A Military Encyclopedia
Based on Operations in the Italian Campaigns, 1943-1945.

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Chapter Six

SIGNALS

Section 1. Friendly Hazards to Wire Circuits

Vehicles constituted the major hazard to field wire circuits from friendly sources particularly where wire had been carelessly laid along shoulders of roads. Tracked vehicles were a particular nuisance because of their ability to leave roads at any point. Between 80% to 90% of the faults from friendly sources were due to vehicles. Engineer activity (blasting, road clearance, demolition of mines, etc.) accounted for a portion of the troubles. Cable circuits underground were damaged in some instances by Engineer work on roads and culverts. It became SOP to furnish Army and Corps Signal and Engineer Officers with route plans of underground cable and main overhead arteries. Engineers quickly learned to notify Signal Officers on intended work which might endanger lines, in order that steps could be taken to prevent this damage.

Section 2. Cabling of Field Wire Circuits Along Highways

Cabling field wire circuits along main axes was a general practice instituted at the request of staff officers to improve appearance along roads. While such cabling prevented some troubles, and improved appearance, it actually did not improve service. On the other hand it made trouble shooting a very difficult task, and made it impossible for units to recover wire. Cabling should only be done through towns and at overhead crossings. At other points wire should be laid off the road and should be policed and kept off the road but not cabled.

Cabling of field wire was also found to be inadvisable by British formations in forward areas. Spaced D8 (9" spacing between wires) circuits, by their nature, made cabling impossible.

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Section 3. Method of Tagging Field Wire Lines

The practice outlined in FM 24-5 was found to be entirely satisfactory by U.S. units.

British formations, however, were not satisfied with their line tagging (labelling) method.

The existing British wire tagging (line label) method has certain disadvantages. It was too bulky. Linemen could not conveniently carry enough. It required a separate piece of spun yarn to affix - this wasted time.

The following design for an ideal wire tag for British use was suggested:

It should be not larger than 2-1/2" by 1-1/2".

It should be shaped for different arms of the service and different levels. This assists rapid identification.

It should be fabricated of light thin plasticised wood or cardboard, but rough for easy transcription.

It should have two lengths of copper wire, permanently attached to the label, for rapid affixation to the line.

A system was devised in Eighth Army for the marking of wire tags, using the Signal Office call signs (telegraph call sign - See Sig. Trg. (all Arms) 1938 Appx 1) of the unit concerned, plus a serial or circuit number. The method was found satisfactory.

At points where several lines were labelled together and where linemen could achieve ready access to the lines for testing purposes, larger-numbered notice boards were erected. The locations of such points, and the board numbers, were recorded on the cable route plan kept by the Signal-master (Communication Officer) or Fault Controller. By this means coordination and control of maintenance parties are greatly enhanced.

Section 4. Repeating Coils in Trouble Shooting

One unit placed a repeating coil in the center of a line running cross-country over a mountain, In event of trouble a resistance check immediately revealed on which side of center the fault lay so that only one team had to go out on the trouble.

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A repeating coil, obviously, cannot be used in this manner on a simplexed line.

Section 5. Applicability of Wire W-143 (U.S. only)

W-143 was designed for use in communicating over distances greater than the range of W-110B where other long-range facilities were not available. W-143 proved quite satisfactory when used properly. It is a much more delicate wire than W-110B and must be carefully laid. When its use is contemplated, consideration should be given to the above. It will often be more expedient to use repeaters, particularly where the requirements are of short duration. If W-143 is used, linemen should be cautious not to use test clips in checking lines. The minute holes caused by the clips allow the graphite covering to come in contact with the conductors, causing partial shorts. Overhead construction is recommended with W-143 whenever possible.

Section 6. Wire Net recommended for Infantry Rifle Company

In many situations it was evident that Infantry rifle companies needed a wire network. This was particularly true in a static situation when it became highly desirable to establish wire communication with each platoon, OP [Observation Post] and the CO. Replacing the CE-11s with TP-3s and providing a small light-weight six-drop switch board would give the desired result with a minimum increase in equipment.

Section 7. Wire Equipment and Personnel for TD Battalions (U.S. only)

Tank Destroyer Battalions employed in their basic role needed no more wire equipment than T/E [Table of Equipment] allowed. However, TDs were employed quite extensively as artillery in which case considerable wire equipment became essential.
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TD units were supplied with excess signal equipment throughout the Italian campaign. Personnel to operate this equipment presented a great problem and one that was not solved satisfactorily. Drivers, radio operators, etc., were employed as wire personnel and in many cases functioned in both their original and secondary capacity. The following is a general statement of the requirements of a TD Battalion.

a. With the platoon a suitable fire control wire system was set up using the RM-29s at the SP [Self-Propelled] guns and an EE-8 phone at the platoon. A phone was also required for use to company. W-130 reels mounted on each SP vehicle were satisfactory for laying wire. Additional personnel were not required.

b. Each company except the Reconnaissance Company had a BD-71, RL-31, RL-27, and sufficient EE=8s for two local phones, a test phone, and OPs. Personnel sufficient for installation and maintenance were obtained with difficulty from within the company.

c. Battalion required a BD-72 at the Forward CP [Command Post] and a BD-71 at the Service and Supply installation along with necessary personnel and equipment for installation and maintenance.

Section 8. Techniques Employed in Effecting Wire Communications during River Crossing Operations

River crossing operations demanded utmost reliability of communications, which necessitated careful prior planning. Wire communication was normally not established until Battalion CPs had moved across.

Before the operation, lines were laid forward to as near the Battalion crossing points as possible. Alternate routes were chosen to reduce the danger of dislocation of communications by enemy fire. At the time of assault, these lines were quickly extended to the river bank, where manned test points were established.
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Several crossings were then made, each containing sufficient pairs for the full set-up, in order that circuits could be quickly switched in event of damage to the main crossings. Crossing points were kept well clear of proposed bridging sites where possible.

The actual technique of effecting the cable crossing depended to a very large degree on the nature of the river. It was found better to suspend wires above water level where this was practicable (rivers up to 75 yards in width). Initial suspended crossings were normally made with field wire. Rubber covered cable was sometimes used for submerged crossings in the early stages. Where suspension was impracticable owing to the width of the river, it was necessary to sink the wire. New field cable and spiral-four or quad cable were satisfactory for immersion, and gave satisfactory results. When it was proposed to make an immersed crossing, the necessary number of field cable pairs or rubber covered cables were prepared beforehand into single ropes of the required length, bound securely at small intervals. Such ropes, with plenty of spare length for end terminations and other unforeseen difficulties, were wound on special reels ready for use. It was essential to use sinkers to ensure that the wires lay on the bed of the river and were thus less subject to the "drag" of the current. Sinkers tied to the "ropes" were placed at short distances from either bank and spaced at equal intervals of approximately 50 ft. across the river. A useful form of sinker or cable anchor is an ammunition case which can be filled with gravel or stones at the river bank. A further method of sinking the wires, which was tried, was to bind a heavy steel messenger wire with the rope of cables to be immersed. This had the advantage that the strain at the bank anchors was taken by the steel messenger and not by the wires. It was also found advisable to bury the wires from the shore anchors down the river banks, to a point just below the point of entry into the water.

One of the main difficulties encountered in effecting wide river crossings was the handling of the assault boats used for the crossings by inexperienced communications personnel, who were at the same time struggling with reels and other cable laying impedimenta in the boat.
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In the case of some river crossings made in Italy, very strong currents were met, and considerable difficulties were encountered in navigating the required course. A need was felt for special assault boats, *fitted with outboard motors*, and each in charge of an Engineer coxswain, for allotment on a scale of one per assaulting brigade (Brit.) or regiment (U.S.). As it was necessary to keep cable crossings well clear of proposed bridging sites and infantry crossings or ferry points, it was necessary for all crossing parties to carry mine detectors.

Section 9. Availability of Organic Personnel for Recovery of Abandoned Field Wire

U.S. experience demonstrated that an Infantry Division, even in a slow moving situation could recover not more than approximately 50% of its field wire. In a rapid advance it was necessary to abandon all field wire. Corps, in a rapidly moving situation, were forced to leave circuits on the ground but in most cases would send crews back to recover such wire. Normally, Corps Signal Battalions could recover all wire they laid, as could Army Signal units.

The practice in Italy was, in static situations, to utilize personnel from Corps and Army Signal Battalions to recover wire abandoned during a previous rapid move.

Lack of sufficient wire personnel in British units above regimental level made it impossible for these to make a general practice of recovering abandoned field wire using organic personnel.

The only units who succeeded in doing this were Dominion units which had a larger proportion of linemen, and Signal sub-units working with Artillery who also had more linemen per mile of wire laid.

Personnel were not left behind to recover wire unless it was unlikely they would be required for forward laying for a considerable time.
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This was necessary because in both British and American units, especially below Division level, limited numbers of wire personnel made it essential that adequate rest periods be allowed whenever possible. When personnel were required for forward laying it was important that they were fresh and located forward, where they were required.

Recovery teams, made up of unskilled Italian personnel under the supervision of Allied military personnel and furnished with military equipment and transportation, were organized to follow up and recover wire in rear of Corps. This proved very satisfactory and during rapid movement was the primary means of wire recovery. For administrative reasons Italian military personnel were found to be more satisfactory than civilians.

Section 10. Assignment of Telephone Code Names

U.S. units agreed that telephone code names should be assigned to all organic units of Corps and Divisions, and to units normally assigned to those organizations. Practice at Army was to assign codes names to units served from the Army switchboard only if such units had a switchboard. For units with only a telephone, the unit designation was used. This proved more efficient than to attempt to assign code names to all units served from an Army board.

It was not the practice in the British Army to use telephone code names, except when operating under command of U.S. formations. In the latter case, no great difficulties were met in the adoption of this procedure, but it was not generally felt that the universal use of telephone code names should be introduced into British practice. Regimental names of British units help the routing of telephone calls in the same way that way that code names assist in the U.S. Army. The introduction of telephone code names into purely British practice was used only in the case of switching centers in forward and rear areas.

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Section 11. Necessity for "Priority" Telephone Calls (U.S. only)

The use of URGENT and PRIORITY calls became necessary in order that congested lines would not hold up highly important conversations of operational nature between key staff personnel. The use of URGENT in classifying a call was limited to key personnel authorized to make this classification.

In headquarters of Divisions and below, the PRIORITY type call was not generally accepted, the feeling being that at that level a call could be classed as URGENT or would not be important enough to deserve any priority rating.

At Corps and higher headquarters the PRIORITY call became essential in order that important traffic, not necessarily operational in nature, could be cleared efficiently. The PRIORITY call was always a booked call and the originating party was given a circuit as soon as one cleared. Circuits were not interrupted for a PRIORITY call.

Section 12. Use of Telegraph Sets within a Division

The TG-5 was not used by U.S. units. Staff officers became accustomed to, and dependent upon, extensive telephone systems, using them even though messages sent by telegraph would have in many cases served the purpose equally well.

The British Army made wide use of their equivalent of the TG-5, the Fullerphone, in communication systems below Corps level. In the British Army its use was SOP between Division and Infantry Brigade, but not between Infantry Brigade and Infantry Battalion or between Division Artillery and Artillery Regiments. There was, however, an increasing practice of using telegraph between Division Artillery and Artillery Regiments, and in static conditions it was usual to employ telegraph on Infantry Brigade to Battalion links.

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Section 13. Practicability of Teleprinter Switchboards at British Army Group and Army (British only)

Army (U.S.) habitually used Teletype[®] switchboards at both echelons [Forward and Rear] of Army Headquarters. Army (Brit.) did not use tele-typewriter switchboards, except for switching DAF (Desert Air Force) circuits. Army Group (Allied) occasionally used a switchboard for teleprinter circuits, but never for its Teletype circuits.

"British experience indicated that, provided an efficient TER* procedure is organized, considerable advantage is gained by the use of a Teletype switchboard at Army Group."

"At Army the proportion of "through" messages was small, and the links were generally worked to capacity during busy periods. Since these links were fully loaded with other than "through" traffic, the provision of a switchboard would not have been worthwhile even though TER* procedure was also adopted."

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*: TER procedure is a system of re-transmission, whereby in a switched telegraph network, should the desired outlet be found busy, a local terminal station accepts the message for re-transmission. In such a system certain stations only are nominated as TER stations for specified outlets.
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Section 14. Minimum Requirements for Wire Communications within Army Group

1. Communication between Army Group and Army

a. Two speech circuits were required from [Allied 15th] Army Group to [U.S. Fifth and British Eighth] Army Headquarters.

b. Two speech circuits were required from TAF (at Army Group) to TAC at Army (U.S.). One speech circuit was found necessary from TAF (at Army Group) to TAC at Army (British).

c. One lateral was required from TAC British to TAC U.S.

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2. Within Armies the following minimum channels were found necessary

a. U.S.

(1) Army to Base Section.

Seven speech channels and four Teletype circuits. These were provided by using four open-wire circuits from Base Section to Army, and working two CF-1 carrier systems to provide the seven speech channels, using the eighth speech channel to provide the four Teletype circuits by use of a CF-2 carrier system. The four physical circuits required were constructed and carried forward along Army axis of signal communication by Army Signal units.

(2) Army to Corps.

Four speech channels and one Teletype circuit. These were provided by working a CF-1 carrier system on two physical circuits which were spiral-four cable, open-wire, or a series combination of the two. The Teletype circuit was provided by a simplex on one of the physical circuits.

(3) In addition to the channels mentioned, it was SOP for Army to provide two speech circuits and one Teletype circuit to any Task Force or Division directly under Army. These circuits were normally field wire or spiral-four depending on the distance involved. The Teletype circuit was provided by simplexing one of the physical circuits.

(4) Corps to Divisions.

(a) Two speech channels to each Division.

(b) One Teletype circuit to each Division.

Circuits were usually spiral-four. It became SOP to use CF-1 carried between Corps and Divisions. This provided additional circuits if needed. In some cases one channel was used to provide a lateral between Divisions.

(5) Corps to Corps troops.

(a) Two speech circuits were provided to Corps Artillery Headquarters and to the AAA [Anti-Aircraft Artillery] Brigade. Other Corps troops were served with one line.

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(6) Circuits within a Division were:

(a) Division to Regiment - two speech circuits.

(b) Division to Divisional troops - one speech circuit.

(c) Regiment to Battalion - one speech circuit..

(7) The above data was a minimum standard, and, in many instances, particularly in static situations, with extended fronts, additional circuits were provided as required.

b. British

(1) Army to Corps.

Three speech plus one teleprinter channel were found necessary. One speech channel was an alternate with a different, but not necessarily a direct, routing.

(2) Corps to Divisions.

Two speech channels plus one telegraph (Fullerphone) channel were necessary. One speech channel was an alternate with a different, but not necessarily a direct, routing.

(3) Division to Brigades.

Two speech channels, one being an alternate routing (via a lateral Brigade if convenient).

(4) Brigade to Battalions.

Two speech channels, one being an alternate routing via a lateral Battalion or Artillery Regiment.

(5) TAC to MORU (U.S. equivalent SOR)

Two speech circuits were found necessary.

Section 15. Use of Telephone Carrier between Corps and Divisions

Carrier systems were installed between Corps and Divisions to improve security of speech circuits. No increase in security classification above CONFIDENTIAL was given these carrier circuits.
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Most Signal Officers at Corps and below believed that the gain in security did not warrant the use of the carrier but felt that the improvement in the quality of the circuit made employment of carrier worthwhile.

When a CF-1 system was employed the VF channel No. 1 was generally not used. When all remaining channels were not used for direct circuits to Divisions, one was used to furnish a lateral between Divisions.

In the British Army it became SOP to employ "1+1" system (one voice frequency plus one carrier channel) between Corps and Divisions.

Section 16. Shelters Required for Switchboards and Terminal Equipment

Divisions used trailers to house switchboards and other terminal equipment, but in most cases preferred to install equipment in a tent or building where it could be dug in and protected.

At U.S. Corps and Army levels, where necessity for protection from artillery fire was slight, the use of 10-ton vans proved highly satisfactory and efficient. A K-60 truck provided an excellent shelter for equipment at Corps.

At Fifth Army, half of the equipment was installed in vans; the remainder was not mounted vehicularly but was moved by whatever transportation was available. This provided a flexible set-up giving a mobile, sheltered installation where required, and also additional equipment which could be housed in buildings. Buildings were proffered whenever available because they provided better operating conditions.

In all cases where vehicular installations were made, equipment was so installed that it was readily removable when it was necessary or desirable to make a ground installation.

British practice was generally the same as the above except for the difference in vehicles used.

The vehicles used at British Corps Headquarters and above did not, however, prove to be sufficiently large to accommodate the switchboards and all the necessary terminal equipment, and at the same time include a small fault control office.
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It was necessary to improvise special terminal equipment vehicles for the carrier equipment, leaving the official TEV (Terminal Equipment Vehicle) for housing the switchboard frames and fault control only.

The TEV (Division) was built to contain both the Division switchboard and the Message Center (Signal Office). This proved undesirable and certain Divisions obtained surplus vehicles to house the switchboards and frames leaving more space in the TEV for the Message Center.

Section 17. Types of Circuit for which 5 and 10 pair Cables are Used (U.S. only)

Five- and ten-pair cable was used extensively for local use in CP areas. It was easily and rapidly installed and permitted a neater installation than field wire.

Five- and ten-pair cable was also used to bring wire lines from a wire head on a main road into a CP. In these instances, distances were less than a mile.

Section 18. Utility of MAL compared with RPL for Rapid Line Construction

Experience proved that RPL [Rapid Pole Line] was not a satisfactory system of building open-wire. Contrary to the implication of its name, Rapid Pole Line did not permit rapid construction. Warping of poles and arms caused continuous trouble after construction had been completed. Where a Rapid Pole Line was required and British MAL (Multi Air Line) was available the latter was employed. MAL, a light pole line, constructed with lance poles and a maximum of two cross-arms carrying four circuits of light (70 lb.) copper, proved a very satisfactory system. It was easily and rapidly constructed and gave excellent service.

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Section 19. Types of Wire Used for Army and Corps Wire Axes

American experience has proven that the best construction between Army and Corps is open-wire. Rapidly-moving situations at times made it necessary to follow Corps with spiral-four but this was replaced with open-wire as soon as possible. Between Corps and Divisions spiral-four was used entirely and proved rapid and efficient.

British practice was to use MAL between Army and Corps, and Spaced Field Cable (9 in. spacing between wires) between Corps and Divisions, when laid by the Signals unit concerned.

British experience developed the following PL practices. When Line of Communication pole artery coincided with the Army Axis, L of C personnel were employed to build PL as far forward as possible in advance of Army to enable such PL circuits to be employed for Army to Corps communications. This avoided the duplication of work caused by the erection of MAL and its subsequent replacement on the same

route by PL. Army arteries were built in advance of Corps in a similar manner, but by Army Signals, when the Army was not moving on an L of C Axis.

Corps not moving on the Army Axis, at times patched up existing PL routes on their axes, but this was avoided when the subsequent rehabilitation of the PL routes was to be carried out by L of C personnel.

MAL and Spaced Field Cable proved sufficiently rapid and suitable for their respective purposes.

Section 20. Construction of Spiral-Four Cable (Quad Cable) Routes

It was found that in order to obtain the most trouble-free service, spiral-four (quad cable) should be placed in the air. Existing poles or trees along the axis were used or lance poles were set.
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Where the installation was to be semi-permanent, use was made of messenger wire. Metallic connection-covers between cable lengths of U.S. spiral-four should be removed and stubs should be weatherproofed with rubber and friction tape.

Section 21. Use of Several Carrier Systems on Open Wire Leads

The extent to which carrier systems can be applied in an open-wire route depends on the type of transposition system employed. Civil practice in Italy did not, in general foresee the application of high-frequency carrier systems. In practice it was found that there was substantially no limitation to the number of systems that could be applied, utilizing frequencies up to 10 to 12 KC/s. The type of transposition system that was found most adaptable to military needs was the TIMO system which employs "Diagonal Pairs" in groups which rotate through 90 degrees on a 6 bay-interval scheme. It was usual practice to have 30 kc carrier systems at the outer ends of cross-arms with two interactive groups working either at voice frequency of up to 10 kc/s, in which case no distance limitations were experienced.

Two examples showing the extent to which several carrier systems have been operated on the same routes are given below.

a.

(1) Carrier system used between Florence and Traversa:

Pair 1	1 CT-1+1 (Active)
Pair 2	1 CT-1+4 MK II
Pair 3 and 4	2 CF-1/CF-7
Pair 5	1 CT-1+1 (Active)
Pair 6	1 CF-1/CF-7
Pair 7 and 8	2 CT-1+4 MK II
Total 8	

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(2) Transposition: TIMO

(3) Pole Diagram [not shown at this time]

(4) Wire: 104 copper (British 200 lb.)

(5) Distance: 30 miles

(6) General: The CF-1, 1+4, and 1+1 systems were all operated as two-wire systems. Three CF-2 systems utilized a channel each of the CF-1s and three simplex Teletype circuits were also established. A total of 15 Teletype and 38 speech channels were established.

b.

(1) Carrier system used between Florence and Leghorn [Livorno]:

Pair 1 and 2	2 CF-1/CF-7
Pair 3 and 4	1 CF-1
Pair 5 and 6	Fault control and physical
Pair 7 and 8	2 CT-1+4 MK II
Pair 9	1 CF-1/CF-7
Pair 10	1 CT-1+1
Total 7	

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(2) Transposition: TIMO

(3) Pole Diagram [not shown at this time]

(4) Wire: 104 copper

(5) Distance: 70 miles (not repeatered)

(6) General: Two CF-2s and one half 40 C-1 VF Teletype systems were also employed. A total of 28 speech and 18 Teletype systems were established

Note: CF-1 - One VF speech plus three carrier speech channels.
CF-7 - Hybrid coil permitting operation of CF-1 as two-wire system.
CT 1+1 - One VF speech plus one carrier speech channel.

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CT1+4 - One FV speech plus four carrier speech channels. (high-frequency)
CF-2 - Four channel VF Teletype system.
Half 40 C-1 - Six channel VF Teletype system.

Section 22. Use of Foreign Transposition Scheme in Rehabilitation of Open Wire Routes

From theoretical considerations, when patching or extending a foreign route, the foreign transposition must be carried on unless:

a. The existing route terminates at, or is cut back to the end of a complete transposition section.

b. A complete re-wiring of the existing route is necessary.

In the Italian theater, experience showed that demolitions, and the effects of our own and enemy fire, required the complete re-wiring of most routes. When re-wiring routes over which U.S. or British Army carrier systems were to be employed, it was found advantageous to utilize the Italian TIMO system. This foreign transposition system generally required less materiel that the flat pair types, and local resources could be used to the fullest extent. When linemen became accustomed to it, it was found quicker to build than the standard Army types. A main consideration was the employment of a common theater system.

For the above-mentioned reasons, a foreign transposition system was adopted almost entirely on rehabilitated routes except where the operation of a high-frequency carrier system was planned for each pair, in which case the "C" type (U.S.) transposition was employed.

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Section 23. Radio Requirements which were not met by Existing Equipment

In general, U.S. radio sets met the requirements for which they were designed; however, a few deficiences appeared.

The SCR-536 did not give the desired results for Infantry Platoon and Company communication. It was subject to loss because of the method of carrying it; sound from the speaker gave away positions to the enemy; and the frequency range in which it operated made operation at night difficult. A modified version, which allowed it to be slung on the operator's side and which utilized headphones and separate microphone, was an improvement, but awkward to operate because of the position of the transmit-receive switch.

It was found that rod antennas on sets used in forward positions could be seen by the enemy and drew small arms fire. Various improvised antennas were used in attempts to overcome this hazard.

Difficulty was experienced in the mountains by the Infantry and Artillery with the heavy SCR-584 and the SCR-610.

British Army radio sets, in general, met the requirements for which they were designed, except in the case of the Infantry sets.

The disadvantages met with British Infantry sets were as follows, and it was felt that these could be eradicated in future set design.

WS 118 or its American manufactured counterpart WS 48, used for Infantry Battalion to Company communication, was satisfactory except that it operated in the 6-9 mc/s frequency band, the range being considerably reduced at night due to noise pick up. It was not provided with crystal control and was liable to get off frequency during operation, if in the hands of poorly trained personnel.

The same disadvantages applied to WS 38 which was used forward of Company Headquarters.
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WS 38 had the additional disadvantage that it was not provided with a hand set for use by an officer or commander wishing to speak on the set. The difficulty of rendering the wearer inconspicuous was overcome by a locally improvised method of wearing the set in a hip haversack, and by the use of ground antennas.

The fact that two separate sets were required for operation within the Infantry Battalion was also a disadvantage, and it was recommended that *one set* should be designed to cover the following requirements:

Infantry Battalion to Company link.
Infantry Company to Platoon link.
Infantry mortar-base-plate to OP link.
Infantry-Tank Co-operation set.

In order to obtain satisfactory and interference-free day and night working, it was felt that the frequency range of the set should be in the order of 40 mc/s, and that the range should be from 3 to 4 miles under all conditions. The weight of the Platoon to Company set must not exceed 20 pounds. The set should be crystal-controlled and should have sufficient channels for the number of nets required in a Division.

No standard radio-teleprinter set was available in the British Army and although other sets were modified (SCR-399) to operate for this purpose, it was felt that the future range of British sets should include this facility. This facility may well be combined with a multi-channel voice set, but probably due to the security restrictions which were imposed on voice radio circuits the need for such multi-channel sets was not strongly expressed. Higher formations did feel, however, that the reduction of the number of sets at a headquarters by combining these into single multi-channel terminals, would be an advantage, even if the introduction of the multi-channel sets did entail the use of very high frequencies and hence relay stations to overcome the optical range difficulties.

Section 24. Radio Sets for Air OP Communication

The standard SCR-510 and SCR-610 proved entirely satisfactory in Air OP communication in U.S. Forces. An alternate means of communication in OP planes and the ground was provided with the SCR-300.
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The set was easily installed behind the rear seat of either the Cub plane or the L-5, and provided satisfactory communication up to ten miles. By use of the RC-63 (half rhombic antenna) at the ground station, communication at a distance of twenty-five miles to a plane at 3000 feet was successful. This means of communication may be used in emergencies between Infantry or reconnaissance elements and air observers.

In British practice the standard set eventually employed was the No. 22 set (AM). This was on the whole quite satisfactory. Disadvantages were that the set worked in the 2 to 8 mc band and was therefore subject to considerable interference from other nets. A higher frequency set was advocated. The No. 22 set

was too heavy, weighing 54 pounds less batteries. and was difficult to net while in the air, as this required the use of both hands.

Section 25. Tank-Infantry Communication

The problem of tank-Infantry communication was not solved satisfactorily. Some progress and improvements were made. The problem was not confined entirely to communication between tank and Infantry but in U.S. practice it was related to problems of communication between the tank units themselves. Lack of combined Infantry-tank training accentuated the problem.

One of the best links between tanks and Infantry was the AN/VRC-3 (tank version of the SCR-300). This set in the tank operated in the Infantry net and was satisfactory to the Infantry because it required no additional equipment. The tanker on the other hand was burdened with another radio to operate. This difficulty was overcome in some cases by putting an infantryman in the tank to operate the AN/VRC-3.

Another method of providing communication was for the tank unit to supply a Liaison Officer with an SCR-510 radio. The size of the SCR-510 made it difficult to transport, and it was therefore not completely satisfactory.

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A combination of the two above-mentioned methods; i.e. SCR-300 link and Liaison Officers, was also used, giving two channels instead of one. This was the most satisfactory method used.

The use of a telephone mounted on the outside of the tank and connected to the tank interphone system was not particularly well thought of by either tank or Infantry personnel. The tanker disliked it because damage to the installation might render the interphone useless; the infantryman disliked it because he had to expose himself to get to the phone. There were, however, instances where it was an advantage. In British units it was considered a necessity and steps were taken to overcome the technical difficulties encountered.

A suggestion made by both Infantry and tank personnel was that the Infantry be provided with a radio of the size of the SCR-300 which could be operated with the SCR-500 series FM sets. This would not replace the SCR-300 but would be an auxiliary set to be used only when tanks and Infantry were operating together. This set would also fit the requirement for a set which could communicate with individual tanks.

British experience also showed that a great deal of the difficulty was brought about by lack of combined Infantry-tank training, but more by lack of training in the use of Platoon and Company sets by the Infantry themselves.

The British 38 set (comparable to the SCR-536) was worked to a similar set mounted inside its tank, but so arranged that the Tank Commander could use it with the same microphone and headphones he used on his main set. Its short range of about 2000 yards limited its usefulness. It did, however, provide a communication link between Infantry and the individual tank, a definite advantage which could not be had

with U.S. equipment, and was used as the main means of communication when a Tank Troop was working directly with an Infantry Company or Platoon.

When a Tank Squadron (U.S. Company) was in support of an Infantry Battalion a Liaison Officer was sent to the Infantry Battalion.
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This did not provide sufficient flexibility and it became necessary to mount a second set in the Squadron Commander's tank which operated on the Infantry Battalion command net, thus providing another link from Tank Commander to Infantry Commander and also permitting direct communication between Tank Commander and Infantry Company if necessary. This proved to be the most satisfactory system and was used extensively.

When a Tank Squadron (U.S. Company) was operating in support of an Infantry Battalion, it was usual for the Squadron Liaison Officer to be at Company CP, remaining with the Company Commander at all times. For this reason he was provided with a WS 18 or 48 (equivalent to SCR-300) with which he maintained direct communication with the Tank Squadron Commander who had a similar set in his tank.

This latter method was very successful and led to the belief that it was best to employ Liaison Officers from tank units down to Infantry Company CPs as a standard operating procedure, but unfortunately Tank Squadrons had insufficient officers to allow this to be put into effect.

Section 26. SCR-536 to direct a Tank-Dozer (U.S. only)

Excellent results were obtained by the use of an SCR-536 link between a Tank Dozer and an observer on the ground. The tank was able to operate buttoned up while under [enemy] observation and the observer outside could direct its operation from a defiladed position.

Section 27. Operation of a Radio Link between Division and Regiment (U.S. only)

It was common practice for Divisions to send SCR-193 radios with operators to each Infantry Regiment to supply the radio link between Division and Regiment. This radio team acted also as a small Message Center, doing its own cryptographing, and delivering its own messages.
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Although the Infantry Regiment had an SCR-284 (later replaced by an SCR-694) it never gave reliable communication. Division Signal Officers believed it preferable to supply to the Regiments a radio and the personnel to operate it from the Division Signal Company, rather that to alter the Regimental T/O [Table of Organization] to provide an SCR-193 for each Regiment. Regimental radio personnel and the SCR-284 so released were made available for other communication purposes with the Regiment.

Section 28. Location of Radio Transmitters at Division, Corps and Army

In U.S. units it became SOP for units above Division to locate their radio transmitter outside of the CP area. Placing the transmitter, and in most cases the receivers, outside the CP was done mostly to facilitate control and to keep away from sources of man-made interference. Locations at the different levels were generally as follows:

a. Division: The location of radio receivers and transmitters at Division was in close proximity to the CP, usually about 500 yards. Remote-control was not used and messages were delivered from the Message Center to the particular radio which was to transmit it by foot messenger.

b. Corps: The most practical location of transmitters at Corps level was in the bivouac area of the Operations Company of the Signal Battalion. Transmitters were remotely controlled from a point in the CP. A Teletype circuit was installed from Message Center to the transmitter area for use when, in emergencies, it was necessary to place control at the transmitters.

c. Army: At Army, transmitters were placed at least a mile from the CP. Because of the greater distances worked, it was necessary that the best transmitter location available be chosen.
[p. 277]
Remote-control was used, and receivers were located near the Message Center.

British Practice was as follows:

a. Division: All transmitters were operated from their respective vehicles and were located, suitably dispersed, in the Division CP area. The high power R/T sets were kept well away from all other stations and remotely controlled from respective CVs (Command Vehicles). W/T sets were placed as close as possible to the message center consistent with suitable transmitter location.

b. Corps: W/T transmitters were located within or just outside the Corps CP area, depending on the availability of a suitable radio site. This site was normally not more than a half mile from CP. The receivers of these sets were mounted in a central receiving vehicle located near Message Center from which transmitters were remote-controlled. The R/T transmitter and receiver of the main forward control link to Division was located close to the G-3 Operations Office with a direct remote-control in that office. The Corps Artillery Commander's R/T forward control was similarly located, complete, near the Corps Artillery Section Office.

c. Army: Two transmitter sites, each containing approximately half of the available transmitters were located at distances up to one mile from the CP. Each site was connected to the central receiving room by means of a multi-pair cable running by a different route. The sites chosen were the most favorable from the radio point of view. One site was a standby for the other in the case of an emergency. Further sites were required for:

(1) Radio/Teleprinter links, which had to be kept well clear of any source of man-made interference, and whose aerials had to be high in view of the "optical path" tendency of the frequencies in use.

(2) The Army R/T forward control set. This set was normally located near the G-3 Operations Office with a direct remote-control to the staff.

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(3) No. 10 Sets (UHF multi-channel sets) if provided.

d. It was found desirable to locate the W/T transmitters of the Air Support Signal Unit at the main Army transmitter parks to avoid the interference they caused in the central Army receiving room in the CP area.

Section 29. Enemy Fire on Radio Transmitter Sites

The impression given by manuals, and through instruction, that radio transmitters attract artillery fire caused communication personnel to silence radios to an unwarranted extent, thus wasting valuable communication facilities.

Experience disproved the idea that the enemy used radio direction finding equipment to bring fire on radio stations. To quote one Infantry Division,

"Many instances were brought up indicating enemy shelling due to direction finding equipment used on our radio transmitters. In every case investigated it was found that the cause was not DF. Common causes were:

a. Visual sight of the operator, antenna, or troop concentrations.

b. Location of the transmitter near a worthwhile target such as a gun position or prominent crossroad.

c. Transmission in the clear of friendly locations or movements."

Section 30. Practicality of Link Sign Procedure (U.S. only)

"Link Sign" radio procedure was used by U.S. units throughout all operations in the Italian theater. Coupled with the "Army Code Sign System" for assigning radio call signs, it proved more efficient and more secure than the double call sign procedure taught in the United States.

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Section 31. Requirements, and Provision of Air Messenger Service at Army Headquarters and Below

Divisions made little use of Cub planes for delivering messages. In emergencies Cubs obtained from Artillery units were used. This proved unsatisfactory as the number of times planes were required was small, and no hardship was felt by the Artillery.

Although it was not a standard practice, Corps made frequent use of Cubs to reach Divisions whose CPs were at a distance and when roads and traffic made motor messenger too slow. Some difficulty was experienced in finding suitable landing fields near Division Headquarters. Cubs were also used laterally between Corps. It proved quite practical at U.S. Corps to use Cubs from the attached liaison group (Air Force) to provide regular messenger service. Planes were allotted when necessary to British Corps from either Allied Intercommunication Flight (RAF) or from Corps Artillery.

Both U.S. and British Armies made extensive use of air messenger service by Cubs to Corps, separate forces, and Base Sections. Army demands for air service were great enough to warrant the recommended attachment of an air-messenger unit to the Army Signal services. Such units should be sufficient in size to provide two runs a day to all subordinate major units plus, in the case of the British Army, a pool for allocation to Corps. Contrary to U.S. opinion, the British felt that air-messenger service at Army should be a Signal function to insure handling of messages throughout by Signal personnel.

Section 32. Handling of Priority Messages by MDLS

Within an Army, the handling of priority envelope traffic required definite control. Special messengers were available to staffs at all times and were used as required. However, by publishing schedules of regular messenger runs, which were made up to meet requirements of sections originating daily reports, the call for special messengers was greatly reduced.
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The schedule of regular messenger runs was given wide distribution to the staff sections, with the request that envelope traffic be timed to meet scheduled runs. When a staff section knew it would have urgent traffic ready shortly after a scheduled run, it contacted the Message Center Officer and informed him of this fact. It was left to the discretion of the Message Center Officer whether to hold the run a short time or send a special messenger. This often saved duplicate runs within a short space of time.

In rear areas, however, where traffic often passed through several intermediate offices, and could be transmitted by several different means (air, motor, etc) a system of priorities was considered desirable to ensure that urgent mail received proper treatment at all stages of its journey. The use of colored bags or colored bag tags was suggested as a method of differentiation between priorities of various bundles of traffic.

Section 33. Reproduction and Distribution of Messages (U.S. only)

Message Centers were not used to reproduce messages.

At Army all incoming traffic was routed directly from Message Center to the Mail and Distribution Section of the AGD [Adjutant General Division] which was located nearby. This section of the AGD made copies and distribution required and indicated the action addressee dependent upon the nature of the message.

On outgoing messages staff sections were required to furnish and deliver two copies to Message Center and one each to AG Records, C/S [Chief of Staff], and each interested staff section.

At Corps and Divisions, operational messages were delivered by Message Center to sections concerned, which then were responsible for making necessary copies for other interested sections, and for transmittal of messages to AG for file. Non-operational messages were delivered directly to the AG representative of the echelon concerned unless addressed to a specific section.
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Originating sections were required to deliver to Message Center one copy of an outgoing message for each addressee and one for Message Center file. If internal distribution to other staff sections was required as well, the originating section prepared copies and made that distribution.

At Army Group Headquarters reproduction and distribution of incoming messages was accomplished by an SMC (Staff Message Control) under operational control of the Adjutant General. One of the local recipients was designated as ACTION as indicated by the contents of the message. Local distribution of copies of outgoing messages was the responsibility of the originating section. The Message Center passed a copy of each outgoing message to the SMC for filing and as a reference for dealing with replies.

Section 34. Security Classification of Teletype Circuits

The practice of permitting transmission of CONFIDENTIAL materiel in the clear by Teletype was followed throughout all operations. This increased speed of transmission and greatly relieved cipher personnel. It was generally agreed by Signal Officers that Teletype circuits within an Army area were secure from interception, and in no case was an instance of wire tapping suspected or found. It was felt by U.S. personnel that the greatest drawback to transmission of SECRET materiel in the clear was the loss of security by the additional friendly personnel who would, of necessity, have access to such materiel. However, both British and U.S. personnel agreed that the volume of SECRET traffic was never so great that cipher personnel could not cope with it adequately.

Section 35. Practicability of including a Radio Teletype Link in a Land Line System (U.S. only)

From a security viewpoint it was felt that it was practicable to connect a radio Teletype link into a Teletype switchboard and thus give land-line subscribers direct access to the radio link.
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This was done in one instance and proved satisfactory. Necessity for constant supervision to see that no clear text passed over the air was stressed, and this hazard was considered the only drawback to the use of such a circuit.

Section 36. High Grade Crypto Systems for Units of less than Division Strength

Task Forces of less than a division in strength and of special organization were occasionally attached to Army or Corps. Where the employment of these forces was such that there was little danger of the CP being captured, a crypto team with sigaba[sic] could profitably have been used. This would have provided essential security otherwise impossible, and traffic could have been cleared much more rapidly. Teams should be made up of three men with one sigaba. They should be provided from an Army Signal unit, and attached as directed by the Army Signal Officer.

When it was necessary to equip units (less than division strength) with high grade cipher, the OTP (One Time Pad) and the M-209 were used.

Section 37. Traffic Control Communication

A Signal Operations Company was utilized to provide necessary communication for Army (U.S.) traffic control and Transportation Headquarters which demanded a fairly extensive communication network.

Within Corps and Divisions a much more limited system was required. In the case of both Division and Corps, adequate Signal personnel were available to provide required communication from TCPs [Traffic Control Posts] to the nearest switchboard and to construct other point-to-point circuits. In some cases telephones for their posts and enough wire laying equipment to set up their own communication on one-way stretches were furnished to the MPs by the Signal unit concerned.

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On occasions when it was impossible to establish wire communication within the time limit the situation demanded, SCR-193s in carryalls and with operating personnel were used until such time as the traffic post could be tied in by wire. Radio teams were provided with a special digraph code for purely traffic control messages, and with M-209 for longer and more detailed messages.

Similar problems were met in the British Army and were overcome in much the same way. TCPs for movement control were linked to the main wire network where possible by the responsible headquarters signal personnel. It was not possible to allot special wire personnel. TCPs at all levels were provided with radio sets WS 22 (equivalent to SCR-193). Insufficient Royal Signals personnel were available in organic signal units to man the radio sets. Regimental communication personnel were obtained from disbanded AAA units for this purpose. As security is vital on movement control nets, it was strongly advocated that additional Royal Signals personnel should be provided for this purpose and that a special code should be introduced. Slidex, which was used by the British, was not considered sufficiently secure and was too slow to operate.

Section 38. Electrical Power Requirements for Signal Installations (U.S. only)

Headquarters power sources (Engineer) were not satisfactory as a source of electricity to light Message Centers and to operate code machines at Army, Corps, or Divisions. Where extra Signal Corps power units were not available, the generators, which supplied communication installations (switch board, Teletype, etc.) were used to supply Message Center as well. These generators were not of large capacity and extra demands overloaded them Where possible, provision was made so that signal installations had 24-hour service from a central source which was large enough to provide for all requirements. This eliminated the use of several small power units within a small area and simplified maintenance problems.

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Section 39. Provision of Communication Specialist Replacements within a Field Army (U.S. only)

During certain periods specialist replacements became a problem, particularly in lower echelons. Wire personnel in particular were not available in sufficient numbers to replace casualties. In order to alleviate this situation, several systems of unit training and allocation were set up by the Divisions.

a. Personnel who had some experience or seemed qualified were taken from the Division replacement pool, attached to the Signal Company, and there received training prior to their assignment to an Infantry unit. These men were given basic instruction and they were further trained by giving them training on the job in Division rear areas.

b. In some cases the selected replacements were kept in the Division replacement pool where they received training and instruction in their particular specialty.

c. Another system used was to assign replacements immediately to the individual unit for training prior to their entry into combat, thus giving them the advantage of training with the organization with which they would later serve. During combat these men were either returned to the replacement pool or attached to the Signal Company where their training was continued until they were needed.

Section 40. Signal Information and Monitoring Services (U.S. only)

1. SIAM (Signal Information and Monitoring Service) was developed from the British "J" and "phantom" services, combining the monitoring of the "J" services and the system of phantom Liaison Officers with radio transmitters.

2. The SIAM service performed two functions:

a. It provided the Army Commanders and the Commanders of Corps and Divisions with prompt, tactical information from front line units - information which, when sent through normal channels, took considerably longer to reach the aforementioned headquarters.

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b. It provided a check upon the radio and cryptographic security of radio nets within the Army.

3. A provisional company was organized by NATOUSA [North African Theater of Operations, United States Army] and was used during the march on Rome. SIAM functioned well and provided valuable information. This SIAM Company, reorganized under War Department T/O&E, was attached to the Seventh Army prior to the invasion of France. NATOUSA then ordered activation of a new Company.

4. The operation of the SIAM service was the responsibility of the Army Signal Officer, through the Signal Intelligence [Section] (SIS) Officer.

a. Operating personnel and equipment for the service were provided by the SIAM Company. The operating platoons of this Company were known as SIAM Platoons, and were designated as the Army Platoon, Corps Platoon, Division Platoon, and Armored Division Platoon, according to their level of operation. This Company was designed to cover any size Army, the number of platoons being dependent upon the size of the Army. The Platoon was not attached to a Division for anything but rations, so that an unbiased policing job could be performed, and the work of all platoons on the Army front could be coordinated by Army Headquarters.

b. SIAM Platoons were assigned with the purpose of covering the radio nets of the entire Army front. Normally, a SIAM Platoon was located with Army Headquarters, each Corps Headquarters, and in the sector of each Division. These platoons were under the direct control of Army for both technical and tactical direction.

c. The Army and Division platoons had assigned to them a tactically trained officer whose duty was to maintain active liaison with the Army and Division staff sections.

5. The monitoring procedure was standard for all platoons.

a. SIAM platoons maintained a continuous monitoring coverage of the active radio nets in the Army to provide a check upon the security of radio procedure and of message traffic of these nets.

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The Army Platoon monitored Army nets, Corps Platoons monitored Corps nets, and Division Platoons monitored Division nets. The Platoon Commander determined the nets to be monitored after coordination with the Signal Officer of the unit for which it was responsible. In order to ensure efficient monitoring, the important active nets (command, liaison, reconnaissance, artillery, and air support) were monitored continuously. Other nets were monitored as often as possible.

b. Monitoring was on a 24-hour a day basis, except in cases where the net being monitored was closed during the night. Each monitoring operator kept a monitoring log of all transmissions, except that all message texts were copied on separate message blanks and were sent to the Platoon Message Center immediately. The heading of all messages, however, were included on the monitoring logs. Monitoring logs were sent to the Platoon Message Center at the end of each day.

c. At the Platoon Message Center all cryptographed messages were decryptographed, and all messages, both cryptographed and clear text, were studied by the Platoon Commander to determine if they contained any violation of security. Monitoring logs were checked for violation of operating procedure.

d. Where a violation of security was found by the Platoon Commander an immediate report, containing the transmission, time, call sign identifications, violation, and a statement showing why the transmission was a violation of security, was made. The original copy was forwarded to the Army Signal Officer, Attn: SIS, and copies were sent to the G-2 and Signal Officer of the Corps or Division concerned. This report was for the information of the Corps or Division involved, and did not constitute a "command letter". All clear text violations which might have been of immediate consequence to our own troops were brought to the attention of the G-2 without delay. Violations of radio procedure were brought to the attention of the Signal Officer by a written report.
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These reports by Platoon Commanders were not intended to eliminate the need for "command letters" from Army Headquarters, but were for the immediate information of the personnel to whom they were distributed for such action as they might consider necessary.

e. Monitoring logs, with the cipher texts of the messages, were forwarded daily to the Army Signal Officer, Attn: SIS, for further study and evaluation. A mission assignment, operation report, and copies of violation reports accompanied each set of logs.

f. Net frequencies were checked periodically and, in all cases where such checks indicated a net was operating off frequency, an immediate report was made to the Signal Officer concerned.

g. SIS supplied each platoon with a file of security publications. In addition, the Platoon Commander obtained copies of local radio instructions from the Signal Officer of the unit being monitored.

h. In view of the fact that the Platoon Commander could not stay with the Platoon at all times, it was necessary to have at least one qualified NCO on duty during his absence to act as Security Chief.

6. The processing on information was standardized for all platoons and Liaison Officers.

a. The SIAM service established and maintained SIAM radio nets operating from Division Platoons to the Army Platoons, with the Corps Platoons acting as "listening" stations, for the purpose of relaying front line information directly to Corps and Army Headquarters. The number of SIAM nets operating depended upon the tactical situation. Information of one Corps and its Divisions was sent down the SIAM net which included the other Corps in the form of actual important intercepts, and in the form of sitreps [Situation Reports] prepared by the SIAM Liaison Officer at Army Headquarters using both SIAM information and information from the Army G-3 Section.

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b. The information relayed on the SIAM net was obtained by two methods.

(1) Intercepted messages: All messages intercepted by Division Platoon were evaluated by the Platoon Commander, and messages which had tactical value were relayed to Army and Corps without delay. All, except insecure messages, were relayed in their original form. Insecure messages were re-enciphered in the M-209 or One Time Pad system before transmittal on the SIAM net. New message headings were made up and the principles of paraphrasing were observed. The plain text of all messages was given to the Division, Corps, and Army staff sections.

(2) Liaison Officer reports: In order to supplement the information obtained by intercept, SIAM Liaison Officers submitted to Army SIAM short periodic reports on front line locations, type and amount of enemy resistance, etc. This information was obtained from the Division staff sections.

c. The information collected by SIAM, whether by intercept or liaison, always indicated the source of the information (e.g.: Intercepted from ... , G-2 reports, G-3 reports, liaison reports). No messages contained any opinions of SIAM officers. Specific items of information requested by staff sections were obtained whenever practicable.

7. SIAM information was not intended to bypass or replace official channels, but, rather, was designed to provide in the minimum time, a picture of the front line tactical situation, and also to verify information received from other sources such as photo reconnaissance, tactical reconnaissance, etc. It was not intended to be used as the basis for official reports, nor was it intended to be acted upon. It was intended to be a preview of reports which would come back through the slower, normal channels.

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Section 41. Additional Communication Requirements of an Armored Division (U.S. only)

Extended experience in combat in the Mediterranean Theater showed that the Armored Division habitually required an extensive telephone communication system, necessitating additional wire equipment. It was nearly always impossible to establish and maintain wire communication from the Division to the Combat Commands and within the Commands themselves, even in the fastest moving situations encountered. In slower situations and under static conditions extensive wire nets were built up.

The SCR-510 was too heavy for the Armored Infantry to carry and therefore did not provide as satisfactory communication as might have been realized from a lighter, more portable set of the size and weight of the SCR-300, but with the frequency range of the SCR-510.

[end of chapter]

original have been corrected. Further annotations - primarily abbreviation and acronym expansions - and insertions of clearly dropped words appear in 'square brackets'.
 - Patrick Skelly, for milhist.net]

[Transcribed 2002-12-28]