

BART POLICE RADIO SIMULCAST UPGRADE

Karl Witbeck

SR. Communications Engineer

Project Goal

- **To improve maintainability and wide-area coverage of the Bart Police Department simulcast channel during the construction of a new 800 MHz trunked radio system.**

Existing System Description

- **31 UHF Base Stations total, not including receive only sites.**
- **System designed to cover five Bay Area Counties and 100 miles of track.**
- **Only one main half-duplex simulcast channel shared by 160 sworn officers**
- **System controlled by a 22 position radio/telephone console (4 dedicated for Police)**

EXISTING EQUIPMENT

- **Base Station Types**
 - **Motorola MSF5000**
 - **Motorola Compa**
 - **Aerotron**
 - **Ericsson Master III**
 - **Ericsson Master IIe**
 - **Ericsson Master II**

EXISTING EQUIPMENT-CONT...

- **Console Equipment**
 - Positron Industries TRCC integrated radio and telephone system
- **Simulcast Control Equipment**
 - Comterm Delay Lines (10us resolution)
 - Pulsecom audio distribution amplifiers
 - Positron Industries Tone Keying Controllers and limiters

EXISTING EQUIPMENT-CONT...

- **Simulcast Alignment Equipment**
 - Wismer & Becker custom test and alignment system
 - HP phase meter
 - Tektronics storage scope
- **TX & RX Base Station links**
 - Northern Telecom D4 Channel Banks with copper T-1 Spans
 - Lease Lines
 - **DMC Digital Microwave**

THE PROBLEM!

- A new trunked radio system contract had been signed, but it would take several years to complete.
- BART Police were complaining bitterly about the poor performance of the existing system and could not live with the performance of the existing system for several more years.
- An interim solution was needed.

THE SOLUTION

- **Replace simulcast control equipment**
- **Install GPS master clocks at all above ground sites**
- **Replace very old duplexers and antennas**
- **Synchronize all T-1 circuits to a master clock**

NEW EQUIPMENT

- Convex 2046 quad delay cards (1us resolution)
- Convex 2015 computer controlled test access switch for alignment
- Convex 806A delay measurement system
- Spectracom 8195 GPS clocks
- Spectracom 8120 frequency synthesizers
- TX/RX duplexers UHF

THE RESULTS

- Heterodyne problems were eliminated
- Coverage was generally improved
- Speech quality improved in overlap areas
- Overlap area phasing distortion could not be eliminated do to poor phase jitter of 4wire E & M cards used for base station links.

CONCLUSION

- **A simulcast system is only as good as the weakest link!**
- **Every aspect of the base station links must be quantified and controlled.**

I WILL NOT BE THE WEEK LINK!

- Pharaoh-Prince of Egypt

