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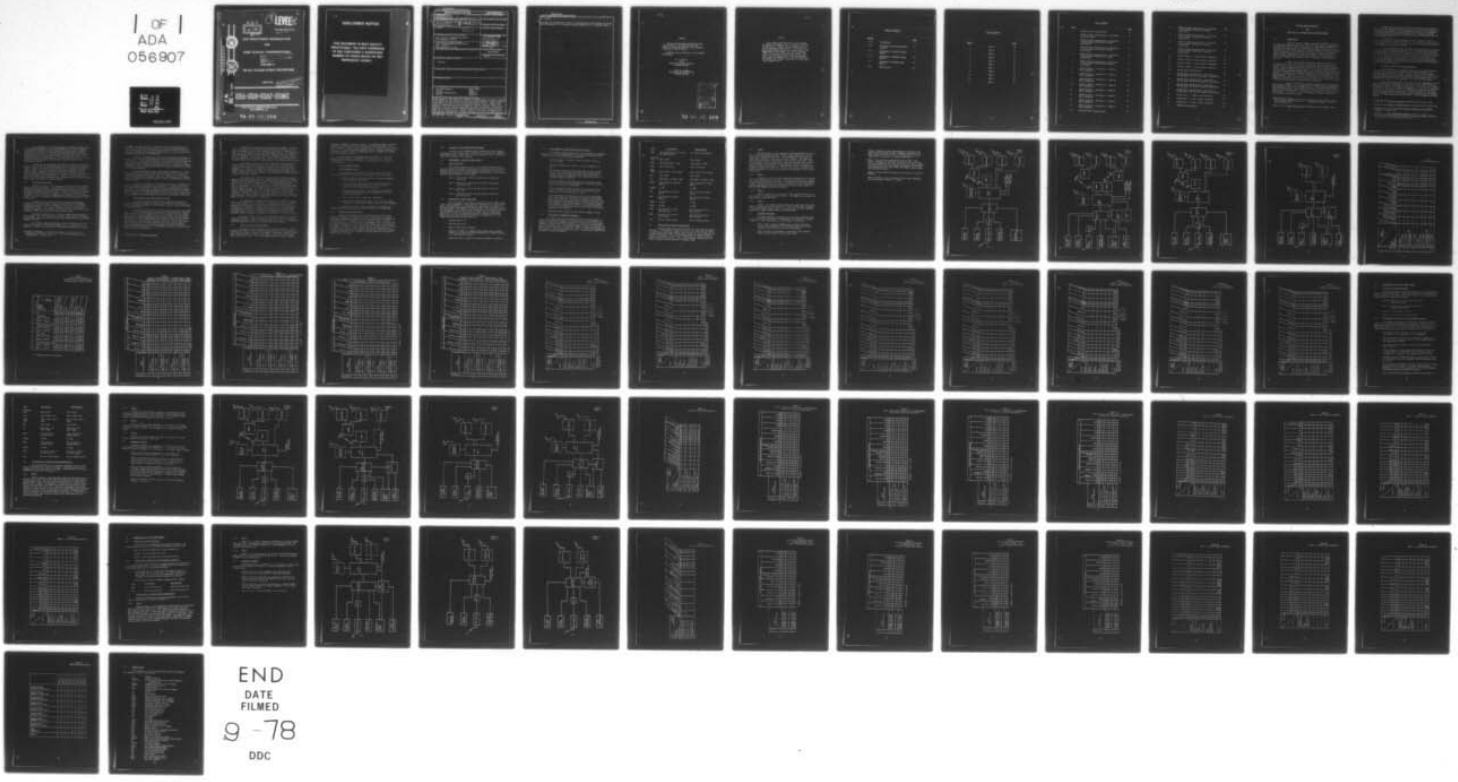

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COST EFFECTIVENESS PROGRAM PLAN

FOR

JOINT TACTICAL COMMUNICATIONS

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VOLUME V

TRI-TAC STYLIZED NODAL DESCRIPTIONS

JUNE 1978

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The purpose of this volume is to identify a limited number of typical stylized nodal models that have been developed by the TRI-TAC Office to define a range of alternatives for various types of cost effectiveness studies. Eleven nodal types are identified; four contain AN/TTC-39 switches, four are based on the AN/TTC-42, and three address the SB-3865 unit level switchboard. Each node is described in terms of a block diagram which shows its major elements and how they will be interconnected. Specific details of each node are presented and additionally, variations of the nodal configurations can be readily developed

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by either (1) revising one or more of the ground rules which changes the equipment allocations; or (2) varying the major assemblies in a "stylized" node.

VOLUME V

TRI-TAC Stylized Nodal Descriptions have been prepared by the Operations Research Division, Operations Research, Test & Analysis Directorate, TRI-TAC Office.

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Preface

The stylized nodes described in this document are based on information that is current at the time of publication. Primary source documents were the TRI-TAC equipment specifications. If a source document should change, such as the configuration of the COMSEC module in the CNCE, the count of equipment found at a node will probably be influenced. The users of this document should update the equipment tables when such changes occur. The TRI-TAC Office will modify this document periodically or when significant changes occur.

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STYLIZED NODAL DESCRIPTION

FOR

JOINT TACTICAL COMMUNICATIONS SYSTEMS/EQUIPMENT

1.0 INTRODUCTION

The Joint Tactical Communications (TRI-TAC) Office conducts the Cost Effectiveness Program Plan (CEPP) for joint tactical communications in conjunction with the Services and Agencies. The CEPP establishes the procedures and instructions for applying the concepts and tools of design to cost and cost effectiveness analysis to system planning, trade-offs, testing, economic analyses, and cost analyses involved in acquisition processes of joint tactical communication systems and equipment. The CEPP comprises several volumes and appendices devoted to measures of effectiveness, life cycle cost estimating and analyses, threat information, and technology forecasts.

Volume I [1] of the CEPP provides an overview of the scope of the Plan as it affects the Services and Agencies, and the TRI-TAC Office. It establishes a joint Service/Agency Cost Effectiveness Coordinating Committee. It also emphasizes that the instructions and guidelines contained in the follow-on volumes should be used in the following areas associated with TRI-TAC systems/subsystems/equipment and related development/acquisition contracts: architectural planning; economic/cost analyses; design and integrated logistic trade-offs; base line and independent costing efforts; program management and planning studies; and decision coordinating papers (DCP). Moreover, it stresses that the CEPP should be used in the contractual process involving TRI-TAC equipment development and procurement.

Volume II [2] provides a conceptual model useful for performing effectiveness analyses at the system level for planning and cost-effectiveness studies of joint tactical communications. It also provides guidelines for the modification and application of this model to similar types of problems at the equipment level. The model is also applicable to the design of test programs. It presents joint Service/Agency coordinated Measures of Effectiveness of TRI-TAC programs.

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[1] Joint Tactical Communications Office, Cost Effectiveness Program Plan for Joint Tactical Communications, Vol I - Management Overview, TTO-ORT-032-75-VIA, November 1975.

[2] Ibid, Vol II - System Effectiveness, TTO-ORT-032-74-V2, November 1974.

Volume III[1] serves as TRI-TAC Office instructions and guidance to the Services and Agencies for their preparation, reporting, and tracking of life cycle cost estimates of TRI-TAC systems, subsystems, and equipments. It provides formats for reporting TRI-TAC costs in a manner to enhance TRI-TAC financial management and planning by the Services/Agencies/TRI-TAC Office/and ASD (C^3I).

Volume IV[2] provides preliminary threat information useful for planning and analytical modeling purposes. This Volume is being replaced by a more extensive effort by the TRI-TAC Office and the Services and Agencies. It is scheduled for completion in 1978.

Since initiation in 1973, the CEPP has established and coordinated the basic joint Service/Agency methods, factors, formats, and definitions for performing cost effective type analysis. Recently, the TRI-TAC Office and the Services and Agencies have concentrated on coordinating proper input data to the models and analytical techniques mentioned in Volumes II and III. Most importantly, these volumes and their inputs have since been effectively applied by the TRI-TAC Office and the Program Managers/System Program Office (PM/SPO) to the contractual planning process of almost all of the TRI-TAC equipment programs.

1.1 TRI-TAC Cost Effective Program Approach

The TRI-TAC Office is charged by DOD Directive 5148.7[3], with the responsibility for achieving interoperability among telecommunication systems and providing for the timely fielding of the most cost effective telecommunication technology without a wasteful duplication of effort. The CEPP was initiated to assist in fulfilling the TRI-TAC responsibility for insuring the fielding of these equipments in a cost effective manner.

Cost effectiveness analysis is a very practical management tool to assist and advise decision makers at all levels. It is used to evaluate alternative systems or equipments in terms of estimated total costs, risks, and benefits, effectiveness, and/or performance. It is a type of analytical study that is "designed to assist a decision maker in identifying a preferred choice among possible alternatives."[4] Most importantly, it provides analysts, planners, and decision makers useful visibility into the implications of the time phased funding and benefits of broad management planning choices.

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[1] Ibid, Vol III, Life Cycle Costing, TTO-ORT-032-78C-V3, April 1978.

[2] Ibid, Vol IV, Threat to TRI-TAC Systems, TT-ORT-032-76-V4, October 1976.

[3] DOD Directive, 5148.7, The Joint Tactical Communications (TRI-TAC) Program, 17 January 1978.

[4] Quade, E. S., Cost Effectiveness Analysis, edited by Goldman, T. A., Washington Operations Research Council, Praeger Publications, New York, 1967, Chapter 1, "Introduction and Overview," p. 1.

The application of cost effectiveness to advanced programs, such as the TRI-TAC equipment, is usually handicapped by the lack of adequate descriptions of the theater level compositon of proposed new equipment. In the case of TRI-TAC, cost analysis and Integrated Logistic Support studies of total forces of nodal equipment have shown the need for better input data particulary data which will help in requirement studies. The stylized nodes that are described in this volume are nodal models that can be used to define a range of alternatives for various types of cost effectiveness studies.

The TRI-TAC Program Budget Guide (PBG) [1/], prepared by the TRI-TAC Office to also assist the Services/Agencies in their planning and budgeting process, presents equipment quantities that may be required for several types of nodes. The allocation ground rules that are used in the PBG present single estimates of quantity and are not compatible with the approach used in structuring the range of estimates for the stylized nodes that are described in this document. As a result, a close correlation will not be found between the quantities, especially in the percent security levels, that are listed in the two documents.

1.2 TRI-TAC Stylized Nodes

The TRI-TAC Office is the systems architect for Tactical Communication Systems and equipment. In performing this portion of its mission, TRI-TAC has defined the system architecture and has developed a series of equipment performance specifications that are used by the Services and NSA to develop specific families of equipment. The services will use these equipments to structure tactical communication systems that can be tailored to meet a variety of deployment requirements in diverse geographical areas of the world.

At present there are in excess of thirteen TRI-TAC equipment programs that have been tasked to the Services and NSA for development. A complete description of these equipments can be found in the TRI-TAC Program Budget Guide. Many of these taskings require the development of a family of equipment. For example, the largest family, the Digital Group Multiplexer (DGM), will consist of twelve distinct items.

The basic building blocks of tactical communication systems are the switching nodes. The nucleous of the nodes is the automatic telephone type switches. Associated with each switch are assemblages from the TRI-TAC equipment programs.

An infinite number of nodal types could be assembled due to the versatility and variety of TRI-TAC equipment types. In certain types of studies, for example, determining the maintenance requirements for a node,

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1/ Planning, Programming, and Budgeting Guidance for Joint Tactical Communications Programs, Short Title: TRI-TAC Program/Budget Guide, TTO-OAM-060-77, 1 January 1978.

the number of nodal types must be bounded if any meaningful results are expected. The purpose of this manual is to identify a limited number of typical nodal types that have been developed by the TRI-TAC Office in an attempt to simplify the management/analytic problem. They are referred to throughout the document as stylized nodes.

One basic assumption was used in this nodal model development. It is that there are many more similarities than differences between nodes of a given type. It also seemed reasonable to conclude that these similarities will exist within and between the service applications. Based on these assumptions, eleven nodal types have been identified. Four contain AN/TTC-39 switches, four are based on the AN/TTC-42, and three address the SB-3865 unit level switchboard.

The Service/Agency users of this document should find it to be a rather simple task to correlate the stylized nodes to specific nodal configurations that will exist in real life. For example, if a particular type Corps area node will require a 300 line circuit switch and no message switch, by referring to Table 1, page 16, it can be determined that this is a Type "C" node.

A long term objective of the TRI-TAC program is to provide an all digital communication capability for the services. Economic limitations will not permit the services to field all digital systems until at least the 1990's. In the meantime, transitional systems employing TRI-TAC equipment with a heavy mix of analog inventory items will be used to structure these systems. The stylized nodes that are described in this document look at the equipment mixes that will exist during the transitional time frame.

1.3 Applications of the Stylized Nodal Concept

The stylized nodes are analytic tools supporting cost effectiveness analysis.[1/] Originally, these stylized nodes were formulated to address the mobility measure of effectiveness; however, other applications are quite meaningful.

The mobility problem can be reduced to nodal set-up and tear-down time. The basic problem is that equipment specifications state a requirement for a set-up and tear-down time for that equipment while the Service user must look at the problem of how fast they can move an entire communications node. The nodal movement problem transcends the individual equipment problems in that consideration must be given to how the node can be moved using the least amount of resources. Basically, the user must determine how resources can be shared among the different nodal equipments. These shared resources can be people, transport and material handling vehicles, maintenance shops, etc. Nodal analysis permits the user to place such a problem into perspective.

1/ Ibid, Vol II - System Effectiveness.

Other uses of the stylized nodes soon become apparent. In life cycle cost analysis, the shared resource considerations become critical in that very seldom is a man totally committed to one piece of equipment in a node. He may be there to service all nodal COMSEC devices, all transmitters, or in some cases, he may be cross-trained to operate or maintain several types of equipment. The stylized node concept permits the analyst again to put such situations into perspective in that he can determine how much of the nodal "labor pool" should be charged against the equipment being analyzed.

The logistic planners have encountered similar requirements for stylized nodes. To minimize support costs, which are a subset of life cycle costs, personnel, test equipment, transport, and material handling equipment, etc., must be considered as shared resources at a node. The support system, including the supply and maintenance hierachy must also be shared. These basic logistic problems can be identified and examined based on the stylized nodal concept.

The first user of the stylized nodes was the National Security Agency on the TENLEY/SEELEY contract. TENLEY/SEELEY is a family of COMSEC devices which when installed in various TRI-TAC assemblages, provide encryption for various modes of communications. It was determined that ILS and LCC cost studies on the individual devices within this equipment family were not meaningful. This was primarily due to the previously mentioned shared resource concept. The stylized nodes provided an identification of types of COMSEC equipment that will appear at each type of node as well as a means to determine the head count of these equipments for each nodal variation. The ILS/LCC analyses, using these inputs, are still in process but preliminary results indicate that modifications to the support concepts may be in order as a function of nodal type.

In certain cases, communication networks are required for particular types of analysis. The problem of support system design is illustrative. The numbers, types and locations of equipment are critical input parameters in structuring a support system. This type of information can be generated by overlaying a communication network on a force deployment and identifying the type of stylized node that would be required at each switching point. Distances to higher level maintenance facilities and equipment density parameters can then be estimated by the logistic planners.

The above examples of uses of the stylized nodes are not intended to be all inclusive. These thoughts are presented to give the analyst or communication planner ideas as to how the nodes can be used. It is expected that other uses will be found for them the more they are used.

1.4 Structure of the Stylized Nodes

Each node is first described in this report in terms of a block diagram which shows its major elements and how they will be interconnected. Node type A in Figure 1 is used as an example. The numbers (range) of each major equipment that can appear at the node is listed in a table called Nodal Variations, Table 1. The cable systems that may be used to provide

internodal trunking are listed in Table 2. The COMSEC and DGM's equipments required at the node but not to be included in major subsystems can be found in Table 3. Similar tables are provided for various levels of security, Tables 4-6. The COMSEC and DGM equipments found in the major subsystems are found in Tables 7 and 8. A consolidated table of COMSEC rack requirements is contained in Table 32.

This pattern is followed throughout the manual for the other AN/TTC-39 nodes as well as the AN/TTC-42 and SB-3865 nodes. Specific descriptions of the figures and tables are presented in the sections on each nodal type.

1.5 Use of Equipment Tables

1.5.1 Nodal Equipment Totals

To determine the total number of TRI-TAC items included in a particular AN/TTC-39 nodal variation, the following steps are required:

a. Refer to Tables 1 and 2 and determine the major assemblies and cable systems equipments.

b. Refer to Tables 3 through 6 and determine the quantities of subscriber and DGM equipment for a given level of security in a particular nodal variation.

c. Refer to Tables 7 through 14 and determine the quantities of COMSEC and DGM items in major assemblies of a particular nodal variation.

d. Refer to Table 32 for COMSEC rack requirements.

e. Add the items selected from Tables 1 and 2 and the results of steps b, c, and d above to obtain the total nodal estimate.

A similar approach would also be followed in estimating the equipments that would be found at either an AN/TTC-42 or SB-3865 node.

1.5.2 Additional Nodal Variations

Additional variations of nodal configurations can be readily developed by either (1) revising one or more of the ground rules which changes the equipment allocations; or (2) varying the major assemblies in a "stylized" node. For example, a Type A node, Variation 1, has been stylized with a Type 1 CNCE and two to four SRWBR's. Node A can be varied by assuming employment of a Type III CNCE and reducing the requirement to one SRWBR. The COMSEC and DGM items in the Type III CNCE can be determined by referring to Table 11. Other changes may require recomputation of estimated items based on how the ground rules and definitions are changed. A similar procedure would be followed to develop additional AN/TTC-42 or SB-3865 nodal variations.

2.0 Structure of the Stylized Nodal Document

Sections 1 and 2 present general information on this document. Sections 3, 4, and 5 present specific details on the AN/TTC-39, AN/TTC-42, and SB-3865 nodes, in that order. Section 6 contains a list of abbreviations that are used in this document.

3.0 DEVELOPMENT OF AN/TTC-39 NODAL MODELS

3.1 Nodal Variations

This section presents a set of four stylized AN/TTC-39 nodes. The stylized nodes illustrate variations in configuration based on CS and MS mixes, levels of security to be provided, and varying applications of other TRI-TAC equipment to include COMSEC and multiplexing. The following AN/TTC-39 switch variations are included:

- Node A: 600-line CS (4A/1D and 3A/2D matrix variations) with no MS
- Node B: 600-line CS (4A/1D and 3A/2D matrix variations) with 50-line MS
- Node C: 300-line CS (2A/1D and 1A/2D matrix variations) with no MS
- Node D: 300-line CS (2A/1D and 1A/2D matrix variations) with 50-line MS.

3.1.1 Examination of Nodal Variations

The four nodes were defined to illustrate the most common variations of major assemblies. Then, applying a uniform set of rules, definitions, and parameters to each variation, the quantities (or ranges) of TRI-TAC equipment assemblages and separate items in the various subsystems were determined. Each required nodal variation was then examined to determine equipment population variations that might result from providing either 10-, 30-, 60-, or 100-percent security to digital subscribers. Major nodal variations selected are detailed in Subsections 3.2. The common variations selected were based on:

- Type and size of CS
- Type and size of MS
- Type of nodal control facility
- Presence or absence of communications system control element (CSCE), one or more short-range wideband radio (SRWBR) systems, or a cable extension system
- Number and types of surface and space transmission terminals.

3.1.2 Establishment of Ground Rules and Definitions

To provide a consistent basis for the development of equipment estimates and a common understanding of the analytical approach, the following rules and definitions were established:

- A digital matrix is assumed to have 150 lines for use as loops or trunks.
- The loop-to-trunk ratio (L/TR) at the CS is assumed to be 60:40.
- The levels of security to be provided (10, 30, 60, and 100 percent) will have reference to the number of digital subscribers who are provided with digital subscriber voice terminals (DSVT) for operation in the secure voice mode via the digital matrix of the CS.
- The high estimate of DSVT subscribers will be based on 10, 30, 60, or 100 percent (as appropriate) of the total digital usable lines (one or two matrices).
- The low estimates of DSVT subscribers will be based on 10, 30, 60, or 100 percent of the loop portion (60:40 loop-to-trunk ratio) of the usable matrix capacity.
- Only one estimate for 100-percent security will be provided, and it will assume that the total loop portion (L/TR) terminates DSVT subscribers (60 percent of usable matrix capacity). Note: Because of the selected loop-to-trunk ratio (60:40), the high estimate for 60-percent security and the single estimate for 100-percent security are identical in this illustration. A change in the assumed ratio (or in other ground rules) would produce different results.
- Internodal cable systems will have assumed lengths of 8 km.

3.1.3 Development of Equipment Parameters

To insure that later cost-benefit analysis could be based on logical and consistent premises, basic parameters were established to be applied in developing estimates of ranges of equipment in the four nodes. Equipment variations will occur because of such factors as analog/digital (A/D) matrix mixes, types of subscriber equipment, degrees of security, and number of data terminals to be provided. The following uniform parameters were applied to each nodal variation in order to determine the high and low estimates of TRI-TAC equipments:

Item	Low Estimate	High Estimate
DSVT	Per definitions of 10, 30, 60, and 100% security	Per security definitions
Extension Unit	50% of DSVT	50% of DSVT
DNVT	50% loop portion - DSVT	Loop portion - DSVT
DLED	20% of S&F lines	50% of S&F lines
MRTT (SST)	20% of DSVT + 30% of DLED	20% of DSVT + 30% of DLED
TDF	20% of DSVT	20% of DSVT
DA	100% DLED + 33% DSVT - MRTT	100% DLED + 33% DSVT - MRTT
RLGM	Four systems per digital matrix	Eight systems per digital matrix
RLGMCD	In CNCE	In CNCE
RMC	Two systems per digital matrix	Four systems per digital matrix
TGM	One system per digital matrix	Two systems per digital matrix
LSCDM	In CNCE	In CNCE
HSCDM	In CNCE	In CNCE
HSPR	One every 400 m in HS cable system	One every 400 m in HS cable system
LSPR	One every 1.6 km in LS cable system	One every 1.6 km in LS cable system
LGM	One per digital matrix	Two per digital matrix

3.2 Illustration of Nodal Configurations

The basic nodal variations developed are illustrated in Figures 1 through 4. The subscriber subsystem access to the nodes have been shown as terminating in the nodal switch. Nodal access can also be made through the CNCE, particularly when an RLGM/RLGMCD system or a radio extension facility is required. In order not to complicate the diagrams, only the switch access has been shown. Also in these diagrams, dashed boxes are used to indicate variable numbers of equipment items.

3.2.1 Node A

Figure 1 depicts a node employing a 600-line AN/TTC-39 CS with no MS. A Type I communications nodal control element (CNCE) would provide control and multiplexing functions. Main transmission links to other nodes employ satellite, tropo, and LOS radio terminals. One SRWBR link carries the main digital trunk groups to and from the radio park. Internodal trunking may also be provided by high- and low-speed cable systems, as illustrated. The subscriber access subsystem includes a variety of analog and digital subscribers, a communications center, and mobile radio terminals served by the nodal CS. Access to the node also includes both analog and digital unit level switches (ULS) and terminals of the tactical data systems.

3.2.2 Node B

Figure 2 is a similar nodal configuration employing a 50-line MS (S&F) with the 600-line CS. A CSCE is located at this node and is assumed to be controlling several other nodes. Two SRWBR systems provide up/down-the-hill transmission paths for separated radio parks. Static subscribers include dedicated loop subscribers employing dedicated loop encryption device (DLED) COMSEC devices for MS access.

3.2.3 Node C

Figure 3 depicts a node employing a 300-line AN/TTC-39 CS and no MS. A Type III CNCE provides nodal control. One SRWBR system provides the digital path to the radio park.

3.2.4 Node D

Figure 4 is a similar nodal configuration employing a 50-line MS (S&F) in conjunction with the 300-line CS. This node has been configured to illustrate use of coaxial cables for connection to all radio terminals rather than a SRWBR system as used in the other nodes.

3.3 Equipment Estimates

Estimated equipment requirements for each nodal variation based on the above rules, definitions, and parameters are presented in Tables 1 through 14. A brief description of these tables is as follows:

- Table 1 lists the major assemblies in each nodal variation. Low and high estimates of radio terminals have been provided because of the flexibility of those requirements.
- Table 2 provides the estimates of internodal cable systems that have been assumed in the stylized nodes.

- Tables 3 through 6 provide the estimates of subscriber and digital group multiplexer (DGM) equipments required in each nodal variation if 10-, 30-, 60-, or 100-percent security, respectively, is provided for digital subscribers.

- Table 7 lists the major assemblies listed in Table 1 for Node A - Variation 1 (4A/1D mix) and provides the quantities of TRI-TAC COMSEC and DGM items included in each major assembly. Low and high estimates of equipment requirements are provided where appropriate, and nodal totals for items in major assemblies have been computed.

- Table 8 provides similar information for Variation 2 of Node A (3A/2D).

- Tables 9 through 14 list the items found in major assemblies in the variations of Nodes B, C, and D.

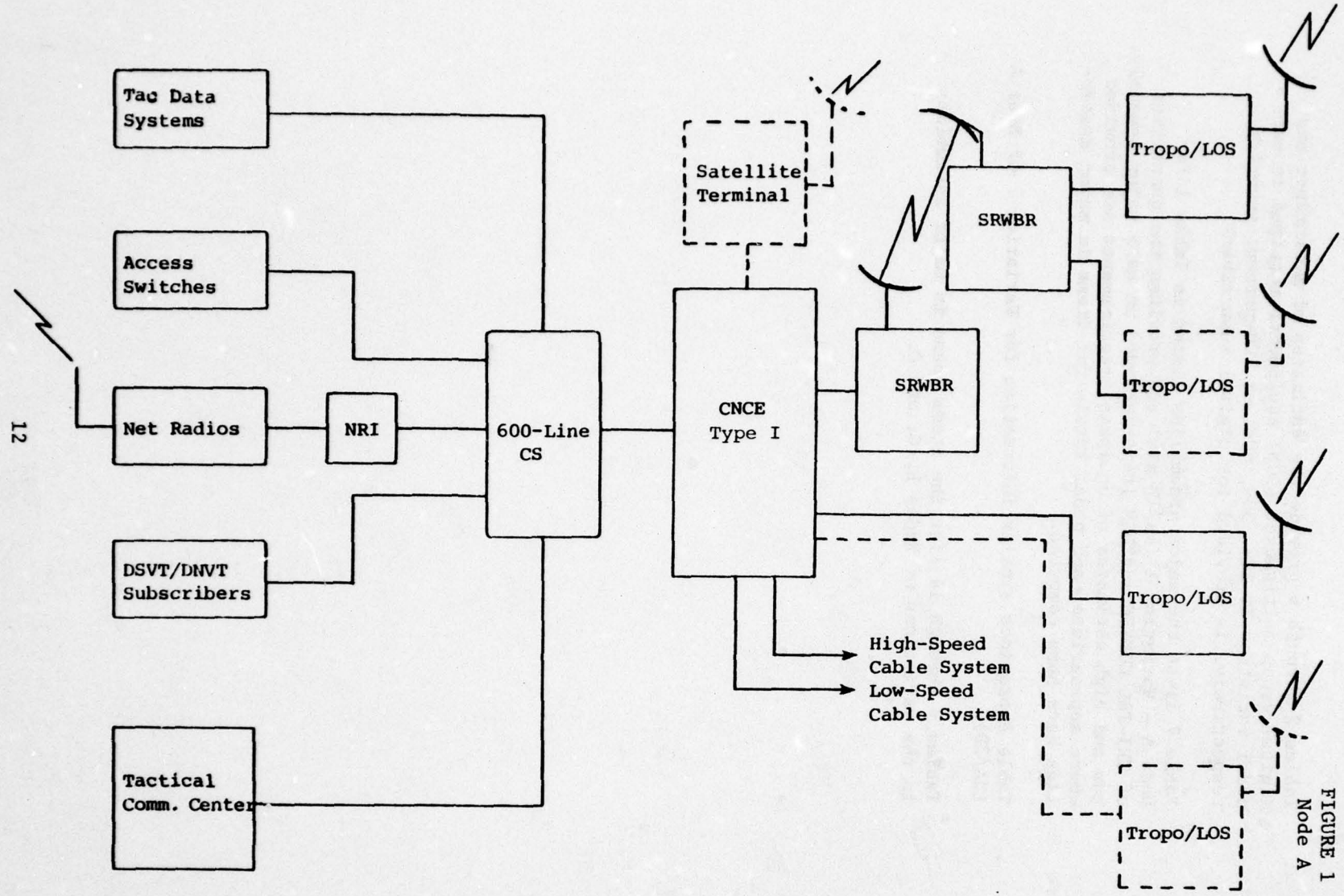

FIGURE 1
Node A

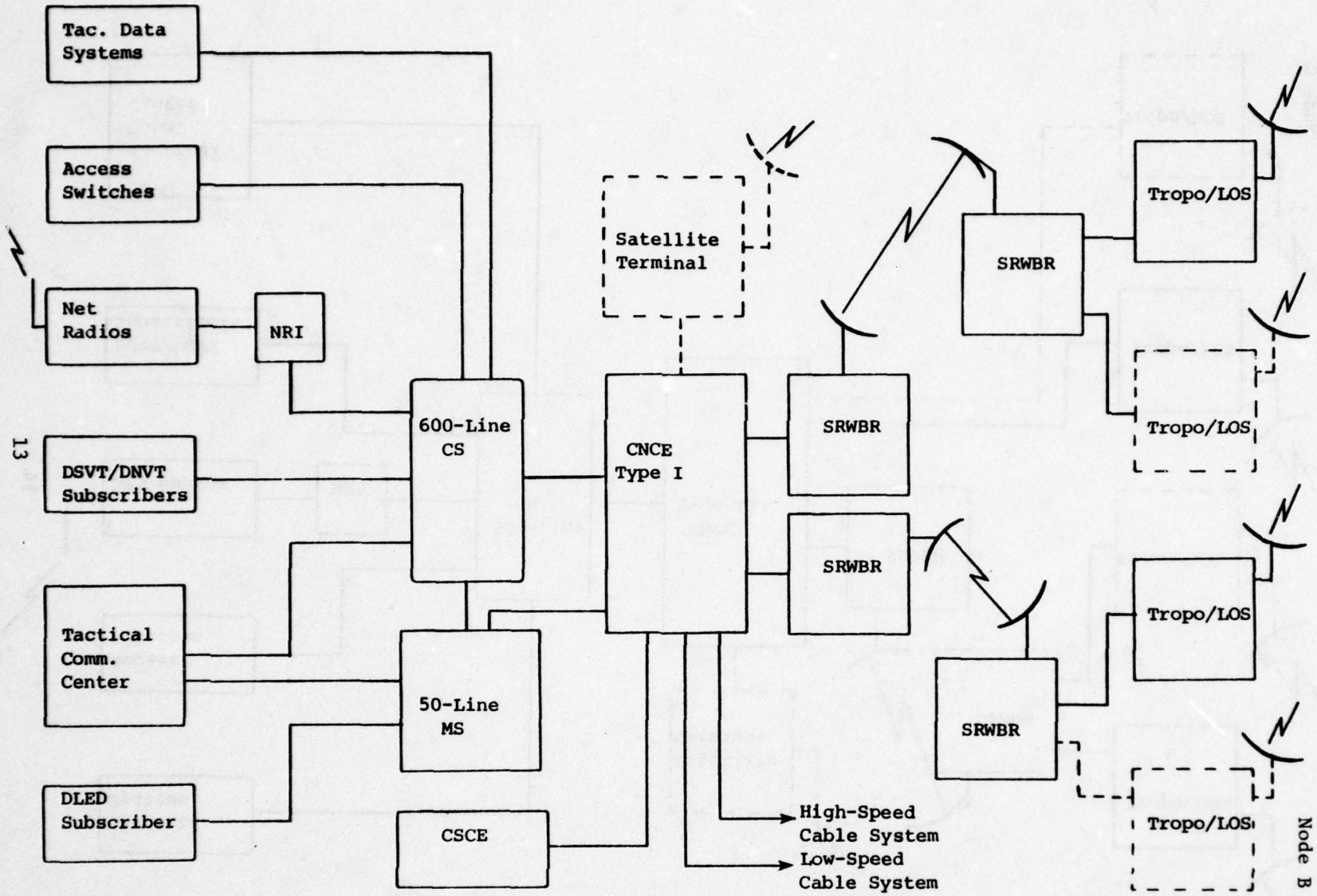

FIGURE 2
Node B

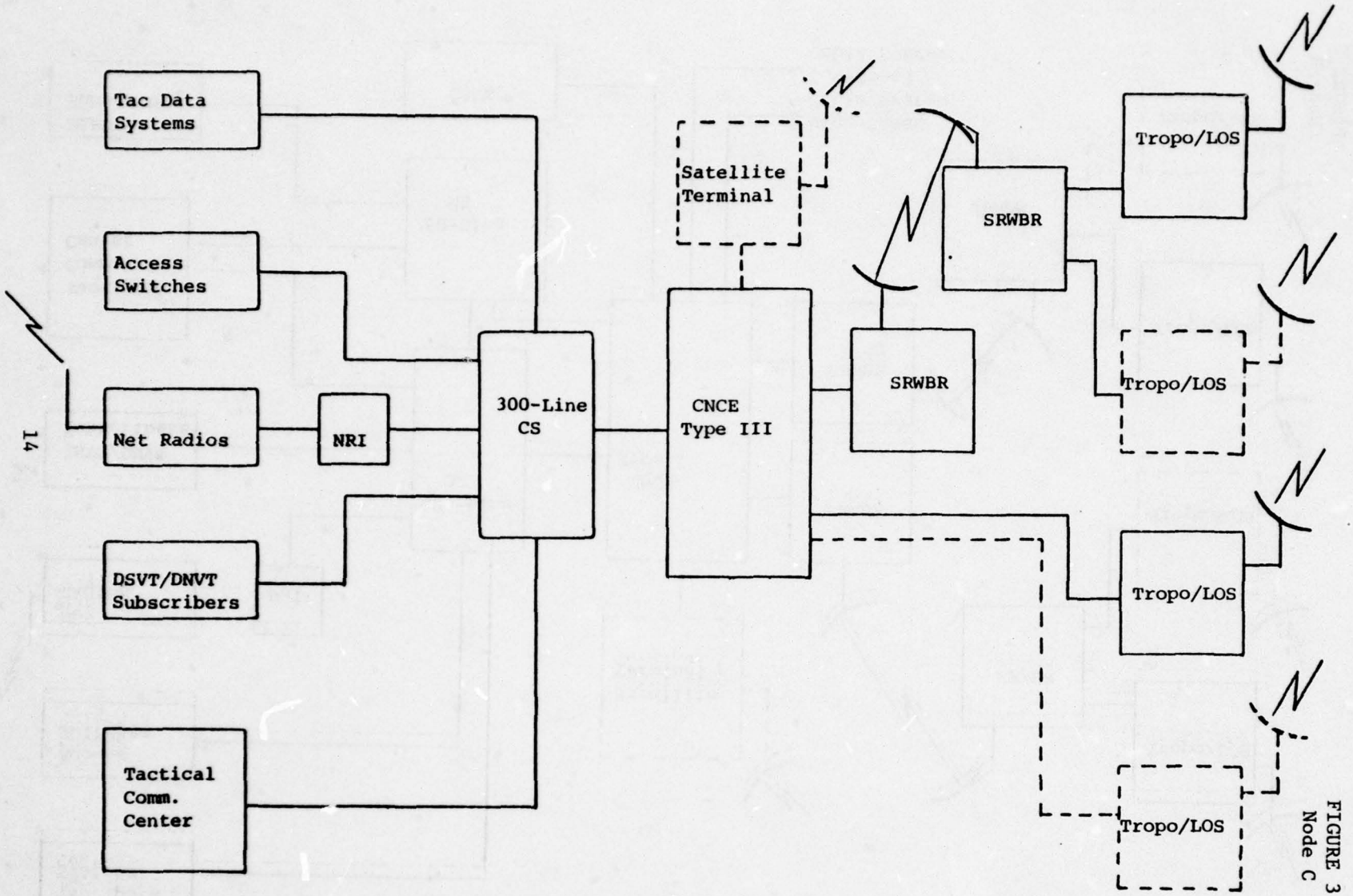

FIGURE 3
Node C

FIGURE 4
Node D

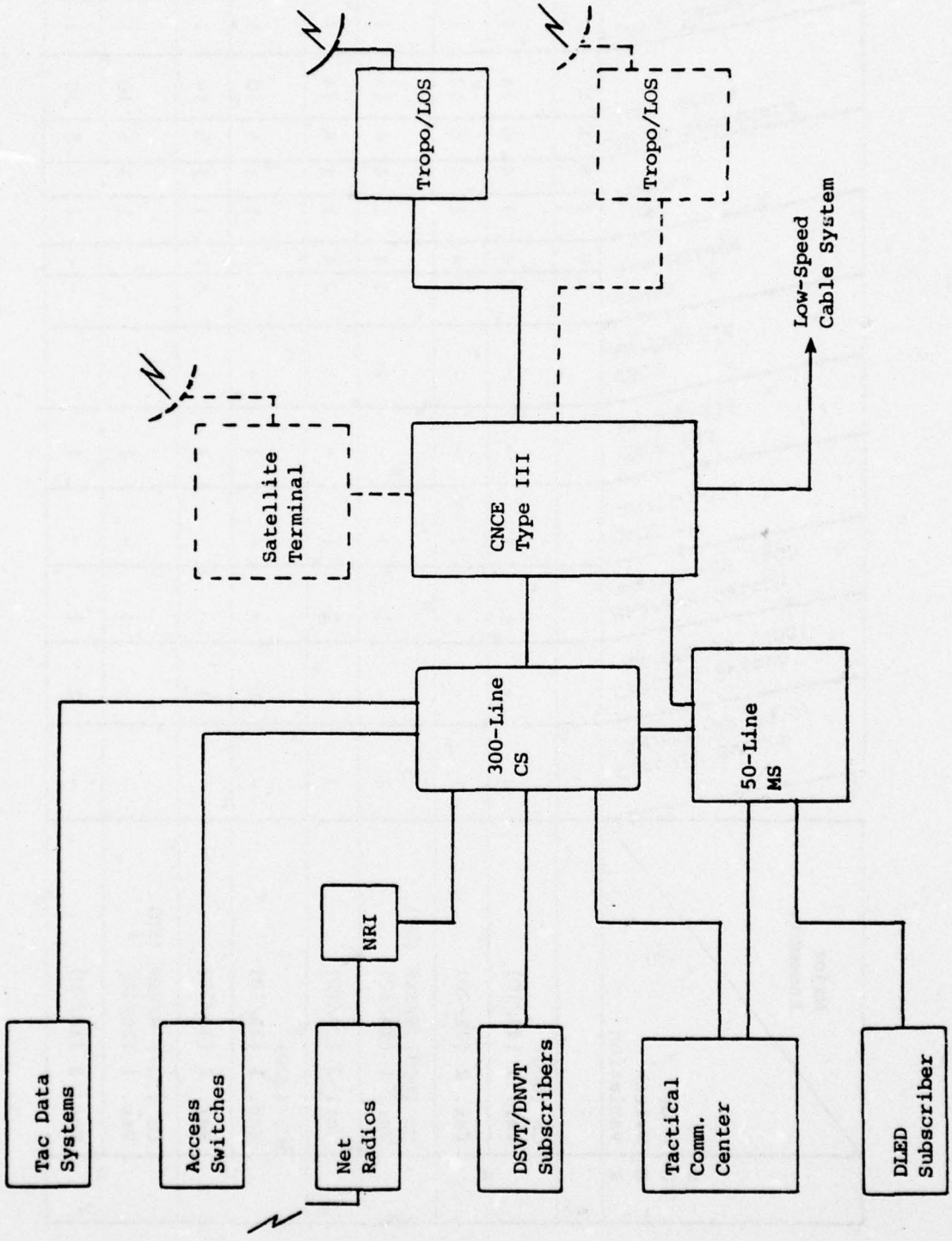

TABLE 1
Nodal Configurations

NODE	Nodal Switch Variation	Major Assembly	Circuit Switch AN/TTC-39 (600)	Circuit Switch AN/TTC-39 (300)	Message Switch AN/TYC-39 (50)	CNCE I AN/TSQ-111	CNCE III AN/TSQ-111	CSCE AN/TYQ-116	SRWBR Assemblage L	SRWBR Assemblage H	NRI Module L	NRI Module H	Radio Terminals (LOS, etc.) L	Radio Terminals (LOS, etc.) H	MTCC Tactical Comm. Center
A		CS (600) Var. 1 (4A/1D)	1	-	-	1	-	-	2	4	1	4	6	14	1
		Var. 2 (3A/2D)	1	-	-	1	-	-	2	4	1	4	6	14	1
B		CS (600) W/S&F (50) Var. 1 (4A/1D)	1	-	1	1	-	1	2	4	1	4	6	14	1
		Var. 2 (3A/2D)	1	-	1	1	-	1	2	4	1	4	6	14	1
C		CS (300) Var. 1 (2A/1D)	-	1	-	-	1	-	0	2	1	3	5	10	1
		Var. 2 (1A/2D)	-	1	-	-	1	-	0	2	1	3	5	10	1
D		CS (300) W/S&F (50) Var. 1 (2A/1D)	-	1	1	-	1	-	-	-	1	3	5	10	1
		Var. 2 (1A/2D)	-	1	1	-	1	-	-	-	1	3	5	10	1

TABLE 2
Nodal Configurations -
Internodal Cable System Equipment
(Assumed System Length is 8 km)

NODE	Nodal Switch Variation / Major Assembly	LS Cable System		LSCDM*		LSPR		HS Cable System		HSCDM*		HSPR	
		L	H	L	H	L	H	L	H	L	H	L	H
A	CS (600) Var. 1 (4A/1D)	1	2	-	-	4	8	-	-	-	-	19	38
	Var. 2 (3A/2D)	1	2	-	-	4	8	1	2	-	-	19	38
B	CS (600) W/S&F(50) Var. 1 (4A/1D)	1	2	-	-	4	8	1	2	-	-	19	38
	Var. 2 (3A/2D)	1	2	-	-	4	8	1	2	-	-	19	38
C	CS (300) Var. 1 (2A/1D)	-	1	-	-	4	8	-	-	-	-	19	38
	Var. 2 (1A/2D)	1	2	-	-	4	8	-	-	-	-	19	38
D	CS (300) W/S&F (50) Var. 1 (2A/1D)	-	1	-	-	4	8	-	-	-	-	19	38
	Var. 2 (1A/2D)	1	2	-	-	4	8	-	-	-	-	19	38

* Located in CNCE of each node.

TABLE 3

Nodal Configurations - Subscriber & DGM Equipment 10% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Major Assembly: DSVT (KY 68) L	DSVT (KY 68) H	Ext. Telephone Unit L	Ext. Telephone Unit H	DNVT (TA-954) L	DNVT (TA-954) H	DLED (KG-84) L	DLED (KG-84) H	Dig. FAX (AN/UXC-4) L	Dig. FAX (AN/UXC-4) H	Data Adapter (MX-9810, MX-9811) L	Data Adapter (MX-9810, MX-9811) H	MRDT (SST) L	MRDT (SST) H	RLGM L	RLGM H	RLGMCD* L	RLGMCD* H	RMC L	RMC H	TGM L	TGM H	LGM L	LGM H
A	CS (600) Var. 1 (4A/1D)	9	15	5	8	36	75	-	-	2	3	1	2	2	3	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	18	30	9	15	72	150	-	-	4	6	2	4	4	6	8	16	-	-	4	8	2	4	2	4
B	CS (600) W/S&F (50) Var. 1 (4A/1D)	9	15	5	8	36	75	10	25	2	3	8	20	5	11	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	18	30	9	15	72	150	10	25	4	6	9	22	7	14	8	16	-	-	4	8	2	4	2	4
C	CS (300) Var. 1 (2A/1D)	9	15	5	8	36	75	-	-	2	3	1	2	2	3	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	18	30	9	15	72	150	-	-	4	6	2	4	4	6	8	16	-	-	4	8	2	4	2	4
D	CS (300) W/S&F (50) Var. 1 (2A/1D)	9	15	5	8	36	75	10	25	2	3	8	20	5	11	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	18	30	9	15	72	150	10	25	4	6	9	22	7	14	8	16	-	-	4	8	2	4	2	4

* RLGMCD - Located in CNCE.

TABLE 4

Nodal Configurations - Subscriber & DGM Equipment
30% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Major Assembly																							
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRTT (SST)		RLGM		RLGMCD*		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
A	CS (600) Var. 1 (4A/1D)	27	45	14	23	18	45	-	-	5	9	3	5	5	9	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	54	90	27	45	36	90	-	-	11	18	5	9	11	18	8	16	-	-	4	8	2	4	2	4
B	CS (600) W/S&F (50) Var. 1 (4A/1D)	27	45	14	23	18	45	10	25	5	9	10	22	8	17	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	54	90	27	45	36	90	10	25	11	18	12	27	14	25	8	16	-	-	4	8	2	4	2	4
C	CS (300) Var. 1 (2A/1D)	27	45	14	23	18	45	-	-	5	9	3	5	5	9	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	54	90	27	45	36	90	-	-	11	18	5	9	11	18	8	16	-	-	4	8	2	4	2	4
D	CS (300) W/S&F (50) Var. 1 (2A/1D)	27	45	14	23	18	45	10	25	5	9	10	22	8	17	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	54	90	27	45	36	90	10	25	11	18	12	27	14	25	8	16	-	-	4	8	2	4	2	4

* RLGMCD - Located in CNCE.

TABLE 5
Nodal Configurations - Subscriber and DGM Equipment
60% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Major Assembly																							
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRTT (SST)		RLGM		RLGMCD*		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
A	CS (600) Var. 1 (4A/1D)	54	90	27	45	-	-	-	-	11	18	7	12	11	18	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	108	180	54	90	-	-	-	-	22	36	14	24	22	36	8	16	-	-	4	8	2	4	2	4
B	CS (600) W/S&F (50) Var. 1 (4A/1D)	54	90	27	45	-	-	10	25	11	18	14	29	14	26	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	108	180	54	90	-	-	10	25	22	36	21	41	25	44	8	16	-	-	4	8	2	4	2	4
C	CS (300) Var. 1 (2A/1D)	54	90	27	45	-	-	-	-	11	18	7	12	11	18	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	108	180	54	90	-	-	-	-	22	36	14	24	22	36	8	16	-	-	4	8	2	4	2	4
D	CS (300) W/S&F (50) Var. 1 (2A/1D)	54	90	27	45	-	-	10	25	11	18	14	29	14	26	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	108	180	54	90	-	-	10	25	22	36	21	41	25	44	8	16	-	-	4	8	2	4	2	4

* RLGMCD - Located in CNCE.

TABLE 6

Nodal Configurations - Subscriber & DGM Equipment 100% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Major Assembly: DSVT (KY 68) L	DSVT (KY 68) H	Ext. Telephone Unit L	Ext. Telephone Unit H	DNVT (TA-954) L	DNVT (TA-954) H	DLED (KG-84) L	DLED (KG-84) H	Dig. FAX (AN/UXC-4) L	Dig. FAX (AN/UXC-4) H	Data Adapter (MX-9810, MX-9811) L	Data Adapter (MX-9810, MX-9811) H	MRTT (SST) L	MRTT (SST) H	RLGM L	RLGM H	RLGMCD* L	RLGMCD* H	RMC L	RMC H	TGM L	TGM H	LGM L	LGM H
A	CS (600) Var. 1 (4A/1D)	-	90	-	45	-	-	-	-	-	18	-	12	-	18	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	-	180	-	90	-	-	-	-	-	36	-	24	-	36	8	16	-	-	4	8	2	4	2	4
B	CS (600) W/S&F (50) Var. 1 (4A/1D)	-	90	-	45	-	-	10	25	-	18	-	29	-	26	4	8	-	-	2	4	1	2	1	2
	Var. 2 (3A/2D)	-	180	-	90	-	-	10	25	-	36	-	41	-	44	8	16	-	-	4	8	2	4	2	4
C	CS (300) Var. 1 (2A/1D)	-	90	-	45	-	-	-	-	-	18	-	12	-	18	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	-	180	-	90	-	-	-	-	-	36	-	24	-	36	8	16	-	-	4	8	2	4	2	4
D	CS (300) W/S&F (50) Var. 1 (2A/1D)	-	90	-	45	-	-	10	25	-	18	-	29	-	26	4	8	-	-	2	4	1	2	1	2
	Var. 2 (1A/2D)	-	180	-	90	-	-	10	25	-	36	-	41	-	44	8	16	-	-	4	8	2	4	2	4

* RLGMCD - Located in CNCE.

TABLE 7
Node A - Variation 1
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (TKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	HGX-83 (AKDC/RCU)	KYK-15 (NCD)	KYK-13 (ETD)	KX-68 (DSVT)	KG-84 (DLED)	HGX-84 (ICU)	KX-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLCMCD	LGM	TGM	MGM	MRTT (SST)
CS (600) AN/TTC-39 (4A/1D)	1	1	64*	8*	6	2	2	1	1	3	-	4	-	-	-	-	-	-	-	-	-
CNCE I AN/TSQ-111	1	1	16	2	12	1	1	1	1	3	-	-	2	26	2	8	6	-	-	2	-
SEMBR Assemblage	2	4	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1	-
NRI Module	1	4	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	6	14	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
Totals			80	10	L 19	H 32	3	2	2	8	L 18	H 44	4	L 11	H 24	L 56	H 88	L 4	H 6	L 8	H 12	L 6	H 12	L 28	L 6	H 14	L 4	H 6	3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

*	LKG L	LKG H	CU L	CU H
10%	14	20	2	3
30%	20	28	3	4
60%	21	31	3	4
100%	12	16	2	2

TABLE 8
Node A - Variation 2
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (IKC)	MGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	MGX-83 (AKDC/KCU)	KXX-15 (NCD)	KXK-13 (ETD)	KX-68 (DSVT)	KG-84 (DLED)	MGX-84 (ICU)	KX-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGMCD	LGM	TGM	MGM	MRTT (SST)
CS (600) AN/TTC-39 (IA/2D)	1	1	64*	8*	6	2	2	1	1	3	-	4	-	-	-	-	-	-	-	-	-
CNCE I AN/TSQ-111	1	1	16	2	12	1	1	1	1	3	-	-	2	26	2	8	6	-	-	2	-
SMWDR Assemblage	2	4	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1	-
NKI Module	1	4	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	6	14	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
Totals			80	10	L 24 / H 12	3	3	2	2	8	L 18 / H 44	4	L 11 / H 24	L 56 / H 88	L 4 / H 6	8	6	L 12 / H 28	L 6 / H 14	L 4 / H 6	L H 3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

*	LKG L	LKG H	CU L	CU H
10%	23	33	3	5
30%	32	48	4	6
60%	35	52	5	7
100%	18	25	3	4

TABLE 9

Node B - Variation 1

Items in Major Assemblies

Assembly \ Common or Similar Components	No. of Assemblies in Node: L	H	KG-82 (IKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	HGX-83 (AKDC/RCU)	KXX-15 (NCD)	KXX-13 (ETD)	KX-68 (DSVT)	KG-84 (DLED)	HGX-64 (ICU)	KX-56 (VINSON)	Group Modems	HSCDM	LSCDM	RLGMCD	LGM	TGM	MGM	MRTT (SST)
CS (600) AN/TYC-39 (4A/1D)	1	1	64*	8*	6	2	2	1	1	3	-	4	-	-	-	-	-	-	-	-	-
MS (50) AN/TYC-39	1	1	48	6	3	2	1	1	1	2	-	2	-	-	-	-	-	-	-	-	-
CNCE I AN/TSQ-111	1	1	16	2	12	1	1	1	1	3	-	-	2	26	2	8	6	-	-	2	-
ISCE AN/TYQ-116	1	1	16	2	-	-	-	-	-	4	-	-	-	4	-	-	-	-	-	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	3
SRDBR Assembly	1	1	-	-	-	-	-	-	-	-	-	-	1	12	-	-	-	-	-	-	-
BBI Module	1	1	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	6	11	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Totals			144	18	L 12 H 12	5	4	3	3	14	L 20 H 46	6	L 11 H 24	L 60 H 92	L 4 H 6	8	6	L 12 H 28	L 6 H 14	L 4 H 6	3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

LKG	CU
L H	L H
10% 14	20 2 3
30% 20	28 3 4
60% 21	31 3 4
100% 12	16 2 2

TABLE 10
Node B - Variation 2
Items in Major Assemblies

Assembly	Common or Similar Components	No. of Assemblies in Node	KG-82 (TSEC)	HGX-82 (CU)	KG-82 (TSEC)	KG-83 (KYG)	HGX-83 (HCDC/KCU)	KYK-15 (NCD)	KYK-13 (BID)	KI-68 (DSVT)	KG-84 (DIED)	HGX-84 (ICU)	KI-58 (VINSON)	Group Modems	HSCDM	LSCDM	KLGMCD	LCM	TCM	MCM	MRTT (SST)
CS (600) AN/TYC-39 (SA/ZD)		1	1	1	1	1	1	1	1	1	-	4	-	-	-	-	-	-	-	-	-
		4	4	4*	6	2	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
MS (50) AN/TYC-39		1	1	1	6	2	2	1	1	1	-	2	-	-	-	-	-	-	-	-	-
		4	4	48	3	1	1	1	1	2	-	-	-	-	-	-	-	-	-	-	-
CBCE I AN/TSQ-111		1	1	16	2	1	1	1	1	3	-	-	2	26	2	8	6	-	-	2	-
		4	4		12	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CSCE AN/TYQ-116		1	1	16	2	-	-	-	-	4	-	-	-	4	-	-	-	-	-	-	-
		4	4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tactical Comm. Center (PTCC)		1	1	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-	3
		4	4	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
SPARTA Assemblage		2	4	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1	-
		4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEI Module		1	4	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
		4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)		6	14	-	-	1	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Totals			144	18	27	18	4	3	3	14	20	46	6	11	24	60	92	4	6	8	6	12	28	6	14	4	6	3

LKG		CU	
*	L	H	L	H
10%	23	33	3	5
30%	32	48	4	6
60%	35	52	5	7
100%	18	25	3	4

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

TABLE 11
Node C - Variation 1
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	MCX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	MCX-83 (AJCC/RCU)	KYK-15 (NCD)	KYK-13 (ETD)	KY-58 (DSVT)	KG-84 (DLED)	MCX-84 (ICU)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	KLSMOD	LGM	TGM	MGM	MHTI (SST)
CS (300) AN/TTC-39 (2A/1D)	1	1	32*	4*	6	2	2	1	1	3	-	2	-	-	-	-	-	-	-	-	-
CNCE III AN/TSQ-111	1	1	16	2	12	1	1	1	1	2	-	-	1	26	1	6	4	-	-	1	-
SMMR Assemblage	0	2	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	-	-
NRT Module	1	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	5	10	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
Totals			48	6	L 23 H 26	3	3	2	2	7	L 12 H 30	2	L 7 H 16	L 31 H 60	L 1 H 1	1	1	L 10 H 20	L 5 H 10	L 1 H 1	3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

%	LKG L	LKG H	CU L	CU H
10%	14	20	2	3
30%	20	28	3	4
60%	21	31	3	4
100%	12	16	2	2

TABLE 12
Node C - Variation 2
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	MGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	MGX-83 (AUDC/RCU)	KXX-15 (NCD)	KXX-13 (ETD)	KX-68 (DSVT)	KG-84 (DLED)	MGX-84 (ICU)	KX-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGMCD	LGM	TGM	MGM	MRTT (SST)
CS (300) AN/TTC-39 (1A/2D)	1	1	32*	4*	6	2	2	1	1	3	-	2	-	-	-	-	-	-	-	-	-
CNCE III AN/TSQ-111	1	1	16	2	12	1	1	1	1	2	-	-	1	26	1	6	4	-	-	1	-
SIGMBR Assemblage	0	2	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	20	10	3	-
NRI Module	1	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	5	10	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
Totals			48	6	L 23	H 28	3	2	2	7	L 12	H 30	2	L 7	H 16	L 31	H 60	L 1	H 3	L 10	H 20	L 5	H 10	L 1	H 3	3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

%	LKG L	LKG H	CU L	CU H
10%	20	23	3	3
30%	28	31	4	4
60%	31	32	4	4
99%	16	21	2	3

TABLE 13
Node D - Variation 1
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-82 (TED)	KG-83 (KVG)	HGX-83 (AKDC/RCU)	KYX-15 (NCD)	KYK-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	HGX-84 (ICU)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGMCD	LGM	TGM	MGM	MKIT (SST)
CS (300) AN/TTC-39 (2A/1D)	1	1	12*	4*	6	2	2	1	1	3	-	2	-	-	-	-	-	-	-	-	-
MS (50) AN/TYC-39	1	1	48	6	3	2	1	1	1	2	-	2	-	-	-	-	-	-	-	-	-
CNCE III AN/TSQ-111	1	1	16	2	12	1	1	1	1	2	-	-	1	26	6	4	-	-	-	1	-
NRI Module	1	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc.)	5	10	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Com Center (MTCC)	1	1																		1	
Totals			96	12	26	11	5	4	3	3	9	4	14	27	6	4	10	20	5	10	1	3

*	LKG L	LKG H	CU L	CU H
10%	14	20	2	3
30%	20	28	3	4
60%	21	31	3	4
100%	12	16	2	2

* Maximum quantity per specification. IKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

TABLE 14
Node D - Variation 2
Items in Major Assemblies

Assembly / Common or Similar Components	No. of Assemblies in Node L	H	KG-82 (IKG)	HCX-82 (CU)	KG-81 (TED)	KG-83 (KYG)	HCX-83 (AKDC/KCU)	KYK-15 (NCD)	KYK-13 (ZTD)	KY-68 (DSVT)	KG-84 (DLED)	HCX-84 (ICU)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	FLGMCD	LGM	TGM	MGM	MRTT (SST)
CS (300) AN/TYC-39 (IA/2D)	1	1	12*	4*	6	2	2	1	1	3	-	2	-	-	-	-		-	-	-	-
MS (50) AN/TYC-39	1	1	48	6	3	2	1	1	1	2	-	-	-	-	-	-		-	-	-	-
CHCH III AN/TSQ-111	1	1	16	2	12	1	1	1	1	2	-	-	1	26	1	6	4				
NRI Module	1	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (IUS, etc.)	5	10	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Tactical Comm. Center (MTCC)	1	1	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	3
Totals			96	12	L 26 / H 41	5	4	3	3	9	L 14 / H 28	4	L 7 / H 14	L 31 / H 31	1	6	L 4 / H 10	L 20 / H 20	L 5 / H 10	1	3

* Maximum quantity per specification. LKGs and CUs will vary based on degree of security to be provided. Quantities shown in table are approximate only.

	LKG L	LKG H	CU L	CU H
10%	20	23	3	3
30%	28	31	4	4
60%	31	32	4	4
100%	16	21	2	3

4.0 DEVELOPMENT OF AN/TTC-42 NODAL MODELS

4.1 Selection of Nodal Variations

This section proposes nodal configurations for the employment of Unit Level Switches AN/TTC-42. Four nodal variations were developed in a manner similar to that applied to AN/TTC-39 nodes. The following variations of AN/TTC-42 nodes were selected:

- Node E: 150-line Unit Level Switch AN/TTC-42 (ULCS) with no MS
- Node F: 150-line ULCS with 24-line Unit Level Message Switch (ULMS)
- Node G: 75-line ULCS with no MS
- Node H: 75-line ULCS with 12-line ULMS.

4.2 Ground Rules, Definitions, and Equipment Parameters

To maintain consistency in the analytical process, the rules, definitions, and equipment parameters established for AN/TTC-39 nodal models were adhered to; only the necessary modifications were made. The changes necessitated by the differences between large tandem switching nodes (AN/TTC-39) and the smaller nodes (AN/TTC-42) are as follows:

- The 150-line ULCS is assumed to have the same basic capacities as one digital matrix of the AN/TTC-39.
- The loop-to-trunk ratio (L/TR) of the ULCS is assumed to be 70:30 to provide a slightly higher loop requirement than with the tandem switch (60:40).
- The 75-line ULCS is treated as one-half of an AN/TTC-39 digital matrix.
- The low estimate of DSVT subscribers is based on 10, 30, 60, or 100 percent (as appropriate) of the loop ratio (L/TR) assuming that 75 percent of the available loops are in use.
- The high estimate of DSVT subscribers is based on 10, 30, 60, or 100 percent of the L/TR, assuming that all available loops are in use.
- All calculations are based on the full digital capacity of the AN/TTC-42 (150 or 75 lines). If analog terminations are assumed (up to 24 may be accommodated), the digital equipment calculations should be adjusted accordingly.
- The following modified equipment parameters were assumed:

Item	Low Estimate	High Estimate
Extension Unit	50% of DSVT	50% of DSVT
DLED	20% of ULMS lines	50% of ULMS lines
MRTT (SST)	20% of DSVT + 30% of DLED	20% of DSVT + 30% of DLED
TDF	20% of DSVT	20% of DSVT
DA	100% DLED + 33% DSVT - MRTT	100% DLED + 33% DSVT - MRTT
RLGM	Four Systems per digital matrix	Eight systems per digital matrix
LRGMCD	In CNCE	In CNCE
RMC	Two systems per digital matrix	Four systems per digital matrix
LSCDM	In CNCE	In CNCE
LSPR	One every 1.6 km in LS cable system	One every 1.6 km in LS cable system
LGM	One per digital matrix	Two per digital matrix

4.3 Illustration of AN/TTC-42 Nodal Configurations

The basic AN/TTC-42 nodal variations developed for use in this study are illustrated in Figures 5 through 8. Subscriber access can be through either the nodal switch or the CNCE. Qualification of the access problem are spelled out in paragraph 3.2.

4.3.1 Node E

Figure 5 depicts a node employing a 150-line ULCS with no MS. A CNCE Type X (or later version that may be developed for this application) provides nodal control and certain multiplexing functions. Main transmission links to other nodes may employ a combination of satellite, tropo, and LOS radio terminals. One SRWBR link carries the main digital trunk groups to and from the radio park. Internodal trunking may also be provided by LS cable systems, as illustrated. The subscriber access subsystem includes a variety of analog and digital subscribers, a communications center, and mobile radio terminals served by the nodal CS. Access to the node also includes both analog and digital ULS's and terminals of the tactical data systems.

4.3.2 Node F

Figure 6 is a similar nodal configuration employing a 24-line ULMS with the 150-line ULCS. Static subscribers include dedicated loop subscribers employing dedicated loop encryption devices (DLED) for ULMS access. The other nodal features are the same as Node E.

4.3.3 Node G

Figure 7 depicts a node employing a 75-line ULCS and no ULMS. This node is similar to Node E in all other respects except that an SRWBR system is not used. Paths to radio terminals are provided by coaxial cables.

4.3.4 Node H

Figure 8 is a similar nodal configuration employing a 12-line ULMS in conjunction with the 75-line ULCS.

4.4 Equipment Estimates

Estimated equipment requirements for the AN/TTC-42 nodal variations based on the preceding rules, definitions, and parameters are presented in Tables 15 through 23. A brief description of these tables follows:

- Table 15 lists the major assemblies and internodal cable system that have been assumed for each nodal variation.
- Tables 16 through 19 provide the estimates of subscriber and digital group multiplexer (DGM) equipments required in each nodal variation if 10-, 30-, 60-, or 100-percent security, respectively, is provided for digital subscribers.
- Table 20 lists the major assemblies presented in Table 16 for Node E (150-line ULCS with no ULMS) and provides quantities of TRI-TAC COMSEC and DGM items included in each major assembly. Low and high estimates of equipment requirements are provided where appropriate, and nodal totals for items in major assemblies have been computed.
- Tables 21 through 23 list the items found in major assemblies in Nodes F, G, and H.

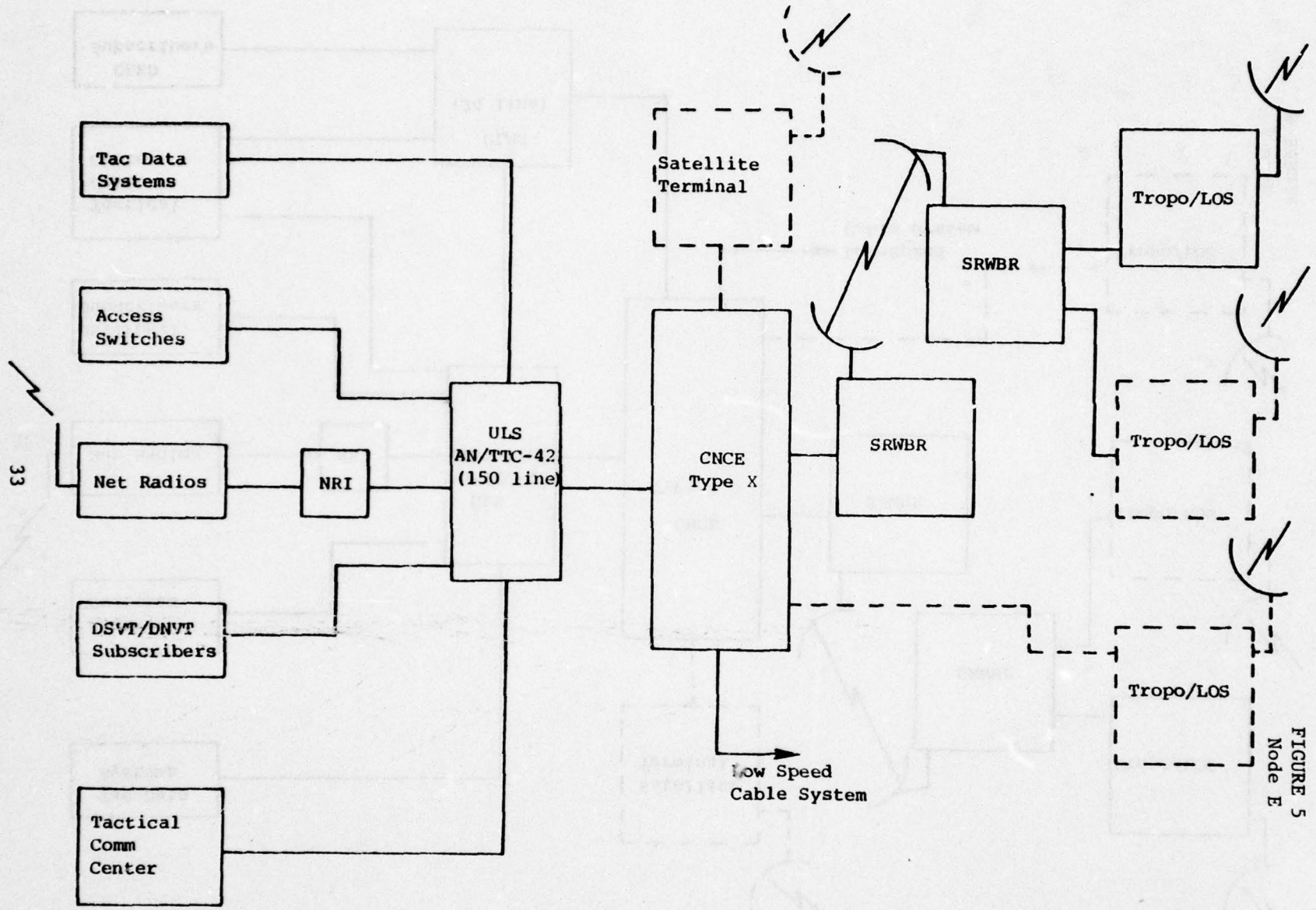

FIGURE 5
Node E

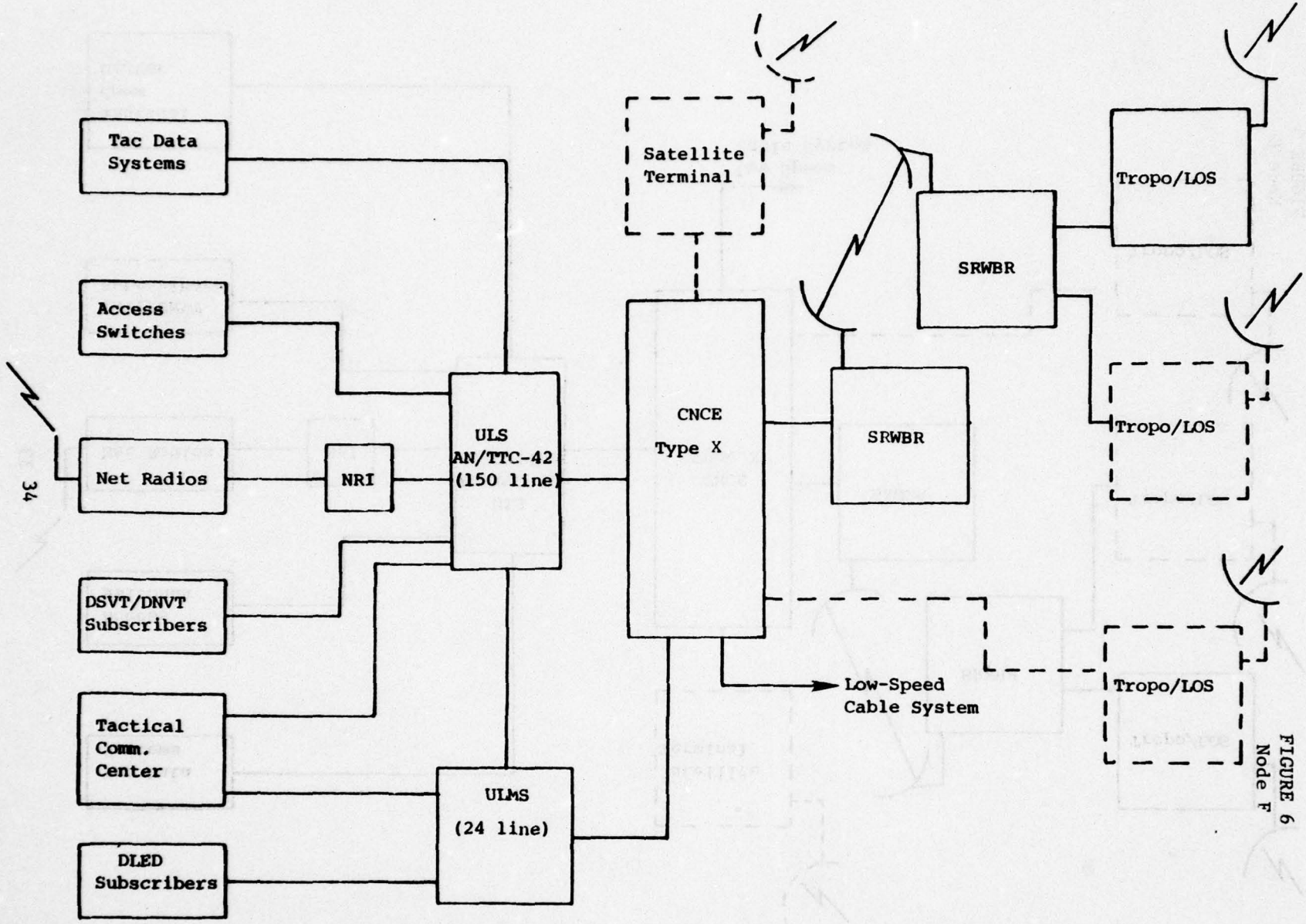

FIGURE 6
Node F

FIGURE 7
Node G

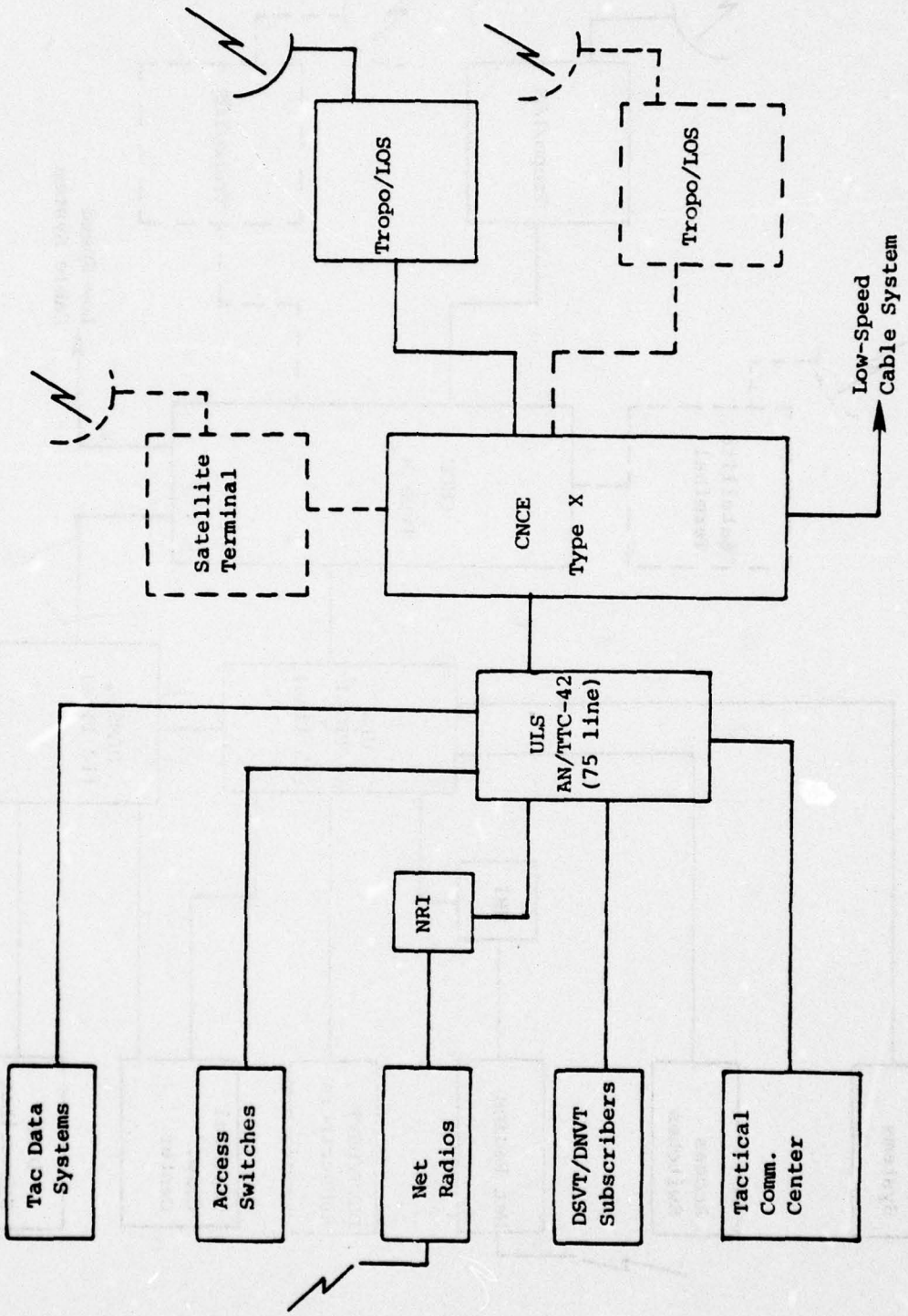

FIGURE 8
Node H

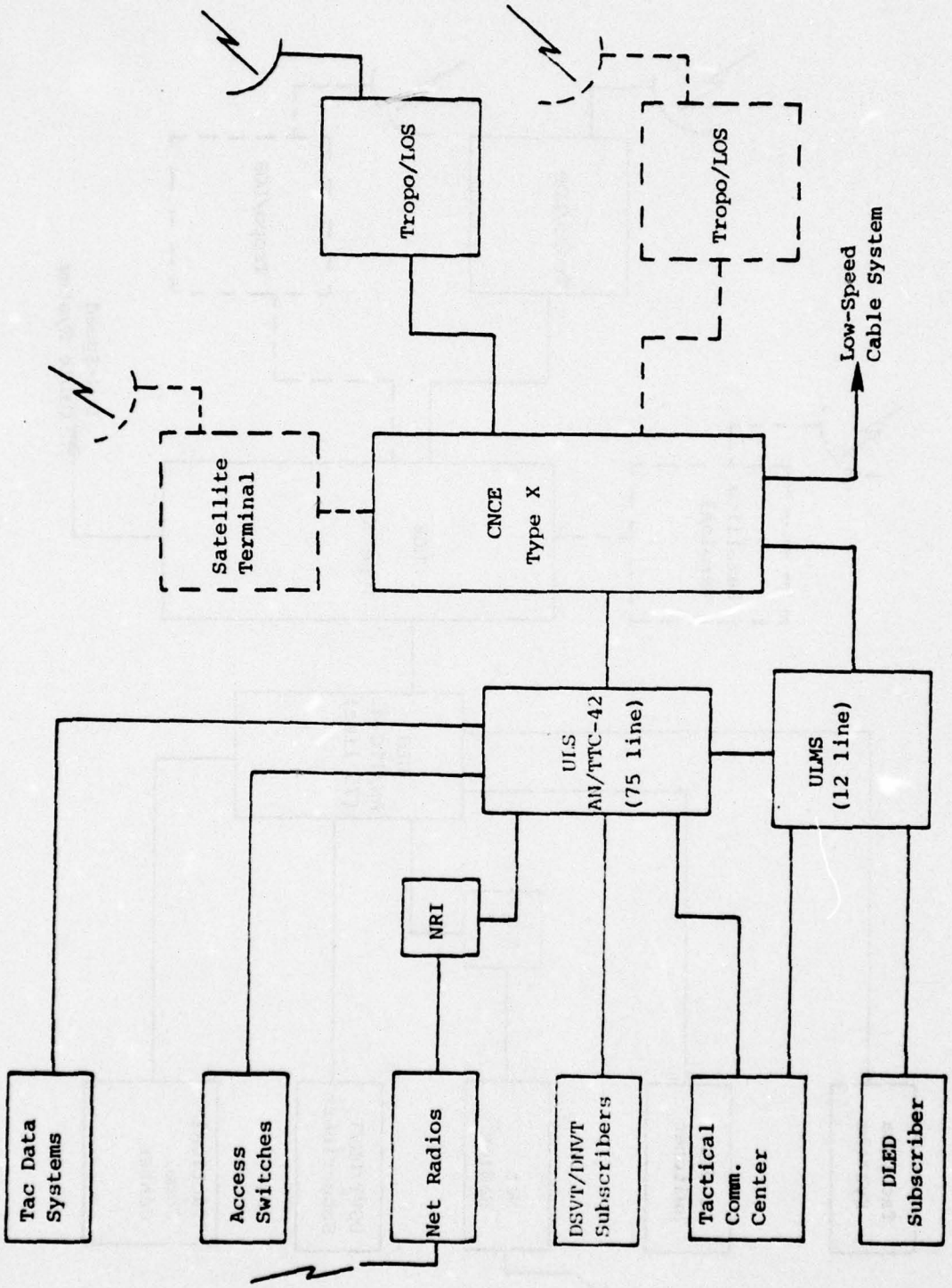

TABLE 15
AN/TTC-42 Nodal Configurations

NODE	Nodal Switch Variation / Major Assembly	Circuit Switch	AN/TTC-42 (150) Circuit Switch	AN/TTC-42 (75) Message Switch	ULMS-24 Message Switch	ULMS-12 Message Switch	CNCE- X	AN/TSQ-111 Tactical Comm Center (M/CC)	Low-Speed Cable System	LSPR	SRWBR Assembly	NRI Module	Radio Terminals (LOS, etc.)		
										L H	L H	L H	L H	L	R
E	ULS (150 line)	1	-	-	-		1	1	1 2	4 8	1 1	1 1	3	2	5
F	ULS (150 line) with ULMS (24 line)	1	-	1	-		1	1	1 2	4 8	1 1	1 1	3	2	5
G	ULS (75 line)	-	1	-	-		1	1	0 1	0 4	0 1	1 2		1	4
H	ULS (75 line) with ULMS (12 line)	-	1	-	1		1	1	0 1	0 4	0 1	1 2		1	4

TABLE 16
Nodal Configurations-Subscriber & DGM Equipment
10% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Subscriber And DGM Equipment																							
		DSVT (XY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRTT		RLGM		RLGMCD**		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
E	ULS (150 line)	8	11	4	6	71	94	-	-	2	3	1	1	2	3	4	8	-	-	2	4	-	-	1	2
F	ULS (150 line) with ULMS (24 line)	8	11	4	6	71	94	5	12	2	3	4	10	4	6	4	8	-	-	2	4	-	-	1	2
G	ULS (75 line)	4	6	2	3	36	47	-	-	1	2	1	1	1	2	2	4	-	-	1	2	-	-	0	1
H	ULS (75 line) with ULMS (12 line)	4	6	2	3	36	47	3	6	1	2	2	5	2	3	2	4	-	-	1	2	-	-	0	1

*RLGMCD - Located in CNCE.

TABLE 17
Nodal Configurations-Subscriber & DGM Equipment
30% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Subscriber And DGM Equipment																							
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRTT		RLGM		RLGMCD**		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
E	ULS (150 line)	24	32	12	16	55	73	-	-	5	7	3	4	5	7	4	8	-	-	2	4	-	-	1	2
F	ULS (150 line) with ULMS (24 line)	24	32	12	16	55	73	5	12	5	7	6	13	7	10	4	8	-	-	2	4	-	-	1	2
G	ULS (75 line)	12	16	6	8	28	37	-	-	3	4	1	2	3	4	2	4	-	-	1	2	-	-	0	1
H	ULS (75 line) with ULMS (12 line)	12	16	6	8	28	37	3	6	3	4	3	6	4	5	2	4	-	-	1	2	-	-	0	1

*RLGMCD - Located in CNCE.

TABLE 18
Nodal Configurations-Subscriber & DGM Equipment
60% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Subscriber And DGM Equipment																							
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRFT		RLGM		RLGMCD**		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
E	ULS (150 line)	47	63	24	32	32	42	-	-	10	13	6	11	10	13	4	8	-	-	2	4	-	-	1	2
F	ULS (150 line) with ULMS (24 line)	47	63	24	32	32	42	5	12	10	13	9	17	12	16	4	8	-	-	2	4	-	-	1	2
G	ULS (75 line)	24	32	12	16	16	21	-	-	5	7	3	4	5	7	2	4	-	-	1	2	-	-	0	1
H	ULS (75 line) with ULMS (12 line)	24	32	12	16	16	21	3	6	5	7	5	9	6	8	2	4	-	-	1	2	-	-	0	1

* RLGMCD - Located in CNCE.

TABLE 19
Nodal Configurations-Subscriber & DGM Equipment
100% Security (Digital Subscriber)

NODE	Nodal Switch Variation	Subscriber And DGM Equipment																							
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRTT		RLGM		RLGMCD**		RMC		TGM		LGM	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
E	ULS (150 line)	79	105	40	53	-	-	-	-	16	21	10	14	16	21	4	8	-	-	2	4	-	-	1	2
F	ULS (150 line) with ULMS (24 line)	79	105	40	53	-	-	5	12	16	21	13	23	18	24	4	8	-	-	2	4	-	-	1	2
G	ULS (75 line)	40	53	20	27	-	-	-	-	8	11	5	7	8	11	2	4	-	-	1	2	-	-	0	1
H	ULS (75 line) with ULMS (12 line)	40	53	20	27	-	-	3	6	8	11	7	11	9	13	2	4	-	-	1	2	-	-	0	1

*RLGMCD - Located in CNCE.

TABLE 20
Node E - Items in Major Assemblies

Assembly / Common Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	KGX-93 (ADC)	KXX-15 (NCD)	KXX-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRTT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGNCD	LGM	TGM	MGM
ULS AN/TTC-42 (150 line)	1	1	16	2	6	-	2	1	2	1	-	-	1	-	-	-	-	-	-	-
CNCE-X AN/TSQ-111	1	1	-	-	6	-	-	1	1	1	-	-	1	12	-	2	2	-	-	-
Tactical Comm Center (MTCC)*	1	1	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-	-
SRWBR Assemblage	1	1	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1
NRI Module	1	3	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	2	5	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-
Totals			16	2	L H 14 1	-	2	2	3	4	L H 8 18	3	L H 6 11	L H 26 29	L H 1 1	2	2	L H 4 10	L H 2 3	L H 1 1

TABLE 21
Node F - Items in Major Assemblies

Common Components / Assembly	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	KGX-93 (ADDC)	KXX-15 (NCD)	KXX-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGNCD	LGM	TGM	MGM	KXB-78 (Mod) (DSVT)
														L H				L H	L H	L H	
ULS AN/TTC-42 (150 line)	1	1	16	2	6	-	2	1	2	1	-	-	1	-	-	-	-	-	-	-	-
ULMS (24 line) AN/TYC-11	1	1	16	2	-	-	-	1	1	1	-	2	1	-	-	-	-	-	-	-	4
CNCE-X AN/TSQ-111	1	1	-	-	6	-	-	1	1	1	-	-	1	12	2	2	2	-	-	-	-
Tactical Comm Center (MTCC)*	1	1	-	-	-	-	-	-	-	2	2	3	-	-	-	-	-	-	-	-	-
SRMBR Assemblage	1	1	-	-	-	-	-	-	-	~	2	-	1	12	1	-	-	-	-	1	-
NRI Module	1	3	-	-	-	-	-	-	-	~	2	..	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	2	5	-	-	1	-	-	-	-	~	2	-	1	1	-	-	-	2	1	-	-
			L H		L H						L H							L H	L H	L H	
Totals			32	4	2 5	-	2	3	4	5	10 20	5	7 12	26 29	1 1	2	2	4 10	2 5	1 1	4

TABLE 22
Node G - Items in Major Assemblies

Assembly / Common Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (IKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	KGX-93 (ADC)	KXX-15 (NCD)	KXX-13 (ETD)	KY-68 (DSVT)	KG-84 (XLED)	MRT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGMCD	LGM	TGM	MGM
ULS AN/TTC-42 (75 line)	1	1	8	1	4	-	1	1	2	1	-	-	1	-	-	-	-	-	-	-
CNCE- X AN/TSQ-111	1	1	-	-	6	-	-	1	1	1	-	-	1	12	-	2	2	-	-	-
Tactical Comm Center (MTCC)*	1	1	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-	-
SRWBR Assemblage	0	1	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1
VRI Module	1	2	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	1	4	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-
Totals			8	1	L 11 / H 4	-	1	2	3	4	L 4 / H 14	3	L 4 / H 9	L 13 / H 28	L 0 / H 1	2	2	L 2 / H 8	L 1 / H 4	L 0 / H 1

TABLE 23
Node H - Items in Major Assemblies

Common Components / Assembly	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-81 (TED)	KG-83 (KVG)	KGX-93 (AUDC)	KXX-15 (NCD)	KXX-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRTT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGNCD	LGM	TGM	MGM	KYB-78 (Mod) (DSVT)
																		L H	L H	L H	
																		2 8	1 4	0 1	
ULS AN/TYC-42 (75 line)	1	1	8	1	4	-	1	1	2	1	-	-	1	-	-	-	-	-	-	-	-
ULMS (12 Line) AN/TYC-11	1	1	8	1	-	-	-	1	1	1	-	1	1	-	-	-	-	-	-	-	4
CNCE-X AN/TSQ-111	1	1	-	-	6	-	-	1	1	1	-	-	1	12	-	2	-	-	-	-	-
Tactical Comm Center (MTCC)	1	1	-	-	-	-	-	-	-	2	2	3	-	-	-	-	-	-	-	-	-
SRWBR Assemblage	0	1	-	-	-	-	-	-	-	-	2	-	1	12	1	-	-	-	-	1	-
NRI Module	1	2	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	1	4	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-	-
					L H 11 14	-	1	3	4	5	L H 6 16	4	L H 5 10	L H 13 28	L H 0 1	2	2	L H 2 8	L H 1 4	L H 0 1	4
Totals			16	2																	

5.0 DEVELOPMENT OF SB-3865 NODAL MODELS

5.1 Selection of Nodal Variations

The SB-3865 is a 30/60/90 line Unit Level Switchboard. The following nodal variations of the SB-3865 switchboard were developed:

Node J: 60-line SB-3865 with 12-line ULS AN/TYC-11

Node K: 30-line SB-3865 with no MS

Node L: 30-line SB-3865 with 12-line ULMS AN/GYC-7.

5.2 Ground Rules, Definitions, and Equipment Parameters

The rules, definitions, and equipment parameters established for the AN/TTC-42 nodal models, as listed in Subsection 4.2, were applied to the SB-3865 nodes with the following exceptions:

- All calculations are based on the full digital capacity of the SB-3865 (30, 60, or 90 lines). If analog terminations are assumed (up to four may be accommodated), the digital equipment calculations should be adjusted accordingly.

- The following modified equipment parameters were assumed:

Item	Low Estimate	High Estimate
RLGM	Two per 30-line unit	Three per 30-line unit
RMC	One per 30-line unit	Two per 30-line unit

5.3 Illustration of SB-3865 Nodal Configurations

The basic SB-3865 nodal variations developed for use in this study are illustrated in Figures 9 through 11.

5.3.1 Node J

Figure 9 depicts a node employing a 60-line version of the SB-3865 with a 12-line ULMS, AN/TYC-11. A CNCE Type X (or a later version of a small CNCE) provides nodal control and certain multiplexing functions. Main transmission links to other nodes may be provided by satellite, tropo, and LOS radio terminals and low-speed cable systems, as illustrated. Paths to radio terminals are provided by coaxial cables. The subscriber access subsystem includes a variety of analog and digital subscribers, a communications center, mobile radio terminals served by the ULCS, and dedicated loop subscribers served by the ULMS.

5.3.2 Node K

Figure 10 is a nodal configuration employing one 30-line SB-3865 unit with no MS. Communication center service is provided by MRTT (SST) terminals rather than an MTCC assemblage. A CNCE assemblage is not required in the smaller node.

5.3.3 Node L

Figure 11 is a node employing the 12-line "throw-on-the-ground" ULMS, AN/GYC-7, in conjunction with the 30-line CS. This node is similar to Node K in all other respects.

5.4 Equipment Estimates

Estimated equipment requirements for the SB-3865 nodal variations are presented in Tables 24 through 31. A brief description of these tables follows:

- Table 24 lists the major assemblies and internodal cable systems that have been assumed for each nodal variation.
- Tables 25 through 28 provide the estimates of subscriber and DGM equipments required in each nodal variation for the four levels of security considered.
- Tables 29 through 31 provide the quantities of TRI-TAC COMSEC and DGM items included in the major assemblies of each of the three nodal variations.
- Table 32 lists the TRI-TAC COMSEC rack requirements.

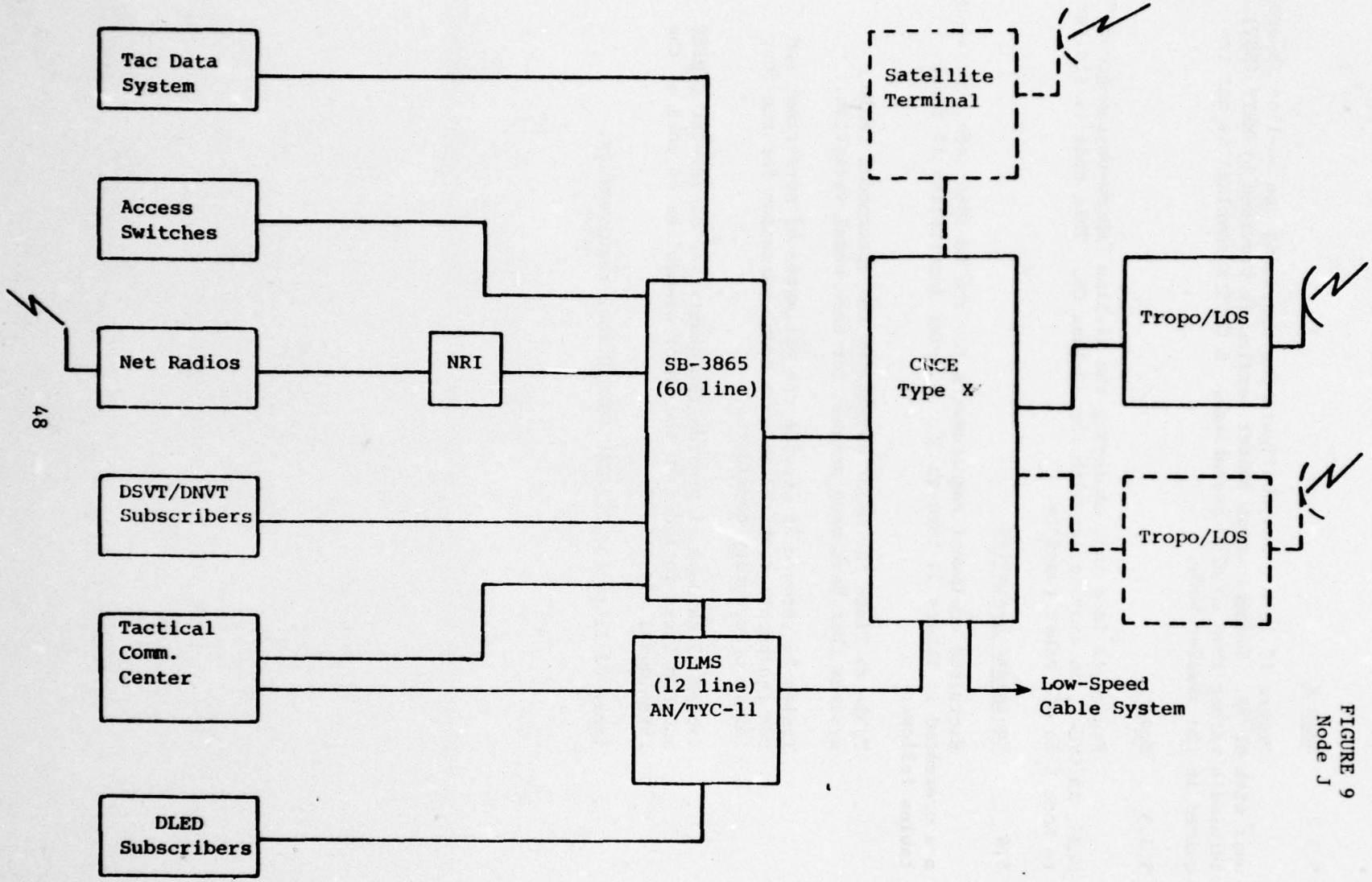

FIGURE 9
Node J

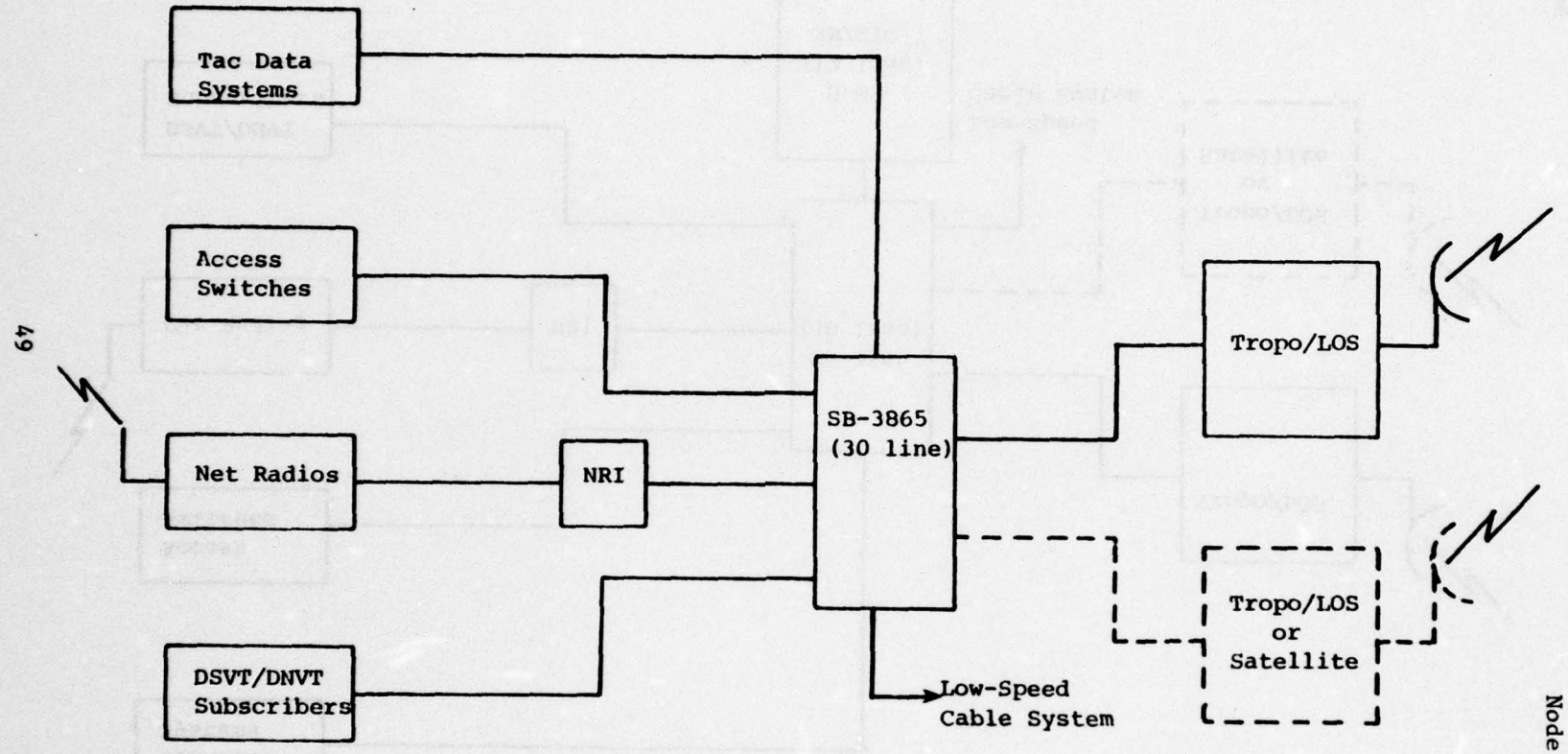

FIGURE 10
Node K

FIGURE 11
Node L

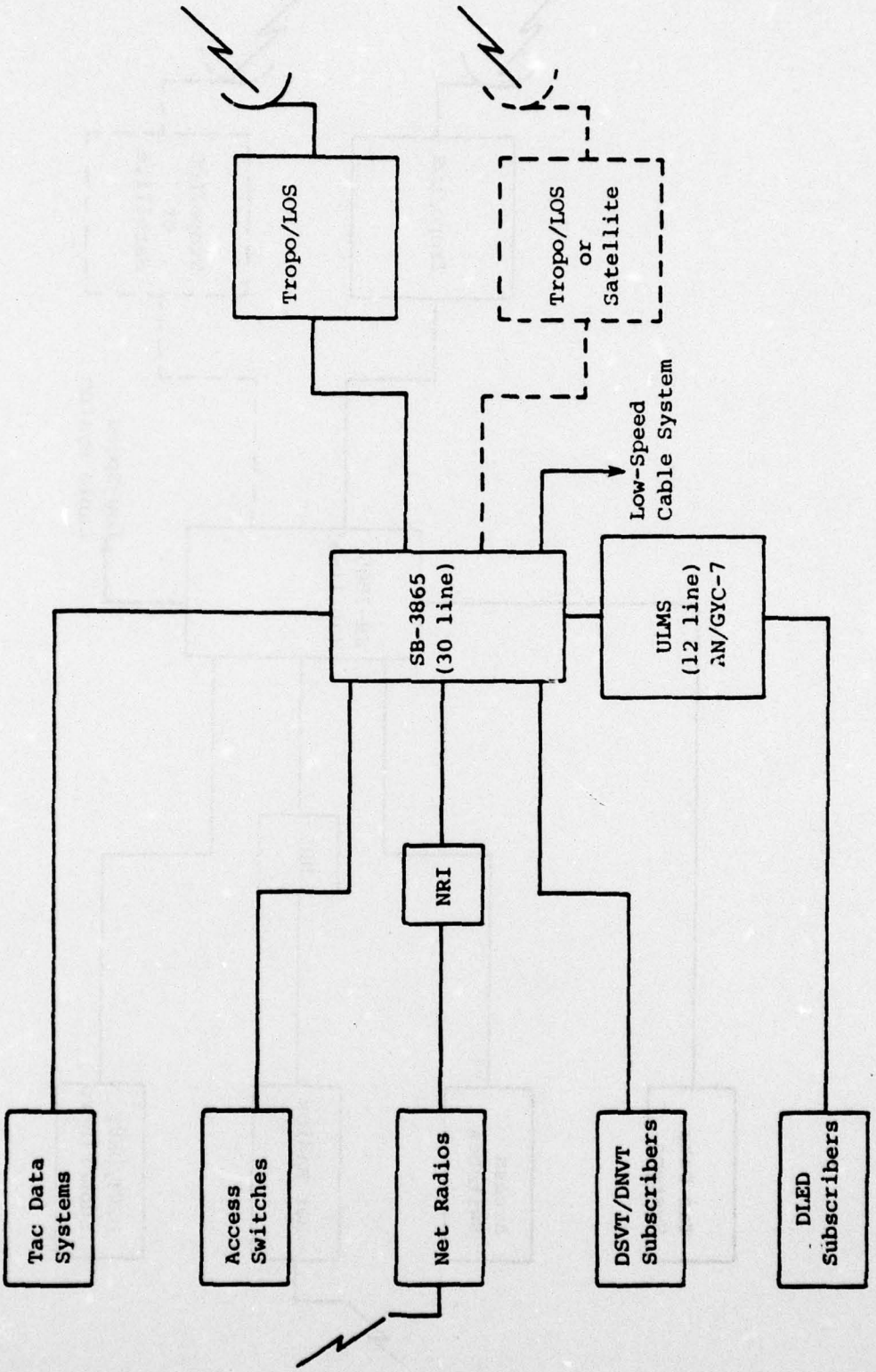

TABLE 24
SB-3865 Nodal Configurations

NODE	Nodal Switch Variation / Major Assembly	Switchboard SB-3865 (60-line)	Switchboard SB-3865 (30-line)	Message Switch AN/TYC-11 (12-line)	Message Switch AN/GYC-7 (12-line)	CNCE- X AN/TSQ-111	Tactical Comm Center (MTCC)	Low-Speed Cable System		ISPR		NMI Module		Radio Terminals (LOS, etc.)	
								L	H	L	H	L	H	L	H
J	SB-3865 (60-line) w/ULMS (12-line)	1	-	1	-	1	1	1	2	4	8	1	2	1	2
K	SB-3865 (30-line)	-	1	-	-	-	-	1	1	0	4	1	1	0	1
L	SB-3865 (30-line) w/ULMS (12 line)	-	1	-	1	-	-	1	1	0	4	1	1	0	1

TABLE 25
Nodal Configurations-Subscriber
and DGM Equipment - 10%
Security (Digital Subscribers)

Nodal	Switch Variation	Subscriber And DGM Equipment																							
		DSVT (KY 68)		Ext. Telephone Unit		DMTM (TA-954)		DLED (KG-84)		Dig. FAX (AN/UXC-4)		Data Adapter (NX-9810, NX-9811)		MRFT		PLGN		RLGMCD**		RMC			
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H		
J	SB-3865 (60 line) w/ULMS (12 line)	3	4	2	2	29	38	3	6	1	1	2	4	2	3	4	6	←	←	2	4		
K	SB-3865 (30 line)	2	2	1	1	14	19	-	-	1	1	0	1	1	1	2	3	←	←	1	2		
L	SB-3865 (30 line) w/ULMS (12 line)	2	2	1	1	14	19	3	6	1	1	2	4	2	2	2	3	←	←	1	2		

*LRGMCD - Located in CNCE.

TABLE 26
Nodal Configurations-Subscriber and DGM Equipment - 30% Security (Digital Subscribers)

Node	Nodal Switch Variation	Subscriber And DGM Equipment																					
		DSV3 (KY 68)		Ext. Telephone Unit		DNV3 (EA-954)		DLED (KG-64)		Dig. FAX (AN/UXC-4)		Data Adapter (MX-9810, MX-9811)		MFDT		RLGM		RLGNCD**		RMC	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
J	SB-3865 (60 line) w/ULMS (12 line)	10	13	5	7	22	29	3	6	2	3	3	5	3	5	4	6	-	-	2	4
K	SB-3865 (30 line)	5	7	3	4	11	14	-	-	1	2	1	1	1	2	2	3	-	-	1	2
L	SB-3865 (30 line) w/ULMS (12 line)	5	7	3	4	11	14	3	6	1	2	3	4	2	4	2	3	-	-	1	2

*RLGMCD - Located in CNCE.

TABLE 27
Nodal Configurations-Subscriber
and DGM Equipment - 30%
Security (Digital Subscribers)

Node	Nodal Switch Variation	Subscriber And DGM Equipment																							
		DSVT (KX 68)		Ext. Telephone Unit		DNVT (TX-954)		DLED (KG-84)		Dig. PAX (AN/UXC-4)		Data Adapter (MX-9810, NX-9811)		MRMT		RLGM		RLGMCD**		RMC			
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H		
J	SB-3865 (60 line) w/ULMS (12 line)	19	25	10	13	13	17	3	6	4	5	4	7	5	7	4	6	-	-	2	4		
K	SB-3865 (30 line)	10	13	5	7	6	8	-	-	2	3	2	2	2	3	2	3	-	-	1	2		
L	SB-3865 (30 line) w/ULMS (12 line)	10	13	5	7	6	8	3	6	2	3	3	5	3	5	2	3	-	-	1	2		

*RLGMCD - Located in CNCE.

TABLE 28
Nodal Configurations-Subscriber and DGM Equipment - 100% Security (Digital Subscribers)

NODE	Nodal Switch Variation	Subscriber And DGM Equipment																					
		DSVT (KY 68)		Ext. Telephone Unit		DNVT (TA-954)		DLED (KG-84)		Dig. FAX (AM/UXC-4)		Data Adapter (MX-9810, MX-9811)		MRFT		RLGN		RLGMCD**		RMC	
		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
J	SB-3865 (60 line) w/ULMS (12 line)	32	42	16	21	-	-	3	6	6	8	6	10	7	10	4	6	-	-	2	4
K	SB-3865 (30 line)	16	21	8	11	-	-	-	-	3	4	2	3	3	4	2	3	-	-	1	2
L	SB-3865 (30 line) w/ULMS (12 line)	16	21	8	11	-	-	3	6	3	4	4	7	4	6	2	3	-	-	1	2

*RLGMCD - Located in CNCE.

TABLE 29
Node J - Items in Major Assemblies

Assembly / Common Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-93 (STED)	KG-83 (KYG)	KGX-93 (AXDC)	KXX-15 (NCD)	KXX-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRTT (SST)	KY-58 (VINSON)	Group Modems	HSCCM	LSCCM	RLGNCD	LCM	TGM	MGM	KYB-78 (Mod) (DSVT)
Switchboard SB-3865 (60 line)	1	1	4	-	2	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
ULMS AN/TYC-11 (12 line)	1	1	8	1	-	-	-	1	1	1	-	1	1	-	-	-	-	-	-	-	4
CNCE-X AN/TSQ-111	1	1	-	-	-	-	-	1	1	1	-	-	1	12	-	2	2	-	-	-	-
Tactical Comm Center (MTCC)	1	1	-	-	-	-	-	-	-	2	2	3	-	-	-	-	-	-	-	-	-
NRI Module	1	2	-	-	-	-	+	-	-	-	2	-	1	-	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	1	2	-	+	1	-	+	-	-	-	2	-	1	1	-	-	-	2	1	-	-
Totals			8	1	L 3 / H 4	-	-	2	3	5	L 6 / H 10	4	L 4 / H 6	L 13 / H 14	-	2	2	L 2 / H 4	L 1 / H 2	-	4

TABLE 30
Node K - Items in Major Assemblies

Common Components / Assembly	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-82 (LKG)	HGX-82 (CU)	KG-93 (STED)	KG-83 (KVG)	KGX-93 (AKDC)	KYX-15 (NCD)	KYK-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRTT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	FLCNCD	LCM	TGM	MCM
Switchboard SB-3865 (30 line)	1	1	-	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
NRI Module	1	1	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	0	1	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-
Totals			-	-	L H 1 2 -	-	-	-	1	1	L H 2 4	-	L H 1 2	L H 0 1	-	-	-	L H 0 2	L H 0 1	-

TABLE 31
Node L - Items in Major Assemblies

Assembly / Common Components	No. of Assemblies in Node L	No. of Assemblies in Node H	KG-77 (LKG)	HGX-77 (CU)	KG-93 (STED)	KG-83 (KVG)	KGX-93 (AKDC)	KTX-15 (NCD)	KYK-13 (ETD)	KY-68 (DSVT)	KG-84 (DLED)	MRIT (SST)	KY-58 (VINSON)	Group Modems	HSCDM	LSCDM	RLGNCD	LGM	TGM	MGM
Switchboard SB-3865 (30 line)	1	1	-	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
ULMS AN/GYC-7 (12 line)	1	1	8	1	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
NRI Module	1	1	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Radio Terminals (LOS, etc)	0	1	-	-	1	-	-	-	-	-	2	-	1	1	-	-	-	2	1	-
Totals			8	1	L 0 / H 2	-	-	-	2	1	L 2 / H 4	1	L 1 / H 2	L 0 / H 1	-	-	-	L 0 / H 2	L 0 / H 1	-

TABLE 32
COMSEC Rack Requirements

	HGF-82	HGF-83	HGF-85	HGF-91	HGF-92	HGF-93	HGF-94	HGF-78
Circuit Switch AN/TTC-39 (600 line)	1			2				
Circuit Switch AN/TTC-39 (300 line)			1	2				
Message Switch AN/TYC-39 (50 line)		1		1				
Message Switch AN/TCY-39 (25 line)		1		1				
Circuit Switch AN/TTC-42 (150 line)						2	2	
Circuit Switch AN/TTC-42 (75 line)						2	2	
Message Switch AN/TYC-11 (24 line)	2							1
Message Switch AN/TYC-11 (12 line)	1							1
CNCE AN/TSQ-111					2		4	
CNCE - X							2	

6.0 ABBREVIATIONS

The following is a list of abbreviations used in the tables and diagrams included in this report:

A	Analog
A/D	Analog-to-digital
AKDC/RCU	Automatic Key Distribution Center/Rekeying Control Unit
CNCE	Communications Nodal Control Element
COMSEC	Communications Security
CS	Circuit Switch
CSCE	Communications System Control Element
CU	Control Unit
D	Digital
DA	Data Adapter
DGM	Digital Group Multiplexer
DLED	Dedicated Loop Encryption Device
DNVT	Digital Non-Secure Voice Terminal
DSVT	Digital Subscriber Voice Terminal
ETD	Electronic Transfer Device
HSCDM	High-Speed Cable Driver Modem
HSPR	High-Speed Pulse Restorer
ICU	Interface Control Unit
KVG	Key Variable Generator
LGM	Loop Group Multiplexer
LKG	Loop Key Generator
LOS	Line-of-Sight
LR	Loop Ratio
LS	Low Speed
LSCDM	Low-Speed Cable Driver Modem
LSPR	Low-Speed Pulse Restorer
MGM	Master Group Multiplexer
MRTT	Modular Record Traffic Terminal
MS	Message Switch
MTCC	Modular Tactical Communications Center
NSA	National Security Agency
NCD	Net Control Device
NRI	Net Radio Interface
RLGM	Remote Loop Group Multiplexer
RLGMCD	Remote Loop Group Multiplexer Cable Driver
RMC	Remote Multiplexer Combiner
SA	Subscriber Access
SATTML	Satellite Terminal
S&F	Store-and-Forward (Message Switch)
SRWBR	Short-Range Wideband Radio
TDF	Tactical Digital Facsimile
TED	Trunk Encryption Device
TGM	Trunk Group Multiplexer
TS	Trunk Switch
ULCS	Unit Level Circuit Switch
ULMS	Unit Level Message Switch
ULS	Unit Level Switch