GL BJC

DRCPM-MSCS-PM 876
SUBJECT: Information Support for Annual Meeting of AUSA, 11-13 Oct 76

TO Information Office
ATTN: DRSEL-IO
ECOM

FROM Chief
Prog Man Div

DATE 15 JUN 1976 CMT2
Mr. Pontecorvo/mm/52313

Forwarded for your action and attached as inclosure 2 is initial information as discussed per telephone conversation between Mr. Finucane and Mr. Pontecorvo this date.

Russell K. Cleveland

RUSSELL K. CLEVELAND
MAJOR, GS
Chief, Program Management Division
MSCS

2 incls
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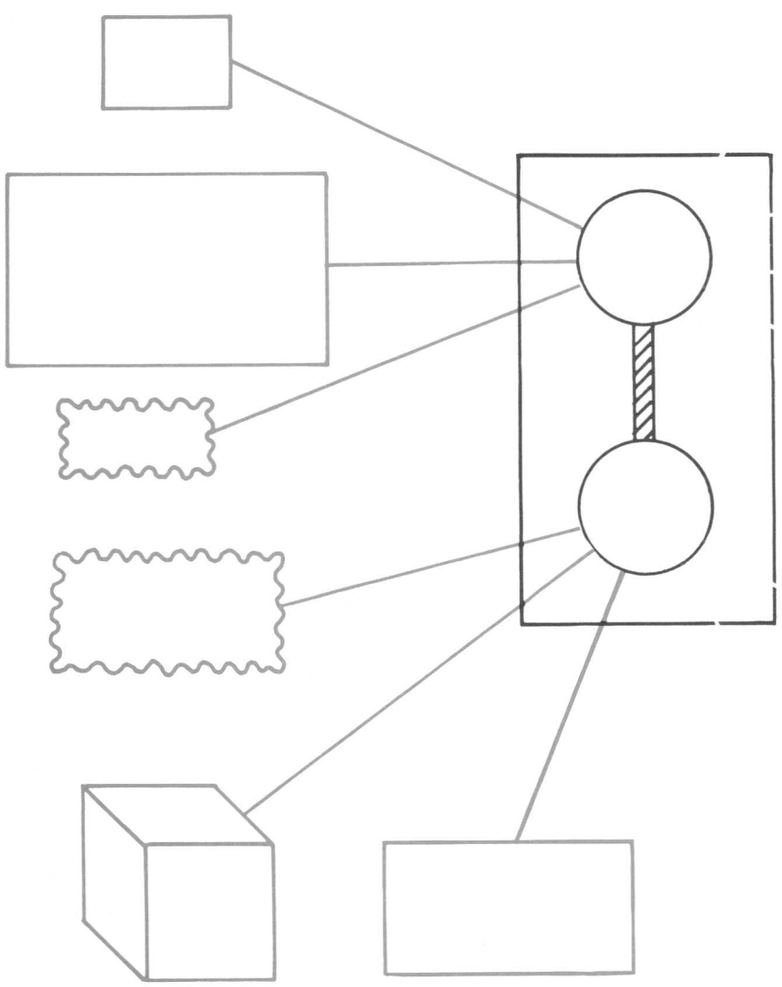
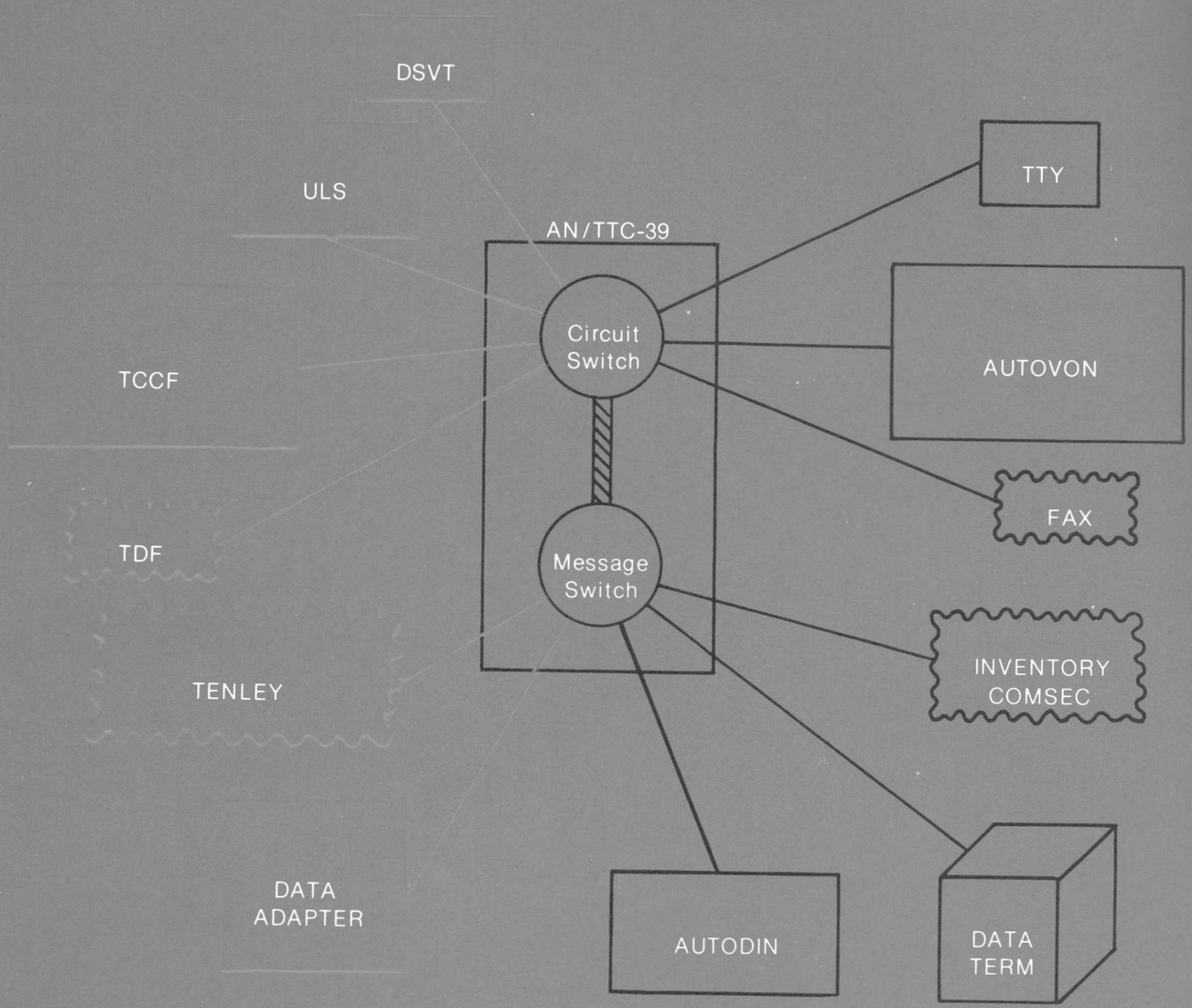
The AN/TTC-39 Switching System

A Bridge To The Future



GTE SYLVANIA
INCORPORATED

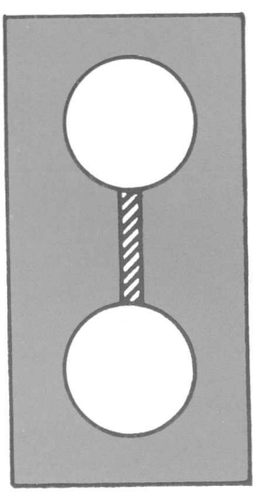

DSVT
ULS
AN/TTC-39
TTY
Circuit Switch
AUTOVON
TCCF
FAX
TDF
Message Switch
INVENTORY COMSEC
TENLEY
DATA ADAPTER
AUTODIN
DATA TERM

THE AN/TTC-39: ANALOG AND DIGITAL COMMUNICATIONS

The AN/TTC-39 is a bridge to the future. By handling a combination of analog voice, digital voice, and analog and digital data, it will meet both present and future tactical and strategic communications needs.

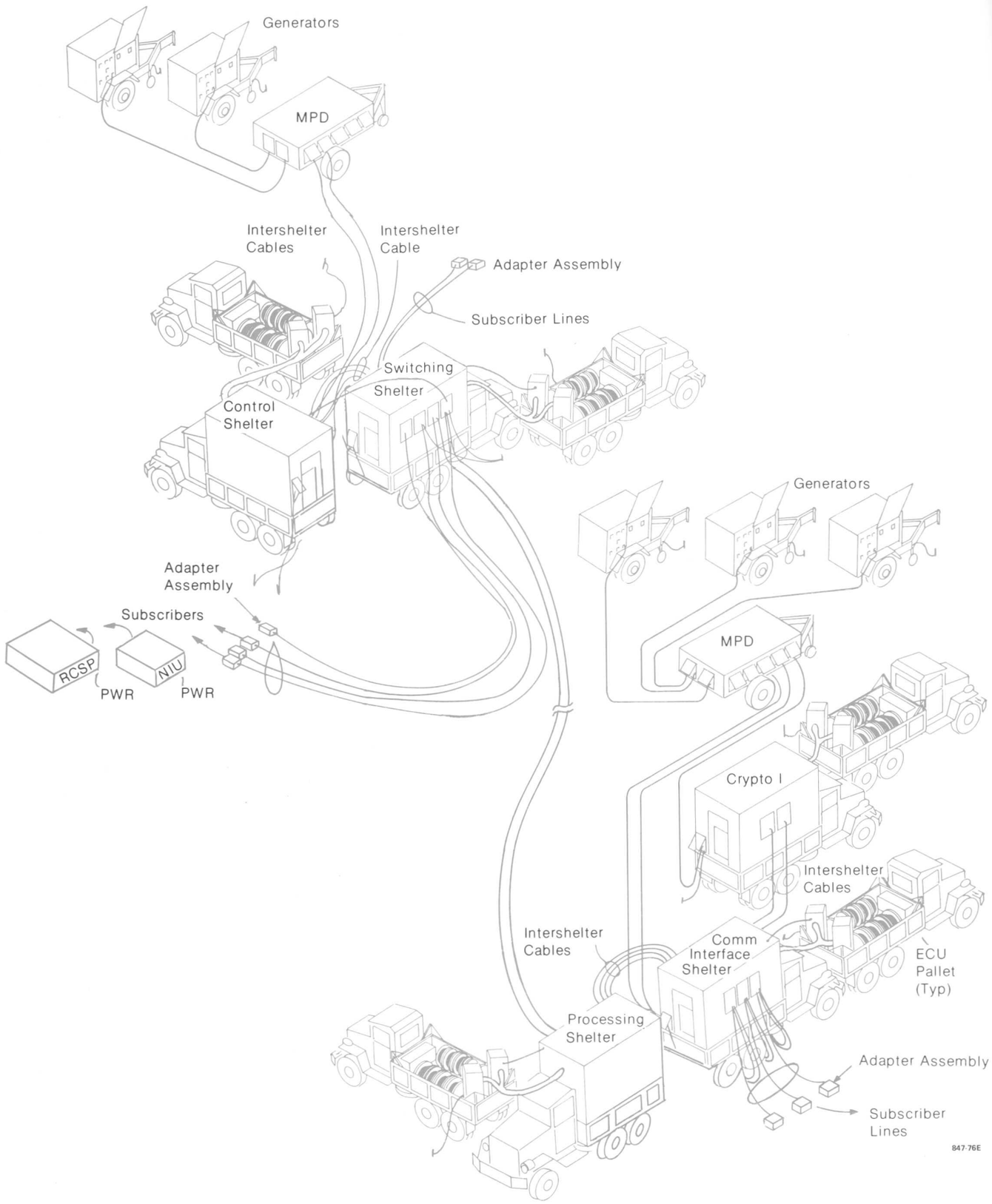
It has been designed to allow DOD services and agencies (Army, Navy, Air Force, Marines, DCA) to make full use of existing communication equipment inventories while phasing in the equipment of the 1980's and beyond.

The AN/TTC-39 family of switches is hybrid, modular, mobile, transportable, and automatic. It consists of two types of switches, circuit and message, which are designed to perform different but complementary functions. The circuit switch handles voice as well as data communication, and the message switch handles data exclusively. Together, they provide secure automatic switching service for voice traffic and store forward service for data traffic.



Meeting TRI-TAC's Needs

Technical definitions and requirements for the AN/TTC-39 have originated from the Joint Tactical Communications Office (TRI-TAC) which was established in 1971 to provide a focal point for the management of tactical communications within the Department of Defense. As the systems architect, TRI-TAC's missions include the achievement of the necessary degree of interoperability among current and future U.S. tactical and other DOD telecommunications systems, and the resolution of the interface with the Defense Communications System and the tactical communications systems of NATO and other allied governments - - in the most cost effective manner. Under the direction of the Army Project Manager for Multi Service Communications Systems (MSCS), the AN/TTC-39 is being developed by GTE Sylvania to meet TRI-TAC's objectives at affordable production costs in the immediate future, and for many years to come.



Tactical Field Area Switch Complex

AN OVERVIEW OF THE SYSTEM: MODULAR, FLEXIBLE, COMPLETE

The AN/TTC-39 can operate with a wide range of transmissions systems, such as satellite communication, tropospheric scatter and microwave communication, cable systems, data terminals, and voice telephones.

Several circuit switch configurations are possible, beginning with the simplest which is the 150/300 line single shelter switch, and continuing with a 600 line switch composed of a control shelter and a switching equipment shelter. Larger assemblages, of up to 2400 lines, are configured by interconnecting multiple 600 line switches. Van and fixed plant installations can be provided with the same switching functions as the tactical shelter configurations.

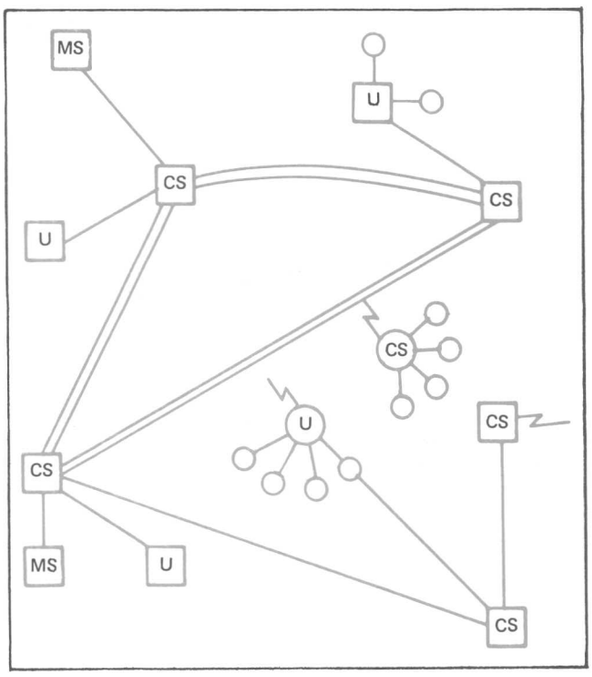
In the circuit switch the mix of digital and analog switching capabilities can be varied to meet specific needs. Both hardware and software are modular to provide a family of compatible switching combinations.

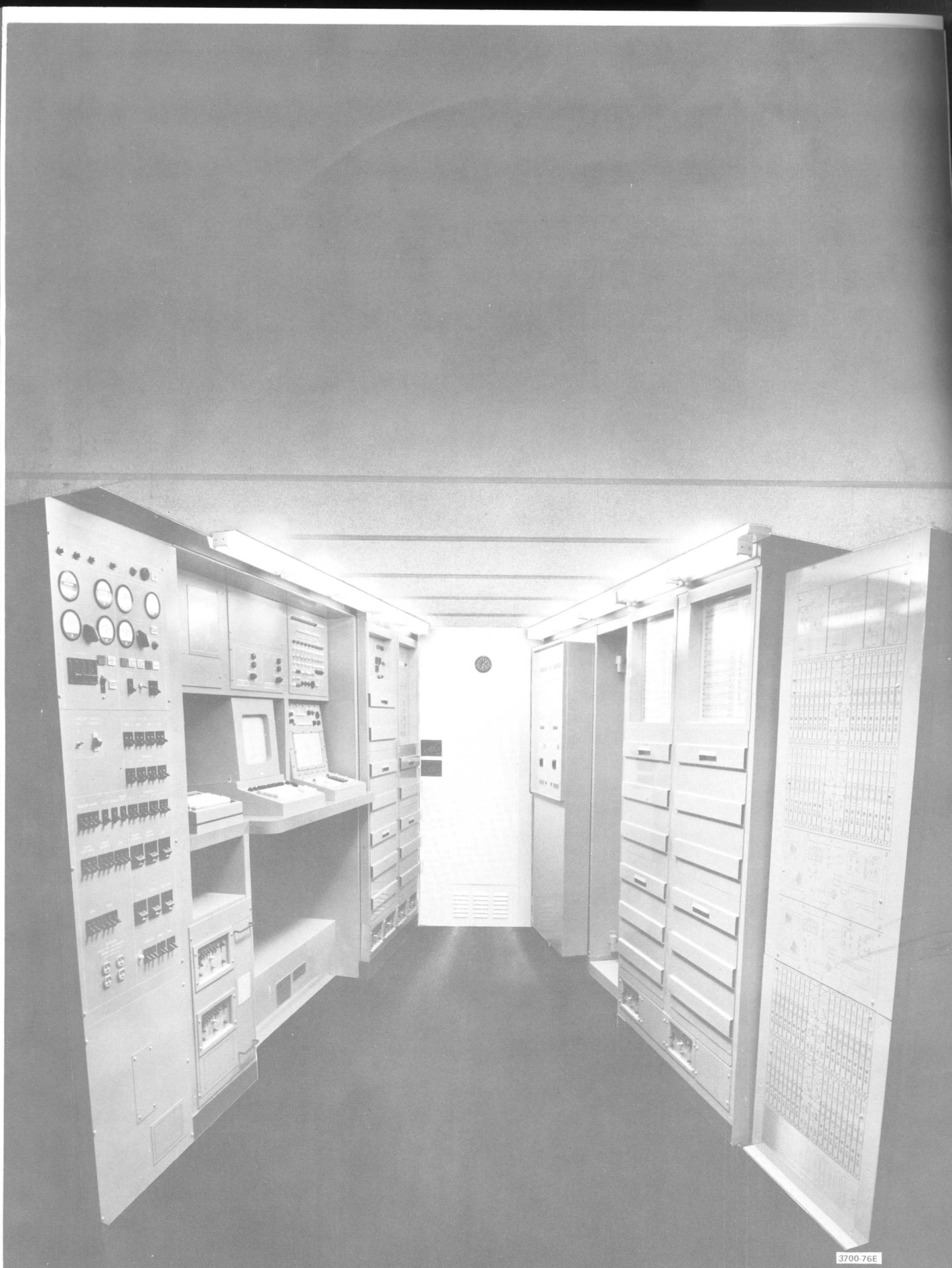
The message switch can also be implemented in many digital communications mode configurations.

The design of the switches allows for rapid change of line assignments without significant equipment change. The software data base (subscriber assignments and characteristics), can be revised or replaced via a switch supervisor console or remotely via other data base entry systems.

Inherent in the design of each switch is the flexibility to utilize the present inventory of COMSEC equipment and COMSEC equipment of the future. A new generation of cryptographic equipment (TENLEY) is being developed for use with the AN/TTC-39 circuit and message switches and other tactical equipment.

Circuit and message switching functions are independent of one another - one does not have to be present for the other to operate.




3700-76E

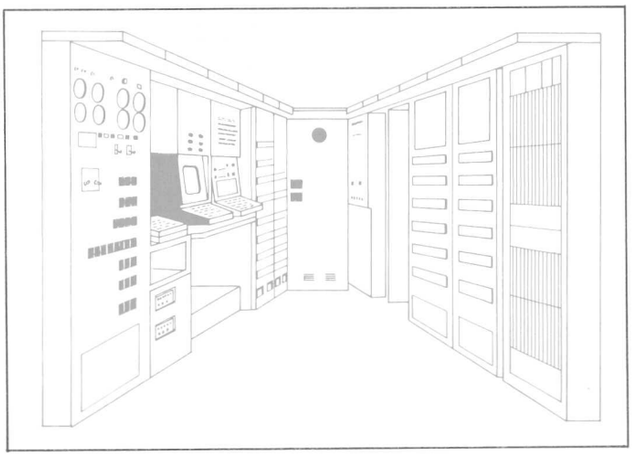
THE CIRCUIT SWITCH: HYBRID ANALOG/DIGITAL CAPABILITY

The AN/TTC-39 circuit switch will interface with AUTOVON, AUTOSEVOCOM, AN/TTC-25, AN/TTC-30, AN/TTC-38, SB-3614/TT, and other existing telephone switches and terminal equipment.

The circuit switch can signal and supervise many types of trunks and lines, including ring down, dial pulse, tone, or digital, and provide a compatible connection between incompatible subscribers. It also interfaces with the newly developed TRI-TAC Digital Subscriber Voice Terminal (DSVT) which operates with digital code words and digitized tones, instead of analog signals.

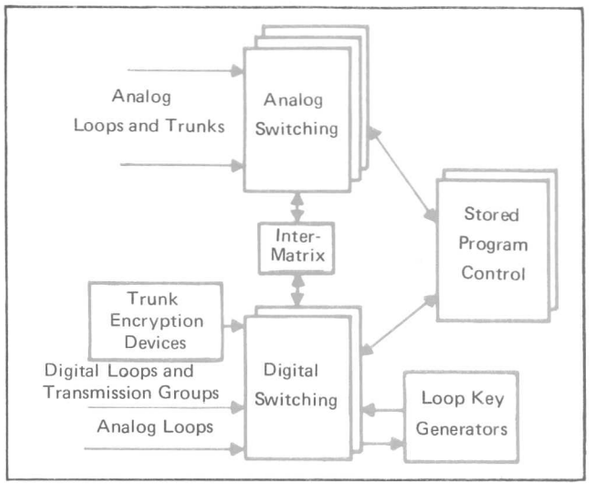
The circuit switch has been programmed to minimize the effects of such network problems as equipment failure, traffic congestion, lack of secure paths, and noisy communication, and to take the best of several alternate courses of action - - all in less than a second for any one call. Each circuit switch can handle thousands of calls every hour.

To provide for orderly transition from the present analog system to the predominantly digital communications systems of the future, the circuit switch can be equipped with a mix of both analog (space



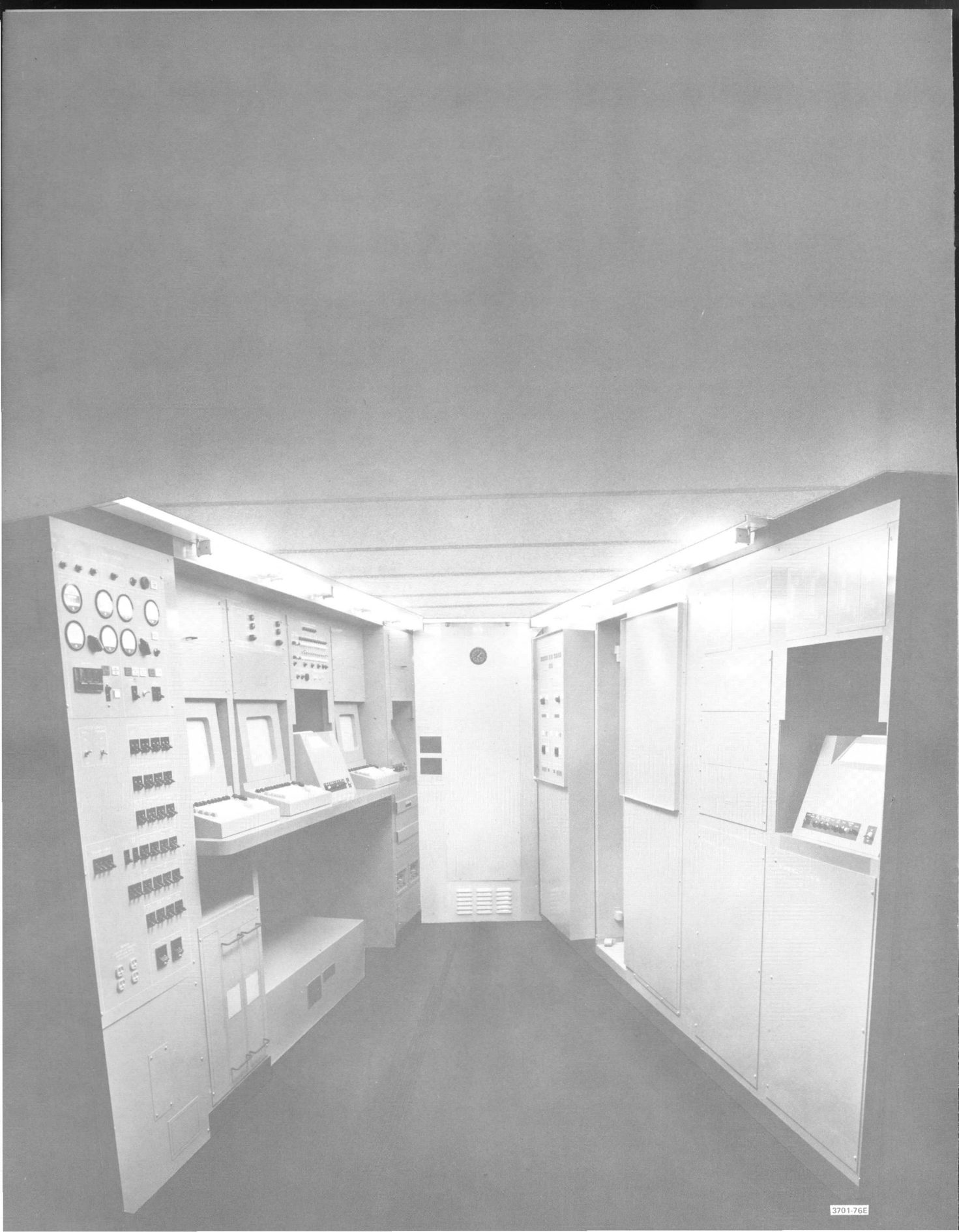
division) and digital (time division) matrices under control of the same central processor.

The circuit switch space division matrix is implemented with the same solid state cross-point devices that have been fundamental to GTE Sylvania switches which have proven their reliability in



many applications. The non-blocking time division matrix can handle the newly developed digital security telephones as well as digital secure data terminals. The combination of space and time division switching matrices under computer control provides a hybrid switch that can interface with both current and future analog and digital systems.

The circuit switch has many features which make it especially useful in tactical situations. These include progressive and pre-program conferencing; five levels of precedence; "hot line" service; line grouping; and automatic call transfer.


3701-76E

THE MESSAGE SWITCH: ELIMINATES DATA TERMINAL INCOMPATIBILITY PROBLEMS

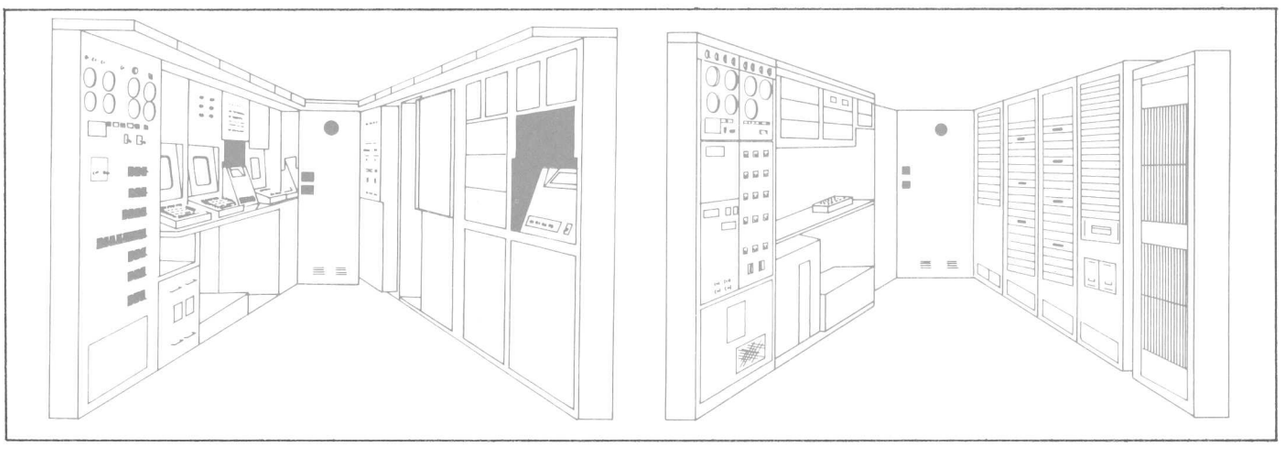
The message switch provides a means for data terminal equipments with dissimilar characteristics to communicate with one another. It is provided with hardware and software that permits it to understand, and to be understood by, any military data terminal. It can communicate with terminals operating at various transmission speeds, modes of operation using Baudot or ASCII data codes and ACP-127, ACP-127M, or JANAP-128 message formats.

In total, it can handle up to 540 types of data transmission, and it will interconnect with the world-wide strategic AUTODIN (Automatic Digital Network).

systems operators to interrogate the switch and retrieve any of the above information that is handled within a predesignated period.

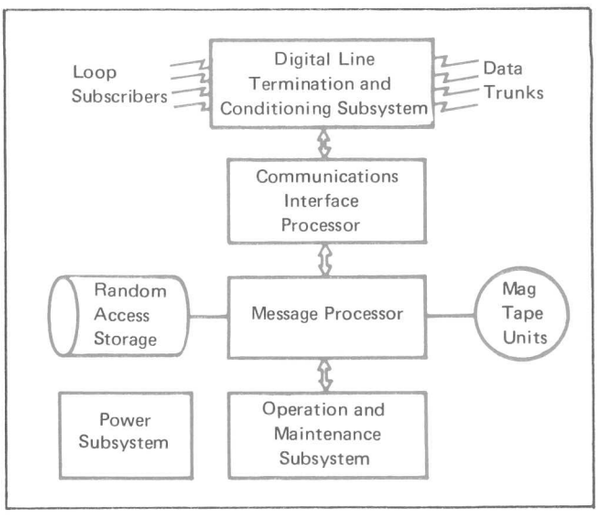
The message switch is capable of processing messages intended for the theater (U), strategic (R), and the intellience (Y) communities, simultaneously on a non-interfering basis. It provides for 6 precedence designators from routine through CRITICAL, 6 preempting levels, and it will handle 8 security categories.

It can process up to 81,000,000 characters per day, with a one second peak throughput of up to 9,000 characters. Single messages may be as long as 44,000 characters.



The switch accepts incoming data from a terminal by precisely accommodating that terminal's language, alphabet, speed and communications procedure. It then validates, stores for retransmission, and records the data for possible future use. Finally, the message switch prepares the data so that it is compatible with the data terminal language, alphabet, speed of operation, and communications procedure of each of the destinations - even when they are radically different from those of the originator.

The message switch provides stringent message accountability. For all practical purposes, no message acknowledged by the switch can be sent to the wrong destination, delivered with a significant error, or lost from the system. Every message, including originator, time of entry, priority, security level, destinations, and time of delivery acknowledgements, is stored by the switch. This storage allows



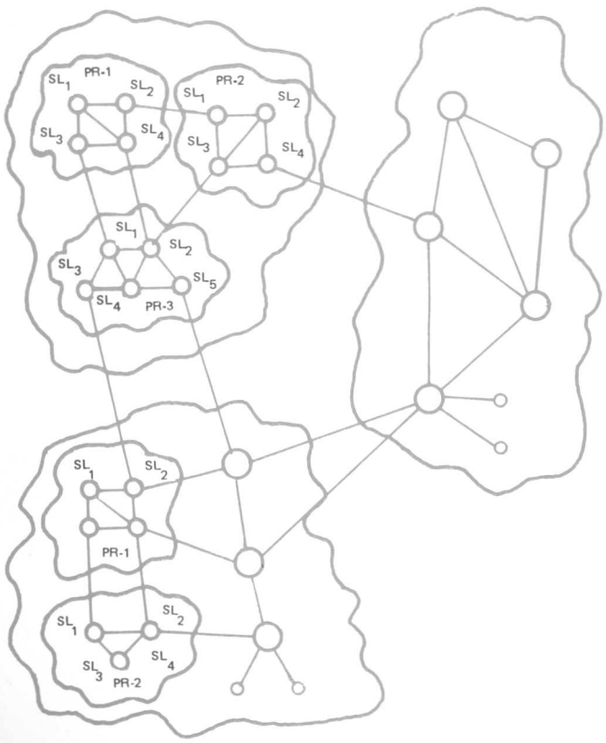
SUMMARY:
MEETING TOMORROW'S NEEDS, TODAY

The AN/TTC-39 is a major step in providing digital circuit and message switching which will meet tactical and strategic communications needs of the future without obsoleting today's analog communications equipment.

It incorporates state of the art technology and makes maximum use of proven communications and switching technologies.

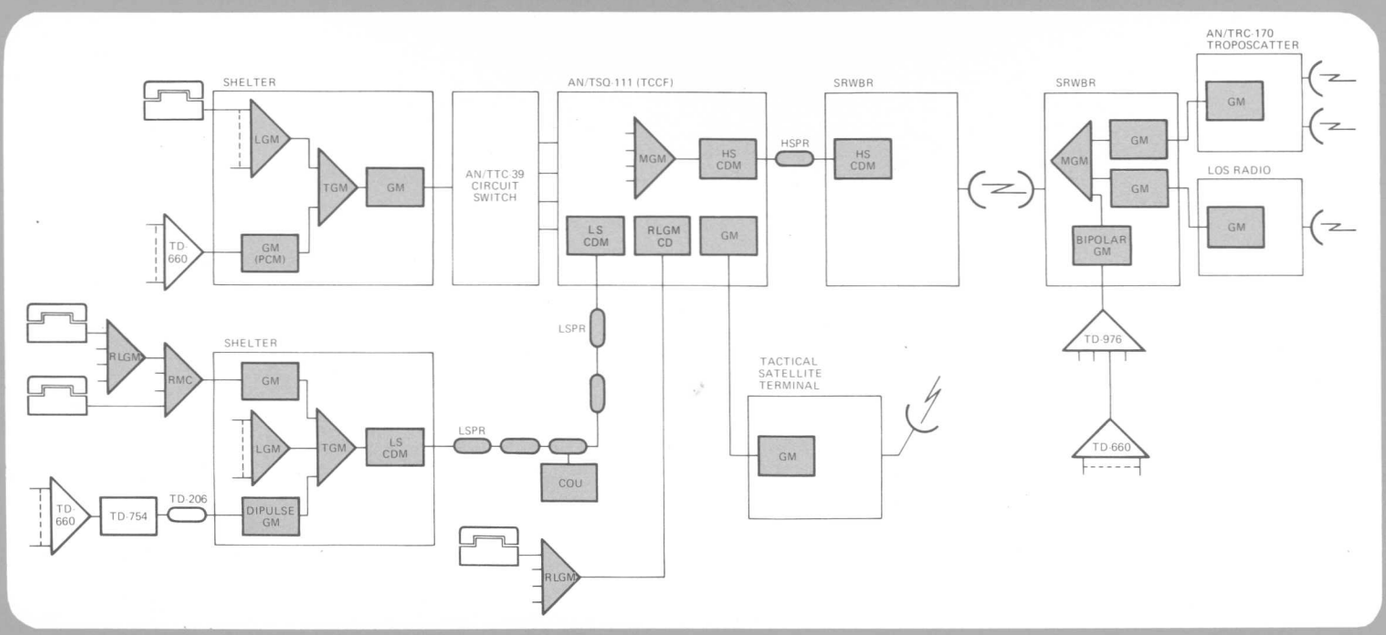
It is versatile, dependable, mobile, and affordable - - with inherent survivability, flexibility, accountability, and security.

By fulfilling its mission for TRI-TAC, it will usher in a new age of tactical and strategic communications.



RAYTHEON

DIGITAL GROUP MULTIPLEX EQUIPMENT



TRI-TAC COMMUNICATIONS SYSTEM

THE DGM EQUIPMENT WAS DEVELOPED FOR PROJECT MANAGER,
MULTISERVICE COMMUNICATIONS SYSTEMS, FORT MONMOUTH, NJ

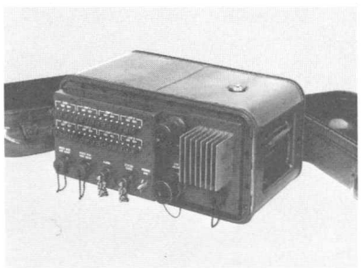
RAYTHEON

DIGITAL GROUP M

REMOTE LOOP GROUP MULTIPLEXER (RLGM)

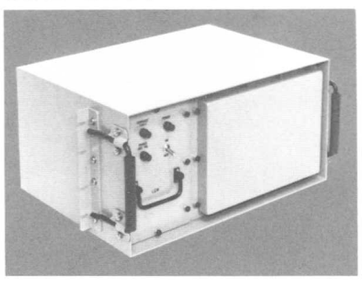
The functions of this unit are to combine four individual 32 or 16 Kb/s digital channel inputs into a single time division multiplexed output of 144 or 72 Kb/s respectively (loop group). It also performs demultiplexing of the 144 or 72 Kb/s loop group into four individual channels of 32 or 16 Kb/s. It contains loop modems on each channel to transmit and receive conditioned diphase signals via field wire to interconnect Digital Secure Voice Terminal (DSVT) or Digital Nonsecure Voice Terminal (DNVT) digital telephone sets. A group modem on the multiplexed side allows transmission of conditioned diphase signals via coax cable to RMC, GM, or RLGM/CD units. The RLGM provides power to each interconnecting DSVT. The RLGM has a self-contained power supply operating from either dc (28V) or ac (115V 50/60/400 Hz) prime power, or it may receive all its operating power from the RMC or RLGM/CD via CX-11230 coaxial cable. It is designed for exposed field use and is used in conjunction with the RLGM/CD, RMC, GM, COU, and DSVT.

REMOTE MULTIPLEXER COMBINER (RMC)



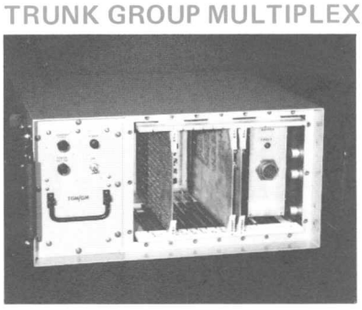
This unit time division multiplexes an input loop group (72, 128, 144, 256 or 288 Kb/s) from another RMC or RLGM and/or up to eight digital subscriber loops (32 or 16 Kb/s) into a single digital output group of 256, 288, 512 or 576 Kb/s depending upon the type and mix of input rates. It has a loop modem for each subscriber channel and provides power for interconnecting DSVT units via field wire. It has a group modem on both input and output for interconnecting to other units via CX-11230 cable at group rates. The RMC provides power via coax cable to interconnecting RLGM units. It is designed for exposed field use and operates from either dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with the RLGM, GM, COU and DSVT.

LOOP GROUP MULTIPLEXER (LGM)



This unit time division multiplexes 7, 8, 15 or 16 digital subscriber channels (16 or 32 Kb/s) into a single output bit stream of 256, 288, 512 or 576 Kb/s depending on the number and bit rate of the inputs. It contains loop modems to provide conditioned diphase signals via field wire to interconnecting DSVT or DNVT telephones. It also provides power via the field wire to interconnecting DSVT units. The LGM is designed for shelter rack mounting, operates from either dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with the TGM, MGM, GM, CDM, DSVT, and TED.

TRUNK GROUP MULTIPLEXER (TGM)

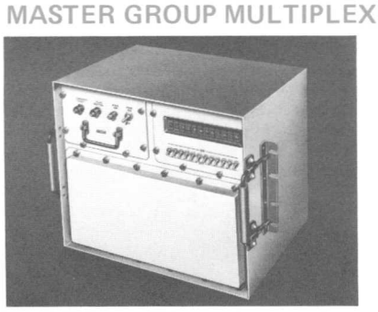


This unit multiplexes two, three or four group inputs of various rates into a super group. It does this in three distinct rate structures such that input and output rates must be within the same rate family.

	I	II	III
Inputs	128,256 512,1024,2048 Kb/s	144,288,576,1152,2304	144
Outputs	128,256,512,1024,2048, 4096 Kb/s	144,288,576,1152,2304, 4068	288,576

The TGM is also capable of providing single group operation when the group input is 576 Kb/s or lower. For single input operations, the output rate is equal to the input. A microcontroller is used to create a highly flexible framing structure in order to handle the wide variety of possible input/output combinations. The TGM is designed for rack mounting in shelters, operates on dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with LGM, RLGM CD, MGM, GM, CDM, and TED.

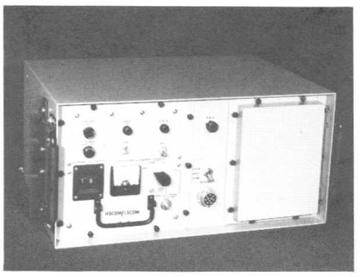
MASTER GROUP MULTIPLEXER (MGM)



This unit asynchronously time division multiplexes up to 12 digital input group signals ranging from 72 to 4915.2 Kb/s into a master group of either 9.36 or 18.72 Mb/s. On its input side, the MGM can accept any TRI-TAC group or supergroup signal and group outputs from TD-660 and TD-976 through appropriate interfacing modems. On the master group side, the MGM interfaces with the HSCDM and the SRWBR. It also synchronously multiplexes two 16 or 32 Kb/s channels either digital voice orderwire or telemetry. The MGM is designed for shelter rack mounting and operates from either dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with the LGM, RLGM/CD, TGM, GM, CDM, TED, SRWBR and CNCE.

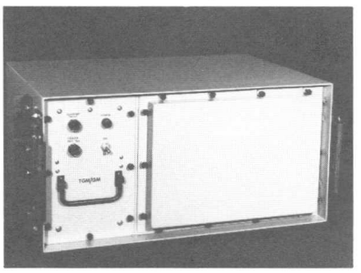
LTIPLEX EQUIPMENT

CABLE DRIVER MODEM (LSCDM AND HSCDM)



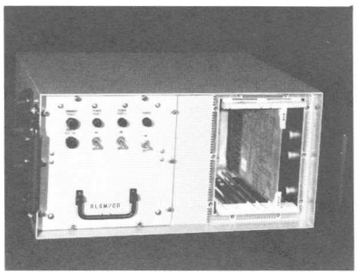
There are two types of CDM units: low speed (LSCDM) and high speed (HSCDM). The LSCDM accepts group bit rates from 72 to 2048 Kb/s and converts them to conditioned diphase with a fixed output rate of 2304 Kb/s. It also provides power for low speed pulse restorers (LSPR) in a cable system up to 64 Km. The HSCDM accepts input master group rates of 4096, 4608, 9360 and 18720 Kb/s and converts them to conditioned diphase signals at a fixed output rate of 19.2 Mb/s It also provides power for high speed pulse restorers (HSPR) in a repeated cable system up to 8 Km. Both CDM units are designed for rack mounting in a shelter and operate from dc (28V) or ac (115V, 50/60/400 Hz) prime power. The CDMs are used in conjunction with PRs, LGM, MGM, TGM, COU, TED, SRWBR and CNCE.

GROUP MODEM (GM)



This unit provides for transmission of group rate signals over nonrepeatered coaxial cable. It can handle up to six cable interfaces within the same equipment case, and provides diphase, dipulse, bipolar, and PCM cable interfaces in any mix. The conditioned diphase cable signal mode accepts input rates from 72 Kb/s to 4.608 Mb/s. The dipulse mode accepts inputs at 288, 576, 1152 and 2304 Kb/s with a dipulse output rate at 2304 Kb/s (TD-754 compatibility). The bipolar cable signal mode accepts 4.9152 Mb/s input with cable output signals at 4.9152 Mb/s (TD-976 compatibility). The PCM mode accepts TD-660 inputs at 288 and 576 Kb/s with unbalanced NRZ outputs at the same rates (TD-660 compatibility). The GM is designed for rack mounting in shelters, operates from dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with the LGM, RLGM, RMC, TGM, MGM, COU, TD-660, TD-754, TD-206, TD-976, TD-982 and TED.

REMOTE LOOP GROUP MULTIPLEXER CABLE DRIVER (RLGM/CD)



This unit provides coaxial cable interface between the RLGM unit and the TSQ-111 or extension facilities. It converts 72 or 144 Kb/s NRZ data to conditioned diphase for transmission over CX-11230 cable at lengths up to two miles without repeaters. The RLGM/CD equipment contains two full duplex modems per unit, each operating independently. The unit also provides power via the cable to operate two RLGMs and their associated DSVT units It is designed for rack mounting in shelters and operates from dc (28V) or ac (115V, 50/60/400 Hz) prime power. It is used in conjunction with the RLGM, MGM, COU, TGM, and CNCE.

PULSE RESTORER (LSPR AND HSPR)

Two types of pulse restorers are used in the TRI-TAC system: a low speed (LSPR) and a high speed unit (HSPR). The LSPR is used in repeatered coaxial cable systems in conjunction with the LSCDM to regenerate the cable signal each 1.6 Km in the system. It is a two way unit which detects and regenerates conditioned diphase signals at 2.304 Mb/s. The HSPR is used in repeatered coaxial cable systems in conjunction with the HSCDM to regenerate the cable signal each 0.4 Km in the system. It is a two-way unit which detects and regenerates conditioned diphase signals at 19.2 Mb/s rates. Both pulse restorers are field exposed and portable and are powered by CDM units at each end of the cable section. In addition, both carry orderwire circuits and provide loading and access to the orderwire signals. They are used in conjunction with the CDMs and COU.

CABLE ORDERWIRE UNIT (COU)

This unit provides field maintenance of the high speed and low speed cable systems. It allows access to the cable system maintenance orderwires, monitors low and high speed conditioned diphase signals and performs measurement of the PR power feed current. The COU is designed for field portable exposed use, and is mounted in a combination case. Power for the COU is provided by two internal 9V batteries with provision for an external battery supply. It is used in conjunction with the CDMs, PRs, RLGM, RMC, RLGM/CD and the diphase GM.

GENERAL

All DGM equipments, except for the PR and COU, incorporate BITE for organizational level maintenance by replacement of printed circuit boards and power supplies. A summary Fault Alarm is displayed on the unit front panel, with an additional display on the affected Lowest Replaceable Unit (LRU). An analog voice maintenance orderwire, a digital secure voice orderwire, and digital telemetry is provided on the selected DGM units in accord with operational requirements.

Digital Group Multiplex Equipment Characteristics

ABBREV.	UNIT NAME	TYPE UNIT	SIZE (in.) (H x D x W)	WEIGHT (lb)	INPUT POWER (W)	NO. OF LRUs	MTBF (hr)
RLGM	REMOTE LOOP GROUP MULTIPLEXER	FIELD EXPOSED	8.5 x 13 x 17.25	34	32	8	4,000
RMC	REMOTE MULTIPLEXER COMBINER	FIELD EXPOSED	8.5 x 13 x 17.25	40	111	13	2,500
LGM	LOOP GROUP MULTIPLEXER	SHELTER	8.5 x 12 x 17.25	33	137	14	3,000
TGM	TRUNK GROUP MULTIPLEXER	SHELTER	8.5 x 12 x 17.25	32	73	12	5,000
MGM	MASTER GROUP MULTIPLEXER	SHELTER	14 x 12 x 17.25	45	154	26	6,000
LSCDM	LOW SPEED CABLE DRIVER MODEM	SHELTER	8.5 x 12 x 17.25	31	83	7	6,000
HSCDM	HIGH SPEED CABLE DRIVER MODEM	SHELTER	8.5 x 12 x 17.25	31	92	7	6,000
GM	GROUP MODEM	SHELTER	8.5 x 12 x 17.25	35	65	14	6,000
RLGM/CD	REMOTE LOOP GROUP MULTIPLEXER CABLE DRIVER	SHELTER	8.5 x 12 x 17.25	33	173	5	4,000
LSPR	LOW SPEED PULSE RESTORER	FIELD EXPOSED	4.0 diam x 10	6.9	0.7	1	50,000
HSPR	HIGH SPEED PULSE RESTORER	FIELD EXPOSED	4.0 diam x 10	6.9	1.2	1	50,000
COU	CABLE ORDERWIRE UNIT	PORTABLE FIELD EXPOSED	12 x 11 x 11	20	3.0	1	10,000

RAYTHEON COMPANY
EQUIPMENT DIVISION
COMMUNICATIONS SYSTEMS LABORATORY
528 BOSTON POST ROAD, SUDBURY, MASS. 01776
(617) 443-9521