

# Extension of Secure Audio and Video Data from the NTC through the Public Switched Telephone Network.

P. Michael Main

## Raytheon E-Systems Richardson Operation

### ABSTRACT

*The United States Army National Training Center (NTC) at Ft. Irwin, California, can support the training of an entire heavy brigade task force. The brigade is, however, an integral part of the division, and the division commanders and their staffs need to train with the brigades. This is difficult because two thirds of the division is still at the home station, and the day-to-day responsibilities of the commander and staff do not magically go away when one of the brigades is doing an NTC rotation.*

*Raytheon E-Systems Richardson Operation with the 4<sup>th</sup> Infantry Division (Mechanized) at Ft. Hood, Texas demonstrated the capability to remote live audio and video from a brigade rotation at the NTC to the divisions home station at Ft. Hood to provide the desired training for the division commander and his staff. In order to accomplish this task it was necessary to secure a temporary, data grade leased line spanning four states, two Regional Bell Operating Companies (RBOCs), and one long distance carrier, which can be a daunting task. Adding the requirement of end-to-end encryption acceptable to the DOD further complicates this process.*

*We developed a logical architecture to accomplish the task with specific GFE and commercial equipment and produced a successful demonstration system. Our experiences and user perceptions of the system have been used to develop an approach to fielding a fully satisfactory production system for our customer.*

### INTRODUCTION

To meet the requirements for FORCE XXI, and be prepared, on short notice, for any type of operation, in any geographical area throughout the world, maximizing the effect of scarce training resources will be crucial. Division commanders and their staffs require a training environment that supports their readiness to plan and implement the actions of battalions, brigades, and other division assets. The tempo of rapid force projection

demands that commanders make and communicate decisions quickly, to execute operations that deny the enemy a pause, and to exploit opportunities according to the commander's intent. Because it is not possible to train an entire division at one time, the commander and his staff are torn between the need to train in the field with the remotely deployed battalion or brigade and the necessity of day-to-day operations of the rest of the division at the home station. What is missing to support this remote interactive staff training are the information links with live exercises at the training ranges at the National Training Center (NTC), Ft. Carson, Ft. Polk, Ft. Bliss, Ft. Hood, etc. Without these information links, the synthetic environment needed to integrate live, simulated, and home station training interactively is incomplete.

### OBJECTIVES

The solution to this requirement is to create an environment, called "Command Link." This will offer many advantages.

- Provides commanders with the means to validate combat tactics before live training in the exercise area.
- Provides commanders with RF monitoring feedback on their use of the RF spectrum.
- Provides educational systems where communications are taught, practiced, and evaluated against established standards.
- Provides commanders with asset planning and operational implementation in real time from remote locations.
- Provides real-time connectivity between the live training being conducted at home stations, CTCs and simulation centers throughout the world.
- Provides real-time observation of the procedures used to integrate and manage

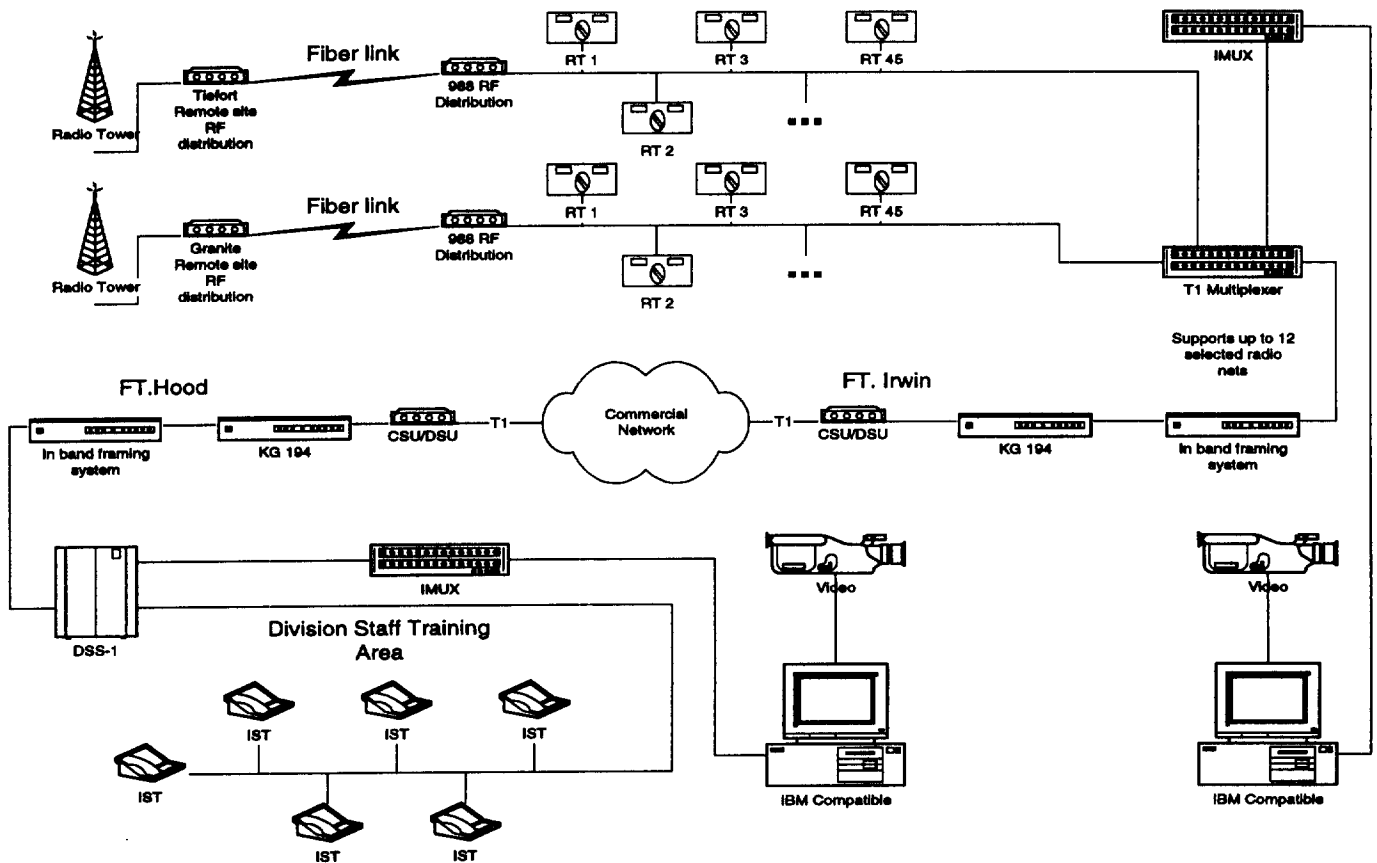


Figure 1, Command Link, demonstration.

information in the Tactical Operations Centers (TOCs) at each echelon of command.

- Provides home station training to maintain the edge developed at the CTCs and increase readiness in the face of shrinking training budgets.
- Provides the capability to observe the development of situational awareness in live training exercises in an unobtrusive manner.
- Provides for the metering of information flow and its impact on situational awareness in planning for attack/defense operations.

The actual system installed for the demonstration which took place on 16 July through 30 July, 1996, implemented a significant subset of the capabilities listed above.

## SECURITY REQUIREMENT

It is generally true that training in the US military is not classified, and specifically, training at the NTC is seldom classified in nature. It is, however, also true that this information is *not* made available for unlimited distribution for a variety of reasons. As a consequence, it was deemed necessary to encrypt the transmitted information over those portions of the communications channel which were part of the public carrier network. The encryption/decryption hardware, specifically KG194s was GFE. It was, however, the responsibility of Raytheon E-Systems to incorporate this equipment into the rest of the system.

## DEMONSTRATION SYSTEM

The system installed at Ft. Hood during the 2<sup>nd</sup> brigade rotation at the NTC, Ft. Irwin, CA, is shown schematically in Figure 1. The Antennas, RF fiber link, SINCGARS radios, and T1 multiplexer located at Ft. Irwin are part of the SINCGARS Monitor and Control

System (SMCS) installed at the NTC by Raytheon E-Systems Richardson earlier this year. Starting at the Ft. Irwin end, the IMUX inverse multiplexes the video stream of six DS0 channels onto one V.35 (384Kbps) channel. This V.35 (384Kbps) video channel and seven radio nets (one per DS0 channel) are fed into the Coastcom T1 multiplexer to form a 1.544Mbps T1 line. The T1 line feeds an SLI 600 inband framing unit where the bandwidth is reduced from 1.544Mbps to 1.536Mbps and framing is embedded in a selected bit of a DS0 channel. This allows the data stream to be encrypted with the KG194 encryption unit. The encrypted 1.536Mbps channel feeds a CSU/DSU (Channel Service Unit/Data Service Unit) where it is reframed to 1.544Mbps for transmission across the commercial long distance network as a leased T1 line. At Ft. Hood, the commercial T1 leased line enters a CSU/DSU where it is again reduced to 1.536Mbps and decrypted by another KG194. The clear text is then reframed at 1.544Mbps by another SLI 600 inband framing unit and directed into a Raytheon E-Systems DSS-1 portable red/black (classified/unclassified) switch. From the switch, the seven phone channels are broken out and sent to Raytheon E-Systems Integrated Services Telephone (IST) end instruments equipped with auxiliary speakers. The six video channels are sent to another IMUX and multiplexed into a V.35 (384Kbps) video channel which is connected to a personal computer outfitted with Picturitel hardware and software for display.

### RESULTS OF OBSERVATIONS AND INTERVIEWS

Feedback from personnel who used the NTC remote Command Link demonstration facility during the 2<sup>nd</sup> brigade rotation has been consistently positive. The general consensus was that the real-time audio and video provided a significantly enhanced experience for division staff personnel located at the home station which was superior to the taped After Action Reviews (AAR) which would be available only after the rotation was over. The AARs do not include Rock Drills and contain only a minimal amount of the unfolding battle on the analysts' displays. The impact of watching the brigade struggle for six hours trying to cross ten kilometers of open terrain while sustaining heavy casualties is lost in the one or two minute summary at an AAR. This real-time environment, which conveyed the urgency of battle, was especially useful for those individuals who had never had the opportunity to actually participate in an NTC rotation. A number of the division staff were especially impressed with this capability which allowed them to "participate"

in the NTC experience while still maintaining their busy day-to-day schedules.

### LESSONS LEARNED

While the demonstration was certainly successful, there are always things which can be improved based on experience. The following have been identified:

- Less than adequate leased line quality - adequate time must be allowed for the phone companies to set up and *test* the leased line. The installation should only be accepted when the line meets the required Bit Error Rate (BER).
- Familiarity of technicians with equipment - with the exception of the cryptographic equipment and the inband framers, the rest of the installation used standard telecommunications gear, and placed no unusual demands on the technicians. However, the cryptographic units and the inband framers are definitely not standard telecommunications equipment. These units require significant configuration and require the fabrication of custom cables. It is necessary to allow sufficient time for the technicians involved to become familiar with the equipment and to thoroughly test the setup.
- Scheduling of support personnel - while all concerned parties made valiant efforts in this area, anytime anything "out-of-the-ordinary" is scheduled during "non-regular" hours, especially things which continue for an extended period, the availability of support personnel becomes an issue, and requires careful planning.
- Ease of operation - after installation, it would be desirable for the system to be no more difficult to operate than cable TV and a VCR.
- Video quality - while the quality of the live video (AARs and Rock Drills) was acceptable, the quality of the computer generated video (the digital maps from the analysts stations) needs to be improved to the point that the unit designations are legible.

An immediate observation, following directly from the this list, is that an official, customer appointed point of contact (POC) at both the NTC and the receiving site (Ft. Hood in this case), would significantly facilitate the smooth installation and operation of the system.

### **SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

Based on the successful completion of the demonstration, we believe that the Army, and specifically, the 4<sup>th</sup> Infantry Division (Mechanized) would benefit from a permanent home station monitoring capability, initially at Ft. Hood, and eventually at other operational divisions and service schools. We believe that the cost of the permanent installation would be rapidly defrayed by the savings in travel expenses. The recurring cost would essentially be parts and labor for maintenance, and the cost of the T1 line. With the cooperation of the NTC we can offer audio and video with a quality essentially identical to that available at the NTC, and graphics from the analysts terminals which is limited only by the available display device.

We also conclude that a home station monitoring capability should be considered at the appropriate time for

several service schools. The schools selected would be those with the mission of producing commanders and staff officers for all echelons within divisions and task forces. Examples of these schools would be the Command and General Staff College and the Officer's Advance Course for each service branch such as The Armor School at Ft. Knox, The Infantry School at Ft. Benning and The Artillery School at Ft. Sill. This capability at these geographically separate schools would then also be available periodically for National Guard and Reserve Division staffs and commanders. In addition, a condensed orientation could be provided to senior ROTC personnel and West Point cadets during their regularly scheduled visits to these installations.

We believe that this demonstration represents a successful outcome of the cooperative efforts of the G6 staff of the 4<sup>th</sup> Infantry Division (Mechanized), the NTC Operations Group staff, and the C<sup>3</sup> department of Raytheon E-Systems. We look forward to having the opportunity to continue to work with the 4<sup>th</sup> Infantry Division (Mechanized) to support their training needs and the Force XXI AWE.