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MITRE Technical Report

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Description of TRI-TAC Equipment Acquisition Program.

William F. de Dufour

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METREK Division of The MITRE Corporation
1820 Dolley Madison Blvd. McLean, Virginia 22101

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ABSTRACT

The TRI-TAC Programs are briefly reviewed. Descriptive information is provided along with preliminary sketches of the equipment. A brief history of the TRI-TAC Program and organization is also provided. The MTR is in the format of a "facing-page-text briefing".

TABLE OF CONTENTS

- Brief history of TRI-TAC program

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  - Transmission
  - Communications security

- Development schedules and status

1.0 INTRODUCTION

JOINT TACTICAL COMMUNICATION (TRI-TAC) PROGRAM

This presentation provides an overview of the TRI-TAC Program. It is divided into four segments. The evolution of the TRI-TAC Program is described in the first segment along with the key dates associated with the program. The second segment discusses the organization of the TRI-TAC Office and its relationship to the Secretary of Defense. The third and largest segment presents a brief discussion of the individual items of equipment that comprise the hardware acquisition portion of the TRI-TAC Program. The development schedules and status of the various hardware acquisition programs in TRI-TAC are reviewed in the last section.

This report was prepared by METREK for the U.S. Army Directorate for Battlefield Systems Integration (DBSI). It serves to document the effort made to identify and describe equipment that is being developed under the aegis of the Department of Defense TRI-TAC Program. It represents one of the first steps in a systematic effort being performed by METREK to assess current Army tactical communications planning and to assist the Army in defining tactical communications architecture and capabilities needed in the 1985 time frame and beyond.
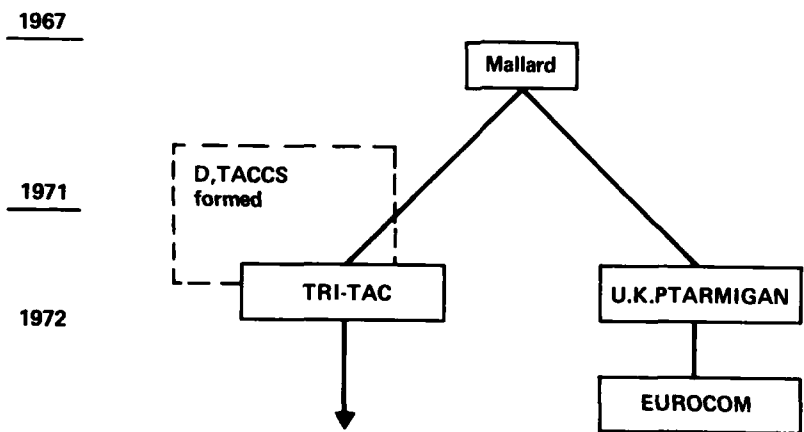
Joint Tactical Communications (TRI-TAC) Program

2.0

Brief History
TRI-TAC Program

The TRI-TAC Program evolved from work performed on Project MALLARD during the interval 1967 to 1969. Project MALLARD was an attempt to obtain a cooperative international development of compatible tactical digital military communications systems. The United States of America, the United Kingdom, Canada and Australia, participated in Project MALLARD with a goal to achieve interoperability and economy through commonality of equipment among all four countries. By 1969, at the end of Phase I of the MALLARD Project, an overall systems design had been agreed upon by the Project members. Shortly thereafter the United States pulled out of the MALLARD Project. The United Kingdom continued with their military communications program, that has since become known as the PTARMIGAN System. PTARMIGAN is expected to form the basis for the European Military Communications System, EUROCOM.

The U.S. withdrew from the MALLARD Project after the Senate Armed Service Committee recommended that first priority be given to satisfying U.S. Joint Service Telecommunications Requirements without the complications of active international participation characterized by the MALLARD Project. In July 1970, recommendations were made to the President and the Secretary of Defense to provide for higher management supervision of the Telecommunications functions. Accordingly, a new position, Director, Telecommunications and Command and Control Systems (D,TACCS) was established to provide this assistance to the Secretary of Defense. The first task that D,TACCS undertook was to give careful consideration to recommendations of the Senate Armed Services Committee that focused on four areas: interoperability, communications commonality, centralized management of telecommunications, and cost. The TRI-TAC Program was an outgrowth of these considerations. Recently the office of D,TACCS was reorganized and supervision of the TRI-TAC Program now resides under the Assistant Secretary for Defense, Command, Control, Communications, and Intelligence, ASD(C^3I).

TRI-TAC Program Evolution

1967

1971

1972

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                              +-----------+
                              |  Mallard  |
                              +-----------+
                               /         \
        +----------------+    /           \
        | D,TACCS        |   /             \
        | formed         |  /               \
        +----------------+ /                  \
              +-----------+              +------------------+
              |  TRI-TAC  |              | U.K.PTARMIGAN    |
              +-----------+              +------------------+
                    |                            |
                    v                    +------------------+
                                         |     EUROCOM      |
                                         +------------------+
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The focus of the Congressional recommendations related to telecommunications are as follows:

- Achieve the necessary degree of interoperability among tactical communications systems and other DoD telecommunications systems.
- Place in the field new tactical communications equipment using the most effective technology.
- Eliminate duplication where feasible in the development of military service equipment.
- Perform the above in the most economical manner.

With these objectives in mind the Deputy Secretary of Defense approved the Joint Tactical Communications (TRI-TAC) Program in February 1971. In May of the same year the Joint Tactical Communications (TRI-TAC) Office was established to manage the program.

1970   Focus of Congressional Recommendations

- Interoperability
- Communications commonality
- Centralized management of telecommunications
- Cost
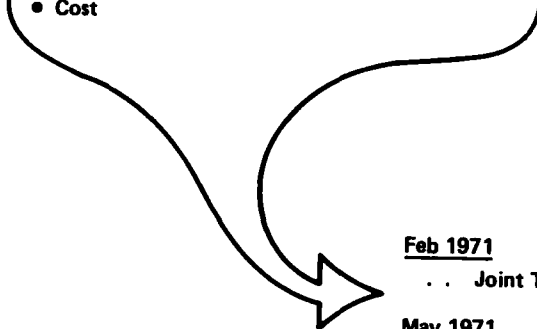
Feb 1971
.. Joint Tactical Communications (TRI-TAC) Program

May 1971
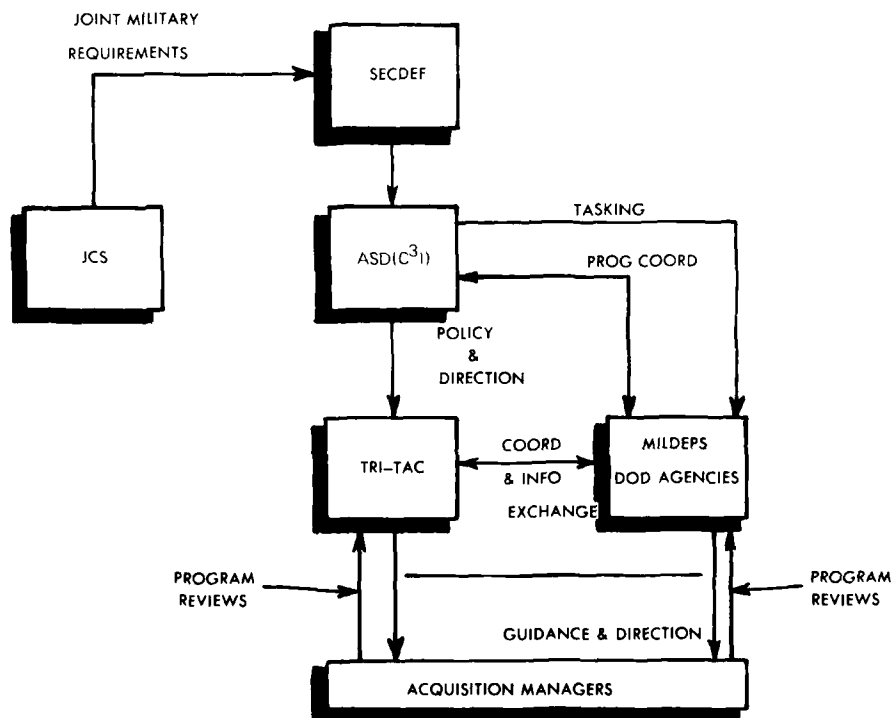.. Joint Tactical Communications (TRI-TAC) Office

3.0
TRI-TAC
Office

The TRI-TAC Office is a jointly staffed DoD organization located near Fort Monmouth, New Jersey. The Director is under the direction, authority, and control of the Secretary of Defense with primary staff supervision by the ASD(C^3I). The TRI-TAC Office is involved with the Military Departments and DoD agencies that have requirements for tactical common user communications equipment. The TRI-TAC Office provides a coordination and information exchange function which has as a goal to resolve differences and to help define requirements for equipment that will satisfy the needs of several users. When agreement is reached and a requirement has been established for a specific piece of hardware, a service or agency is tasked to provide the program management function for the acquisition of that piece of hardware. The Acquisition Manager in the TRI-TAC Program performs a role similar to that performed by the Program Manager in military hardware acquisition programs. However, in the TRI-TAC Program structure three management aspects, normally the province of the Program Manager, are reserved to the TRI-TAC Office. The TRI-TAC Office retains:

- Control of specifications
- Responsibility for test management
- Approval authority for changes in schedule or scope.

The Acquisition Manager for the Army's TRI-TAC hardware programs is the Multiple-Service Communications System (MSCS) Office at CORADCOM (provisional).

TRI-TAC Office Relationships

JOINT MILITARY
REQUIREMENTS

SECDEF

JCS

ASD(C^{3}I)

TASKING

PROG COORD

POLICY
&
DIRECTION

TRI–TAC

COORD
& INFO
EXCHANGE

MILDEPS

DOD AGENCIES

PROGRAM
REVIEWS

PROGRAM
REVIEWS

GUIDANCE & DIRECTION

ACQUISITION MANAGERS

The major functions of the TRI-TAC Office include the following:

● Provides planning and program advice to the $ASD(C^3I)$ and other DoD components concerning development and implementation of the TRI-TAC Program.

● Responsiblity for the definition and engineering of the TRI-TAC system concept and equipment.

● In response to joint military service requirements, it coordinates the development, the production, the planning and reporting of the Joint Development Test and Evaluation, and the Initial Operational Test and Evaluation of the TRI-TAC equipment.
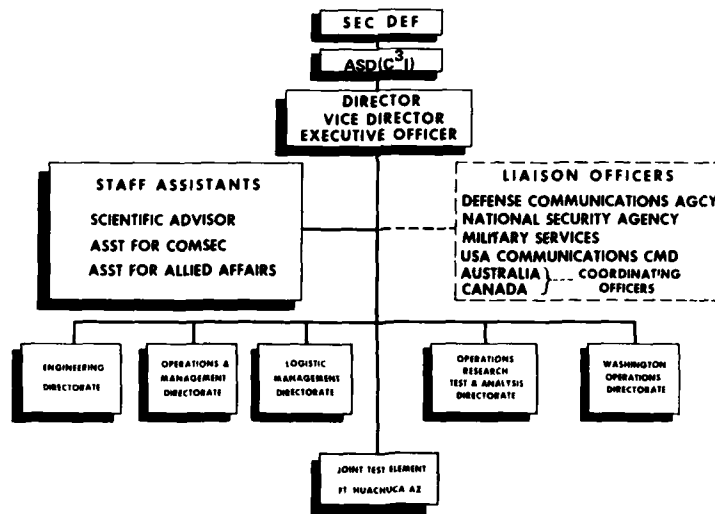
TRI-TAC Office Functions

- Planning/program advice to ASD (C^3I)

- Definition and engineering

- Coordination of:
    - Development
    - Production
    - DT&E
    - IOT&E

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The Director of the Joint Tactical Communications (TRI-TAC) Office obtains his authority from the Secretary of Defense through the Assistant Secretary of Defense, Command, Control, Communications and Intelligence. He has three key staff assistants: a Scientific Advisor, an Assistant for Communications Security, and since this Office interfaces with NATO an Assistant for Allied Affairs. Close liason is maintained with the Defense Communication Agency, the National Security Agency, the Military Services, the United States Army Communication Command, and with the Australian and Canadian Military Services. There are four major Directorates located at the TRI-TAC Office in New Jersey. These are the Engineering, Operations Management, Logistics Management, and Operations Research Test and Analysis Directorates. The assigned manpower is heavily weighted to the Engineering Directorate. A Washington Operations Directorate is maintained in the Pentagon. Test operations are under the control of the Joint Test element at Fort Huachuca, Arizona.

Joint Tactical Communications (TRI-TAC) Office

ORGANIZATION

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                        ┌──────────┐
                        │ SEC DEF  │
                        └────┬─────┘
                        ┌────┴─────┐
                        │ ASD(C³I) │
                        └────┬─────┘
                 ┌───────────┴────────────┐
                 │      DIRECTOR          │
                 │   VICE DIRECTOR        │
                 │  EXECUTIVE OFFICER     │
                 └───────────┬────────────┘
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STAFF ASSISTANTS	LIAISON OFFICERS
SCIENTIFIC ADVISOR	DEFENSE COMMUNICATIONS AGCY
ASST FOR COMSEC	NATIONAL SECURITY AGENCY
ASST FOR ALLIED AFFAIRS	MILITARY SERVICES
	USA COMMUNICATIONS CMD
	AUSTRALIA) --- COORDINATING
	CANADA) OFFICERS

- ENGINEERING DIRECTORATE
- OPERATIONS & MANAGEMENT DIRECTORATE
- LOGISTIC MANAGEMENT DIRECTORATE
- OPERATIONS RESEARCH TEST & ANALYSIS DIRECTORATE
- WASHINGTON OPERATIONS DIRECTORATE

- JOINT TEST ELEMENT FT HUACHUCA AZ

4.0
TRI-TAC
Equipment

The equipment that has been identified with the TRI-TAC hardware acquisition program will be reviewed in this section of this presentation. Since the TRI-TAC hardware acquisition program encompasses the full range of equipment likely to be found in a military switched, multi-channel communications system, we have found it convenient to group these equipments into the following five categories: Switching and Control, Static Subscriber Access, Mobile Subscriber Access, Transmission, and Communications Security. Individual pieces of equipment falling in these categories will be identified and described briefly. Equipment development schedules (through CY83) were obtained from the TRI-TAC Office. Scheduled dates for both the Initial Operational Test and Evaluation and the start of Production Delivery are presented. To provide a feeling for the Army TRI-TAC hardware procurement requirements, estimates are included based on the INTACS* force model (1 Theatre Army, 3 Corps, 15 2/3 Divisions).

The following overview of the TRI-TAC Program equipment relationships is presented as an aid to understanding how these pieces of equipment may be assembled to provide a tactical communications system.

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* Integrated Tactical Communications System

TRI-TAC Equipment

- Switching & control
- Static subscriber access
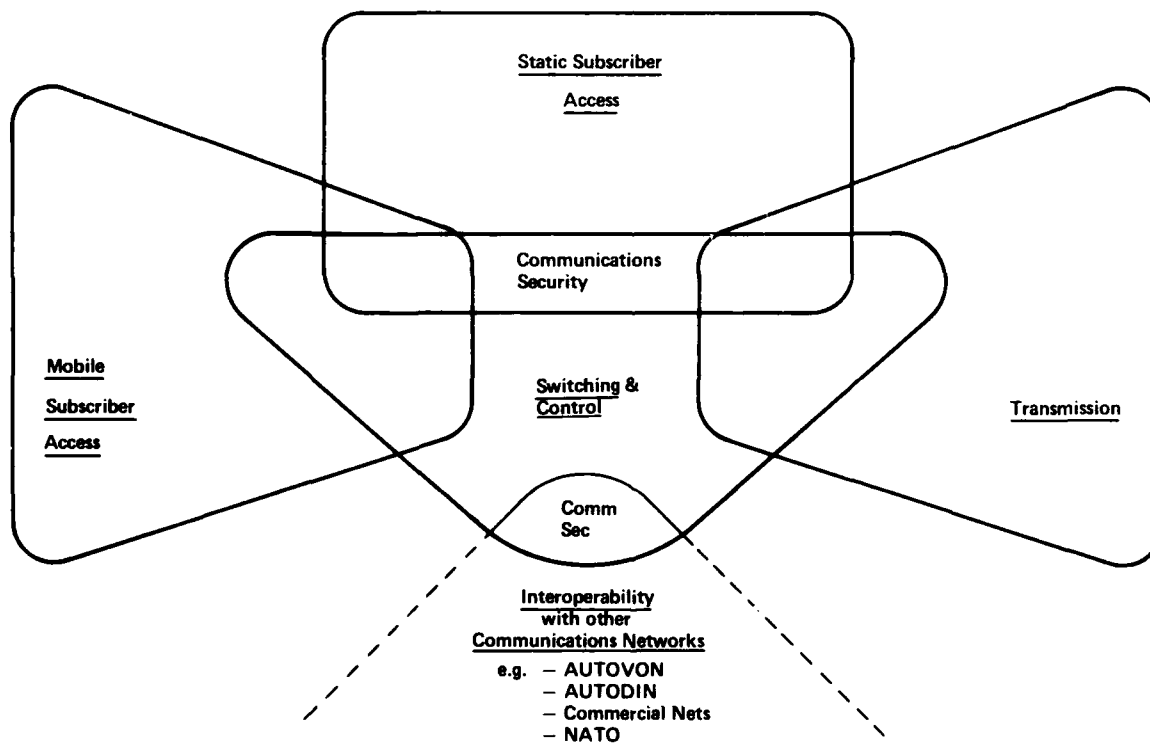- Mobile subscriber access
- Transmission
- Communications security

4.1
Overview

The Switching and Control equipment provides the central focus for the flow of traffic in a multichannel switched communications network assembled with TRI-TAC hardware. Traffic generated by static subscribers will flow through communications security devices into the switching and control equipment where it will be routed either to other static subscribers, mobile subscribers, transmission links to other communications nodes, or out of the TRI-TAC hardware assemblages to external communications networks. Similar paths exist through the switching and control equipment for traffic originating with mobile subscribers, other communications nodes, or external communications networks. The Switching and Control equipment is being designed to be compatible with current inventory communications equipment so that introduction of TRI-TAC hardware will allow for evolutionary growth to an all digital, 100% secure communications system.

Static Subscriber Access hardware development programs are aimed at providing: new digital telephones; adaptors to allow continued use of existing equipment; a family of multiplexer devices to permit combining individual digital circuits into groups to conserve channel requirements; and devices aimed at providing improved capability to carry record traffic. The Mobile Subscriber Access hardware development programs will be aimed at providing equipment that will offer mobile subscribers a dial-up capability to talk to other mobile subscribers, to access the multichannel switched network, or to interface with net radio circuits. Equipment being developed in the Transmission hardware acquisition programs will provide radio equipment that will facilitate the interconnection of switching nodes by both terrestrial and satellite RF links. Communications Security equipment is being developed, mostly in modular form, to be included where required as integral parts of the developing TRI-TAC family of communications equipment.

TRI-TAC Equipment Relationships

Static Subscriber
Access

Communications
Security

Mobile
Subscriber
Access

Switching &
Control

Transmission

Comm
Sec

Interoperability
with other
Communications Networks

e.g. – AUTOVON
– AUTODIN
– Commercial Nets
– NATO

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4.2

Switching and Control

There are four major Switching and Control hardware acquisition programs. The U.S. Army has been tasked with the development of two of these programs, the TTC-39 circuit switch and the TYC-13 message switch. This equipment provides the major trunk switching capability that will be made available through the TRI-TAC Program. The U.S. Air Force has been tasked with the development of the Tactical Communications Control Facilities that will provide both management control and automatic testing, A/D - D/A conversion, multiplexing, and routing capabilities for the RF communication trunks connecting the switches. The U.S. Marine Corps has been tasked with the development of the Unit Level Switch program. This program includes the TTC-42, a smaller version of the TTC-39, and the team transportable 30 line Unit Level switchboard, the SB-3865. Prior to describing the individual equipment in the switching and control hardware acquisition program it is useful to review the switching and control hierarchy within the TRI-TAC Program.

Switching & Control
Hardware Acquisition Programs

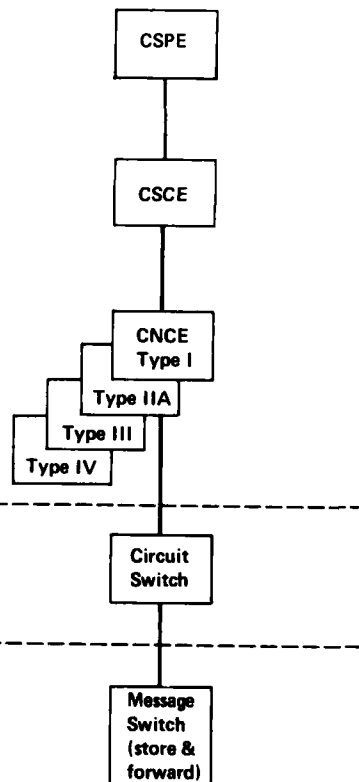|	Service Tasked
● AN/TTC-39 circuit switch	USA
● AN/TYC-13 message switch	USA
● Tactical Communications Control Facilities (TCCF)	USAF
● Unit Level Switch (ULS)	USMC
● AN/TTC-42	
● SB-3865	

The Tactical Communications Control Facilities (TCCF) will provide three levels of communications network planning, management and control. The Communications Systems Planning Element (CSPE) is conceived as a facility containing the equipment required to support the top level planning and management of a large tactical communications network. CSPE design efforts have not yet progressed beyond the preliminary conceptual planning stage and will not be reviewed further in this presentation. The equipment in a Communications Systems Control Element (CSCE) supports real time or near real time operational management of a portion of a large network. Equipment in the CSCE monitors the status of the trunk circuits in its network and automatically directs changes in network routing or configuration and institutes traffic control measures to maintain effective communications throughout the network. Equipment in the Communications Nodal Control Element (CNCE) accepts network routing instructions from the CSCE and through its multiplexing capabilities, automatically establishes the digital groups that are transmitted over the trunk circuits to other CNCE's. The CNCE also monitors and tests transmission circuits. There is a requirement to have one CNCE per switching node. One CSCE can perform the management function for up to 16 CNCE's. While four types of CNCE's have been identified, development of only Type I and Type III is scheduled at this time.

The key piece of equipment in the TRI-TAC switching and control hierarchy is the TTC-39 circuit switch. This switch provides the capabilities required to receive, process, and route calls and to provide a broad set of service features to subscribers. The TTC-39 switch accesses the tactical communications network trunk circuits through a CNCE. It is planned to build the circuit switch in both a 300 line and a 600 line configuration. Four switches may be interconnected to provide terminations for up to 2400 lines. A companion message switch, the TYC-13, can terminate either 25 or 50 lines. The TYC-13 message switch has a store and forward capability and can be operated in conjunction with the TTC-39 circuit switch for access to the multichannel RF trunks.

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Switching and Control Hierarchy

```
                                                  ┌──────────┐
                                                  │   CSPE   │
                                                  └──────────┘
                                                        │
Tactical Communications Control Facilities (TCCF)       │
                                                  ┌──────────┐
  ● Communication System Planning                 │   CSCE   │
    Element (CSPE)                                 └──────────┘
                                                        │
  ● Communication System Control                  ┌──────────┐
    Element (CSCE)                               ┌│   CNCE   │
                                               ┌─┤│  Type I  │
  ● Communication Nodal Control              ┌─┤ │└──────────┘
    Element (CNCE)                           │ │ Type IIA │
                                             │ Type III │
                                           Type IV │
────────────────────────────────────────────────────────────────
TTC-39 Circuit Switch                             ┌──────────┐
  (300/600 lines—                                 │ Circuit  │
   expandable to 2400 lines)                      │  Switch  │
                                                  └──────────┘
────────────────────────────────────────────────────────────────
TYC-13 Message Switch                             ┌──────────┐
  (25/50 lines)                                   │ Message  │
                                                  │  Switch  │
                                                  │ (store & │
                                                  │ forward) │
                                                  └──────────┘
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The switching hierarchy also includes lower level switch functions. The TTC-42 is part of the Unit Level Switch hardware acquisition program and is currently planned to be built in two models. One will provide switching for 75 lines and the other will provide switching for 150 lines. The TTC-42 circuit switch may be considered as a smaller version of the TTC-39 circuit switch. The smallest switching device in the TRI-TAC program under the Unit Level Switch hardware acquisiton program is the SB-3865 Unit Level Automatic Switchboard. The Automatic Switchboard is conceived as a team transportable automatic telephone switchboard capable of handling 30 lines but stackable to 60 or 90 lines. The SB-3865 is designed to be interoperable with the TTC-42.

Switching and Control Hierarchy
(Cont'd)

TTC-39 Circuit Switch

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                            ▲
                            │
                    ┌───────────────┐
                    │   Circuit     │
                    │   Switch      │
                    └───────────────┘
                            │
─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─│─ ─ ─ ─ ─ ─ ─ ─ ─
                            │
TTC-42 Unit Level Switch    ┌───────────────┐
(75/150 Lines)              │   ULS         │
                            │   (TTC-42)    │
                            └───────────────┘
                            │
─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─│─ ─ ─ ─ ─ ─ ─ ─ ─
                            │
SB-3865 Unit Level Switch   ┌───────────────┐
  (30 lines/stackable to    │   ULS         │
  60/90 lines)              │   (SB-3865)   │
                            └───────────────┘
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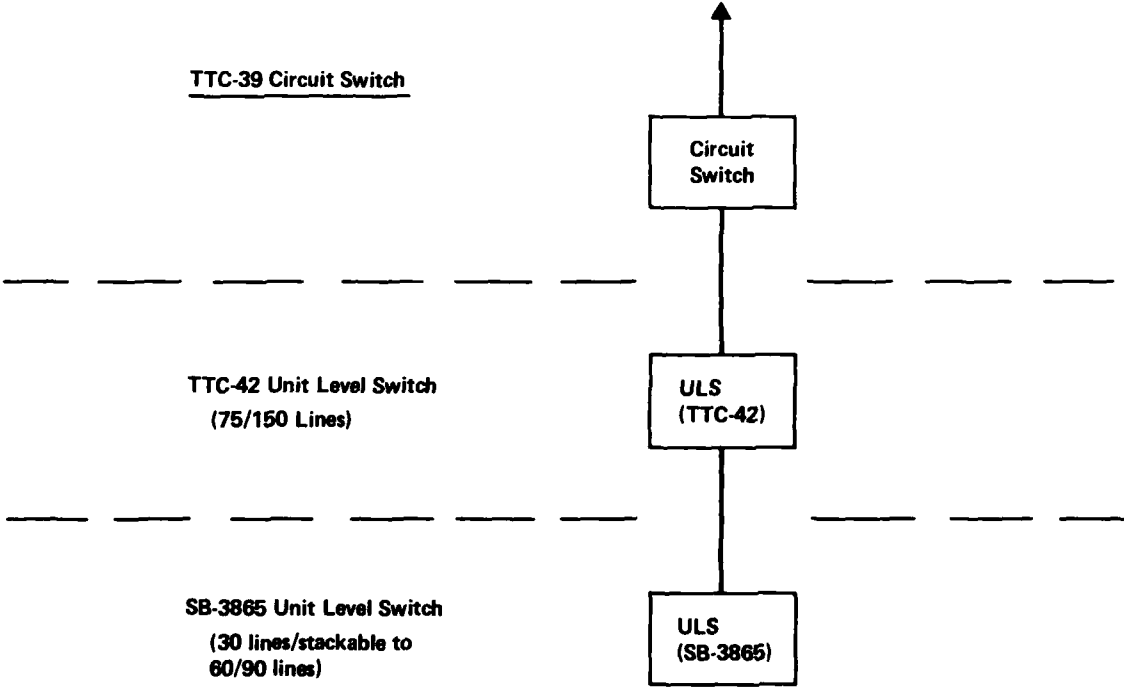
The TTC-39 circuit switch provides switching functions for both analog and digital circuits. The external analog interface of this switch has been designed to be directly interchangable with the current inventory TTC-38. The TTC-39 switch is modular in concept and can be assembled to provide various mixes of analog and digital circuit terminations. The basic switch is designed to terminate 600 lines in a two-shelter configuration. A single shelter 300 line switch is also planned. The switch is designed to be compatible with the signaling plans that the military communications network is likely to interface with. The switch capabilities include progressive or preprogrammed full duplex conferencing, broadcast capability, five levels of precedence, call transfer, abbreviated and compressed dialing, and numerous other features to provide maximum flexibility.

The development schedule for this equipment has been extended twice. The Initial Operational Test and Evaluation (IOTE) is currently scheduled to be complete in early fiscal 1980. Low rate Initial Production is scheduled to start in the first quarter of fiscal 1982.

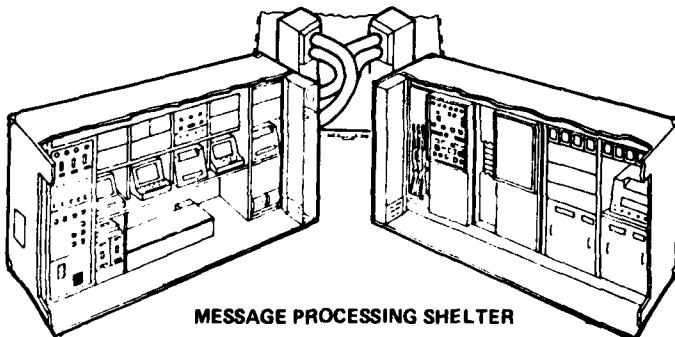Estimated Army Requirements:
(INTACS force Model)
- 300 line switches - 66
- 600 line switches -   6

TTC-39 Circuit Switch (600 Line)

Control Shelter

Switching Shelter
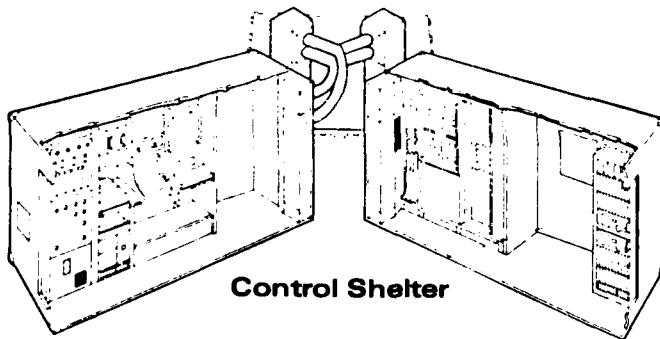
- Provides switching function for analog and digital circuits
- Modular—analog/digital circuit mix can be varied.
- Stores directory and performs call routing
- Performs precedence functions, establishes conference nets, transfers calls etc.
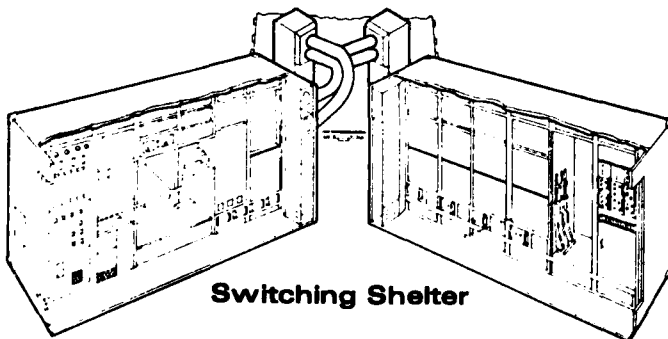
- <u>STATUS:</u> In full scale equipment development—schedule has been slipped twice—IOTE complete early FY80
- <u>CONTRACTOR:</u> GTE Sylvania

The TYC-13 message switch provides the functions and services related to the handling, processing, and switching of messages in a store-and-forward mode of operation. This message switch performs the various bookkeeping and administrative functions that are required to store, forward, and provide security protection to message traffic that originates with users directly connected to the switch. It also handles traffic received on trunks connected to other message switching centers either directly or through a TTC-39 circuit switch. When the message switch is connected to a switched network through a TTC-39 circuit switch it can service up to 9 adjacent nodes. The message switch has the capability of operating independently from a TTC-39 using either cable or RF multichannel trunks which are accessed through a CNCE. The message switch may process messages intended for the theater, and for strategic or intelligence communities simultaneously on a non-interfering basis. Trunk interfaces for the message switch include another TYC-13 message switch, a TTC-39 circuit switch or the AUTODIN network. Development of the message switch is progressing according to schedule. The Initial Operational Test and Evaluation for this switch is scheduled early in fiscal 1980. Low rate initial production is scheduled to start in the first quarter of fiscal 1982.

Estimated Army Requirements:
(INTACS force Model)
● 50 line S&F switch – 20

TYC-13 Message Switch (50 Line)

MESSAGE SWITCH
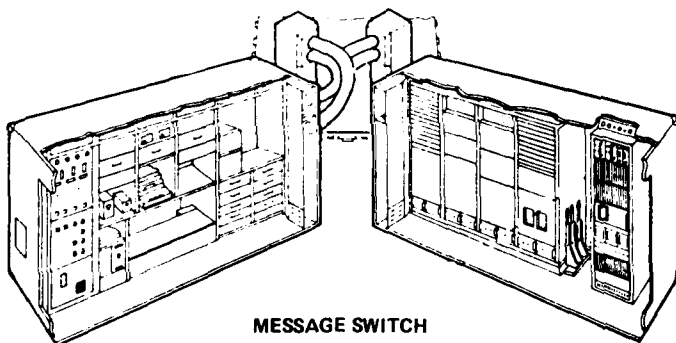
MESSAGE PROCESSING SHELTER

- Electronic store & forward
- Accesses switched network through TTC-39/CNCE
- Services up to 9 nodes (TTC-39 switch)
- Can operate independently from TTC-39
- Stores directory and performs message routing

- <u>STATUS:</u> In full scale equipment development—IOTE early FY80

- <u>CONTRACTOR:</u> GTE Sylvania

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The Communications Nodal Control Equipment (CNCE) is part of the Tactical Communications Control Facilities (TCCF). The CNCE provides the interface between the TTC-39 circuit switch and the data and voice trunk circuits that interconnect the switching nodes in the tactical communications network. The CNCE is modular in design and can handle both analog and/or digital local subscriber and multichannel trunk transmission circuits.

Four configurations of the CNCE were identified in the TRI-TAC conceptual studies. The major differences among these configurations relate to the ability to handle different ratios of analog to digital circuits, the requirement for an integral processor, and the number of shelters required. The Type I CNCE shown here is configured to handle predominantely analog circuits, is housed in two shelters, and requires a processor. The Type I CNCE is in the full scale equipment development phase with an Initial Operational Test and Evaluation (IOTE) date scheduled for late fiscal 1979.

As indicated earlier, only the Type I and III CNCE's are currently being considered for development. The conceptual design for the Type IIA CNCE shows that it would handle only digital circuits, would require a processor, and would be contained in two shelters. The conceptual design for the Type IV CNCE shows that it would handle about an equal number of analog and digital circuits, would not require a processor, and it would be contained in one shelter. Neither the Type IIA or the Type IV CNCE's are included in current TRI-TAC acquisition plans. However, the INTACS study and the Army's budget planning calls for acquisition of Type II and Type IV CNCE's.
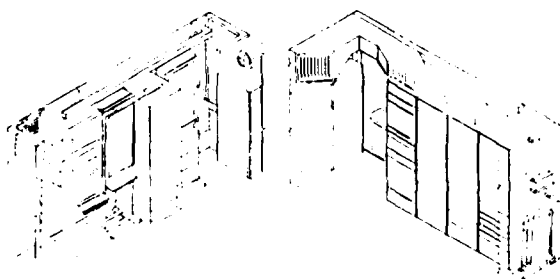
Estimated Army Requirements
(INTACS Force Model)
- CNCE Type I   - No requirement identified
- CNCE Type IIA - 72
- CNCE Type IV   - 257

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TCCF - Communications Nodal
Control Equipment (Type I)
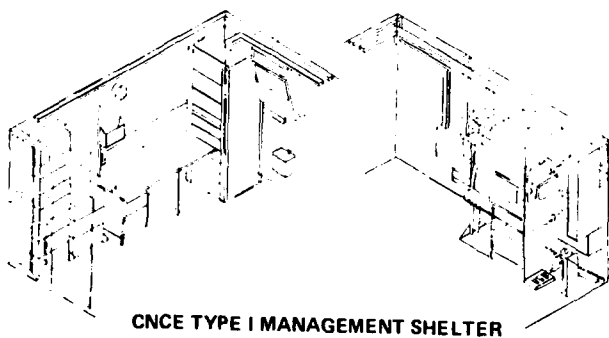
CNCE TYPE I MANAGEMENT SHELTER

CNCE TYPE I TECHNICAL SHELTER

- Provides node control for up to 4 switches

- Forms transmission groups and feeds cable or RF trunk circuits

- Tests transmission circuits

- Type I configured for predominantly analog circuits

- STATUS: In full scale equipment development—IOTE late FY79
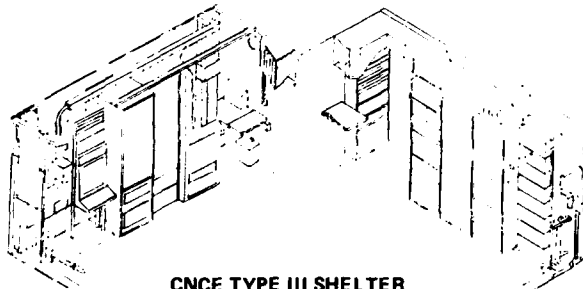
- CONTRACTOR: Martin Marietta

The Communications Nodal Control Equipment (CNCE) Type III will be configured for an approximately equal number of analog and digital circuits. It will include a processor and it will be contained in a single shelter. The CNCE Type III will perform functions similar to the CNCE Type I. It is envisioned that the CNCE Type III will be phased in as more digital circuits appear in the military network. The Type III CNCE is in full scale equipment development with the Initial Operational Test and Evaluation (IOTE) scheduled for late fiscal 1979.

Estimated Army Requirement:

(INTACS Force Model)

- CNCE Type III – No requirement
                          identified

TCCF - Communication Nodal Control Equipment (Type III)

- Provides node control for up to 4 switches
- Forms transmission groups and feeds cable or RF trunk circuits
- Tests transmission circuits
- Type III configured for equal analog/digital circuits

CNCE TYPE III SHELTER

- STATUS: In full scale equipment development—IOTE late FY79

- CONTRACTOR: Martin Marietta

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The Communications Systems Control Element (CSCE) contains equipment which provides real-time monitoring of a portion of a deployed tactical communications network. CSCE personnel, using the information processing, display, and communication capabilities of the CSCE, will manage the allocation and use of communications resources within that portion of the tactical communication network through the supervisory control of the CNCE's in the network. CSCE is capable of providing this management and control function for up to 16 CNCE's. The CSCE performs the following functions:

- Network performance and trunk circuit status monitoring
- Traffic control management
- Transmission system routing control
- COMSEC resources management
- Sole-user network management
- Control of the subscriber directory data base

The CSCE is in the concept validation phase with an Initial Operational Test and Evaluation (IOTE) scheduled to be completed by the end of fiscal year 1982.

Estimated Army Requirements:
(INTACS Force Model)
- At Division — 14
- EAD — 38

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TCCF - Communications System Control Element
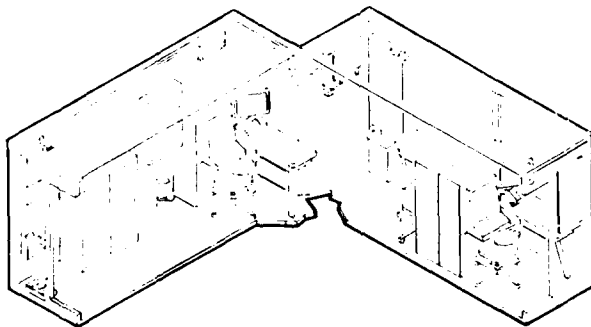
CSCE MANAGEMENT SHELTER

- Provides network control for 16 nodes
- Maintains/updates status of RF trunk circuits
- Tells CNCE which RF trunks are up and where they go
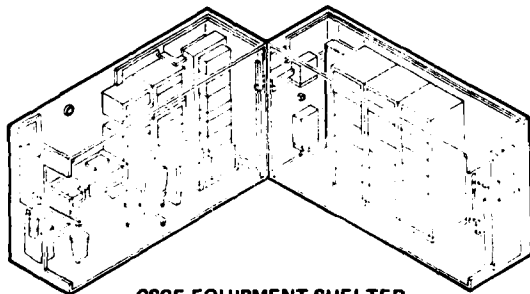
CSCE EQUIPMENT SHELTER

- <u>STATUS:</u> In validation phase— IOTE complete end FY82

- <u>CONTRACTOR:</u> Martin Marietta

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The TTC-42 Unit Level Switch (ULS) is being developed for the purpose of extending the digital secure communications capabilities into the lower echelons of military organizations. This switch is being developed in a 75 and 150 line configuration. Both of these units will be built into shelters and will provide automatic switching service similar to the TTC-39. The TTC-42 will have progressive conferencing but not preprogrammed conferencing and will have all other functions of the TTC-39 except attendant recall, essential user by-pass, and broadcast mode. The TTC-42 uses a Time Division Matrix for switching both analog and digital circuits. Full scale equipment development of the TTC-42 has just begun. The Initial Operational Test and Evaluation should be completed late in the fiscal 1981.

Estimated Army Requirements:
(INTACS force Model)
- 75 line - 35
- 150 line - 18

TTC-42 ULS (75 Line Circuit Switch)
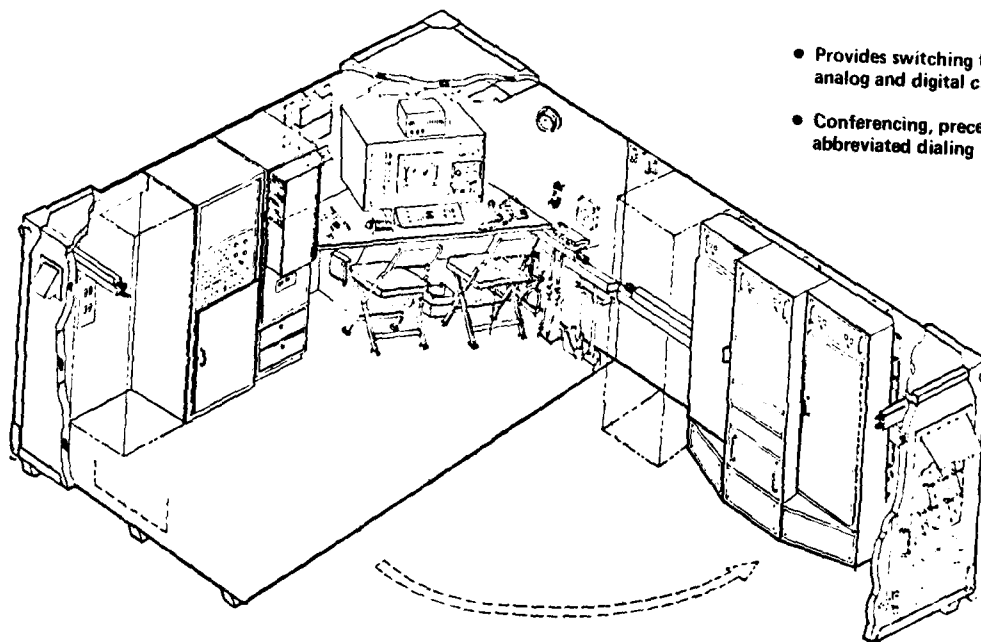
- Provides switching function for analog and digital circuits

- Conferencing, precedence, abbreviated dialing

- STATUS: Full scale equipment development has just started— IOTE late FY81

- CONTRACTOR: ITT

45

The 30 line Automatic Switchboard SB-3865 is a team transportable telephone switchboard that provides automatic switching service and subscriber service functions to the TRI-TAC family of digital telephone terminal instruments. It also can be configured with a mix of analog and digital line terminations. This switchboard is sized so as to provide switching among 30 lines. The SB-3865 can be stacked in 2 and 3 unit configurations to provide 60-line and 90-line switching capacities respectively. These switchboards feature a precedence function and conferencing through the use of a switchboard attendant. The SB-3865 is a member of the TRI-TAC Unit Level Switch (ULS) family and is interoperable with the TTC-42 Unit Level Switch. Details on the status of the development of this switchboard are not available at this time.

Estimated Army Requirements
(INTACS force Model)
- 30 line switchboards - 425
- 60 line switchboards - 244

SB-3865 (30 Line Automatic Switchboard)
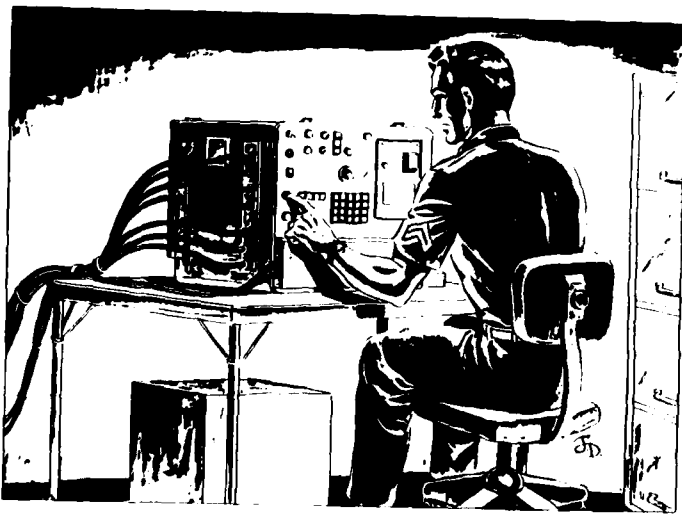
- Team transportable
- Automatic switching service
- Interoperable with TTC-42 ULS
- Precedence
- Attendant action conferencing

- **STATUS:**

- **CONTRACTOR:**

4.3

Static Subscriber Access

The TRI-TAC Static Subscriber Access hardware acquisition programs include the development of many individual pieces of equipment. These will be considered in more detail in the pages that follow. These programs and the Service or Agency tasked with the hardware development and acquisition are identified in the chart. The programs aimed at developing new subscriber sets having a digital output include: The Digital Non-secure Voice Terminal (DNVT); two types of Digital Secure Voice Terminals (DVST), a field version and a desk version; and the Advanced Narrow-band Digital Voice Terminal (ANDVT). In addition, a Data Adapter program has been implemented to provide a means for interfacing the current military data devices to the TRI-TAC switched network. A family of Digital Group Multiplexers is being developed to provide means for combining individual channels of digital information into progressively larger groups. A Tactical Digital Facsimile device is under development that will provide various shades of grey in a hard copy output. A program is also underway to develop the equipment required to provide a Modular Record Traffic Terminal.

Static Subscriber Access
Hardware Acquisition Programs

	Service/Agency Tasked
● Digital Non-Secure Voice Terminal (DNVT)	USAF
● Digital Secure Voice Terminal (DSVT)	NSA
● KY-68/E2 Seeley (field version)	
● KY-78/E1 Seeley (desk version)	
● Advanced narrowband digital voice terminal	NSA
● Data adapter	USAF
● Digital group multiplexers	USA
● Tactical digital facsimile	USN
● Modular record traffic terminal	USA

The Digital Non-secure Voice Terminal (DNVT), here shown in a Full Scale Equipment Development mock up, is being developed to provide a digitized voice output that will be compatible with the TRI-TAC 16/32/s digital channel input requirements. The digitized output signal will be derived using Continuously Variable Slope Delta (CVSD) modulation and will provide a non-encrypted digital input to the TRI-TAC hardware. The DNVT is near completion of the concept validation phase. The INTACS force model calls for about 11.5 thousand DNVT at the Theatre level and a similar quantity at the Corps level. The Initial Operational Test and Evaluation (IOTE) is expected early in fiscal year 1981. Production Delivery is scheduled to start in the fourth quarter of 1982.

Estimated Army Requirements
(INTACS Force Model)
- DNVTS - 28,248

Digital Non-Secure Voice Terminal (Mock-up)

- 16/32 kbs output
- CVSD modulation
- Non-encrypted interface with TTC-39, TTC-42 & SB-3865

- STATUS: Concept validation phase near completion IOTE early FY81

- CONTRACTOR: —

Digital Secure Voice Terminal (DSVT) development is being undertaken through the SEELEY Program. Two versions of this terminal are under development. The KY-68/E2 is the field version of the DSVT while the KY-78/E1 is the desk version. Photos of this equipment could not be obtained. The DSVTs are being designed to provide a 16/32kb/s encrypted digital output for either voice or digital data input. The field version of the DSVT will be compatible with the unit level automatic switchboard (SB-3865) but surprisingly, will not be compatible with the current configuration of the TTC-39. It is anticipated that the TTC-39 will be modified to be compatible with the KY-68/E2 field version of the DSVT. The development status of the DSVT has not been determined.

Estimated Army Requirements:
(INTACS Force Model)
● DSVT - 2974

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Digital Secure Voice Terminal (DVST)

- Will provide 16/32 kb/s encrypted voice output
- Will accept data input and provide 16/32 kb/s encrypted digital output
- Up to 6 extension phones

KY-68/E2 (field)

KY-78/E1 (desk)

- STATUS: Being developed by NSA— status not determined

- CONTRACTOR: Not determined

55

The third member of the secure voice terminal family is the Advanced Narrow-band Digital Voice Terminal (ANDVT). This device is in the early conceptual phase of study. It will provide an encrypted digital output that is compatible with the TRI-TAC hardware. The ANDVT is in the conceptual study phase which is scheduled to be completed by the fourth quarter of fiscal 1978. Requirement for ANDVT was not identified in the INTACS study. Development of the ANDVT concept post-dates the INTACS study, therefore force model requirements do not exist.

# Advanced Narrowband Digital Voice Terminal
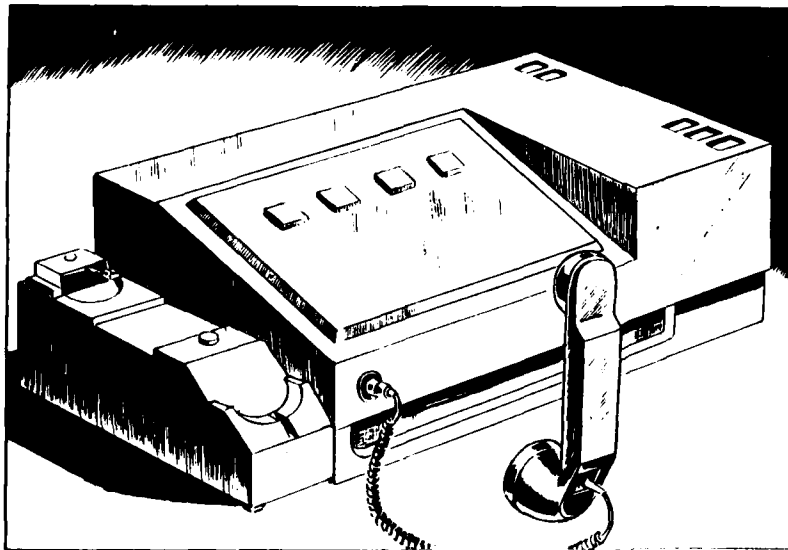
- 4 kHz bandwidth
- Secure
- Digital output

- STATUS: In conceptual study phase

- CONTRACTOR: —

The Data Adapter (MX-9542/USG) is being developed to provide a means to retain continued use of certain classes of current and planned data terminals. These terminals include tele- typewriters, printers, facsimile devices, computer source terminals and other digital data system and voice frequency telegraph equipment. The Data Adapter as presently conceived will compensate for differences in protocol and bit-rate between these data terminals and the TRI- TAC switching and transmission equipment. The Data Adapter will accept digital bit streams that are asynchronous with the TRI-TAC system at bit-rates up to a maximum of 1/8th of the loop transmission rates for the TRI-TAC equipment (i.e. 16/32kb/s). The output of the Digital Adapter may be set at 2.4, 16, or 32kb/s in a format compatible with the TRI-TAC hardware. The digital output of the Data Adapter will be non-secure. Full scale equipment development of the Data Adapter is expected to start in the middle of fiscal year 1978. Initial Operational Test and Evaluation is expected to be complete early in fiscal year 1980. Requirements for the Data Adapter were not identified in the INTACS Objective System Study.

Data Adapter (DA)
(MX-9542/USC)
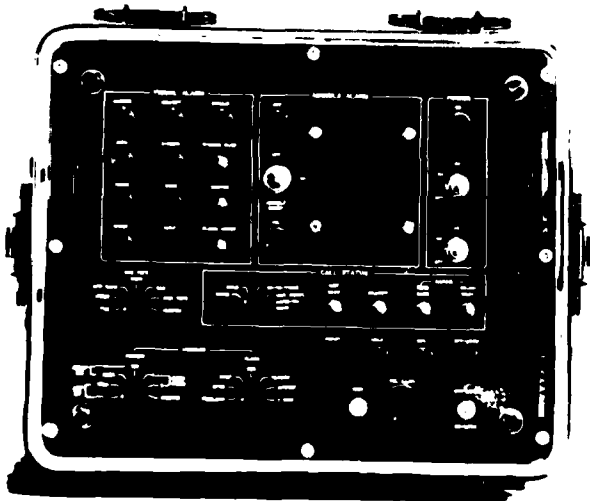
- Digital output (non-secure)
- Accepts current inventory non-voice inputs, e.g.
    - TTY
    - Printers
    - Facsimile
    - Digital data systems
- Accepts asynchronous bit rate up to 1/8 loop transmission rate

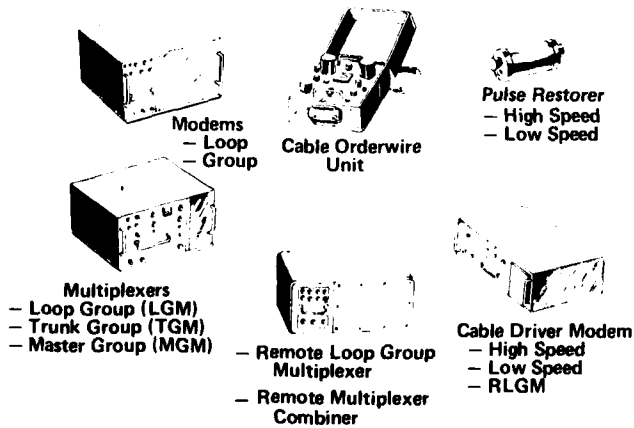- STATUS: Full scale equipment development start mid FY78—IOTE early FY80

- CONTRACTOR:

The Digital Group Multiplexer (DGM) is a family of equipment being developed to provide a very high degree of flexibility in the manner in which information from subscriber circuits can be combined into progressively larger groups for transmission over cables or radio circuits. There are over a dozen different pieces of equipment being developed in the program. These illustrations are meant to be representative only of the general size and shape of the members of the DGM famly. The Loop Group Multiplexer (LGM) accepts up to 15 subscriber circuit inputs and forms them into a single Group. The Trunk Group Multiplexer (TGM) accepts up to four Groups and forms then into the next higher level of multiplexing, a Super Group. The Master Group Multiplexer (MGM) accepts up to 12 Super Groups and forms a Master Group. The maximum bit-rate allowable in the Master Group is 18.720 Mb/s. At this rate, the Master Group output may be transmitted up to 8km over coaxial cable using cable drivers and pulse restorers. With a lower Master Group bit-rate of 2.048Mb/s, a transmission path up to 64km may be achieved. Other members of the DGM family include modems, cable order wire units to provide multiplexing capability at locations remote from switching centers, Remote Loop Group Multiplexer (RGLM) and the Remote Multiplexer Combiners (RMC). The Digital Group Multiplexer family of equipment is in full scale equipment development. The Initial Operational Test and Evaluation is expected to be completed by early fiscal year 1980.

Estimated Army Requirements:
(INTACS Force Model)
- RLGM – 552
- RMC – 552

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Digital Group Multiplexer Family

Modems
— Loop
— Group

Cable Orderwire
Unit

Pulse Restorer
— High Speed
— Low Speed

Multiplexers
— Loop Group (LGM)
— Trunk Group (TGM)
— Master Group (MGM)

— Remote Loop Group
  Multiplexer

— Remote Multiplexer
  Combiner

Cable Driver Modem
— High Speed
— Low Speed
— RLGM

- Reduces wire stringing requirement
- Combines output of digital devices into multiplexed bit streams (loop groups)
- Combines loop groups into higher order groups
- Drives coaxial cables

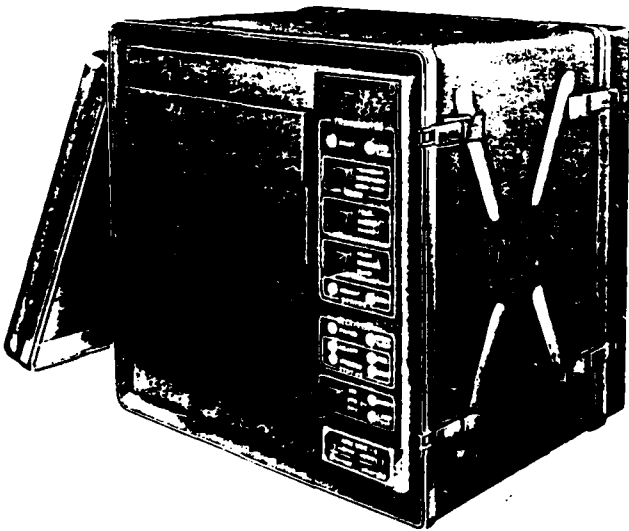- STATUS: In full scale equipment development—IOTE early FY80

- CONTRACTOR:

61

The Tactical Digital Facsimile (TDF) equipment (AN/UXC-4) is being developed to provide hard copy facsimile with grey scale capability. It is anticipated that the equipment will provide the user with a capability for rapid encrypted transmission and reception of low resolution black and white and/or limited grey scale material such as typewritten or hand-written documents, fingerprint records, maps, charts, overlays, sketches, and photographs. Two versions of this device were planned, one having a capability to resolve 8 shades of grey, the other to resolve 32 shades of grey. The program apparently has been changed to provide only one grey scale capability; however, details of the current TDF program were not available. The TRI-TAC program schedules show that the Tactical Digital Facsimile equipment is in full scale equipment development, with the Initial Operational Test and Evaluation scheduled to be completed by mid fiscal year 1980.

Estimated Army Requirements
(INTACS Force Model)
- TDF (8 shades of grey) - 450
- TDF (32 shades of grey) - 263

Tactical Digital Facsimile (AN/UXC-4)

- Provides capability to transmit graphics, photos, maps, etc.

- STATUS: In full scale equipment development—IOTE mid FY80

- CONTRACTOR:

The designation Modular Record Traffic Terminal (MRTT) is a generic name applied to different assemblages of record traffic equipment. A conceptual study is underway to define these equipment configurations. Facsimile traffic will predominate in areas forward of Division, while teletype will predominate in the rear. The illustration shows the types of equipment that may be found in an MRTT. Equipment quantities at each MRTT will vary with the function that the MRTT is supporting. An MRTT configuration may include the following: a Tactical Record Traffic Processor (TRTP) that interconnects and controls the operation of the MRTT equipment; a Tactical Digital Facsimile (TDF) terminal that can transmit 9 x 11 inch document in about 18 seconds, and a Tactical Record Traffic Terminal (TRTT) to provide for teletype transmission and reception. The TRTT is illustrated here by the printer, the visual display unit (VDU) and keyboard. The VDU is intended to aid in composing a message prior to transmission. It is expected that some type of hardcopy reproduction equipment will also be required. The MRTT conceptual study is scheduled to be completed early in fiscal 1978. The Initial Operational Test and Evaluation is scheduled to be completed in the latter part of the fiscal year 1981.

Estimated Army Requirements:
(INTACS Force Model)
- TRTT - 1792
- TRTP - 146

Modular Record Traffic Terminal
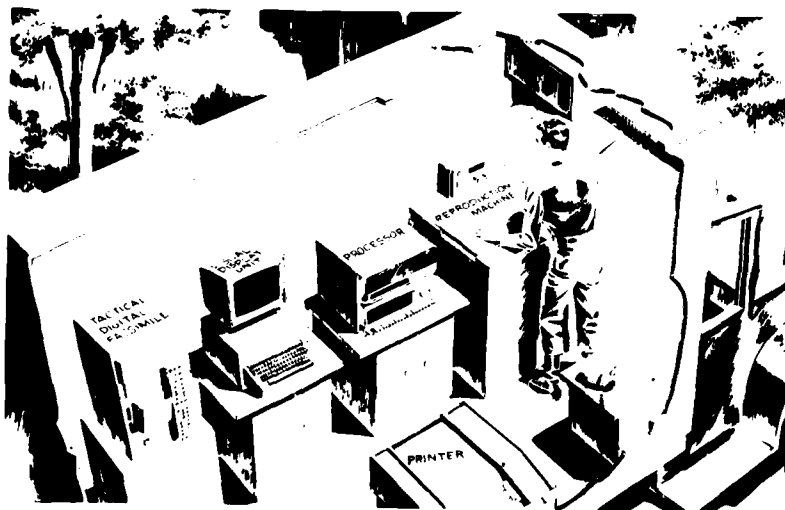
- A single subscriber MRTT may include:

  - Keyboard
  - Printer
  - Display Unit
  - Controller/ Processor
  - External interface

- STATUS: In conceptual study phase—IOTE late FY81

- CONTRACTOR: —

4.4

Mobile Subscriber Access

The Mobile Subscriber Access (MSA) program is intended to provide secure automatic switched telephone service to Mobile subscribers who require access to a multichannel switched communications system. Equipment developed on this program will also provide an interface between the single channel net radio users and the multichannel switched communications system or a Mobile Subscriber. This acquisition program is divided into two major components, the Mobile Subscriber Equipment (MSE) and the Net Radio Interface (NRI). These will be described separately. It is anticipated that this equipment will be used primarily at Division Level and below.

Mobile Subscriber Access
Hardware Acquisition Programs

	Service Tasked
● Mobile Subscriber Equipment (MSE)	USA
● Mobile Subscriber Terminal (MST)	
● Mobile Subscriber Central (MSC)	
● Access Unit (AU)	
● Net Radio Interface (NRI)	USA

The Mobile Subscriber Equipment (MSE) is currently in the conceptual phase. A Joint Service Operational Requirement (JSOR) for the MSE is being drafted. Validation of the MSE configuration is scheduled to be completed late in fiscal year 1980. At this time the concept for the Mobile Subscriber Equipment includes three major pieces of equipment. The Mobile Subscriber Terminal (MST) is a device that provides secure automatic dial-up radio telephone service to high priority users. It operates in voice, record traffic, facsimile, and data modes. Communication with other MST's may be direct or through a Mobile Subscriber Central (MSC). The MSC provides a mobile radio telephone switching center for the MSE. It furnishes automatic call switching and retransmission for mobile subscribers. It also serves as an interface for calls both to single channel radio nets and to the tactical switched multichannel communications network through a collocated Unit Level Switch. The Access Unit (AU) permits static subscribers to access the mobile subscriber radio telephone network on a shared basis through a Unit Level or TTC-39 switch. The MSE is a key element in the INTACS planning. The Initial Operational Test and Evaluation completion date for this MSE is not included on the development schedules obtained from the TRI-TAC Office.

Estimated Army Requirements:
(INTACS force Model)
- MST – 4,796
- MSC – 114
- AU – 888

Mobile Subscriber Equipment (MSE)

- Provide mobile subscriber dial up capability to other mobile subscribers
- Provide mobile subscribers with access to switched network

- STATUS: Concept validation start FY79—IOTE after FY84

- CONTRACTOR: —

71

The Net Radio Interface (NRI) is also in the conceptual phase. This unit will provide a link between the net control station of a combat radio net and the Mobile Subscriber Central. It is anticipated that this link will be a half-duplex push-to-talk circuit and that operator assistance will be required at some point in the call. The Initial Operational Test and Evaluation of the Net Radio Interface is currently scheduled to be completed about the middle of fiscal year 1981.
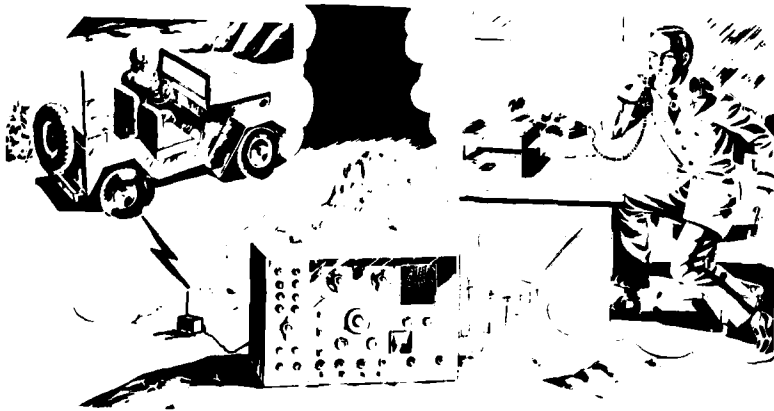
Estimated Army Requirements:
(INTACS Force Model)
● NRI – 1272

72

Net Radio Interface

- Provide net radio user with access to subscribers of switch multi-channel network

- STATUS: Conceptual study completed—IOTE FY81

- CONTRACTOR: —

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4.5

Transmission

The four Transmission hardware acquisition programs will be discussed in this section. The AN/TRC-170 TROPO Radio Terminals are troposcatter radio sets that will provide transmission and reception over ranges up to 200 miles. The Short Range Wide Band Radio (SRWBR) is intended to provide a radio communication link between the CNCE's at a switching node and multichannel radio relay equipment that may be located a few miles away from the CNCE. This link is sometimes referred to as the "down the hill" radio. There are also two development programs to provide modems for UHF and SHF satellite communication systems.

Transmission
Hardware Acquisition Programs

|	Service Tasked
● TROPO terminal (AN/TRC-170 ( )	USAF
● Short Range Wide Band Radio (SRWBR)	USAF
● UHF satellite modem	USN
● SHF satellite modem	USA

77

The TRC-170 TROPO terminal program consists of a family of digital troposcatter radio sets. These sets will accomodate digital modulation in power ranges of 1, 2, and 10kW and will provide communications up to a maximum range of 200 miles. These radio sets will accept digital data rates of 1.024/2.048Mb/s which are compatible with the output of the Trunk Group Multiplexer (TGM). These terminals provide the capability for transmission of up to 63 traffic channels. The TRC-170 TROPO terminal is in full scale equipment development. The Initial Operational Test and Evaluation is scheduled to be complete by the middle of fiscal year 1980.

Estimated Army Requirements
(INTACS Force Model)
- TRC-( ) 1kw - 32
- TRC-( ) 10kw - 8

Tropo Terminal (AN/TRC-170)

- Digital data link for ranges up to 200 mile
- Data rate 1.024/2.048 Mb/s
- Up to 63 traffic channels
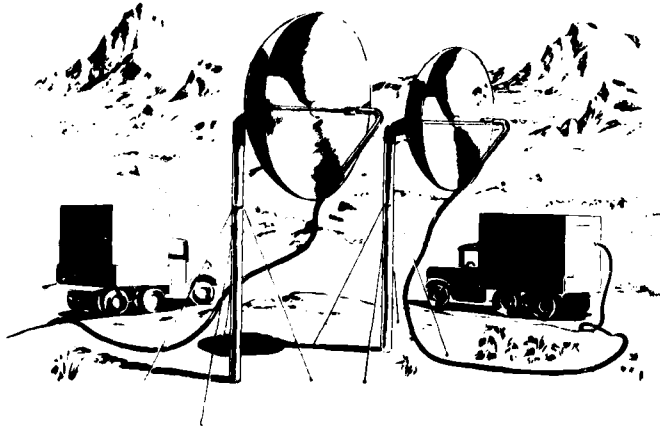
- STATUS: In full scale equipment development—IOTE mid FY80

- CONTRACTOR: Raytheon\

The Short Range Wide Band Radio (SRWBR) is intended to replace certain cable and radio links for the "down-the-hill" function and to provide for certain intra-base data/voice transmission needs. An approved specification has not as yet been issued for the SRWBR. The present concept includes a requirement for a time division multiplex microwave link with the capability of handling a bit-rate of up to 20Mb/s. Definition of SRWBR equipment concepts is currently under review. The conceptual goals for the SRWBR include a range of up to 15 miles. Full Scale Equipment Development is scheduled to start in fiscal year 1979. The Initial Operational Test and Evaluation is scheduled to be completed by the middle of fiscal year 1981.

> Estimated Army Requirements
> (INTACS Force Model)
> ● SRWBR - 40

Short Range Wide Band Radio (SRWBR)
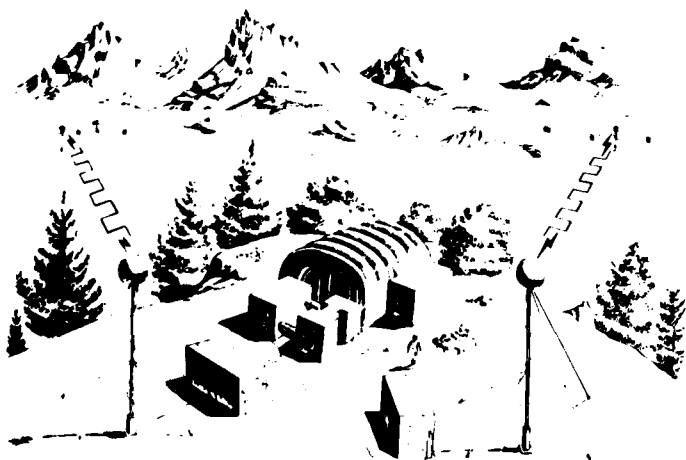
- Provides "down the hill" transmission
- "Intra-base" short distance cable replacement
- TDMX up to 20 Mb/s
- Range to 15 miles

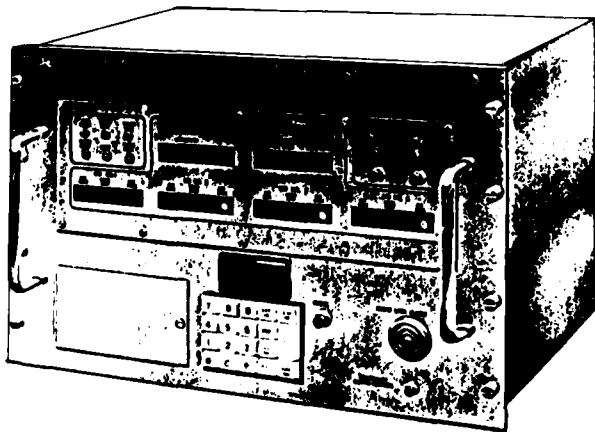- STATUS: Full scale equipment development start FY79-IOTE mid FY81

- CONTRACTOR: —

The UHF satellite modem will provide the capability to the Army to efficiently utilize the 25kHz radio frequency channels of the Fleet Satellite Communications (FLTSATCOM) satellite in a demand assigned, time division multiplexed multiple access (DA/TDMA) Mode. Initially, this will be manually operated capability but eventually will be fully automated. Full scale equipment development is scheduled to be complete by mid-fiscal year 1978. The Initial Operational Test and Evaluation is scheduled to be complete early in fiscal year 1979.

Estimated Army Requirements
(INTACS Force Structure)
● UHF Modems - 505

UHF Satellite Modem

- Increases throughput capacity
  of Fleet Satellite Communication
  Satellite by providing DA/TDMA
  capability.

- STATUS: Full scale equipment
  development Mid FY78-IOTE
  early FY79

- CONTRACTOR: Not identified

83

Tne SHF satellite modem will meet the TRI-TAC trunking requirement and will interface with the TTC-39 circuit switch. It will provide a demand assigned, time division multiplexed multiple access (DA/TDMA) capability for Army ground stations. The schedule for TRI-TAC hardware acquisition programs indicate that the SHF model should be in the conceptual phase at this time. Conceptual validation of this model is not scheduled to begin until the middle of fiscal year 1978. The beginning of full scale equipment development is not scheduled until the early part of fiscal year 1982.

Estimated Army Requirements
(INTACS Force Model)
- SHF Modem, 8 channel   – 87
- SHF Modem, 36 channel – 30
- SHF Modem, 144 channel – 6

SHF Satellite Modem

(Concept Validation Planned Mid FY 78)

4.6

Communications Security

TRI-TAC planning includes a goal to provide, eventually, 100% secure digital communications within networks assembled using TRI-TAC hardware. To this extent numerous security devices will be included, in modular form, within TRI-TAC hardware. These modular communications security elements will be discussed in this section. Certain subscriber access equipment such as the DSVT and the ANDVT provide encrypted digital outputs use integral communications security devices and were discussed earlier. Descriptive information was obtained on only two of the communications security modular elements, the Dedicated Loop Encryption Device (DLED) and the VINSON KY-57.

Communications Security
Hardware Acquisition Programs

	Agency Tasked
● Dedicated Loop Encryption Device (DLED)-TSEC/KG-84	NSA
● VINSON KY57	NSA
● Communications security for:	NSA

- TTC-39
- TTC-42
- SB-3865
- MSE
- NRI
-
-
-
-

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The Dedicated Loop Encryption Device (DLED) is a key generator that provides for encryption and decryption of teletypewriter and other data traffic on dedicated circuits. The specific application identified with TRI-TAC hardware is as a key generator between the Data Adapter and the Loop Group Modem. The status of development of the Dedicated Loop Encryption Device has not been determined.

Estimated Army Requirement:

(INTACS Force Model)

● DLED — No requirement identified

Dedicated Loop Encryption Device (DLED)

- Key generator for use on dedicated line between data adapter and loop group modem
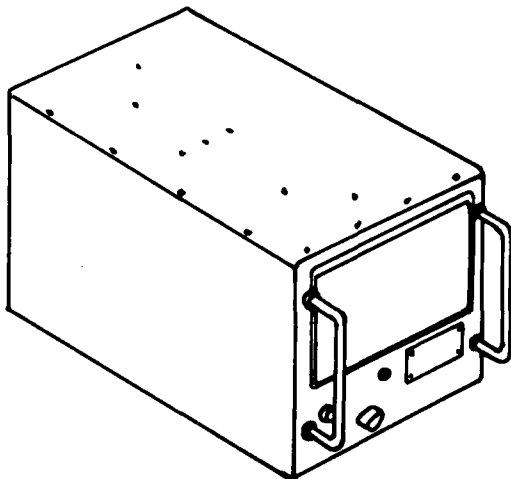
- STATUS: Not determined

- CONTRACTOR: Not determined

The VINSON KY-57 is an encryption device for use in a half-duplex (push-to-talk) VHF/UHF
radios and in wirelines. The VINSON device will operate with both voice and data communications
at a bit-rate of 16kb/s. It is anticipated that the VINSON device would be used to provide
secure data communications with the Mobile Subscriber Equipment and would also operate in con-
figurations involving the Net Radio Interface Equipment. The VINSON is equiped with a handset
for direct access voice communications. It may also be used to encrypt the output of the
Data Adapter. Photos of the VINSON device were not obtained. The status of development of the
VINSON has not been determined.

Estimated Army Requirement:
(INTACS Force Model)
- VINSON - 63,241

VINSON (KY57)

- Crypto device for half-duplex
  (push-to-talk) VHF/UHF
  radios and wirelines
- Operates both voice and
  data communications
- Operates at 16 kb/s

VINSON (KY57)

- STATUS: Under development by NSA
  Status not determined

- CONTRACTOR: Not identified

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5.0
Development Schedules

These summary development schedules provide a recap of the major TRI-TAC development programs, the service or agency responsible for hardware acquisition, the current status of development, and the date that the Initial Operational Test and Evaluation is scheduled to be completed. Additional information is provided relative to the dates when production of the hardware items are scheduled to start. Information in these summary schedules was obtained from a TRI-TAC Office Working Paper generated by the Program Assessment Division of the Operations and Management Directorate. Scheduled information in this TRI-TAC Office Working Paper was not carried out beyond the first quarter of FY 1984.

Acronyms and abbreviations, other than for TRI-TAC equipment nomenclature and service/agency tasked for equipment development, that are used in this summary schedule are:

FSED - Full Scale Equipment Development

LRIP - Low Rate Initial Production

Prod Del - Production Delivery

NR - Not Reported

TRI-TAC SUMMARY DEVELOPMENT SCHEDULES*

Dates[1] - Quarter/FY

PROGRAM	RESPONSIBILITY	CURRENT STATUS	IOTE	PRODUCTION
SWITCHING & CONTROL				
AN/TTC - 39	USA	FSED - 2/79	1/80	LRIP - start 1/82
AN/TYC - 13	USA	FSED - 4/78	1/80	LRIP - start 1/82
TCCF (CNCE)	USAF	FSED - 4/78	4/79	LRIP - start 1/82
TTC - 42	USMC	FSED - 3/80	4/81	Prod Del - start 2/83
SB - 3865	USMC	NR	NR	NR
STATIC SUBSCRIBER ACCESS				
DSVT	USAF	Concept Validation - 4/77	1/81	Prod Del - start 4/82
DSVT	NSA	(Status Not Determined)	--	--
ANDVT	NSA	Conceptual Study - 4/78	2/83	Prod Del - start FY 84
LX	USAF	Concept Validation Complete	4/80	Prod Del - start 4/82
DGM	USA	FSED - 3/78	1/80	LRIP - start 1/82
TDF	USN	FSED - 4/79	2/80	Prod Del - start 1/82
MRTI	USA	Conceptual Study - 3/81	3/81	Prod Del - start 3/83
MOBILE SUBSCRIBER ACCESS				
MSE	USA	Concept Study Complete	beyond 1/84	beyond FY 84
NRI	USA	Concept Study Complete	2/81	Prod Del - start 1/84
TRANSMISSION				
TROPO Term.	USAF	FSED - 2/79	2/80	Prod Del - start 4/82
SRWBR	USAF	Conceptual Study Complete	2/81	Prod Del - start 4/83
UHF Sat. Mod.	USN	FSED - 3/78	1/79	Prod Del - start 1/81
SHF Sat. Mod.	USA	Concept Study Complete	beyond 1/84	beyond FY 84
COMMUNICATIONS SECURITY				
DLED	NSA	NR	NR	NR
VINSON	NSA	NR	NR	NR

Note: 1 - Dates given are completion dates unless otherwise noted

*TRI-TAC Office Working Paper
12 July 1977

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SUMMARY

This brief review of the TRI-TAC equipment development and acquisition programs has described the function, purpose and the nature of the various types of tactical communications equipment that comprise this joint service communications program. In addition, information on the development status and expected Army requirements for each piece of TRI-TAC equipment has been provided.

As may be apparent, there are many ways in which this equipment may be integrated to meet the needs of each Service. This integration of TRI-TAC hardware into the broad range of tactical communications equipment already fielded by the Army or in various stages of development must be done in the context of continually evolving Army requirements. At the same time, due consideration must be paid to the vagaries and exigences associated with such a large scale complex and sophisticated hardware development program. The concept to accomplish this over-all systems integration remains to be established.

It is intended that distribution of this document will serve to familarize users, developers and other interested parties with the hardware elements that comprise the TRI-TAC program and to stimulate dialog as to how these elements can best be used by the Army in the 1980's and 90's.

SUMMARY

● TRI-TAC DEVELOPING DIVERSE EQUIPMENTS

● NEED FOR ORDERLY INTEGRATION OF TRI-TAC
WITH EXISTING AND PLANNED CAPABILITIES

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	G. Craig
	L. Erlichman
	E. Famolari

INTERNAL (47)

W-72	J. Gasparotti
	F. Owens
	D. Shulman
	R. Virostek
	C. Woodbridge
W-73	R. Hamilton
	D. Penrod

MITRE/METREK Library

W-70 Library (D. Anderson)

EXTERNAL (12)

DARCOM/DBSI
5001 Eisenhower Avenue
Alexandria, VA 22333

Major General Ira A. Hunt (12)
Colonel Richard W. Wilmot

END

DATE
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12-80

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