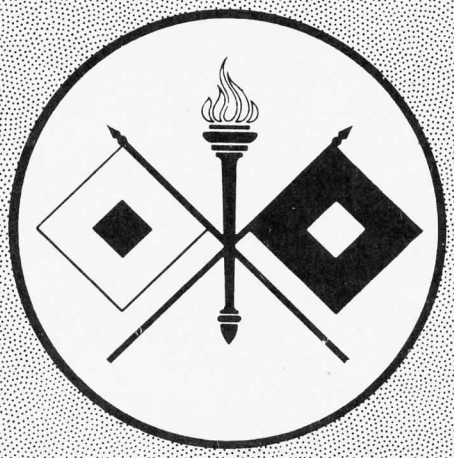
No. 26

RESTRICTED

SIGNAL CORPS TECHNICAL INFORMATION LETTER

JANUARY · 1944

ARMY SERVICE FORCES · OFFICE OF THE CHIEF SIGNAL OFFICER



SIGNAL CORPS TECHNICAL

INFORMATION LETTER

Number 26 January 1944

RESTRICTED

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WAR DEPARTMENT · ARMY SERVICE FORCES

OFFICE OF THE CHIEF SIGNAL OFFICER

E SERVICE DIVISION · SPECIAL ACTIVITIES BRANCH

SCTIL

PURPOSE The Signal Corps Technical Information Letter is a monthly publication designed to keep personnel informed on Signal Corps matters. It provides means for the general dissemination of information of widely varied nature to Signal Corps officers as a whole and for the interchange of information among the different Signal Corps organizations and installations.

SOURCE OF MATERIAL This Letter is compiled largely from information available in the divisions and branches of the Office of the Chief Signal Officer. All Signal Corps training centers and other agencies are invited to submit items of general interest. Such items should reach the Office of the Chief Signal Officer (SPSAY) not later than the 15th of each month for inclusion in the Letter of the following month.

DISTRIBUTION Distribution of the Letter is made to Signal Corps organizations, Signal sections of organizations and headquarters not Signal, and Signal headquarters and installations here and overseas. It is also available for distribution to communications officers of other arms and to others who, though not Signal Corps officers, nevertheless have direct technical interest in Signal Corps equipment or for other reasons are aided by this publication in performing the functions of their assignments.

Distribution is to organizational units rather than individuals and it is expected that a single copy will serve each smaller unit, while in larger units copies will in general be required on the basis of one to each five interested officers (or other key personnel).

Any organization, installation or other unit mentioned above which does not now receive the SCTIL, or receives too few or too many copies, can rectify the condition by addressing the Chief Signal Officer, SPSAY, Washington.

* * * * *

The material presented in the SCTIL is informative and suggestive. Nothing herein should be construed as directive nor should requisitions for new types of equipment be submitted on the basis of data contained herein.

TABLE OF CONTENTS

SOMEWHERE IN AUSTRALIA -- DRESS REHEARSAL FOR AMPHIBIOUS OFFENSIVE OPERATIONS TO COME.

EXPERIENCES OF

A DIVISION SIGO IN THE S.W. PACIFIC

A recent article on Jungle Warfare, published in the October 1943 issue of the SCTIL, presenting a general picture of combat and signal communication operations in the South and Southwest Pacific Areas, was extracted from reports on a number of operations. No two of these operations were identical, most of them involved tactics that were new and unfamiliar to Allied units participating.

In the present issue the activities of a division signal company and the personal experiences of the division signal officer provide a more detailed picture of one particular operation. Dates and names given in the original report have been omitted, but the operations have been retained in chronological order.

The material contained in this article is published as a matter of general interest and should not be considered as tactical doctrine.

ACTIVITIES PRIOR TO EMBARKATION

To put the situation mildly, a new division signal officer, transferred without previous warning into an infantry division already alerted for foreign service -- destination unknown -- has his hands full. It is natural to expect that a Signal officer so assigned will have some knowledge of his duties and his unit's general mission. He can have no doubts regarding the scope of his responsibilities when the division commander states: "The Chief of Staff and myself have a limited knowledge of Signal Corps equipment. Our previous experience, however, makes us fully aware as to what we want. You will give us that communication. The complete responsibility for signal communication installations, policies and training throughout the division, its artillery and tank destroyer battalion rests with you. When signal communications function properly, as we expect they will, expect no praise. If they fail, expect plenty of hell."

An immediate estimate of the situation revealed that the division had been recently converted from a square to a triangular organization and

that the signal communication units had not yet been entirely reorganized or provided with all of their T/BA equipment. Completion of reorganization, packing and loading of equipment and such training as could be sandwiched into the schedule kept the Signal company and communication sections busy night and day for the next month.

The movement of the division from its home station to the port of embarkation was accomplished rapidly. Most of the troops were moved directly from the troop train onto the waiting transport.

TRAINING ABOARD THE TRANSPORT

Once aboard, troop commanders were able to set up command posts near their units and to arrange for a limited amount of training. Signal company personnel operated a central message center and furnished scheduled and special messengers to all unit headquarters.

During the voyage, communication personnel became better acquainted through signal conferences and informal contacts.

THEATRE TRAINING - FIRST BIVOUAC

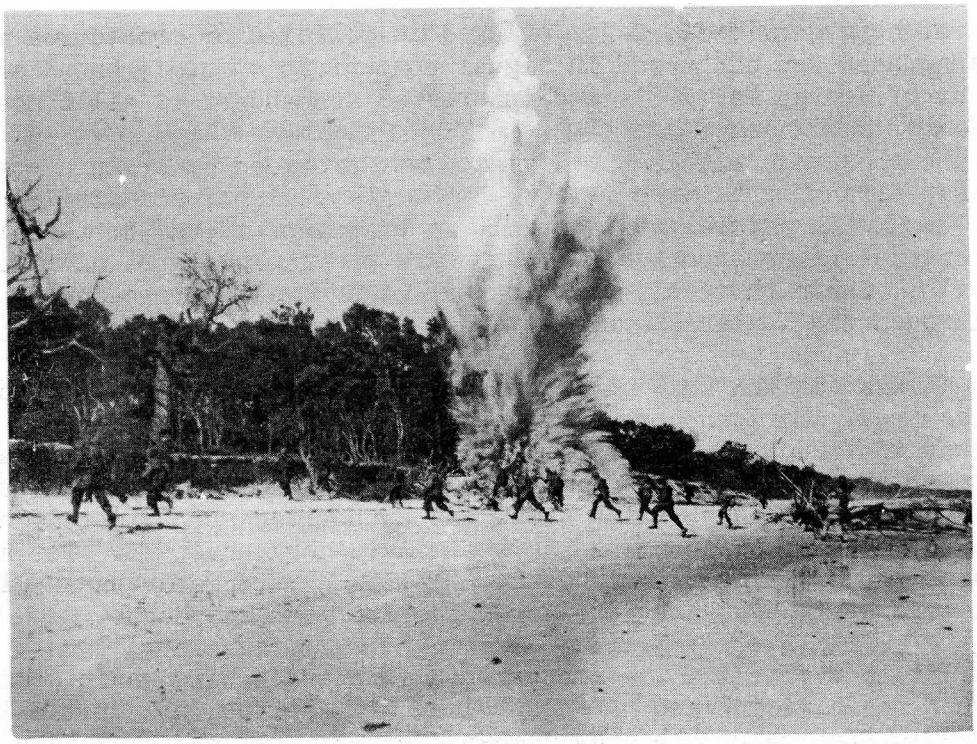
The division disembarked in a South Australian port and traveled by rail to an inland bivouac area. Limited dock and rail facilities delayed transfer of divisional equipment from the disembarking port and additional signal equipment from the U.S. Army Signal Depot to the bivouac area.

The theatre commander directed that the division be put through an intensive combat training course, to include amphibious, airborne and jungle combat training. Since it was anticipated that the division would be involved in operations with Australian units, all training phases included combined operations.

Immediate Problems

Conferences with signal officers of the higher Allied Headquarters revealed that certain problems were involved in combined operations training, such as: 1. The variation between American and Australian tactical organizations. Within the Australian division the brigade compares with the U.S. regiments, but units such as the reconnaissance troop and tank destroyer battalions do not exist as separate organizations. Since the American division was to be under the command of an Australian Army Headquarters, it was necessary that American signalmen, and particularly in the division signal company, understand Australian Army organization.

2. The organization and technical control of Australian Army Signal Corps troops. Australian division signal companies are divided into radio, telephone, message center and messenger teams. Each of these teams is organized and equipped to operate as two sections. During combat operations



MAKING A BEACH LANDING DURING A PRACTICE ASSAULT IN AUSTRALIA.

one section of each team employed remains with the division, the other is attached to the brigade - which has no organic signal communication personnel or equipment. When the brigade mission has been completed, the communication section returns to the signal company.

3. The limited types of Australian signal equipment - rarely interchangeable with American signal equipment.

4. Differences in speech, technical terms and phraseology. Much of the Australian Signal Operation Instructions had to be "interpreted" into American Signal Corps terms to avoid misunderstanding.

5. Differences of opinion on the type of training required. Many officers of the Australian Army Headquarters had returned recently from the Middle East and were thinking in terms of desert operations. Other Australian and American staff officers felt that major emphasis should be placed on jungle and amphibious operations.

Solutions Attained by Combined Policies

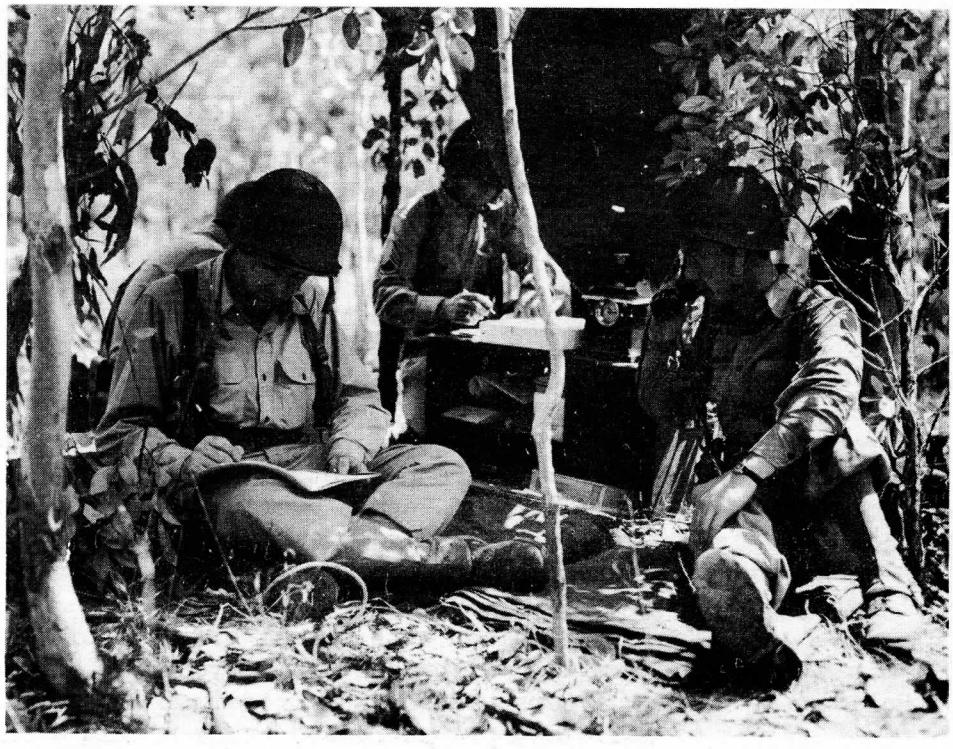
Constant liaison with signal officers of Australian Army and with the U.S. Army Supply Services Headquarters and GHQ resulted in a clarification of policies, procedure and terms within a short time. A discussion of the advantages and limitations of the procedure of each service resulted in the publication of a combined SOP - to the mutual

advantage of both services. Major changes in policies or procedures were usually announced and discussed in signal communication conferences and classes attended by officers, key NCO's and interested commanders of all concerned.

Telephone service within the division was provided by organic communication units. Arrangements were made with the Australian Postmaster General's Department and with several Australian Army units for trunks to the division headquarters telephone exchange. Switchboard operators at the division exchange revised their phraseology to conform to Australian procedure when calling through the latter's exchange.

When it was decided that additional permanent wire plant was needed in the bivouac area, American communication personnel were given a taste of permanent plant construction - using Australian equipment and materials and working under Australian supervision. In making the new installations, it was discovered that an Australian staff was authorized approximately half the number of telephones furnished to a similar American staff. The Australians assured the Division Signal Office that, if a more generous supply of equipment were available, they preferred the American standards.

Very little difficulty was encountered in coordinating radio communication between the division and the Australian military units. Initially the division radio station of the Army command net was operated by a team from Army which provided its own set. American radio operators learned the Aus-



A MESSAGE CENTER DURING SIMULATED FIELD OPERATIONS.

tralian procedures quickly, however, and soon replaced the Army team and employed an SCR-299 in the net.

In addition to the various phases of specialist and section training referred to previously, communication CPX's were held, using signal communication personnel of all division units. Rapid movement of CP's, made without interrupting signal communication, was stressed in day and night problems. Emphasis was also placed on physical hardening, use and care of weapons and training in jungle "lore."

RECONNAISSANCE OF THE COMBAT THEATRE

At this time very little of the information on jungle warfare which is now available was known to the Allied forces. Consequently, it was decided that a group of division staff officers should make an air reconnaissance of Northern Australia and New Guinea. Although the reconnaissance was hurried, it was decided that, on the basis of information obtained, a new training schedule should be set up for the division, in which the following would be emphasized:

1. Acclimation to tropical heat, humidity and storms.
2. Protective measures against jungle diseases (particularly malaria), insect bites and sunburn.
3. A knowledge of tropical food, animals and fish.
4. Information on the eccentricities and most successful means of dealing with natives.
5. The limitations of tactical jungle operations. This phase of training covered the types of tactical operations possible - i.e., employment of patrols - rather than battalions or regiments - as the primary combat units, the limited extent to which motor transportation can be used in dense jungles ahd the necessity for limiting equipment to man or animal carried pack loads.
6. Training of signal personnel to give them a working knowledge of all means of communication.

The training schedules, issued on the basis of the reconnaissance, included practical day and night compass courses, modernized American Indian and Civil War fighting tricks, added to build up interest and enthusiasm for the new training courses. Finally, plans were made to set up a staging area in the Australian jungle to provide more realistic training.

THE JUNGLE STAGING AREA

Preparation and Transportation

Prior to the movement of the division to the new staging area several members of the general staff, the division surgeon and the division signal officer inspected the proposed site and made plans for the movement to and occupation of the area.

LOADING SIGNAL CO. ORGANIZATIONAL EQUIPMENT DURING AUSTRALIAN TRAINING

Factors, considered in planning the staging area, were: 1. Location - Of a nature that would permit acclimation of troops to terrain and climatic conditions similar to those which they expected to encounter in combat.

2. Defense - The means of safeguarding installations and troops from possible enemy air attack and the proposed plans for staging coast defense problems, based on anticipated Jap landings along the eastern coast of Australia, were of primary importance.

3. Transportation - The accessibility of the area to existing roads and railroads for the division movement and for future rapid evacuation or combat operations was considered.

4. Troop Disposition - It was considered advisable to plan the placement of troops as for a tactical operation, in as far as training and administration considerations would allow.

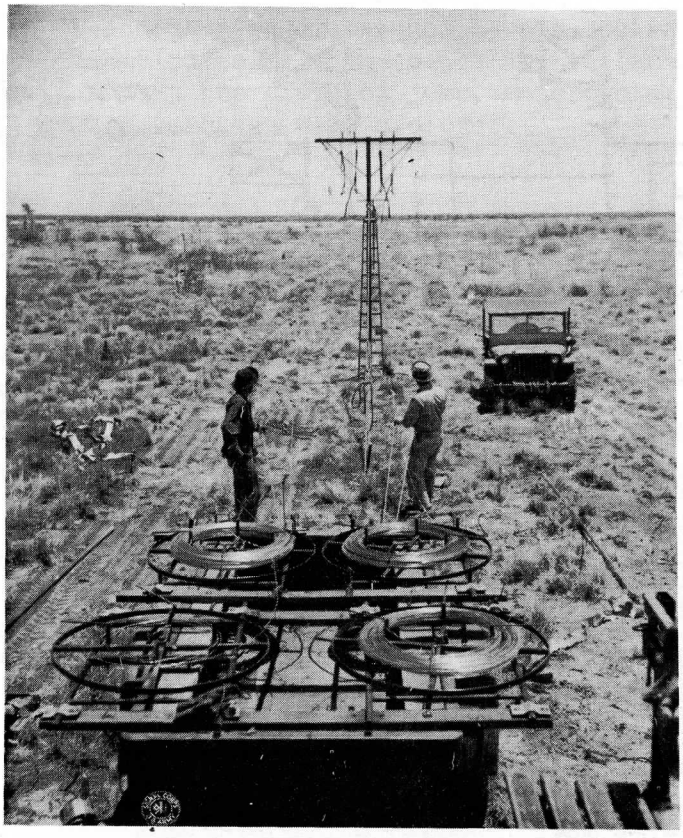
5. Signal Communications - Initially it was considered advisable to locate the division CP in a large town near the staging area so that local and long distance telephone circuits would be immediately available.

Because of the variety of rail gauges adopted by states of the Australian Commonwealth, it was impossible to transport division troops and equipment to the staging area by rail without unloading and loading at several points. Therefore, the first leg of the movement was made by truck to eliminate one reloading.

Fixed Wire Facilities

Since the staging area was located some distance from a populated area, it was necessary for the division to install its own utilities and signal communication facilities.

Division units had been dispersed widely along a road leading inland from the coast, with the artillery range seventeen miles from the division CP. No commercial circuits were available along this road and the distance was beyond the wet weather range of Wire W-110, even when loading coils or the available field repeaters were used on the line. So an open wire pole line seemed to be the best solution to this problem. The Australian Army Headquarters granted approval for construction of the line after a study indicated that the new division bivouac was a logical staging area for future troop training.



AMERICAN COMMUNICATIONS PERSONNEL CONSTRUCTING POLE LINE WITH AUSTRALIAN MATERIAL

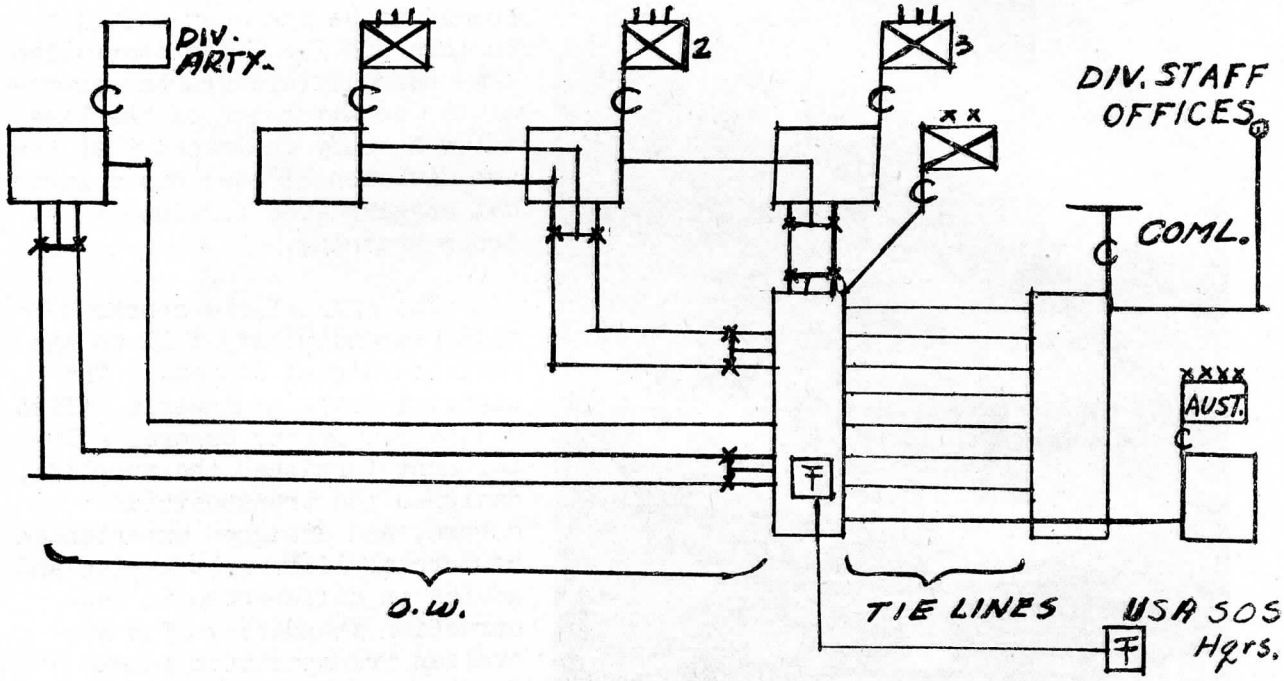
The bulk of the construction responsibility fell to the Division Signal Company. The district plant engineer's office of the Postmaster General's Department furnished the supplies, designed the transposition scheme, and assigned experienced commercial linemen to assist and advise on differences in construction standards. The Australian transposition scheme differs from the American in that wires are strung, in an 8 pin lead, from pins 1 to 8 on pole "A" to the same pins on consecutive poles. Point transpositions were made at each seventh pole (30 poles per mile) on special brackets.

In spite of equipment shortages and their limited experience in open wire construction, the signal company construction platoon and linemen from infantry and artillery units performed every one of the line construction operations. These operations included the selection, felling, trimming and framing of native trees utilized as poles, surveying and staking out the line and cutting-in transpositions.

Upon completion of the new line all of the circuits were terminated in a Telephone Central Office Set TC-4 which had been located adjacent to the

Division CP. As previously noted, the CP was initially established in the town nearest to the staging area. Seven tie lines were provided between the local commercial exchange and the Division telephone exchange so that those division staff offices which were located in the town and had only commercial telephone service could communicate readily with major units in the staging area - through the Division telephone exchange. Civilian personnel at the commercial exchange had no access to U.S. Army tie lines.

A diagram of the primary division wire net is given here:



Teletype service was available between the division CP and Headquarters, U.S. Army Services of Supply, as indicated on the diagram. (Note:- SOS is still used in some theatres to designate ASF headquarters.) No teletype was used in the division wire net.

When the division commander moved his headquarters to the field at a later date, it was located along the open wire line axis. Very little additional construction was necessary to make this change. The switching arrangement remained fundamentally the same, except that all staff phones were now terminated in the TC-4, which had been moved into the field, and only four tie lines were provided into the commercial telephone exchange.

Radio Net Operation

Radio communication was established with the Australian Army and with strategical units of the RAAF to provide secondary tactical communication channels and a practical means of training division radio operators. Within the division all standard nets were placed on 24 hour standby operation.

Some of the routine Division Command net traffic was handled by an auxiliary net, established to bring less experienced signal company operators up to 20 words per minute.

Message Centers and Messengers

The code and cipher section used Australian codes between the Division and the Australian Army, American codes within the Division and to USASOS and GHQ. Some code personnel of regimental communication sections were brought into Division message center to learn the use of Australian codes and ciphers.

Messages were dispatched by air courier, rail courier and through the government postal system to the Australian Army Headquarters, USASOS and US GHQ. Within the Division jeep, motorcycle, and bicycle were scheduled and special messengers were employed.

COMBAT TRAINING

The final division training program was based on information obtained from Allied units that had fought in the Philippines, Malaya, New Guinea, and Guadalcanal and provided, primarily, for acclimitization and hardening

FIELD TRAINING PROBLEMS IN THE S.W. PACIFIC AREA, PACKING COMPLETE EQUIPMENT FOR ACTION INCLUDING SIGNAL SUPPLIES, 75-MM. PACK HOWITZERS, FOOD AND AMMUNITION.

of the troops and for team, unit and combined training in amphibious and jungle operations.

Staff officers were trained in a "Joint Overseas Operations School" by Allied Army, Navy and Air Force officers who taught from combat experience. At the conclusion of the course, students and instructors prepared an Amphibious SOP as a guide for troop organization and training.

Hardening and field training requirements for the individual were achieved through:

1. Marches and jungle patrol exercises. Short, stiff marches were gradually increased to longer, more comprehensive combat exercises of over 24 hours' duration.

2. Exposure of the entire body to gradual tanning.

3. Combined obstacle and compass courses through jungle and over streams -- designed to create a competitive spirit among the troops and to provide a practical course in movement by compass.

4. Individual weapon courses - employing man-sized, moving targets placed along jungle trails and manipulated so that they appeared and disappeared suddenly - instead of the conventional range targets.

5. Comprehensive instruction in suppressive treatment of jungle diseases.

6. Training in the handling, loading and unloading of assault boats and

SUPPLIES COMING ASHORE DURING AN AMPHIBIOUS MANEUVER.

and thorough exercises in climbing and descending ropes and cargo nets - first on land-based mock-ups and later in simulated amphibious operations.

7. Instructions in means of self-preservation, including identification of edible jungle plants and fruit, the use of raw fish to provide food and water, swimming lessons for non-swimmers, and methods of fighting off sharks.

On the basis of intelligence reports that Jap snipers were instructed to "get the officers, they always carry pistols," all signal personnel were armed with rifles (in lieu of carbines), all dressed alike. Metal insignia were not worn.

Team Training

Training in this phase was based on the belief that the signal company should be divided into small, general purpose teams, designed to accompany and provide communications for jungle and amphibious task forces.

Signal teams were trained in the employment of all means of communication and in the use and repair of basic signal equipment and materials (Wire W-110, W-130, Telephone EE-8 and Reel Equipment CE-11, hand-carried reels, and Radio Set SCR-536-( ), SCR-288-( ) and SCR-193). Generally, it was determined that task force signal equipment should be limited to that which individuals could carry or which headquarters units could move ashore or through the jungle in a jeep.

Combined Unit Training

This phase provided a test of the newly devised employment of tactical units and their attached service teams.

Signal teams, carrying only weapons, individual equipment, field rations and an SCR-288, accompanied Infantry units on overnight problems, to furnish communications with the base headquarters. Various tests of pack, hand-carried and jeep-mounted radios and the available panels and pyrotechnics were conducted during unit problems to show the troops what could and what could not be done with each type of equipment.

The wisdom of personnel and equipment tests, made during this phase of training, was to be evident soon - in actual combat.

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The second part of this article, to appear in the February SCTIL, will continue with a description of actual combat experiences of this Division Signal Officer.

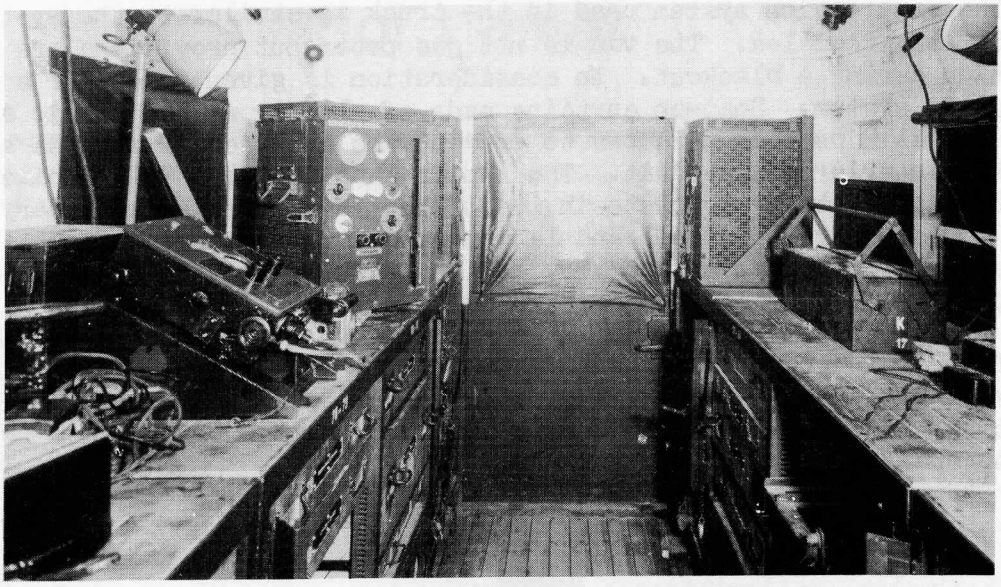
24-67549ABCD

CAPTURED GERMAN REPAIR SHOP

A German Automotive Electrical Repair Shop is now situated at the Camp Coles Signal Laboratory where an investigation of its components is being conducted by the Captured Equipment Test Section of the Test and Maintenance Equipment Branch. This investigation will cover features of the truck which may be of advantage to American troops should any similar trucks be captured in the future. It should be noted that this unit is for automotive and electrical repair rather than signal or communication maintenance. Therefore, only a general comparison between the German repair unit and similar units of American design can be made.

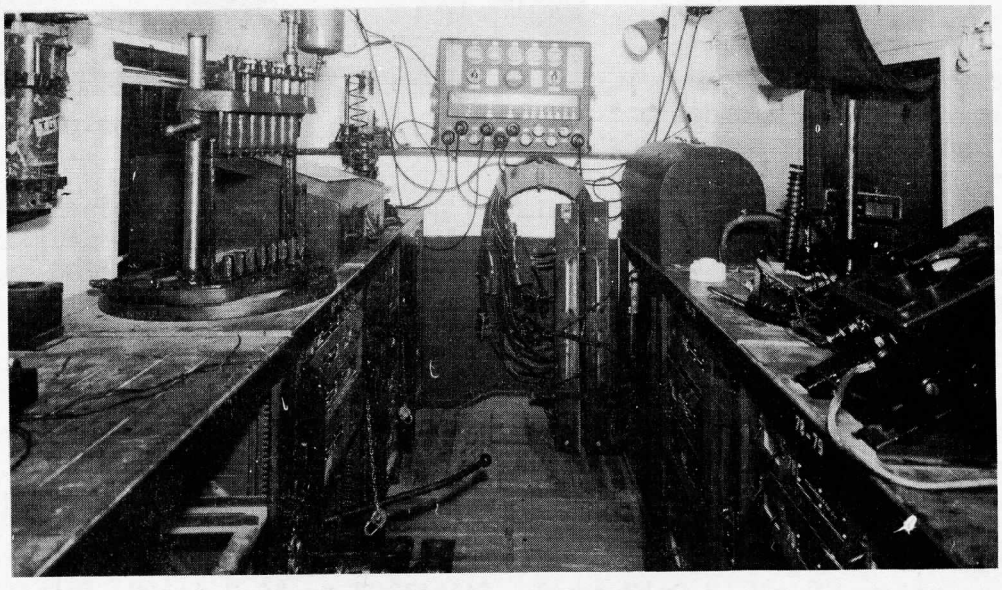
The German Automotive Electrical Repair Shop is mounted on a 4½ ton Diesel-powered chassis, with dual rear wheels, and with front and rear drive. The truck is equipped with a van body resembling American van-type trucks. The roof of the body is removable, apparently designed to conserve shipping space, as the top of the van body can be lowered to the same level as the truck cab. The light construction of the body is made possible by the use of fibre board (press board or Masonite), reinforced at the intersections with steel corners and strips.

The mobile shop is equipped with a distribution panel which is light in weight and ruggedly constructed. Current for the panel may be supplied either from a gasoline or Diesel-driven generator, supplying three phase, 220-380 A.C. voltage. Commercial power may also be used. Three selenium type battery chargers having a capacity of 15 amperes are the only source of low-voltage D.C.



INTERIOR VIEW FROM FRONT.

In the mobile repair shop the hand tools are stored in various sized wooden drawers containing mortised recesses. These hand tools include vulcanizing, soldering and electrical testing equipment and storage battery maintenance equipment. Larger equipment included in the repair truck are such items as a sewing machine, bench drill press and Diesel injection pump testers. Lighting is afforded by two permanently mounted lights and two removable swivel type lamps.



INTERIOR VIEW FROM REAR.

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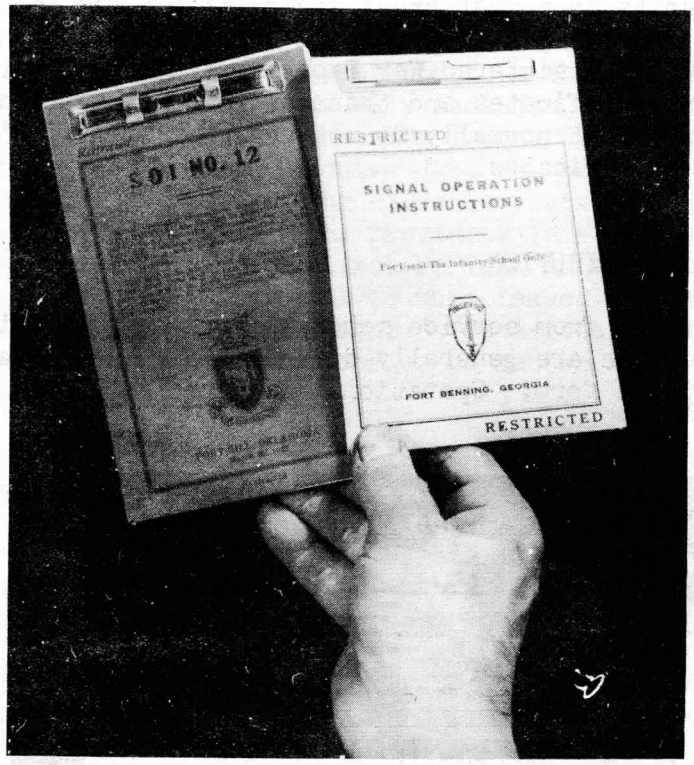
The suppression system used in the truck is similar to the system used in U.S. Army vehicles. The van is not gas proof but provisions are made for operation during a blackout. No consideration is given to either a heating or cooling system. Snap-on curtains made of closely meshed fabric are provided for all doors and windows to prevent the entrance of insects and dust into the interior of the unit. The repair shop is completely mobile. It does not appear to be complete in itself but to require an auxiliary mobile unit including drill presses and lathes in order to comprise an entire repair unit. The design of the body of the truck is such that it can also be equipped as other types of repair units.

The repair truck seems to have been designed compactly and logically. All available space appears to be utilized to advantage. In general, the layout of the interior of the German mobile unit resembles that of U.S. Army mobile repair units.

SOI TRENDS

The material contained in this article is not to be considered as tactical doctrine. It represents a survey of trends and a summary of new ideas digested from a detailed study of available Signal Operation Instructions (SOI's) issued during the last eighteen months by units in overseas theatres of operations, by defense and base commands, by sectors, harbor defenses and military districts, and by units undergoing training in the United States. In view of the fact that there is considerable differences of opinion as to the size, form, classification, distribution, and contents of SOI's issued by units in the United States as compared to those issued by units overseas, it is believed that the information presented will be of particular interest to those Signal Corps officers whose duties include the preparation of SOI's.



POCKET-SIZE SOI'S ARE FAVORED BY SCHOOLS.

SIZE

Usually SOI's from service schools are pocket size, those from units engaged in combat are letter-size, while those from tactical units undergoing training in the United States are about evenly divided between the two with a few odd in-betweens. Occasionally legal-size SOI's occur among those received from Base Commands and Defense Commands.

FORM

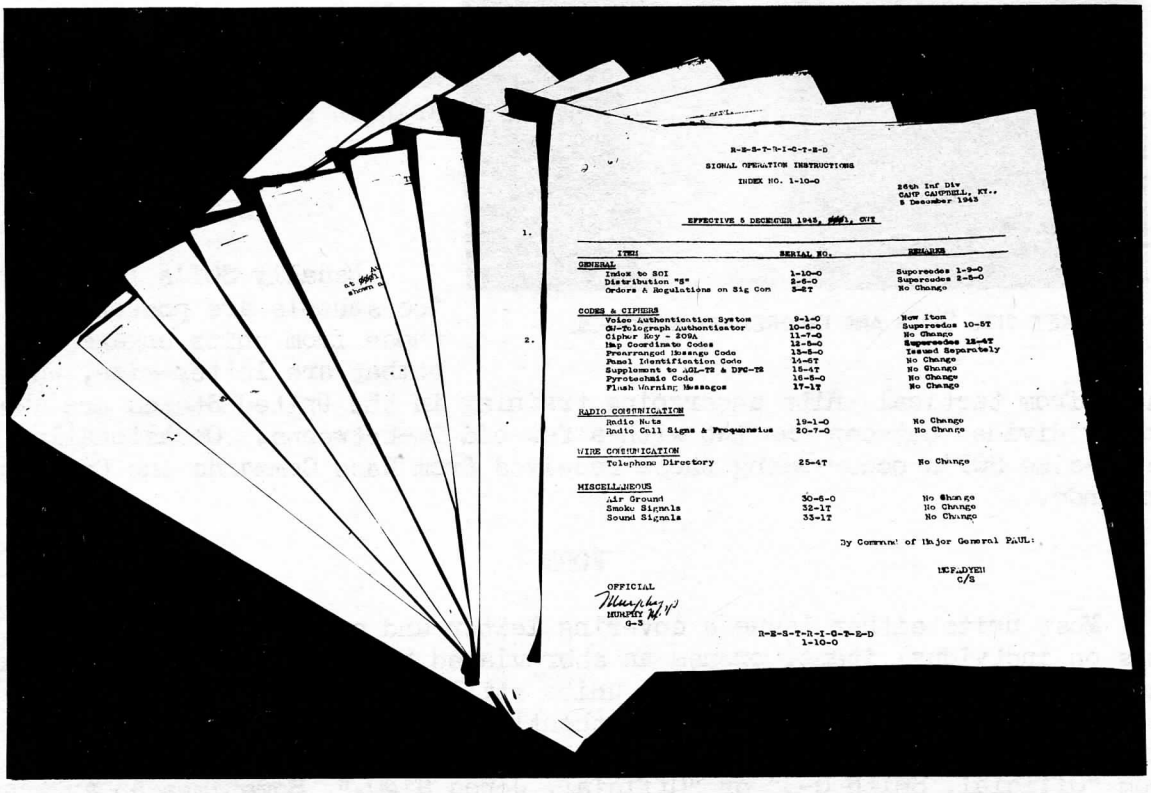
Most units either issue a covering letter and omit headings and endings on individual items, or use an abbreviated heading and ending on each individual item. Corps and larger units still favor the long formal ending with the signature of G-3 for the authentication, while units the size of division or smaller usually authenticate their items using the abbreviated from "Official, Smith G-3" or "Official, Jones SigO." Sometimes an authenticating initial only is used in the abbreviated ending.

CLASSIFICATION

A majority of units in the United States issue two sets of SOI's, a "Training Set" and an "Operational Set." The Training Set, frequently issued in a bound folder containing a complete set of items, is classified "restricted." It is intended for post, camp or station use. The Operational Set is issued as separate items rather than in bound folder form. Some items are classified "restricted," others "confidential." Such items are intended for operational or maneuver use. The classification scheme for Operational SOI's is generally followed by units in combat areas except that a few items are classified "secret." A few units register their SOI's requiring the same type of accounting as prescribed for registered War Department documents; i.e., semi-annual reports, destruction certificates and transfer reports. Tactical units including those engaged in combat normally do not register their SOI's nor do they require destruction certificates.

DISTRIBUTION

Training SOI's, including those from service schools, replacement training centers and unit training centers are generally distributed by complete sets, frequently printed in pamphlet form. Operational editions published



R-E-S-T-R-I-C-T-E-D

SIGNAL OPERATION INSTRUCTIONS

INDEX NO. 1-10-0

94th Inf Div
CAMP CAMPBELL, KY.,
8 December 1943

EFFECTIVE 8 DECEMBER 1943, [illegible], CWT

ITEM	SERIAL NO.	REMARKS
GENERAL		
Index to SOI	1-10-0	Supersedes 1-9-0
Distribution "S"	2-6-0	Supersedes 2-5-0
Orders & Regulations on Sig Con	3-4T	No Change
CODES & CIPHERS		
Voice Authentication Systems	9-1-0	New Item
CM-Telegraph Authenticator	10-6-0	Supersedes 10-5T
Cipher Key - ZOA	11-7-0	No Change
Map Coordinate Codes	12-5-0	Superseded 12-4T
Prearranged Message Code	13-5-0	Issued Separately
Panel Identification Code	14-6T	No Change
Supplement to AGL-T2 & DPC-T2	15-4T	No Change
Pyrotechnic Code	16-5-0	No Change
Flash Warning Messages	17-1T	No Change
RADIO COMMUNICATION		
Radio Nets	19-1-0	No Change
Radio Call Signs & Frequencies	20-7-0	No Change
WIRE COMMUNICATION		
Telephone Directory	25-4T	No Change
MISCELLANEOUS		
Air Ground	30-6-0	No Change
Smoke Signals	32-1T	No Change
Sound Signals	33-1T	No Change

By Command of Major General PAUL:

HEADYEN
C/S

OFFICIAL
MURPHY
G-3

R-E-S-T-R-I-C-T-E-D
1-10-0

TYPICAL DIVISION SOI, ISSUED AS INDIVIDUAL ITEMS ON LETTER-SIZE PAGES.

during the unit training period or at the beginning of the combined training period, use a distribution approximating that used in combat. Most units the size of division or smaller make this distribution by individual items. A number of Air Force units prefer to divide items into groups for distribution purposes, while headquarters of corps and above frequently make distribution by complete copies.

CONTENT

General Instruction Sheets — Nearly all units issue instruction sheets, similar to the form shown in Par. 265a FM 24-5, and generally including the same instructions. Air Corps units frequently define the extracts which may be made as including "effective data for not exceeding two days from items providing daily changes, and effective data for not exceeding one effective period in the case of items providing less frequent changes," and further provide "Such extracts will not be left in aircraft on the ground, but will be removed by the individual to whom issued and stored in a secure place until the start of the next flight." Occasionally corps and army instruction sheets include restrictions as to matter which may be included in SOI's of subordinate units.

Index — A few units, usually those assigned to harbor defense or similar installations, issue no indexes. This practice, while common for fixed installations where only a few items of SOI are issued, is not followed by units who issue a large number of items which are changed frequently. Most units issue a revision of the index with each revision of any other item.

Distribution "S" — When the SOI is issued complete, the Distribution "S" consists of two columns, the first being a list of offices and units, and the second showing for each the number of copies of the complete SOI received. When the SOI is issued by individual items, Distribution "S" appears in a form similar to the sample shown in FM 24-5. When the items are issued by groups, Distribution "S" follows the same form, but with fewer columns, and with letters rather than item numbers, for column headings. A key is added, to identify the letters; for example, A is shown to apply to items 1, 2, 3, 5, 8, 9, 14 and 16; B to items 4, 10, 11, 15 and 17, etc. The notation as to distribution on each item appears as two letters, for example: Distribution S-A.

Codes and Ciphers — Supplements to codes, cipher key lists, pin and lug settings, panel identification codes, air-ground and ground-air signals, pyrotechnic codes and sound warnings are universally the same in form and application. Air Corps units include "Aircraft Recognition Signals." An item frequently added to the code and cipher section of SOI's is a list of holders of the various codes and cipher devices. This item, though of a doubtful value to units of the size of division, provides an excellent method of coordinating and routing cryp-

during the unit training period or at the beginning of the combined training period, use a distribution approximating that used in combat. Most units the size of division or smaller make this distribution by individual items. A number of Air Force units prefer to divide items into groups for distribution purposes, while headquarters of corps and above frequently make distribution by complete copies.

CONTENT

General Instruction Sheets — Nearly all units issue instruction sheets, similar to the form shown in Par. 265a FM 24-5, and generally including the same instructions. Air Corps units frequently define the extracts which may be made as including "effective data for not exceeding two days from items providing daily changes, and effective data for not exceeding one effective period in the case of items providing less frequent changes," and further provide "Such extracts will not be left in aircraft on the ground, but will be removed by the individual to whom issued and stored in a secure place until the start of the next flight." Occasionally corps and army instruction sheets include restrictions as to matter which may be included in SOI's of subordinate units.

Index — A few units, usually those assigned to harbor defense or similar installations, issue no indexes. This practice, while common for fixed installations where only a few items of SOI are issued, is not followed by units who issue a large number of items which are changed frequently. Most units issue a revision of the index with each revision of any other item.

Distribution "S" — When the SOI is issued complete, the Distribution "S" consists of two columns, the first being a list of offices and units, and the second showing for each the number of copies of the complete SOI received. When the SOI is issued by individual items, Distribution "S" appears in a form similar to the sample shown in FM 24-5. When the items are issued by groups, Distribution "S" follows the same form, but with fewer columns, and with letters rather than item numbers, for column headings. A key is added, to identify the letters; for example, A is shown to apply to items 1, 2, 3, 5, 8, 9, 14 and 16; B to items 4, 10, 11, 15 and 17, etc. The notation as to distribution on each item appears as two letters, for example: Distribution S-A.

Codes and Ciphers — Supplements to codes, cipher key lists, pin and lug settings, panel identification codes, air-ground and ground-air signals, pyrotechnic codes and sound warnings are universally the same in form and application. Air Corps units include "Aircraft Recognition Signals." An item frequently added to the code and cipher section of SOI's is a list of holders of the various codes and cipher devices. This item, though of a doubtful value to units of the size of division, provides an excellent method of coordinating and routing cryp-

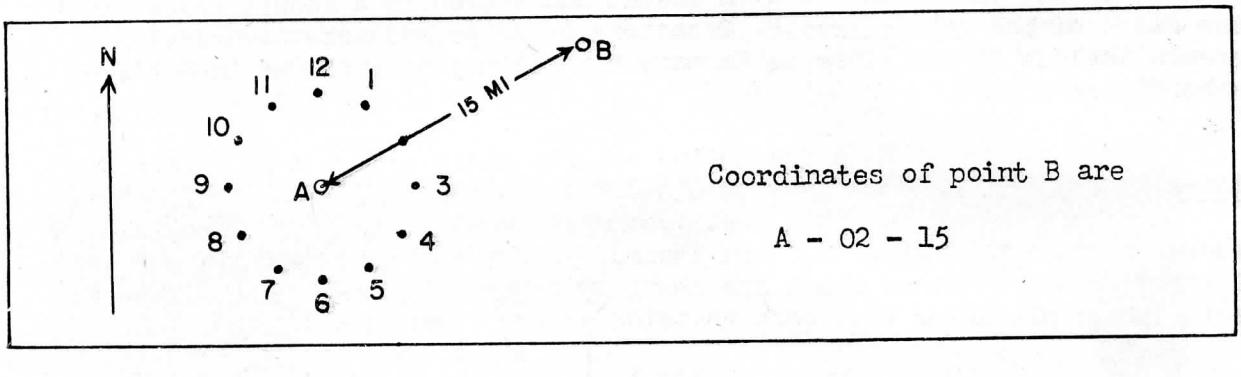
tographed traffic in units where large numbers of code and cipher systems are in use.

Reference Data

The item "Index to Regulations and Orders on Signal Communication" normally appears in the SOI of units in training and at stations in the U. S. or inactive theatres. Most units in combat omit this item.

Map Coordinates and Codes

Map reference systems include the Template M1 in very few cases. JAN grid appears to be used primarily in higher headquarters where a special map is available. Thrust line and polar coordinates are about equal in popularity. One variation of the polar coordinate system known as a "Map Coordinate Clock Code" uses a number of reference points indicated by letters or two-digit numbers, directions given in hours, 1200 being north, and distances given in miles. Such a system (as illustrated) may be committed to memory by memorizing the reference points and their designations.



A wide variety of systems for cryptographing map coordinates are in use. The present tendency is to use relatively simple codes, having adequate security, which will facilitate the handling of messages.

Brevity of Prearranged Message Codes

The most commonly used codes of this type are those using two-letter groups for code equivalents as in the sample shown in FM 24-5. One report from a theatre indicated a belief that the movement of a certain unit from one portion of the line to another had been traced by the enemy because of the continued use by this unit of a distinctive type of code groups in their prearranged message code. The report recommended the adoption of a standard list of code groups for prearranged message codes, each unit to prepare its own code, but using only code groups drawn from the list.

One Cavalry reconnaissance unit in North Africa adopted a prearranged message code shortly after the occurrence of the following incident. On approaching the south side of a certain town the commander of the platoon announced by radio in the clear "Entering _____ from south." Within a few seconds a heavy enemy barrage covered the south end of the town. On clear-

ing the town the Commander announced in the clear, "Leaving ____" upon which the barrage, which had continued south of the town, shifted to cover the north end of the town. The commander later expressed the belief that this experience could have been avoided if a prearranged message code had been in use.

Authentication Systems

A great variety of authentication systems are used. A discussion of the security principles governing preparation of authentication systems is beyond the scope of this article. A new publication covering preparation and use of authentication systems will be issued shortly by the War Department.

Directories

Telephone code names for units, not generally used above corps, are sometimes used at corps level and almost always from corps down. Common practice is for Army to allot a block of initial letters to corps, corps to sub-allot or prescribe names for next lower headquarters with the provision that all names in the unit begin with the same letter. Generally division directories prescribe code names for all subordinate units. There is a slight tendency to use separate directory names for rear echelon, OP, advance message centers, etc., rather than the code name of the CP followed by rear, OP, etc.

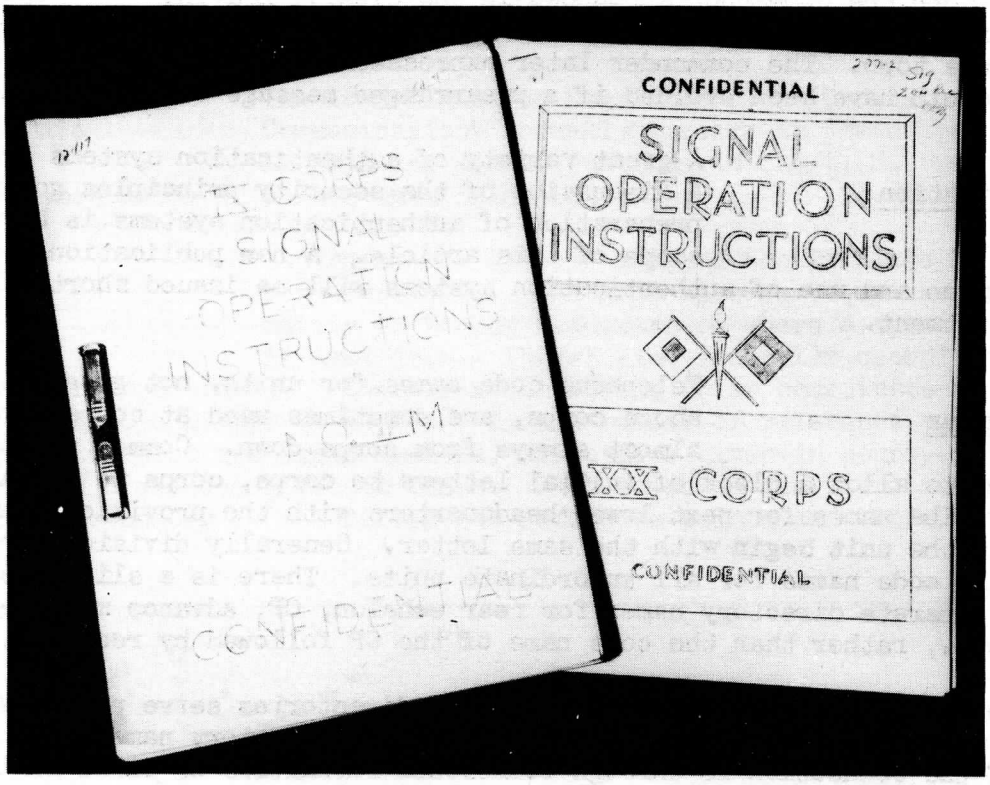
Some attempts have been noted to make directories serve purposes of secrecy, such as a prohibition against the use of directory names when any part of the connection is through commercial facilities or fixed military installations. If the purpose of using directory names is primarily to facilitate the handling of calls, such a prohibition would appear to defeat the purpose of the directory. One division completely abandoned the use of telephone code names, for a time, then adopted the last name of the commander of each unit as a code name for the unit. Apparently this division did not encounter the problem of having two or more units commanded by officers having the same last name.

Most divisions use the standard numbers for offices and officers shown in paragraph 265m of FM 24-5. At times, however, the list is expanded or modified, due to the installation of additional telephones in some of the offices.

Telegraph and teletype directories are in general use only at corps and higher headquarters, although a few divisions do publish them. The trend is to assign separate call signs for teletype and radio stations located at the same headquarters. Telegraph and teletype call signs are seldom changed. This practice appears to facilitate the handling of teletype messages, particularly those relayed through one or more intermediate stations. Air Corps units frequently issue TWX directories as items of SOI.

Wire-tagging Codes

Very few SOI's include wire-tagging codes. About fifty percent of the wire-tagging codes studied provide for notching the edges or cutting the corners of the wire tags to aid in distinguishing wire lines laid by different units.



THE TREND AMONG CORPS AND HIGHER HEADQUARTERS IS TOWARD BOUND, LETTER-SIZE SOI's.

Frequencies and Call Signs

Radio-frequency and call-sign assignments follow generally the sample form in FM 24-5. However, there is an increasing tendency to publish one item for call signs and another for frequencies. Some headquarters reduce this item to a single paragraph, reading substantially as follows: "Assignment of frequencies and call signs to each subordinate unit will be made by letter from this headquarters. Each unit, upon receipt of the above-mentioned letter, will attach it to this page." The letter to each subordinate unit then includes only the frequencies and call signs to be used by that particular unit. Although such a system appears to provide greater security for call signs and frequencies, the chances of difficulty due to interference between neighboring stations of different subordinate units might be increased. A few units prescribe power limitations for each station for each type of emission.

MISCELLANEOUS

Miscellaneous items frequently encountered include sunrise and moon phase tables, time conversion charts, the phonetic alphabet, standard frequencies and time broadcasts, and flash or blitz message items. This last, appearing largely in harbor defense, military district and sector SOI's

prescribes a sequence of elements to be used in sending flash warning messages; for example: How many (a platoon, a squadron, etc.); What (tanks, parachutists, bombers, destroyers, etc.); Doing what (attacking, moving, flying, etc.); Which way (north, etc.); Where (name of geographical feature); When (time observed); and a brevity code for each element to be used if available. In some commands, forms are provided with the code and code equivalents. The writer then circles the applicable code groups on the form and files the message for transmission. If the warning is given by telephone, the "flash" or "blitz" designation obtains priority; if by radio, the symbol O for urgent is attached by the radio operator; if by teletype, operators are instructed to break, if necessary, and send "flash" or "blitz" followed by the message.

One SOI studied contains practically no instructions, each item showing simply the effective date and data to be used. Instructions for application of the data are found in a supplementary publication SSI (Standing Signal Instructions) consisting of items lettered to correspond with the numbered items of SOI. SSI-A explains SOI-1. Since the instructions seldom change, the SSI item carries no issue number.

Occasionally instructions are found in SOI's which, though dealing with Signal communications, are normally found in SOP's, for example: "Each messenger vehicle will display a yellow flag. Traffic control posts will accord highest priority to vehicles displaying such flags." "When the antenna of a radio vehicle becomes entangled with overhead wire, personnel in the vehicle should jump, not step, from the vehicle to the ground." In the same category falls an announcement of policy with respect to precedence classification of messages and a prohibition against attaching field wire to power poles.

An interesting deviation from normal procedure in the preparation of SOI's is furnished by the SOI used during the campaign on Guadalcanal. The SOI's for this command were all published by the Headquarters of the Island Command in a single publication of four sections. The first section contained material applicable to all elements of the Island Command; the other three sections included material applicable to the three divisions, one section being devoted to each division. Each section included an index, which listed the items of that section and of the general section as well. No sunrise and moon phase table and no wire tagging code appeared in this SOI.

SOI's for U.S. Army Forces in the South Pacific Area included no sunrise and moon phase tables and no wire tagging codes. Though units in North Africa as of July did include sunrise and moon phase tables and time zone charts, they omitted wire-tagging codes and indexes to regulations and orders.

Allied Force Headquarters instead of issuing Signal Operation Instructions issues "Signal Instructions" in a single series similar to a series of special orders. The same practice is followed by Headquarters, U.S. Army Forces in the Middle East, apparently with satisfactory results.

TRANSMISSION SECURITY

During this war most of the security propaganda has been directed toward quelling unnecessary talk. In the field of Transmission Security, radio operators do not have to talk to reveal vital information to the enemy. The mere fact that a station is on the air provides the enemy with a source of intelligence. Intercept stations and direction finders enable the enemy to record and tabulate every transmission. It can be assumed that every time a transmitter is placed in operation enemy interception takes place.

To an enemy staff of traffic analysts every breach of radio procedure is of telling significance. Special attention is given to each violation. It does not matter whether the violation tells a complete story; the information imparted may be infinitesmal, but its "straw-weight" may break a communications system.

Transmission security consists of withholding from the enemy information which might be made available to him through his study of our traffic (by all methods other than cryptanalysis), and of preventing the enemy from making use of our communication system to obtain navigational assistance or for purposes of deception. Transmission security may best be accomplished by the maintenance of strict circuit discipline and the suppression of all superfluous transmissions which tend to give information to the enemy.

As a means of ascertaining the state of transmission security existing in the field, a plan of decentralized control is employed. Commanders of all units in the field, through their signal and communication officers, maintain a constant check on the operating efficiency of their subordinate units and submit brief monthly reports to the next higher headquarters. This process continues until a report is prepared by a headquarters directly under the control of the War Department. These reports, prepared monthly, are then forwarded to the Chief Signal Officer.

The consolidated reports are closely examined to determine the degree of transmission security supervision being employed in the field. Generally it is found that the "quality" of the reports reflects positive indication of transmission security existing within units. Analysis and comparison of reports reveal certain trends in violations and the frequency of occurrence of particular types of violations. A knowledge of these trends is necessary in order that the various types may be effectively checked. In processing these reports over a period of five months, the following types of violations have been repeatedly noted in the order of occurrence indicated:

1. Use of unauthorized amateur and/or commercial prosigns.
2. Omission of approved Army procedure.
3. Use of plain language in place of applicable prosigns and operating signals.
4. Use of call signs more than twice.

5. Superfluous and excessive procedure.
6. Use of repeat sign, IMI, to cover an error.
7. "Chatting" by operators.
8. Use of both AR and K or one in place of the other.
9. Use of less than 8 E's in erase sign.

An analysis of the consolidated monthly reports also reveals the measures being taken by units in the field to insure transmission security within their respective organizations. These measures fall for the most part under the headings of training, training aids and unit monitoring. In addition, immediate corrective action is taken by unit commanders with respect to individual violations of transmission security.

Transmission security is included as a prescribed subject in radio operators' schools and in classes on radio procedure for commissioned and enlisted personnel of communication units. To vitalize training programs and stimulate interest in security, some units have utilized training aids such as type-phrases, posters, intelligence films, and dramatized recordings.

A further examination of reports discloses that whenever possible, if facilities permit, monitoring is undertaken within units. It is noteworthy that commanders of units in combat are attaching steadily increasing importance to the monitoring of friendly transmissions. Monitoring or intercept logs of friendly transmissions are usually referred for remedial action to the officer in charge of radio communications. Such a monitoring service should require that the net control station, the agency responsible for the maintenance of net discipline, keep accurate logs on all stations within the net and report violations of transmission security.

The type of remedial action taken by the responsible officer deserves thought and consideration in that "spot" correction is always the most effective, although there are numerous alternatives. The reports cite various forms, such as action taken by the net control station, transgressor stations notified by discrepancy reports, violations explained with a view toward correction in daily critiques, immediate action taken by telephone, radio operators called by the monitoring station operator, and necessary personal reprimands given with an explanation of the security violation.

If the serious consequences of violations of transmission security are understood by communications personnel, prescribed radio procedure will be more closely followed. War Department Technical Bulletin TB SIG-2 entitled "Think Next Time" (available through AGO channels), which presents a series of factual incidents in the field of communications, illustrates clearly a few of the violations occurring daily, with attendant results. The thought should be constantly borne in mind that transmission security is the only effective counter-measure against enemy efforts to obtain intelligence by an analysis of our transmissions.

USING THE NEW NUMBER SHEET

Since the adoption of the new Message Center Number Sheet (W.D. Sig C, Form No. 244), much discussion has arisen concerning its use, especially in units whose SOP calls for keeping a record on a number sheet of incoming and relay messages, as well as outgoing messages.

The primary purpose of this number sheet is to provide an index to the information contained in the message center files, and the secondary purpose is to have available, for quick reference, pertinent information concerning a message. The Message Center Section of the Officers' School, Eastern Signal Corps Training Center, has adopted the following SOP:

W. D., Sig. C. Form 244

WAR DEPARTMENT
SIGNAL CORPS, U. S. ARMY

OUTGOING **NUMBER SHEET**

1ST INF DIV (UNIT) — I Corps (ORGANIZATION) — 26 Nov 43 (DATE)

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
1	P	X					3 Inf	1015 Q
2	R		X				I Corps	1100Q
3	P		/				2 Inf	1120Q
4	O				/		I Corps	1125Q SPEC
5								
6								
7								

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
51								
52								
53								
54								
55								
56								
57								

Separate number sheets will be used for outgoing, incoming, and relay traffic and each number sheet will be appropriately marked to the left of the words "Number Sheet" on the form.

In the space marked "Unit," the name (or code name) of the headquarters served by the message center will be entered. In the space marked "Organization," the name (or code name) of the next superior headquarters will be entered. Examples: Number sheets for the 3d Bn of the 5th Inf. will be marked — (Unit) 3d Bn.; (Organization) 5th Inf. Number sheets for the 2d Inf Div of the I Corps will be marked — (Unit) 2d Inf Div; (Organization) I Corps. The designation of the message center should be entered in the upper right corner of the number sheet in order to distinguish between forward and rear echelons.

The unit, organization and date will be entered at the top of the number sheet, which will not be used for more than one day. Any additional number sheets, if required, will be numbered in sequence, and the messages numbered consecutively for any one day. At the end of the 24-hour day, the

word "closed" and the time of closing will be written on the line below the last numbered line used during the day. If any line has been left blank, the reason will be written on that line and initialed to verify that it was an omission of a line and not a loss of a message.

Outgoing Messages

1. The counter clerk (message center chief in small units) receives an outgoing message in duplicate and enters the time of receipt in the "Time Filed" space on both copies of the message.

2. The counter clerk consults his Outgoing Number Sheet, assigns the lowest unused number to the message by writing the number in the space provided on both copies of the message, and then draws a slant (/) through the corresponding number on the Outgoing Number Sheet.

3. The counter clerk determines the specific means by which the message is to be transmitted and writes it, abbreviated, in the space provided on both copies of the message.

4. After the original has been sent out, the counter clerk transcribes the necessary data from the duplicate onto the Outgoing Number Sheet. The information transcribed includes:

a. Abbreviation indicating precedence, in the column marked "Prec."
b. A slant (/) in the proper square under "TG," "TT," "Rad," or "Msgr" to indicate the specific means used to transmit the message.
c. Abbreviation indicating addressee, in the "To" column.
d. Time signed, in the space in the blank column.

If the message is to be sent by any specific means other than those listed on the form, the specific means will be noted in the blank column before entering the time signed. Unusual characteristics of a message which might serve to simplify its identification may be entered in the blank column. Example: The fact that a special messenger was used to deliver the message.

5. When the signed delivery list or the serviced copy is returned to the message center, the counter clerk draws an opposing slant (\), forming an X on the Outgoing Number Sheet under the specific means used for that message.

Incoming Messages (For local delivery)

1. The counter clerk receives incoming messages. (In large message centers there may be two counter clerks, one being designated to accept messages for local delivery only.)

2. The counter clerk consults his Incoming Number Sheet and assigns the lowest unused number to the message by writing the number on the back of the message (number is written on both copies if message is received electrically) and encircling it. He draws a slant (/) through the corresponding number on the Incoming Number Sheet.

W. D., Sig. C. Form 244

WAR DEPARTMENT
SIGNAL CORPS, U. S. ARMY

INCOMING **NUMBER SHEET**

1st INF DIV (UNIT) — I CORPS (ORGANIZATION) — 26 Nov 43 (DATE)

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
/1	OP	X				I Inf		1025Q
/2	P		X			I Corps		1030Q
/3	R			/		2 Inf		1100Q
4								
5								
6								
7								

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
51								
52								
53								
54								
55								
56								
57								

3. The counter clerk then enters the following information on the Incoming Number Sheet:

a. The abbreviation indicating the precedence of the message, in the column marked "Prec."

b. A slant (/) under "TG," "TT," "Rad," or "Msgr," to indicate the specific means by which the message was received.

c. The abbreviation indicating the sender, in the "From" column.

d. The time of origin (time signed) in the space in the blank column.

If the message is received by any specific means other than those listed on the form, this specific means, as well as any other pertinent identifying data, will be noted in the blank column.

4. When the message has been delivered, the messenger dispatcher sends the signed delivery list to the counter clerk. The counter clerk then draws an opposing slant (\), forming an X on the Incoming Number sheet under the specific means by which that message was received.

Relay Number Sheet

The Relay Number Sheet will be handled in a like manner, but with the following points of difference:

1. Identification of both the sender and the addressee will be entered in the "From" and "To" columns, respectively.

2. The relay message number will be placed on the back of the message (just as the incoming message number is placed on an incoming message), but will be preceded by the letter "R."

3. If the message is to be relayed by a specific means different than that by which it was received, an "N" will be placed in the square under the specific means by which it was received, and a slant (/) under the specific means by which it is to be sent. An opposing slant (\) is drawn through the previously drawn slant when the message is cleared.

W. D., Sig. C. Form 244

RELAY

WAR DEPARTMENT
SIGNAL CORPS, U. S. ARMY

PEI-X

NUMBER SHEET

1st INF DIV (UNIT) | I CORPS (ORGANIZATION) | 26 Nov 43 (DATE)

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
1	R	X	N			I Corps	I Inf 1ØØ5Q	
2	P		/		N	2 Inf	I Corps 1Ø3ØQ	
3	R			X		1 Inf	I Corps 1227Q	
4								
5								
6								
7								

NO.	PREC	TG	TT	RAD	MSGR	FROM	TO	
51								
52								
53								
54								
55								
56								
57								

If either an outgoing message or a relay message should be sent to one specific means for transmission, and then for some reason the message must be sent by some other specific means, a circle (Ø) will be placed over the previously drawn slant (/), and a slant (/) placed under the other specific means. The opposing slant (\) will be drawn through the last drawn slant when the message is cleared.

In the case of secret messages, the official designation of the sender will be entered in the "From" column of the Outgoing Number Sheet (in addition to other entries), and the word "Secret" will be entered in the right-hand blank column. Incoming secret messages will be handled in the same manner as any other message, as far as the number sheet is concerned.

MESSAGE CENTER SERVICE

In the article "The Message Center's Service" starting on page 19 of the October SCTIL, one of the suggestions made was that those sending messages leave the choice of transmission medium up to the message center chief. Some readers have interpreted this as implying that the sender of the message has the choice of selecting the communication medium if he so desires.

The intent of the article was to amplify the necessity for the writer to refrain from designating the means of transmission and confine himself to the preparation of messages as defined in paragraph 38 of FM 24-5, Signal Communications. The responsibility for determining the means of transmission used to expedite the sending of any message rests with the Message Center Chief as prescribed in paragraph 39 of the Field Manual. It was not the intent of this article to suggest violation of regulations but rather to point out the fallacy and discourage the practice followed in some instances by writers of messages of specifying the means of communications.

READING WIRE TAGS AT NIGHT

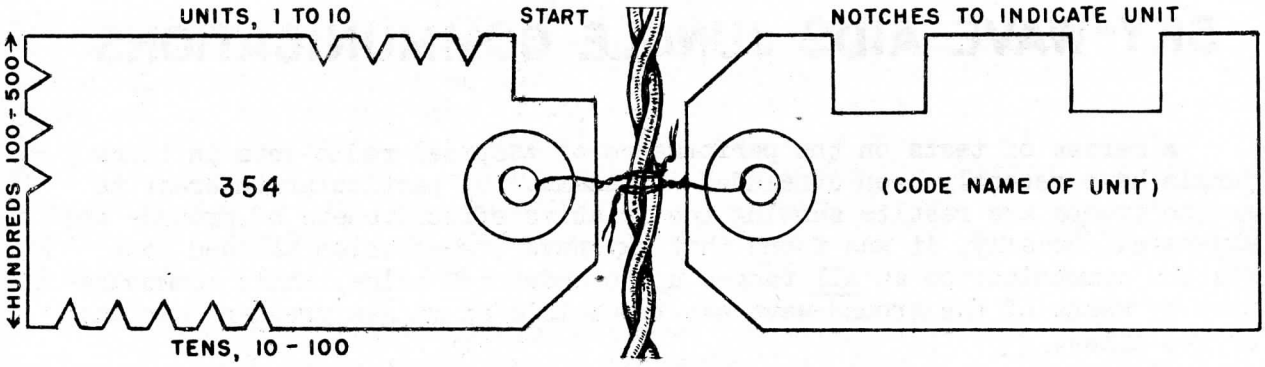
Numerous reports from overseas stress the difficulty of repairing wire lines at night under combat conditions and attribute a large part of this difficulty to the inability of linemen to distinguish between lines in the dark. Many suggestions have been offered for overcoming this difficulty, most of which recommend that wire or tags be marked with fluorescent material, which will be illuminated by ultra-violet light, and that flashlights be equipped with ultra-violet filters.

PAST PROPOSALS

It is interesting to note that the present Tag MC-72 was originally adopted in 1926 after a study of a number of tags by the Signal Corps Board (Case No. 30, dated 23 December 1925). In 1927 (Case No. 30A) the Board considered several schemes for notching or punching tags to make them easily recognized at night and recommended that no uniform code be adopted for this purpose, but that a statement be included in appropriate literature authorizing commanders to devise suitable marking systems when required. Paragraph 189c FM 24-5 suggests: "* * * colored or partially colored tags, tags having distinctive shapes, * * * If colors are used, care must be taken that they will be identifiable at night with available light sources." Signal Corps Board Case No. 30B, 1930, considered and recommended against the adoption of a smaller fiber tag equipped with a brass loop, such as are used for tagging door keys. In September of 1930 the Board in Case No. 30C considered a suggestion to use tags made of tin in various shapes (triangles, half-discs, rectangles, diamonds, etc.) to indicate units, and with edges notched to indicate circuit numbers. Scrap tin would be used to improvise tags when standard tags were not available. This suggestion was based on experience in World War I. The Board recommended against the standardization of these tags since tin was considered a critical item and adhered to its former findings and recommendations as to the shape and notching.

A recent study of fluorescent materials has shown the use of such means for marking either wire or tags to be impractical. A Flashlight TL-122-A equipped with an ultraviolet filter does not make fluorescent markings stand out clearly. Even the Blackout Hand Lamp submitted by the Continental Lithograph Corporation requires that a 6 volt, half ampere, Mazda lamp #605 be burned at over brilliance in order to produce sufficient ultra-violet light to illuminate fluorescent materials. Fluorescent materials are not recommended for continuous outdoor use because they do not stand up under sunlight or high humidity. Exceptions to the above are fluorescent materials which may be protected from moisture by vitreous enamel, which must be baked on and which is, in general, limited to the protection of signs, markers, and dials.

One simple system of marking, illustrated herewith, provides for num-



TAGS NOTCHED FOR READING IN THE DARK.

bers under 600 by notching one corner to indicate the starting point, making one to ten V shaped notches on one edge for numbers 1 to 10, one to ten notches on the other edge for numbers 10 to 100, and one to five notches on the end for numbers 100 to 500. If it is necessary to distinguish between units following the same wire route or to indicate numbers above 600, an additional tag having one or more square notches or cut in the shape of a triangle, diamond, semicircle or cross may be added at the same point. These tags may be prepared in advance of laying the wire. When this is done, all the tags for one circuit may be notched simultaneously to save time.

RECLAMATION OF WIRE W-110-B

It has been reported that many posts, camps, and stations have a surplus of Wire W-110-B in Class B and C condition. It is further reported that a large percentage of this wire could be reclaimed and used for initial issue to newly activated organizations and for additional issue during training periods. It is indicated that the wire could be placed in usable condition by Fourth Echelon Service Command Repair Shops. In view of critical supply conditions, it is urged that immediate action be taken by posts, camps and stations to arrange for the reclamation of this wire. Lengths of 100 feet or over, with insulation in good condition, should be reclaimed. Shorter lengths should be retained for splicing training purposes. After reclamation the quantities of reclaimed wire on hand should be reported through normal channels as Wire W-110-B, Class B. Every effort should be made to utilize reclaimed wire for training purposes so that sufficient new wire will be available for troops going overseas.

SKY-WAVE AIDS JUNGLE COMMUNICATIONS

A series of tests on the performance of tactical radio sets in thick jungle have recently been concluded in Panama. Of particular interest to ground troops are results showing the relative effectiveness of ground- and sky-wave. Briefly, it was found that sky-wave transmission allowed consistent communication at all ranges up to about 100 miles, while communication by means of the ground-wave was impossible at ranges greater than one or two miles.

It was found that the Radio Set SCR-694 (performance essentially the same as Radio Set SCR-284) would not push a satisfactory signal over a distance greater than one or two miles in dense jungle when used with an ordinary whip antenna. The vertical whip antenna is most efficient for producing a vertically polarized ground-wave.

The reason for this abnormally short range lies in the fact that the dense growth attenuates the ground-wave in an extreme manner, while the high level of noise usually found in tropical regions makes an unusually high field strength necessary for proper reception.

To establish communications over a greater range, horizontal antennas were used. These antennas allow a strong signal to be radiated skywards, where it is reflected to earth again by the ionosphere. To those troops attempting radio communication in dense jungle, it should be of the greatest interest to know that it was easier to communicate over ten miles of jungle by sending a radio wave a hundred miles up to the ionosphere and back again than it was to propagate it directly.

It is believed that this is the first case where the sky-wave has been deliberately used for transmission over such a short distance. Naturally, it is necessary that both transmitting and receiving antennas be horizontal for maximum efficiency under this plan.

The opinion is prevalent that long experience or great theoretical knowledge is necessary to produce reliable communications by the sky-wave, leading to some timidity in relying on it. The principal reason for this appears to be that the reflecting layers responsible for the phenomenon are called by the rather formidable title of "ionosphere."

The ionosphere has been extensively studied and its behavior in relationship to radio waves carefully analyzed. As a result, it is possible to predict a few months in advance what may reasonably be expected in the way of reliable range for any particular frequency at any particular time of day. Proper use of these predictions allows an intelligent choice of frequencies to be made for a particular problem, or, conversely, will allow intelligent use of available facilities. Such forecasts are published by the Interservice Radio Propagation Laboratory and are disseminated to the

Army by the Communication Liaison Branch, OCSigO. The forecasts are available upon request to the above office and are published each month for a period of several months in advance. They are in the form of charts and graphs and may be readily used by anyone caring to read the publication carefully. A handbook on radio propagation has also been prepared (Preliminary TM 11-499), explaining the various factors of sky-wave propagation in a thorough manner and is available on request to the above office. Special communication problems involving ionosphere forecasting may also be referred to the Communication Liaison Branch, OCSigO, for recommendations.

By using the forecasts mentioned above, the group in Panama was able to establish communications with 65 percent reliability over a 100-mile range, using the SCR-694 (modified to go to 2 mc/sec., but with no increase in normal power). An interesting sidelight on the results obtained is a comparison of the reliability of communications when frequencies were chosen by the judgment of experienced radio officers and when chosen according to the predictions mentioned above. For instance, at a range of 40 miles, communications were out 35 percent of the time on frequencies chosen by "experience." When frequencies were chosen according to the predictions, communications were out only 7 percent of the time, a very respectable improvement.

A more comprehensive article on these tests will be published in the next issue.

CALCULATIONS FOR ANTENNA ORIENTATION

In the October 1943 issue of the Signal Corps Technical Information Letter (page 23), a method of determining great circle routes was described utilizing Ageton tables. It was also indicated that in order to operate a rhombic antenna properly, it must be orientated in the right direction and laid out on the great circle route. It is also desirable to orient other types of antennas in the correct direction to obtain maximum efficiency. To assist those who do not have the Ageton tables available, a formula method for computing the great circle course is presented in this article.

Figures 1, 2, and 3 each indicate two locations A and B on the surface of the earth with known latitudes and longitudes. Figure 1 illustrates the condition where both locations are north of the equator, Figure 2 illustrates the condition where one location is north of equator and the other location is south of the equator, and Figure 3 illustrates the case where both locations are south of the equator.

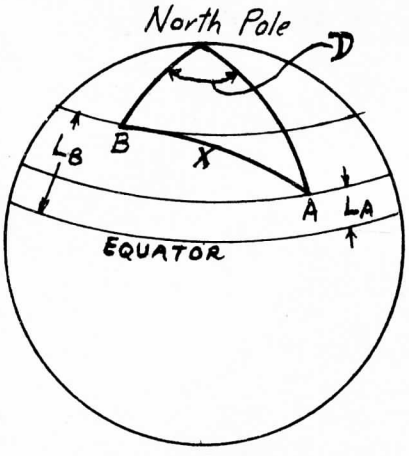


Fig. 1

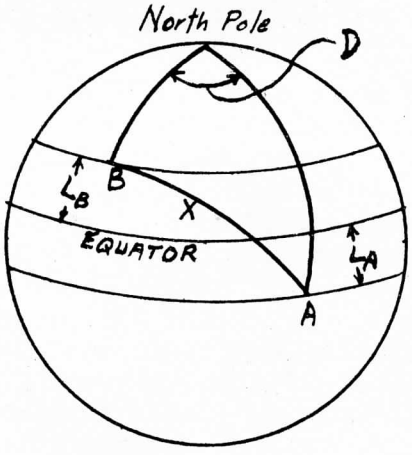


Fig. 2

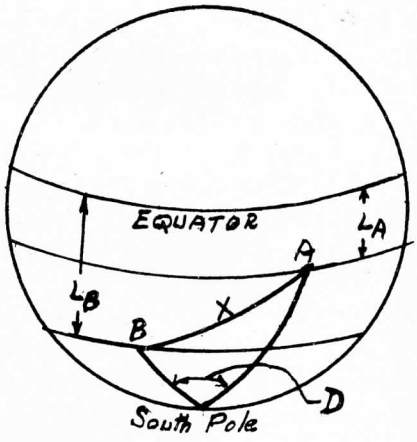


Fig. 3

In order to determine the number of degrees in angles A and B (which are the great circle bearings for these points) the following formulas may be used:

$$(1)\ \text{TAN}\ \tfrac{1}{2}\ (B + A) = \frac{\text{Cos}\ \frac{1}{2}\ (L_B - L_A) \times \text{Cot}\ \frac{1}{2}\ D}{\text{Sin}\ \frac{1}{2}\ (L_B + L_A)}$$

$$(2)\ \text{TAN}\ \tfrac{1}{2}\ (B - A) = \frac{\text{Sin}\ \frac{1}{2}\ (L_B - L_A) \times \text{Cot}\ \frac{1}{2}\ D}{\text{Cos}\ \frac{1}{2}\ (L_B + L_A)}$$

where A = bearing from Station A to Station B

B = bearing from Station B to Station A (Assume Station B as one with the greater latitude)

L_A = Latitude of Station A

L_B = Latitude of Station B

D = Difference in longitudes between Station A and B

In order to simplify the mathematical computations, the logarithms of equations, (1) and (2) may be used thus:

(3) $\text{Log tan } \frac{1}{2}(B + A) = \log \cos \frac{1}{2}(L_B - L_A) + \log \cot \frac{1}{2} D - \log \sin \frac{1}{2}(L_B + L_A)$

(4) $\text{Log tan } \frac{1}{2}(B - A) = \log \sin \frac{1}{2}(L_B - L_A) + \log \cot \frac{1}{2} D - \log \cos \frac{1}{2}(L_B + L_A)$

After angles $\frac{1}{2}(B + A)$ and $\frac{1}{2}(B - A)$ are determined, angles A and B may be found by addition or subtraction as follows:

(5) $\frac{1}{2}(B + A) + \frac{1}{2}(B - A) = B$

(6) $\frac{1}{2}(B + A) - \frac{1}{2}(B - A) = A$

To illustrate this method of computation, a typical example is given below:

Receiver B - Ft. Sam Houston, Texas, - Lat. (L_B) 29° 27' N., Long. 98° 26' W.

Transmitter A - Ft. Brown, Texas, - Lat. (L_A) 25° 54' N., Long. 97° 30' W.

$\frac{1}{2}(L_B - L_A) = \frac{1}{2}(29° 27' - 25° 54') = 1° 47'$

$\frac{1}{2}(L_B + L_A) = \frac{1}{2}(29° 27' + 25° 54') = 27° 41'$

$\frac{1}{2} D = \frac{1}{2}(98° 26' - 97° 30') = 28'$

Using formulas (3) and (4)

	Log cos	1° 47'	= 9.99979-10		log sin	1° 47' = 8.49304-10
Add	Log cot	28'	= 2.08911	Add	log cot	28' = 2.08911
			12.08890-10			10.58215-10
Sub	Log sin	27° 41'	= 9.66706-10	Sub	Log cos	27° 41' = 9.94720-10
	Log tan $\frac{1}{2}(B + A)$		= 2.42184		Log tan $\frac{1}{2}(B-A)$	= .63495
	(7) $\frac{1}{2}(B + A)$		= 89° 47'		(8) $\frac{1}{2}(B - A)$	= 76° 57'

From formulas (5) and (6)

Ft. Brown - A = 89° 47' - 76° 57' = 12° 50' W of True N. (See Fig. 4)

Ft. Sam Houston - B = 89° 47' + 76° 57' = 166° 44' E of True N.(See Fig.5

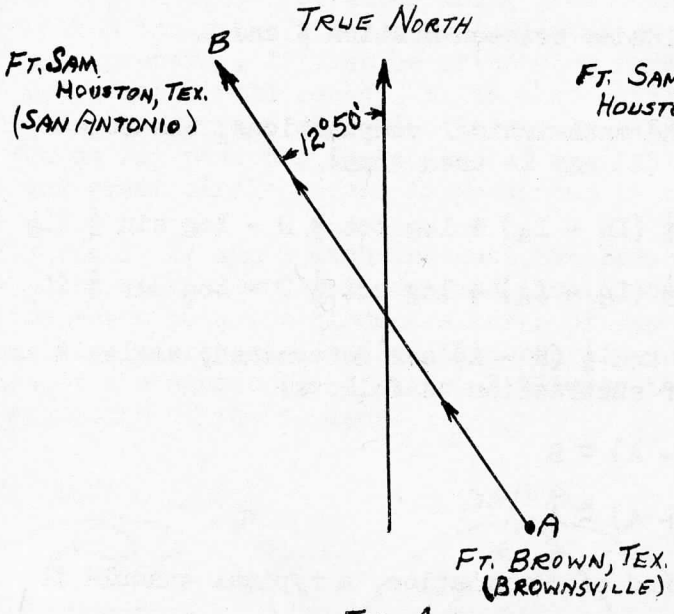


Fig. 4

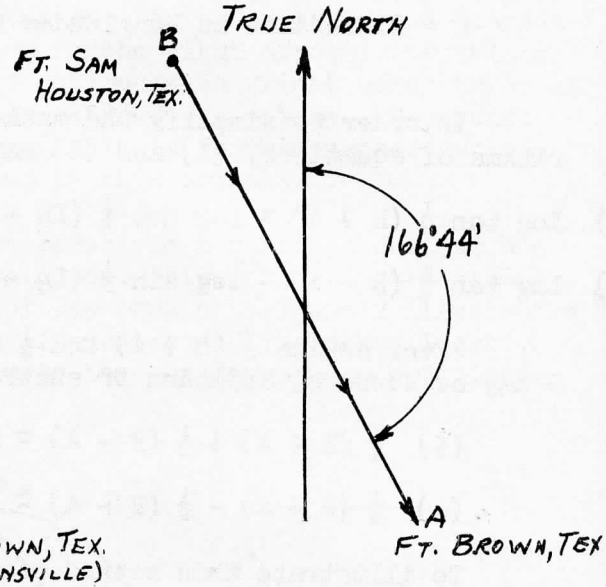


Fig. 5

In order to determine the great circle distance between any two stations, the following formula is used:

$$\text{Tan } \tfrac{1}{2} d = \frac{\sin \tfrac{1}{2} (B + A) \times \text{Tan } \tfrac{1}{2} (L_B - L_A)}{\text{Sin } \tfrac{1}{2} (B - A)}$$

Where d = angular distance in degrees

The angle d may be converted to great circle distance X as follows:

d x 60 = distance in nautical miles

d x 69.057 = distance in statute miles

d x 111.136 = distance in kilometers

Utilizing the example cited above

$\frac{1}{2}(B + A) = 89^\circ\ 47'$
$\frac{1}{2}(B - A) = 76^\circ\ 57'$
$\frac{1}{2}(L_B - L_A) = 1^\circ\ 47'$

	Log sin $89^\circ\ 47'$	$= 0.00000$
Add	Log tan $1^\circ\ 47'$	$= \underline{8.49325-10}$
		$8.49325-10$
Sub	Log sin $76^\circ\ 57'$	$= \underline{9.98863-10}$
	Log tan $\frac{1}{2}$ d	$= 8.50462-10$
	$\frac{1}{2}$ d	$= 1^\circ\ 50'$
	d	$= 3^\circ\ 40' = 3.667^\circ$

Linear distance = 69.057 x 3.667° = 253 statute miles, the great circle bearing distance between Ft. Brown and Ft. Sam Houston.

It is to be noted, in the above formulas, that North latitudes should be taken as positive and South latitudes as negative. For example, if Station A is 50 S. latitude and Station B is 70 N. latitude, then:

$$\frac{1}{2}(L_B + L_A) = \frac{1}{2}(70^\circ + (-50^\circ)) = 10^\circ$$

$$\frac{1}{2}(L_B - L_A) = \frac{1}{2}(70^\circ - (-50^\circ)) = 60^\circ$$

If Station A and B are located south of the equator (Figure 3) and the sum of the latitudes $(L_B + L_A)$ is negative, computations will be greatly simplified if the bearings are calculated with respect to true south and the bearings converted afterwards to bearings east or west of true north as is appropriate.

It should further be noted that the magnetic declination of the respective stations must be either added to or subtracted from the true azimuth to obtain the actual position of the antenna being installed.

RADAR OPERATION NOT HARMFUL TO THE EYES

The operation of radar scopes does not injure the eyes, according to new evidence presented by the NDRC Oscilloscope Project, located at the Southern Signal Corps School, Camp Murphy, Florida.

The visual capabilities of 244 air-warning operators, all in the Orlando area, were measured and then compared with the visual capabilities of a group of 112 non-operators. Also, the capabilities of long-term operators were compared with those of short-term operators.

Data were obtained on binocular acuity for both near and far vision, on monocular acuity for far vision, on vertical and lateral eye muscle balance during both near and far fixation, and on depth perception and color vision. The tests were made with a special instrument known as the "Ortho-Rater." Information was also obtained from each man on his visual history and on any complaints of fatigue or eye strain.

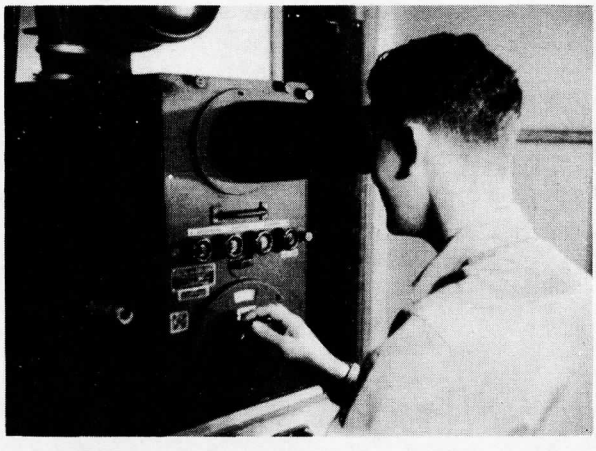
The men whose eyes were tested had been operating radar scopes on air-warning sets for periods ranging from a few days to two years. They ranged in age from 18 to 37. The average age was 25. The average length of operator experience for the group was ten months.

The shifts were typically six or eight hours in duration. Teams of four men each were the common rule, and the men rotated assignments during their shift. They seldom remained at the scopes for longer than a hour at a time. The usual periods of scope operation were about thirty minutes.

The non-operators were Army enlisted men studying at a midwestern

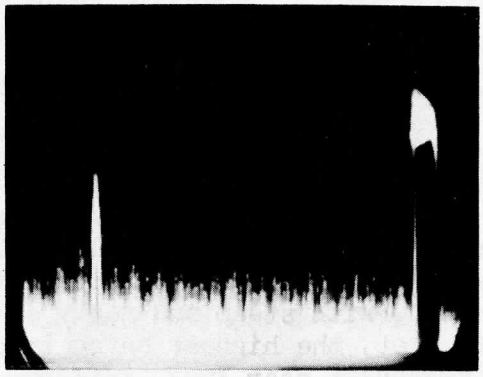
An Operator on the Job

In some radar operations, the operator sits in a semi-darkened room and looks thru a tube at the face of the oscilloscope. He adjusts the various controls and reports what he sees. At times, he must withdraw his face from the tube, look momentarily at the dials below the tube, and then back at the scope.



What the Operator Sees

The operator looks at a pattern of light on a dark background like that shown here. He interprets what he sees in order to give information on the location of aircraft. The pattern is constantly changing and moving and there is a large amount of flicker.



university under the Army Specialist Training Program. Their ages were about the same as those of the operators.

The results of the investigation justified the following conclusions:

1. The visual capabilities of the 244 radar operators were not significantly different from those of the 112 non-operators.
2. There were no significant differences in visual efficiency between a group of 58 veteran operators (18 months or more of experience) and a group of 52 short-term operators (2 months or less of experience). Every analysis that could be made of the results showed that the vision of the veteran compared more than favorably with the vision of the beginners.
3. Symptoms of visual fatigue and eye strain were reported no more frequently by veteran operators than by inexperienced operators.
4. A common complaint among operators was that if they remained at the scope for "too long a time" (two or three hours or more), they suffered from eye strain, headaches, and other symptoms of eye distress. But the same men admitted that similar symptoms occurred if they read for too long a time; so the visual complaints were not specific to oscilloscope operation.
5. As a whole, the results indicated that radar operation did not impair the visual efficiency of the air-warning operators.

Rumors are often circulated among radar operators that continued work at the scopes will damage their eyes. The results of the Camp Murphy Project should be effective in combating such rumors. The rumors probably arise from boredom and dissatisfaction with the task being done. An occasional operator with defective vision may experience genuine visual distress. His complaints tend to support the belief that oscilloscope operation damages the eyes.

Men with visual defects should be detected by careful visual examination and should be relieved of oscilloscope duties until their eyes have been corrected by means of glasses. The Ortho-Rater is a suitable instrument for detecting visual deficiencies and might well be used during the selection of radar operators. A complete visual examination with the Ortho-Rater can be made in ten or fifteen minutes.

PIGEONS

NOTES ON PIGEONS IN THE CALIFORNIA AND ARIZONA DESERT

The Desert Training Center

The main topographic features of the Desert Training Center area are moderately high mountains, large flat barren valleys and occasional dry salt lake beds. The mountains form disconnected ranges running generally north or south, with steep and rocky sides. In altitude they range from 2,000 to 7,400 feet, the highest being in the northwestern section and the lowest in the southeast near Yuma, Arizona. Except for the Colorado River, no streams or lakes are found. Most of the valleys are interconnected and all the mountains can be bypassed. Three main highways cross the area from east to west and one from north to south.

Climate

Temperatures during the day occasionally rise to 125 degrees in the shade. In summer the temperature frequently falls from above 100 degrees in the daytime to below 75 degrees at night, and in winter frequently rises from below freezing point in the early morning to as high as 100 degrees at mid-day. Cloud bursts, wind storms, or drops in temperature may occur at any time without warning. Yearly rainfall is less than five inches. Prevailing winds are from the south in the summer, and from the north in winter. July, August and September are normally considered the rainy months, though peak rainfall for any of these months seldom exceeds .37 inches, which usually comes as a cloud burst.

Desert Plants

The three principal types of plants found on the desert are cactus, greasewood and sagebrush. The cactus, which often reaches more than 15 feet in height, is the least common. Sagebrush is a small plant seldom rising over two feet above the ground. Greasewood is the most common and is found throughout most of the desert valleys.

Employment of Pigeons in the Desert Training Center

In general the use of homing pigeons as a means of signal communication in the Desert Training Center has proven very satisfactory, in spite of the fact that the general topography and climate found in the desert probably offer more resistance to the successful flying of pigeons than in any other region.

The effective use of pigeons is dependent upon the method by which they are employed. They can be utilized in most instances by ground troops and by aircraft as a means of communication from air to ground during periods of radio silence.

Establishment of Lofts

Lofts in the desert are best employed in either a permanent or semi-permanent location. It has been found that pigeons under six months of age can be frequently resettled to new locations in the desert area, requiring approximately one week to safely accomplish this task. Attempts to resettle old pigeons in the desert have proven a definitely unsatisfactory experiment and should not be attempted unless emergency requires it. Results, after participation in three maneuvers, have definitely proven that it is practically impossible to maintain a pigeon loft at the headquarters of the armored division or even armored corps. The great mobility of armored divisions and armored corps headquarters under tactical conditions render the settling of pigeons an impossibility. Even the checker-board method of resettlement is not very practical due to the fact that an armored corps will move approximately once each week and sometimes even more frequently.

Training

The training of young pigeons is begun after the birds have reached their fifth week, with more time for settling and ranging required than in normal wooded terrain. It would not be advisable to quote exact figures since sporadic desert sand storms frequently disrupt training flights. Young pigeons are group-tossed up to a distance of fifty miles after which they are brought within a mile of the loft to be double-tossed until the desired 75 or 100 mile distance is attained. It has been definitely proven that, for best results, pigeons should be double-tossed when used for message work in the desert. Single direction flying is considered the only practical solution in training birds for desert terrain. Since the radiation from the mountain ranges causes updrafts of air, which are believed to frighten pigeons, the pigeons tend to circumvent these ranges and seek the interconnecting valleys as their route of flight.

Flights

The maximum advisable distance in flying pigeons in the desert should not exceed 100 miles and should preferably not exceed 75 miles. Extreme temperatures, sometimes in excess of 120 degrees in the shade, will seriously reduce the speed of pigeons and average speeds in excess of 39 m.p.h. over well flown routes can not be expected. Pigeons released in the evening after 1800 will return to their lofts more rapidly than at any other time of the day. Those released in the morning before 0900 will average the second best time, while those released at noon will show the slowest time in returning to the loft, frequently refusing to fly until the extreme heat of the day has subsided after which they will return to their loft.

Food and Water

Pigeon Food as described in paragraph #3, under Food Mixture (TM 11-410) is considered ideal feed in the training of desert pigeons. A constant supply of cool water should be kept before the pigeons at all times, both in the loft (PG-46-A) and in the container (PG-51). The rate of evaporation and dehydration reaches an extremely high level in these desert regions.

Breeding

In general, breeding actvities can be conducted throughout the entire year in the Desert Training Center. The average period of incubation has been found to be between 16 and 17 days from the time the second egg is laid until the first egg hatches. The rate of breeding is considerably increased as compared with cooler climates and the death rate of young pigeons in the nest is noticeably low.

Disease

Very little disease has been detected among pigeons in the Desert Training Center. No cases of paratyphoid have as yet been noticed and, out of 2,500 pigeons, canker is seldom detected while the few pigeons which have contracted this disease have recovered, with proper treatment, in an amazingly short time.

Tactical Report on Pigeons in the June-July 1943 Desert Maneuver

The tactical mission of the 3rd Platoon, 280th Signal Pigeon Company in supplying pigeon communication to the combat units participating in this maneuver proved very satisfactory. Pigeon communication was furnished to Red and Blue Forces, and also to air umpire units. Pigeon lofts were established at strategic locations throughout the maneuver area. This arrangement of lofts made it possible for the organization to furnish pigeon communication from any and every point within the designated maneuver area. Pigeons were delivered each day to corps and division message centers. These pigeons were redistributed to combat teams, scouting patrols, and reconnaissance units upon orders of the immediate Signal officer. Numerous plain-text and encoded messages, as well as map overlays, were carried to the home loft and were immediately phoned or delivered to the proper designation.

In the few instances that tactical conditions did not warrant the employment of pigeons by the combat units, practice routine messages were sent to designated locations to familiarize the various personnel in the use and handling of pigeons. This proved to be of much training value to all personnel participating, including the pigeoneers.

Infantry and armored scouting patrols as well as advancing combat teams found pigeons very valuable in maintaining contact with their higher headquarters. A point of unusual interest was the employment of pigeons by suicide squads situated on the summits of Palen, Little Maria, and McCoy mountains by Red Forces. These suicide squads were established on numerous peaks for a certain prearranged tactical mission in the early stage of the maneuver. Pigeon communication was used entirely to convey messages back to the headquarters of the Red Forces since no other reasonable means of communication was available to the units. Some birds were held five days in the small combat containers under extreme temperatures and upon being released with messages returned to their home lofts in excellent time.

The uses of pigeons by the Blue Forces were very similar to those employed by the Red Forces. Cavalry units operating with the Blue Forces in

many tactical situations found numerous occasions to use pigeons to communicate back to higher headquarters.

Air-to-Ground Communication

Pigeon Detachment No. 3 located at Desert Center Army Air Base proved most valuable to the air umpire units working from that base. Pigeons released from umpire planes proved a most secret and rapid means of signal communication from aircraft to ground station.

Combat Efficiency

The combat efficiency of this platoon was extremely satisfactory during the maneuver. It is to be noted that a one hundred percent delivery of all messages sent by pigeons was accomplished. The pigeon speeds during the maneuver averaged approximately thirty-five miles per hour.

AN EXPERIMENT IN TEAMING PIGEONS AND DOGS

A detachment of the 828th Signal Pigeon Replacement Company has recently returned from Cat Island, Gulfport, Mississippi, where experiments were conducted using pigeons in conjunction with war dogs as a means of military communication.

Cat Island was selected for war dog training because of the island's similarity to islands of the south Pacific and because it was felt that the dogs' chief value would be in jungle warfare. It is a small body of land, roughly seven miles long and six miles wide, located approximately eight miles out in the Mississippi Sound, south of Gulfport, Mississippi. The vegetation is chiefly scrub oak, palmetto palm trees, and marsh grass, varying in density from marsh grass land to heavy growth. The beaches forming the perimeter of the island are covered with a very fine, white sand. Where the beach is absent, swamps extend to the shore land. The swamps form excellent breeding grounds for mosquitos. These insects were present in sufficient numbers to prove a nuisance to both human personnel and animals.

Dog Training

There were, when the pigeon detachment arrived, three types of dog training in progress upon the island. Tactically, this training was divided into scouting, casualty aid, and messenger service. Of the three classes of training, the pigeon experiment was concerned only with messenger service.

Upon the premise that a well trained scout dog can detect and give notice to its handler of human scent, and upon the further premise that Japanese body odor presents a distinct scent, these dogs were trained to recognize Japanese scent and give warning when they did so. American-Japanese military personnel were employed as decoys. For casualty dogs, a different type of training was employed. They were taught to recognize a fallen man as an injured man and to bring medical personnel to the "wounded" man. The tactical value of such aid as these scout and casualty dogs were able to supply, in jungle terrain where visibility and maneuverability are limited,

has proven their utility.

The Messenger Dog and Pigeons

The messenger dog is trained to carry communication swiftly over terrain where it would be difficult for a man to travel, or where it would be tactically impossible to send a mounted or dismounted messenger. The message these dogs carry in a leather collar pouch. The Pigeon Detachment was sent to the War Dog Training Center to conduct experiments in conjunction with this last type of dogs and to test existing equipment.

Extreme heat upon the island during the month of July and the early part of August proved less of a problem than had been anticipated. The lofts (mobile type) were established, the birds gradually accustomed to work in the heat of the day, and within seven days a line of pigeon communication was established on the island. Care was necessary in settling the birds with regard to the profuse amount of glaring sand and surrounding water, which tended to confuse them.

Communication upon the island when the pigeon detachment arrived was limited to mounted messenger and truck. The points between which communication was necessary were the main camp upon the western end of the island and the advanced training bivouac on the eastern side. The distance between was four miles. The pigeons once established became the most rapid means of communication upon the island.

After a week of preliminary training by the pigeon detachment, they were incorporated into the dog training program. The work was done under simulated battle conditions. One phase of the problem was to have a dog carry pigeons forward to an isolated outpost position where neither vehicle nor man could reach. A further experiment was releasing a messenger dog and a message-bearing pigeon simultaneously over a mile and one-quarter course. The dog covered the distance in eight minutes; the pigeon arrived in one minute and fifteen seconds.

The carriers used to transport pigeons upon the dog's harness were of wicker construction, cylindrical at the mouth and roughly contured to the pigeon's body. The pigeon's lack of ability to balance itself within this compartment and the relatively rough interior caused roughage and damage to the pigeon's plumage as the dog moved with this carrier over uneven terrain. Action has been taken by the pigeon detachment commander to redesign the carrier and remedy its faults.

An emergency pigeon carrier, which was made use of when sending pigeon messengers by dog, were used shell casings from the artillery. These cylindrical cardboard cannisters proved excellent improvisions for moving individual birds over short distances; and it is believed that these cylinders of cardboard, found wherever the artillery is in action, should suggest themselves as emergency containers for the transport of message birds whenever the normal crate or container is not available.

The work with the birds under semi-tropical condition in a terrain heavily infested with mosquitos proved that these insects are as annoying to the pigeons as to man. The mosquitos appeared to attack the pigeons about their eye ceres and legs and it was evident upon observation that they did annoy the birds. For this reason, it was necessary to cover the quarter-inch mesh on the loft with a finer screening.

Summary

Work on the island proved very successful and, before the pigeon detachment was recalled, its birds and personnel were incorporated in a training film built around the subject of training war dogs. In the report of the Detachment to its headquarters, the following conclusions were presented:

1. The use of dogs to carry pigeons to forward positions, where a mounted or dismounted messenger would be subjected to direct enemy fire, is both practical and feasible.

2. The combination of dogs and pigeons to provide communication over short distances in the jungle where terrain is often impassable is tactically sound.

3. The present type of wicker carrier designed to be used with dogs is impractical and of physical harm to the pigeon being transported.

4. A new design, modifying the present type of carrier to make it more secure from the standpoint of the bird being carried, has been prepared by the War Dog Pigeon Detachment Commander and submitted to the Pigeon Service.

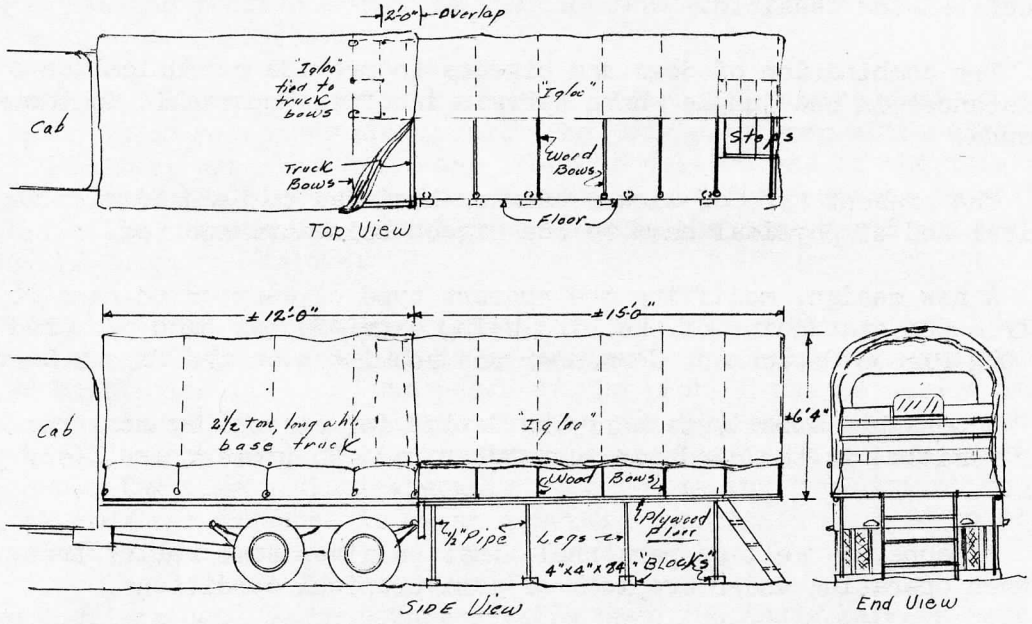
5. A possible substitute carrying device for pigeons by dogs (or horse or motor vehicle) is the cardboard cannister used to protect artillery projectiles.

6. Pigeons, as well as personnel, must be given some relief from mosquitos when operating under tropical or semi-tropical conditions.

DESERT C.P. "IGLOO"

While operating on desert maneuvers one corps signal officer found that Shelter HO-17 was very uncomfortable because of the hot weather and that neither the shelter nor the body of the 2-1/2 ton, long wheel-base cargo truck gave him sufficient office space for the corps signal officer's installation. Consequently it was decided that two birds could be killed with one stone by constructing a light weight, easily ventilated CP "Igloo" that could be set up rapidly as an extension to the rear of the truck body and that would double the floor space provided in the truck.

A sketch of the "approved solution," accomplished with 3/4" plywood, sections of 1/2" galvanized pipe, a tent and a bit of ingenuity, is shown here.



The Tent, C.P., Truck, as issued by the Q.M., consisted of a 17' x 15' duck tarpaulin, with end curtains and wooden bows, and was intended to be set up on the ground, supported by the bows provided, or on the bows of a truck - extending to the sides and rear of the truck body.

In constructing the "Igloo" floor, 3/4" plywood was fastened to a pipe framework and folding pipe legs added to support the floor at truck bed level. Either 2" x 4" or 4" x 4" blocks were placed under the legs to provide a solid bearing.

When the CP moved the tent and bows were folded, like an accordian, against the rear bow of the truck and tied there securely. The pipe legs were folded up under the floor and the entire floor assembly slid completely into the truck body. With the tailgate closed, the assembly rode well over

rough terrain. The "Igloo" could be assembled or disassembled in about 15 minutes.

For blackout operations double curtains were added at the rear of the "Igloo," one at the head of the stairs and the other covering the entire rear.

The complete "Igloo" weighed approximately 150 pounds and cost about $210.

FREQUENCY ASSIGNMENT TRAINING

"On the job" frequency assignment training is being given in Communication Liaison Branch, OCSigO, in cooperation with Military Training Branch, to fourteen officer-graduates of the Frequency Assignment Course at Fort Monmouth. This training was initiated to give Signal officers concerned with the allocation of frequencies and call signs a better background and understanding of the subject as related to Ground Forces in the United States and all forces in theatres of operation.

The instruction is being given to the officers in groups of four or five at a time for a period of two weeks each. Eight of the officers scheduled to take the training are attending maneuvers while the first group of five officers are receiving instruction. The officers attending the maneuvers will be briefed beforehand concerning the main features which should be observed during the maneuvers. Upon completion of the instruction four of the officers will return to their Ground Force units. The other officers will attend the Wave Propagation Course to be given at the Bureau of Standards by the Interservice Radio Propagation Laboratory before coming to Communication Liaison Branch.

Instruction will include the following subjects:

Importance of the control and allocation of frequencies and call signs.
International allocation of frequencies and call signs including conventions, arrangements and publications.
Control of communications within the United States and frequency assignment agencies.
Allocation of frequencies and call signs within the army at home and in the theatres.
Present use of the radio-frequency spectrum including available records of uses of frequencies and the use of these records.
The ionosphere and its importance in the selection of frequencies for reliable communication.
Interference problems and their solution.
Frequency and geographical separation required in assigning frequencies.
Records of assignments of frequencies and call signs which should be maintained.
Necessity for the coordination of all assignments.
Procedure to be followed in applying to higher headquarters in various areas or theatres.
Actual problems wherein this knowledge will be applied.

The subject of frequency assignment is so large that this brief course can at best no more than acquaint these officers with the principal types of problems they may encounter and the sources of information to aid in their solution.

EQUIPMENT NOTES

SIGNAL CORPS BOARD

Signal Corps Board Case No. 531

Two-wire Operation of Field Carrier Equipment, approved by the CSigO, 9 December 1943.

The Signal Corps Board in this case was directed to service test recently developed field carrier equipment separately designed for two-wire operation. The major items tested included Converter Set TC-33-( ) (Carrier, 2 wire - 4 wire), Repeater Set TC-37-( ) (Carrier, 2 wire), Telephone Unit EE-105-( ), and Carrier Hybrid CF-7-( ).

Tactical four-channel carrier equipment has been standardized and procured for military use. However, this equipment was designed to operate on a four-wire basis and intended primarily for use on Spiral-4 Cable.

Telephone Terminal Set TC-21-( ) and Repeater Set TC-23-( ), the major items of equipment used on the four-wire tactical carrier system may, of course, also be used on open wire lines on a four-wire basis. Because open wire is capable of handling higher frequencies and maintaining good transmission over greater distances than the Spiral-4 Cable, it has been found possible to transmit the entire four-channel carrier transmission over a single pair of open wires by stepping up the frequency employed in one direction of transmission. This possibility has lead to the development of Converter Set TC-33-( ) (Carrier, 2 wire - 4 wire) and Repeater Set TC-37-( ) (Carrier, 2 wire).

This converter set consists of one Converter CF-4-( ) (Carrier 2 wire - 4 wire) with the necessary auxiliary equipment for connecting, grounding, and powering the converter. A photograph of Converter CF-4-A (Carrier, 2 wire - 4 wire) is reproduced as Figure 1.

When associated with Telephone Terminal Set TC-21-( ) (Carrier) the converter steps up or modulates the band of frequencies in one direction of transmission from the original 200 - 11,600 cycles into a new band of from 20,850 - 32,250 cycles. This new band of frequencies is then transmitted over the same pair of conduc-

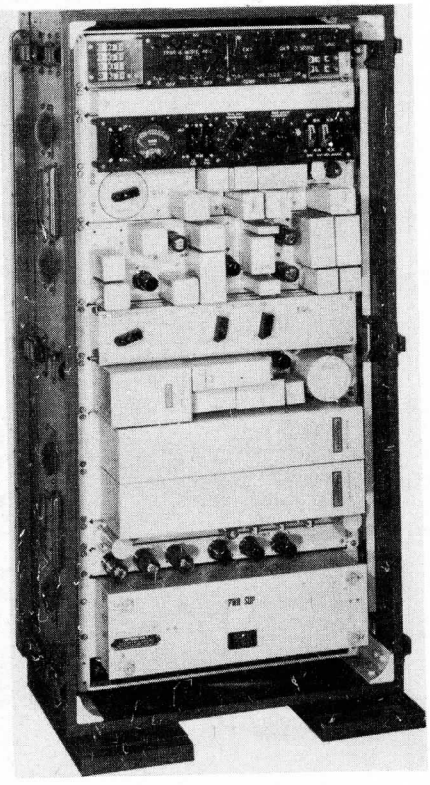


FIG. 1 - CONVERTER CF-4-A (CARRIER, 2 WIRE - 4 WIRE)

tors as the transmission of the other 200 - 11,600 cycle band in the opposite direction.

At the receiving end of the system, the high frequency band is selected and demodulated or stepped down to its original value of from 200 - 11,600 cycles by means of Converter CF-4-( ) (Carrier, 2 wire - 4 wire) and is then passed into Telephone Terminal Set TC-21-( ) from which point it is handled in the same way as the regular four-channel, four-wire transmissions.

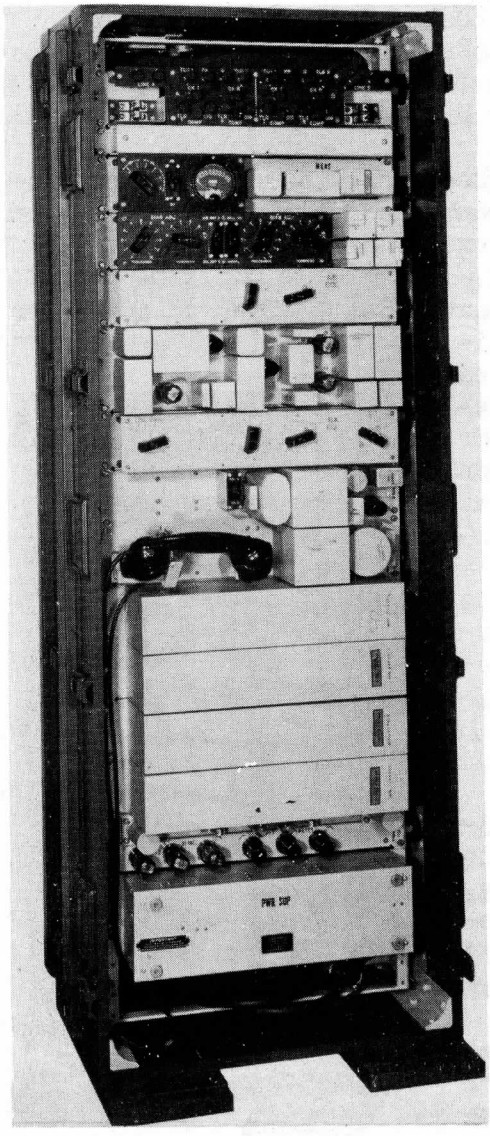


FIG. 2 - REPEATER CF-5-A, (CARRIER, 2 WIRE).

Repeater Set TC-37-( ) (Carrier, 2-wire) consists of one Repeater CF-5-( ) (Carrier) with the necessary equipment for connecting, grounding, and powering the repeater. It contains filters designed to separate the high- and low-frequency band, as well as two separate amplifiers, each capable of amplifying its own band (200 - 11,600 cycles in one direction and 20,850 - 32,250 cycles in the opposite direction).

Repeater CF-5-A (Carrier, 2 wire) is mounted in a portable case with removable front and rear covers. It measures 19½" x 24" x 64" and weighs about 400 pounds. This repeater is shown in Figure 2.

By means of Converter Set TC-33-( ) (Carrier, 2 wire - 4 wire) and Repeater Set TC-37-( ) (Carrier, 2 wire), in conjunction with Telephone Terminal Set TC-21-( ), any or several pairs of an open wire pole line may be used for four-channel carrier transmission. Using 080 40 percent copper steel wire high grade performance up to about 400 miles with a loss of 6-db may be obtained and up to 800 miles with a loss of 9-db. The Board report indicates that repeater spacing of about 90 miles is desirable. Using no repeaters, approximately 135 miles transmission with a 6-db loss and 200 miles with 30-db loss may be obtained. This data is based on the assumption that the entire line section is open wire. The use of entrance or intermediate cables will increase the losses.

Telephone Unit EE-105-( ) was designed to fill the need for an instrument by means of which a lineman may call in on an open wire pair over which the carrier system is

operating, without interfering with the carrier channels. It contains a filter unit and a 1000/20 cycle whistle. By throwing a switch, the Telephone Unit EE-105-( ) may be operated as a regular EE-8-A telephone unit. This telephone is shown as Figure 3.

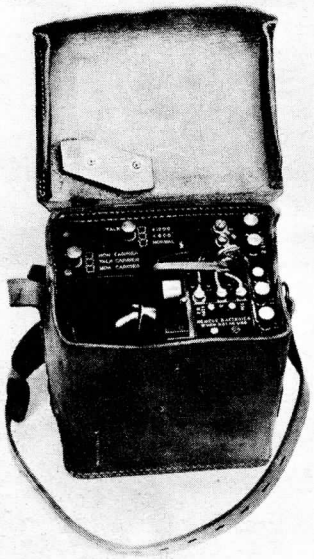


FIG. 3- TELEPHONE UNIT EE-105.

Carrier Hybrid CF-7-( ) was described in detail in the November issue of the Signal Corps Technical Information Letter. It is used in conjunction with the Telephone Terminal Set TC-21-( ) and Repeater Set TC-23-( ) to permit the operation of a four-channel carrier system on one pair of an open wire line. This system employs the principle of hybrid balance. The distance over which satisfactory transmission may take place is dependent upon the degree of balance obtained, as well as the conductivity of the conductors and the existing noise level. Furthermore, not more than two pairs of an open wire pole line may be used due to difficulty from cross-talk. If two pairs are used, they should be separated as far as possible.

A Carrier Hybrid CF-7-( ) must be used between the Telephone Terminal Set TC-21-( ) and the transmitting pair at each end of the line, and, if a Repeater Set TC-23-( ) is used, a Carrier Hybrid CF-7-( ) must be inserted on each side between the repeater and both incoming and outgoing lines. The use of more than one repeater in a system of this type is not recommended.

On page 50 of the November issue of the Signal Corps Technical Information Letter will be found Tables 1 and 2 giving estimated maximum distances of transmission with various types of facilities, degree of balances and losses. Using 080 40 percent copper steel wire with 20-db balance and 6-db loss, the table indicates a maximum repeater section length of 43 miles when using one repeater. If the circuit were of the wire specified, this would mean an 86 mile line could be used with a net of 6 db loss. Entrance cables, switchboard connections, etc., would result in increasing the losses. However, the Board states that satisfactory transmission can usually be obtained to the extent indicated in the table for 20-db balances and 6-db losses.

The greatest field for the use of the carrier system employing the Carrier Hybrid CF-7-( ) appears to be in situations where existing open wire lines are taken over or captured from the enemy and when a stabilized situation allows the advance of open wire lines forward from army headquarters.

The principal advantages of the Carrier Hybrid CF-7-( ) are that it is light, compact, and requires no auxiliary apparatus. It measures 22-1/2" x 9-3/4" x 7-3/4" and weighs 51-1/2 pounds. It is shown in Figure 4.

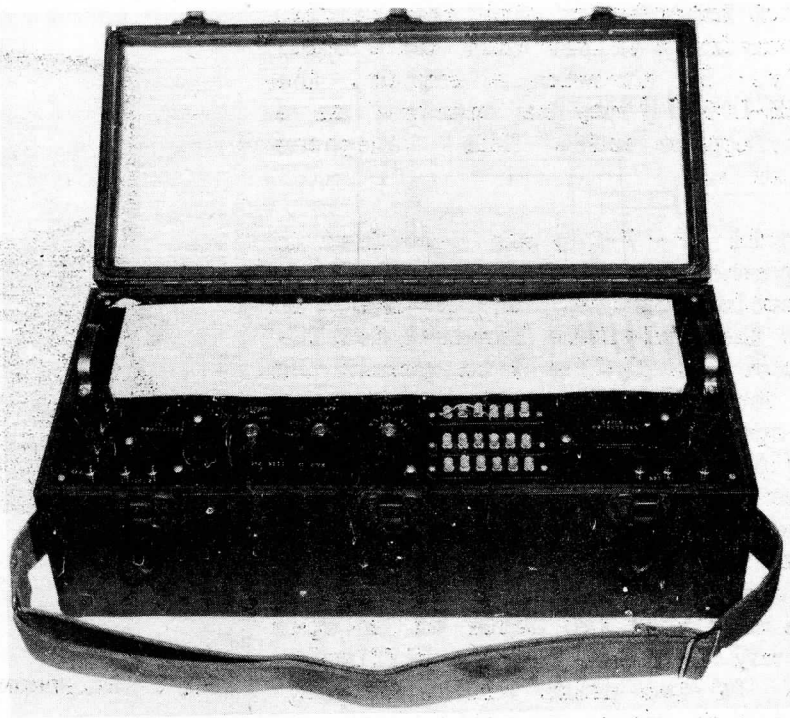


FIG. 4 - CARRIER HYBRID CF-7-( ).

The two-wire carrier equipment was tested under the supervision of the Signal Corps Board on the open wire facility constructed by the 930th Signal Battalion near Gainesville, Florida, in connection with the Signal Corps Board Case No. 440, Supplement II, which is covered in the following report in this issue. Spiral-4 Cable and long range tactical wire facilities (Wire W-143) were constructed specifically for these tests.

The Signal Corps Board found Converter Set TC-33-( ) (Carrier, 2 Wire - 4 wire), Repeater Set TC-37-( ) (Carrier, 2 wire), and Telephone Unit EE-105 -( ), when minor modifications have been made, suitable for the purposes intended.

The approved recommendations provided for the presentation of these items modified as recommended by the Board to the Signal Corps Technical Committee for classification and, when standardized, their procurement and inclusion in the Signal Corps Equipment Pool for issue as directed by theatre commanders. It was also recommended that Carrier Hybrid CF-7-( ) which was standardized 30 June 1943, when modified as suggested by the Board, be procured for inclusion in the Signal Corps Equipment Pool.

Recommendations that action be initiated to prepare appropriate technical manuals describing the major items, to promulgate to the field general information sufficient to acquaint Signal officers with the possibilities

and the limitations of two-wire carrier equipment, and to establish training programs in Signal Corps schools for its use were also approved.

Signal Corps Board Case No. 440, Supplement II

System of Rapid Pole Line Construction for Army Corps Signal Battalions, approved by the Chief Signal Officer, 10 December 1943.

The Signal Corps Board was directed to supervise and report a field test of the equipment and techniques developed under contract with the Bell Telephone Laboratories for the construction of military open wire pole lines. A sufficient length of pole line equipment with 4 circuits was to be constructed, operated, and maintained by Signal Corps personnel in accordance with the information contained in the Field Trial Edition of Technical Manual 11-368, entitled "Field Construction of Open Wire Lines," 24 April 1943, to check its accuracy and indicate any necessary modifications.

A pole line 30 miles long equipped with 4 circuits was constructed by the 930th Signal Battalion near Gainesville, Florida, using the method and material recommended by the Bell Telephone Laboratories for "rapid" pole lines. The features of this type of line were poles 20 feet long constructed of 2 x 4's nailed together to make a 4 x 4 support, spaced 150 feet apart. Crossarm PF-92, supported eight 080 40 percent copper steel wires on Insulators, Toll, IN-15. The 2 x 4's were also to be used to construct X-frames and H-structures when required.

This type of line was later converted to a type called "semi-permanent," the major features of which were 20 foot, Class 9 poles, spaced 300 feet apart, using the same crossarm pins, insulators and wire that were employed in the "rapid" line. Correspondingly heavier guying was used in the "semi-permanent" line.

It was originally considered advantageous to install the "rapid" line while the corps engaged in combat or rapid movement and convert within a period of 90 days to a "semi-permanent" type when opportunity offered. However, the Signal Corps Board found that almost as much labor time was required to install the "rapid" line as to initially construct the "semi-permanent" type. Using the data obtained in the test, it was estimated that the "rapid" line could be laid at the rate of 8.8 miles per 10 hour day by a construction platoon, while during the same time the same organization could construct 7.34 miles of the "semi-permanent" type. It was also found that a construction platoon working 10 hours could convert 8.91 miles of line from "rapid" to "semi-permanent" type. In addition, it was found impracticable to convert from "rapid" to "semi-permanent" types using the material common to the same lines and maintain continuous service. If continuous

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the initial installation of the "rapid" type and later conversion to "semi-permanent" as uneconomical of both labor and material. It was considered preferable to initially install material suitable for lines of the "semi-permanent" nature. During a period of rapid forward advance or combat, Spiral-4 Cable and long range tactical wire could be utilized for transmission facilities until the open wire construction could be installed.

The Board recommended that four types of tactical open wire construction be employed. The initial installation is considered permanent and its type is based upon the condition of "storm loading" expected in the theatre in which the installation is made. "Storm loading" is defined as the effect on an open wire pole line of the combined stresses by simultaneous low temperature, ice on the individual wires, and a wind blowing across the wires.

"Light loading" represents conditions of 30° Fahrenheit minimum temperature and maximum wind pressure of 12 pounds per square foot against wires with no ice (wind of 70 miles per hour). For this type of loading the Board recommends pole lines consisting of 20 foot, 4 x 4's or two 20 foot, 2 x 4's nailed together, spaced 150 feet apart, with one crossarm carrying eight wires. H-structures and X-frames may be used when required.

"Medium loading" exists when at a minimum temperature of 15° Fahrenheit, wind pressure of 8 pounds per square foot is exerted against wire having an ice coating of 1/4" in radial thickness (wind velocity of 60 miles per hour). Where "medium storm loading" is required, the Board recommends round 20 foot, No. 9 poles, spaced 200 feet apart, one crossarm, eight wires. Some larger poles are included in the material lists for special situations.

"Heavy loading" is defined as applying where there is a minimum temperature of zero degrees Fahrenheit and a wind pressure of 8 pounds per square foot on wires covered with a 1/2" radial ice coating. Material lists for this type are the same as for "medium loading" except for provisions for heavier guys at dead ends and H-fixtures.

The Board also recognizes an "extra heavy loading" type which would anticipate conditions worse than those described in "heavy loading." The material list for this type provides spacing of 150 feet and more guy material.

"Medium," "heavy," and "extra heavy loading" types are capable of supporting a second crossarm carrying eight wires. The 88" crossarm is specified. It may be cut in two in case only a four-wire line is desired and shipping weight is a critical feature. The shipping space of 462 ship tons required for the "light loading" type may be reduced to 326 ship tons if material for a four-wire instead of eight-wire line is transported.

The approved recommendations included the initiation of action for the publication of Technical Manual 11-368 and the inclusion of the recommended material for open wire pole lines in the Signal Corps Equipment Pool. The initiation of action toward the standardization of certain minor tools and supplies used on open wire construction and changes in the specification of others was also recommended and approved.

AIRCRAFT RADIO

PROBLEMS OF HIGH ALTITUDE COMMUNICATION (PART II)

Microphones for Use in Aircraft

Last month the problems involved in obtaining satisfactory interphone and radio communication in aircraft operating at high altitudes were generally stated and discussed. The part played by headsets in the overall aircraft communication system and the improvements which have been effected in the design and production of headsets, were discussed. This month it is desired to consider briefly the types of microphones available for use in Army aircraft and their relationship in general to the problem of high-altitude communication.

As in the case of headsets, a reduction in the performance of microphones may be expected when used at altitudes above 15,000 or 20,000 feet. The reasons for the decrease in performance are threefold: (1) physiological changes affecting the physical energy levels of the using personnel; (2) deterioration as a sound-conducting medium of the air-columns between the user's lips and the microphone instrument, due to the decreased pressure of air at high-altitudes; and, (3) changes in the electrical characteristics of the microphone as an effect of the reduced air pressure. The problem as it confronts the user is that as he ascends in altitude his desire to exert himself falls off rapidly, at the same time that he is forced to use his voice more energetically in order to make himself heard.

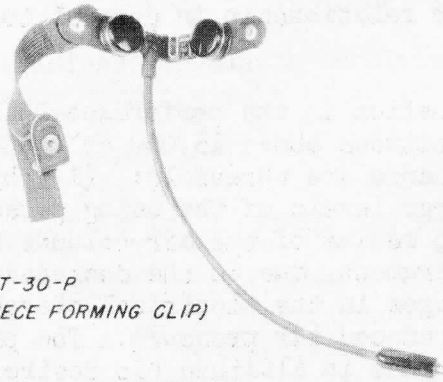
Standard microphone equipment at present in use in Army aircraft is as follows:

1. Microphone T-17. This is the standard hand-held carbon type instrument.
2. Microphone T-30-( ). This is the throat-type carbon microphone, which, in the early stages of its development, was known particularly in British usage as the "Laryngaphone."
3. Microphone ANB-M-C1. This is the carbon microphone for installation in the standard Air Corps oxygen masks, sometimes incorrectly referred to as Microphone T-42-( ).
4. Two other oxygen mask microphones, employing the magnetic instead of the carbon type of unit, are given limited use. These are the Microphone T-34-( ) and T-44-( ). The T-44 is an improved type, which replaces the T-34. Both of these magnetic microphones, which operate at voltage levels considerably lower than the carbon microphones, are used exclusively with Radio Set SCR-522-( ) V.H.F. Command Set.

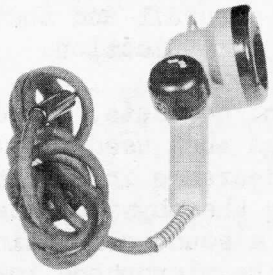
Microphone T-17 is a rugged, sturdy instrument which has given excellent service on the ground as well as in the air. When used with the moisture-proof Microphone Cover M-367, furnished with each microphone, it will perform satisfactorily under the most severe service conditions. However, a hand-

held microphone of the T-17 type has two inherent disadvantages when used in modern-day aircraft. The first is, that it picks up and transmits the engine and propeller noise of the aircraft about as efficiently as it does the voice. At the same time, most crew members of an aircraft have too many duties requiring the use of both hands, and the handling of a microphone at a critical moment in the course of a flight is not always convenient or desirable.

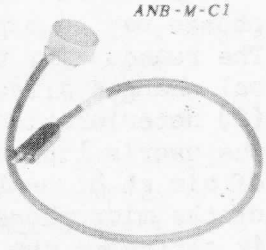
The Microphone T-30-( ) consists of two carbon button microphones mounted on a rubber strip, with a section of elastic band for attachment by means of snap fasteners to the throat. When fitted to the throat, the center of the rubber strip is located just above the Adam's apple, and a microphone button



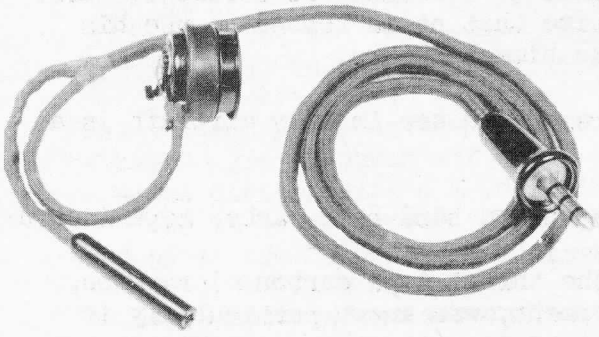
MICROPHONE T-30-P
(WITH NECK-PIECE FORMING CLIP)



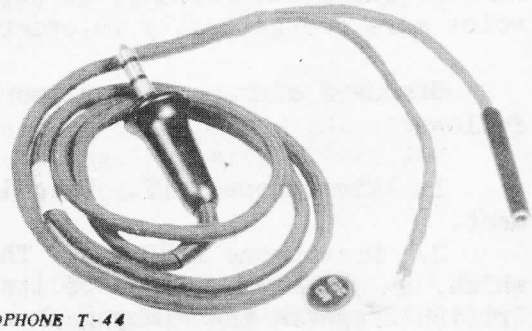
MICROPHONE T-17



MICROPHONE
ANB-M-C1



MICROPHONE T-34-( )

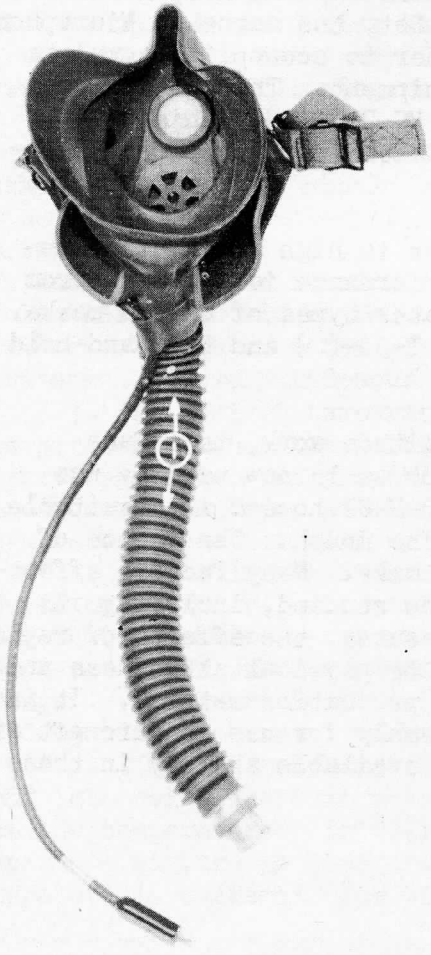


MICROPHONE T-44

rests on either side of the Adam's apple. Later versions are equipped with a metal clip placed at center of the rubber neckpiece. This clip improves the performance of the microphone by fitting the microphone button more snugly to the throat. The T-30 is actuated by the vibrations of the vocal chords transmitted through the microphone buttons in physical contact with the throat. Because the microphone is excited chiefly by contact, it is a good performer with respect to masking airplane engine and other noises. For the same reason, that is, because of its reliance upon contact excitation, rather than upon excitation in the usual manner, by means of the varying impact velocities of sound waves, it is not uniformly a good reproducer of speech. In general, the microphone is deficient in transmitting the higher frequency components of speech. In use, the intelligibility of its output varies widely according to the shape of the throat, voice, and ac-

cent of the individual speaker. However, the microphone has had important practical advantages, in that it leaves the hands free and may be worn with or without the oxygen mask. Its most successful employment has been where the user understood the microphone's limitations and has made an effort to speak deliberately and clearly. The comment of an aircraft pilot that the microphone "made Joe Smith's words run together" was a commentary on the enunciation of Joe Smith rather than upon the microphone.

Microphone ANB-M-C1. This microphone, designed for use in the Air Forces Oxygen Masks A-8-B, A-10, A-10 (Revised) and A-14 (Bulbulian), is a carbon type instrument having excellent electrical stability and response. A complete Microphone ANB-M-C1 consists of a Microphone Unit MC-254-A, a Microphone Cover M-369, and a short length of Cordage CO-219 connecting the microphone unit to a Plug PL-291. Microphone Cover M-369 is used to prevent the accumulation of moisture on and within the microphone unit.



MICROPHONE ANB-M-C1 IN A-14 OXYGEN MASK.

Microphone ANB-M-C1 will provide considerably better performance than any throat type microphone. Under conditions of high altitude and high noise level, the T-17 and ANB-M-C1 are not exactly comparable since the former microphone cannot be used when the oxygen mask is worn. However, tests made to compare the performance of the two microphones in noise at low altitudes show the definite superiority of the ANB-M-C1, principally because of the noise-shield provided by the oxygen mask.

The electrical design of Microphone ANB-M-C1 was carefully selected, after exhaustive tests, in order to obtain maximum performance when used in an oxygen mask. It may be said of this microphone that its design is based upon the most advanced knowledge of the microphone art. Its particular design is such that its electrical response efficiently compensates for the acoustical defects of the oxygen mask. Any oxygen mask, when mounted on the face, provides an acoustical chamber for the voice, having distinct resonance at the lower frequencies. This low frequency resonance must be off-set by increased electrical response in the higher voice frequencies, if maximum fidelity in the reproduction of speech is to be obtained. This, Microphone Unit MC-254-A is designed to do, so that in use an essentially "flat" characteristic for the microphone-mask combination is pro-

vided.

When issued to the user, the ANB-M-C1 must be installed in the oxygen mask. For this purpose, each of the oxygen masks noted above is fitted with a microphone cavity for holding the unit. Inner flaps and outlet holes are also provided for securing the microphone cord in the mask.

As is the case with the Receiver ANB-H-1, described in last month's Letter, the MC-254 unit is a precision device of integral construction. There are no spare parts for the unit. When found faulty for any reason, the unit is replaced.

For all practical purposes, the magnetic type oxygen mask Microphone T-34-( ) and T-44-( ) may be considered as having the same field of use and approximately the same performance characteristics as the Microphone ANB-M-C1. The magnetic type microphone is used rather generally by the British in their aircraft command sets, and, since the standard V.H.F. Command Set, Radio Set SCR-522-( ) is an adaption of the British Command Set, the magnetic Microphone T-34-( ) was adapted from a British model in order to accomplish complete interchangeability in the operation of command equipment. The T-44 is an improved type, using the magnetic Microphone Unit MC-253-( ). This unit externally resembles the carbon Microphone Unit MC-254-( ), but is not electrically interchangeable.

In summary, it may be stated that with respect to high altitude communication, the most efficient carbon microphone performance is obtained from the Microphone ANB-M-C1 installed in one of the later types of oxygen masks. For low altitude work, only the throat Microphone T-30-( ) and the hand-held Microphone T-17 are available.

Under active study at the moment, for low altitude work, is a face microphone to be composed of a lip microphone, such as is now used by the ground forces (Microphone T-45), or Microphone ANB-M-C1 housed in a suitable noise shield and supported by a harness close to the mouth. The choice of a microphone for use in aircraft is not simple to make. Many factors affecting the microphone's performance in service must be studied, including its electrical and mechanical reaction to low air pressures, the effects of rapid and radical changes in temperature and humidity, its physical sturdiness and stability, and its adaptability to precision mass production methods. It is expected that information on a new microphone assembly for use in aircraft at low altitudes (15,000 feet and below) may be made available shortly in these pages of the Information Letter.

GROUND SIGNAL

HIGH AND LOW TEMPERATURE LUBRICATION OF TELETYPEWRITER

The Signal Corps Laboratory, in conjunction with various lubricant manufacturers, has been investigating an all-temperature lubricant for teletypewriters. It is anticipated that teletypewriter equipment will be operated in locations protected from extreme temperatures; however, during storage or transportation the machines will undoubtedly be subjected, at times, to low temperatures. Also, for short periods of time, until the machines have reached the temperature of protected quarters, operation may be required. No all temperature lubricant for teletypewriters has yet been found. However, research is being continued by the Laboratory in this direction.

In view of the need for lubrication information covering the operation of teletypewriters during the present winter and the liability of teletypewriter locations being shifted from low to high ambient temperature, or vice versa, the following recommendations are submitted:

1. Between ambient temperatures of 40° F. and 130° F. the present standard* lubricants should be used.
2. Between ambient temperatures of 40° F. and 100° F. the standard lubrication interval of 550 operating hours should be maintained. Between 100° F. and 130° F. the lubrication interval for the gears and friction clutch felt washers should be reduced until it approaches 150 operating hours at 130° F. The other parts of the apparatus probably will not require relubrication at every 150-hour period.
3. At ambient temperatures below 40° F., it is recommended that the temperature within the teletypewriter cover be raised artificially during non-operating periods if possible. This may be accomplished by placing a lighted incandescent bulb or similar source of heat within the cover. The heat generated by the motor will maintain the temperature during operating periods.
4. If it is not feasible to heat the machine artificially at temperatures below 40° F., the standard oil and grease should be diluted with 50 per cent kerosene by volume for all parts except the friction clutch felt washers. Undiluted oil should be used on these washers at all temperature ranges. The lubrication interval for the diluted lubricants should be about 250 operating hours.
5. It will not be necessary to remove the standard oil from a machine and then relubricate it with the diluted oil when the machine is to operate at low temperature. It will generally only be necessary to apply the oil-kerosene mixture as indicated in paragraph 4 above. If the operating temperature is extremely low or the unit has been exposed to such temperatures,

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* These standard lubricants are Bell Telephone Lab. Spec. KS 7470 oil and BTL Spec. KS 7471 grease which are included in Maintenance Kit ME-7 and are carried in field depot stock.

kerosene should be squirted freely into the type-bar segments, code bars, bell cranks and lever assemblies (not friction clutch felt washers) and the unit allowed to warm up for 5 minutes. The oil-kerosene mixture should then be used for future lubrication. At the lower temperature range, the standard grease should be removed from the motor bearings and the bearings repacked with the grease-kerosene mixture. Care should be taken to prevent over-lubrication of these bearings.

When a machine containing the diluted lubricants is to operate at higher temperatures, these lubricants should not be removed before using undiluted oil and grease. It will be satisfactory to apply standard lubrication as indicated in paragraphs 1 and 2 above; however, the first lubrication interval should be shortened to permit the lubricants in the machine to attain standard viscosity.

SUBSTITUTE CENTRAL OFFICE SET PROCURED TO MEET NEED FOR TC-2 and TC-10

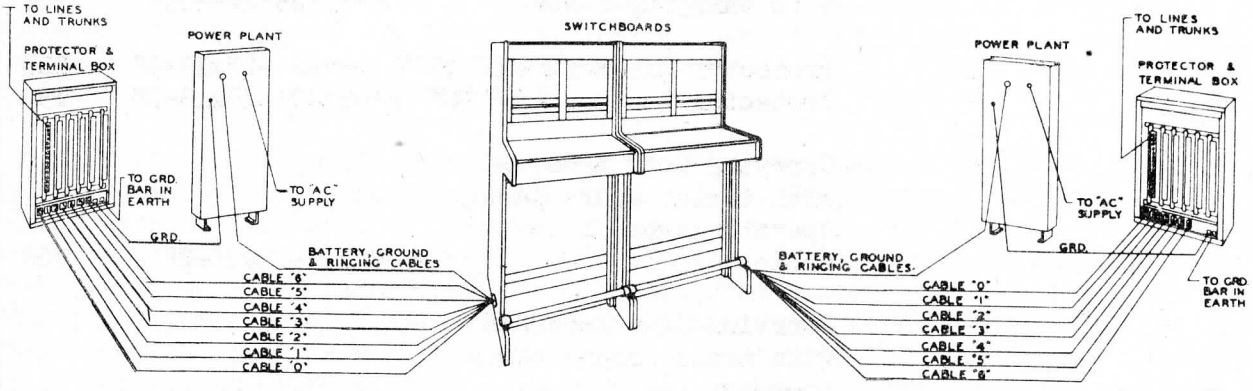
As Telephone Central Office Set TC-2 and TC-10 were not available in sufficient quantities to meet all requirements, a substitute equipment, known as Substitute Telephone Central Office Set Western Electric No. 551-B Modified has been made available for issue until such time as all requirements can be met with the standard Signal Corps equipments. The substitute set is satisfactory for tactical use, except in areas of high humidity. It is, however, not as rugged as the TC-2 or TC-10.

This substitute set is a complete transportable, manually operated telephone central for use within a corps, army or similar sized force for serving magneto and common battery line traffic, as well as originating and terminating trunk facilities to dial or manual common battery offices or other magneto or common battery telephone central office set. The common battery lines and central office trunks use lamps for signals. The magneto line and trunks use drops for signals. The supervisory signals of the cord circuit are lamp type.

For use at corps or similar sized force, the switchboard is a single position, non-multiple, manually operated, magneto and common battery one with the following facilities:

	Equipment
Cord Circuits	10
Telephone and Dial Circuit	1
Central Office Trunk Circuits (manual or dial)	3
Magneto Line or Trunk Circuits	20
Common Battery Line Circuit with Relay	20
Common Battery Line Circuit without Relay	20
Ringing Circuit (Hand Generator)	1
Heater Circuit	1

For use at larger installations, a switchboard similar to the single position one in construction, appearance and equipment layout is available, except that a platform and six foot cords are provided instead of four foot cords. Five interposition trunks are provided in each position in addition to the equipment listed above. The platform permits the use of long cords for completing calls to lines in adjacent positions. The interposition trunk permits the completion of calls to lines in positions which are not adjacent. When so equipped, from two to four positions may be combined for operation in either one or two central switchboard installations.



CABLING DIAGRAM, TWO POSITIONS, W.E. TELEPHONE CENTRAL OFFICE SET 551-B.

A protector frame is provided for each position of the switchboard. The frame is arranged for 100 pairs of protectors, four simplex coils and binding posts for termination of outside lines and trunks. The frame and switchboard are connected together by means of cable soldered to terminal strips in the switchboard and terminated on multiple conductor sockets which are inserted into multiple conductor plugs on the protector frame.

A power cabinet is provided for each position of the switchboard, for 24-volt battery and ringing supply. The power cabinet operates on 105 to 125 volt, 50 to 60 cycle, single phase a.c. service from commercial supply or from Power Unit PE-75-( ). It includes two 6-cell non-spillable type storage batteries, one rectifier, one ringing generator and associated charge and discharge control equipment.

Power Unit PE-75-( ) is furnished, one for the single position switchboard or one for each two-positions of the multi-position switchboard. The power unit is for supplying a.c. service when commercial a.c. service is not available. The power unit is a self-contained, portable, gasoline engine generator set. It provides a supply of 2500 watts, 110 volt, single phase cycle.

Components and their weights and dimensions are:

Substitute for TC-10 Quantity	Substitute for TC-2 Quantity	Description	Approx. Size; Height, Width and Depth	Approx. Unit Weight in Pounds
-	1	Switchboard X-66070A		
		Without Carrying Case	4'-3"x2'-10"x2'-3"	450
		With Carrying Case*	5'-5"x3'-6"x2'-11"	800
4	-	Switchboard X-66070D		
		Without Carrying Case	4'-9"x2'-10"x2'-3"	475
		With Carrying Case*	5'-5"x3'06"x2'-11"	825
-	1	Protector Cabinet X-66070B	3'-8"x2'-4"x1'-8"	150
4	-	Protector Cabinet X-66070F	3'-8"x2'-4"x1'-8"	150
-	1	Carrying Case X-66070C with tools, spare parts, operator sets, loose cables	3'-0"x2'-2"x2'-2"	300
4	-	Carrying Case X-66070E with tools, spare parts, operator set, loose cables	3'-0"x2'-2"x2'-2"	300
4	1	Power Cabinet X-66072A each**	4'-0"x1'-6"x0'-9"	250
2	1	Power Unit PE-75-( ) each	2'-4"x3'-4"x1'-7"	324

* ** - See note, page 68.

PROTECTION OF RADIO SET MOUNTING BOLTS IN LIGHT TANK M5

Armored Force Signal officers will be interested in a method which has been devised for protecting the heads of radio-set mounting bolts in the left sponson of Light Tank M5. Information from the field has stated that these bolt heads are sheared off when the tanks are equipped with steel tracks. This trouble, it is reported, still occurs when the tracks are as tight as possible.

Since the radio set mounting holes in the left sponson are clearance holes, and the head of the mounting bolt must of necessity project from the under side of the sponson floor plate, it has been suggested that the heads of the bolts be welded in place, with considerable weld being placed on the rear of the bolt head to guide the track over the head of the bolt.

The above is published here so that units experiencing such difficulty may be apprised of appropriate remedial measures.

BUNA S INSULATED WIRE W-110-B

The shortage of crude rubber has made it necessary for production of Wire W-110-B to be converted from a rubber insulation to a Buna S insulation by 1 January 1944. Service tests are being conducted on samples of synthetic insulated field wire and the results of these tests will be used as a guide for future improvements and to aid in the preparation of a final Signal Corps specification for production control. Due to the urgency for conversion, however, production of Wire W-110-B with a Buna S insulation will be started under the control of a tentative specification based on the results of laboratory tests on the best Buna S insulation available. It is the purpose of this article to point out that Buna S synthetic rubber is now being used as an insulation for field Wire W-110-B and acquaint the user with some of the development and manufacturing problems involved.

Prior to the rubber shortage, the industry had gained considerable experience with a few synthetics such as Koroseal, Vinylite and Neoprene. These were used because of their desirable characteristics for specific limited applications. The non-inflammable nature of Koroseal and Vinylite compounds, combined with excellent moisture resistance, was responsible for their use for conductor insulations in applications where those properties were needed. They were also used in large quantities for jackets and sheaths, particularly on shipboard cables. Generally speaking, these two thermoplastic compounds, however, have a tendency to soften and flow at elevated temperatures and to become much harder and stiffen seriously at temperatures below Zero F., becoming brittle at the lower temperatures. These limitations, together with their decrease in resistance at elevated temperatures and wide variation in capacitance and power factor with change in temperature, make them generally unsuited for Wire W-110-B insulation. However, in the case of the thin-wall Vinylite insulation of Wire W-130-A, the application of suitable plasticizers has allowed these limitations to be overcome and has resulted in a wire which is mechanically superior to the rubber insulated assault wire.

Neoprene has excellent oil resistance and does not deteriorate in the way rubber compounds do when exposed to sunlight and the weather. These properties make it good jacket material for cables. Nearly all Signal Corps cables and cords for ground use are now being manufactured with Neoprene jackets. The inherent weakness of Neoprene, however, is its poor dielectric properties. Unless these can be greatly improved by compounding, which seems unlikely, this material is unsuited for telephone field wire insulation.

The materials known as Buna S and Butyl exhibit more general kinship to natural rubber, both in chemical structure and in physical and electrical characteristics than most of the other synthetics. Consideration of these properties and the availability of Buna S as a result of the government rubber program have made Buna S a logical substitute for rubber in cord, wire and cable conductor insulations.

Buna S, or GRS as it is sometimes designated, is composed of butadiene and styrene. Part of the butadiene used is of petroleum origin and the rest is derived from grain alcohol. Styrene is made from benzol and ethylene. Buna S consists of three parts of butadiene with one part of styrene. Great variations in the products of the various plants producing Buna S and even variations from batch to batch of the product of a given plant, have in a large measure, been responsible for the difficulties which have been experienced in arriving at a satisfactory insulating compound using this material. No great difficulty is encountered in obtaining a compound which is good either electrically or physically, but it has been somewhat harder to combine good physical and electrical properties in the same compound. For the most part this difficulty has been overcome, but in order to make possible the immediate changeover to Buna S insulation for Wire W-110-B, some slight lowering of specification requirements became necessary.

Generally speaking, the unaged elongation tensile strength and toughness of Buna S compounds are somewhat lower than for rubber. After artificial aging in the laboratory, however, rubber compounds usually show considerably greater deterioration than do the Buna S compounds.

The compression strength of Buna S compounds decreased much more at elevated temperatures than did that of rubber, revealing a tendency of these compounds to soften somewhat with rise in temperature. At low temperatures, there is also a tendency for Buna S to stiffen, making wire insulated with this compound slightly harder to handle and more susceptible to damage from sharp blows at low temperatures. Specification control, nevertheless, assures that the wire will be capable of being wound around its own diameter at -40° F. and withstand high temperature aging tests. This should make the wire satisfactory for all temperatures likely to be encountered in service.

The moisture absorption of Buna S insulation, as indicated by change in capacity between an insulated conductor and ground, is about the same or slightly in excess of that for rubber. The talking range of Buna S insulated Wire W-110-B is generally only slightly less and with some compounds is equal or superior to that of wire with rubber insulation.

It is obviously a great problem for the industry to change over from the use of rubber to the use of a compound with which many individual companies have had little or no experience and with which none have had extensive experience. It will, therefore, be necessary during the first month or two of the conversion period, while the manufacturers are gaining experience in compounding this synthetic, to be somewhat lenient in the enforcement of specification requirements. This may lead to some variations in the quality of wire produced during this initiation period.

Laboratory tests and limited service tests indicate that Buna S insulated Wire W-110-B will be as good in service as Wire W-110-B insulated with the rubber compounds now being used. The superior aging qualities generally possessed by Buna S compounds should make these insulations better where long storage periods are involved or in relatively permanent installa-

tions. In equatorial regions where extremely high temperatures are encountered in service, Buna S insulated wire is expected to be slightly inferior physically and equal electrically to present standard rubber insulated wire. At extremely low temperatures, Buna S insulated wire will probably be somewhat inferior in handling characteristics. This inferiority is, however, not expected to be pronounced. As is the case with synthetics in general, Buna S insulation has a greater resistance to sunchecking than rubber compounds now being used.

Since some Buna S compounds have been produced which are superior, electrically, to rubber compounds and others which were better physically, it seems very probable that an insulation may soon be produced which will be at least equal in every respect and superior in most of its characteristics to rubber insulations.

ATTACHMENT KIT IMPROVES REEL UNIT RL-31

A reinforced frame and manually operated brake have been incorporated in present production of Reel Unit RL-31 in order to make this equipment stronger and suitable for rapid field wire construction at the increased speeds now encountered. The improved design has been designated Reel Unit RL-31-B. An attachment kit, which includes the new brake and a set of leg braces for reinforcing the frame, is also in production for issue to all using organizations having Reel Units RL-31 of the old design, in order that these equipments can be modified to be the practical equivalent of the RL-31-B design. Signal Corps Stock No. 6H6231/82 has been assigned to this kit and deliveries to Signal Corps depots are anticipated at an early date. Two copies of Technical Bulletin TB 11-362-1, which includes installation instructions for the attachment kit, will be packed with each kit.

ATTACHMENT KIT IMPROVES REEL UNIT RL-26

A reinforced frame, Zerk lubricating fittings and a new braking system have been incorporated in the design of Reel Unit RL-26 in order to make this equipment stronger and more suitable for rapid field wire construction at the increased speeds now encountered. A limited number of the modified equipments, which have been designated RL-26-B and C, are in production. The RL-26-C is the same as the RL-26-B except for minor modifications and the addition of a box for tools and spare parts.

An attachment kit, which includes the necessary items for modifying Reel Unit RL-26 and RL-26-A to be the practical equivalent of the RL-26-B is also in production and will be available in the immediate future for issue to using organizations now having Reel Units RL-26 and RL-26-A. This kit has been assigned Signal Corps Stock No. 6H6226A/K11. Instructions for making the modifications are included in Technical Bulletin No. 11-360-1. Two copies of this bulletin will be packed with each kit.

Subsequent to the RL-26-B and C designs, it was found to be desirable to completely redesign this equipment to provide a more powerful motor, improved clutches and a stronger frame and, also, to make the reel unit suitable for use with British Drum No. 7 and Reel DR-7 as well as Reel DR-5. The redesigned reel unit has been designated RL-26-D and production of this unit has started.

NOTES RELATING TO SUBSTITUTE TC SET, PAGE 64

* The carrying case in which the switchboard is packed should be stored for use during subsequent moves of the switchboard.

** The carrying case for the power cabinet may be used as an operator's chair. In any event it, too, should be retained for subsequent moves.

REQUIREMENTS PLANNING

CHANGE IN THE PARTS LIST OF COMPLETE 100-MILE SPIRAL-FOUR CARRIER SYSTEMS

A review of the items included in the parts list for a complete 100-mile spiral-four carrier system indicated that some of the items are included on tables of equipment and tables of basic allowances as organizational equipment. As a result of this study, the parts list of the 100-mile spiral-four carrier system has been revised so as to delete Telephone EE-8-A or Telephone EE-8-B, Battery BA-30, Tape TL-83 and Tape TL-192.

Action has been initiated to include the following items on T/O-E 11-500, Signal Service Organization, Column GP - Spiral-Four Cable Section, in the next published revision:

Test Set TS-26/TSM or Test Set EE-65	each 5
Test Set TS-27/TSM	each 2
Telephone EE-8-( )	each 13

Action has been initiated to include the following items in OCSigO Circular 10-1 for Column GP of T/O-E 11-500:

Tape TL-83	each 15
Tape TL-192	each 15

This action will provide, by separate issue, testing equipment not previously included in the parts list so that it will be available for each spiral-four cable section.

SWITCHBOARD BD-9 AND SWITCHBOARD BD-11

At the time of reclassifying Switchboard BD-9 and Switchboard BD-11 as obsolete, it was considered that Switchboard BD-71 and Switchboard BD-72 would provide for all needs for a small monocord switchboard.

The Army Ground Forces have indicated that there is a requirement in jungle, mountain and amphibious operations for a small switchboard which will provide for interconnecting a few telephone lines. A development project, "lightweight switchboard," has been assigned to the development of this switchboard. However, it is not anticipated that service test models will be available before the fourth quarter of the fiscal year 1944.

Due to the fact that reports from theatres of operations indicate that switchboards BD-71 and BD-72 are too heavy for jungle operations, the Signal Corps depots have been requested to withhold further salvage operations on switchboards BD-9 and BD-11.

Consideration has been given to assembling the available Switchboard Unit EE-2 into improvised switchboards similar to the BD-9 and BD-11. However, at a conference with Colonel F. L. Ankenbrandt, Signal Corps, 26 November 1943, it was recommended that the available switchboard units EE-2 now in depot stock be shipped to theatres as individual units where they can be assembled into improvised switchboards. Shipment of a limited quantity of Switchboard BD-9, Switchboard BD-11 and Switchboard Unit EE-2, for use in jungle operations, has already been made.

Some switchboards BD-9 and BD-11 and switchboard units EE-2 are still in stock in depots in usable conditions.

Due to the fact that switchboards BD-9 and BD-11 are not expected to be placed on T/BA or T/E, and since it is only intended to issue subject switchboards now in stock to theatres as a special issue on requisitions as requested, it is not considered necessary to reclassify these two items from obsolete to limited standard.

WIRE THROWER RL-37

Reports which have been received from the Signal Corps Board, Eastern Signal Corps Training Center, Eastern Signal Corps School, Central Signal Corps School and 30th Infantry Division, substantially agree that Wire Thrower RL-37 is not practical for use by tactical organizations. It was felt that the British might be interested in obtaining some of this equipment, but information recently received indicates that they no longer have a requirement for this item. In view of these facts, it has been recommended that action be taken to have Wire Thrower RL-37 reclassified from limited standard to obsolete.

NEW FIELD PHOTOGRAPHIC EQUIPMENT

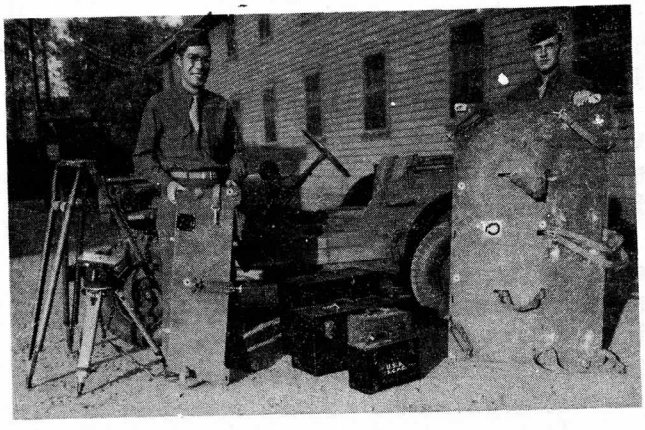
Camera Equipment Carrier for Jeeps

The lack of adequate transportation facilities has been a serious handicap to field camera units. In a majority of cases, camera crews are required to transfer their equipment from one vehicle to another many times before reaching their destination. Frequently, no transportation whatsoever is available. In line with the suggestions of field and overseas camera crews, a unit consisting of the equipment described below provides rapid transportation and operation of photographic equipment under almost any circumstances.

JEEP EQUIPMENT CARRIER IN USE.

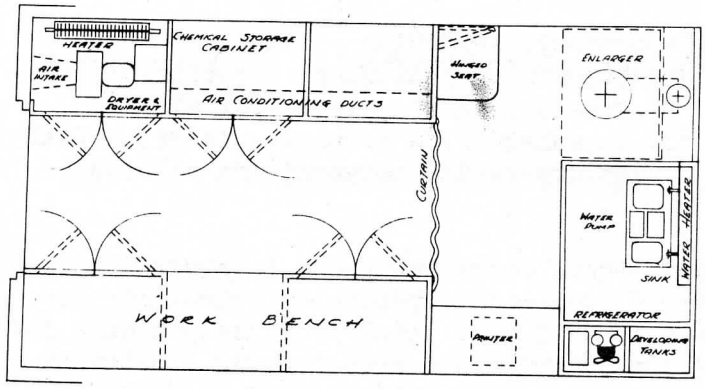
This equipment carrier, designed for the jeep, has been developed by the Pictorial Engineering and Research Laboratory Division of the Signal Corps Photographic Center. The carrier consists of a pair of platforms which may be mounted on any standard jeep without alteration to the vehicle. Camera equipment is held in place by canvas straps, snap hooks, and buckles. The over-all result provides a method of securing photographic equipment for rapid transportation without the need for setting up equipment after short moves.

An accompanying photograph shows the platforms which are light in weight and easy to ship because of their compactness. The strapping down method of holding camera cases and equipment in place permits the securing of different types and sizes of cases without any special adjustments. The tripod can be carried mounted while the jeep is in motion. This permits the quick set-up of the camera when the pictures are to be taken.

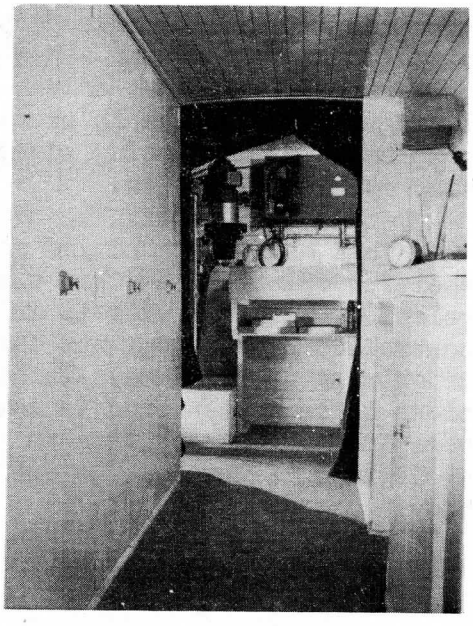


THE TWO PLATFORMS COMPRISING THE NEW CARRIER.

This platform permits the carrying of the following equipment: standard 35mm motion picture camera in streamlined case, standard tripod with tilt head, baby tripod, magazine case, two



FLOOR PLAN OF LABORATORY.



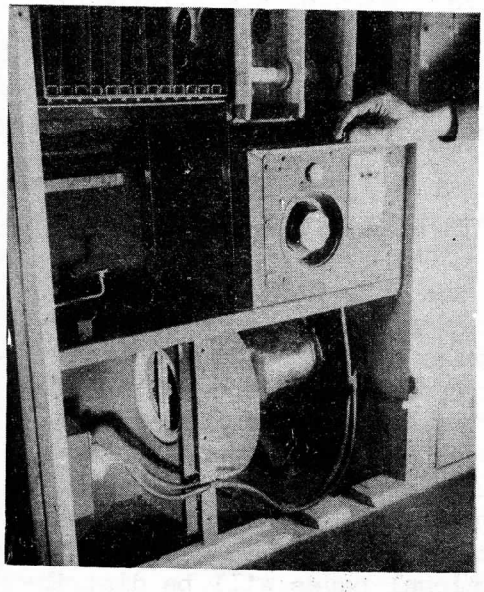
GENERAL INTERIOR VIEW OF LABORATORY.——→

battery cases, and extra film supply in cans.

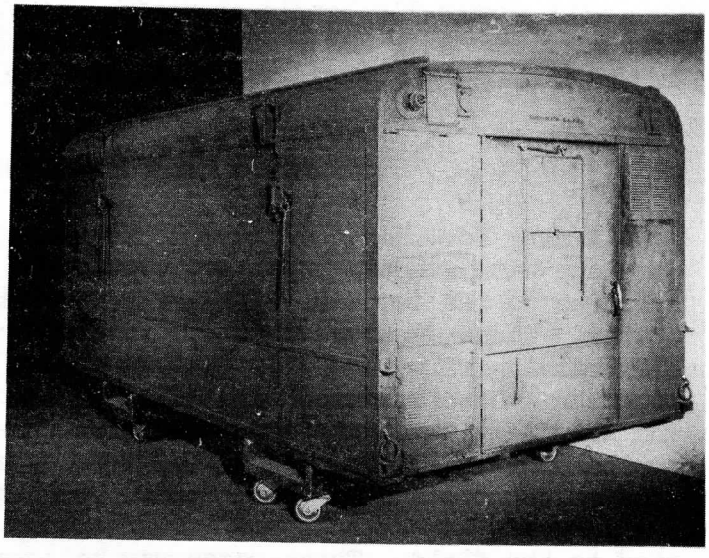
Mobile Photographic Laboratory

Another development of the same division is Shelter HO-27 (Mobile) photographic laboratory. This laboratory is designed as an adaptation of Shelter HO-17, a familiar unit to most combat crews. Originally this shelter was to be a conversion with a few shelves and platforms provided for the mounting of the laboratory equipment. However, the more critical needs of photographic units in the field became apparent as the development of the unit progressed.

The final unit incorporates all the fea-



DRYING AND AIR CIRCULATING UNIT.



EXTERIOR VIEW OF THE MOBILE LABORATORY.

tures of a first-class production laboratory, including an electric water circulating system with a pump, a gasoline water heater, an electrically refrigerated sink, a gas-driven power generator, and an electrical air circulating system. Space is provided for an enlarger, a contact printer, a full complement of developing equipment, film dryers and hangers, and all necessary small accessories.

This unit has employed standard Signal Corps equipment in every case where practicable, and has a system of complete temperature control for developing. The interior is fully air conditioned, which provides not only for controlled processing, but for the comfort of the operator under conditions of extreme temperature. It has been tested under all of the varied conditions to be encountered in combat. Later additions to its completeness which were found necessary were an efficient water purifying system and an emergency lighting circuit. The entire unit may be mounted on a $2\frac{1}{2}$ T 6 x 6 truck body.

V-MAIL EXPANDS

Since 1 January 1943 the number of V-Mail letters sent from and received at the various stations in the United States has increased 800 percent. A substantial rise is anticipated during December with the handling of Christmas mail. The system of handling mail by the V-Mail process has become tremendously popular, both overseas and in the United States, due to the speed of handling and guarantee of delivery.

To handle the increased volume, the Chicago V-Mail Station was opened and began operation on Saturday, 20 November 1943. This station will generally cover the central portion of the United States, west of the Alleghenies and east of the Rocky Mountains, and it is anticipated that the Chicago Station will eventually handle approximately fifty percent of all V-Mail sent and received. This makes three V-Mail stations which are operating in the United States -- New York, Chicago, and San Francisco.

TRAINING FILM AND FILM BULLETIN DIGESTS

During November, 872 sets of Training Film and Film Bulletin Digests, complete with subject index and catalogued according to services, were distributed to the central libraries and sub-libraries throughout the United States. These digests contain a complete summary of the subject matter of all training films and film bulletins made for the Army Ground Forces and which have been approved for training purposes at both Army Ground Forces and Army Service Forces installations. There is a separate page for each motion picture, giving its title, identification number, running time, and a brief description of the purposes and contents of the film. As new training subjects are released and distributed, additional pages will be distributed to the field. These pages may be inserted in the proper places within these looseleaf digests. These books should serve as a permanent record and reference manual on all subjects released by Army Pictorial Service.

DRY CELL BATTERY INFORMATION CHART

CORRECTED TO 28 DECEMBER

This issue of Chart of Signal Corps Dry Batteries, dated 28 December 1943, supersedes the one dated 16 October 1943, which appeared in No. 24 of the SCTIL.

The new issue, published herewith, includes listings of six low-temperature types of dry batteries and four additional conventional types of dry batteries which did not appear on the earlier list, while it omits descriptions of several types of dry batteries which are not actually employed in any equipment. It also includes several revisions of data necessitated by changes in applicable specifications.

CHART OF SIGNAL CORPS DRY BATTERIES

28 DECEMBER 1943

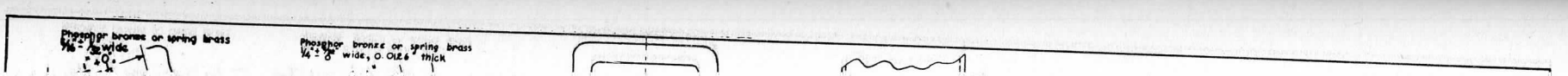
SIGNAL CORPS BATTERY	SIGNAL CORPS STOCK NO.	TERMINAL VOLTAGE	TERMINAL TYPES	NO. AND TYPE OF CELLS (NOTE 9)	DIMENSIONS (INCHES) LENGTH	WIDTH	HEIGHT	OVERALL HEIGHT	VOLUME (CU. FT.)	WEIGHT (lb.)	TEST DATA: RESISTANCE (OHMS)	INITIAL DRAIN (AMPS)	DISCHARGE SCHEDULE	END VOLTAGE	SPECIFIED SERVICE LIFE: INITIAL	3 MONTH	6 MONTH	9 MONTH	12 MONTH	SIGNAL CORPS DRAWING	SIGNAL CORPS SPEC	SIGNAL CORPS BATTERY
BA-1	3A1	3	Flat Cap	2 E	1 11/32	Dia.	6 1/16	6 1/8	0.005	0.63	13.33	0.225	4 mins. each 1/4 hr. 10 hr. per day, 5 days per week LEAKAGE TEST 10 ohms (Note 11)	1.67	8.0 days	7.2 days	6.8 days	6.4 days	6.0 days	11204A1	70-101	BA-1
~~BA-2~~ ~~BA-102~~ Note 5	3A2	22.5	Flexible Lead	15 A	3 1/2	2 3/32	2 21/32	3 1/32 (Note 1)	0.013	1	2500	0.009	Continuously	17	80 hrs.	75 hrs	70 hrs	60 hrs	50 hrs	11206A1	~~70-102~~ 70-202	~~BA-2~~ ~~BA-102~~
BA-8	3A8	22.5	Flexible Lead	15 D	6 5/8	4 1/8	3 1/8	3 1/2 (Note 1)	0.055	4.5	1250	0.018	Continuously	17	225 hrs	220 hrs	210 hrs	200 hrs	195 hrs	11207A1	70-108	BA-8
BA-9	3A9	4.5	Flat Spring (Figure 1)	3 B	2 17/32	27/32	2 5/8	3 1/16	0.0038	0.38	20	0.225	4 mins. each hr, 10 hrs. per day, 5 days per week	2.8	7.00 days	6.75 days	6.25 days	5.50 days	5.00 days	11203A1	70-109	BA-9
BA-15-A	3A15A	1.5	Screw & Nut	2 F	2 21/32	1 5/16	4 1/16	4 7/16	0.009	0.88	20	0.15	2 BA-15-A in series discharged continuously	1.8	85 hrs	80 hrs	75 hrs	70 hrs	60 hrs	SC-A-1661	70-115	BA-15-A
BA-23	3A23	1.5	Screw & Nut	1 #6	2 5/8	Dia.	6 1/8	6 11/16	0.021	2.4	7.5	0.2	Continuously	0.9	175 hrs	170 hrs	160 hrs	145 hrs	125 hrs	11205A1	70-123	BA-23
BA-26	3A26	22.5, 45	Spring Clip	30 F	8 1/4	4 1/2	7 3/8	7 15/16	0.17	12.4	2000	0.023	Continuously	17 V. per 22.5 V. Sect.	300 hrs	290 hrs	275 hrs	255 hrs	230 hrs	11212A1	70-126	BA-26
BA-27 ~~BA-127~~ Note 5	3A27	-1.5, -3, -4.5	Screw & Nut	3 D	4 1/16	1 1/2	3 1/8	3 1/2	0.0124	1	20	0.225	4 mins. each hr., 10 hrs per day, 5 days per week	2.8	26 days	25 days	24 days	21 days	18 days	11213A1	~~70-127~~ 70-227	~~BA-27~~ ~~BA-127~~
BA-28	3A28	4.5	Flat Spring (Figure 2)	3 A	2 1/16	11/16	2 5/16	2 11/16	0.0022	0.25	50	0.09	4 mins. each hr., 10 hrs per day. 5 days per week	2.8	11.00 days	10.50 days	10.00 days	9.00 days	7.50 days	11214A1	70-128	BA-28
BA-30 ~~BA-130~~ Note 5	3A30	1.5	Flat Can	1 D	1 11/32	Dia.	2 11/32	2 13/32	0.0019	0.25	13.33	0.225	2 BA-30 in series 4 mins. each 1/2 hr, 10 hrs per day, 5 days per week LEAKAGE TEST 2 BA-30 in series thru 10 ohms (Note 11)	1.67	16 days	15 days	14 days	13 days	12 days	SC-A-535	~~70-130~~ 70-230	~~BA-30~~ ~~BA-130~~
BA-31	3A31	4.5	Screw & Nut	3 B	2 13/32	27/32	2 23/32	3 3/16	0.0038	0.38	20	0.225	4 mins. each hr, 10 hrs per day, 5 days per week	2.8	7.00 days	6.75 days	6.25 days	5.50 days	5.00 days	SC-A-1662	70-131	BA-31
BA-32	3A32	3 "A" Unit 144 "B" Unit -13.5 "C" Unit 4.5 "M" Unit	Socket (5 hole) (Figure 3)	6 Q 96 B 9 B 3 B	8	5	6 13/16	7 7/32	0.167	14	7.5 7.5 3,600 7,200 540 open 90 open	0.4 0.4 0.04 0.02 0.025 0 0.05 0	Each unit 2 mins. thru first resistance, 4 mins. thru second resistance cycle repeated	2 115 11.5 3.5	25 hrs	24 hrs	23 hrs	21 hrs	18 hrs	SC-D-1465	70-132	BA-32
BA-33	3A33	45, 135	Screw & Nut	90 A	6 1/4	3 9/16	5 5/16	5 3/4	0.074	6	15,000	0.009	Continuously	100	80 hrs	75 hrs	70 hrs	60 hrs	50 hrs	SC-A-6811	70-133	BA-33
BA-34	3A34	-1.5, -3, -4.5, -6, -7.5	Screw & Nut, -7.5 is Flexible Lead	5 B	4 1/8	7/8	2 7/8	3 3/8	0.0071	0.63	35	0.214	4 mins. each hr, 10 hrs per day, 5 days per week	4.5	7.0 days	6.5 days	6.0 days	5.5 days	5.0 days	SC-A-1411	70-134	BA-34
BA-35	3A35	1.5	Screw & Nut	4 F	2 11/16	2 11/16	4	4 7/16	0.0185	1.5	7.5	0.2	Continuously	0.9	125 hrs	120 hrs	110 hrs	95hrs	75 hrs	SC-A-6383	70-135	BA-35
BA-36	3A36	22.5, 45	Screw & Nut	30 B	4 1/4	2 9/16	5 7/8	6 3/8	0.04	3	3,000	0.015	Continuously	35	60 hrs	55 hrs	50 hrs	45 hrs	40 hrs	SC-A-6384	70-136	BA-36
BA-37	3A37	1.5	Flat Cap	1 J	1 11/32	Dia.	6 1/8	6 3/16	0.005	0.63	5	0.3	5 hrs per day, 5 days per week LEAKAGE TEST 3 ohms (Note 11)	1	12.50 hrs	12.25 hrs	12.00 hrs	11.50 hrs	11.00 hrs	SC-A-6385	70-137	BA-37
~~BA-38~~ ~~BA-138~~ Note 5	3A38	103.5	Flat Cap (Figure 4)	69 N	1 11/32	1 11/32	11 21/32	11 23/32	0.0122	1.25	3,000 8,000	0.035 0.013	2 mins. thru first resistance, 4 mins. for second, cycle repeated	65	6.00 hrs	5.75 hrs	4.75 hrs			SC-A-6386	~~70-138~~ 70-238	~~BA-38~~ ~~BA-138~~
BA-38-R					1 11/32	1 11/32	11 21/32	11 23/32												SC-A-10009		BA-38-R
~~BA-39~~ ~~BA-139~~ Note 5	3A39	7.5 "A" Unit 150 "B" Unit	Socket (5 hole) (Figure 5)	5 F 100 A	6 1/2	3 13/16	7 1/8	7 9/16	0.109	8.5	37.5 3,600	0.2 0.042	Each unit 2 mins. discharge, 4 minutes open circuit, cycle repeated	5.5 110	40 hrs	38 hrs	35 hrs	30 hrs	20 hrs	SC-D-6300	~~70-139~~ 70-239	~~BA-39~~ ~~BA-139~~
~~BA-40~~ ~~BA-140~~	3A40	1.5 "A" Unit	Socket (4 hole)	4 Q	5 5/8	4 1/4	7	7 7/8	0.034	7.4	2.3 2.3	0.65 0.65	2 mins. thru first resistance, 4 minutes thru second resis-	1.1	20.0 hrs	19.5 hrs	18.0 hrs	16.0 hrs	14.0 hrs	SC-D-6301	70-140	BA-40

~~BA-40~~ ~~BA-140~~ Note 8	3A40	1.5 "A" Unit — 90 "B" Unit	Socket (4 hole) (Figure 6)	4 G — 60 B	$5\frac{5}{16}$	$4\frac{1}{8}$	7	$7\frac{7}{16}$	0.094	7.4	2.3 — 2.3 — 2000 — 4100	0.65 — 0.65 — 0.945 — 0.022	2 mins. thru first resistance, 4 minutes thru second resistance, cycle repeated	1.1 — 65	20.0 hrs	19.5 hrs	18.0 hrs	16.0 hrs	14.0 hrs	SC-D-6301	70-140 ~~70-240~~	~~BA-40~~ ~~BA-140~~
BA-41	3A41	4.5 "A" Unit — 25.5 "B_1" Unit — 60 "B_2" Unit	Socket (5 hole) (Figure 7)	3 M — 17 M — 40 M	$2\frac{3}{8}$	$2\frac{1}{8}$	$3\frac{1}{2}$	$3\frac{1}{2}$	0.0103	1	80,000	0.0011	Continuously	65	100 hrs	90 hrs	35 hrs			SC-A-6303	70-141	BA-41
BA-42	3A42	1.5	Flat Cap	1 C	$1\frac{1}{32}$	Dia.	$1\frac{27}{32}$	$1\frac{29}{32}$	0.00094	0.125	15	0.20	2 BA-42 in series 4 mins. each hr, 10 hrs per day, 5 days per week — LEAKAGE TEST — 2 BA-42 in series thru 1.5 ohms (Note 11)	1.87	9.0 days	8.65 days	7.97 days	7.26 days	6.22 days	SC-A-535	70-142	BA-42
BA-43	3A43	1.5 "A" Unit — 90 "B" Unit — 45 "C" Unit	Socket (6 hole) (Figure 8)	4 F — 60 AA — 30 N	$3\frac{7}{8}$	$3\frac{21}{32}$	$7\frac{1}{16}$	$7\frac{1}{4}$ (Note 2)	0.065	5.13	4.3 — 7500 — 40000	0.35 — 0.012 — 0.0011	10 hrs per day, 5 days per week	1.1 — 65 — 35	30 hrs	26 hrs	20 hrs			SC-A-7065	70-143	BA-43
BA-44	3A44	6	Screw & Nut	4 #6	$10\frac{1}{2}$	$2\frac{3}{4}$	$6\frac{3}{4}$	$7\frac{1}{2}$ (Note 3)	0.125	9		0.5	Constant current discharge	4	25.0 hrs	24.0 hrs	23.0 hrs	22.0 hrs	21.0 hrs	SC-A-7057	70-144	BA-44
BA-45 (Note 5)		1.25	Flat Cap	1 Bias Cell	$\frac{5}{8}$	Dia.	$\frac{11}{32}$	$\frac{11}{32}$	0.00006	.005			Check open circuit voltage							SC-A-7058		BA-45
BA-48	3A48	1.5 "A" Unit — 90 "B" Unit	Socket (4 prong) (Figure 9)	6 GD — 60 A	10	$2\frac{7}{32}$	$4\frac{7}{8}$	$4\frac{7}{8}$	0.063	5	5 — 9000	0.1 — 0.01	5 hrs per day, 5 days per week	1.1 — 65	60 hrs	57 hrs	53 hrs	47 hrs	40 hrs	SC-A-6905	70-148	BA-48
BA-49	3A49	1.5 "A" Unit — 67.5 "B_1" Unit — 67.5 "B_2" Unit	Socket (5 pin) Plus 2 guide holes in top (Figure 10)	2 B — 45 F — 45 M	$5\frac{9}{16}$	$1\frac{1}{2}$	$6\frac{9}{16}$	$6\frac{9}{16}$ (Note 4)	0.032	2.5	3 — 4.1 — 3000 — 13500	0.5 — 2.15 — 0.045 — 0.01	2 mins for 1st resistance, 4 mins for second resistance — B_1 and B_2 connected in series and discharged thru 1st resistance for 2 mins and thru 2nd resistance for 4 mins.	1.1 — 100	6.0 hrs	5.75 hrs	4.75 hrs			SC-A-7069	70-149	BA-49
BA-50		3	Wire Coil Socket	2 AA	$1\frac{1}{8}$	$\frac{9}{16}$	2	$2\frac{3}{8}$	0.00096	0.1	12	0.25	Continuously	1.8		30 mins.	20 mins.			SC-A-11320	70-150	BA-50
BA-51	3A51	67.5	Snap Fastener (Figure 11)	45 N	$2\frac{11}{16}$	$1\frac{3}{8}$	$3\frac{11}{16}$	$3\frac{3}{4}$	0.008	0.88	2000 — 5300	0.034 — 0.013	2 mins. thru 2000 ohms, 4 mins. thru 5300 ohms, cycle repeated	50	6.00 hrs	5.75 hrs	4.75 hrs			SC-A-8810	70-151	BA-51
BA-53	3A53	22.5, 45	Screw& Nut	30 AA	$3\frac{1}{16}$	$1\frac{15}{16}$	$4\frac{9}{16}$	$5\frac{1}{8}$	0.0175	1.63	3800	0.012	Continuously	34	10.00 hrs	9.17 hrs	8.33 hrs	6.66hrs		SC-A-9557	70-153	BA-53
BA-56	3A56	45	Snap Fastener (Figure 12)	30 N	$2\frac{9}{16}$	$\frac{31}{32}$	$3\frac{41}{64}$	$3\frac{11}{16}$	0.0053	0.63	1300 — 3500	0.035 — 0.013	2 mins. thru 1300 ohms, 4 mins. thru 3500 ohms, cycle repeated	28	6.00 hrs	5.75hrs	4.75 hrs			SC-A-11236	70-156	BA-56
BA-57		1.5 "A" Unit — 90 "B" Unit	Socket (3 hole) (Figure 13)	8 R — 60 F	$4\frac{1}{16}$	$1\frac{15}{16}$	$4\frac{9}{16}$	$4\frac{9}{16}$	0.0207	1.56	4 — 7500	0.38 — 0.012	Continuously	1.0 — 68	110 mins.	105 mins	80 mins			SC-A-9589	70-157	BA-57
BA-58	3A58	1.5	Flat Cap	1 AA	$\frac{35}{64}$	Dia.	$1\frac{29}{32}$	$1\frac{31}{32}$	0.00027	0.0312	40	0.075	2 BA-58 in series 4 mins. each hr, 10 hrs per day, 5 days per week — LEAKAGE TEST — 2 BA-58 in series thru 20 ohms (Note 11)	1.87	10 days	9.00 days	7.25 days	5.50 days		SC-A-9558	70-158	BA-58
BA-59	3A59	45	Socket (5 hole) (Figure 14)	30 165 Mini-Max	$3\frac{17}{32}$	$1\frac{3}{4}$	$5\frac{1}{2}$	$5\frac{1}{2}$	0.0197	2	1500	0.03	Continuously	35	10 hrs	9.5 hrs	9.0 hrs	7.75 hrs	6.5 hrs	SC-A-9628	70-159	BA-59
BA-63	3A63	22.5, 45	Socket (5 hole) (Figure 15)	30 AA	3	$2\frac{5}{16}$	$4\frac{1}{8}$	$4\frac{1}{8}$	0.0167	1.38	3800	0.012	Continuously	34	10.00 hrs	9.17 hrs	8.33 hrs	6.66 hrs		SC-A-9559	70-163	BA-63
BA-65	3A65	1.5	Socket (2 hole) (Figure 16)	4 F	$2\frac{5}{8}$	$2\frac{5}{8}$	$4\frac{1}{16}$	$4\frac{1}{16}$	0.0162	1.5	7.5	0.2	Continuously	0.9	125 hrs	120 hrs	110 hrs	95 hrs	75 hrs	SC-A-9560	70-165	BA-65
BA-67		3 "A" Unit — 90 "B" Unit	Socket (Figure 17)	8 R — 60 P	$4\frac{1}{16}$	$1\frac{15}{16}$	$4\frac{9}{16}$	$4\frac{9}{16}$	0.021	1.56	16 — 7500	0.19 — 0.012	Continuously	2.2 — 68	110 mins	105 mins	80 mins			SC-A-7623	70-167	BA-67
BA-70	3A70	4.5 "A" Unit — 90 "B_1" Unit — 60 "B_2" Unit	Socket (8 hole) (Figure 18)	9 Q — 60 B — 40 B	$10\frac{3}{8}$	$4\frac{9}{16}$	$7\frac{7}{8}$	$8\frac{7}{32}$	0.225	16	12.5 — 8.00 — 5850 — 2150	0.36 — 0.56 — 0.026 — 0.07	4 mins. thru 1st resistance, 2 mins. thru 2nd resistance, repeated — B_1 and B_2 in series, 4 mins. thru 1st resistance, 2 mins. thru 2nd resistance, cycle repeated	3.6 — 110	16 hrs	15 hrs	14 hrs	13 hrs	11 hrs	SC-D-7085	70-170	BA-70
BA-80	3A80	4.5 "A" Unit — 90 "B_1" Unit — 60 "B_2" Unit	Socket (8 hole) (Figure 18)	9 F — 60 A — 40 A	$10\frac{3}{8}$	$4\frac{9}{16}$	$5\frac{3}{8}$	$5\frac{23}{32}$	0.156	9	12.5 — 8.00 — 5850 — 2150	0.36 — 0.56 — 0.026 — 0.07	4 mins. thru 1st resistance, 2 mins. thru 2nd resistance, repeated — B_1 and B_2 in series, 4 mins. thru 1st resistance, 2 mins. thru 2nd resistance, cycle repeated	3.6 — 110	8.00 hrs	7.50 hrs	7.00 hrs	6.25 hrs	5.00 hrs	SC-D-11237	70-180	BA-80

SIGNAL CORPS BATTERY	SIGNAL CORPS STOCK NO.	TERMINAL VOLTAGE	TERMINAL TYPES	NO. AND TYPE OF CELLS (NOTE 9)	DIMENSIONS (INCHES)				VOLUME (CU. FT.)	WEIGHT (lb.)	TEST DATA									SIGNAL CORPS DRAWING	SIGNAL CORPS SPEC	SIGNAL CORPS BATTERY
					LENGTH	WIDTH	HEIGHT	OVERALL HEIGHT			RESISTANCE (OHMS)	INITIAL DRAIN (AMPS)	DISCHARGE SCHEDULE	END VOLTAGE	SPECIFIED SERVICE LIFE							
															INITIAL	3 MONTH	6 MONTH	9 MONTH	12 MONTH			
BA-200/U	3A275-200	6	Spring Type	4 F	2 11/16	2 11/16	3 13/16	4 3/8	0.018	1.5	40	0.15	Continuously	4	12.0 hrs	11.5 hrs	11.0 hrs	10.0 hrs	8.5 hrs	SC-D-6693	70-300	BA-200/U
BA-202/UF (Note 6)	3A413	1.5	Flat Cap	1 D	1 11/32	Dia	2 3/8	2 7/16	0.0019	0.25	0.070	11 (Note 7)	2 BA-202/UF in series, 0.005 seconds each 1/4 hr, 6 hrs per day, 5 days per week MARAGON TEST After service test, batteries stored at 70 ± 20° F. and 35 ± 5% relative humidity, and observed daily for 15 days	0.50	100 dischgs	95 dischgs	90 dischgs	84 dischgs	75 dischgs	SC-A-7660	70-302	BA-202/UF
BA-203/U	3A275-203	6	Socket (Figure 19)	8 F	3 1/16	2 25/32	5 9/16	5 9/16	0.035	3.25	20	0.30	Continuously	4	12.0 hrs	11.5 hrs	11.0 hrs	10.0 hrs	8.5 hrs	SC-A-7661	70-303	BA-203/U
BA-204/U		3	Socket Type (Figure 20)	2 F	2 11/16	1 3/8	4 5/16	4 3/8	0.0094	0.88	1.6	1.88	1 min. each hr, 10 hrs per day, 5 days per week	1.8	5.0 days	4.6 days	4.3 days	4.0 days	3.3 days	SC-A-7434	70-304	BA-204/U
BA-205/U		3	Screw & Nut	2 F	2 11/16	1 5/16	4 1/16	4 9/16	0.0093	0.88	20	0.15	Continuously	2.4	10.0 hrs	9.4 hrs	8.8 hrs	8.2 hrs	7.0 hrs	SC-A-4835	70-305	BA-205/U
BA-206/U		9	Screw & Nut	6 #6	7 7/8	5 5/16	6 13/16	7 5/16	0.178	15.5	45	0.20	Continuously	5.4	175 hrs	170 hrs	160 hrs	145 hrs	125 hrs	SC-A-7703	70-306	BA-206/U
BA-207/U		9	Screw & Nut	24 F	8 9/16	4 1/16	6 7/16	7 1/16	0.143	9.5	45	0.20	Continuously	5.4	125 hrs	120 hrs	110 hrs	95 hrs	75 hrs	SC-D-7435	70-307	BA-207/U

NOTES

1. 3/8" allowance has been made for space occupied by flexible lead.
2. Allowance has been made for space occupied by the web strap.
3. Web strap does not project beyond terminals except when used as a handle. Dimension includes space occupied by terminals.
4. Ring does not project beyond flange on bottom of the battery, except when used as handle. Dimension includes space occupied by flange.
5. Nomenclature of BA-45 is Biax Cell, not Battery.
6. BA-202/UF is similar to BA-30 except for a high flash current characteristic.
7. The internal resistance of BA-202/UF has been included in the calculation of the initial drain since it is large as compared with the load resistance.
8. This battery is a low temperature type corresponding to the conventional type bearing a nomenclature number which is 100 smaller, e.g., Battery BA-102 corresponds to BA-2. The two batteries are physically identical and electrically interchangeable, except that the low temperature type has a better service life at low temperature. Artic test performance shall be 20 per cent of service life values.
9. Except where otherwise shown, cell type designation is in accordance with American Standards Association System.
10. The information on this chart should not be used for the purpose of bidding or manufacture. Specifications or drawings for such purposes should be obtained from the Contracting Officer directly or through an intermediary prospective bidder or contractor.
11. For the leakage test, the battery is discharged for 24 hours through the resistance listed, and then stored for 15 days after which time the battery is examined for leakage.



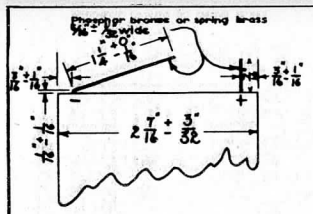


FIG. 1 BA-9

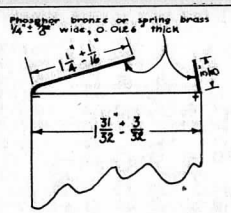
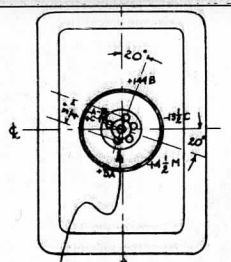


FIG. 2 BA-28



Y-16 Socket as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 3 BA-32

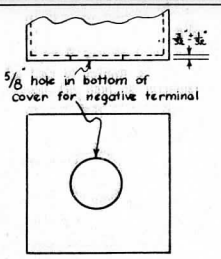
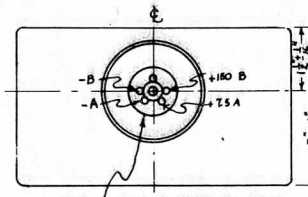
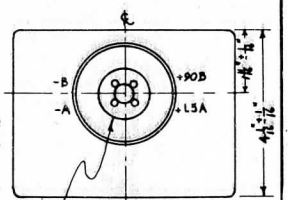


FIG. 4 BA-38, BA-38-R, BA-138



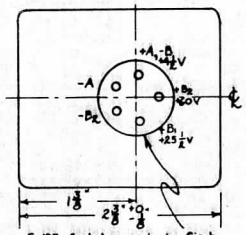
Y-16 Socket as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 5 BA-39, BA-139



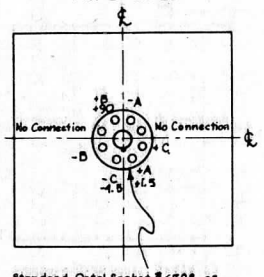
X-16 Socket as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 6 BA-40, BA-140



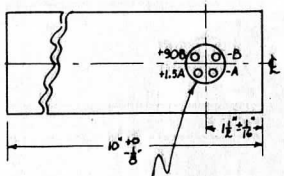
F-128 Socket as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 7 BA-41



Standard Octal Socket #6798 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 8 BA-43



Socket F-121 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 9 BA-48

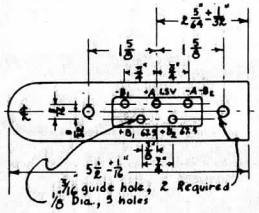


FIG. 10 BA-49

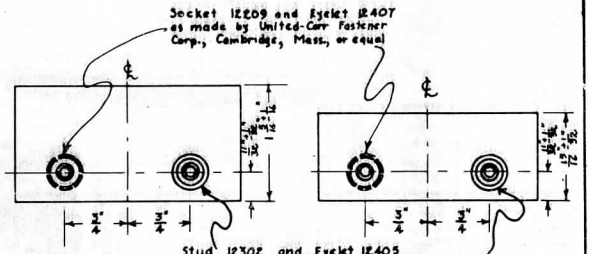
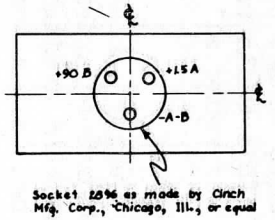


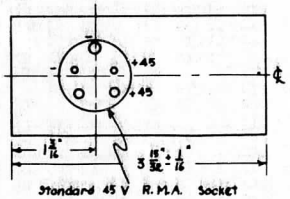
FIG. 11 BA-51

FIG. 12 BA-56



Socket 2896 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 13 BA-57



Standard 45 V R.M.A. Socket

FIG. 14 BA-59

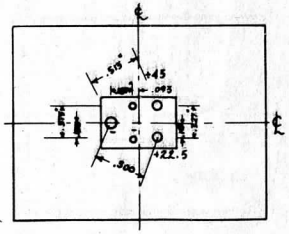
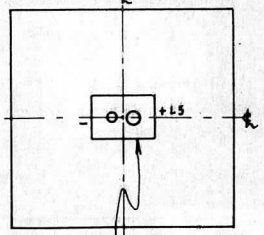
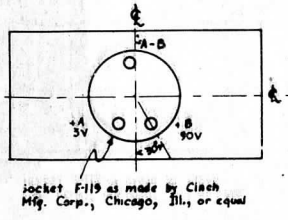


FIG. 15 BA-63



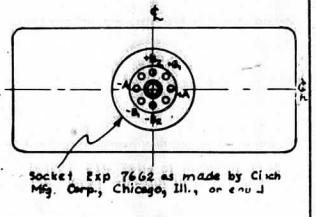
Socket 2624 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 16 BA-65



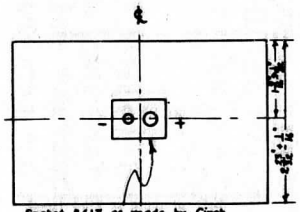
Socket F-119 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 17 BA-67



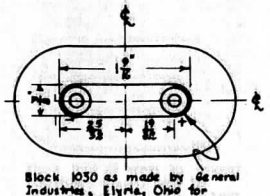
Socket Exp 7662 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 18 BA-70, BA-80



Socket 2613 as made by Cinch Mfg. Corp., Chicago, Ill., or equal

FIG. 19 BA-203/U



Block 1030 as made by General Industries, Elyria, Ohio for National Carbon Co., Inc., or equal

FIG. 20 BA-204/U

TESTBOARD FOR DIVISION OR CORPS

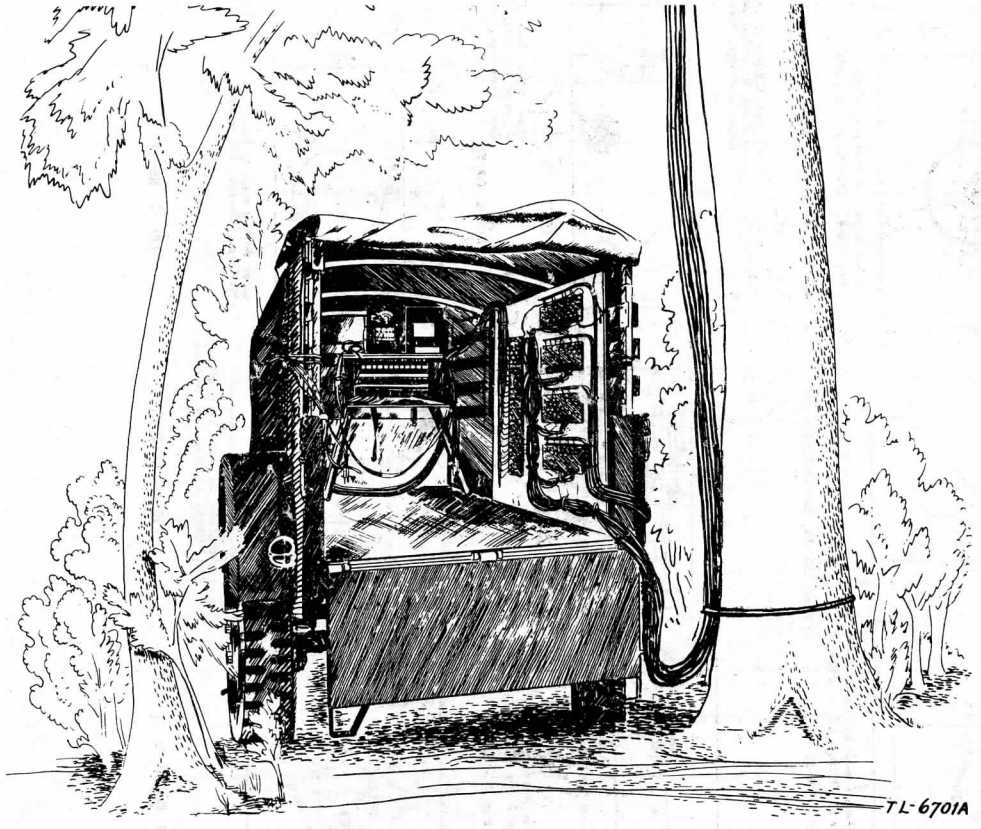


FIG. 1

It is generally recognized that the use of a small testboard at division and corps, and units with comparable wire systems, will result in improved speed and efficiency of service. Circuits under construction or repair can be terminated in drops convenient to the testman, rather than in a bank of telephones or at the command post switchboard. Furthermore, testing can be accomplished at the testboard rather than at frames or terminal strips, where a considerable amount of congestion and confusion often exists. The testboard normally should be located at the construction center. However under certain circumstances it may be desirable to locate it close to the switchboard and frame. This would permit the testing of all trunks and locals at a single point and would allow the testboard to be located behind protectors.

The desirability of using testboards at division and corps is evidenced by the fact that many Signal organizations have improvised small testboards from equipment which has been available for such use. The 53rd Signal Battalion has constructed and used a testboard consisting of 35 Switchboard

Unit EE-2-C and a Test Set EE-65 with a cord and plug attached. Each construction company of the battalion was equipped with two of these testboards. The EE-2-C units were rewired to provide for connection to trunks and switchboard lines. The circuit was so arranged that with the key in its down position, the trunk is connected to the switchboard, the drop and jack of the testboard being disconnected. When the key is in its center position, the switchboard is disconnected and the trunk is connected to the drop and jack of the testboard. When the switch is held in its upper position, the switchboard is connected to the drop and jack of the testboard, the trunk being disconnected. All tests are made by plugging the EE-65 into the proper jack. Monitoring can be accomplished by holding the plug against the line terminals.

It has been reported that this testboard proved to be very satisfactory in combat in both North Africa and Sicily, and was particularly useful in rapidly moving situations. However, in several command post locations during the extremely high-speed pursuit in Sicily, the number of trunks was so small that II Corps used only one or two Telephone Central Office Set TC-4 and the testboard was not installed.

The Second Signal Company some time ago developed a testboard similar in circuit to the arrangement suggested in paragraph 208 of Field Manual 24-5, 19 October 1942. This board contained twenty drops and twenty double-pole, double-throw switches for switching trunks to switchboard or to testboard. Trunks and entrance cables from the switchboard were terminated in jacks. Test Set EE-65 was made a part of this testboard with a cord and plug which could be inserted in any of these jacks for testing. Patching cords permitted the patching of any of the circuits terminated.

Based upon this testboard of the Second Signal Company, the Eatontown Signal Laboratory recently completed development of a 20-drop board known as Testboard BD-103. Space for the EE-65 was provided, with a cord and plug for making tests on any of the circuits terminated at the board. Patching keys, when turned to the "TEST" position, disconnect the trunks from the switchboard and permit the testing of the trunks or the lines to the switchboard by plugging the EE-65 into appropriate jacks. When turned to the "PATCH" position, the trunks are connected through to the switchboard. Any circuit may be monitored by plugging the EE-65 or a telephone into the proper jack.

In connection with a service test of the BD-103, recently conducted by the Signal Corps Board, the Board indicated that it considered the testboard arrangement taught by the Officers' School at Fort Monmouth to be preferable to that of the BD-103. The Officers' School has approached the testboard problem from a different point of view from that contemplated in the design of the above board, the BD-103, or the testboard built by the 53rd Signal Battalion. A standard monocord switchboard, such as Switchboard BD-72, is used with the EE-65 or other test equipment as a testboard. Instead of terminating all trunks and switchboard lines at the testboard, the BD-72 is located in the vicinity of a frame or terminal strips. Circuits under test or construction are removed from frame or terminal strips and are connected to

the BD-72. When tests have been completed, these circuits are reconnected to frame or terminal strips. Figure 1 shows a testboard consisting of a BD-72 and an EE-65, together with associated terminal strips, installed in a 1-ton trailer.

A wiring diagram of the arrangement described in the preceding paragraph is shown in Figure 2. Drop 4 of the testboard is used for a talking circuit to the switchboard, drop 3 is used for a local telephone, drop 11 is termin-

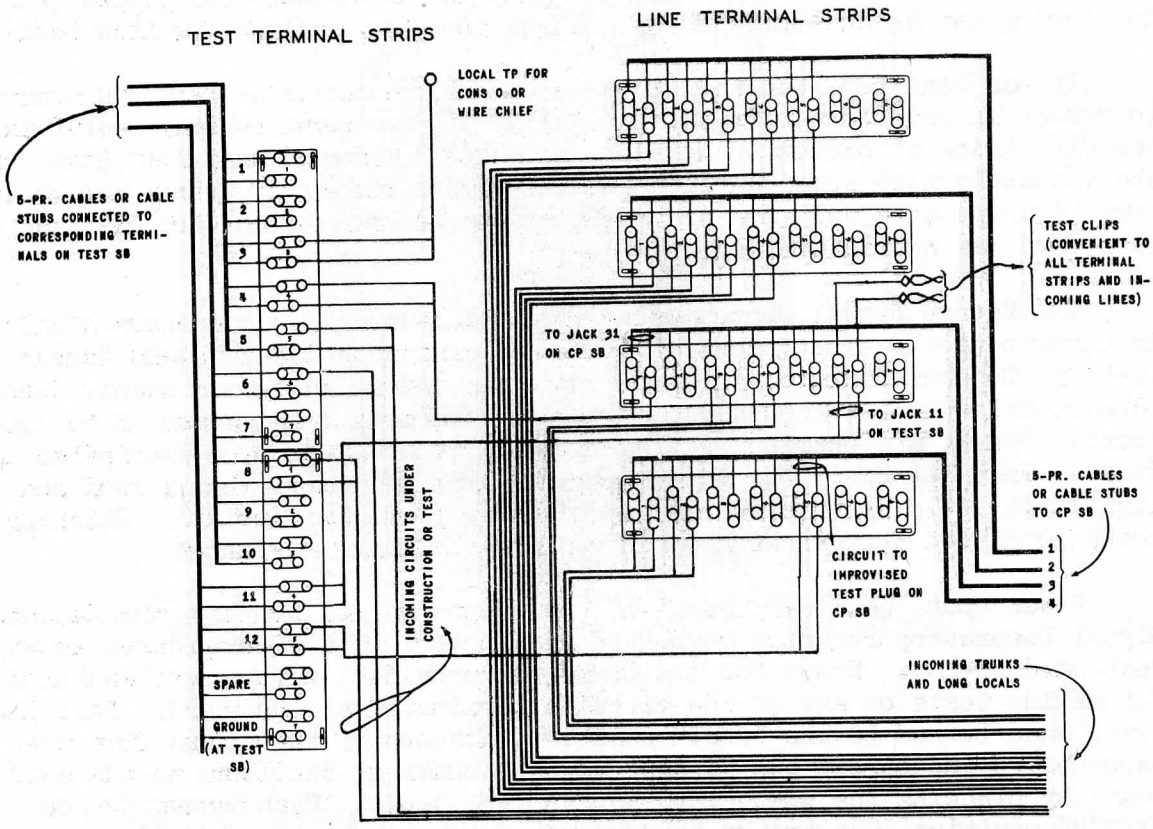


FIG. 2

ated in test clips for the purpose of monitoring circuits while in operation, and drop 12 terminates in an improvised test plug at the switchboard for testing local lines which are not connected through the terminal strips. Lines 1 and 2 are equipped with repeating coils and are reserved for testing directly on simplex and phantom circuits if this becomes necessary. The remaining six drops are terminated at the test terminal strips, thus providing facilities for six lines under test or construction to be connected to the testboard at the same time. The test man can answer calls from trouble shooters or crew chiefs on any of the six lines and can test each one individually with his testing equipment when required. Circuits are terminated in the testboard only for initial testing or when in trouble. Test terminal

strips shown in Figure 2 are used merely as a convenience and may be eliminated by connecting lines directly into the BD-72.

The arrangement shown in Figures 1 and 2 has two advantages over the BD-103 type equipment. First, connections are made to the testboard only when circuits are under construction or repair. This results in a considerable saving of equipment as compared to the BD-103 or similar board arrangement, which requires separate drops and jacks for every trunk or long local. Second, the use of a standard switchboard as a testboard will permit its use as a switchboard at the construction center during the installation of the regular switchboard, as a supplement to other switchboards, or, in an emergency, as a substitute for other switchboards. The BD-103 type of equipment, on the other hand, cannot be used as a switchboard. During the very rapid moves of the 53rd Signal Battalion in Sicily, the testboards built by that organization probably were seldom used. If BD-72's had been the testboard equipment for that battalion, they might have been very useful as switchboards during such rapid moves.

The termination of both trunk circuits and switchboard lines at the testboard obviates the necessity for patching and making connections to the testboard at frame or terminal strips. In this respect, the specially developed testboards, such as the BD-103 board, are superior to the BD-72 used in the manner recommended by the Signal Corps Board. However, the Board suggested that this difficulty might be overcome by the use of a small patching panel which could be used in conjunction with the testboard. This patching panel might consist of jacks at which trunks, switchboard lines, and lines to the BD-72 testboard would terminate. Patching cords could be used for patching or for connecting any circuit for test. In addition to jacks for terminating all circuits, jacks for monitoring circuits while in operation should be provided. The patching panel probably should be located on top of, or adjacent to, the testboard. The EE-65 or other test equipment may be plugged into either the test switchboard or the patching panel.

At this time, the problem of suitable testboard equipment for use at division, corps and units with comparable wire systems is being considered by the Army Ground Forces, the Army Air Forces and the Chief Signal Officer. Until a final decision is reached on this matter, the foregoing description of the use of the BD-72 as recommended by the Signal Corps Board is furnished for the information of units in the field.

RADIOSONDES

Although Weather in its various forms had aroused curiosity and, to some extent, scientific interest over the ages, it was only early in the eighteen hundreds that an attempt was made to find what conditions existed in the upper air; that is, the layer of air which is beyond arm's reach of the man on the ground. Balloons were first used to indicate something about the wind. Balloons and kites were in general use by the year nineteen hundred. Shortly thereafter an instrument known as a meteorograph came into use. This was an instrument which would provide a record of the meteorological elements existing in the surrounding atmosphere wherever the instrument might be located. Since that time, such instruments have been used attached to airplanes in flight, and attached to balloons and kites, to measure the ambient temperature, the pressure and the humidity, at any particular altitude above the surface of the earth where it may be operated.

The instrument most commonly used in these days is known to the Army as Radiosonde ML-141-( ), which is illustrated in Figures 1 and 2 and the dia-

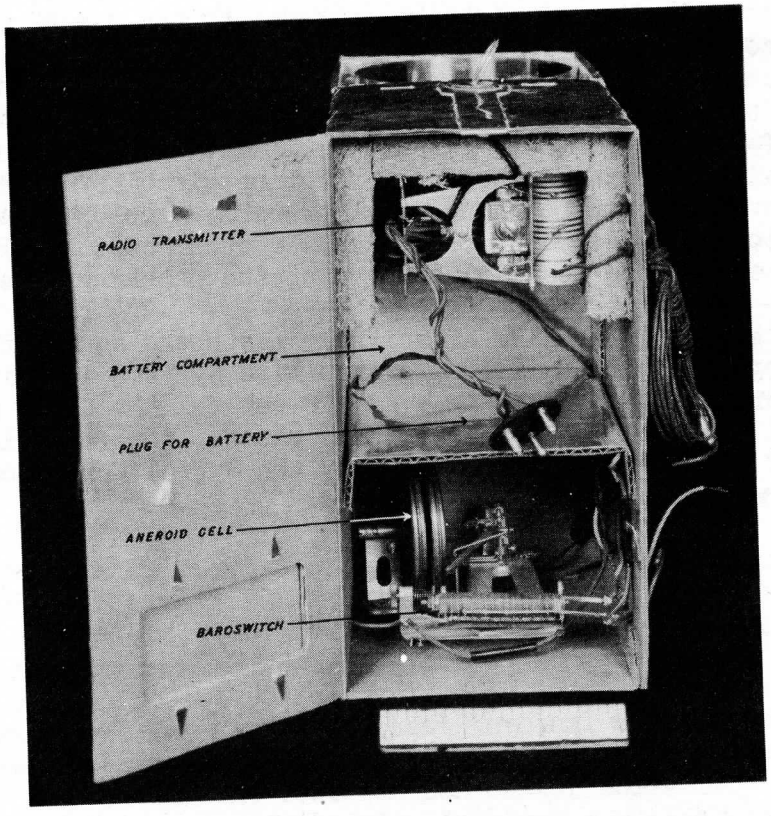


FIG. 1 - FRONT VIEW OF INTERIOR OF RADIOSONDE ML-141-TI.

RESTRICTED

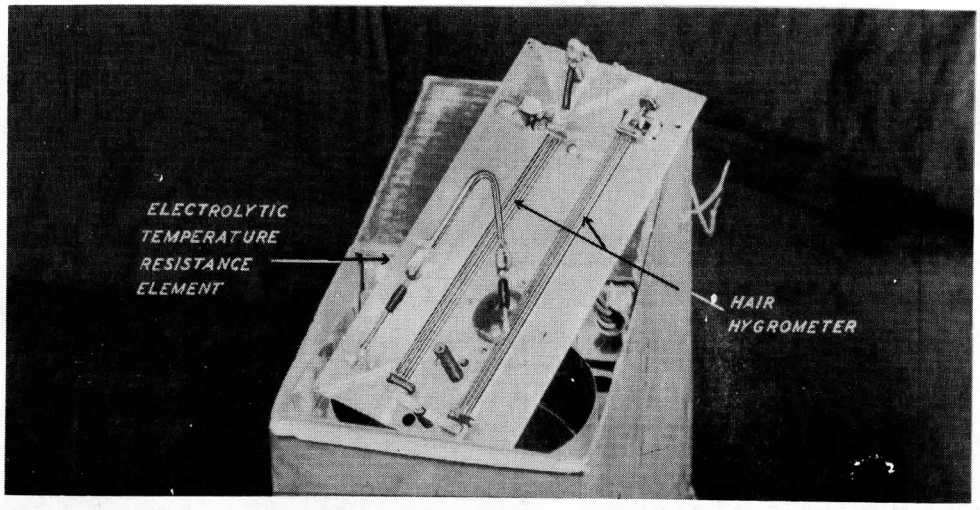


FIG. 2 - THE TEMPERATURE AND HUMIDITY ELEMENTS WITHDRAWN FROM HOUSING IN RADIOSONDE.

gram, Figure 3. In this instrument an aneroid barometer is so coupled mechanically that as it expands or contracts with changes in pressure it causes a contact arm to slide across a switching device (S in Figure 3), consisting of a series of alternate conductors and non-conductors. Certain of these conductors switch various resistances into a small audio-modulated radio transmitter circuit which operates on a frequency of 72.2 mc. A sensitive radio receiver, usually located on the ground, receives this audio-modulated signal and transmits the modulation to a frequency meter which in turn activates a recorder. A record is made on a continuous roll of paper (Figure 4) which furnishes a direct measure of the audio frequencies being transmitted by the radiosondes. Thus, since we can calibrate the instrument to determine the pressure at which each contact will be made, we are able to measure the conditions at various points within the atmosphere through which this instrument may be carried by a balloon. This balloon must be large enough to support the weight of the meteorograph, the transmitter, its battery, and possibly additional ballast sometimes used to slow down the rate of ascent during the earlier portion of the flight.

A small "V" shaped glass tube containing a liquid whose electrical resistance varies with temperature is connected in a circuit which becomes operative each time the contact arm of the switch (S) touches a non-conducting section. This varying resistance causes fluctuation of the audio frequency recorded at the ground station and furnishes a measure of the temperature found at any point during the ascent.

Of the various means for measuring humidity, the most common one still involves the use of human hair, which flexes in length as the moisture content in the air varies. A group of such hairs is connected so as to mechanically vary the resistance of (R), Figure 3. This in turn causes variation in the modulation frequency applied to the transmitter carrier during the periods when the pressure-controlled switch arm is touching any of the con-

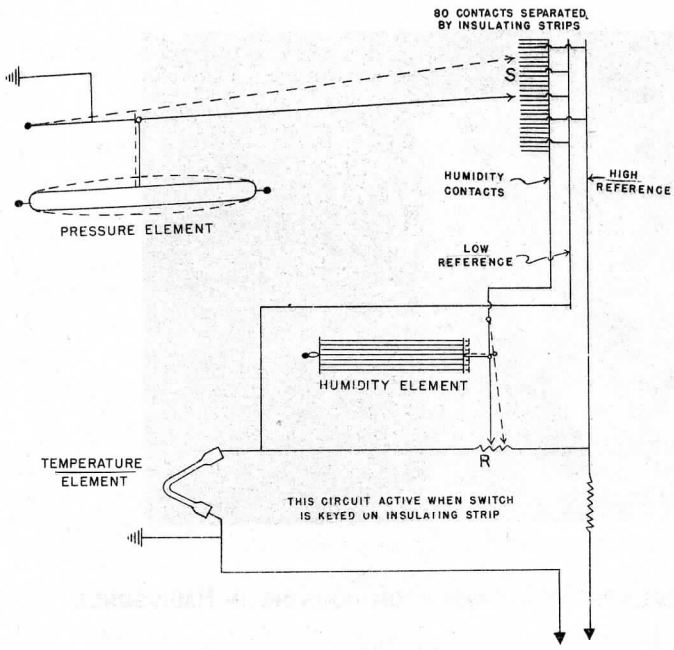


FIG. 3 - PRESSURE, TEMPERATURE AND HUMIDITY MEASUREMENT CONTROLS OF THE RADIOSONDE.

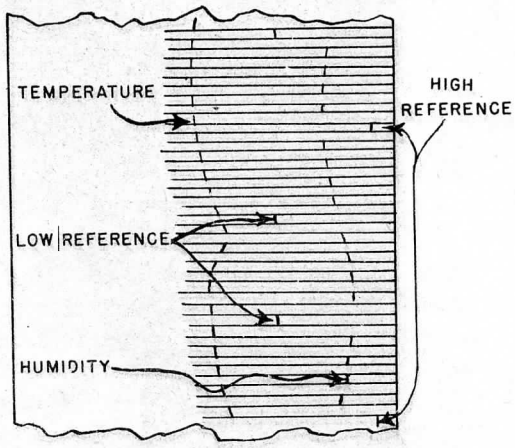


FIG. 4 - SECTION OF RECORDER RECORD.

ducting elements except every fifth one. In this way measures of the humidities found at various altitudes during ascent are obtained. Every fifth contact switches a fixed resistance into the circuit, causing a reference frequency to be transmitted; each third of these is a high reference and the others are low references.

By distributing the contacting surfaces in the switching device so that the transmission of reference frequencies, temperature values, and humidity values occur in a definite order, it is possible to mechanically sort out the frequencies received. Using calibration curves and certain tables and charts, an interpretation of the record becomes a routine matter. The values of temperature and humidity at various significant levels are regularly transmitted over the weather network. The use of this information for single station and long range forecasting has become paramount and it also has definite value as supporting evidence for the synoptic analyses of surface weather maps.

The radiosonde is carried into the upper air by a rubber balloon filled with sufficient hydrogen gas to carry the instrument and its necessary operating parts. It is released from the ground at the end of a string approximately 40 feet long. An antenna extends above and below the instrument. The lower antenna may be weighted in a high wind to prevent wrapping around the instrument. An operator sitting at the ground station during the flight can make his preliminary computations as the record rolls from the machine. From the spacing of the record, it is possible to recognize the limit of the ascent, the point where the balloon bursts due to its expansion in the rarer atmosphere, and when the radiosonde starts dropping to earth. If equipped with a small parachute, the radiosonde may return to earth at a rate

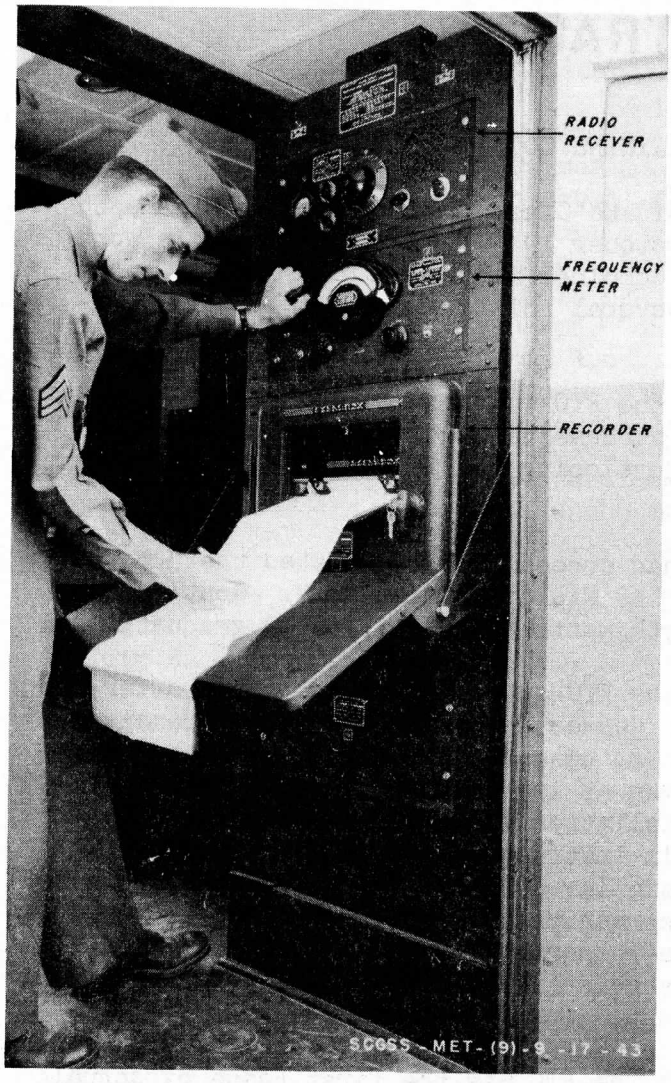


FIG. 5 - A GROUND-STATION WHERE SIGNALS FROM THE RADIOSONDE ARE PICKED UP AND RECORDED.

which permits receiving a record during descent as well. When ascents are made during the sunny hours, the difference of some readings due to insolation effects may be determined by the comparison of the readings made during ascent and during descent.

Certain improvements are being incorporated in existing radiosonde. It is anticipated that by 1 January 1944 the present temperature tube will be replaced by a ceramic resistor, the electric resistance of which varies due to its use of a chemical substance which is sensitive to temperature changes. It is also anticipated that the present hair hygrometer will be replaced by a resistor whose resistance varies with the effect of humidity on a substance. In both cases, the chemical substance concerned is supported by a solid material.

During the development and early extensive use of radiosondes, various problems have been encountered. One problem is that of storage. The meteorological elements may change their calibration if left standing on the shelves over a long period of time, particularly in hot and humid climates. The operation of the instrument depends upon a dry cell whose shelf life is also limited. When in transit or in storage at high temperatures, the present temperature element has been known to have been broken by the excessive expansion of the liquid which it contains. A number of problems have been encountered during manufacture. For a time reports of leaky pressure cells, faulty transmitters, and in a few cases poor operation of switching devices were reported. Recently, reports indicate these difficulties have been materially reduced.

Much work has been done on radiosondes which will operate on principles other than the above. None of these has, however, reached a stage satisfactory for commercial production, though some have shown considerable promise.

MILITARY TRAINING

REPORT ON FIELD TRAINING COURSES OCS

The first Signal Corps Officer Candidate Class to pursue the new 4-month course of instruction was graduated 26 October 1943. The fourth month's work consisted of a series of field problems combined into a Field Training Course. The first trial of the FTC brought out several points which should be of general interest.

From the beginning the emphasis of the FTC was not so much on signal technique, since it is anticipated that all successful candidates will attend officers' specialty classes, but rather on developing the leadership and initiative of the candidates.

Only those officer candidates who had successfully completed the 3 months of academic instruction participated in the field training work. Continued satisfactory performance during the fourth month was required for graduation.

The faculty officers in charge of the FTC acted as observers, interfering with the operations only when it was deemed necessary to prevent damage to equipment or injury to personnel. In no case did an officer take charge of an installation. Each candidate was given at least three opportunities to function as officer-in-charge of an installation. The officer candidate was required to make all decisions, issue all instructions, organize teams, work out shifts, and take care of all other similar details. The officers make corrections and suggestions at critiques between phases, but during a phase candidates were required to assume the same responsibilities and make the decisions that will be expected of them as second lieutenants in Signal Corps units.

Officers and candidates alike were unanimous in stating that the FTC is a very valuable addition to the Course. The FTC was the first taste of actual field operation for many candidates. They gained invaluable experience in estimating situations and making decisions; learned that instructions must be clear but not too rigid, if they are to meet changing conditions. Many learned, the hard way, the absolute necessity of taking care of personnel equipment in the field.

The FTC provides an excellent criterion for determining which candidates will develop into suitable Signal Corps officers in field units. The faculty officers had ample opportunity to observe each candidate under adverse conditions such as frequent, unexpected moves of CP's during day or night, shortage of personnel within installations, extreme physical fatigue, and subjection to tear gas, smoke, and booby traps. Those candidates who met these difficulties and overcame them were commissioned. Those who were commissioned from this class not only had a good academic background, but had had an opportunity to put their learning to practical use. These officers have proved, by doing, that they can function efficiently as Signal Corps officers.

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NEW "PERFORMANCE LABORATORY" TO TEST PROFICIENCY OF S. C. SPECIALISTS

Success in warfare depends increasingly upon the individual soldier's ability to do his job. Weak links must be discovered and strengthened before battle, lest the entire chain break at the critical moment. Likewise in the training of Signal Corps units, men must be qualified to fulfill their duties as specified by the specialist serial numbers in AR 615-26 before they are capable of taking their places on a team for field training. Determining the state of proficiency of the various Signal Corps men arriving from different camps in the United States to join newly activated units is a crucial problem facing Col. Carroll O. Bickelhaupt, Commanding Officer of the Eastern Signal Corps Unit Training Center, Camp Wood, Fort Monmouth, New Jersey, and the commanding officers of the units under his command.

It was to overcome this problem and to provide the necessary equipment and personnel to administer standardized performance tests for each specialty that the Commanding Officer has authorized the Training Division, under the direction of Col. Albert F. Hogle, to create a "Performance Test Laboratory."

Housed in three G.I. buildings in Camp Wood is a collection of machinery and equipment designed to test nearly any Signal Corps enlisted man's ability to apply practically his specialist's knowledge and to determine his qualifications for his particular job in one of the many units assigned to this center. The tests themselves are based on performance tests conducted over a period of eighteen months by the Test Section, Standards and Control Branch, Training Division, of the former Eastern Signal Corps Replacement Training Center located at Camp Wood.

The supervisors of these performance tests are non-commissioned "experts" in their various lines drawn primarily from instructional and supervising cadres of the former Eastern Signal Corps Replacement Training Center.

At the present time, the laboratory, though still in its infancy, is equipped to test the following military specialties: Cable Splicer (039), Electrician (078), Frameman T&T (089), Insideman T&T (095), Installer-Repairman T&T (097), Repeaterman T&T (187), Teletypewriter Operator (237), Teletypewriter Mechanic (239), Switchboard Installer T&T (232), Wire Chief T&T (261), Installer, toll, T&T (384), Telephone Switchboard Operator (650), Wire Chief T&T (595), Switchboard-Installer T&T, dial (231), T&T equipment Repairman (646), Automatic Telephone System Maintenance Man (115), Telephone Operator (309), Radio Repairman (647) (648) (649), Radio Operator (766) (776) (777), Radar Repairman (952) (953) (954) (955), Submarine Cable Operator (777), Telegraph Operator (236), Stenographer (213), Typist (247), Message Center Clerk and Chief (667) (674), Messenger (675) (676), Instrument Repairman (098), Powerman T&T (166), Instrument Repairman (Elec) (338), Armorer (511), Power Plant Attendant (189) (013) and Power Plant Installer (385).

The following will serve as typical examples of application of partial test procedures in the performance laboratory:

1. An Installer-Repairman (097) will complete a wiring plan using a

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wiring plan diagram; test to discover and distinguish between opens, shorts, crosses and grounds; install a common battery telephone; locate trouble on a TP-6 installation which includes drop wire, protector and inside wiring.

2. A Cable Splicer (039) will do joint wiping; random splicing; test splicing; and splicing of aerial cables.

3. A Message Center Chief (774) and Message Center Clerk (667) will be given both an individual and group performance test. In the individual performance test he will service incoming and outgoing messages, by messenger and by electrical means, both in plain and in secret text, functioning in all jobs necessary for these operations. In the group performance test, he will fill every position in message center being rotated from one to another until he has occupied all posts.

4. A Radio Repairman (647) (648) (649) will measure indicated voltages and resistances given a schematic and pictorial diagram; perform a specific soldering job; complete the circuit, given the essential parts of a radio; test an assorted lot of tubes; check the frequency and align transmitters.

When a unit commander is satisfied that an enlisted man has the required background or has received the necessary training in his specialty, he reports that man to the Standards and Control Section of the Training Division as ready for testing. The laboratory with its equipment, facilities, supervisory personnel and testing methods is able to appraise the training status of the soldier.

Based on the results of the tests, the Standards and Control Section is in a position to report that the enlisted man has met requirements and is qualified, that he will need further training, or that he should be reclassified. Thus when all men in a unit have qualified for their individual jobs, the unit is ready to begin team training, the final phase of preparation for combat.

SIGNAL TRAINING FOR PERSONNEL OF OTHER ARMS

Reports from maneuver areas indicate that many officers of the major components of the Army are in doubt as to the procedure to be followed in securing training quotas in Signal Corps schools. The following reference and information will be helpful:

Organizations under the control of ASF, having a requirement for training, should submit requests for quotas in accordance with the provisions of ASF Circular No. 87, 23 September 1943 and amended by ASF Circular No. 110, 4 November 1943.

Unit commanders of organizations under the control of AGF, AAF, and the Defense Commands should secure quotas by application, through channels, to the Commanding General, AGF; the Commanding General, AAF, Attention: Asst. Chief of Air Staff Training; and the Commanding Generals of the Defense Commands, whichever the case may be.

Training required will be provided to the extent of available capacities.

COMBAT TRAINING AT CAMP KOHLER

VILLAGE COMBAT TRAINING

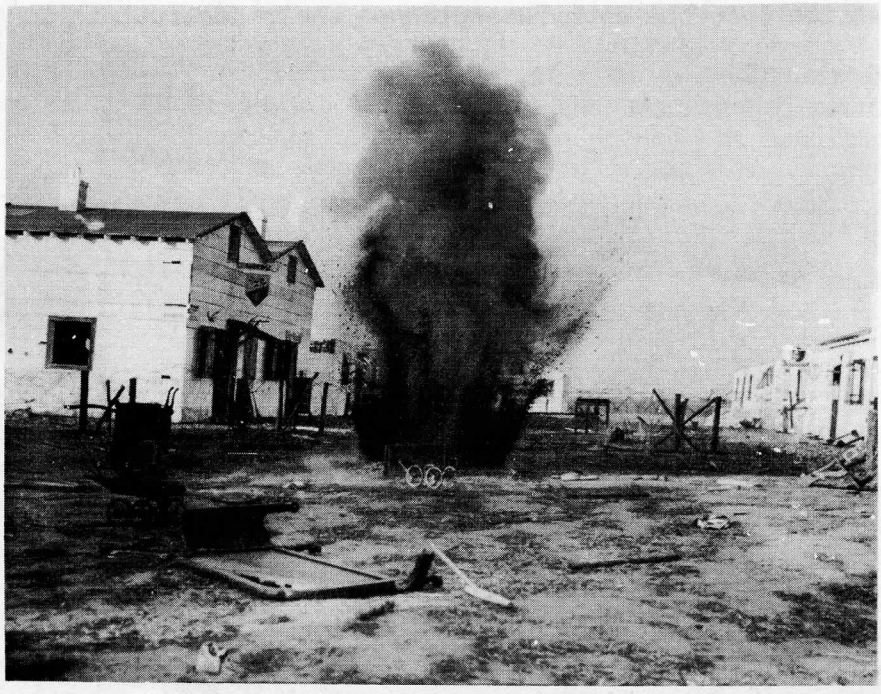
Small clouds of dust settle slowly in the debris-strewn street of the now ominously silent village as a last lurking figure disappears into a shattered doorway.

In the distance, across a stubble field, crouching G.I.'s listen to final instructions of an officer:

"We know only that the village is lightly defended," he announces. "To take it we must move cautiously, but swiftly. The objective will be the enemy's command post at the far end of the street. That is all. Move out."

That is the setting for a simulated combat maneuver at Camp Kohler's new "French Village," where soldiers meet the "enemy" with real weapons and blank ammunition. When the problem ends, no one is hurt, but every man knows whether or not he would have survived had the shells been real, the combat actual.

"I died when I stepped incautiously into the street and exposed myself to that machine gun fire," one reflects, or "that booby trap attached to the



FRENCH VILLAGE - THROUGH THIS BARRICADED STREET TRAINEES ADVANCE IN A COMBAT TRAINING MANEUVER, USING BLANK AMMUNITION, DUMMY GRENADES, AND OTHER PROPS OF WAR.

door handle in the cafe put me out of the fight."

All these encounters with death, in this terrifying realistic enemy-held viciously-mined village, are discussed calmly at a critique which takes place right after the raid while the details are fresh in the minds of the men.

Every heart beats more quickly as the advancing troops wait tensely for the first crack of rifle fire aimed at advance scouts. Then they move forward in short rushes, hitting the ground fast and hard. Approaching the village on a line with the main street, they scamper hurriedly through the barbed wire entanglement and into the first wrecked buildings.

THE DRAPERY IS ATTACHED TO A BOOBY TRAP WHICH THE CURIOUS SOLDIER IS ABOUT TO SPRING. IT'S JUST ONE OF MANY INNOCENT LOOKING DECOYS IN THE FRENCH VILLAGE.

Impressed with the general attention to detail in the furnishings of of each French shop, restaurant, saloon or office, the men warily avoid all objects which might be booby-trapped, but soon realize that the enemy has planned their destruction in great detail.

STREET FIGHTING IN THE SIMULATED FRENCH VILLAGE.

Amid the din of constant rifle fire, booby traps are exploding every few minutes, and the paralyzing concussion of the land mines blowing up in the street clouds the mind momentarily.

Medics following in the wake of the scurrying troops pin tags on those who would obviously have been casulaties from firing, mock grenades (dirt-filled sacks) booby traps, or other instruments. In this type of maneuver, the percentage of casualties would admittedly be large, even though only eight "nazis" are defending the village.

Carefully observing every detail of the combat, officers of the Small Arms branch take notes and point out good and bad points of the actual maneuver during a discussion which follows. They get an idea about what type of obstacles confuse and delay the men most, witness their ingenuity, or lack of it, in getting through wire, and observe their reactions to real battle sounds and setting.

For the men it is invaluable experience -- grim and convincing, uncomfortable yet exciting -- and they are unanimous in their assertion that it is one of the most beneficial single elements of their combat training here.

LUNK TRAINER

"Abandon hope, all ye who enter here," is the gloomy warning tacked over the entrance of Camp Kohler's newest training device, the Lunk Trainer.

Combining all the nightmarish aspects of vicious combat warfare with additional insidious creations of instructors, the underground proving ground for message center trainees is the ultimate in pre-combat conditioning.

The Lunk Trainer differs from Kohler's other battle inoculation facilities, the Infiltration Course, French Village, etc., in that it is designed to place stress on all the senses -- sight, hearing, smell, touch, taste.

Focal point of the area, on a slope near the field tents east of camp, is a large dugout, 25 by 35 feet inside, and 10 feet deep. The cave runs into the hill at the back and opens on an approach barricaded with two rows of double-apron barbed wire. A trench leads to the double curtained doorway.

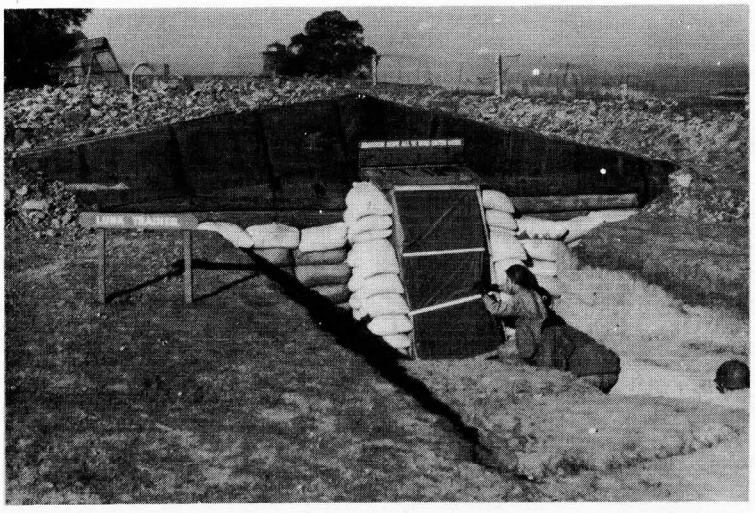
A crew of message center men huddled in the starting trench some 50 feet out in front get the signal to advance with their equipment and set up a station inside. The interior of the cave represents a forward position on the front lines. The locale has just been vacated by the enemy, and a battle is in progress. Also it is the middle of the night. Main object of the cave is to provide darkness and controlled conditions.

Wriggling under the wire through a dense cloud of white phosphorous smoke, the communications men creep forward to the doorway and plunge into a madman's version of a carnival funhouse.

MOVING UP TOWARD THE ENTRANCE OF THE LUNK TRAINER DURING A COMBAT MANEUVER.

Greeted by an exploding booby trap and the noisy whirring of a huge propeller which seems perilously close, trainees pause in the inky darkness, trying to orient themselves.

Then organized pandemonium breaks loose. The whir of the motor gets louder, the air is filled with dust. The chatter of machine gun fire galvanizes them into action. In a blinding flash of light, which illuminates the gruesome surroundings strewn with bloody bones, dummy corpses, and aban-



MESSAGE CENTER TRAINEES HAVE TO PERFORM THEIR VITAL COMMUNICATIONS WORK UNDER HARROWING CONDITIONS WHEN THEY ENTER THIS COMBAT TRAINING CHAMBER.

TRAINEES SET UP A HASTY MESSAGE CENTER IN A SLIT TRENCH AND FOXHOLES INSIDE THE NEW LUNK TRAINER.

doned equipment, the men spot some foxholes.

Taking cover hastily, they go to work. Between the booby trap explosions and gunfire, they hear the agonizing moans, groans and gurgles of the wounded. And as if these torments were not enough, the room suddenly fills with gas, and the trainees stop work long enough to fumble in the darkness for their masks.

At last there comes a welcome "Roger" from the corps command post they are trying to contact, and the instructors throw open the doors and lead the shaken but uninjured heroes out into the welcome sunshine and fresh air.

It took two months to blast out the hole and prepare the heavily timbered dugout. Installation of the motor with the 7-foot prop, provided by Motor Transport, required considerable time.

From the control room at the back of the cave the public address sound effects, lights, and motor are operated. While trainees are in the chamber, an officer is with them, keeping in touch with the control room by telephone to order more gas, more wind, or certain sound effects.

The routine is reserved for specialist trainees who are well along in their message center work, usually about the sixth week. Eight or ten at a time take part in the maneuver, which lasts about an hour.

Designed by the Training Aids branch, it is one of the first trainers of this type to be put into operation. Variations of the original Lunk Trainer at Ft. Benning, Ga., are now being constructed at other camps.

VISUAL TRAINING AIDS

BLOCK LAYOUT AIDS STUDY OF THE SUPERHETERODYNE

An operating superheterodyne receiver built up in block diagram form was constructed and is used by the Radio Division of the Central Signal Corps School at Camp Crowder, Missouri.

Each stage is complete in one block and is so constructed that it plugs into the board as shown in the accompanying illustration. This demonstrator has been found to be very successful in impressing on the student's mind the

HERE THE I.F. BLOCK IS REMOVED TO SHOW PLUG-IN CONNECTIONS.

type of signal existing in each stage. The board has also been found to be very useful in demonstrating to the student that when each stage is examined separately, the superheterodyne receiver is not a complicated set.

Operation

The demonstrator is used in conjunction with the lecture on the superheterodyne receiver. Each stage is discussed and explained separately. That block is then removed and passed among the students so that they may see exactly what equipment makes up the stage. Thus in the radio frequency amplifier

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block the tube, antenna coil, tuning capacitor and the various fixed capacitors and resistors associated with that stage are all mounted on the same metal chassis and may be examined by the class. The various blocks are then plugged into the board and the power turned on. The importance of ganging tuning capacitors is demonstrated by showing the difficulty of tuning in a signal when each stage must be tuned separately. The principle of tracking is shown by calling attention to the fact that as one tuning capacitor is varied the other two must also be changed in the same direction and through the same angle to keep the set aligned. A padder capacitor is incorporated in the tuning circuit of the high frequency oscillator and the method of aligning a set is demonstrated by throwing the set out of line, while tuned to a broadcast station, by changing the setting of the oscillator tuning capacitor, then bringing it back into alignment by means of the padder.

The necessity of a beat-frequency oscillator in receiving c.w. signals is explained in detail. Its use is demonstrated by turning it on while tuned to a broadcast station and listening to the beat note as the frequency of the BFO is varied. Attention is also called to the distortion caused by the BFO while receiving voice modulated signals.

Construction — Each block consists of a metal chassis $7\frac{1}{4}$ inches x $7\frac{1}{4}$ inches x 2 inches with the connections brought out to banana plugs which plug into jacks mounted on the board. Each block is colored to represent the signal or signals existing in that stage. For example, the radio-frequency amplifier is red, the high-frequency oscillator is yellow, the mixer is half red and half yellow to show the presence of the two signals. The intermediate-frequency stage is orange, the second detector is half orange and half blue, the audio-frequency amplifier is blue, the BFO is light yellow and the power supply is blue. The board itself is fibre composition, the dimensions being 4 feet x 2 feet 6 inches. All interstage wiring is behind the board and the antenna is a loop around the wood frame on which the fibre panel is fastened. The loud-speaker is permanently mounted on the panel and is connected to the output stage by twisted pair and snap connectors.

The circuit used is the conventional superheterodyne circuit. Each block is complete in itself and contains all equipment necessary for the operation of the stage. The various blocks are mounted on the board in an arrangement similar to the one with which the students are familiar in drawing the block diagram of the superheterodyne.

FREQUENCY MODULATION DEMONSTRATOR

Another demonstrator, one of the latest developed and used in the Radio Division of the Central Signal Corps School at Camp Crowder, Missouri, is a reactance-tube modulator and a frequency indicator to show, visually, that it is the frequency and not the amplitude of the carrier wave that changes in frequency modulation. This demonstrator has been found to be very successful in driving home to the student this fundamental concept of frequency modulation.

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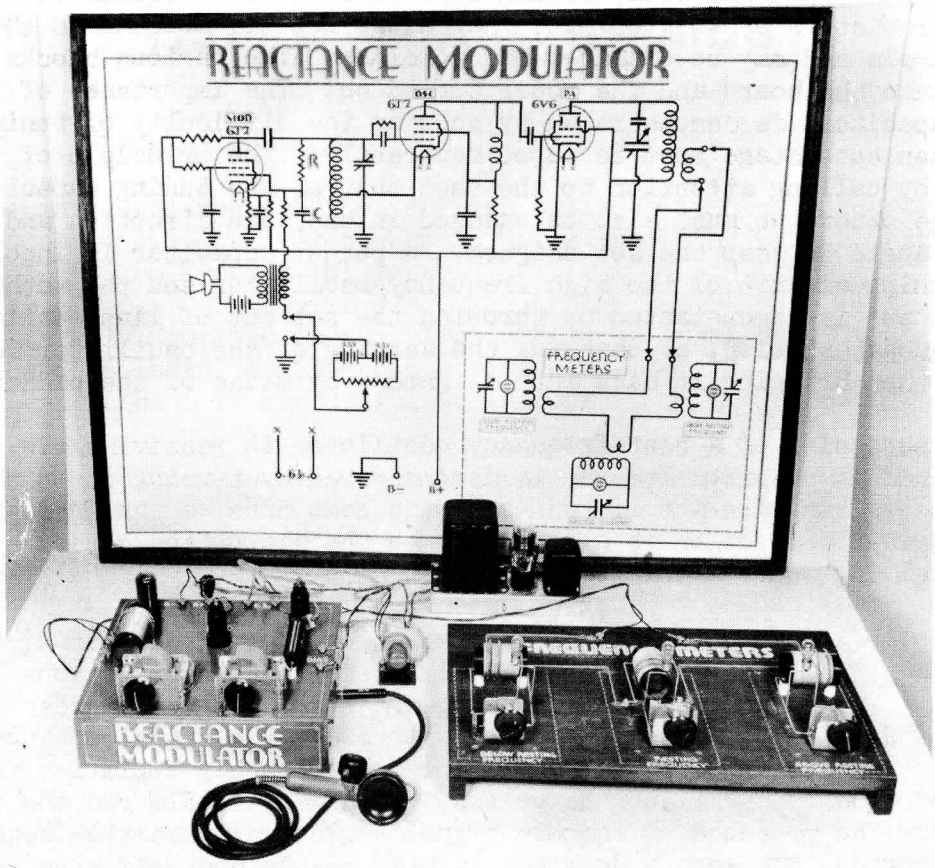

The demonstrator consists of an FM transmitter and a visual frequency indicator as illustrated. The frequency-modulated transmitter is a reactance-tube modulator, an oscillator and a power amplifier. The power amplifier is link coupled to the frequency indicator which consists of three tuned circuits across each of which is connected a neon lamp.

Operation

With no modulation present the oscillator and power amplifier of the frequency-modulated transmitter are adjusted to a frequency between 5000 and 10,000 kilocycles. The tuned circuit of the frequency indicator, marked "Resting Frequency," is adjusted to resonance at this same frequency. The neon lamp across this circuit will then be illuminated. The other two tuned circuits are then adjusted to frequencies slightly above and slightly below this resting frequency. When the student speaks into the microphone, the carrier frequency output of the frequency modulated transmitter varies at an audio rate causing the other two tuned indicator circuits to become resonant and the neon lamps to flicker at an audio rate. This indicates that the frequency of the carrier is varying above and below the resting frequency. This same effect can be demonstrated in slow motion by varying the bias on the modulator tube by means of the potentiometer shown in the circuit diagram. The bias can be varied from plus $4\frac{1}{2}$ volts to minus $4\frac{1}{2}$ volts.

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Function of Circuit Elements

The reactance tube modulator is a 6J7 tube, the grid bias of which can be varied by the signal from the microphone or by the variable bias. This reactance tube modulator causes the frequency of the oscillator to vary in accordance with the change of modulator bias. The oscillator is of the Hartley type and uses a 6J7 tube. The output of the oscillator is amplified by the power amplifier using a 6V6 tube. The output of the power amplifier is link coupled to the three tuned circuits which are simply constructed of fixed aircore coils and variable capacitors. Neon lamps across each circuit indicate when that circuit is tuned to resonance. Operating voltages are obtained from a vacuum tube power supply.

The parts used are those found in any commercial receiver. The coils were wound on insulating tubing.

MILITARY PERSONNEL

THE CSigO's RESPONSIBILITY INVOLVING REQUISITIONS FOR MILITARY PERSONNEL

What happens when a commanding officer of a Signal unit needs additional personnel? How does he go about getting the men he needs? What determines whether or not, and how soon, he will receive them?

These questions are among those most frequently heard by the Chief Signal Officer and they represent one of the most important problems referred to Military Personnel Branch, Office of the Chief Signal Officer. One of the prime responsibilities of this Branch is getting the men to get the message through, seeing that they are properly chosen and placed in the right jobs, and coordinating the needs of the various elements of the Army utilizing communications personnel so that Signal Corps missions can be carried out successfully from the jungles of New Guinea to the coasts of Italy.

The highly technical nature of the Signal Corps demands a thorough knowledge of the type of personnel needed, and the way it is to be utilized when requisitioning personnel. If men are not requisitioned properly, the skills and abilities of Signal Corps men are wasted and cannot be used to the greatest extent. Because of the rapid growth of the Signal Corps and the many changes which have occurred in techniques, training, and standards of performance, it is imperative that a close watch be kept on the supply and demand for Signal Corps troops. As an example of what can happen when requisitions are not filled properly, there is the classic case of a group of well trained and qualified code clerks, who were assigned to the Quartermaster Corps to check supplies.

Overall Procedure in Requisitioning Personnel

In the first place, a commanding officer should determine what he has on hand in the way of personnel. In this connection, the value of proper classification of Signal Corps men cannot be emphasized too strongly. The training of Signal specialists represents a considerable investment and the skills of such men should be utilized to the maximum degree consistent with the mission of the unit to which they are assigned. If men are not qualified to perform the duties to which they are assigned, they should be shifted around until they are performing the jobs for which they are best qualified. In some cases, training programs can be instituted to make the necessary adjustments. Then the commanding officer can compare his organization as it exists with the Table of Organization or Authorization for the unit. If there are overages, they should be reported as surplus. If shortages exist, requisitions should be placed for the men needed. If it appears that a change in the Table of Organization is justified, this matter should be taken up with the next higher command for consideration. With the exception of Signal units in the Army Air Forces (which handles its own requisitions for Air Force personnel) all requisitions are forwarded to The Adjutant General through channels, on standardized forms. Requisitions for

officers are made out on an unnumbered AGO Form entitled "Commissioned Personnel Replacement Requisition," and AGO Form 210 is used for enlisted men. Also to the Adjutant General go reports on the numbers and types of officers and men who will become available upon certain dates. These availability reports come from schools, replacement training centers, reception centers, and officer and enlisted men's surplus in overhead positions. Thus, The Adjutant General's Office acts as a central point for both the supply and demand of officers and men.

Military Personnel Branch, Office of the Chief Signal Officer, has been given recommendatory powers on the requisitioning of officer personnel and retains a liaison officer in the Office of The Adjutant General to check requisitions, availability and assignment of Signal Corps enlisted men.

Requisitions for Enlisted Men

In requisitioning enlisted men, The Adjutant General's Memorandum No. W615-67-43 dated 7 September 1943, subject, "Requisitions for Replacements of Enlisted Men," and AG Memo 341 (5-6-42) EC-M, dated 6 May 1942, subject, "Requisitions for Enlisted Replacements for Units in Continental United States," should be consulted for the procedures to be followed and schedules of specification serial numbers and titles of the military jobs actually trained in replacement training centers and schools. Enlisted men are not to be requisitioned for SSN's which represent allied occupations not trained by RTC's or schools of the service (these SSN's are listed in the memo dated 7 September 1943). For these jobs enlisted men trained in the primary military specification serial number should be used and developed. Another point which must be stressed strongly is the fact that commanding officers must not submit requisitions for fillers until previous requisitions have been filled or nearly filled, unless the status of the unit changes to such a degree that previous requisitions are no longer applicable. Therefore, a commanding officer must also determine how he stands on the requisitions already made out, before he makes out new ones.

Requisitions placed for enlisted men are assigned priority numbers, determined by the type of unit and assignment represented by the request. At the present time, requisitions for loss replacements for overseas units are given the highest priority and are filled first. Next to be filled are requisitions for units that have to be ready for overseas shipment at an early date. Further down on the list are continental units which are not scheduled for early shipment overseas. Availability reports on enlisted men prepared by training centers indicate specification serial numbers and dates when training will be completed. Therefore, a requisition, after being filed in the proper priority, is studied and compared with the number of men available in the correct specialties at the time they are needed.

For example, suppose an overseas requisition is received for loss replacements of ten Radio Operators, SSN 776. Availability reports indicate that fifteen Radio Operators, SSN 776, are to be graduated from a Signal Corps school within a week. As this requisition has the highest priority, ten of these fifteen men are selected for that particular requisition and

a classified order is issued by The Adjutant General and sent to the school from which these radio operators are to be graduated, indicating that they are to be assigned a shipment number and transferred to "X" depot at such and such a date. As a follow-up, the school sends a report to The Adjutant General at the time these men are shipped, stating whether or not the entire ten men requested were sent. The number short-shipped, with the corresponding specification serial numbers, is noted, so that The Adjutant General can secure the necessary supplementary personnel to completely fill the requisition.

Another factor entering into the problem of assigning enlisted men is the coordination of requirements with training programs. Some types of Signal specialist training are not given at replacement training centers. Certain numbers of enlisted men are therefore taken from RTC's and placed in Signal Corps schools. All men must complete training prior to assignment. Timing of reports and orders is of considerable importance in order to insure an even flow of men in and out of replacement training centers and schools. Availability reports are, therefore, made out three weeks in advance of graduation dates, predicting the number of men which may ordinarily be expected to successfully complete the courses to which they were assigned. Possible delay in units receiving fillers directly from reception centers may be due to War Department policy of filling quotas allotted to RTC's first each week. Other policies aside from priorities, availability, training requirements and special emergencies come into the picture. For example, the Army Ground Forces submit requisitions to The Adjutant General only when Army Ground Forces units are 7 percent or more understrength — and report men available when their units are more than 2 percent overstrength.

Requisitions for Officers

Requisitions for Signal Corps officer personnel follow the same policies as those for enlisted men, except that specifications are usually in more detail and jobs which officers are to fill are described more minutely. Requisitioning officers by name for specific assignments is contrary to existing regulations.

The Adjutant General receives officer requisitions from Army Ground Forces and Army Service Forces units and forwards a copy to the Military Personnel Branch, Office of the Chief Signal Officer, for recommendations, inasmuch as the Chief Signal Officer has the major source of available officers in the Signal Corps Officer Replacement Pool, which is under his control. Military Personnel Branch also receives requests from the Army Air Forces and recommends qualified officers accordingly. Availability reports on officers as well as compilations of officer classifications and MOS codes are on hand in Military Personnel Branch to facilitate matching up requisitions with availability and placing the right man in the right job.

According to the priority of the requisition, and the availability of officers, Military Personnel Branch, Office of the Chief Signal Officer, notifies The Adjutant General of the approximate date on which the requisitions will be filled. As officers become available from schools, pools or other sources (such as officers reported surplus, or who have completed their mis-

sions), they are selected according to qualifications for the positions represented on the requisitions and names are forwarded to The Adjutant General as recommendations for assignments.

Military Personnel Branch is well equipped for the classification and selection of officers, being authorized to maintain 201 files, duplicate AGO Form 66-1's (coded punched cards which can be sorted by a mechanical process) and qualification questionnaires.

Requisitions for Overseas Loss Replacements

Overseas depots must be kept filled with certain individuals who are allocated according to predetermined categories so that they can fill the replacement needs of theatre commanders. When the number of personnel at a depot drops below a determined level, the theatre commander requisitions necessary replacements. These requisitions are approved by the Operations Division, War Department General Staff, after it has been determined that the requisition conforms to the loss replacement authorization of the theatre involved. Military Personnel Division, Army Service Forces, is directed to provide the men. This agency then instructs The Adjutant General to issue necessary orders.

In Summary:

What happens when a commanding officer of a Signal unit needs additional personnel?

After taking stock of his outfit and making the most of what he has, he checks to see what requisitions have already been forwarded through channels to The Adjutant General. If previous requisitions have been filled or nearly filled, or his unit has changed so that former requisitions should be cancelled, he prepares a new requisition. To do this, he carefully lists the military occupational specialties required and compares them with what he is authorized to requisition (see AG Memo W615-67-43 dated 7 September 1943), and the Table of Organization or Allotment under which the personnel is authorized.

What determines whether or not, and how soon, he will receive them?

First, the priority number assigned to the requisition; second, the availability of personnel. Time may be saved, however, if the requisition is prepared correctly. Accuracy, completeness, and conformity with existing regulations are essential. Otherwise, the requisition may have to be held up for verification.

Getting the men to get the message through is an important job. Those responsible for submitting requisitions for Signal Corps personnel can bring Victory closer by making sure that the right man is put in the right job, at the right place and the right time. The Chief Signal Officer is ready and willing at all times to lend whatever assistance is necessary, through the recommendatory powers at his command.

SIGNAL CORPS OFFICERS TRAINED IN CIVIL AFFAIRS DUTIES

The war that is being fought today on a global scale involves civilian populations as probably no war in history has done. In the countries where our armies are forging ahead today, the spectacle of devastated areas, wherein the civilian population is suffering under almost primitive conditions, struggling for survival, creates complex problems of both a military and civilian nature.

Retreating enemy troops have adopted the practice of utterly destroying public utilities and private living facilities in towns from which they are forced to withdraw. Demolition of the communications system is rarely overlooked -- attesting to the vital necessity of this phase of civilization to successful military operations.

Law and order must be established in occupied and liberated territories as soon as possible after our troops move in. Wherever communications are seriously disrupted and facilities destroyed, it is essential that officers who have been suitably trained for communications duties in civil affairs sections be on the spot to help in reestablishing radio, telephone and telegraph service for the army, as well as setting up ways and means of reaching the civilian population and disseminating information relative to their welfare.

The organization of separate units for civil affairs duties is an outgrowth of experience in the first World War. At that time, commanding officers were faced with various problems -- getting their troops through, planning for further advances and taking care of the civilian population. During this war, however, the commanders of military operations are free to carry out their tactical plans and leave the problems of civil affairs in the hands of carefully selected, well-trained and capable men who are specifically charged with responsibility for the welfare of civilians in occupied territory.

For the sake of the successful prosecution of the war, and post-war relations of the United Nations, it is imperative that these officers be selected with great care as to qualifications, personality, and the ability to get along well with people of varied backgrounds, beliefs and customs. A broad social outlook, combined with skill in dealing with unusual situations quickly and effectively is of utmost importance. For, in opposition to the Axis method of retaining a permanent military government, with little regard for the welfare of the citizenry, the civil affairs personnel of the Allied Nations is functioning in a purely temporary capacity, its aim being to help the citizens to rehabilitate themselves and rebuild their community, so that eventually they may govern themselves according to their chosen form of civilian administration.

The Signal Corps along with other branches of the arms and services has been called upon to submit to the Provost Marshal General the names of officers who, by civilian and military training and experience as well as by personal attributes, may be suited for civil affairs duties.

At present, there are three main avenues which lead to this type of assignment. One is the School of Military Government at Charlottesville, Va., where officers in the grades of Captain to Lieutenant Colonel, inclusive, are given general, over-all, intensive instruction for twelve weeks, covering the basic theory of administration of civil affairs, its objectives and modus operandi. This course gives a thorough grounding in the subject which can be applied to situations in any of the countries where our troops may have responsibility for civil affairs. This school, located at the University of Virginia, is operated under the general supervision of the Provost Marshal General. Students are selected by the War Department following recommendations based on knowledge or experience particularly fitting them for civil affairs duties. The standards for entering this school are exceedingly high and, despite the consistently high-caliber officer material in the Signal Corps, it is often a case of "many are called, but few are chosen" from those who apply for training at this school.

The Provost Marshal General's School at Fort Custer, Michigan, and the Civil Affairs Training Schools at various civilian universities train officers in the grades of 2d Lieutenant to Lieutenant Colonel, inclusive, for civil affairs duties related to specific areas. For example, one group of men will be selected by qualifications and experience to participate in the administration of territory in Germany and will be given less theory, but more practical instruction regarding techniques and procedures to be used, problems which may be encountered, and geographical information and language training applying to Germany, and so forth. Officers selected for the CATS are also subject to final approval by the Provost Marshal General before being accepted for training.

Both in the Charlottesville and Civil Affairs Training Schools, Signal Corps officers who are assigned to training as civil affairs officers will retain their Signal Corps insignia, at least during training. Insignia may be changed later, depending upon the eventual assignments of officers in theatres of operation.

The third training program for civil affairs duties is a sixty-day civil affairs course given at Fort Custer for selected officers of company grades. Officers selected for this course are also subject to final approval by the Provost Marshal General before acceptance.

The civil affairs training programs at Fort Custer, Michigan, and the several universities should not be confused with the school for Military Police at Fort Custer. To enter the M.P. school, it is necessary for an officer to apply for a transfer to the Corps of Military Police. If the transfer is made, of course, the Signal Corps insignia will be changed to that of the C.M.P.

The Signal Corps has been allotted quotas for both the Charlottesville and Civil Affairs Training Schools. Only a few officers have been requested for the Charlottesville school and, at the present time, only nine Signal Corps officers have been accepted by the Provost Marshal General and assigned

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to this School.

Approximately fifty Signal Corps officers have been accepted for training at the Civil Affairs Training Schools.

At the present time, all quotas for training for civil affairs assignments in the European area have been filled, and no further applications for such training will be accepted, at least until further notice. Far Eastern training will also be announced at a later date.

WOMEN'S ARMY CORPS PERSONNEL IN ENGLAND

A WAC officer recently returned from England has reported on the activities of the first Women's Army Corps personnel to arrive in England. The greater part of this group was engaged in communications work with the Eighth Bomber Command of the 8th Air Force.

This officer was one of the first two WAC officers to be assigned to the 8th Air Force in the United Kingdom. The primary purpose of their assignment was to survey the possibilities for the use of WAC personnel in England and to make arrangements for utilizing such personnel as soon as available. They were assigned to duty in the Signal Section, Eighth Bomber Command.

At the time these officers reached England, WAAF's (Women's Auxiliary Air Force, a British organization of uniformed women) were employed as telephone operators at bomber command headquarters, wing headquarters, and other American stations. These WAAF's had been borrowed from the British Bomber Command upon the approval of the Air Ministry. A Table of Establishment, corresponding to the American Table of Organization, had been approved for WAAF personnel for communication services only, upon which the requisition for WAAF's was based. With the need for women communications personnel thus established, General Ira T. Eaker, Commanding General of the 8th Air Force, directed that WAC personnel replace the borrowed WAAF's as soon as possible and a requisition was sent through for the required number to serve the 8th Bomber Command.

In July of 1943 the first contingent of WAC's arrived in England. Replacement procedures had been determined and, as the majority of the WAAF's were used by the Bomber Command, most of the WAC's arriving in the theatre were assigned to that organization. It was decided that some schooling would be necessary before the WAC's could replace the telephone operators and teletype operators of the WAAF. Arrangements were made with the G.P.O. (British Government Post Office, which owns and operates the communication systems in England) to train one hundred WAC telephone operators at a civilian telephone school. The course was of one week's duration and gave the trainees an idea of the G.P.O., British, and American telephone routings and procedure. Naturally, the phraseology, geographical locations, routing of calls and differences in pronunciation gave the WAC telephone operators some difficulty. However, the British teachers were high in their praise of the American women.

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The one hundred WAC operators were then assigned to operate multiple switchboards at five command headquarters. Soon afterwards their efficiency became apparent to such an extent that the general query was, "When can we get some more?"

WAC personnel assigned to learn teletype operating were also taught in a British school, the length of the course being determined by the progress made. As with the telephone operators, these women distinguished themselves by carrying out their duties with efficiency and devotion to duty which brought praise.

MILITARY ORGANIZATION

ACTIVATIONS

The following Signal Corps units will be activated at the earliest practicable dates in December and in accordance with the instructions given below:

Unit	Authorized Strength OFF	WO	EM	Station of Activation	Activated by CG OF:	Assigned to
560th Sig Depot Co	5	4	182	Ft Jackson, S.C.	Second Army	Second Army
577th Sig Depot Co	5	4	182	Cp Polk, La.	Third Army	Third Army
578th Sig Depot Co	5	4	182	Cp Forrest, Tenn.	Second Army	Second Army
579th Sig Depot Co	5	4	182	Cp Cooke, Calif.	Fourth Army	Fourth Army
60th Sig Rad Int Co	7	1	251	Cp Crowder, Mo.	Second Army	XI Corps
61st Sig Rad Int Co	7	1	251	Cp Polk, La.	Third Army	XIX Corps
62nd Sig Rad Int Co	7	1	251	Cp Cooke, Calif.	Fourth Army	Fourth Army
53rd Sig Repair Co	6	1	181	Ft Jackson, S.C.	Second Army	Second Army
54th Sig Repair Co	6	1	181	Cp Polk, La.	Third Army	Third Army
55th Sig Repair Co	6	1	181	Cp Cooke, Calif.	Fourth Army	Fourth Army

The 2nd and 3rd C Platoons of the Signal Photomail Company were activated by the Commanding General, Military District of Washington, on 1 December 1943, at Fort Myer, Virginia, each unit with an authorized strength of four officers and one hundred thirty enlisted men. The units are assigned to the Military District of Washington for preparation for extended field service and placed under the control of the Chief Signal Officer for training only.

The 3110th Signal Service Battalion was constituted on 4 December 1943 and will be activated on 27 December 1943, at the Eastern Signal Corps Training Center, Fort Monmouth, New Jersey, by the Commanding General of the Training Center. The authorized strength of this unit will be thirty-four

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officers and six hundred thirty enlisted men. Upon activation the unit will be assigned to the Eastern Signal Corps Training Center for preparation for extended field service.

The 980th Signal Service Company was constituted on 6 December 1943 and will be activated on 15 December 1943 at the Eastern Signal Corps Training Center, Fort Monmouth, New Jersey, by the Commanding General of the Training Center. The authorized strength of the unit will be ten officers and two hundred eight enlisted men. Upon activation the unit will be assigned to the Eastern Signal Corps Training Center for preparation for extended field service.

CHANGES OF STATIONS

Organization	Present Station	New Station
236th QM Salvage Collecting Co	Camp Toccoa, Ga.	Cp Gordon, Ga.
79th Infantry Division (79th Signal Company)	C-AMA	Cp Phillips, Kansas
80th Infantry Division (80th Signal Company)	Cp Phillips, Kansas	C-AMA
Det, 282d Signal Pigeon Co	Cp Hale, Colo.	Camp Crowder, Mo.
592d Joint Assault Signal Co	Cp Crowder, Mo.	Camp Pendleton, Calif.
3d Plat, 280th Signal Pigeon Co	C-AMA	Cp Claiborne, La.
1st Plat, 283d Signal Pigeon Co	Cp Claiborne, La.	C-AMA
5th Armored Division (145th Sig Armored Co)	Pine Camp, N. Y.	Indiantown Gap Military Reservation, Pa.
303d Signal Operations Bn	Sunnyvale, Calif.	Fort Ord, Calif.
13th Armored Division (153d Sig Armored Co)	Cp Beale, Calif.	Cp Bowie, Texas
11th Airborne Division (511th Airborne Sig Co)	Cp Mackall, N.C.	Cp Polk, La.
* 292d Joint Assault Signal Co	Cp Bradford, Va.	Cp Pickett, Va.

MISCELLANEOUS

War Department letter dated 26 November 1943 directs that the 9th, 10th, 11th, 12th, 13th, 14th, 17th, 18th, 21st and 28th Signal Center Teams at the Central Signal Unit Training Center, Camp Crowder, Missouri, will be disbanded by the Commanding General, Seventh Service Command, on 10 December 1943.

Effective midnight 30 November - 1 December 1943, the units listed below were relieved from assignment to the Armored Command and assigned as indicated:

* Represents temporary change of station.

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Unit	Station	New Assignment
16th Armored Division (156th Signal Armored Co)	Cp Chaffee, Ark.	X Corps, Third Army
20th Armored Division (160th Signal Armored Co)	Cp Campbell, Ky.	XX Corps, Second Army

The 989th Signal Service Company was reorganized on 6 December 1943 at the Eastern Signal Corps Training Center, Fort Monmouth, New Jersey, by the Commanding General of the Training Center. The new strength of the unit will be twenty-two officers and two hundred sixty-five enlisted men. The unit remains assigned to the Eastern Signal Corps Training Center, Fort Monmouth, for preparation for extended field service.

Effective 1 December 1943, the 289th Signal Company (the signal element in the 4th Engineer Special Brigade) was relieved from the control of the Commanding General, Army Ground Forces, assignment to the Second Army and attachment to the Amphibious Training Command, Atlantic Fleet, and was placed under the control of the Commanding General, Army Service Forces and reassigned to the Fourth Service Command for preparation for extended field service. The unit is now stationed at Camp Gordon Johnston, Florida.

The 987th Signal Operation Company (Special) will be reorganized on 15 December 1943 by the Commanding General, Seventh Service Command, at the Central Signal Corps Training Center, Camp Crowder, Missouri. The unit will have an authorized strength of eight officers and one hundred fourteen enlisted men. Upon reorganization, the unit remains assigned to the Seventh Service Command for preparation for extended field service.