

www.usarmygermany.com

FINAL REPORT

ET-A

(EUROPEAN TROPOSPHERIC-ARMY)



www.usarmygermany.com

DEFENSE COMMUNICATIONS DIVISION **ITT**

I T T
Defense Communications Division
FINAL REPORT
European Tropo-Army Program

Contracts: DA 36-039-SC-88783
DA 36-039-AMC-04880
DAAB 07-67-C-0237
DAAB 07-67-C-0369

15 March 1968

TABLE OF CONTENTS

<u>Page</u>	<u>Title</u>
1	Introduction
2	Initial System
4	High Frequency/Single Side Band
5	Interim System
8	Final System
10	Western Extension
12	Phase II Console System
17	Finalization of European Operations

ILLUSTRATIONS

<u>Figure</u>	<u>Description</u>
1	ET-A Initial System
2	ET-A Interim System
3	ET-A Final System as of 1964
4	ET-A Final System as of 1967
5	Active ET-A System - 1 April 1968 (Connection of Tributaries to Mainline)
6	Active ET-A System - 1 April 1968 (Connection of Tributaries to Mainline)
7	Functional Connections of Tributaries to CRE Vans
8	Functional Connections of Future Tributaries

INTRODUCTION

During the past six years, the Defense Communications Division of International Telephone and Telegraph (ITTDCD), formerly ITT Federal Laboratories, has been engaged in the development, design, manufacture and field implementation of the European Troop-Army Communication System for the U. S. Army.

The high priority placed on the ET-A Program led to a multi-phase plan for implementation which ranged from an Initial System of seven mainline sites to a Final System with command and control and communications capability to all United States Military activities in Europe.

The equipment development and production effort for ET-A was accomplished at ITTDCD's research and manufacturing facilities in Nutley, New Jersey, and at subcontractors' plants. The field implementation effort was performed by International Standard Engineering, Inc., (ISEI), an ITT subsidiary established for performance of Government large system implementation programs in Europe. The ET-A field implementation effort consisted of Program Management, Engineering, Construction, Installation, Maintenance and Operation, Logistic Support, and System Test.

On 15 March 1968, the final phase of ITTDCD's effort was completed and accepted by the Government. At this time, we wish to provide a final report to the Government which recapitulates the history of the ET-A Program and presents a status of the system today. For presentation this report is organized into sections conforming to the various phases of the ET-A System Implementation.

INITIAL SYSTEM

Under contract to the U.S. Signal Supply Agency issued in late 1961, ITT Defense Communications Division (ITDCCD) was tasked with the responsibility for the management, development, design, manufacture, installation, test, maintenance, operation and logistic support of a seven site microwave system from Feldberg/Taunus and Heidelberg, Germany, to Camp Darby, Livorno, Italy. This system consisted of a mixture of line-of-sight, tropospheric scatter and diffraction paths that carried 24 channels of voice communication. In addition to the aforementioned sites, other sites were located at Donnersberg and Feldberg/Schwartzwald, Germany, and Finale Ligure and Coltano, Italy. The basic function of the Initial System, depicted in Figure 1, was to interface with audio channels in the Mediterranean region and to provide a means of relaying circuits to Headquarters, USAFE.

The Initial System was designed as a temporary transportable configuration. A typical site consisted of (a) AN/GRC-66 shelters installed on a concrete foundation, (b) a rehabilitated Army quonset hut which served the dual purpose of shelter for 25 KVA generators and as maintenance and storage area, (c) a 50-gallon fuel tank mounted on a metal rack to provide gravity feed to the generators, and (d) a tower with antennas.

The field implementation of the Initial System was performed in the winter 1962, in the midst of the worst weather experienced in Europe in many years. The severity of the weather made it impossible to hire construction subcontractors at the two remote sites, Feldberg/Schwartzwald and Finale Ligure; however, construction at these sites

was performed by the ISEI installation teams. Shipment of electronic equipment to Italy was delayed because all the mountain passes were closed for the best part of the winter. Notwithstanding these problems the Initial System began carrying traffic in early spring, 1963, and became fully operational on 1 July 1963.

HIGH FREQUENCY/SINGLE SIDEBAND

Shortly after the award of the basic contract, the U.S. Army determined the need for a temporary communications network to provide a command and control capability as an interim system until the completion of ET-A. To serve this purpose, the Signal Corps tasked ITTDCD with the responsibility for installation, operation and maintenance of 37 single sideband stations located at U.S. Army activities in West Germany, the Netherlands and France. The single sideband equipment provided as GFE was standard commercial Collins transmitters, amplifiers and receivers. Each site installation consisted of the three complete HF/SSB sets and two antennas. Normally, two of the three sets of equipment were operated on two different frequencies; the third set is a standby to replace one of the operating units in case of failure.

By March 1963, thirteen (13) HF/SSB stations were installed and the remaining twenty-four (24) stations were added by October 1964. Operation and maintenance of the HF/SSB system was performed exclusively by ISEI Field Electronic Engineers and Technicians until April 1964, at which time a gradual phaseover to Military operators began. By the end of 1964, the operating units of STRATCOM had assumed full responsibility for operation and maintenance of the HF/SSB system.

Although the HF/SSB system was originally intended as a temporary capability, the Army has decided to retain it as a backup for the ET-A System. The current configuration of the HF/SSB system is depicted in Figure 6.

INTERIM SYSTEM

In mid-1963, based on the experience gained during the implementation of the Initial System and the requirement for ET-A to become the first Military communications system built to DCA Standards, the Government issued a new Technical Specification for the ET-A System (USASCC 8.32-63-23/0) to replace the EACP 1-61 Specification in the original contract. This Specification, when married with Modification No. 18 of the basic contract, contractually covered the requirement for the design, manufacture, installation and test of the Interim ET-A System.

The Interim ET-A System involved the following major tasks:

- a) Upgrading of the seven Initial System sites to a semi-permanent configuration,
- b) Addition of eleven (11) new mainline sites (semi-permanent configuration),
- c) Five tributary sites (an operational Military site connected to the ET-A System through a nodal station),
- d) A Push-to-Talk Phase I Console System (command and control).

The Interim System is depicted in Figure 2.

This System provided communications to Belgium and France, and extended the system in West Germany to Bremerhaven in the North and Munich in the Southeast. The eighteen (18) mainline sites formed the skeleton of the ET-A System which eventually were to serve as the nodal points for strategic communications to approximately sixty-five (65) operational NATO Military activities in Northern Europe. The overall system design as then contemplated is shown in Figure 3.

The typical Interim System site consisted of the following:

- a) Semi-permanent power and maintenance building constructed on a concrete foundation. Depending on the power requirements of each site, a variable number of 30, 60 or 100 KVA generators were permanently secured to the building foundation. The maintenance shop section of this building consists of work benches, tools, test equipment and a supply of tools to perform site level maintenance.
- b) Self-supporting towers, antennas, waveguide, and waveguide bridges where required.
- c) AN/GRC-66 radio equipment shelters, TCS 600 multiplex equipment shelters installed upon concrete foundations.
- d) Permanent fuel system.

Work effort on the Interim System began in July 1963. The major portion of construction and installation design was completed in the following two years with the construction and equipment installation phase following design on a site-to-site basis. All major construction work was performed by European contractors with continuous on-site monitoring by ISEI Engineers. Equipment installation and testing was performed by ISEI Engineers.

In conjunction with the implementation of the Interim System, ISEI converted existing permanent building facilities at Site 51.1 and installed two sets of 1 KW quad-diversity tropospheric scatter radio equipment and associated multiplex into that building. An existing generator building at that location was also converted for use as a power station to serve this complement of equipment.

Throughout the field implementation phase of the Interim System, product improvement changes were approved and implemented which led to further system improvements and enlargement of the system capability. Among these changes were the following:

Nodal Communications: The concept of nodal communications was developed to meet the unique requirements of the European Command and Control System. Nodal radio vans were developed which employ power splitting techniques in their transmission lines to provide broadcast communications to specific tributary sites. Configurations of 1 W and 1 KW were manufactured. The receive portions of the nodal radio vans incorporated sufficient quad-diversity equipment to handle up to 8 tributary sites. The nodal design and implementation is a unique communications concept not previously employed in any system. The associated switching vans known as console remote vans were designed to be capable of handling up to three nodal radio vans providing a capability of up to 24 tributary sites reporting into any one nodal location.

Multi-feed Antennas: In conjunction with the requirements of nodal communications, original research work was conducted to develop a unitized antenna to provide for a large number of tributaries, yet providing the gain equivalent of a 6 ft. antenna. As a result of the development program, authority was granted to manufacture 6 multi-feed antennas. Each antenna was designed to cover 120° of azimuth and were equipped with 8 feed horns each. Four of these unique antennas were installed at Munich and will provide the tributary communications for that site.

FINAL SYSTEM

The ET-A Final System was conceived and planned as a permanent site configuration for the eighteen (18) mainline sites and the five (5) tributary sites in the Interim System plus approximately sixty (60) additional tributary sites. The 1967 plan for this configuration is shown in Figure 4.

ITTDCD's responsibility for the Final System was the design and manufacture of the radio, multiplex and switching equipment, towers and antennas. The task of Final System site construction became the responsibility of the Corps of Engineers and the installation of the electronic equipment (and integration of the tributary sites into the mainline system) became the responsibility of STRATCOM.

ITT Defense Communications, as part of their contractual responsibilities under Contracts DA 36-039-SC-88783 and DAAB 07-67-C-0237, implemented signal portions of the ET-A Final System. This included the installation of four console local equipments (out of the six manufactured), the installation of nine console remote equipments (out of the eleven manufactured), and the installation of nine nodal radio equipments (out of the twelve manufactured). ITTDCD also had a contractual responsibility for the manufacture of radio equipment for 67 tributary sites, console tributary terminal equipment for 108 tributaries and responsibility for the design, installation and preparation of a console training facility. ITTDCD also provided the necessary towers to meet the requirements of the 67 tributary configuration.

On 15 March 1968, the console local equipment at CINCEUR will become fully operational. On that date, our currently contracted effort for the ET-A system will have been completed and a major portion of the system will be operational.

WESTERN EXTENSION

The decision of France to withdraw from NATO coupled with their demand for deactivation of all U.S. Military bases and activities by 1 April 1967 rendered the five mainline spurs of ET-A in France defunct. Formerly, this series of French sites was to be extended further south to connect with the Air Force European Mediterranean Tropo System at Gorrramendi, Spain, by the addition of four ET-A mainline sites. When France's decision was made, it became incumbent upon the Army to develop an alternate routing of the ET-A System to provide additional communications with U.S. based activities in the United Kingdom.

By letter contract issued in December 1966, the Army tasked ITTDCD with the responsibility to engineer, install, test and make operational a wideband tropospheric scatter communications segment which would interconnect the existing ET-A System in the Federal Republic of Germany with the existing U.S. Defense Communication System in the United Kingdom and to reconfigure existing ET-A links to permit added communications and requirements. This alternate routing, termed "ETA Western Extension," is included in Figure 4. In specific terms, this task involved the following efforts:

- 1) Preparation of an Engineering Design Plan,
- 2) Engineering, installation, test and activation of a permanent ET-A communications terminal at Martlesham Heath, U.K., with 120-channel capability,
- 3) Engineering, installation, test and activation of a transportable ET-A repeater station at Hoek Van Holland, the Netherlands and Brügger, West Germany, with 120-channel capacity,

- 4) Engineering, installation, test and activation of a transportable ET-A terminal at the previously existing site at Stein, West Germany,
- 5) Reconfiguration and modification of the existing radio, multiplex, and antenna systems at Stein and Feldberg/Taunus, West Germany, to increase channel capacity at these stations from 60 to 180 channels.

The timetable for performance of this work was tied to the Army's need to begin carrying traffic on the Western Extension by 30 June 1967. This ambitious parameter requirement made it necessary for ITTDCD to divert manpower and resources from other projects in Europe and to accelerate all critical phases of work through the use of overtime and by imposing liquidated damages against subcontractors for failure to meet program schedules. By these means and with the excellent cooperation of STRATCOM-EUR, the Western Extension was successfully tested and turned over to the Government prior to the target date and was operational for traffic before 30 June 1967.

ETA PHASE II CONSOLE SYSTEM

The ET-A Phase II Console System is a Command and Control network for military communications which provides the major command headquarters in Europe with rapid access to the operational military activities (tributary sites). This Console System, developed, manufactured and successfully activated by ITTDCD provides the Government with the most advanced command and control switching system in the European Theater.

ISEI has engineered, installed and system tested command and control centers at four headquarters locations for the communications network:

CINCEUR Headquarters	Patch Barracks, Stuttgart (Vai), Germany
USAREUR Headquarters	Campbell Barracks, Heidelberg, Germany
USAFE Headquarters	Lindsey Air Station, Wiesbaden, Germany
NAVEUR Headquarters	London, England

Each of these locations is equipped with Console Local Equipment (CLE) and an operations center. The primary purpose of this automated equipment is to provide the Console operator with the status of availability of the tributary subscribers and to immediately connect a commander to a subscriber or group of subscribers. In addition to this primary function, this equipment serves as the system access points for the console operators and staff officers.

Nine (9) remote switching centers (Console Remote Equipment) were installed and integrated into the Console System by ISEI. These centers serve as the tributary access points to the communication network. Six (6) CRE's are operational in the ET-A System and three (3) in the Air Force 486L System. Each CRE is capable of accepting up to twenty four (24) tributaries either on a "sector" basis as in most of the ET-A sites or on an "individual" basis as in the 486L sites.

The CRE locations are as follows:

ET-A Sites

Site 52, Bremerhaven, West Germany
Site 51.1, Linderhofe, West Germany
Site 8.1, Stein, West Germany
Site 50.1, Hohenstadt, West Germany
Site 11, Munich, West Germany
Site 7, Schoenfeld, West Germany

486L Sites

Site 13/9L, Coltano, Italy
Site 30G, Sahin Tepsi, Turkey
Site 145, Mount Parnis,
Greece

ET-A Phase II subscriber sets were installed by ISEI in Greece, Turkey, Italy and Germany. Eleven (11) locations exist in the ET-A System and twenty-eight (28) locations throughout the 486L System, giving a total of thirty-nine (39) active tributaries in the ET-A Console System. These sets consist of a Tributary Logic Cabinet and a Tributary Control Unit to provide subscriber access to the system.

Figure 5 shows the entire ET-A Communications Network with all active Console System subscribers and all active HF/SSB sites throughout England, West Germany, the Netherlands, Belgium, Italy, Greece and Turkey. More detailed maps of the main portion of the ET-A System are shown in subsequent figures. Figure 6 shows all the active ET-A tributary and SSB sites throughout West Germany, Belgium and the Netherlands with their actual access points into the ET-A Network. Figure 7 is a functional representation of the above and shows by direct connections which CRE services which tributaries. Figure 8 gives a pictorial representation of the inactive tributaries throughout the ET-A Network. Also shown is a tabulation of the remaining Console equipments that have yet to be implemented into the system. TTE's must be installed at all the remaining SSB sites and all the inactive trib sites (when activated) to allow the functional capabilities of the ET-A Console System to be extended to all subscriber sites.

The total number of subscribers and potential subscribers shown on these maps are fifty-eight (58) in the ET-A Network and twenty-eight (28) in the 486L Network giving a total of eighty-six (86). There are an additional three inactive trib sites in the 486L System which makes a total of eighty-nine (89) subscribers that could be made available to the Console Command and Control System. In its present equipped configuration the System has the capability to service one hundred sixteen (116) subscribers.

The Phase II Console System is a solid state, automatic switching system. It utilizes modern state-of-the-art techniques such as a fully duplexed power system, thus enhancing the reliability of the solid state circuitry. Operationally, the headquarters stations control the system by use of the operator's consolettes. Local drop phones are dispersed among the staff officers at the headquarters locations and serve as their access to the network. By lifting the handset the drop requests service from an operator who is attending the consolette. The operator then immediately establishes a conference among the requested drops and tributaries. Several variations are at the disposal of the operator such as a master conference, up to seventeen (17) preset conferences, and any form of a built-up conference. At the discretion of the Console operator any of these conferences can be switched to broadcast wherein all subscribers are placed into a listen only mode. During this broadcast mode display acknowledgements can be made by the subscribers.

Any one of the headquarters stations has identical control operational capabilities. One headquarters exercising this capability is defined as having control of the system. One site is designated as the command site giving it the capability of immediately taking control at any time.

The tributary operator has the capability of requesting service from the operator, in addition to answering calls on a regular or priority basis. His console unit also displays the operational status of his link to his nodal station.

All of the Console System has not been installed to date. Two CLE's, three CRE's, and sixty-five (65) TTE's remain to be added. The subscriber sets (TTE's) will be installed at tributary sites being added to the system by STRATCOM. The spare CLE's provide the Government with a capability to introduce two new tactical command and control headquarters into the ET-A or 486L Systems. The spare CRE's provide the Government with three more remote switching centers that can expand the geographical tributary capability of existing system when new tributaries are programmed.

Because of the advanced design features of the Phase II Console System and the need to train Military operators and maintenance men, ITTDCD established a Console Training Facility at Taylor Barracks in Mannheim, West Germany. The school was equipped with a complete Phase II Console System that is capable of demonstrating every functional aspect of the System. The course outline was divided into three parts. CLE-CRE Maintenance Course, TTE Maintenance Course and an Operators Course. The CLE-CRE Course runs for 8 weeks, the TTE for 2 weeks and the Console Operators for 2 weeks. ITTDCD provided Engineers during the first four months of schooling which enabled two classes to complete the CLE-CRE Maintenance Course and eight classes to complete both the TTE and Operator Courses.

The training facility was made available by the Army to all the services thereby permitting the training of all required personnel. The school remains fully operational to date.

FINALIZATION OF EUROPEAN OPERATIONS

The successful completion of test and Government acceptance of the Phase II Console System on 15 March 1968 marks the finalization of ITTDCD's contractual responsibility for ET-A effort in Europe. This event also keynotes the closeout of International Standard Engineering, Inc. (ISEI), Frankfurt Office, from which the system has been managed during the last six years. During that period, the manpower resources of ISEI have reached a peak of approximately 500 employees in accomplishing the multi-phased ET-A Program described in the previous sections of this report.

Originally, ISEI's European Field Office (EFO) in Frankfurt was organized strictly to perform the field implementation portion of ET-A. When the emphasis of the ET-A Program reverted from CONUS to Europe in mid-1963, the Government and ITTDCD entered into an agreement whereby both parties agreed to establish a management and administration capability at EFO to provide on-the-scene program direction. ISEI's capability included:

Program Management and Administration (Scheduling, Reporting, Cost Control, Cost Analysis, Manpower Planning)

Contract Administration (Proposal Preparation, Negotiations)

Purchasing/Subcontracting (European goods and service)

Coordination of Control of Goods and Services procured in CONUS.

Logistics/Material Control

Engineering Systems Engineering (Propagation Studies, Path Loss Calculation, etc.)

Engineering Implementation Engineering (Survey-site
(continued) and land, Soils, Design, Construction)

Test Engineering

Quality Assurance

Operations Installation
Maintenance and Operation
Maintenance Planning
Equipment Modification

Administrative Services

Accounting

Employee Relations

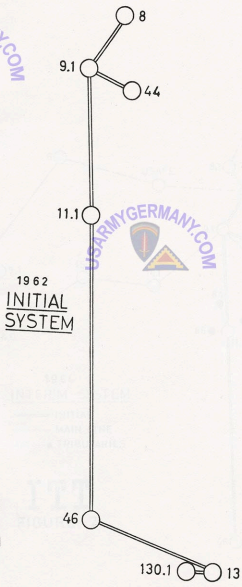
Support Services for Administration of
Government Logistic Support

The staffing of each of the above functions has varied depending on the requirements of the ET-A Program. The activities of the majority of these functions will be finalized at the end of this month. In April, only a small force of persons will remain to accomplish such residual matters as the payment of vendors' final invoices, processing of reports and personnel related documents, closing of bank account, etc.

The closeout of ISEI has, in itself, resulted in an undertaking of large proportions because of the variety and volume of activity engaged in over the last six years. Screening of files and record retention, finalizing purchase order agreements, terminating open agreements with custom clearance and freight forwarding agents, disposition of Government property, reassignment of personnel to other projects, discontinuance of telephone, TWX and reproduction services, are among the many items which require administrative

action. All of these matters were reviewed and a plan was developed covering the action and date required for finalization. At this point ISEI's closeout plan is proceeding on schedule without foreseeable problems.

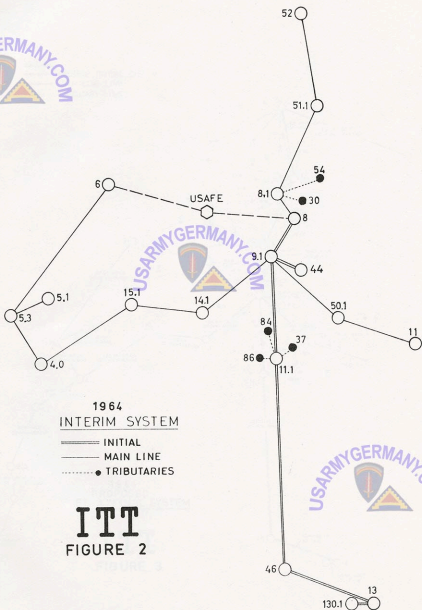
Of noteworthy interest is the accomplishment of the inventory and turnover of all materials that are residual to the needs of ET-A. This inventory conducted jointly by ISEI and SGS, the Government's Contractor for future warehousing and material control, was successfully completed and the final turnover documentation executed by the Government on 29 February 1968.



1962
INITIAL
SYSTEM



ITT
FIGURE 1



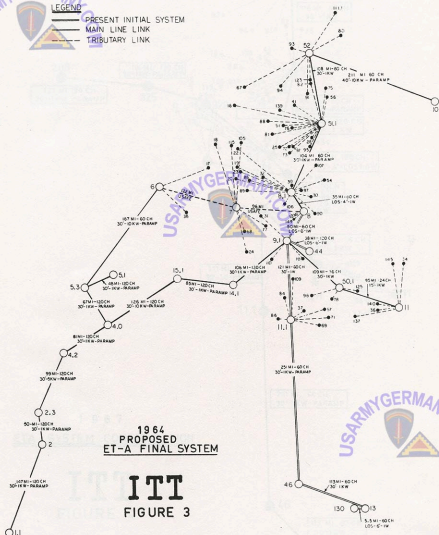


LEGEND

— PRESENT INITIAL SYSTEM

— MAIN LINE LINK

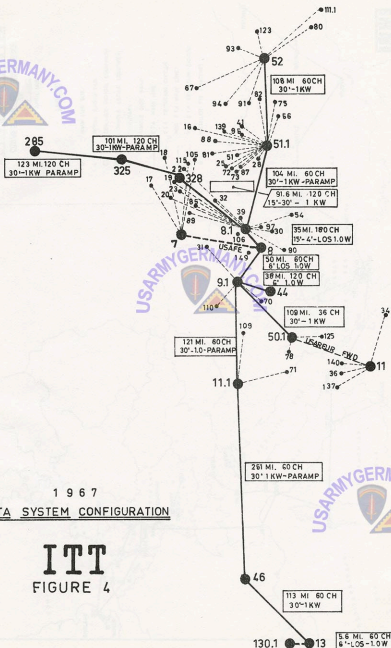
- - - - - TRIBUTARY LINK



1964
PROPOSED
ET-A FINAL SYSTEM

ITT
FIGURE 3





1 9 6 7

ETA SYSTEM CONFIGURATION

ITT

FIGURE 4

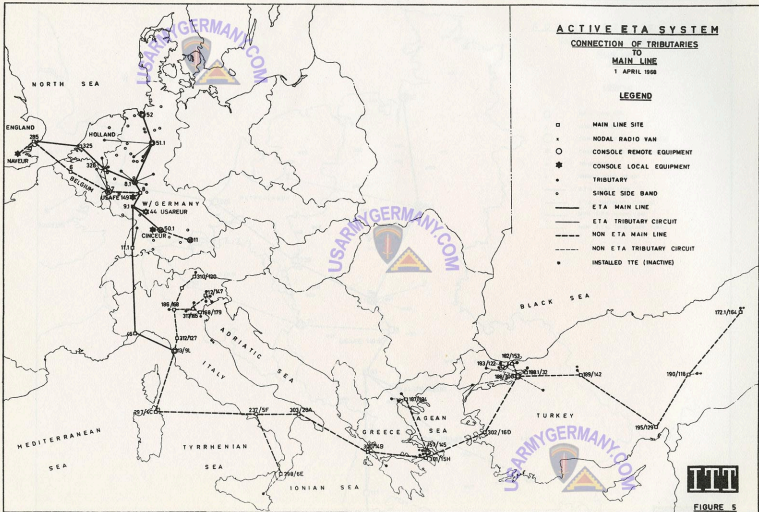


FIGURE 5

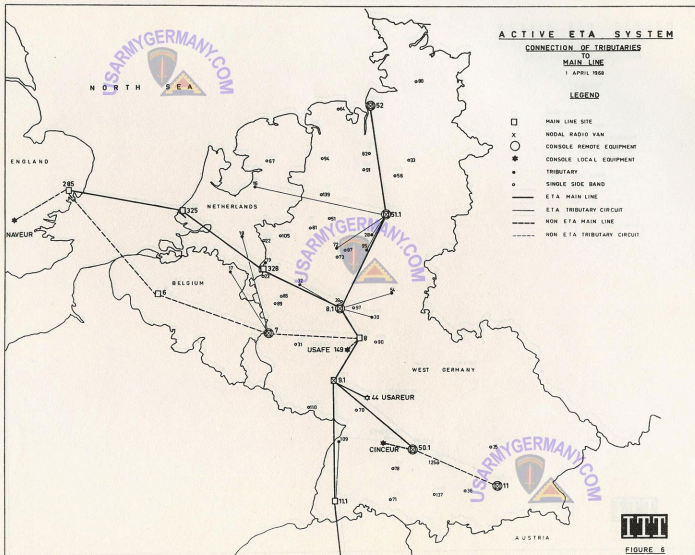
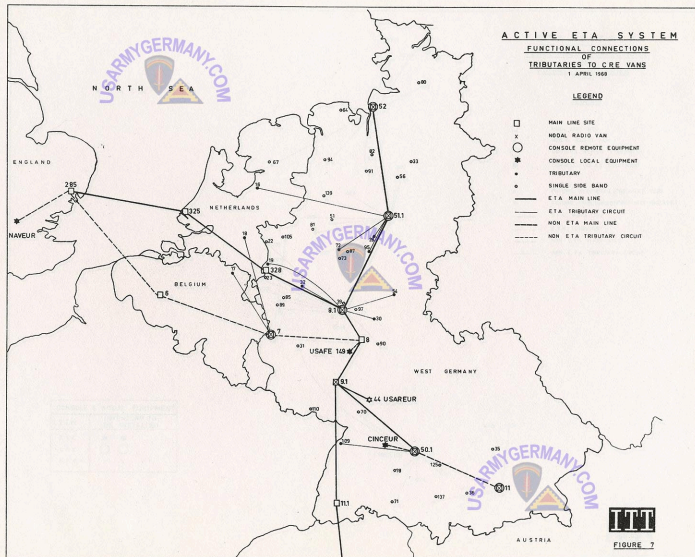


FIGURE 6



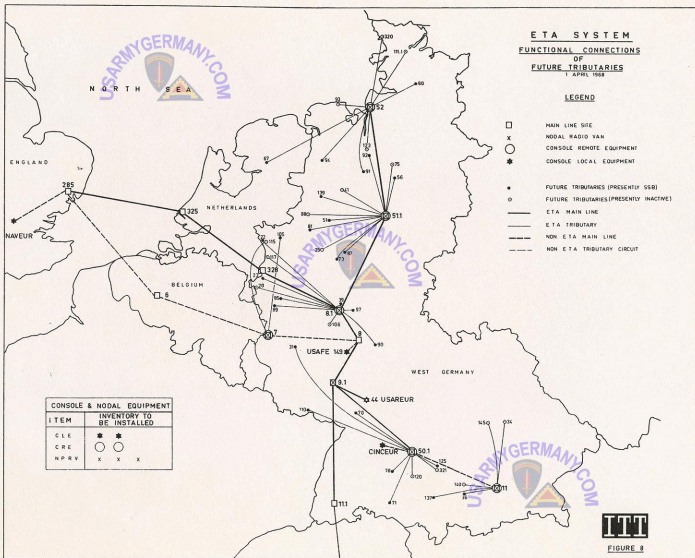


FIGURE 8