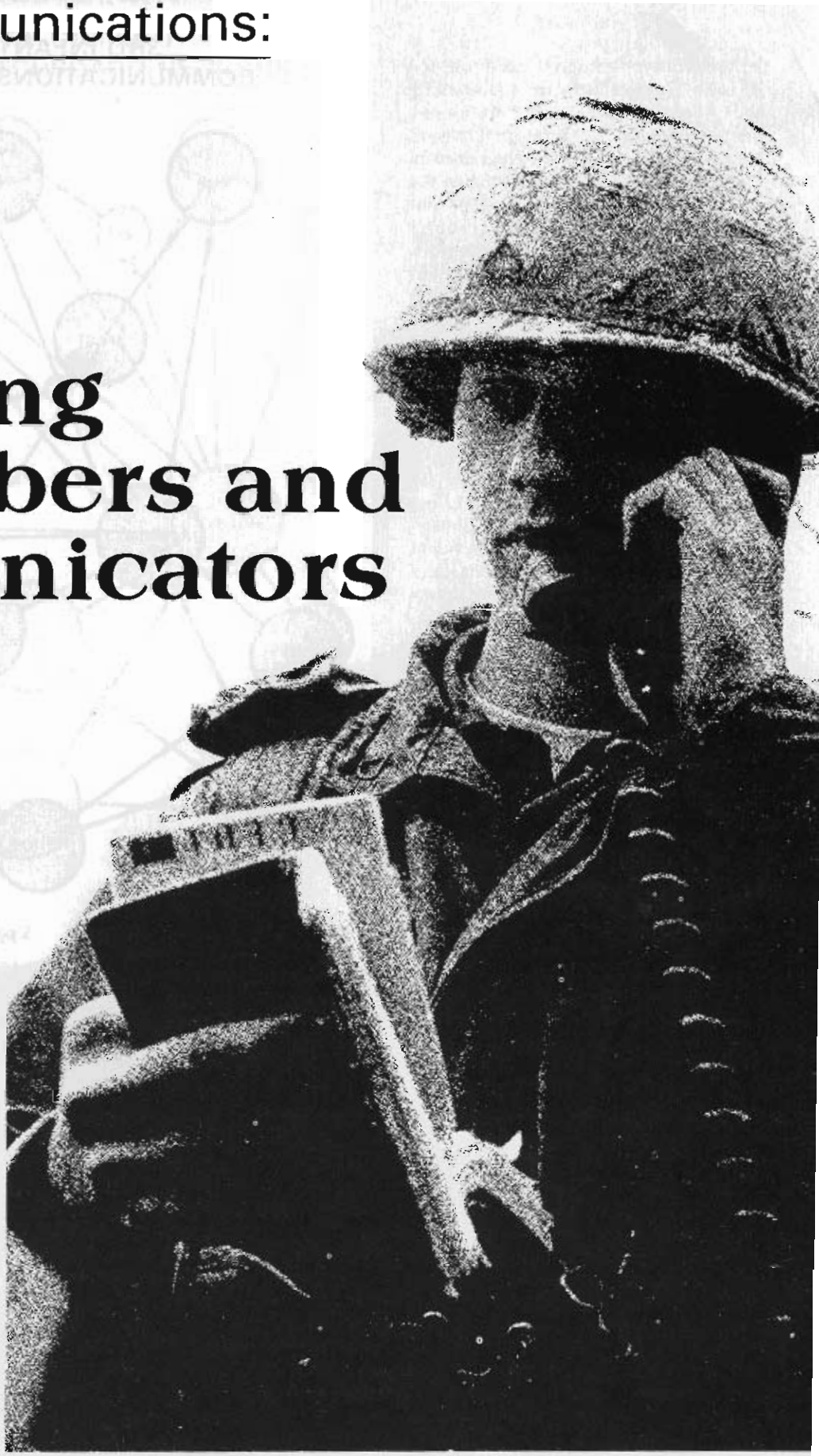
Division communications:

Satisfying subscribers and communicators



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by Maj. John J. Keane, Jr.

In the Fall 1981 issue, the ARMY COMMUNICATOR published an article which I co-authored entitled "Third Infantry Division Communications." The article was intended to demonstrate an approach to establishing a division communications system that solved several immediate problems and made full use of a new communications system (the SB-3614).

It represents what can be done best with today's limited technology in spite of the flaws in the equipment. It does not represent the type of communications system needed for the future, nor is it the type of system that minimizes the

administrative burden placed on the division signal officer for maintaining the system. Based on extensive interviews with 3rd Infantry Division subscribers and my own experience in configuring the system depicted in the AC article, I will define a system that satisfies both the subscriber's requirements *and* the communicator's requirements. Those who are familiar with several other articles on division communications will recognize similarities with other systems presented in AC. However, this system goes beyond other presentations because it allows changes as new equipment is developed.

The first problem in defining a division communications system is to correctly state the requirements. The use of catchy in-words such as "robust," "flexible" or "redundant" does not accurately define the real-world needs of division subscribers. My own impression of a "robust" communications system is one where a well-conditioned soldier runs around the battlefield carrying reels of 26-pair cable on his back, frantically hooking up the cables to any available signal hock. Perhaps the real reason these terms are used is that they are ambiguous enough to disguise the fact that the system is not really defined and flexible enough to allow frequent problem-solving changes. Most subscribers couldn't care less if a communications system is flexible or robust. What division subscribers want from the communications system is:

1. A system that is able to follow the subscriber anywhere in the battlefield. The commander must be free to set up his Tactical Operation Center (TOC) where he needs to be to control the battle and not be limited by peculiarities of the communications system.

2. A system which will allow *instantaneous* transfer of control from the current TOC to the next TOC location. Simultaneous Signal Centers with complete terminal capability at *both ends of the communications links* must be available.

3. A system in which making a connection is simple. The system should do all the work in completing the communications link. The subscriber should not have to follow a complicated routing diagram to complete a call. The method used to get from caller to caller should be invisible.

Each one of these requirements reflects the desires of a significant number of division subscribers based on a series of exercises conducted by the 3rd Infantry Division from 1978 to 1981. In addition to the subscribers' requirements, the following requirement reflects the needs of the *signal battalion for providing service to* the customer:

4. The communications system should be designed to allow changes or reconfigurations with minimal operator input. In essence, changes to the system should be invisible to the operator of a particular communications device.

3RD INFANTRY DIVISION COMMUNICATIONS CENTER NETWORK

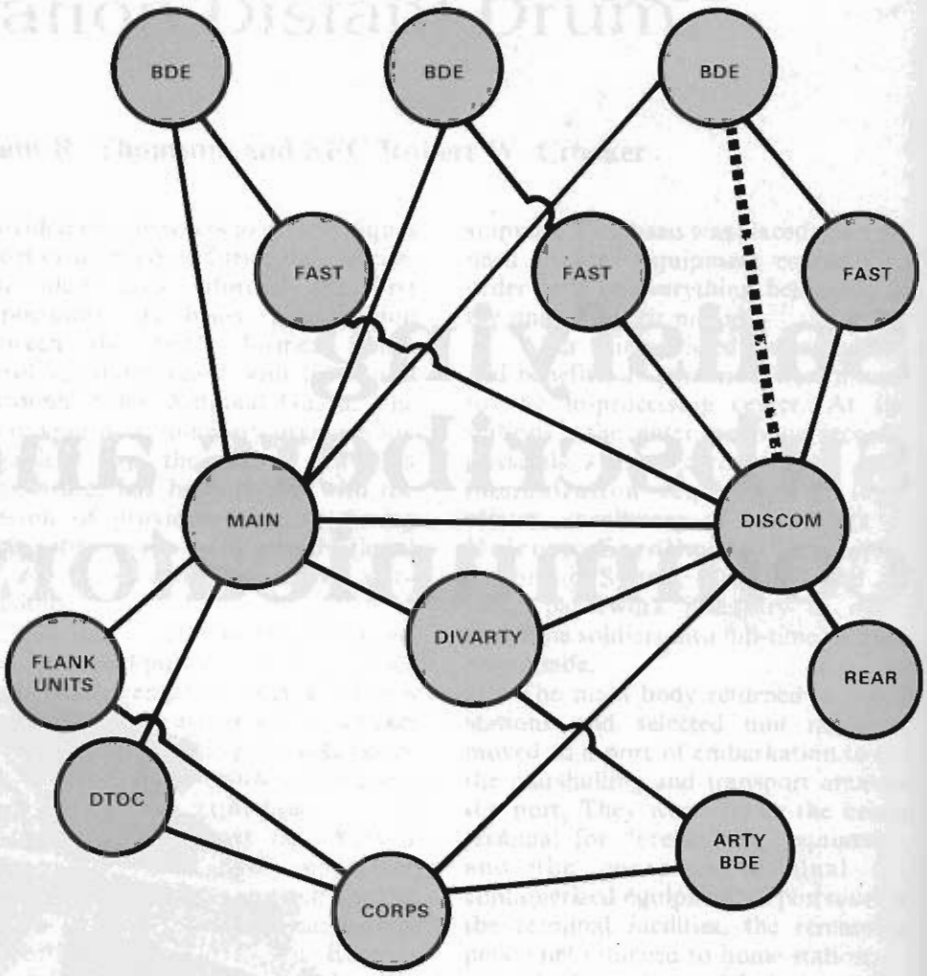


Figure 1

Satisfying the requirements

Some of the four requirements have been stated elsewhere and substantial effort has been dedicated to satisfying them. In particular, substantial effort has been dedicated to solving the first requirement. The problem of following a unit TOC around the battlefield is compounded *by the Line-of-Sight (LOS)* characteristic of the multi-channel communications equipment used to tie together key decision-makers in the division. Commanders like the low electronic signature of this system and the variety of services that can be provided. They do not like the

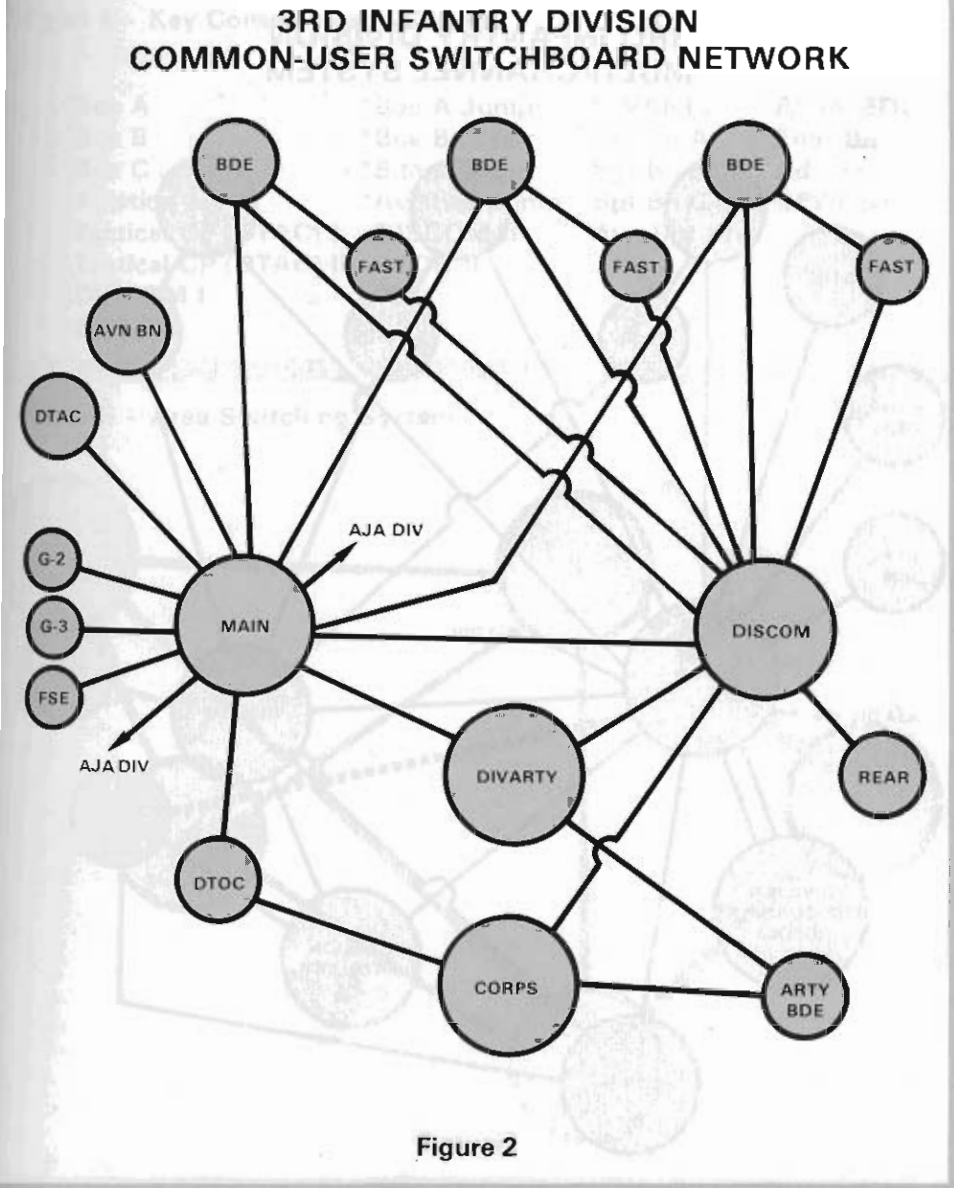


Figure 2

restrictions placed on locating the TOC in order to accommodate the LOS characteristics. Consequently, a number of approaches involving tactical satellite communications systems or other means have been investigated in order to directly attack the LOS problem. Unfortunately, these approaches are irrelevant to satisfying the other requirements. In fact, it can be shown that by satisfying the third requirement to develop fully automatic systems, it is possible to ignore the LOS limitation of the multi-channel communications equipment. This essay, therefore, will emphasize development of a system that satisfies the last three requirements with the net effect of solving the first as well.

A careful scrutiny of division communications systems indicates a strong similarity between the multi-channel system, the telephone trunk diagram, and the teletype routing diagram. Figures 1, 2 and 3 are reproduced from the original AC article. The similarity is intentional. It arises from the characteristics of the terminal equipment used and not the multi-channel equipment. The voice switching system, whether manual (SB-86) or automatic (SB-3614), requires the subscriber to know where he is located and where the party he wants to talk to is located. The degree of complication is exemplified by the requirement for the G-4 to talk to the S-4 at the brigade trains near the forward area support team. The G-4 has several choices. He can dial to the main signal center, then to the brigade, then to the FAST and finally to the S-4. This is due to the nature of the SB-3614 and a weakness in its design: it did not include a feature which would automatically search through the system. If one of the links fails, the G-4 must re-route the call through other links. Although the procedure is complicated, imagine the problems associated with changing this system configuration as units displace through the battlefield. Subscribers would never accept the need to learn a new system every few hours. Therefore, in order to minimize subscriber confusion, the system is kept the same. A possible solution is to re-patch circuits so the network looks the same regardless of the multi-channel configuration. However, this would require a significant number of strap-over circuits, and the field experience is that these circuits have less than a 50 percent chance of working plus almost no chance of being corrected if they do not work. Consequently, the system that minimizes subscriber dissatisfaction and operator confusion is to stick with a fixed configuration. It is at this point that the LOS characteristic of the multi-channel communications equipment impacts on the system configuration. The fixed communications system requires a number of procedures that minimize some problems but satisfy neither the subscriber nor the signal officer:

The few relays available to the signal battalion are deployed to support command signal centers. These sites are fairly free to set up anywhere in sector, but the degree of complexity of the system is increased.

Signal centers not supported by relays are restricted to locations that are LOS to the other signal centers they tie into.

With the number of relays available to the division signal battalion, only a few sites can be supported by relays, and many sites must comply with the restriction of setting up LOS from two other sites. In the 3rd Infantry Division system, this usually meant that the signal center supporting the FAST was limited to certain areas in sector unless the FASTs were given a priority for relays. Other divisions have overcome

these problems by ignoring communications for combat service support elements or separate battalions. Other systems which are called area systems, are really drop-and-insert systems since no alternate means of communications are provided. However, the area concept is the practical way of solving the division problem if the correct approach is taken.

The solution

The first step is to decide which sites will tie into the system. Figure 4 contains the list of all sites that could be deployed at a given time. Each maneuver brigade, the DTAC, the DTOC, DISCOM and Aviation Headquarters (whether brigade or battalion) will be supported by two identically equipped signal centers. This will provide the commander the opportunity to either operate one command post with a complete displacement capability or else two cellular or split command posts with no displacement capability. If the split command post concept is used, control is passed from one site to the other when one is required to displace. The artillery support centers would be provided two signal centers. When the division is not supported by an artillery brigade, the division artillery will be able to operate with the same capability as a maneuver brigade. With an artillery brigade supporting the division, neither is provided a pre-position capability. Control and specified functions are passed between headquarters or to the FSE section at the DTOC or DTAC when either the division artillery or artillery brigade headquarters displaces. The remaining seven sites, brigade support battalions and separate battalions — do not get any pre-position capability and must displace. These units pass responsibility to the appropriate staff element at the DTOC, DTAC, DISCOM, or BDE when movement of the CP is required.

The second step is to establish an area signal center network that connects the sites together. After analyzing the various combinations of switching centers and subscriber requirements *plus* the need to be able to move the system, the signal battalion will be provided five area signal centers. Each

3RD INFANTRY DIVISION MULTI-CHANNEL SYSTEM

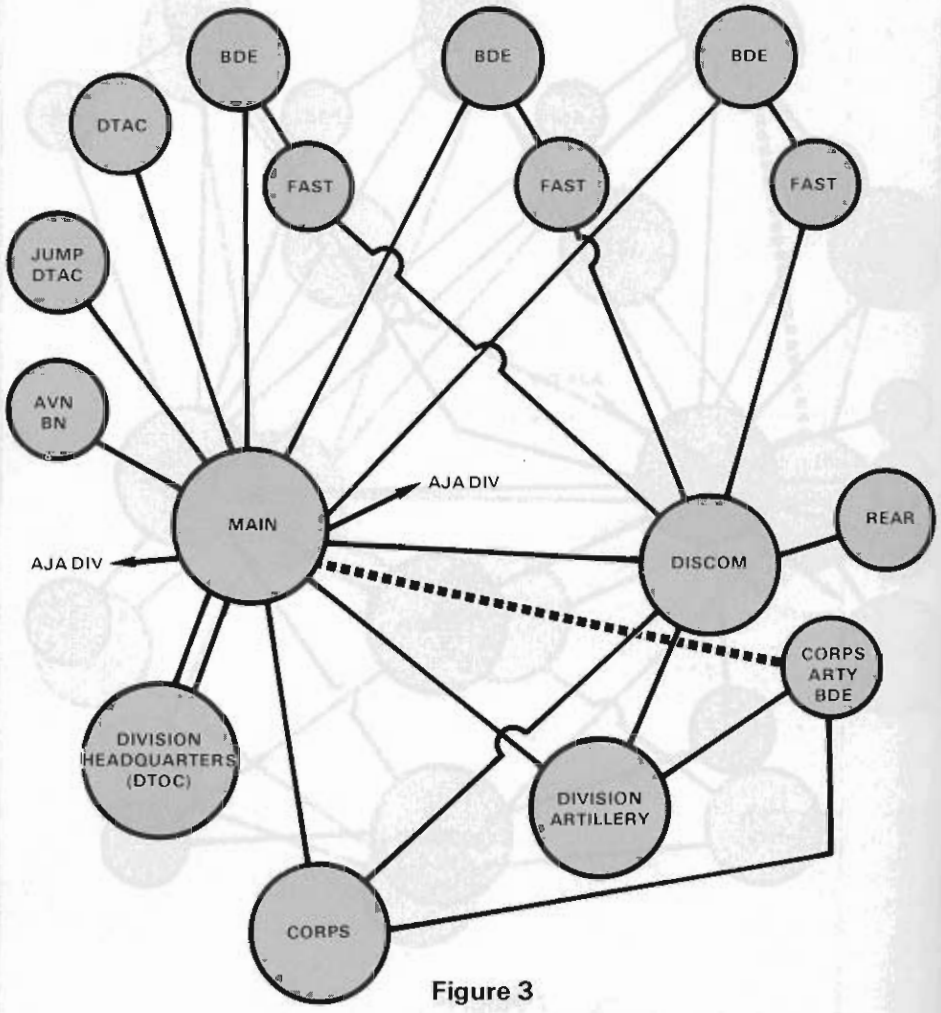


Figure 3

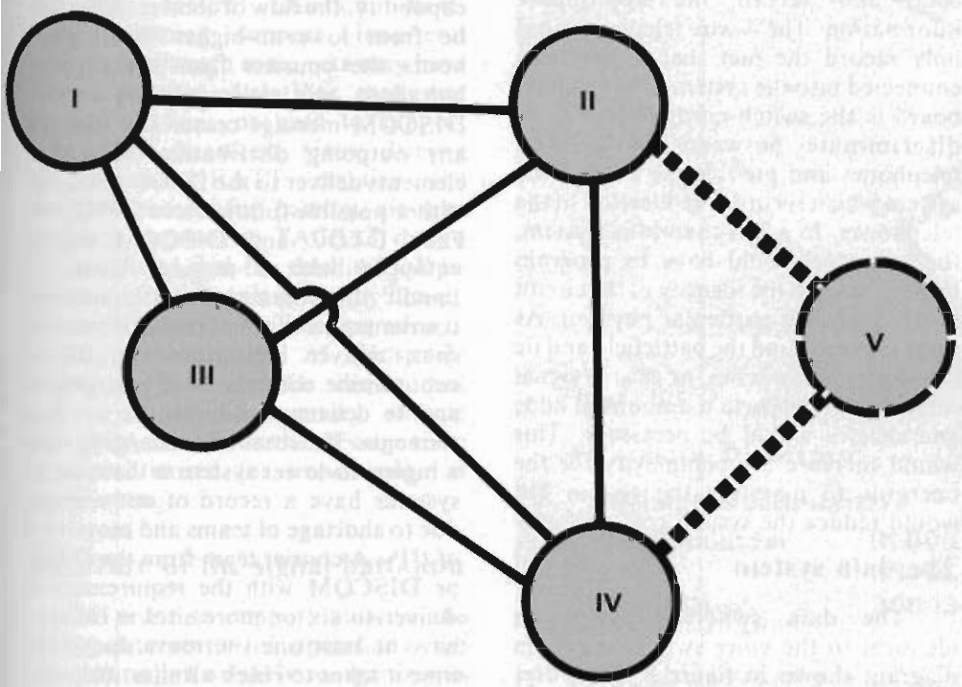
center will have a fully automatic voice and record traffic switching system with the capability to terminate up to 12 multi-channel systems. Four of the centers will be deployed as shown in figure 5. The fifth center will be used at a pre-position site to support relocation of either the sites in figure 4 or one of the area signal centers. The equipment at each area center will be capable of terminating communications from any of the sites in figure 4. The switching centers will be located on terrain that is LOS to potential CP locations. With an analysis of the sector of operations, the division signal officer should be able to site the five locations to cover the entire sector. Most efforts today to establish area systems are based on three area signal centers due to equipment limitations, and, as a result, the signal centers in figure 4 are restricted to locating at sites that are LOS with the area centers. With five sites and fully automatic equipment, the sites can set up anywhere. The equipment at each signal center will have the capacity to automatically search through the system to complete the call or route the message. It should have the capability to automatically terminate and recognize devices without operator programming of the equipment. To see how the system works, consider the example in figures 6a through 6c.

In figure 6a, Brigade A sets up at a location that can be supported by Area Center I. The DTOC is supported by

Figure 4 - Key Communication Sites

*Bde A	*Bde A Jump	*DIVARTY	*ARTY BDE
*Bde B	*Bde B Jump	Spt Bn A	*Engr Bn
*Bde C	*Bde C Jump	Spt Bn B	*Ada Bn
*Aviation	*Aviation Jump	Spt Bn C	*CEWI Bn
Tactical CP (DTAC) I	DISCOM II	*Avn Spt Bn	
Tactical CP (DTAC) II	DTOC II		
DISCOM I			
DTOC I			

Figure 5 - Area Switching System



Area Center IV.

Rather than follow a network as shown in figure 2, the G-3 operations officer at the DTOC looks up the number for the Brigade A S-3 in a telephone book that looks like a commercial directory. The G-3 merely dials the number and the system searches through the network to complete it. The directory is shown in figure 6b.

When Brigade A needs to move to a new site, it can only be supported by Area Center III. The pre-position site is sent out and the full signal center is established. The ideal situation would allow the change to take place without the need to reprogram the switching center equipment. However, the cost of this capability may be excessive, and the requirement to reprogram the switchboard should not impede the system. The reprogramming will allow simultaneous termination of incoming calls at both sites until the original CP displaces.

The entire multi-channel configuration is shown in figure 7. Although no node is shown with 12 systems, the capability to terminate 12 systems is required based on potential relocation of command posts.

The third step to complete the system is to specify the type of terminal equipment provided at each of the sites in figure 4. What follows proposes a significant departure from current doctrine in that ownership of terminal assets will change. Current doctrine fragments responsibility for terminating communications links. Under current doctrine, the C-E section of the sites (asterisked in figure 4) own the switchboard and terminal instruments while the signal battalion owns the multi-channel communications assets. Due to inherent scheduling problems that prevent units from training together, the only time that the *entire* system is tied together is during CPX's or FTX's. As a result, the first few days of most exercises consist of resolving circuit termination problems. This problem of fragmenting circuit termination is caused by the concept of having the system at each signal center provide both command and control as well as internal administrative support. The way to solve the problem is as follows:

Each site listed in figure 4 will be provided a dismounted SB-3614 to be used for internal administrative communications. This switchboard will have the capability to interface with the switching system. This switchboard will be owned and operated by the C-E section that supports the site.

The signal battalion will provide the following support at each signal center except for the two DTOC locations and two DISCOM locations:

- One AN/TRC-145 terminal (2 system capability).
- Eight 4-wire telephones providing direct long — local dial service via the multi-channel link into the area switching center.
- One AN/GRC-142 RATT set for entry into division RATT nets. (2 sets for each artillery center).
- A subscriber data terminal providing direct access via the multi-channel link into the area data switching center.
- An installation team that extends the voice and data terminals from the multi-channel terminal to the TOC.
- A courier team with three couriers to provide 24-hour service.

The two DTOC and DISCOM locations are provided the following by the signal battalion:

- One AN/TRC-113 and one AN/TCC-65 to allow up to three radio systems or four cable systems or combinations thereof.

A sixty line fully automatic switchboard with telephones that can also provide long — local service.

Three AN/GRC-142 RATT sets for entry into division RATT nets.

An enhanced data terminal with three user terminals.

An installation team.

Two courier teams and a message center.

A video cable installation team.

With this separation of responsibilities, several flaws in division communications are resolved. The signal battalion now owns the entire division commander's communications system from terminal instrument to terminal instrument. Consequently, when the signal battalion goes to the field to train, the entire system goes. There is no fragmentation of circuit termination responsibility as there is under current doctrine. In addition, each signal officer retains an administrative switchboard to be used during training commitments. This system is the most efficient for training and installation during the initial phases of deployment. The only problem that might arise from this configuration is that the signal battalion may not be familiar with certain peculiarities that a peculiar commander or S-3 requires in establishing the unit TOC. However, this can be overcome by a carefully drawn sketch of the TOC provided by the unit C-E officer. Too often we let minor irritants influence the decision as to where the C-E assets belong as opposed to the requirement to make the system work instantly when it is first installed.

The voice system

The physical configuration of the fully automatic switchboard system is shown in figure 8. This physical configuration is invisible to the user since the automatic switches route calls throughout the system the same way a commercial system does. Each one of the switchboards at the area signal center will have the capability to terminate up to 150 2-wire or 4-wire circuits. In addition, all critical functions will have redundant components which allow automatic switching between primary and backup components when the primary fails. The operator will be provided a console which identifies problems, provides status and allows input for instructions needed to change or fix the system. The ideal system would require the operator to program nothing. Each 4-wire terminal board and telephone would have circuitry built in that generates and recognizes an identity code. When the system is first powered-up, the terminal instrument begins generating the code and continues to do so until the circuit is completed. At that point, both terminal positions should recognize the identity code and record the appropriate information. The 4-wire telephone need only record the fact that it has been connected into the system. The terminal board in the switch needs to be able to discriminate between trunks and telephones and provide the data to the system which records the location of the telephones. In a less-than ideal system, the operator would have to program into the system the identity of the circuit terminated at a particular position. As units move around the battlefield and tie into different switches, or as area signal centers move, a certain amount of adds and deletes would be necessary. This would increase the complexity for the operator to maintain the system but would reduce the system cost.

The data system

The data switching system is identical to the voice switching system diagram shown in figure 8. Each user will be provided a terminal by the signal battalion. The installation team will be responsible for setting up the terminal, starting operation and assisting the subscriber when problems arise. However, the unit will provide the operator for the system. Using the concept employed in the Tactical Computer System (TCS) program, input will be provided by the subscriber via a screen display from canned formats stored in the terminal or through facsimile input. Messages will be automatically routed to the subscriber identified by the user. Should the multi-channel link to a particular site fail, the switching centers and terminal devices will retain the message in the waiting-for-delivery queue until the link is restored. When the message is delivered to a listed subscriber, a service message is automatically generated that records the receipt. When all addressees receive the message, it is moved to a file where it can be retained for future reference. The user's terminal will store all incoming messages so the data can be called up on the screen by the operator or printed on hard-copy through the facsimile input/output port.

The courier system

Bulk transfer of data and reports will be handled through an expanded courier system. Since each site in figure 4 is provided a 24-hour courier capability, the flow of courier traffic will be from lower-to-higher. Every four hours the couriers from the support battalions will deliver traffic to the DISCOM message center and pick up any outgoing distribution. All other elements deliver to the DTOC primarily with a possible follow-on to DISCOM. Each DTOC and DISCOM site is equipped with a message center to handle the volume of traffic and two courier teams to transfer traffic between sites, deliver high-priority traffic to subordinate commands in emergencies and to deliver routine traffic to corps elements. The reason for changing from a higher-to-lower system is that courier systems have a record of not working due to shortage of teams and movement of CPs. A courier team from the DTOC or DISCOM with the requirement to deliver to six or more sites is likely to have at least one site move during the time it takes to reach all sites. Based on typical distances between sites in a European sector, it takes up to 12 hours to complete delivery to six outlying sites and even longer when one of the sites moves because the team has to use time looking for the new location. A substantial amount of the time spent by these teams arises from the lack of familiarity with the large sector of operations. Courier teams from subordinate elements would have a less complicated route to follow, be more familiar with the subordinate unit's sector and be more responsive to unexpected relocation of the TOC. In order to reduce the volume of vehicle traffic near the DTOC and DISCOM locations, the message center should be set up in the town nearest to the CP. Hourly and on-call visits from the message center to the CP will provide timely delivery of bulk traffic.

RATT support

Radio teletypewriter support is provided for use in a highly mobile environment for high-priority message traffic. The net structure for the three nets is in figures 9 through 11. There are sufficient RATT sets to insure availability of at least one station at each site in figure 4 in spite of the maintenance performance of the AN/GRC-142. The net structures are based on the nature of the information most likely to be passed over the net — immediate tactical situation, short-range planning support, long-term support. Although some nets may have a large number of stations, many are monitor stations or used to support transition between sites during displacement. RATT remains the alternate means for passing message traffic as opposed to TACSAT due to the likelihood that the satellites will be eliminated as a result of enemy action. The RATT stations will be upgraded to allow transmission of facsimile messages. The facsimile device will contain a limited memory storage capability that allows the message to be read and stored for transmission at higher rates.

Structure of the signal battalion

In order to support units in the appropriate sector of operations, the signal battalion would be reorganized as shown in figures 12a through 12f. The current organization of the division signal battalion based on command relationships maximizes internal control problems for the command operations and support operations companies. The reorganization proposed here minimizes overlapping sectors of responsibility.

A Company will have four platoons as shown in figure 12b. The DTOC and DISCOM support platoons will contain two identical sections each. As indicated earlier, all four sections will be identically equipped to allow full exchange of sites. The relay/retrans platoon and cable platoons are in A Company since the greatest use of video cable and AN/TRC-113 assets will be in support of the DTOC and DISCOM. Most of the assets of this company will be deployed to the rear of or slightly

Figure 6a

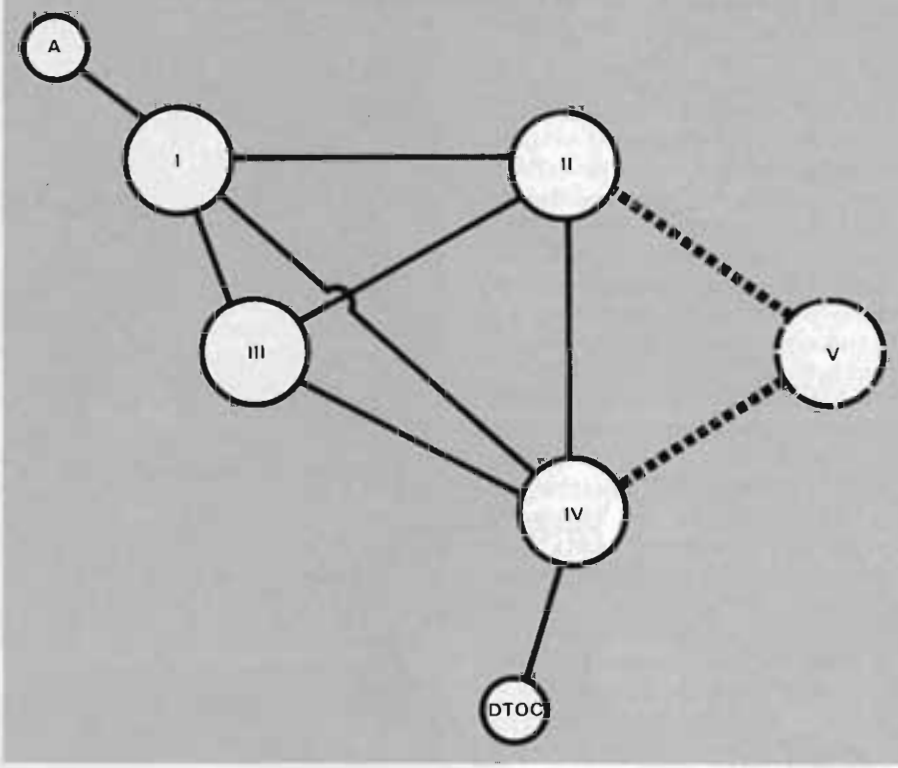
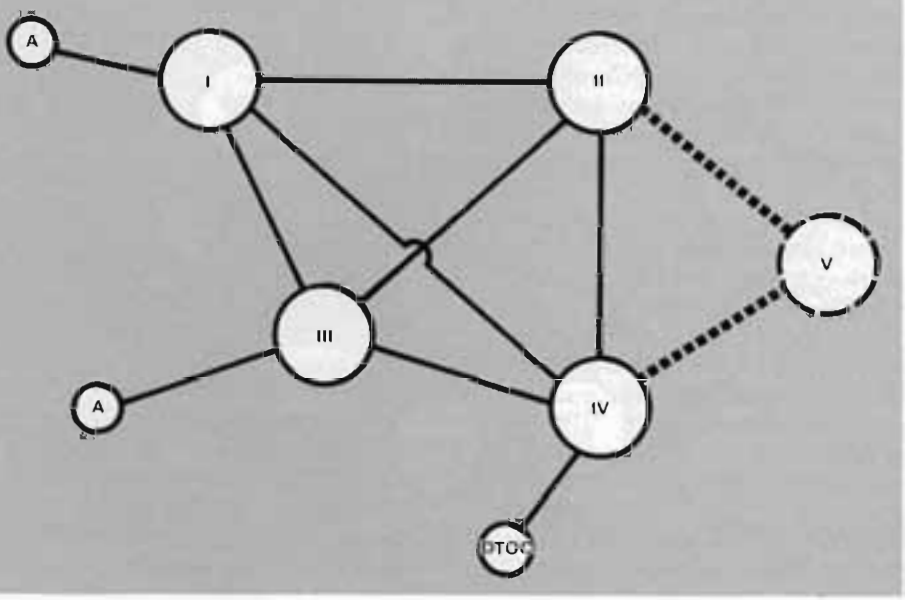


Figure 6b

Telephone Directory

Division Headquarters		Brigade A	
Commander	36006	Commander	11006
C/S	36005	XO	11005
G-3 Opns	36003	S-3	11003

Figure 6c



forward of the rear-most area signal centers.

B Company will also have 4 platoons as shown in figure 12c. B Company will support the DTAC and the brigade headquarters. The DTAC mission is added to B Company due to the probable location of the DTAC forward of the brigade rear boundaries. To allow full concentration by B Company personnel on supporting the command signal centers, responsibility for the brigade support battalions is given to C Company. Each platoon of B Company has two identical teams, and all eight teams are in fact identically equipped to allow full interchangeability of sites. All B Company equipment will be mounted in M577 or equivalent vehicles to give these systems the same degree of protection and mobility that the supported units have.

C Company is no longer the catch-all company for miscellaneous missions. C Company supports those command posts which are located in the center of the division sector. There are eleven nearly-identically equipped teams organized into four platoons as shown in figure 12d.

D Company performs the area signal center mission. It has five area signal center platoons as depicted in figure 12e.

Headquarters and Headquarters Company will take on additional responsibilities. Of primary importance is that all support functions for the battalion are consolidated into this company. The mess section provides support for the entire battalion. Under current organization, each company has its own mess section which is designed to support the company as an entity but cannot be split to support the separate sites that the company operates in the field. The mess section will have the capability to operate two field facilities. When the units in figure 4 are actually deployed, they will be responsible for feeding the supporting signal platoon. One cook from the signal battalion mess section can be attached to each platoon to augment the unit. The maintenance section will contain all motor, generator, and electronic maintenance support for the battalion under the supervision of the battalion maintenance officer. The electronic maintenance section will perform direct support maintenance for all signal battalion systems. It will have the capability to operate one fully-equipped maintenance facility at the battalion trains and four limited maintenance facilities equipped with contact and evacuation teams. The motor/generator maintenance section is also organized along the same lines as the electronic maintenance section except that it performs DS maintenance on generators only and has a track

Figure 7

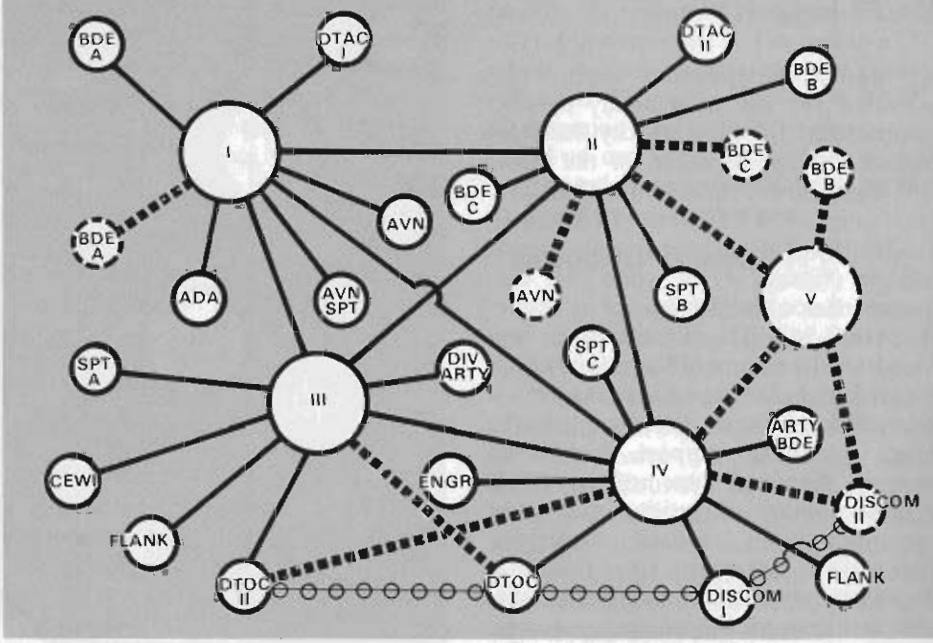
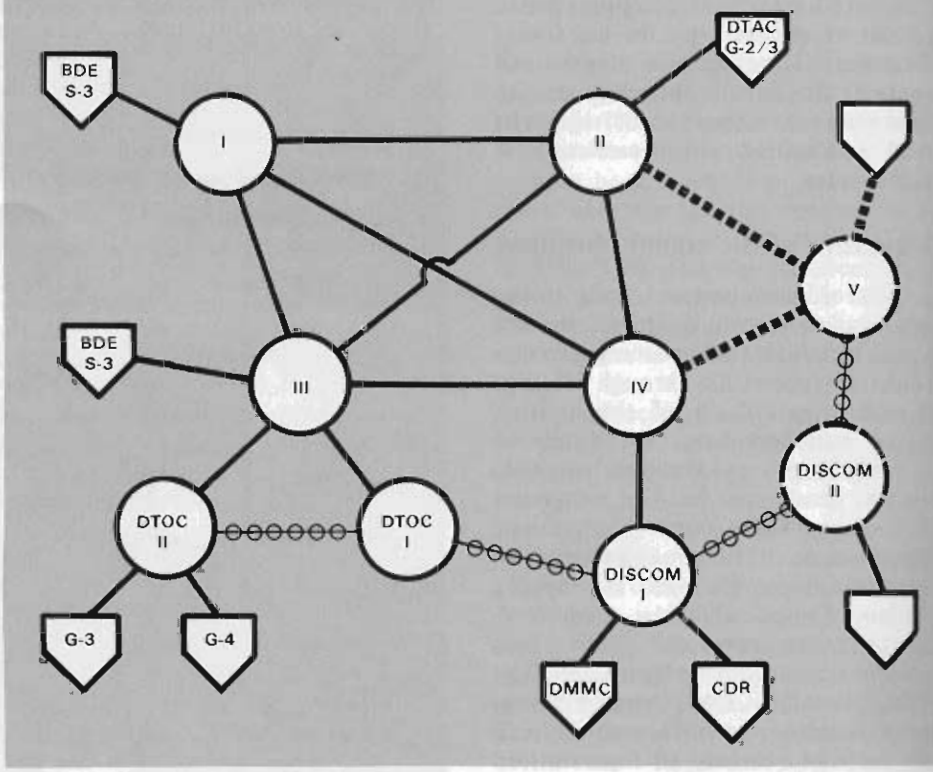


Figure 8 Noise or Data Switching System



maintenance section that deploys forward to support B Company. All maintenance records for both organizational and direct support maintenance are retained in the consolidated record section under the control of a senior (E-6) records clerk. The support platoon controls the POL tankers and cargo vehicles that support the battalion. Organization of this platoon allows the S-4 to be a logistics planner while the platoon leader executes the current scheme.

The other major change in the headquarters is the organization of the S-3 and division C-E section. The assistant division C-E officer must be in close contact with the division staff to develop future communications support plans and coordinate with the S-3 to insure that the plans can be supported by the signal battalion. The S-3 must also have the capability to control the system from each of the nodes. To accomplish both functions, each section must be organized into cells, and the battalion must be equipped with an automated capability to handle systems planning. A prototype system is being developed by the Electromagnetic Compatibility Analysis Center using off-the-shelf technology. This system, the Army Tactical Frequency Engineering System, will provide the means for engineering the system and maintaining system status. With this system, the S-3 and C-E sections can be organized along the following lines:

The S-3 section will consist of the S-3, operations NCO, clerk, and ATFES operations team. With the ATFES system and peripheral equipment mounted in two 2-1/2 ton vehicles, the facility sets up at one of the area signal centers. The section is also equipped with four technical control teams, each consisting of a lieutenant, an E-6, and an ATFES terminal operator. The teams deploy to the remaining area signal centers where they are responsible for maintaining and reporting the status of communications. Each team has an ATFES terminal tied into the main computer that can operate in a limited stand-alone capability for planning/ engineering. In garrison, the officers perform the functions of assistant S-3, assistant S-2, training officer and wire officer. The NCO's perform the same corresponding task.

Figure 9 RATT NET #1

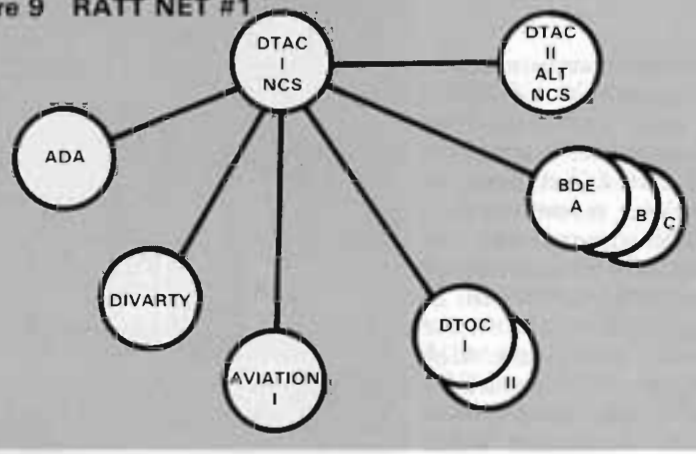


Figure 10 RATT NET #2

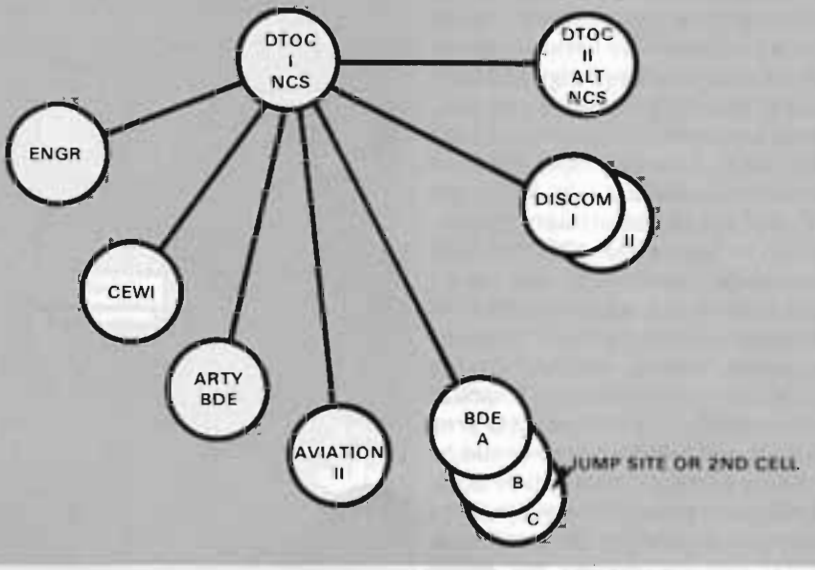
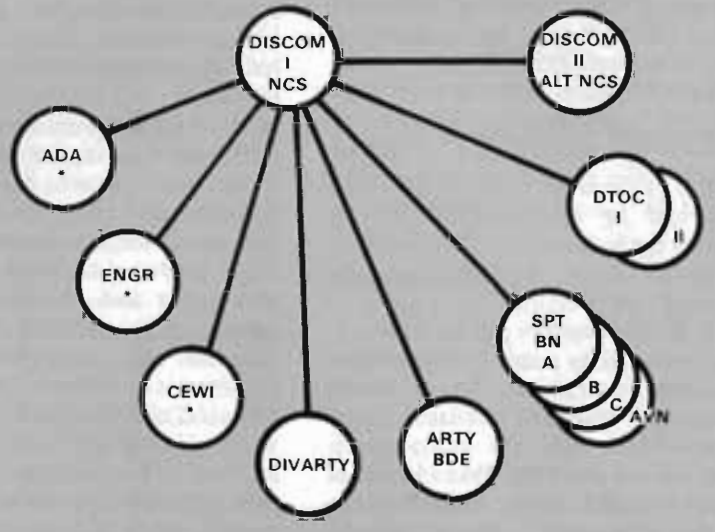


Figure 11 RATT NET #3



*ON ORDER

Structure of RATT NETS #1 and #2 can be adjusted to suit unit requirements

The C-E section consists of the ADCEO, chief signal NCO, COMSEC officer, CEOI team and clerk. This section locates next to the S-3 at the area signal center. Two DTOC support teams consisting of a captain, an E-7, and an ATFES terminal operator equipped with an ATFES terminal are provided at each DTOC location. In garrison, the officers perform the functions of radio officer and ADP management officer while the NCO's serve as frequency management NCO and ADP systems management NCO.

Corps interface

Current doctrine envisions corps interfacing with the division at the main, DISCOM and artillery brigade signal centers. With an area switching system, corps no longer has to — nor should attempt to — follow specific sites around the battlefield. In fact, the DTOC, DISCOM and artillery brigade sites may be located in positions that would require a number of relays from the appropriate corps signal center. If the division used the split CP concept, corps would have to choose between CPs or provide five terminals. It would be best for corps to interface at the area signal centers. Three terminals would be provided to allow termination of a 12-channel system at two of the nodes and a displacement capability. By locating at the area sites, access to the entire division communications system is insured while LOS problems can be minimized. If the division operates as a contingency force without a supporting corps, interface to the supporting headquarters will still take place at the area signal centers.

Commercial interface

The switching system described above can be completely secure by retaining the bulk-encryption devices on the multi-channel equipment or by designing the terminal equipment to contain the encryption device. However, at some point, it may become important to interface with commercial systems that might be available in the sector. This will be particularly important for DISCOM support elements that would like to use commercial facilities. Based on the dispersion of facilities encountered in a number of exercises in Europe, DISCOM would require an entire cable construction company to connect the various elements of the division support base. The distances that would separate these units have been routinely ignored in the past and continue to be ignored today when requirements for survivable cable systems are drawn up for a division. By allowing the system to interface with commercial systems, the time needed to install cable can be eliminated and the requirements for cable can be reduced. The switching centers that interface with the commercial system would require technical compatibility with any system where U.S. Forces are deployed. The system should also allow the commercial telephone to be replaced by one of the tactical telephones or another switchboard. If the terminal instruments contain the COMSEC equipment, the system will remain secure. Consequently, the division signal officer will be able to expand the alternate means of communications between sites and increase the reliability of the entire system. Another distinct advantage would be that the U.S. system would interface with the communications system that our allies would be using. It is highly improbable that our allies will completely ignore the use of existing commercial facilities, and it is much more probable that they are planning to use the commercial system as the backbone for their communications structure. The division needs a commercial interface to enhance reliability and insure interoperability.

The future

One of the keys to this system is the flexibility to change it as technology

Figure 12a

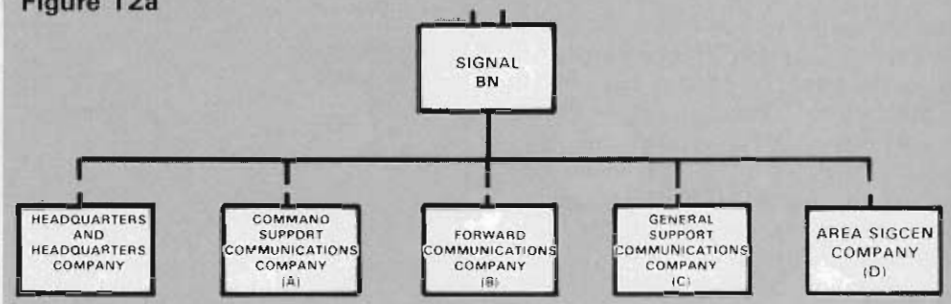


Figure 12b

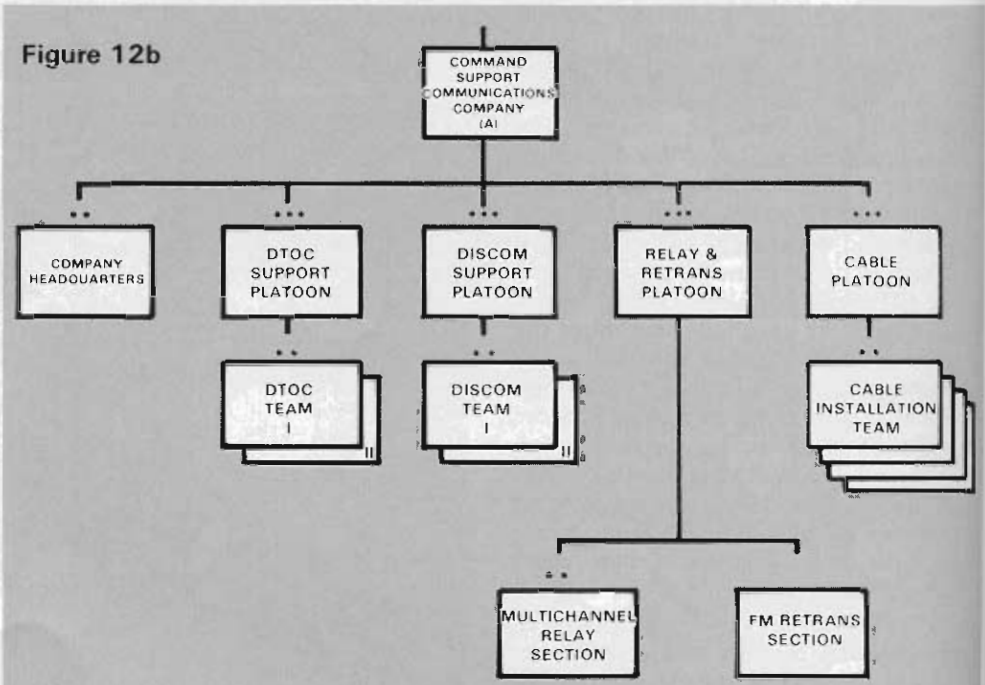


Figure 12c

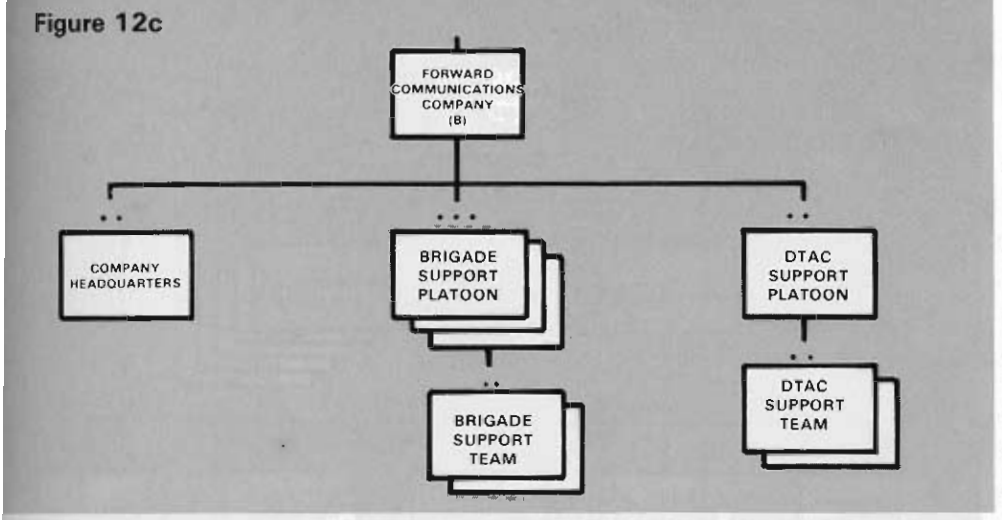
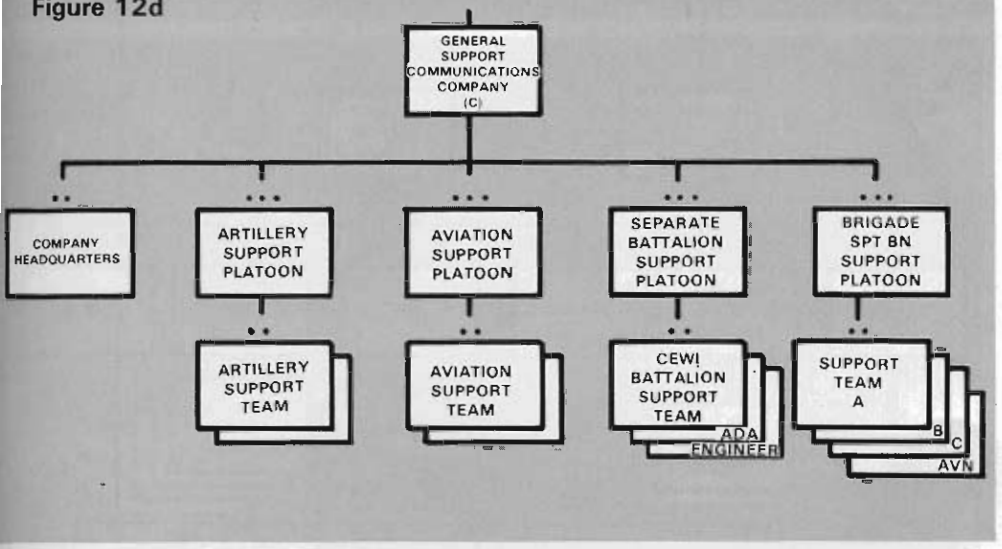


Figure 12d



improves. The flexibility is obtained by eliminating the switchboard at many locations in favor of long-locals. Some may take issue with the fact that a brigade is only provided eight telephones at each CP. They will support their arguments with statistics representing the accumulation of data that clearly shows that a brigade needs 30 telephones to support the CP. Unfortunately, most of the telephone requirements are for internal administrative support and are not essential for command and control. Actual use of automatic switching systems by the 3rd Infantry Division reduced the number of telepbones to 12, and further reduction is possible. As mentioned earlier, the problems arise from confusing administrative requirements with command and control requirements. With eight telephones and one data terminal, the requirements can be met eventually with secure mobile radio-telephones and mobile data stations. The multi-channel links to the brigades, DTAC, aviation, artillery centers, separate battalions, and support battalions can be eliminated by use of mobile devices. In addition, the multi-channel terminal capability at each area signal center can be reduced by the addition of a high-capacity mobile radio telephone terminal. Units would then be guaranteed communications while on the move as well as in fixed environments. The DTOC and DISCOM sites do not give up their multi-channel capability due to the large number of subscribers at each site, and also because these sites can be used as small area signal centers if one of the major centers is lost. Some subscribers at these locations will be issued mobile telephones to support operations away from the CP.

Data requirements can be satisfied the same way. In fact, once the mobile data terminal is developed, RATT can be eliminated. With five major switching centers and four smaller sites at the DTOC and DISCOM locations, there is a high likelihood of several data switching centers surviving. The only problem we face is the expansion of mobile data facilities beyond the sites listed in figure 4. If the number of subscribers is increased to match the initial allocation proposed under the PLRS/JTIDS issue scheme, coverage of the entire division sector is not possible if the system is going to survive. The initial PLRS/JTIDS concept had the master switching centers mounted in "soft" shelters. Based on an analysis of a typical European division sector, a serious conflict arose with the PLRS/JTIDS issue scheme. The bulk of the user units were distributed near the FEBA with only a few stations between them and the sites where the master units would be located. Due to terrain problems, the master units would have to be moved forward of the signal centers where they would be within range of every Eastern Bloc artillery system. In addition, the signal battalion does not have enough support assets to sustain operations of the increased number of sites. In order to survive, the master units must be moved outside the range of enemy artillery. However, in order to cover the entire division sector, mobile relay stations must be provided. With four voice and data relay facilities mounted in a M577 or equivalent vehicle, the signal battalion will be able to guarantee coverage of the brigade sector while the primary switches remain at the area signal centers.

Survivability

One of the key issues that an area switching system addresses is the problem of emitter clusters. The configuration in figure 7 completely disassociates high-electronic signature single-channel emitters from the key multi-channel sites. The only single-channel emitter at these sites would be the signal battalion station in tbe battalion FM command/operations

net. Use of this station would be minimized due to the automatic feature of the voice switching system that would practically eliminate the need to use the FM system. With the ATFES capability, the signal officer could easily locate the signal centers such that the UHF beams were oriented away from the FEBA and in positions that maximized terrain masking. With low-signature systems, terrain masking and orientation of the signature away from the FEBA, the area signal centers can avoid detection for longer periods of time. The fifth or pre-position area signal center gives the signal officer the capability to move the communications system around the battlefield without extensive disruption. The remaining sites in figure 4 will have a large density of high electronic signature emitters, but their use can be minimized through increased survivability and availability of the multi-channel communications system. The conversion to mobile radio telephones and data terminals will provide even greater flexibility and free the commander from having to resort to static operations due to limitations of the communications system.

TACSAT and cellular CP's

Although my original intention was to develop a division system without TACSAT, there may be times that TACSAT communications will be available for the duration of the action. High-capacity (four system) TACSAT terminals can be integrated into the system and support the four or cellular division command posts (two DTOC and two DTAC) in several ways. To perform the mission, the division will need two high-capacity terminals and four single-system terminals. Possible deployment configurations are shown in figures 13 and 14. The key to all deployment schemes is that the high-capacity terminals are located at signal centers with automatic switchboards and that there are two high-capacity terminals to allow movement of the communications system. In figure 13a, the high-capacity terminals (H) are located at area signal centers, and the single-system terminals (S) are located at the command posts. The terminal at Signal Center III is fully committed while the terminal at Signal Center IV is in stand-by. All UHF multi-channel links to the command posts are in monitor status with receivers on but transmitters off. This configuration requires no change to the structure of the signal battalion. In figure 13b, the systems are split between the two high-capacity terminals to minimize commitment of assets at each site. The link between centers III and IV could be either UHF or TACSAT. In figure 14, the high-capacity terminals are located at the rear (DTOC) command posts. The single system terminals are located at the forward (DTAC) command posts and at two of the area signal centers. The TACSAT link shown is only one combination of many that could be used to include mixing UHF and TACSAT links. The only problem with this approach is that the complexity of getting to the DTAC through the switching system is increased. The DTAC sites become dependent on the links into the DTOC rather than the area system. Flexibility is lost when the system is compared to the configuration in figure 13. The size of the DTOC support element and the complexity of the DTOC signal center increases as well. In addition, we wind up once again

Figure 12e

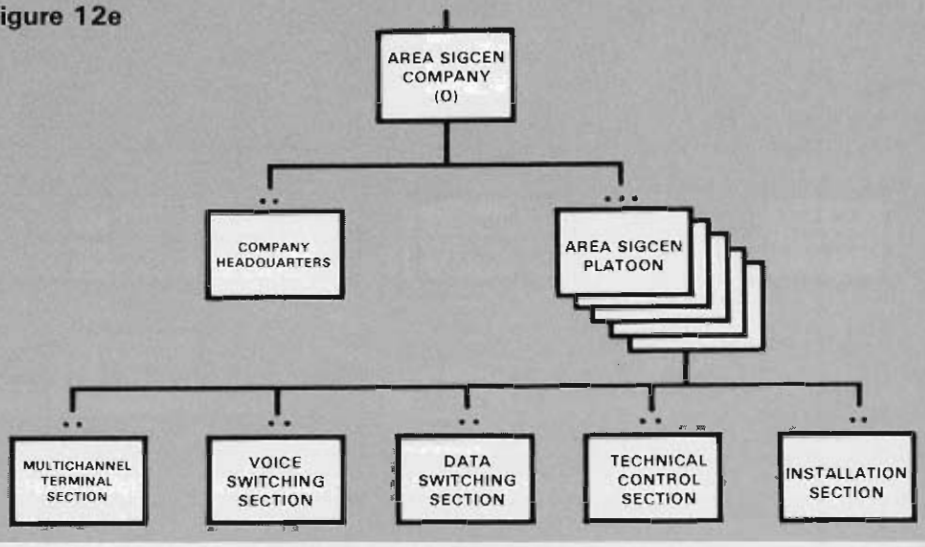


Figure 12f

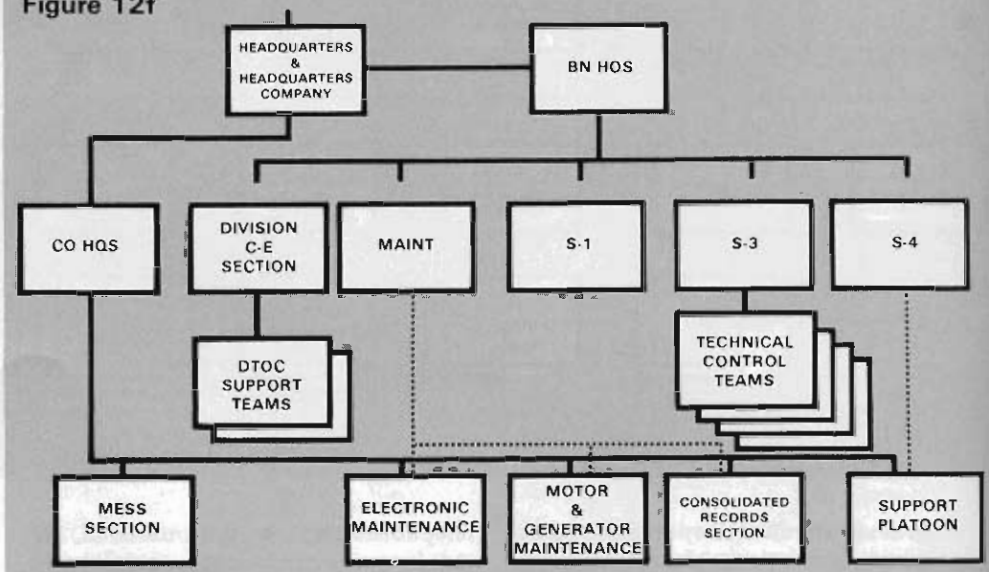


Figure 13a TASCAT Support at Area Signal Center

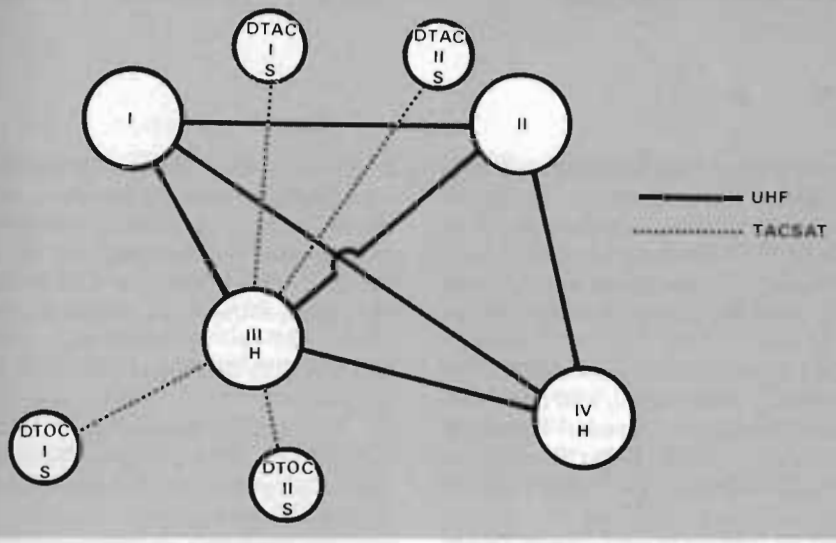
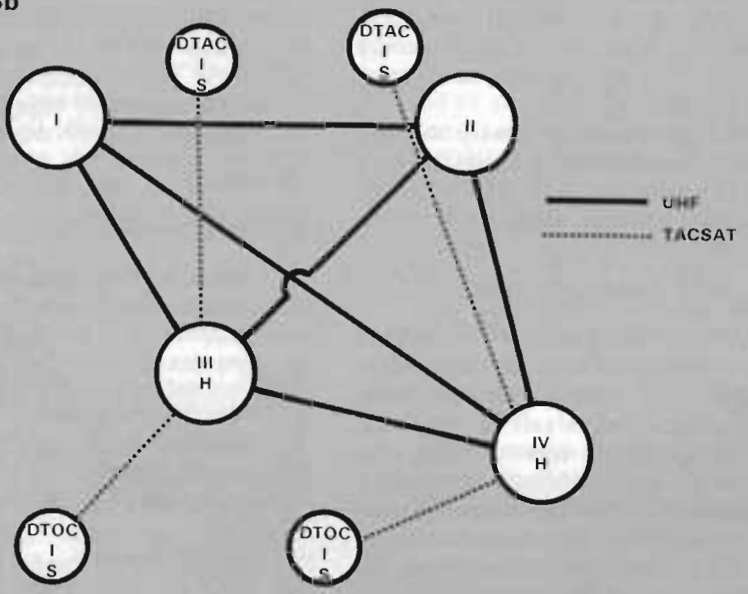


Figure 13b



associating low electronic signature systems with a large density of single-channel emitters. For these reasons, locating the high-capacity terminals as shown in figure 13 provides the greatest flexibility and enhances survivability. If the number of command post cells increases to six, two additional single system terminals are needed and can fit easily into the system shown in figure 13b. The cost would be that no displacement capability is available, and two TACSAT systems would be lost when one of the terminals at centers III and IV displaced. With a third high-capacity terminal, the number of sites supported could be increased to eight, and displacement of a high-capacity terminal would not disrupt the system.

Again, the area switching system is the most effective for supporting split or cellular command posts. In a previous AC article, I stated the division requirement to move command posts freely around the battlefield. This could be done only by treating the division headquarters as just another signal center. The communications hubs must be separated from the command post. Circuit requirements can be substantially reduced by requiring staff elements to share dedicated circuits if dedicated circuits are used. However, under an area switching system with fully automatic equipment, the division needs no dedicated circuits. One distinct advantage to this is the lack of complicated circuits. There is no requirement for any circuit to be extended beyond one multi-channel system. This will greatly simplify circuit installation and restoration for the communicator. Consequently, the hidden benefit of going to a cellular CP concept is that we can provide a less complicated system if the fully automatic switching/area system is used.

The system presented here has the ability to meet the challenges of the future and change as technology changes. It requires a change in the way we think about performing the mission and a commitment to giving the signal battalion the capability to move the system around the battlefield. Every aspect of this system can be met with technology that is available today.

The only limitation is our willingness to try an approach that differs from the way we do business now.

AC

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