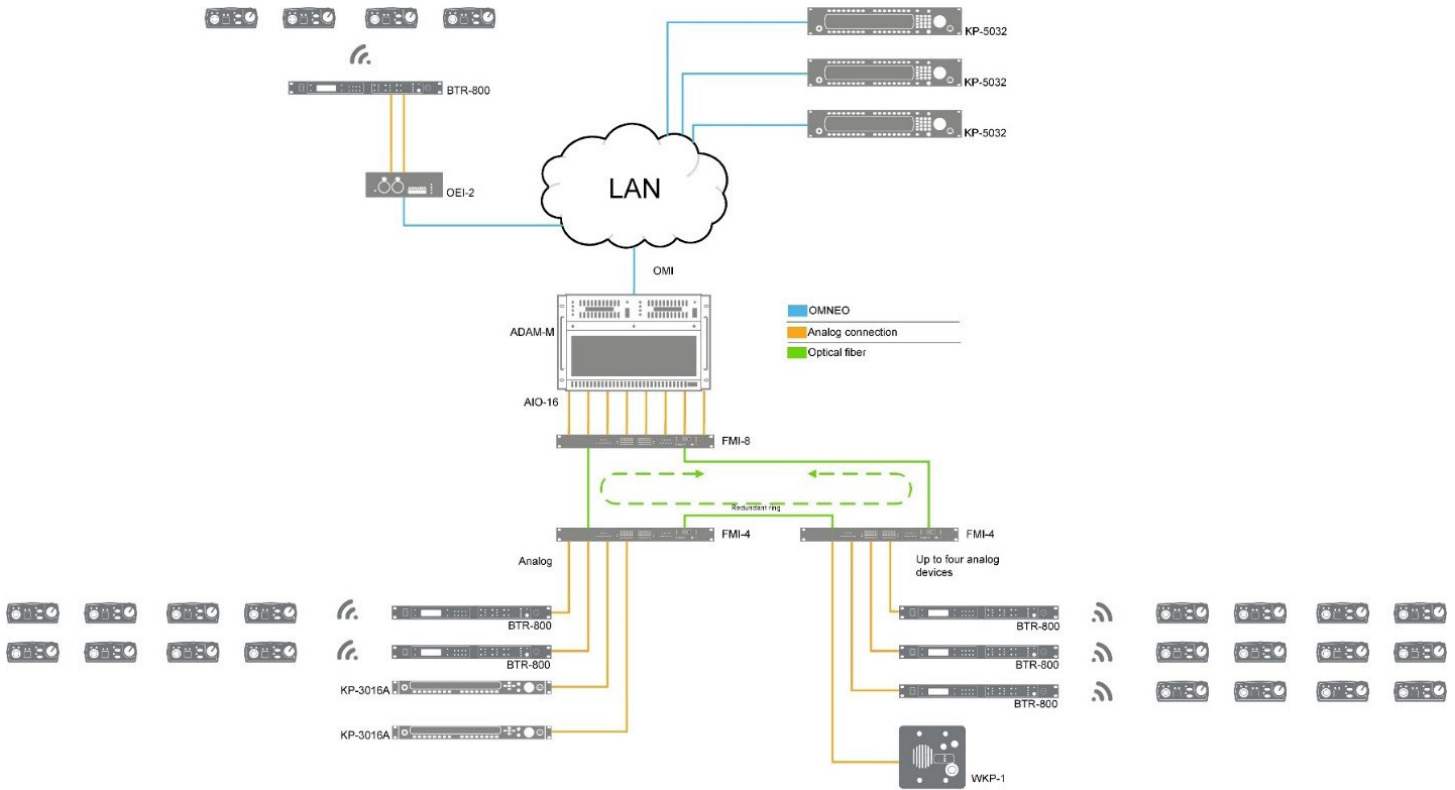


Figure 4. A matrix ties several BTR-800 together, as well as keypanels

In the diagram shown in Figure 4, an ADAM matrix is used to tie several network components together. In the upper left hand corner, a BTR-800 is connected via OMNEO. An OEI-2 converts the analog AIO format to the digital OMNEO format. Note the BTR has two analog lines. In the upper right hand corner, four keypanels are connected via OMNEO. Keypanels are used in the control room. In the lower portion, several BTRs are connected to the matrix via an optical ring. The FMI-Series (FMI-4 and FMI-8) fiber multiplexer interfaces are used to carry the analog signals over fiber, and to create redundancy. If any fiber in the green ring breaks, the audio is instantly rerouted over the alternate path. You can learn more about FMI-Series in a separate Application Note. Finally, a couple of different keypanels are shown, all connected over analog AIO. The KP-3016A is an analog-only keypanel in the KP-Series family. The WKP-1 is an analog one-channel keypanel developed for environmentally demanding applications.