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by N. M. Young, Capt., SigC, 15 Sep 60

SIGNAL CORPS

TECHNICAL INFORMATION LETTER

PURPOSE THE SIGNAL CORPS Technical Information Letter is a monthly publication designed to keep Signal Corps personnel and other military personnel using Signal Corps equipment informed on Signal Corps matters. It provides means for the dissemination and interchange of information of a widely-varied nature, both technical and tactical.

SOURCE THE LETTER is compiled mainly from information available in the divisions and branches of the Office of the Chief Signal Officer. Signal Corps and other communications personnel are invited to submit, through channels, material of general interest. Information on problems encountered and overcome by combat and service communications troops is desired. Such items should reach the Chief Signal Officer (SPSAY) not later than the 15th of each month for inclusion in the letter for the following month.

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WARNING THIS publication is issued solely to give proper and speedy dissemination to timely, useful information concerning pertinent trends and developments. Nothing herein is to be construed as necessarily coinciding with United States Army doctrine. Changes in official doctrine, as they become necessary, will be officially published as such by the War Department.

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LAND LINES FOR AIR POWER

Excerpts From an Account of the 431st, Which Put in Lines From Tunisia to Italy

THE 431ST Signal Heavy Construction Battalion packed its equipment at MacDill Field Tampa, Fla., in August 1942, after several months of maneuvers in the South and entrained for an Atlantic coast port of embarkation. A few weeks later officers and men were comfortably quartered in England in permanent barracks at a Royal Air Force station.

The activities of the 431st from this time on through the Tunisian and Italian campaigns, together with the part it played preparatory to the Pantelleria and Sicily invasions, is typical of the importance of a heavy construction battalion assigned to the Air Forces in a theater of operation. Work varied from the smallest field wire job to the placing and splicing of two 75-mile buried cables from Bari to Foggia in Italy. Today the 431st continues north in Italy as the Italian Campaign progresses, after a brief trip to Southern France to participate in the recent invasion operation there.

In England arrangements were made with the British General Post Office (GPO), Telephone Department, for the battalion to assist in any way possible in British outside plant construction and maintenance activities.

The work consisted of placing new copper line wire, pole replacements, pulling slack wire in open wire lines, replacing guys, and cable splicing work. Although platoon crews had been well organized during maneuvers in the States, this work gave platoon and company commanders an opportunity to reorganize construction crews for actual operation because some enlisted personnel had been added at the port of embarkation in order to bring the battalion up to table of organization strength. Furthermore, it was felt that the men received some excellent experience in this activity by working on a type of plant other than American Standard, a situation which would arise in later operations. The British telephone people likewise benefited by the American method and assistance and they were loud in their praise of the American personnel and equipment.

In December 1942, 1 month after the North Africa landings, the 431st landed in Africa. A bivouac area was established at a former French Air Force school a few miles south of Oran. Telephone work here was not very extensive although some maintenance work was done on the field wire plant at the airdrome and around the headquarters buildings.

The battalion's motor and T/BA equipment was shipped to Oran directly from England where all equipment had been procured to bring the unit up to table of equipment strength. At Oran it was necessary to reassemble this equipment as fast as it arrived. Some of the motor vehicles were immediately taken away from the battalion and shipped east to Tunisia where they were needed by combat units. This presented a vehicle shortage situation which took some time to overcome.

Due to the lack of an appreciable amount of signal work in the Oran and La Senia areas, personnel of the battalion assisted in the unloading of ships, performed airdrome guard duty, and placed steel matting on landing strips for the engineers.

Early in March of 1943 the battalion was assigned to the 12th Air Support Command for operational duties. Administration was by the 12th Air Force Service Command. At that time the Support Command was operating near Kasserine Pass.

The need of a heavy construction battalion to assist the 927th Signal Battalion, Air Support Command, a regularly assigned unit of the Support Command, was such that it was necessary to ship personnel and T/BA equipment to Tunisia by troop carrier aircraft. Motor vehicles were convoyed and they carried some of the heavy construction supplies, such as crossarms. The planes landed men and equipment at an airdrome near Tebessa, approximately 600 miles east of Oran.

The installation and maintenance of a wire network for air force operations is an important function. Uninterrupted telephone service is essential to a successful air operation. Careful selection of initial wire routes and standard installations assist greatly in overcoming line troubles even though speed of installation is usually necessary. These factors all had to be considered in

carrying out pole, wire, and cable work for the Support Command's lines from the tactical control center to aircraft warning ground observer outposts, operational and administrative lines to the various fighter groups, to other headquarters, etc.

The U. S. II Corps was in the vicinity at the time; Signal activities, therefore, for the entire area became the responsibility of the Corps Signal Officer. The II Corps signal battalions, the 53d and 62d, along with the 431st and the 927th, worked together in this phase of the campaign to furnish and maintain telephone communications for ground and air forces in this area.

The 431st was assigned the project of placing 40 miles of 5-pair rubber covered cable from Thelepte to Sbeitla on a French PTT pole line. These circuits were required to provide communications between Support Command headquarters and the control center at Thelepte and its advance outposts around Sbeitla. This was in addition to open wire circuits which had already been established by utilizing PTT open wire lines for II Corps use.

The cable was connected for 4-wire telephone circuit operation with repeaters at each end and at midsection, Kasserine. At first it was attached to poles using a marlin basket weave hitch and allowing a 7-foot sag in spans which averaged 150 to 175 feet. Connectors were placed at a pole in all cases and the surplus cable was coiled up and tied to the pole. Troubles developed, however, apparently due to the tension created on the cable in the spans and it was necessary to lower it to the ground for the entire distance. Transmission under this arrangement and for this distance was not good but the circuits were usable.

JERRIES STRAFE ROUTE

The pole line was in open country and a few near incidents occurred as German fighter planes flew up and down this route on strafing missions. A constant lookout was posted with each crew to watch for such activity. It is felt that this precaution prevented casualties. Enemy planted mines presented the worst hazard to signal troops, therefore, mine detectors were obtained and men were trained to operate them. In addition to mine sweeping, crew chiefs and officers constantly reminded the men to be on the alert for hidden mines. In spite of these measures some casualties and equipment damage was caused by mines.

Company B established its headquarters farther forward the latter part of March after a preliminary move had hastily forced them back due to a German counterattack. It was assigned the job of rehabilitating three circuits on the PTT line from Feriana south to Gafsa, approximately 50 miles almost entirely on the railroad. The enemy had cut down several poles and damaged some wire on a portion of this route in his retreat. Furthermore, it had been reported that much of the route had been mined so that it was necessary to sweep almost the entire distance. This delayed rehabilitation work considerably. In the vicinity of Gafsa there had been much fighting and extensive pole line restoration was necessary.

PATROLS MAINTAIN LINES

A methodical plan of maintenance was devised by the Corps Signal Officer to maintain this large network of circuits. Maintenance activities were divided among the battalions and consisted of constant patrols to repair line conditions which might ultimately cause trouble. Stand-by crews were always available to clear reported troubles.

As the tactical situation moved north, Company A moved to Sbeitla with the advance groups of the Support Command and defense wing. Here the 431st took over most of the work for the Support Command since the 53d and 62d Signal Battalions continued in other localities with II Corps and the 927th took over maintenance of the existing lines in the rear. Again it was necessary to establish lines as fast as new airbases were built back to headquarters and the control center as well as lines to observer stations and other outposts. The Thelepte-Sbeitla 5-pair cable was cut over to operate to the rear from Sbeitla. Most of the lines to the airbases in this area were installed by rehabilitating PTT open wire lines although some additional iron and copper wire was placed on the PTT poles.

Statistics of work actually performed by the 431st Signal Battalion are not available but it is known that the four battalions working with II Corps from March to mid-April rehabilitated over 4,000 wire miles of PTT line, built about 550 wire miles of new line, placed over 700 poles, installed approximately 65 miles of spiral-four cable, constructed about 400 wire miles of British multi-airline, and then maintained over 2,000 circuit miles of wire.

In the middle of April, the Support Command again moved east, 90 miles southwest of Tunis and in an area where the Germans and Italians had not been active. Headquarters was set up in a town, and the air defense wing, about 5 miles away. Ten-pair rubber covered cable was placed between the two by Company B. Company A worked on a 25-mile subsidiary line.

A platoon from B Company was then loaned to the Tactical Air Force to construct another 20 miles of this type line in the Kairouan area.

The battalion on the 15th of May, 3 days after the end of the Tunisian Campaign, began building up communications on Cape Bon for the Support Command and the Tactical Air Force for further operations against the enemy across the Mediterranean Sea.

Early in the summer of 1943 heavy bombardment groups of the Northwest African Strategic Air Forces were assigned to central Tunisia airdromes, and the 431st was designated to build several miles of tactical open wire line construction and rehabilitate PTT lines from Air Force headquarters at Tunis to these airdromes, wing headquarters, and service groups. The battalion was then transferred to the Northwest African Air Forces (NAAF) for operational duties to construct and maintain these lines for administrative, operational and service command use.

FRENCH PTT LINES USED

Throughout the entire Tunisian Campaign extensive use was made of French PTT open wire lines varying from 1 to 30 circuits on a pole line. Linemen readily became familiar with the French practices of open wire construction and maintenance. Much use was made of German 2-pair cable, similar to our spiral-four cable, particularly for circuit leads on to the airdromes. A large amount of this cable was left behind by the enemy and it was used to good advantage by several American signal units. Some British multi-airline (MAL) construction, the British equivalent of our tactical open wire line construction, was employed by both British and American units.

Early in October 1943, the 431st Signal Battalion, assigned to the Northwest African Air Forces for operations and to the 12th Air Force Service Command for administration, was shipped to Italy to assist in building up the wire network for the air forces which were to operate from airfields on the east coast of Italy. Here again it was necessary to provide operational and administrative telephone lines between tactical and strategic air force headquarters and their wings, groups, and service command units. At this time airfields were being prepared by engineers at Foggia and at other locations south, although the Tactical Air Force was already using some of the fields.

The battalion debarked at a port on the west coast and convoyed across to Foggia where it established quarters in a new Italian Army barracks. It was the first American unit of any size in the Foggia section of Italy. This was British Eighth Army territory and Eighth Army combat units were only a few miles north of Foggia at the time.

Operation of the telephone systems in Italy is divided between the State and five companies. The State operates most of the long-distance lines and the companies provide the urban and some of the inter-urban services in five different sections of Italy. In Foggia, Bari, Naples, and the communities south on to the "heel" of Italy the exchange telephone systems are operated by the Societá Esercizi Telefonici, more commonly referred to as the SET. Prior to the war, SET operated about 35 automatic and 96 manual exchanges for a total of approximately 59,000 subscribers. In the larger cities the number of telephones

OPENING A CABLE TRENCH IN ITALY FOR REHABILITATION.

varied from about two to eight per 100 inhabitants. Several of the smaller communities had no exchange service but did have toll service to the larger towns through one public telephone.

Open wire lines in southern Italy were generally in good condition. There were also good intercity cables in some areas and the pole plant was also found to be in good condition.

The Italian Air Force, Italian Aeronautica, had an open wire line for its operations from the Foggia airfields south to Bari and on to the "heel." This line was found to be in excellent condition and it was utilized by the Allies as a backbone feeder route on the east coast.

The first major project was to make good four existing circuits and to place two additional copper circuits on the two 6-pin cross arms of the Italian Aeronautica line from Foggia to Bari, approximately 75 miles. This work was immediately followed by the installation of two 10-pin type A cross arms and 10 copper circuits, phantom transposed, to meet the initial telephone and teletypewriter circuit requirements of the air forces, Army, and Navy between these points. Company A performed most of this work with one platoon working out of Foggia and the second platoon being stationed at a halfway point, Andria, 45 miles south of Foggia.

Signal personnel arrangements for carrying out this project were well scheduled. The 431st started the job and later the 435th Signal Heavy Construction Battalion moved in to Italy after operating in the Middle East with the 9th Air Force and for a short time in Tunisia. This unit was also assigned to NAAF for operations and it established a bivouac area a few miles north of Bari to work on the Bari end of the project.

SHIP CARRYING WIRE SUNK

Delay in signal supply shipments to Italy held up final operation of the new circuits. This condition was further aggravated by an enemy air attack causing the loss of a ship which was carrying a portion of the copper wire scheduled for this project. The work was finally completed in December.

The wires on the Italian crossarms were transposed in accord with the existing transposition scheme, simply by continuously rotating all four wires of two pairs. Wires were arranged in groups of four on the corners of a square and diagonally opposite wires constituted a pair. The American Bell ABC System was used for wires on the 10-pin arms. No difficulties were experienced from the use of two different transposition systems on the same pole line.

The Foggia SET central office building, all of the toll entrance open wire lines, and the underground toll entrance cable at the rear of the building had been severely damaged by Allied bombings during the enemy occupation of Foggia. Strangely enough no damage was caused to the exchange underground cables and the 800-line cable distribution frame in the central office basement.

The 431st was given full responsibility for the entire SET cable, wire, and pole plant in Foggia. The civilian population had been largely evacuated at this time; consequently there were no requirements for exchange services. Several buildings were taken over for various military commands and headquarters, mostly for the air forces. Records of the Foggia cable plant had been lost in the building wreckage, therefore, one of the first problems was to test out each cable lead and build up a record of the cables, cable counts, and ter-

At the time of the British Eighth Army drive in late October a platoon of the 431st was dispatched to the front to assist British signal units in the Campobasso area. Again American signal practices proved to be outstanding and the Royal Signals company commander in reporting his appreciation to the commanding officer of the 431st quoted the commanding officer, British — Corps Signals, as follows:

> This is the first time a division has moved to the battle area and had immediate pole line communication. * * * I need hardly say how important this has been to the successful prosecution of this particular phase of the Italian Campaign.
>
> * * * * *
>
> The above has been made possible by the assistance given me by your fellows under your orders, and apart from any official appreciation that will be given for the work of 431st Signal Battalion, I offer you the thanks of myself and the officers and men of my company who appreciate to the full, not only the progress we are making, but the fact that we are making this progress without the flogging effort that has had to be applied in the past to keep up the permanent line communications with such a mobile organization as the Eighth Army.

minal locations and multiples. This work was performed by the cable splicers of both companies. The record was built up and men were then stationed at the telephone building to make cable pair assignments and crosswiring connections for new telephone services to the various headquarters and to perform testing on the toll lines. Toll lines were terminated at the Air Force headquarters switchboard.

One mile of new 51-pair and 101-pair aerial cable was placed as a toll entrance cable for the San Severo, Manfredonia, Bari, and Naples leads. This cable was spliced to existing cables near the entrance to the central office basement. Two 10-pin arms of wire were placed on the new toll entrance line so that open wire carrier circuits could be routed to the central office through a minimum length of cable. Telephone carrier circuits were established to Bari and Naples utilizing British carrier terminal equipment. British Royal Signals personnel was assigned to maintain this equipment.

ITALIAN LINES REHABILITATED

Company B performed the rehabilitation and installation of open wire lines to the several airfields around Foggia while A Company was on the Bari job. Existing Italian lines were used for most of these circuits and some British MAL. Major rehabilitation work on the Foggia-Naples 40- and 50-wire line between Foggia and Benevento was also performed by B Company. Minor rebuilding was necessary on the Foggia-San Severo line.

After the 431st and the 435th battalions had completed the Foggia-Bari open wire project, the British Signal Officer of the Army Group which controlled engineering of this line ruled that the entire pole line be 4-way storm guyed every 10 poles regardless of existing guys. The line now carried 32 No. 8-, 10-, 12-, and 14-gauge wires on the two 6-pin and two 10-pin arms. Poles in general were 25 feet and 30 feet, classes 5, 6, and 7. The line was sheltered for much of the distance by olive trees since it had been built through olive groves outside the highway limits. Italian weather authorities stated that this section of Italy was free from freezing rain storms which might cause ice loading on wires, the principal reason for storm guying an open wire line. Prevailing winds were nearly parallel to the line.

While such an elaborate guying plan did not conform to American Signal Corps practices, the work was carried out as specified with a few variations. Some additional guying was justified, however, due to the shallow depths at which poles had to be set on account of ledge in the Foggia Plains area.

The demand for telephone circuits along this route increased constantly. To meet additional circuit requirements, Army Group obtained authority for the installation of two buried cables between the Foggia SET building and a new repeater station which was to be constructed on the outskirts of Bari. The 431st was assigned to the northern half of this route and the 435th, the southern half.

Each battalion surveyed and staked out its respective sections for the route of the cables. It was decided that the cables in general should follow the route of the Italian Aeronautica pole line. Much of this line passes through olive groves and at first some concern was expressed about possible damage to olive trees with trenching equipment. However, trees were spaced in rows far enough apart so that the machines passed between them with little difficulty although some damage may have been caused to tree roots.

Arrangements were made with the British Royal Engineers for the use of plow and trenching equipment. The British furnished personnel to operate this equipment and these men were quartered and rationed with the battalions.

PLOW TOWED BY TRACTOR

At the Foggia end, an ordinary 2-blade V-plow was towed by an 8-ton tractor. A B trench, 2 feet deep and about 3 feet wide at the top, was thus provided. The tractor-plow combination was preceded along the route by a cutting machine towed by a smaller tractor. The purpose of the cutter was to detect ledge, cut tree roots, and loosen boulders so that they could be removed before the plow reached them. The cutter consisted of a large parabolical shaped cutting arm set to a depth of 2 feet. The tractor towing the plow straddled this earth cut.

On the Foggia Plains section good progress was made due to the rich soil encountered. In some low sections, however, rains created mud which occasionally clogged up the plow but under dry weather conditions the cutter and plow teams were

able to average 3 to 4 miles an hour. Some sandstone conditions necessitated hand digging and civilian labor was employed for this.

At the Bari end of the job a trenching machine was used instead of a plow. This machine provided an excellent trench 2 feet deep and about 1 foot wide but it was much slower than the plow method. Here again when the soil was wet it clogged up the machinery causing delay. Considerable sandstone ledge was encountered here which the trenching machine usually could not penetrate although it did cut the top surface of the stone. Arrangements were made to utilize Italian Army personnel for this digging. The Italians were transported to and from the job by the battalion's trucks.

Trenching at road crossings were all by hand. Pipe was placed under the more important roads and the cable was pulled through it. Pipe was also used on bridges at river crossings.

Cables were laid in the trench 1 foot apart. The cable was fed from a standard cable reel trailer towed by a 4-ton truck. Two such setups were used, with men feeding the cables into the trench from each trailer. At splice points a stake was left marked with load point or splice number. A small tractor with large blade pushed each back into the trench.

The cable was a 7-quad, 16-gauge lead-covered, jute-protected cable of British manufacture. It was shipped to Italian ports in ¼-mile lengths on wood reels and the battalions delivered the reels from the ports or British supply depots to the cable route. Each reel of cable was tested for opens, crosses, and grounds before delivery to the job.

Splicing was performed by cable splicers of both battalions. All seven quads of each cable were loaded at 1-mile points with British load coils in buried cases. A plan of conductor splicing arrangements was devised by Army Group in lieu of capacity unbalance tests. All conductor splices were soldered. British splicing materials were used including a British form of desiccant for drying splices, paper sleeves, muslin for wrapping the splice, lead sleeves, solder, and lamp black paint instead of cable pasters for use at the edge of lead sleeve wipes.

10 POINTS ON ANTIJAMMING

THE FOLLOWING is a suggested method of getting forceful antijamming instructions to radio operators. It can be issued as a field order or as part of an SOI.

On receiving interference, radio operators WILL:

1. Keep on receiving, clear the messages on hand.

2. Test for jamming:

a. Turn the tuning dial thru several channels. If the interference is tuned to your frequency you are being jammed. If it isn't turned, it still may be jamming.

b. Disconnect the antenna and ground the antenna binding post, if the interference doesn't stop, there is something wrong with the receiver.

c. Retune set to normal operating condition.

3. Identify the jamming as one of the following or be able to describe it.

a. Bagpipe. b. Spark. c. Sweepthrough. d. Noise.

4. Report jamming to Communications Officer as soon as possible.

5. Change immediately to prearranged alternate frequency and call sign.

6. If still jammed, change frequency and call sign again, or operate cw.

7. Set frequency and crystal filter (if any) carefully for the best setting.

8. Set beat frequency oscillator (BFO) for best setting, if operating cw.

9. Set the volume control high and low, then choose the best setting.

10. KEEP TRYING!! DIG THE SIGNAL OUT OF THE JAMMING!! Moving to a different location may help.

DIRECTION FINDERS

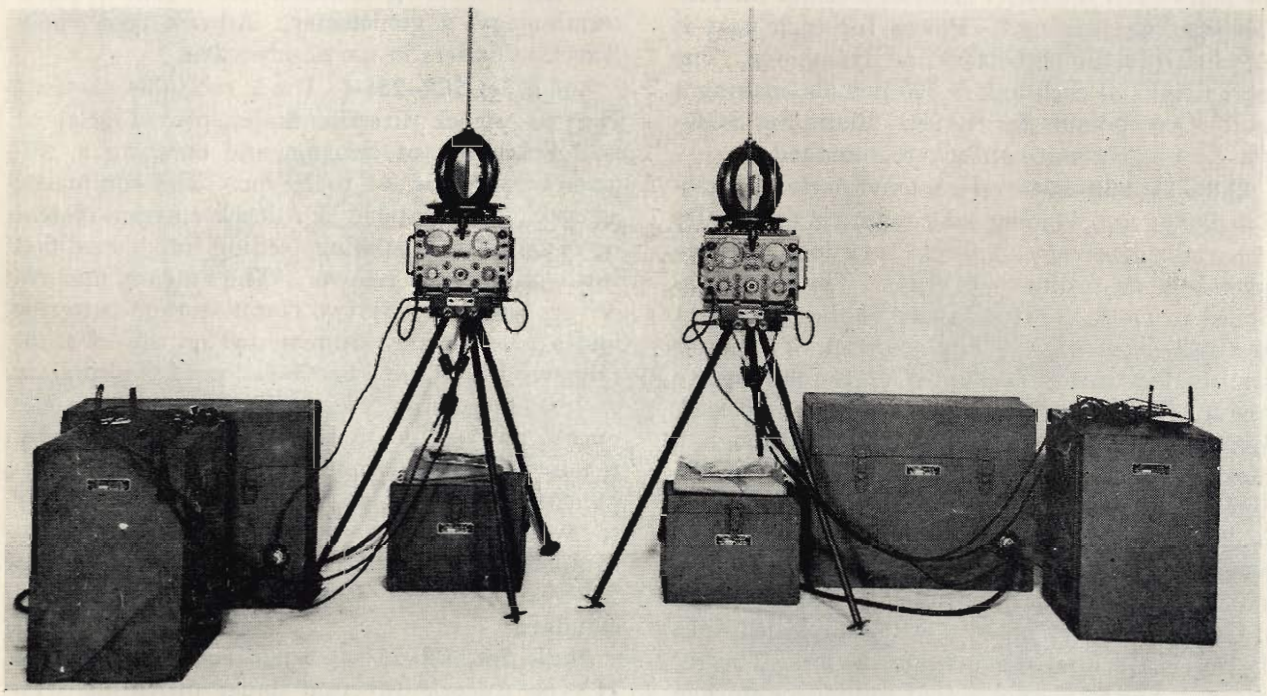
Loop Antennas Are Used for Short Distances; Adcock Systems, for Long Range Work

RADIO DIRECTION finders are used to obtain information about the enemy. The method in which such equipment is employed was discussed in SCTIL No. 34, September 1944. Radio direction finders used in U. S. Army radio intelligence units may be divided into two types: loop direction finders and Adcock direction finders.

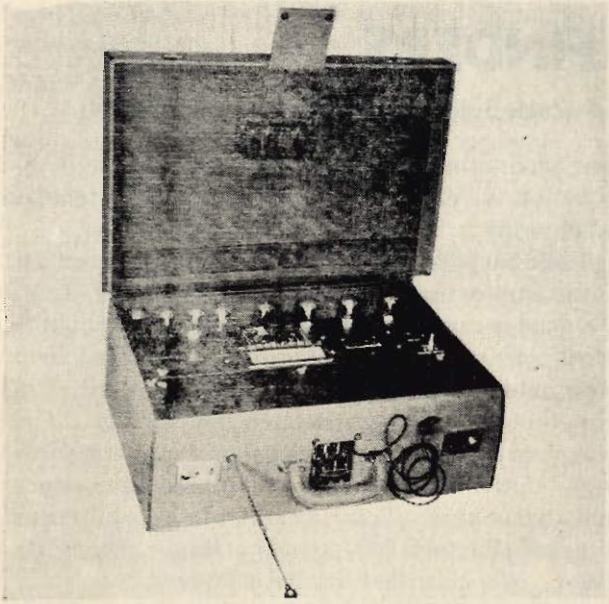
Loop direction finders employ directional loop antennas to determine the direction of incoming signals. Loop equipment is used for short range, light weight, small bulk application. However, loop antennas are subject to certain directional errors due to abnormal polarization of the incoming signal (a radio wave is considered abnormally polarized for the purpose of this discussion when the electric component of its field is other than vertical). Thus for a loop to operate satisfactorily, it must be within a distance from the transmitter where the ground wave makes up a large percentage of the received energy, since sky waves are, in the majority of cases, abnormally polarized. For low and medium power transmitters this is a short distance for medium frequencies and high frequencies over average terrain. Three loop direction finders are in use by U. S. radio intelligence units:

Radio Set SCR–206–( ) is a simple loop direction finder employing aural null indicating of bearing. Frequency range covered is 0.2 to 18.0 mc. Equipment consists of a rotatable 15-inch shielded loop with azimuth scale assembly, both mounted on a nine-tube, 8-band superheterodyne receiver. The complete equipment is mounted on four detachable legs. Power is supplied by a 6-volt storage battery and dynamotor. Total weight of the equipment is approximately 300 pounds. Radio Set SCR–206–( ) is classified limited standard.

Radio Set SCR–503–( ) is a crossed loop direction finder employing crossed-pointer meter indication of bearing and covering a frequency range of 0.1 to 3.0 mc. The equipment consists of two units, each of which is a complete and independently operable direction finder. The high frequency unit covers the frequency range 1.0 to 3.0 mc. The low frequency unit covers the frequency range 0.1 to 1.0 mc. Each unit consists of two



LOOP DIRECTION FINDER RADIO SET SCR–503–A INSTALLED AND SET UP FOR USE. THIS SHOWS THE COMPONENTS FOR BOTH UNITS.



HOUSED IN A SUITCASE, THIS IS RADIO SET SCR–504–A.

shielded 8-inch loops, crossed at a 90° angle, together with an azimuth scale, all mounted on a twin channel superheterodyne receiver. The output of each loop is fed into one channel of the receiver where it is amplified and detected. The output of each channel is fed to one movement of a dual movement meter. The loops are rotated until the pointers of the meter cross on a center line, indicating "on bearing." Power for each unit is supplied by a 12-volt battery and dynamotor. The total weight of each unit is 300 pounds, making a total of 600 pounds for the set. Radio Set SCR–503–( ) is classified substitute standard.

Radio Set SCR–504–( ) is a hand portable direction finder and homing set consisting essentially of a radio receiver and single turn loop antenna housed in an ordinary suitcase. The set is designed to mask the true nature of the equipment to avoid detection. A duplicate set of controls is provided under the handle of the suitcase to operate the receiver when the suitcase is closed. Signals are conveyed to the operator through a "hearing aid" type of earpiece. In operation, the signal is tuned in and the set is rotated in the hand until a "null" or minimum is obtained. The general direction of the source of the signal is indicated by the line perpendicular to the length of the suitcase. No azimuth scale is provided since the set is essentially a homing device. The receiver is powered by a set of miniature storage batteries (BB–51 and BB–52 for both filament and plate supply). A special Battery Charger PE–128–( ) is provided as part of each SCR–504–( ) to charge these miniature batteries. The PE–128–( ) operates from an ordinary 6 or 12-volt vehicular storage battery. The weight of the direction finder portion of the equipment is approximately 26 pounds; total weight of equipment is 80 pounds. It covers the frequency range 0.1 to 65 mc. Radio Set SCR–504–( ) is classified standard.

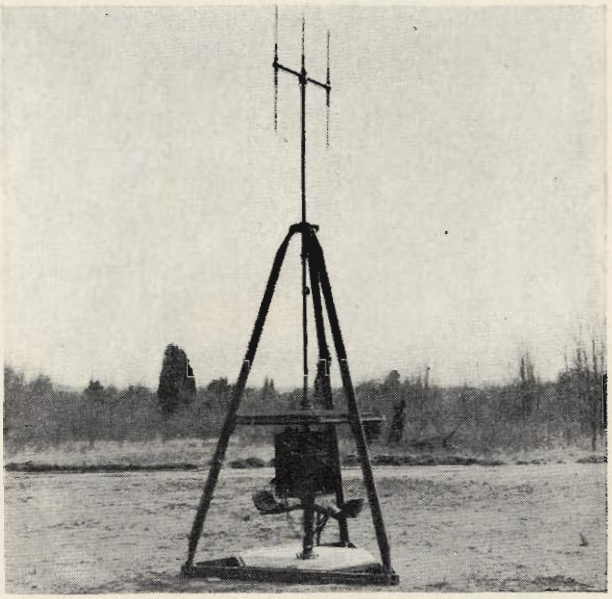
Adcock direction finders employ an antenna system which is not susceptible to large polarization errors. For this reason Adcock systems may be used to obtain long range bearings under conditions where bearings obtained from a loop would be useless. However, in order to obtain adequate sensitivity, the antenna system must be of considerable bulk. In general there are two types of Adcock antenna in use. The rotatable elevated H type consists of two vertical dipoles, one at each end of a horizontal beam, the dipoles being cross-connected to each other. The beam is pivoted in the center and the system is rotated until a "null" or bearing is obtained as in the case of a loop. The crossed U type consists of four monopoles erected at each corner of a square, cross-connected to each other. This type of antenna is fixed, and is effectively rotated by an electric device called a radiogoniometer, or, in general radio terminology, a goniometer. Adcock type radio direction finders in use number five.

Radio Set SCR–255–( ) is a rotatable elevated H type Adcock direction finder, providing aural null indication of bearing, and covering a frequency range of .54 to 30 mc. The equipment consists of a rotatable H Adcock antenna system of 24-foot dipole spacing feeding into a modified National NC–100 receiver. The antenna and receiver, together with two 6-volt storage batteries and a loudspeaker, are mounted on top of a 15-foot wooden tower. The rotation of the antenna and control of the receiver are effected from the operator's position in the base of the tower by remote mechanical controls. All electrical components are located on top of the tower in order to avoid errors due to resonance effects. The equipment weighs approximately 1,200 pounds when set up for operation. It is classified limited standard.

Radio Set SCR–551–( ) is a rotatable elevated H type Adcock direction finder providing left-right cathode ray indication of bearing, and cover-

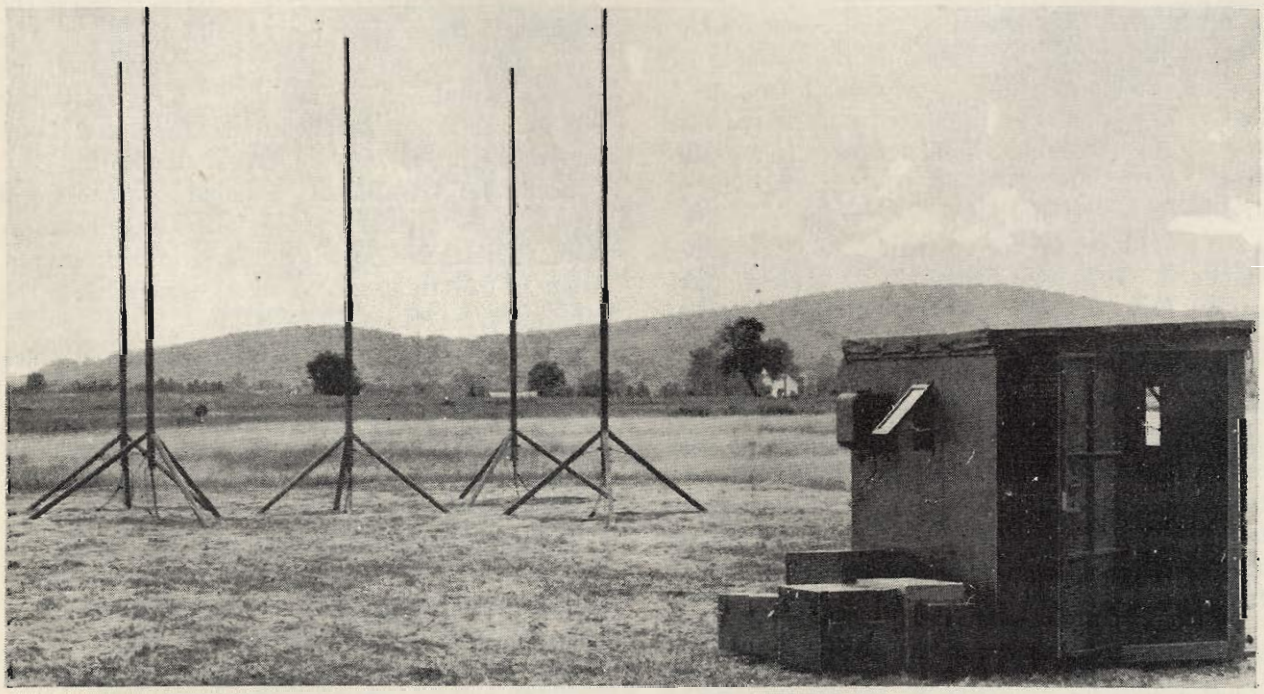
ing a frequency range of 2.0 to 20.0 mc. The equipment consists of an elevated **H** Adcock antenna together with a receiver, indicator, and operator's position mounted on top of a 15-foot wooden tower. The operator's position is inclosed in a circular plywood shelter. The equipment operates on the switched cardioid principle, indication of bearing being obtained when two vertical traces on a cathode ray tube are of equal amplitude. Power is supplied from three 6-volt storage batteries. The equipment weighs approximately 1,200 pounds set up for operation. It is classified limited standard.

Radio Set SCR–555–( ) and SCR–556–( ) are "twins," similar in appearance and construction although covering different frequency ranges. Radio Set SCR–555–( ) covers a frequency range of 18.0 to 65.0 mc while Radio Set SCR–556–( ) covers a frequency range of 65.0 to 156.0 mc. Both sets are rotatable elevated **H** type Adcock direction finders providing left-right meter indication of bearing. The equipment consists of an **H** Adcock antenna mounted on a 14-foot wooden tower. The antenna is connected to a receiver and indicator located at the base of the tower in a plywood shelter. The operator's position is located within this shelter. The equipment operates on the switched-cardioid principle, indication of bearing being obtained when the needle of a zero center type meter is in the zero position. Power is supplied each set from a 12-volt storage battery and a dynamotor. Both sets are classified standard.

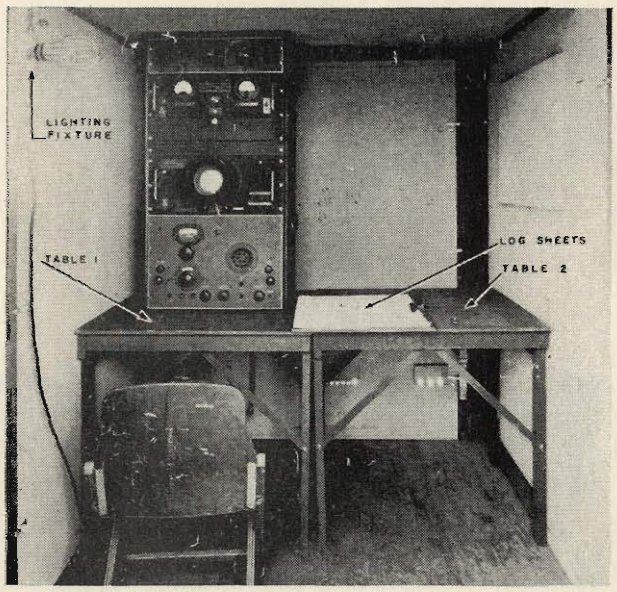


RADIO SET SCR–556–A WITH SHELTER SIDES REMOVED.

Radio Set SCR–291–( ) is a crossed **U** Adcock type direction finder providing instantaneous indication of bearing. The equipment covers a frequency range of 1.5 to 10 mc. When properly



ANTENNAS AND HOUSING ERECTED, THIS PHOTOGRAPH SHOWS RADIO SET SCR–291–A PREPARED FOR FIELD OPERATION.



RADIO SET AN/CRD–2–( ) INSTALLED FOR OPERATION.

employed, this can be extended up to 20 mc. The equipment employs a crossed **U** Adcock antenna system, the output of each monopole of which is fed through a cathode follower and suitable hf cabling to a motor driven radio goniometer. The output of the goniometer is fed to a receiver where it is amplified and detected. The receiver output is fed to the deflecting coils of a cathode ray tube. These coils are rotating at the same speed as the goniometer. This causes a trace, shaped like a "propeller blade," to appear on the cathode ray tube, the edge of which is graduated from 0° to 360°. The position of the trace indicates the bearing of the incoming signal. Power is supplied from two 1.5 kw, 110-volt, 60-cycle engine generator sets. The equipment weighs approximately 4,000 pounds set up for operation. It is classified standard. It is used primarily for aircraft navigation, but a limited quantity has been issued to radio intelligence units.

Radio Set SCR–502–( ) is a crossed **U** type Adcock direction finder covering a frequency range of 1.5 to 30 mc and providing instantaneous indication of bearing. It is similar to SCR–291–( ) but has an additional antenna array to cover the increased frequency range. The equipment weighs approximately 5,000 pounds set up for operation. It is classified limited standard.

Two new radio direction finders have recently been standardized. **Loop Assembly AS–4( )/GR** is not a complete direction finder but an attachment which, when used with a receiver of proper frequency range, will provide a loop type direction finder affording left-right indication of bearing on a double "magic eye" tube. Frequency range of the equipment is 1.2 to 20.0 mc. In conjunction with Loop Antenna Kit AS–169( )/GR and a receiver of the proper frequency range, coverage is 0.075 to 20.0 mc. The equipment consists of four mechanically interchangeable 9-inch loops each covering part of the 1.2 to 20.0 mc frequency range, an omnidirectional antenna and a control box with azimuth scale. The loop covering the desired frequency range is mounted on the control box, which is connected to the receiver, and the equipment is then ready to function.

The equipment operates on the switched cardioid principle, the output of the omnidirectional antenna being alternately added to and subtracted from the output of the loop by an electronic switching unit in the control box. This produces alternate cardioid reception patterns 180° out of phase. A line through the intersection of these cardioids is the bearing line. The equipment operates from any 12-volt dc or 110-volt dc source, and weighs 80 pounds complete with carrying case and four loops.

Loop Antenna Kit AS–169( )/GR consists of 4 additional loops for AS–4( )/GR to cover the additional frequency range of 0.075 to 1.2 mc. The equipment weighs a total of approximately 20 pounds including carrying case. Loop Assembly AS–4( )/GR is substitute standard and Loop Antenna Kit AS–169( )/GR is standard.

Radio Set AN/CRD–2( ) which is a crossed **U** type Adcock direction finder providing instantaneous indication of bearing. It covers a frequency range of 0.54 to 30 mc. The set accomplishes the same object as Radio Set SCR–291–( ) and SCR–502–( ) by employing electronic means in place of mechanical rotation of the goniometer and indicator coils. The equipment weighs approximately 800 pounds set up for operation, not including shelter or power units. It requires approximately 450 watts of 110-volt, 60-cycle power. It is classified standard but no sets have been manufactured to date. It is intended as a replacement for Radio Set SCR–255–( ) and SCR–551–( ) and a substitute for Radio Set SCR–502–( ).

Both of these new equipments are expected to be ready for issue by the middle of 1945.

COMMUNICATIONS IN PARIS

Signal Center, Telephone and Radio Provided Shortly After City Was Liberated

ALTHOUGH PARIS had not been the scene of any great battle, the fighting that had taken place in the city between the French Forces of the Interior and German troops—plus the fact that the Germans had been in the city for 4 years and had, with usual Teutonic efficiency, destroyed what they could not carry away—left communication facilities in a highly disorganized state. Added to this was the job of imposing Allied military channels on existing circuits, and a problem of first magnitude had to be licked.

Allied military communications for the city of Paris was quickly organized into three major sections. This included a signal center section, a telephone section, and a radio section. The signal center included cryptography, message center, and teletype operations. The telephone section consisted of toll, local, and orders, with a special group for liaison with the French Poste Telephone et Telegraph Company. This organization formed the signal section of Headquarters Communication Zone (Forward).

Signal Center

An entire wing of 1 building, consisting of 10 rooms, was set aside for the signal center. Rooms were divided among message center, overseas, land lines, teletype, radio operation, manual radio, Boehme and teletype, and radio maintenance.

The largest room was 20 x 10 feet and inadequate space tended to bog down operations. Also lack of communication channels put the burden of clearing traffic on the GHQ messenger service and the Air Delivery Letter Service for both incoming and outgoing traffic. Messages came in via courier in batches of 150 to 200 at a time. At no time was there a steady flow of traffic.

Limited facilities, lack of personnel, and lack of equipment, especially teletype and cryptography at the start, caused a delay in the handling of the traffic. However, additional personnel and equipment that were added to the signal center facilities did not help toward making an efficient production line for the processing of messages. This was due to cramped space and bad room lay-out. A traffic peak of 1,500 messages a day was handled and approximately 120,000 code groups were put through at one time. Traffic to WAR was patched through London for direct transmission to the U. S.

Telephone

Early in September an advance group of the telephone section, consisting of 1 officer and 22 enlisted men, undertook the task of providing telephone service for Headquarters, Communication Zone, in Paris. Facilities in the headquarters building consisted of an automatic telephone plant equipped to handle 1,300 extension lines with an associated 12-position switchboard relay. From this central plant radiated underground cable terminations in about 20 other buildings in the vicinity.

Certain problems arose immediately, even though most of the plant was relatively undamaged. The switchboard and automatic equipment were of German manufacture and were quite different from anything that had been encountered in the U. S. or in the Army. Most of the designations strips multiple cards, etc., had been destroyed. Those that had been left had been scattered about along with a few circuit diagrams and circuit descriptions. These of course were all in German and especially trained interpreters had to be secured to translate the technical German.

In view of this lack of information it was necessary to buzz out leads, to trace cables, to make up new multiple charts, to learn German circuits and terms and methods, to experiment and gradually to bring a semblance of order into the disordered system.

This original force was augmented the first week by one additional officer and several non-coms, with considerable commercial telephone background. The work of rehabilitation went forward rapidly.

In addition to the operation of the plant, installation of actual instruments was also required. Originally 3 installers had begun work at the headquarters building, but these three were soon increased to 10 after the first week. A separate force of 60 installers was provided for all other jobs.

At the end of the third week about 1,200 telephones had been installed outside the main building. The total telephones connected directly to the headquarters building switchboard approximated, however, 1,300 since a number of extensions required at least 1 bridged telephone. These figures do not include telephones connected directly to the Paris exchange or to subsidiary switchboards. Nine complete switchboards were installed, in some cases having to be completely rebuilt. Consuming time and slowing down completions of installations were cable runs and removals.

A number of unusual features complicated the operation of the associated manual switchboard. Designations were all in German. The operator could talk on only one end of a cord pair at a time and never to both parties. Monitoring was accomplished by pushing a special button. At first a tone was also applied to the circuit when this was done, but this was soon removed. Listening and ringing operations were accomplished by a unique manipulation of associated keys. An idle test was provided instead of busy signal. When the tip of the calling cord was connected to the jack sleeve, a green pilot lamp and an audible tone in the operators telephone circuit was brought in. The associated listening key, of course, had to be operated.

In most other respects the switchboard was similar to a normal dial PBX operation. Multiple arrangement of trunk and tie line jacks, however, was not entirely adequate for use as a combined local and toll switching center. This naturally reflected in the quality of service. Operating personnel, which gradually grew to a total of 68 men, adapted themselves to the new types of equipment and techniques and were soon able to operate 9 other switchboards in addition to the headquarters board.

The first directory was published on the morning of 4 September. It consisted of 1 page and had 36 listings. In about 2 weeks a directory section was established and on 20 September it published a 37-page directory.

Long distance facilities were provided by the French PTT company. By the end of September, 28 positions on the Paris military switchboard were allotted by the French for Communication Zone use. Into this board were brought 43 trunks from the Communication Zone local board, 15 other Paris trunks and 141 long distance trunk lines from switching centers throughout France.

Operations through the French PTT were slowed down at first until phrases and lists of technical terms were set up and issued to French civilian employees. Lack of sufficient French personnel also slowed down the handling of American Army demands. Some duplication of contracts and contradictory and duplicating orders ensued at the beginning until liaison officers were appointed to coordinate American Army contacts. Damage done by enemy action required in many cases large repair jobs before orders could be completed. With a reorganization of PTT procedures for handling Army work a 75 percent increase in efficiency occurred.

Radio Relay

One of the first radio relay circuits was from Communication Zone (Forward) to Communication Zone (Rear). Operation at first was unsatisfactory due to failing signals at two relay stations. Lines were connected to the switchboard on 10 September but because of the faulty relay signals, teletype operation was intermittent. A new circuit replaced the original circuit and proved to be more satisfactory. Power was supplied from PE-75s.

A second circuit was operated from Communication Zone (Forward) to ASCZ. Teletype was cut in and proved to be satisfactory. A third circuit, Communication Zone to London, consisted of four teletype channels. This circuit also served as a teletype conference circuit to Washington.

Some trouble was experienced due to radio interference and fading signals, and also by voice channel ringing failures. This latter was caused by the type ringer putting out 60-cycle current. This was corrected by using a sub-cycle ringer. Commercial power proved unsatisfactory, voltage surges blowing out rectifier tubes. Operation was accomplished with a PE-95 as a source of power.

Radio

The two major difficulties in setting up radio communications was that of power and keying lines to antennas. Portable power units solved the first problem. Original keying lines had been destroyed by the FFI. However, with the cooperation of the French PTT, two pair of wires enable two manual circuits, one to SHAEF and the other to Communication Zone, to be set up. German wire was used on top of the headquarters building and

captured receivers were used for reception. Several German 1-kw transmitters were located and were also used for transmission.

A point-to-point circuit to London was the third circuit to be put into operation. Boehme equipment was used to produce a high speed operation. However, when this equipment was received it was found to be damaged and 24 hours of work was required to put the equipment back in operating condition. For the first few days, only one frequency was available with which to work the London-Paris circuit. However, additional frequencies were subsequently authorized and contact was maintained on a continuous basis thereafter.

BATTLE OF THE HEDGEROWS

The following is extracted from a Military Intelligence Service report of an interview with a member of an infantry unit who recently returned to the States. This soldier's unit was about 12 miles north of Cherbourg, France.

HEADQUARTERS COMPANY'S communications were divided into a radio section and a telephone section. In setting up telephone connections within the — Battalion, with the Division and between the OP and CP, No. 10 small, double wire of black color was used at all times. From four to five Telephones EE–8A were operated through each switchboard, which was usually set up as near the CP as possible. The switchboard, drop-leaf portable type, was frequently set up in a wine cellar and when so situated was well protected. The wire was laid both by day and by night, and wherever possible was thrown into and along the hedges at the side of the road. At points where it was necessary to string the wire across the road it was fixed to trees, or where there were no trees at the point of crossing, telephone poles were used. Wire was frequently broken by shell fire, tanks, and other heavy motor vehicles.

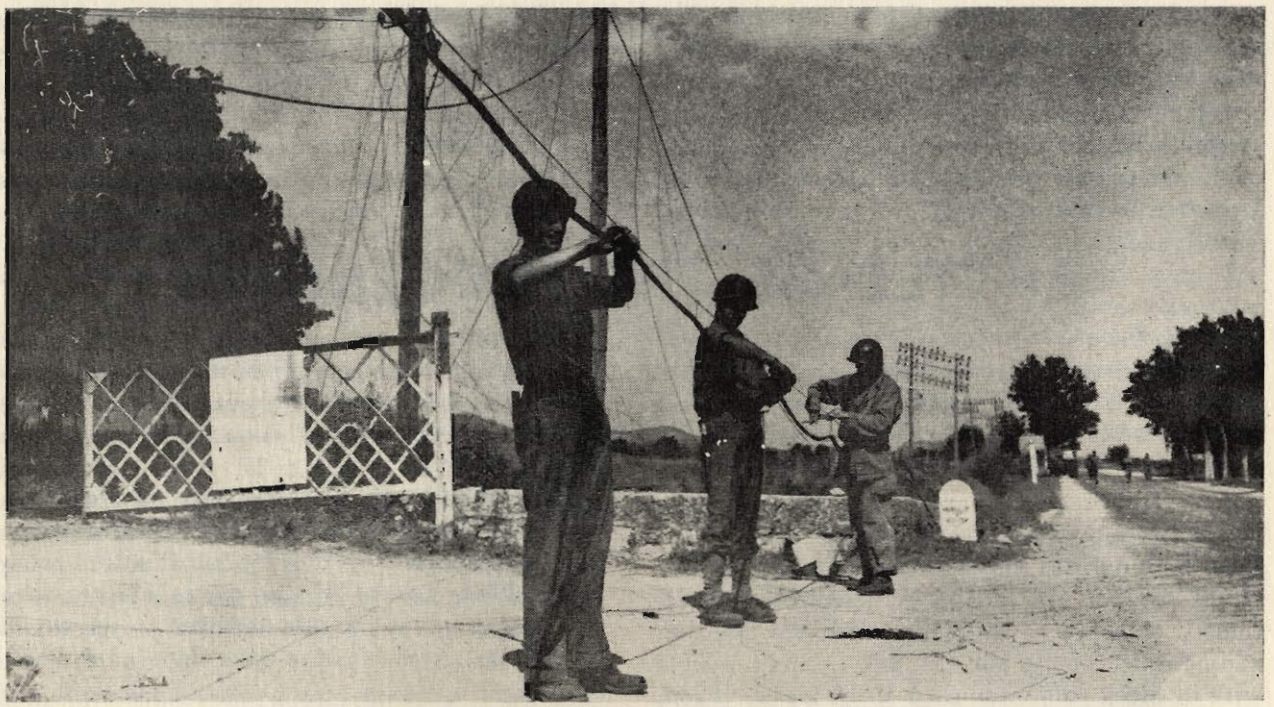
A jeep was frequently used in laying the wire. The jeeps which were so used had a reel mount installed on the rear. A .30 caliber machine gun was also mounted on the jeep. When laying wire by use of such a jeep in territories where snipers were likely to be encountered, the five-man wire crew was generally employed as follows: two of the crew, armed with M–1 rifles, would proceed on foot at some distance ahead of the jeep, the distance ahead being governed by the terrain and vegetation; one of the crew would drive the jeep while another manned the machine gun; the fifth member of the crew followed behind the jeep at varying distances for the purpose of throwing or placing the wire along and upon hedges and at places in the ditch alongside of the road. Reels DR–4 were used, and were usually discarded when and where the wire ran off; however, from two to three reels were generally kept on hand in case there was need for a reel in taking up wire when moving forward.

Most of the wire that was laid was taken up when the company moved forward; however, when there was any likelihood of the battalion following being able to use the wire as it was laid, the wire was tagged by the use of a tag upon which would be written * * *, the color code of the battalion.

Four linemen were usually available, which permitted two to sleep while the other two were laying line or making any necessary repairs.

It was considered that the TL leather scabbard containing wire cutting pliers and a pocket knife was adequate in the way of individual equipment. Pole climbers were not carried, as the trees were small and easily climbed without the aid of climbers.

STRINGING WIRE ALONG THE HEDGEROWS OF NORMANDY.



SEVENTH ARMY SIGNAL MEN SETTING UP SPIRAL-FOUR CABLE ON MESSENGER IN THE BRIGNOLES AREA OF SOUTHERN FRANCE.

SEVENTH ARMY SIGNALS

Although Short on Personnel and Equipment, Communications Kept Up With the Advance

THE RAPID advance northward of the United States Seventh Army, covering over 400 miles in 30 days, placed a tremendous burden on available Signal troops. Most of the necessary Signal troops had been phased late to provide for large numbers of combat troops in the early lifts. Except for beach signal companies (special), only part of a signal battalion was available until D plus 12 to Army for tactical communications. Only one signal battalion and one construction battalion were available to provide communication to the airborne task forces, to rear echelon, to the beach control group, to Continental Base Section, to French Army B, and to the fast moving VI Corps advancing north. Signal supplies disappeared to forward units as fast as they were unloaded at the three beaches. Owing to lack of trucks, signal supply to forward units was still critical at D plus 35 and remained so until railroads took over some of the transportation burden. The arrival of Continental Base Section and Headquarters, Sixth Army Group, neither fully equipped nor prepared to take over their responsibilities, was another burden placed upon the shoulders of Seventh Army supply and communications personnel. However, critical situations have been met and will continue to be overcome by personnel of Seventh Army signal service as long as is necessary to do the job.

Spiral-four was invaluable in installing long lines rapidly, although the connectors still ground out. However, Seventh Army Headquarters was never out of wire communications with VI Corps. The T/O for signal battalion, army type, on which this battalion is organized, more than proved itself in this operation. In the early stages, when no other construction units were ashore, and frequent displacement of command posts for long distances were normal, the battalion functioned as planned, even though handicapped by not having all vehicles and personnel ashore, and by the necessity for hauling signal supplies from the beaches. The T/O proved to be adequate, and well balanced.

Attachment of a special service force to the airborne task force created in effect a provisional di-

vision employed as infantry. The — Signal Company, Airborne, had to function as a division signal company for this force, and was not equipped for such service either in vehicles, personnel, or equipment. A readily available source of Signal Corps personnel for such emergencies should be provided as it is for other arms.

Casualties in signal units were light and did not impair functioning of any unit.

Each signal unit phased in the early lifts should have all personnel, equipment, and vehicles phased in the same lift. Some vital signal units were on four different ships with consequent delay in assembly on the beach.

A certain percentage of rail and truck transportation should be allocated for shipping signal supplies from the beaches to the forward dumps. Failure to do so places the burden of transporting signal supplies from the beaches on the organic vehicles of signal units and reduces the effectiveness of those units on their normal assignments. Signal equipment functioned without fault during the initial landing phases. No losses due to faulty waterproofing occurred. Signal supplies arrived on time and in sufficient quantities on the beaches.

Last minute changes in plans before embarkation should be avoided. It was necessary at the last minute to fly radio sets to depots for frequency changes. Spiral four and carrier have been very satisfactory but the cable must be placed in the air on messenger. L–5 messenger airplanes proved invaluable. These planes were also used very successfully for open wire reconnaissance. We found no deficiencies in communications, and have received no criticisms or complaints on our communications system. From forward to rear, the only request we heard was "Keep the wire and batteries coming," which was done, apparently resulting in satisfactory service throughout the command.

AN SCR–300 FURNISHES BEACH COMMUNICATIONS ON D-DAY.

RED BALL EXPRESS

COMMUNICATIONS ON the famous Red Ball Express highway was furnished by a six-station radio net, using Radio Set SCR–399–( ), according to a report received recently from ETO. The net enabled the motor transport brigade in charge of convoy movements along this 200-mile speedway to control traffic and to be kept advised of conditions all along the route.

The Red Ball Express highway was a giant loop that feed one-way traffic to the front lines and sent empty trucks back to Normandy for more cargo. Lack of railroad facilities in France made formation of this trucking system necessary.

The radio communications system went into operation late in August 1944. Net Control Station was at headquarters of the motor transport brigade and averaged from 2,000 to 5,000 groups per day. A peak of 5,873 groups for 1 day was reached early in the system's operation.

When a convoy departed from the western terminus of the route, a message was forwarded to all stations along the highway as to the makeup of the convoy, its destination, and instructions for handling. Stations along the route kept the motor transport brigade, through the NCS, advised as to progress of convoys, calls for repair trucks, break-downs, relief of personnel, etc.

In addition to the radio net, the motor transport brigade had four trunk circuits connected to the military switchboard in Paris. Communications between ADSEC headquarters and motor transport brigade headquarters was also maintained by GHQ trunk messenger service.

BUILDING WITH BULLDOZERS

THE CHIEF Signal Officer, on returning from a trip through the Pacific areas, directed that a Signal Corps team be organized for use with signal construction units to clear a path through the jungle, level sites, and perform other jobs, requiring the use of a bulldozer. Thus, the Right of Way Construction Team was originated. The team is incorporated in T/O & E 11–500, Signal Service Organization, dated 22 September 1944, as Team "HE" and consists of two men, construction machine operators, equipped with a D–7 Bulldozer, also a 6-ton prime mover and a 20-ton semi-trailer, to make the unit sufficiently mobile that it can be quickly moved from one location to another.

This team was informally approved by the War Department General Staff in April 1944. Immediately men were put in training and equipment was assembled for their use. Pacific Theater commanders were queried as to their requirements and a flood of demands for this type of unit came pouring in.

It has been apparent for some time that the existing methods of using an earth auger mounted on a truck was not satisfactory to meet all requirements. The truck was continually getting bogged down in soft ground or breaking down, due to the rough usage and nature of the terrain in which it had to operate. The solution was obvious; mount the earth auger on a tractor. A modification kit was made up and the standard skidmounted gasoline engine driven earth auger mounted on the rear of a D–7 Bulldozer. The result is a highly efficient unit which can clear and level a site, dig a 20-inch hole and set a 45-foot class 1 pole. Further, the tractor can be easily loaded on its trailer and quickly moved from one job to another.

The "HE" Team is intended primarily for use with the heavy construction company and is listed in the "Remarks" column of T/O & E 11–67, Change 2, with the note that the construction company may be augmented by a Right of Way Construction Team when approved by the War Department.

"HE" Teams have already started to flow overseas and, as their full usefulness is demonstrated, it is expected the demand for this team will be even greater.

IN TRAVELING POSITION, THIS TRACTOR-MOUNTED EARTH AUGER IS JUST ABOUT TO BE PUT INTO OPERATION BY THE OPERATOR.

SELECTION OF INDICATORS

Code Clerks Must Select Indicators at Random, Not by Word Choices or Mechanical Patterns

THERE ARE always new ways of doing something wrong. In cryptography this truth may be applied to many procedures, particularly the selection of message indicators.

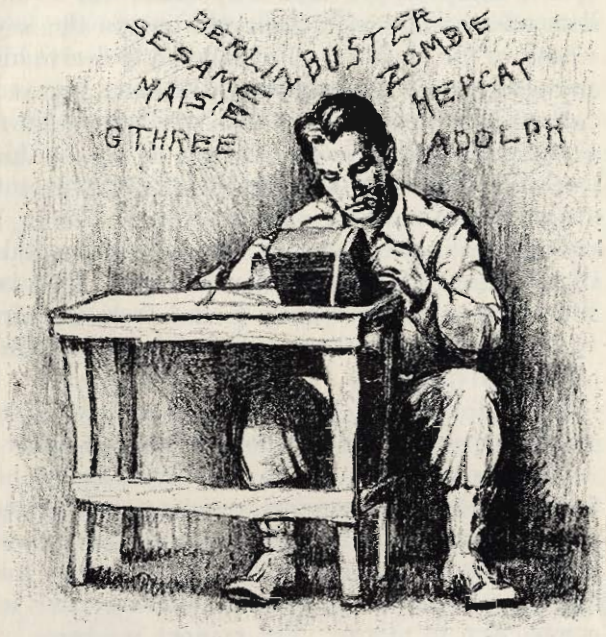
One of the most important protective measures taken to preserve the security of U. S. Army cryptographic systems is the selection of message indicators at random. For example, systems employing the Converter M–209–( ) are decidedly insecure when indicators are improperly chosen; when indicators are chosen at random and then enciphered, M–209–( ) systems present great difficulties to enemy cryptanalysts. The examples given in the following discussion will refer specifically to M–209–( ) indicators, but the same general principles apply to the selection of indicators used with other types of systems.

Unless closely supervised, code clerks tend to make two types of mistakes with indicators. They choose words like BERLIN, MAISIE, or GTHREE for their indicators. They use some mechanical method of selecting indicators which produces nonrandom groups. The fact that a group of letters cannot be found in the dictionary or even pronounced is no test of whether or not it is random.

Use of the same indicator more than once for M–209–( ) messages permits those messages to be broken easily, and subjects the entire system to compromise. If indicators are not chosen at random, repetitions are inevitable. The man who chooses MAISIE supposes that he is alone in his choice. Actually there may be several code clerks who are also partial to Maisie and equally inclined to choose her name.

This type of mechanical selection which produces a nonrandom indicator is worthless. The following errors, repeated many times in combat by one of our armored divisions, show that it is necessary to choose random indicators consciously, and not take them for granted.

Code clerk Jones enciphers a message on his M–209–( ). Code clerk Smith, at the receiving headquarters, finds the internal indicator, sets the letter counter at zero, sets up the initial alignment of key wheels, and deciphers the message. An



hour later Smith receives a plain-text message to be enciphered. He turns the letter counter back to zero (automatically returning the wheels to the alignment used as the internal indicator for the first message), and uses that alignment as the external indicator for the second message.

When enemy cryptanalysts discover that a code clerk at a particular headquarters makes a practice of turning his M–209–( ) back to zero and using the alignment of letters that appears for his external indicator, they will concentrate their efforts on solution of traffic from that headquarters.

Now suppose, as sometimes happens, that code clerk Jones also turns his letter counter back to zero to get the indicator for his next message. If Jones happens to choose the same system indicator letter that Smith chose, Jones' second message is in depth with Smith's message; that is both messages have been enciphered with the same key sequence. Solution of the two messages is an easy matter. When the results of this solution are applied to Jones' first message, the cryptanalysts will have a much easier job in constructing the daily key.

As a precaution against making this sort of

error, it is advisable to move the key wheels after deciphering a message as well as before enciphering one.

Yet some mechanical method of selecting indicators is desirable, provided it operates with a random effect. The code clerk who moves the key wheels of his M–209–( ) at random to derive his indicator gets a much greater difference between various indicators than the man who writes down a six-letter group and then sets it up on his machine. Although there are 101,405,850 different six-letter combinations which can be M–209–( ) message indicators, selection from these possibilities is affected by the personal element. That is, when letters are supposedly picked from the air, more often than not they are picked from the mind of the individual.

The fallibility of impartial personal selection will be apparent to those who make the test below:

Record on separate pieces of paper 20 groups of 6 letters selected at random, covering each group as it is written. When all 20 groups have been selected, examine the complete list, and note the frequency with which certain letters appear in comparison to others. The evident weakness of the human element suggests the use of a mechanical method.

Moving the key wheels separately at random is one such method. If the wheels are turned a definite number of times, or in pattern, or if an alignment found on the machine is used, the selection is not random.

Another good method is to mark slips of paper with the individual letters of the alphabet and select the indicator by drawing the slips from a box. Each slip should be replaced in the box before the next one is drawn, or those combinations in which letters are repeated will become impossible, reducing the random element to an important degree.

Sometimes such methods as these will result in a bona fide word or a combination such as ABCDEF. If such an indicator is derived purely by chance, there is no reason why it should not be used.

In any type of selection care must be taken that all letters of the indicator are changed completely for each section of a multi-part message. If this is not done, a comparison of the indicators may furnish enough information for the enemy to solve the message.

TRAFFIC INFORMATION

THE SUMMARY BELOW INDICATES THE VOLUME OF TRAFFIC HANDLED AT AN ALLIED HEADQUARTERS SIGNAL CENTER DURING THE MONTH OF AUGUST 1944

SUMMARY OF TRAFFIC HANDLED (EXCLUDING MOTOR DISPATCH LETTER SERVICE TRAFFIC)

	Sent		Received		Total		Daily average	
	Messages	Groups	Messages	Groups	Messages	Groups	Messages	Groups
Radio	31, 227	4, 962, 822	33, 807	4, 391, 235	65, 034	9, 354, 087	2, 097	301, 744
Teletype	26, 250	3, 645, 269	26, 987	3, 268, 678	53, 237	6, 913, 947	1, 717	223, 030
A. D. L. S	805	123, 067	1, 152	49, 293	1, 957	172, 360	63	5, 560
Total	58, 282	8, 731, 158	61, 946	7, 709, 206	120, 228	16, 440, 394	3, 877	530, 334

URGENTS AND OPERATIONAL PRIORITIES TRAFFIC HANDLED

Sent		Received		Relay	
Messages	Groups	Messages	Groups	Messages	Groups
Percent 8	*Percent* 7	*Percent* 31	*Percent* 32	*Percent* 23	*Percent* 40

DISTRIBUTION OF TRAFFIC IN PERCENT PER 8-HOUR SHIFT

Shift	0001-0800	0800-1700	1700-2400
Incoming	26%	39%	35%
Outgoing	1%	46%	53%

SUMMARY OF CIPHER TRAFFIC HANDLED

	Enciphered groups	Deciphered groups	Total groups	Daily average
U. S. Cipher	683, 002	1, 798, 126	2, 481, 128	80, 036
Br. Cipher	960, 677	1, 329, 542	2, 290, 219	73, 877

AIR AND MOTOR DISPATCH LETTER SERVICE MILEAGE

	Total	Daily average
Motor miles	40, 143	1, 295
Air miles	347, 103	11, 261

SOUND RANGING SET GR–8–( )

Much Lighter Than the GR–3–C, It Records on Teledeltos Paper Instead of Photographically

LIGHTER, EASIER to operate, and more versatile, Sound Ranging Set GR–8–( ) has recently been standardized to replace all Sound Ranging Sets GR–3–C, which is now limited standard. The new set dispenses with photographic recording, and performs all the essential functions of the older item. It can be manpacked instead of requiring vehicular transportation. Procurement has recently been initiated for Sound Ranging Set GR–8–( ).

The recording equipment of GR–8 consists of two units, a Recorder BC–1337–( ) weighing 48 pounds, and a Plate Supply Timer PE–244–( ) weighing 37 pounds. The recording equipment of GR–3–C weighs 450 pounds. Recording in the GR–8 is accomplished by six moving-coil styli in contact with teledeltos paper. An electric current passing from each stylus through the paper leaves a fine, black trace, the wave shape of which corresponds to the electrical impulse received from the microphones.

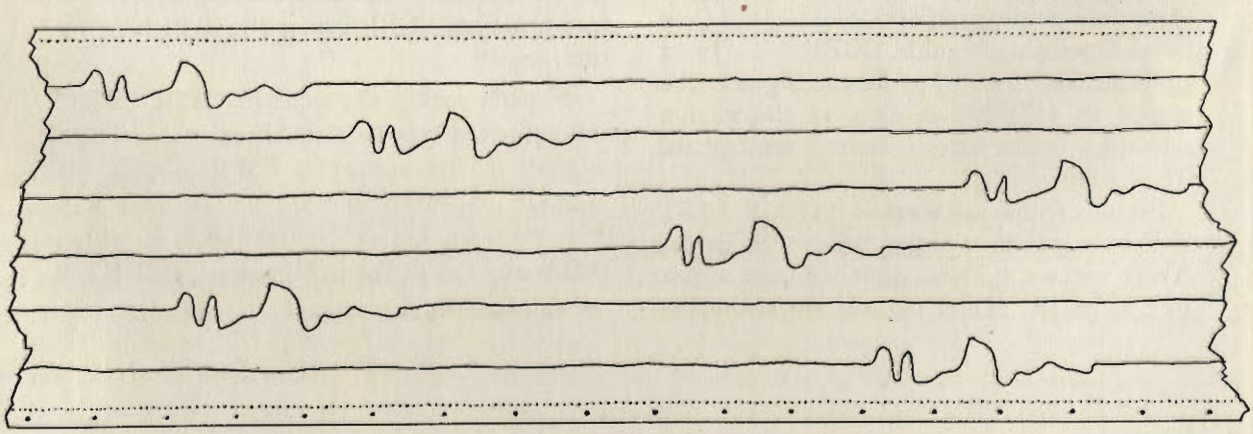
A maximum of six microphones is used with GR–8–( ), as compared with a maximum of eight used with GR–3–C. Microphone T–23, a 10-pound hot-wire microphone, capable of withstanding high temperature and humidity is under procurement to replace Microphone T–21–B, which weighs 25 pounds. Microphone T–23 has a frequency range of from 15 to 60 cycles, as compared with the 15 to 25-cycle range of T–21–B. This permits ranging upon enemy mortars, the muzzle blast of which is higher in frequency than that of other artillery weapons.

The components required for the maintenance of Sound Ranging Set GR–8–( ) will be from 30 percent to 40 percent fewer and will weigh less than those needed for the GR–3–C. No photographic equipment or expendable recording supplies, other than teledeltos paper need be provided. About 250 pounds of photographic supplies were needed for each three months' operation of the GR–3–C.

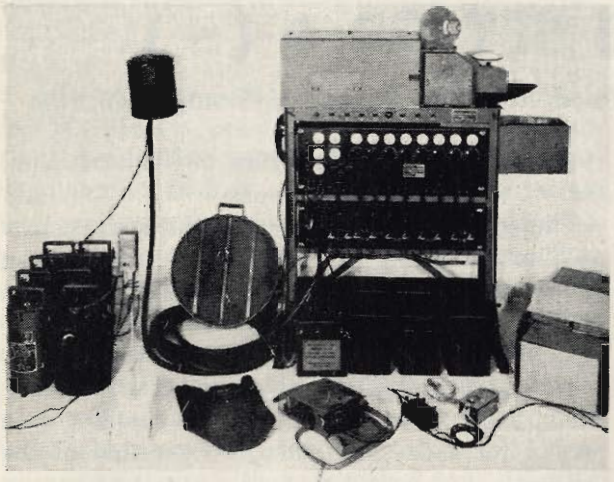
The issue of GR–8–( ) to replace GR–3–C in the field will be accomplished by issuing those components of GR–8–( ) which are not provided as part of GR–3–C. The two equipments already have many minor components in common.

Location of enemy guns by means of sound ranging is accomplished by recording the difference in the length of time required for the sound wave of the gun's muzzle blast to arrive at several microphones. The microphones are placed in various geometric configurations at intervals up to 2,000 yards apart.

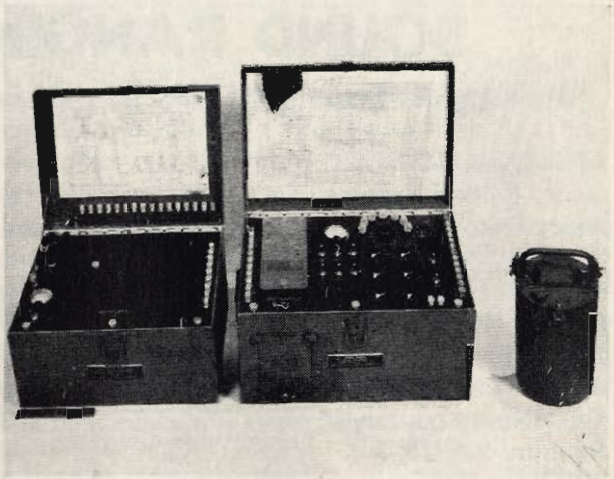
The sound signal detected by each microphone is locally amplified, then transmitted over wire lines to a central station, where a permanent visible recording is made. The record reveals identifying characteristics of the sound waves, and indicates the differences in times of arrival of the same sound at the different microphones.



TELEDELTOS RECORDING OF GR–8 TIME IMPULSES RECEIVED FROM MICROPHONES LOOK LIKE THE ABOVE REPRESENTATION.



COMPLETE ASSEMBLY OF SOUND RANGING SET GR–3–C.



THE THREE-UNIT SOUND RANGING SET GR–8–( )

Utilizing an estimated velocity of sound, based upon atmospheric conditions, the recorded difference in the times of arrival of a sound wave at any two microphones will permit the determination of an azimuth to the sound source. The use of four or more microphones (six in the case of Sound Ranging Set GR–8–( )) will provide several azimuths which, by triangulation, indicate the location of the sound source with sufficient accuracy to permit effective counter-battery fire. Further information on sound ranging may be found in FM–6–120, Field Artillery Field Manual (The Observation Battalion). A Technical Manual on Sound Ranging Set GR–8–(D) is being prepared. Sound Ranging Set GR–3–C is described in TM 11–444.

COMBINED PROCEDURES

SCTIL No. 35, October 1944, carried an article "Combined Procedures" in which an explanation was given of the contents of Combined Operating Signals, CCBP 2–2. In explaining the uses of different signals contained in CCBP 2–2, two of the various markings in the notes column were omitted. They were:

Signals which are marked "ARMY (BR)" in the notes column also appear in the British Army extract. These signals do not appear in FM 24–12. These signals are authorized for use between any two stations, US or British, each of which holds any one of the publications, CCBP 2–2 or the British Army extract.

Signals which are marked "AIR (BR)" also appear in the British Air extract. These signals do not appear in FM 24–13. These signals are authorized for use between any two stations, US or British, each of which holds any one of the publications, CCBP 2–2 or the British Air extract.

REHABILITATING RR CIRCUITS

A Section Car Helps Troubleshoot Wire Lines Along A Railroad Right of Way

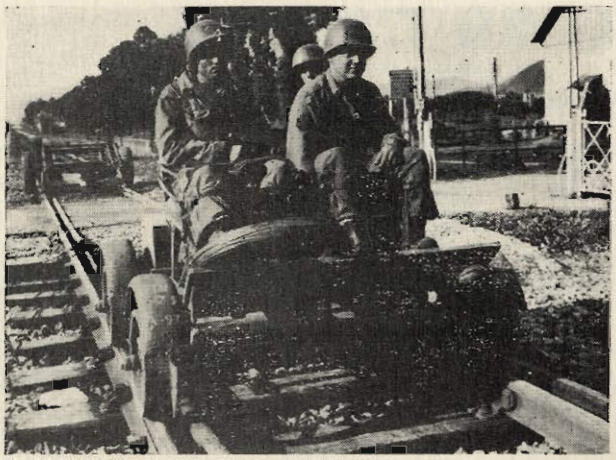
WHEN THE VI Corps signal plan for the invasion of Southern France was drawn, it was decided that much use could be made of existing open wire circuits. Study of intelligence reports showed that a good wire system existed and that the major long distance circuits tended to follow the railroads, often at quite a distance from any roads. It was apparent that some sort of a power-driven vehicle similar to the American section car would be valuable, and all men were instructed to be alert for such equipment.

The first few weeks following the landing were unfruitful in locating such equipment and many long hours were spent in walking lines or in jouncing over the ties in ¼-ton jeeps. However, perseverence was finally rewarded by the discovery of a German section car in good condition and the initiative of the American soldier was again in evidence. Some means of transporting the car from job to job was required and after a few hours of further hunting, enough equipment was gathered to make a very practical trailer. The trailer was built with improvised ramp rails so that the section car could be driven from the trailer onto the railroad tracks or vice versa, reducing considerably the number of men required in handling.

It was found that three or four men could now cover the territory that previously required an entire section or more on foot. The regular construction teams would arrange definite meeting points along the line where roads paralleled or crossed the tracks and the reconnaissance team on the section car would then travel the entire length of the circuits to be repaired, stopping only long enough to make minor repairs, or note data on location and extent of major breaks. The larger jobs were reported to the regular teams at the rendezvous points and men and equipment were dispatched to repair the damage. If a considerable amount was to be done on a remote section, the rail car was used to carry personnel and material to that point.

It was also found that the car could be used to good advantage in laying S–4 cable or Wire W–143 to span long breaks, as the Corps signal troops did not have time to reconstruct such sections and still keep up with the rapidly moving situation. A Reel RL–31 was mounted on the rear of the car and there was sufficient room for two or three extra drums of wire or cable. Since there were few

MOUNTED ON A TRAILER AND TOWED BY A SIGNAL BATTALION TRUCK THE GERMAN SECTION CAR IS TRANSPORTED EASILY.



ON THE LEFT, THE 3-MAN CREW STARTS OUT; ON THE RIGHT A SPOT REPAIR JOB IS TAKEN CARE OF ALONG THE ROUTE.

problems of traffic, overheads, crossings, etc., cable could be layed very rapidly.

It is felt that this equipment was invaluable in the construction and maintenance of the Corps wire system in the rapidly moving campaign in southern France.

SIGNAL INSTRUCTIONS

These Signal Instructions are from AFHQ.

ALLIED FORCE HEADQUARTERS
SIGNAL INSTRUCTIONS
Section X. *Miscellaneous*

Item 2: Procedure for Red Cross Messages.

1. Effective on the date of publication of this instruction, the following procedure will govern the transmission of American Red Cross messages through official Signal channels.

2. Under authority contained in AR 850–75, the American Red Cross will transmit messages for any United States officer or enlisted man who desires information relating to family matters of an urgent nature.

3. *The message must:* a. Relate solely to family or urgent business matters. b. Not exceed 25 plain English words. c. Include individual's first and last name, serial number, unit, and APO number. d. Include name and address within the continental limits of the United States for Red Cross to make delivery or inquiry. e. Not contain terms of endearment, congratulations, greetings, etc. f. Except as indicated in c, above, will not contain any reference to any unit, headquarters, or any location in the command. g. Be approved, censored, and authenticated by the writer's immediate commanding officer, who will indicate these actions over his signature on the message.

4. *One of the following systems will be used:* a. The individual may contact the nearest Red Cross representative who will obtain the necessary facts and transmit them by most expeditious means to the nearest Red Cross Regional Office. b. When no Red Cross representative is available, the organization commander will transmit facts to the nearest Red Cross Regional Office. c. Any United States officer or enlisted man may file a message in duplicate at any Army message center addressed to the American Red Cross (AMCROSS). Message centers will transmit such messages to the nearest Red Cross Regional Office.

5. The Red Cross will transmit information received in answer to inquiries by most expeditious means to the individual concerned.

6. The Red Cross will refuse to accept or forward messages which do not conform to the requirements of paragraph 3, above.

7. *Procedure for handling AMCROSS traffic:*

a. Sealed envelope addressed to AMCROSS. (1) It will normally be transmitted by next scheduled motor or airplane messenger to the nearest American Red Cross Regional Office. (2) It will show a return address of the unit filing the message, or the individual's name, serial number and APO address.

b. Messages filed in duplicate at a message center. (1) The original message normally will be handled as in paragraph 4a, or it may be transmitted in clear over Signal Corps wire telegraph channels available to the nearest Red Cross Regional Office. Precedence below all official traffic will be accorded these messages. The duplicate copy is retained and handled as in normal message center procedure.

8. The American Red Cross Regional Office will prepare a consolidated message, omitting unit designations, of approximately 1,00 words, in triplicate, on the regular message form for transmission to AMCROSS, Washington. The message will then be presented to the base censor for approval and after being censored will be filed at a message center for transmission. All three (3) copies will be given a message center number and filing time. The original will be routed via radio to WAR "in the clear" with the second copy handled as the message center file copy. The third copy will be returned to Red Cross for their file. (Reference number is optional.)

STANDARDIZATION PROGRAM

New Specification Details Requirements and Can Be Used to Ascertain Interchangeability

THE SIGNAL Corps program for standardizing electronic component parts and materials was placed under the official sponsorship of the Signal Corps Standards Agency, 1 January 1943. During the year that followed about a dozen parts and materials were standardized.

This program is fulfilling a definite need which existed years before the present war began. Even if only a few of those components, having the highest mortality rate and most widely used in Signal Corps equipments, had been standardized, the maintenance and supply of these equipments would have been greatly simplified.

Standardization of nomenclature and quality levels is bringing about a sharp reduction in the number of styles and sizes of components necessary to maintenance of signal equipment. Standards also establish a degree of interchangeability between different manufacturers' products that was not possible under the old system of individual manufacturers' type numbered parts.

To insure maximum effectiveness of standardization, the requirements of the Navy Bureau of Ships as well as the Signal Corps have been correlated with the capabilities of industry to meet these standards. This coordinated effort has made possible greatly increased production of known quality components through concentration on a reduced number of standard types.

The first standards approved for use by the Signal Corps were the American War Standard (AWS) specifications written in conjunction with the American Standards Association. These specifications are now being rewritten into Joint Army-Navy (JAN) form as rapidly as possible as are all new standardization projects.

It was felt, early in the program, that all possible steps should be taken to have equipment in current production converted to standards as soon as possible. To merely wait for them to be incorporated into new designs meant that our fighting forces would be deprived of the inherent advantages of standards until these new equipments finally came off the assembly lines. Also, such equipments would represent but a small percentage of equipment already in the field and using nonstandard components.

Early attempts at direct conversion of equipments met with little success. Equipment manufacturers pointed out that the necessary engineering personnel required, to study their equipments in current production, would place undue demands on an already strained manpower situation. Engineers would have to be taken from important development projects to the detriment of the over-all war effort. An even more important legal aspect also entered into the picture since the original equipment contracts called for the nonstandard manufacturer's type numbered components.

During this time, Philadelphia Signal Corps Procurement District was reviewing equipments associated with current contracts. Where panel type meters were used, the standard specification for meters was referenced in the bid request or contract. Capacitors and other standardized components were incorporated in the same manner. As more and more components became standardized this became a cumbersome job, not only to review each equipment but to keep up-to-date on the latest standards. To simplify the work of the procurement districts in the application of standards to current procurement, Philadelphia Signal Corps Procurement District recommended that the Signal Corps Standards Agency issue a Standard Application Bulletin which could be made an integral part of all bid requests and contracts.

The first issue of this bulletin was given the short title SA–1 and outlined the procedures to be followed by the manufacturer in changing-over from nonstandard parts to standard parts wherever possible. The burden of proof for the need of a nonstandard was placed upon the manufacturer of the equipment. As new standard specifications were adopted for Signal Corps use and as experience gained from actual application problems dictated, the bulletin was revised and reissued as SA–2, SA–3, etc.

Increased activity and a more widespread interest in the application of standards to Signal Corps equipment has indicated the desirability of changing the form of the bulletin into a specification covering the same general scope and purpose but greatly expanded in its detail requirements. Such

a specification has now been issued as "Signal Corps Tentative Specification 71–4902—Standard Parts and Materials—Requirements for Use in Signal Corps Equipment." The 36 standard specifications that have been written to date are listed in the annex to this specification which will be kept up-to-date by issuing a new annex as new standards are approved. This specification is expected to be far more effective in making the benefits of standardization directly available to the man in the field, than the Application Bulletins, as it can be referenced by the Laboratories in their general performance-requirement specifications for new equipments as well as by the procurement agencies for equipment previously designed with nonstandards. Standards to be effective must simplify the production and maintenance of the highest possible quality of equipment. The basic idea behind the Application Bulletins and Specification 71–4902 is only one of several means that have been adopted to get these standards working and to get the ball rolling.

CLAY DESICCANTS

DURING THE last 4 months, Army, Navy, and Air Force requirements for silica gel desiccants have pyramided. These increased requirements cannot be satisfied in their entirety by the use of silica gel as a desiccating agent inasmuch as accelerated production has not kept pace with requirements. Effective 1 November, complete allocation of silica gel to the different services took place. To partially alleviate the shortage of silica gel desiccant, investigations have been undertaken by the Signal Corps and the Ordnance Department toward using substitute dehydrating materials. The absorbtive property of certain clays has been known for some time; therefore, the first logical substitute materials to be tested were clays which have been used in oil refining work.

The greater proportion of clay type desiccants may be classified as belonging to or originating from the rock, bentonite. Bentonite is a rock that contains 75 percent or more of the crystalline clay-like minerals montmorillonite or beidellite. Bentonite deposits occur in beds from a few inches thick to many feet in thickness, mainly in the Tertiary, but in certain cases in the Paleozoic and Mesozoic, rocks of the United States and Canada. Other deposits have been reported in Mexico, China, and France. The belief as to the origin of bentonite is that it is the result of devitrification and partial decomposition of volcanic glass.

These clay materials, as they are mined, contain from 7 to 20 percent moisture content. Reduction of this moisture content may be effected in the same manner as with silica gel if the temperature is not increased above 700° Fahrenheit. Usual practice in reactivating silica gel is to maintain a temperature between 300° and 350° F. Temperature above 700° F., in all probability, would destroy the colloidal properties and absorption power of the clay. Careful heat control during reactivation will prevent this deterioration and allow the reuse of the material the same as silica gel. When bentonite is dispersed in water and agitated with more water a permanent suspension results, unless enough soluble electrolytes are present to prevent dispersion, in which case the soluble salts may be washed out by dialysis and the resulting residue suspended in water.

Investigation undertaken by the Ordnance Department and the Signal Corps has resulted in the approval of Attapulgus clay as a desiccant material in certain signal equipment. The use of other clays is being investigated and preliminary approval has been given to a product manufactured by the Filtrol Corporation. Preliminary tests on this product indicate that, on an average, the material will absorb water equally as well, volume per volume, as silica gel within the humidity ranges encountered. It is apparent that the use of this material will require a greater weight in comparison with silica gel but this greater weight will be offset by the greater density of clays over silica gel, ultimately resulting in an equal size bag of desiccant material.

Progressive approval of the use of different clays will relieve the present shortage of silica gel. The supply of different clays of the desiccant type is practically unlimited with respect to their use by the armed services as a dehydrating material.

COMMUNICATIONS AND SUPPLY

Some Thoughts on Wire Communications Requirements Based on Experiences in Italy

THIS ARTICLE deals with some of the problems encountered by signal and communication units during the Italian Campaign as reported in the Chief Signal Officer's Monthly Bulletin, Allied Force Headquarters, August 1944. This operation covered a distance of approximately 125 miles from the Minturno-Cassino sector to the Port of Civitavecchia.

In general, Signal Corps equipment and personnel provided for use by the Army are sufficient to provide a reasonable and adequate field communication system. In fluid situations caused by a rapid advance of combat elements, a wire network comparable to a commercial system is impracticable due to the time required for construction and the hazards of enemy action. An open wire line cannot be constructed as rapidly as an army must move. In anticipation of such situations, provisions of wire nets should be limited to an absolute minimum of heavy construction and the fullest utilization of radio, planes and motor messengers should be planned.

ITALIAN ROLL TRANSPOSITION

The "Italian Roll" method of transposing open wire circuits has proved very satisfactory in combining new construction with rehabilitated existing lines. This method employs four wires spaced equally both horizontally and vertically and forming a square when placed on the two crossarms or pole brackets. Each circuit uses diagonally opposite wires of the square and can be transposed as required by rotating the four wires through 90°. The frequency of transposition of the circuits depends upon the number of groups on the pole line.

The extensive use of spiral-four cable has assisted the Army in maintaining wire communication to corps under the most difficult conditions. Experience indicates that spiral-four cable seldom should be laid on the ground exposed to the hazards of tanks and other traffic, but should be suspended overhead on messenger wire or buried underground.

This report also covered lessons learned regarding signal supply in recent operations which included the preparation for the assault against the main enemy lines.

The preparation for the attack was in accordance with the normal supply plan with small supply depots being established in forward areas. An advance supply of field wire was stocked and concealed across a river in the French sector to provide initial emergency stocks in the event the bridges were destroyed. Signal supplies for the entire operation were anticipated and on hand or maintained in sufficient quantities to cover maintenance and battle losses.

SPIRAL-FOUR DEMANDS INCREASE

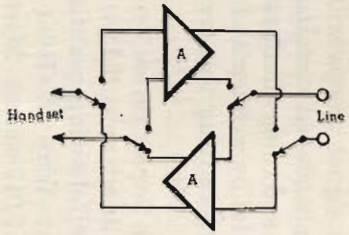
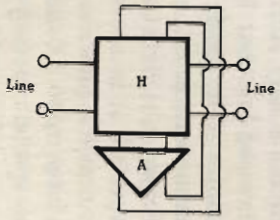
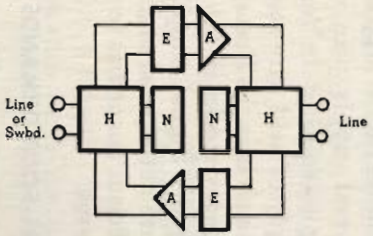
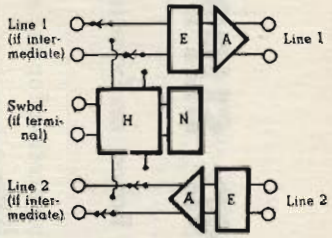
After the defensive positions were overrun and the pursuit of the enemy started, the demand for field wire decreased but that for spiral-four cable increased. Spiral-four cable was the primary means of communication as the corps and divisions advanced. Experience dictates that when a rapid pursuit is expected, it is necessary to have available on short notice a sufficient quantity of spiral-four cable to issue up to 200 miles per week to each corps. Unless special recovery teams are available, all wire and spiral-four cable must be issued from depot stocks during an operation of this type since generally no signal troops will be available for picking up abandoned circuits. Early recovery of field wire and cable eliminates further damage to this material by weather and vehicles as well as by civilians occupying the areas along the wire routes.

During the 7-week period reported for the estimated 125-mile advance, field wire and cable were issued in the following quantities: Wire W–110, 29,559 miles; Wire W–130–( ), 9,314 miles; Spiral-four, 1,047 miles. Most of the units had basic issues with them at the start of the operation which included about 600 miles of spiral-four cable in three signal battalions.

The above report indicates that reserve supplies of spiral-four cable and recovery teams for field wire and cable are necessary to insure adequate communication facilities during all phases of an offensive movement.

TACTICAL TELEPHONE REPEATERS—COMPARATIVE DATA CHART

15 NOVEMBER 1944

	Telephone TP-9	Telephone Repeater EE-89	Telephone Repeater TP-14	Telephone Repeater EE-99
Part of	End item	End item	End item	Telephone Repeater Set TC-29.
Classification	Standard	Standard	Standard	TC-29 is Limited Standard.
Type—Adaptation	"Push-to-talk"—Terminal only	2-wire (21 type)—Intermediate only	2-wire (22 type)—Terminal or intermediate	4-wire (44 type)—Terminal or intermediate.
Functional diagram and distinguishing features				
LEGEND A = Amplifier. H = Hybrid Coil. N = Balancing Network. E = Line Equalizer.	(Relay contacts shown in receive position.) Two amplifiers, no hybrid or bal. net., rec. amp. contains some equalization. Ganged switch (relay) controlled by butterfly switch on handset.	One amplifier, one hybrid without balancing network. Amplifier contains some equalization. (The two lines must balance the hybrid.)	Two amplifiers, two hybrids with balancing networks, two equalizers. Applicable to a wide variety of line facilities; also between unlike facilities.	(Switches shown in intermediate position.) Two amplifiers, one hybrid with*** balancing network, two equalizers. Manually switched for terminal or intermediate adaptation.
Dimensions in inches	10½ high; 11⅝ wide; 7¼ deep	8 high; 6 wide; 7 deep	8 high; 17½ wide, 11 deep	14 high x 12 wide x 8 deep.
Weight in pounds	25 (with batteries)	14½ (with battery)	46½ (no battery—See Note *)	40 (with PE-204); 47 (with batteries).
Maximum gain (1000-cycle)	60 db. (rec.), 23 db. (transmitting—fixed)	24 db	9 db. (terminal) or 18 db. (intermediate)	35 db. (intermediate).
Recommended repeater location (wire W-110-B).	Some benefit by use at one end only, but use at both ends is preferable.	Up to 18-mile line—center, 18- to 25-mile line—quarter points.	At both terminal and intermediate points; 5 mile spacing nominal. (See Note **).	At both terminal and intermediate points—10-mile spacing nominal.
Maximum range—wet weather (wire W-110-B).	35 miles (TP-9 at each end)	1 repeater—18 miles. 2 repeaters—25 miles.	(See Note ***.)	30 miles (unattended); 50 miles (semi-attended); 70 miles (fully attended).
Power source	Internal batteries only	Dry battery (internal or * external)	115/230 v. 50-60-cycle; or 12 v. wet battery	Dry batteries or * power supply PE-204.
Battery complement	1 BA-27, 1 BA-65, 3 BA-2	1 BA-40	External 12 v. or dry A and B batteries*	3 BA-23 and 4 BA-36 or PE-204 and 12 v. battery.
Battery life	1 week (continuous), 2 weeks (normal use)	2 weeks (continuous operation)	Nominal 1 week for external dry battery	1 week (continuous operation).
Tube complement	3 JAN3Q5GT	1 JAN3Q5GT	2 JAN6G6G	2 JAN3Q5GT and 2 JAN1LN5.
Lightning protection	None—provide where needed.	None—provide where needed	W. E. Co. No. 26 and No. 27 blocks	W. E. Co. No. 26 and No. 27 blocks.
Running spares	1 spare tube	1 spare tube	2 spare tubes and fuses; 1 spare vibrator	3 sets spare tubes furnished (TC-29).
Circuit facilities	1 telephone (Ckt. may be simplexed*)	1 telephone, 1 simplex (thru)**	1 telephone, 1 simplex (taps provided)	1 telephone, 2 simplex. (See Note **.)
Ringing	20-cycle (direct to line)	20-cycle (thru hybrid coil)	20-cycle (ring—thru repeat coil)	20-cycle (phantom ckt.) or V. F. ringing.
Adjustable controls	1 gain (rec.), 1 signaling (silent or bell**)	Single gain control (2 db. per step)	2 gain; 2 equalizer; 6 balancing network	2 gain; 2 equalizer; 2 circuit.
Monitoring	None (not applicable)	Built-in headphone	Built-in headphone	Use telephone EE-8-( ).
Level indication	Adjust rec. gain to suit operator	Monitor for "singing"	Monitor for "singing"	Neon lamp.
Housing	Cast aluminum immersionproof case	Plywood field case (alum. later ***)	Plywood field case	Plywood field case.
Technical manual	TM 11-2059	TM 11-2006	TM 11-2007	TM 11-348.
Signal Corps Stock No.	4B5500-9	4B3289 ( )	4B3250-14	4B3299 ( ).
NOTES	*Simplex coils are not provided. **Silent signal is nonpositional drop.	*An auxiliary battery cable is provided whereby an external source of 1.5 v. and 90 v. may be used in lieu of internal BA-40. **For simplex telegraph drop, add simplex coils externally. ***An immersionproof aluminum housing will be specified on all future procurement (EE-89-B).	*Not designed for internal batteries. Dry battery operation of this repeater is not considered of primary importance. **This repeater is not primarily designed for use on W-110-B, but is capable of application to 33 different line facilities. ***The maximum range obtainable on any facility will be determined by tolerable signal to noise ratio and circuit loss desired.	*PE-204 operates from external 12 v. storage battery and will fit in battery compartment in lieu of dry batteries. **If simplex circuits are employed for d. c. telegraph, V. F. ringing must be used on the telephone circuit. ***The balancing network is a fixed compromise to match the impedance of a terminating switchboard or telephone.

EQUIPMENT NOTES

GROUND SIGNAL

TEST SET TS–26/TSM

TEST SET TS–26/TSM (Stock No. 3F4325–26) is primarily a lineman's portable volt-ohmmeter. It is designed for use in detecting and locating grounds, crosses, shorts, and opens on telephone lines, and in measuring insulation and conductor resistance, and line and battery voltage. Provision is made for locating opens in lines by the "capacity kick" method. Telephone EE–8 may be used for signaling and talking in conjunction with this test set.

Test Set TS–26/TSM is classified as a standard item. Procurement has been made and deliveries are in progress. Future requirements for Weston Volt-ohmmeter Model 564 Type C (when used for wire communications), Test Set EE–65 and Cabinet BE–70–( ) will be supplied by procurement and issue of Test Set TS–26/TSM in accordance with T/O and E's, when stocks of the three separate items are not sufficient.

The test set is approximately 4″ x 7″ x 8″ in size and weighs about 5 pounds. A detailed description together with operation and maintenance information, circuit diagrams, and test interpretation charts, is published in Technical Manual TM 11–2017.

PORTABLE TEST SET FOR LINEMAN, THE TS–26/TSM.

Pending availability of Test Set TS–26/TSM, information relative to field improvisation and use of an equivalent test set was published in SCTIL No. 23, October 1943, under the title: Methods and New Equipment for Testing Wire Systems.

FACTORY SPLICES IN W–110–B

Due to the long lengths in which it is necessary to furnish field wire, manufacturers must splice conductors before insulating. These are known as "manufacturers' splices." Some difficulty has been encountered in the field due to some of these splices eventually opening. This situation has been aggravated by the absence of any visible indication of the location of such splices. Since it is obviously impractical to stop production machinery to permit examination of each splice by an inspector and since electrical tests immediately after manufacture indicate that all splices are satisfactory electrically, it has been necessary to investigate at considerable length various methods of reducing difficulties which might be encountered from this source.

The first step to improve this situation has been to develop splices which would be mechanically and electrically satisfactory even though the operator making the splice does not exercise a high degree of skill in soldering, and to incorporate the improved splicing procedure in specifications. In addition, statistical quality control methods have been introduced in order to improve the above situation.

In order to further reduce field difficulties resulting from manufacturers' splices, such splices in Wire W–110–B are now being marked for identification. The marking consists of red lacquer applied to the insulation of the finished wire. By this means, manufacturers' splices may be readily located by the user of the wire when tests indicate that a circuit is open and there is no other visible evidence of a broken wire or field-made splice. This marking, which is now required of all manufacturers of Wire W–110–B, has been employed by most of them since late in 1943. Due to the fact that wire manufactured without a marking may still be available for issue, lack of a red mark on Wire W–110–B does not necessarily

indicate that there are no manufacturers' splices in the conductor. Possibilities of applying this marking procedure to other types of wire are being investigated.

TS–10 CLIP TROUBLES

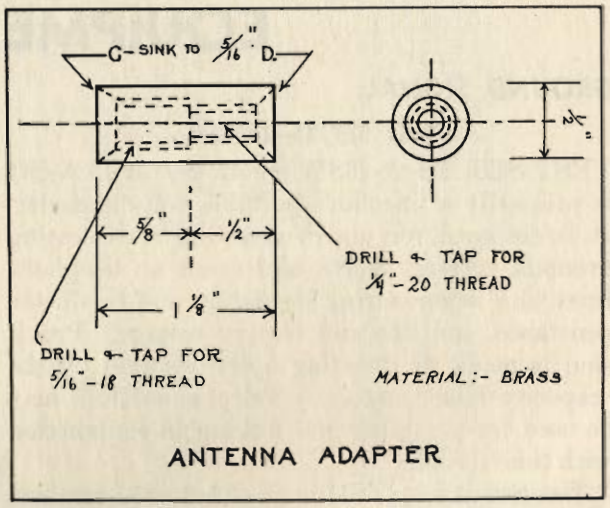
Field reports indicate a large percentage of clips of Handset TS–10–( ) become detached from the cord or that the insulation close to the clips becomes frayed resulting in the conductors shorting. This can be prevented by modifying the cord as follows:

1. Pry open clamps holding wire to the clips.
2. Remove the screws, nuts, flatwashers and lockwashers holding the conductor terminals to the clips.
3. Pry open the clamps holding the wire to the terminals.
4. Unsolder the terminals from the wire.
5. Cut a suitable length of transparent plastic tubing (Transflex), Stock No. 3G2300–1. 3, one for each lead.
6. Slip the tubing over each lead.
7. Solder the leads to the original terminals and crimp the terminals around the original insulation.
8. Mount the terminals to the clips using the original screws, flatwashers, lockwashers and nuts.
9. Slide the tubing as far as possible toward the terminals and fasten clamp around the tubing.
10. Apply a twine serving over part of the cordage and sleeves to alleviate strain on the tinsel conductors at the termination of the cordage. Apply a coat of moisture proof lacquer, if available, over the twine serving.
11. Check over-all performance of handset.

ANTENNA SUBSTITUTES

The following emergency methods are suggested by NATOUSA in the event that the antennas listed below are destroyed faster than they can be replaced through signal supply channels.

Antenna AN–45–( ). (Stock No. 2A245.) This antenna, if not available, may be replaced by Antennas AN–29, AN–29B, AN–30 and AN–30B. To effect this substitution an adapter must be used. This adapter consists of a coupling made of ½″ round brass stock 1⅛″ long, tapped for ¼″–20 standard thread on one end and 5/16–18 standard thread on the other end. This adapter can be easily fabricated by field units; see accompanying drawing. If no substitute antennas are available, 36′ of antenna Wire W–29 (Stock No. 1B29) can be used. This is sufficient to permit the improvisation of a 9′ and a 27′ antenna, either of which may be used as the situation permits. This wire may be fastened between the knurled nut and the square portion of the antenna terminal. In either case, the power amplifier plate air padding capacitor, accessible through the top cover of Radio Receiver and Transmitter BC–620–( ) (2C5360), should be returned for minimum deflection as shown on the meter on the front of the Radio Receiving Transmitter BC–620–( ) chassis.



ANTENNA ADAPTER

Antenna AN–75–( ). (Stock No. 2A275–75.) This is a telescopic antenna which contains nine sections and extends to a height of seven feet. It is used with the Radio Set SCR–593–( ) radio receiver. For emergency purposes, an 8′ length of either Wire W–126 (Stock No. 1B127) or Wire W–128 (Stock No. 1B128) may be used, the bare end of the wire being plugged into the center control of the antenna plug which is located on the right hand side of Radio Receiver BC–728–( ) (Stock No. 2C4728). When this type of antenna is used, it is necessary to retune the r-f tuning knobs (black No. 2), and the antenna tuning knobs (black No. 3), for maximum signal on the respective channels. Oscillator tuning knobs (brown No. 1) should not be touched.

It should be noted that for portable operation the lead-in on Antenna AN–75–( ) is used as a sling for carrying the Radio Set SCR–593–( ), the antenna being clamped to the radio receiver housing. If a wire antenna is used, carrying facilities will have to be improvised.

Antenna AN–130–( ). (Stock No. 2A275–130.) Antenna consists of two sections 33 inches in length when assembled and is used with Radio Set SCR–300–A.

Antenna AN–131–A is also designed for the SCR–300–A and may be used if available. For emergency purposes, a 10′ 8″ length of either No. 8 or No. 12 insulated wire will be used. This may

be supported on a light vertical pole, the base end of the wire fastening under a bolt screwed into the antenna terminal.

MAINTENANCE

FIELD REPORT DIGESTS

So that personnel in the field will know what is being done to improve equipment for which one or more failures have been reported, two new technical bulletins have been prepared. They will contain short reviews of the reported failures and the corrective actions taken to eliminate or lessen the failures, up to the time of publication. These bulletins will cover ground signal equipment and ground radar equipment. Titles and numbers are:

TB SIG 118—*Digest of Field Reports (on Signal Corps) for Ground Signal Equipment*

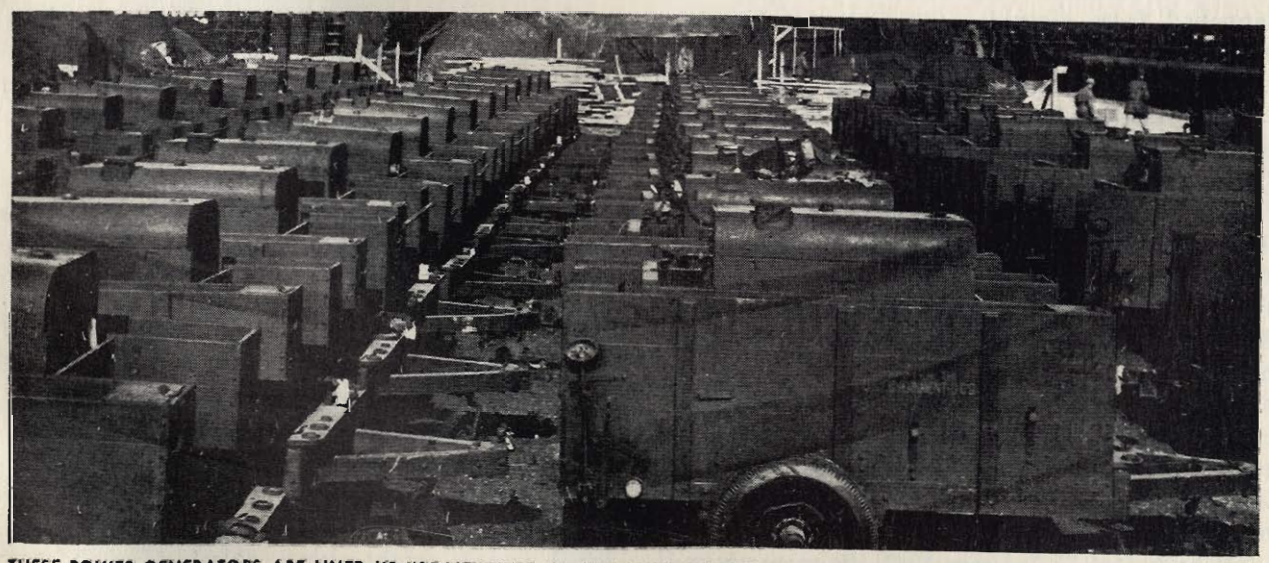
TB SIG 132—*Digest of Field Reports (on Signal Corps) for Ground Radar Equipment*

Samples of the type of information to be found in these bulletins follow:

Subject of Investigation	Corrective Action to Date
Detector Set SCR-625-( )	
Report from Philadelphia Signal Corps Procurement District that color coding of Search Coil C-446-( ) is not the same for all manufacturers. (1)	Technical Bulletin TB 11-1122-3 dated 27 July 1944, outlines precautions to be observed when installing new Search Coil C-446-( ).
Radio Set SCR-188-( )	
Engineering tests on production models of Rectifier RA-34-H reveal that Terminal Strip, reference No. 972, is inadequately moisture-proofed, resulting in arc-over between adjacent high voltage terminals.	Production modified to require impregnation of terminal strip 972 with Insul-X-95-T modification work order covering new tube clamps will include installation of ceramic high voltage bushings on terminal strip 972.
Radio Set SCR-284-( )	
Report from the field on unsatisfactory operation of early production models due to lack of dial locks. (2)	Dial locks were incorporated in production starting with serial number 17691. Modification work order in preparation.
Axle RL-27-( )	
Report from the field that groove in axle weakens it and causes breakage.	Axle has been redesigned for future procurements. No field modification possible. Broken axles may be repaired by welding.
Vulcanizing Equipment TE-54, TE-55-( )	
Employee's suggestion submitted for splicing gauge to be used with Vulcanizing Equipment TE-55-( ).	Applicable parts list to be revised to incorporate splicing gauges.

The first issue of TB SIG 118 is scheduled for publication about 15 December. TB SIG 132 will be out about 23 December. These two technical bulletins will be distributed through the usual Adjutant General channels. Succeeding issues will be identified as Change 1, Change 2, etc., to TB SIG 118 or TB SIG 132.

READY FOR THE TRIP ACROSS



THESE POWER GENERATORS ARE LINED UP "SOMEWHERE IN ENGLAND" AWAITING THE CALL FROM THE FAR SIDE TO GO INTO ACTION.

MILITARY PERSONNEL

CERTAIN ITEMS TRANSFERRED

THE TRANSFER of responsibility for the research, development, procurement, storage, issue, and maintenance of 573 items of communications and radar equipment, acknowledged as being peculiar to the Air Forces, from the Army Service Forces to the Army Air Forces is under way. A Board on Transfer of Radar and Communications Responsibilities, composed of representatives from the major commands concerned, has been established by the War Department to negotiate transactions.

Certain officers have been designated in both the Signal Corps and the Air Forces as contact officers to handle specified phases of the program, and to work out details. Any problem or idea brought up by an officer in the one command is coordinated with the contact officer designated to handle that work in the other command. Matters ready for action are then referred to the Board, which reviews them, makes final decision, and provides for the issuance of necessary directives.

War Department Circular No. 429, dated 3 November 1944, defines the nature of the transfer by providing that whenever the term "equipment peculiar to the Army Air Forces" is used, it will be construed to include communications equipment (1) used exclusively in aircraft; (2) used on the ground exclusively for the detection, operation, or control of aircraft; (3) guided missiles equipment launched from aircraft; (4) test and training equipment required for the successful use, operation and maintenance of such items.

The Circular also outlines the several phases of action—the first step being effective at 2400, 15 October 1944, when, by unanimous decision of the Board, the research and development of airborne equipment and related activities at both the Signal Corps Aircraft Signal Agency and the Dayton Signal Corps Publications Agency were transferred. Funds, functions, personnel, personnel authorizations, equipment, facilities, and records at these establishments were involved. In addition, certain administrative and technical personnel in other overhead positions directly connected with the research and development of airborne equipment were transferred.

On or before 31 January 1945, the research and development of ground equipment peculiar to the Air Forces will be transferred. Several items now being worked on at the Signal Corps Ground Signal Agency are involved. Arrangements will be made locally for the housing of equipment and personnel transferred when the change is complete.

Responsibility for the procurement, inspection, storage, and issue of items listed will be transferred by 1 April 1945. When taken, this action will involve some items currently stored and issued at the various Signal Corps procurement districts and depots. Although the transfer described may be completed, contracts for any of the equipment listed which were entered into by the Signal Corps will be continued until terminated. Contract renewals and new contracts will be negotiated by the Air Forces.

WAC SERVICE BATTALION

The 3341st Signal Service Battalion (WAC) recently activated in the European Theater under Table of Organization 11–500, with a strength of 28 officers and 523 enlisted women, is the first T/O unit of its kind to be formed.

Consisting of a headquarters and three lettered companies, the Battalion will operate the signal centers in Paris and several other large base section headquarters. Message center, teletype, and switchboard operating teams are included.

Two officers and 180 of the enlisted women needed are already on the job. They moved in with other American troops when Paris was first occupied. The remainder will be sent in casual detachments from installations in the continental United States and will become an integral part of the Battalion upon arrival at their destination.

Use of women in overseas Signal Corps activities is not new. Six operating units, totaling more than 225 girls, were formed and trained in World War I to serve First, Second, and Third Army Headquarters. Their linguistic ability and skill in both local and long-distance operating, combined with the psychological consideration of having women on the Army switchboard, contributed much to the smooth and efficient functioning of the overseas telephone system.

The Signal Corps was quick to realize the part which women might play in World War II, and

gave strong support to the recruiting program. Surveys made indicated clearly that women could perform approximately 144 technical Signal Corps duties effectively. As a matter of fact, it was demonstrated that manual dexterity, attention to details, and the ability to carry on routine operations for long periods of time made women vastly superior to men in certain of those Signal Corps duties which did not entail heavy manual labor.

Due to their adaptability to communications work, the use of women for Signal Corps functions has been more extensive in World War II than in World War I. In addition to successfully replacing men in many continental installations, Signal Corps Wacs have been used in the European and North African Theaters of Operation, and both Theater Commanders have been enthusiastic in their praise of the work done. Evidence of the trust placed in them is found in the fact that 29 Wacs, 5 of whom were Signal Corps Wacs stationed at the War Department Signal Center, were selected as telephone operators and security mail clerks for the Quebec Conference.

Prior to the issuance of War Department Circular 308, dated 19 July 1944, there was no authorization to form Wacs into T/O units, and Wac communication personnel were shipped as casuals to fill allotments under theater overhead. This arrangement was not entirely satisfactory, since the individuals could not be given team and unit training, and administration of the large numbers of communication personnel assigned to important headquarters was difficult.

Activation of an all Wac table of organization unit paves the way for the application of training procedures and requirements typical of male organizations, and will result in the establishment of an "esprit de corps" much higher than possible with a casual assembly of Wac communication specialists.

PLANT ENGINEERING UNITS

The Plant Engineering Agency, Army Communications Service, with headquarters at Philadelphia and 4 geographical sector headquarters will soon administer 20 regional headquarters and 487 units scattered throughout the world. A large backlog of projects associated with radio installation and maintenance work for the Army Airways Communications System has necessitated a 150-percent increase in personnel authorization.

To facilitate administration of the personnel involved, the units will be formed from columns HA, HB, or HD of T/O 11–500, whereas the regional headquarters will consist of columns AD and AK of the same T/O. Both the new units and the regional headquarters will now be considered as part of the troop basis rather than allotted overhead strength as previously classified. Work of the type performed by the Plant Engineering Agency requires specialists with a high degree of training.

USMC NOMENCLATURE

SINCE SEPTEMBER 1944, the U. S. Marine Corps has been using the official Army-Navy nomenclature system to identify all designs of signal equipment and associated items procured direct from commercial sources. Equipments obtained from either the Army or Navy are being identified by the nomenclature previously assigned by either of the services.

It is expected that the use of this system will simplify property accounting, cataloging, and tables of allowances.

At the request of Marine Corps headquarters, several new groups of equipment, with appropriate group indicators have been added to the "AN" system, to prevent many frequently listed items from falling into the miscellaneous classification. Several of these new groups and their indicators—such as TL for tools, LC for line construction material, and PF for pole fittings—will be recognized as being similar to those previously used in the old Signal Corps nomenclature system.

MILITARY TRAINING

CONTROL NET SYSTEM SAND TABLES

IN THE VHF Section of the Radio Division, Enlisted Men's School, Eastern Signal Corps Schools, Fort Monmouth, visual training aids have solved many instructional problems. The complexity of the course, designed to teach installation and maintenance of VHF Fighter Control Net Systems, demands the use of graphic training aids, one of which is described in this article.

To guide a squadron of fighter planes to intercept enemy aircraft, a VHF Control Net System has to be a complex organization employing a wide variety of equipment distributed over a large area of land. First, there is an elaborate radio system used to (a) maintain ground-to-plane communication and (b) take bearings for direction-finding on the planes in flight. Then, there is an extensive wire system which ties together the necessary ground installations. Since in an operational system these installations are located from 40 to 100 miles apart, it was found extremely difficult to present to the student a clear picture of the tactical and technical correlation of the various components. Thus it was necessary to reduce the whole picture to a visual training aid small enough and graphic enough to give the student a "pilot's eye" view of the system.

The so-called sand table shows both the scope of a VHF Fighter Control Net System and the interrelationship of its components. The flat-surfaced table, 10′ x 8′, stands about knee high above the floor. It is landscaped as a strip of land bordering on the ocean. Arranged on its pictorial terrain are the transmitter and receiver station, direction-finding stations, and the other components of the system required to provide wire ground communication, ground-to-plane communication, and direction-finding facilities. These stations are in the form of small-scale models of the towers, trucks, trailers, and antenna masts, carved from white pine. They are arranged on the table as their real life counterparts appear in the field. This arrangement of equipment enables the student to see at a glance how the component unit should be set up in relation to terrain, the tactical problem at hand, requirements for taking bearings on intercept squadrons, the maintenance of communication with the planes.

The models on the table are connected by strings tagged to represent the routing and number of pairs of the connecting ground stations.

At the edge of the sand table farthest removed from the ocean is a push-button Radio Control Box BC–602–A which is connected to a system of color-coded lights mounted at the locations of the various ground stations. Red lights are used to indicate transmission, green lights for reception, amber for direction-finding, and clear bulbs for control. When the student presses a button on the control unit, simulating the pilot's selection of one of the operating frequencies of the system, these lights are illuminated in the proper sequence, indicating which specific ground stations function on that particular frequency. The control box is the one used in Radio Set SCR–522–A, the fighter pilot's airborne transmitter-receiver. This arrangement enables the student to see which components of the system are brought into operation as the pilot switches his unit for either SEND or RECEIVE on the several operational frequencies.

SIGNAL TRAINING installations are making good use of the SOI's and SOP's forwarded to the Chief Signal Officer in response to the appeal that appeared in SCTIL No. 34, September 1944. The need for such documents, and related signal instructions, from divisions and higher echelons is still great, however. Contributions should be forwarded to the Chief Signal Officer (SPSOI), not SPSOC as previously requested.

GPO 83-040551

WAR DEPARTMENT
ARMY SERVICE FORCES
OFFICE OF THE SIGNAL OFFICER

WASHINGTON, 15 December 1944.

To All Officers, Enlisted Men, and Civilian Employees of the Signal Corps:

Peace on Earth, Good Will Toward Men—as symbolized by the Christ Child whose birth we commemorate at this season of the year—assumes a deeper meaning on this Christmas Day of 1944. Our soldiers and sailors, who during the past 3 years have been tried by fire and bombs, still have a long arduous fight ahead of them.

Crucial battles still lie ahead. Before the final triumph is won, our soldiers and sailors will need all the fighting spirit, all the stout-hearted courage, and all the zealous patriotism they can muster. We of the Signal Corps at home—both soldiers and civilians—must toil diligently, with unfaltering loyalty and devotion, to furnish them the service they must have if they are to achieve their goal. And, like our fighting men, we must have a deep and abiding faith in God.

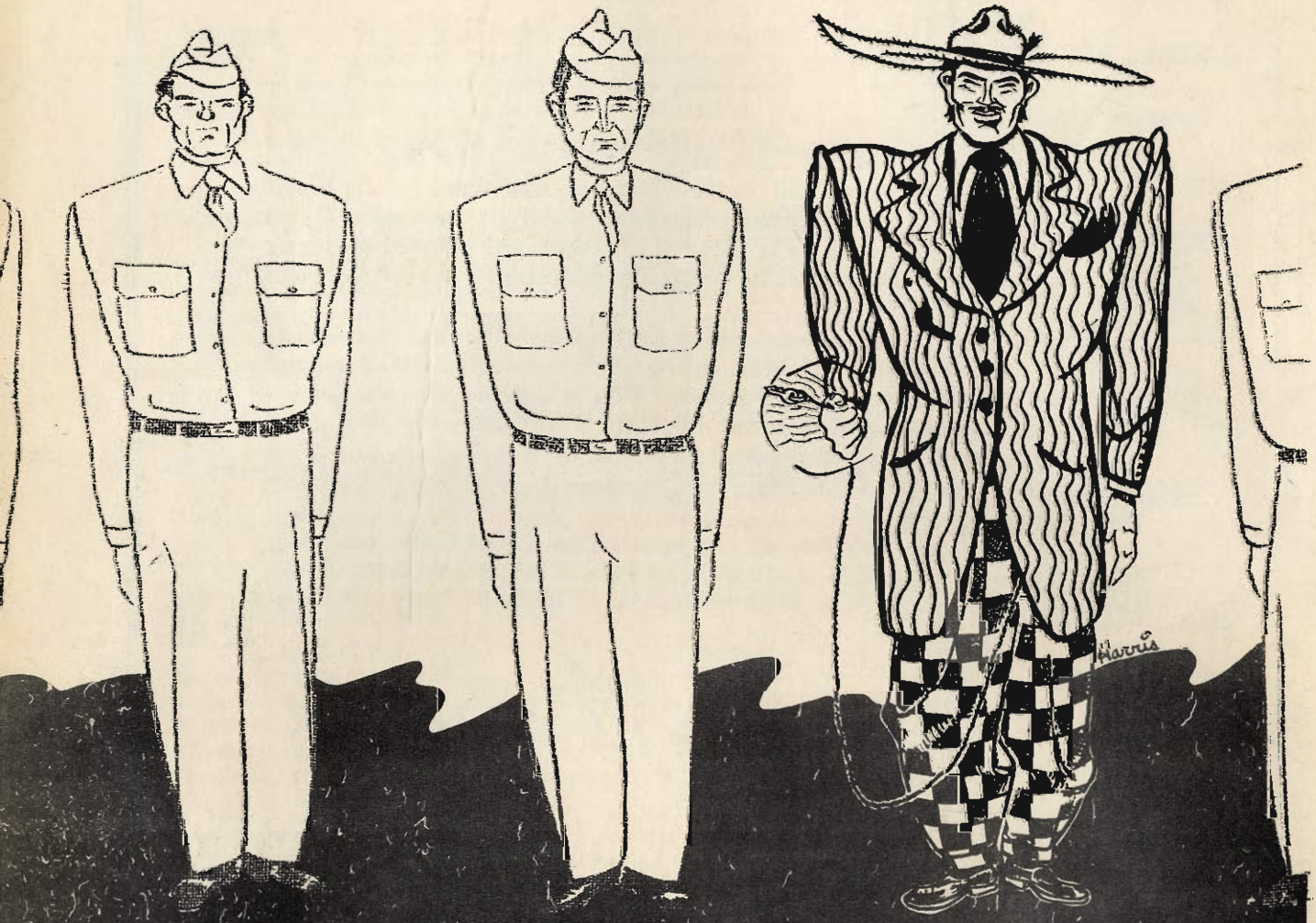
It is my earnest wish that all personnel of the Signal Corps, no matter where they may be stationed, may enjoy a measure of happiness this Christmas, and that the new year will see further advancement toward Victory and Peace.

H. C. Ingles

Major General,
Chief Signal Officer.

THE SIGNAL CORPS MUSEUM
FORT MONMOUTH, NEW JERSEY
PROPERTY OF SIGNAL CORPS, U. S. ARMY

IT'S MURDER! HE SAYS - - -



HAM or COMMERCIAL radio procedure is as out of place as a ZOOT SUIT in the Army.

MORE IMPORTANT: DEVIATIONS FROM AUTHORIZED PROCEDURE HELP ENEMY INTELLIGENCE IDENTIFY YOUR UNIT

CUT ALONG THIS LINE AND POST ON YOUR BULLETIN BOARD