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SIGNAL CORPS
Technical Information Letter

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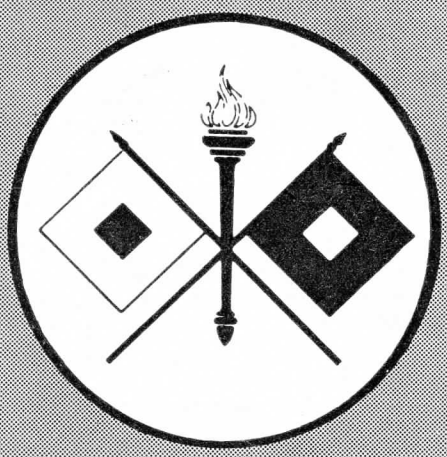
ARMY SERVICE FORCES · OFFICE OF THE CHIEF SIGNAL OFFICER



SIGNAL CORPS

TECHNICAL INFORMATION LETTER

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

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

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Within the continental limits of the United States the Letter is distributed to Signal and other Ground and Service Forces units and installations by the Chief Signal Officer (SPSAY), Washington 25, D. C. Distribution to Army Air Forces units and installations in the continental United States is made by the Commanding General, Army Air Forces (AFMPB), Gravelly Point, Virginia.

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

Publication approved by Bureau of the Budget, Executive Office of the President.

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SIGNAL CORPS CP FLEET

Seaborne Communication Installations Overcome Amphibious Problems in SWPA

MOBILITY OF signal installations on a vast scale was required in the Southwest Pacific Theater of Operations when American and Allied troops began moving up the ladder on their return to the Philippines. Communications not only had to be mobile enough to cope with the long amphibious strokes with which American and Allied troops rolled back the Japanese flood, but also had to be able to cope with thousands of miles of islands and water that constituted the theater of operations.

In essence, communications had to be maritime and mobile at the same time.

Anticipating these problems, in mid-1942, plans were initiated for the acquisition of small vessels that could act as radio relay stations for task forces, meeting the problem of the Pacific distances, or be sent to augment overtaxed communications facilities in any part of the far-flung theater.

An auxiliary ketch and an auxiliary schooner were taken from their Australian freight runs for the job. No U. S. Army radios were suitable for the marine requirements of the ships, but Amalgamated Wireless of Australasia was ahead on production of satisfactory AWA sets for the Royal Australian Navy, so 2 AWA 750-watt (input) transmitters, 1 AWA Marine transmitter and 4 AWA receivers were diverted for each of the vessels.

Antennas were rigged to simulate stays so that the vessels could not be distinguished as communication boats. One transmitter antenna was strung between the masts, another ran from the bowsprit to the foremast at a 60° angle, the two receiver antennas ran from gunwales to mast tops, and an auxiliary antenna for either transmitting or receiving ran from the stern to the top of the after mast. The boats were covered with camouflage paint.

Undersized and cramped (neither was more than 150 tons net nor longer than 100 feet), the ketch and the schooner fulfilled their mission as relay ships. The schooner did duty at Port Moresby during the fighting over the Kokoda Trail, the ketch retransmitted from Milne Bay in the Woodlark operation, and both of them anchored at Nassau Bay in the Salamaua-Lae operations.

Later, another small vessel was used for radio communications. It was a 122-ton schooner with a 100-foot steel hull. It was equipped with 2 AT–20 and 2 TW–12 transmitters, a 500-kilocycle SCR–578 as an emergency transmitter, 2 SCR–608's with CE–2 telegraph carrier terminal equipment for v–h–f links, and 20 AMR–100 receivers for friendly intercept work.

The little vessels were buffeted by an inordinate number of tropical storms and exposed for long periods to the marine growths and reefs of the South Pacific, as well as near-misses of enemy bombs, until these first three had to be turned in to the Transportation Corps.

Valuable lessons were learned in the outfitting and operation of these earlier craft. The hot, tropical sun beating down on the cabins raised the temperature of the operations rooms to as high as 125°, and improved ventilation systems had to be planned. The lengthening lines of communication called for bigger ships that could contain more powerful radios and greater storage space for supplies.

But the little radio boats opened a whole new vista of military communications. The earlier concept, of a fleet of small ships to act as an actual floating command post signal section on amphibious operations, was approaching possibility of realization.

On 21 March 1944, a separate branch was set up to plan communications afloat and supervise installations and operations, the Seaborne Communications Branch of the Signal Corps in the Southwest Pacific, staffed by selected officers with maritime backgrounds and high technical qualifications.

It was difficult to find vessels that met not only the exacting specifications for big radio installations, but could contain all the operational refinements that had been formulated in experience with the earlier boats. And having found such vessels, it was not always easy to acquire them.

Early in March 1944, officers of the Seaborne Communications Branch inspected two vessels at anchor in Sydney harbor. One was chosen.

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The little vessel that was to become the first and smallest of the CP fleet was built in San Francisco in 1942 for the Kiska and Attu operations, out of wood to better resist the ice floes. Although her sister vessels went to Alaska, she was not completed in time and she was sent under her own power to Australia to be used as a tug. She has a beam of 29 feet, 6 inches, an 11-foot draft and twin screws with Atlas Marine Diesel engines of 320 horsepower each.

The Signal Corps built an operations room over the hold, forward of the bridge, and installed two manual c–w AT–20 transmitters, two TW–12 transmitters, eight AMR–100 receivers, an SCR–300, two SCR–808's, an SCR–608, four inverted L antennas, and, in the cargo hold, forward of the ship's engines but completely separated from them, two 15-kilowatt PE–205B's, International Harvester diesel engines, for radio power. The diesels are operated one at a time.

The AT–20 is a 500-watt, medium power transmitter, with a frequency range of 2 to 20 megacycles. The TW–12's are 50-watt high frequency, voice and c–w sets with 1½ to 18 megacycle range, for field use and relay work. The AMR–100's are superheterodyne receivers with a frequency range of 0.48 to 26 megacycles. All this equipment was manufactured in Australia.

The SCR's on the ship are all v–h–f sets, the 808's being used to stand by on Navy frequency in convoy 24 hours a day, the 300 in the CP fleet net, and the 608 for ship-to-shore channels.

With a full forecastle, quarters for the Signal Corps soldiers were installed amidships and aft, and for a signal officer just off the bridge. All personnel share the mess room.

A 20-millimeter antiaircraft gun was placed amidships and another aft, and two 50-calibre machine guns were installed on AA mounts on a forward gun platform.

The ship was given a crew of 6 Army Transport Service officers and 12 enlisted men from the Army Ship and Gun Crews. The ship and gun crew not only runs the vessel and mans the guns, but handles all intership communications.

Installations were completed on 2 June 1944. A first lieutenant and 12 enlisted men were placed aboard for signal operations and maintenance, and on 6 June she headed north out of Sydney.

Hollandia had fallen to the Americans on 22 April. U. S. forces were building it into a gigantic springboard to the Philippines. Its rapid expansion was taxing communications facilities heavily, so she was ordered to Hollandia's Humboldt Bay, arriving on 25 June.

She kedge-anchored close inshore, installed two teletypes, ran telephone and teletype cables ashore, and 2 days after arrival, opened circuits to headquarters at Brisbane, Australia, and advance GHQ at Port Moresby on the other side of New Guinea. By 19 July, shore installations had been built up to the point where the Signal Corps personnel was needed ashore. They worked in the Signal Center, but continued to key through the ship's transmitters.

At Hollandia, the ship handled as much as 11,000 code groups per day. Her capacity has since been determined at 12,500, and on all of her missions she has averaged between 7,000 and 11,000.

On 7 September, the ship hoisted anchor at Hollandia and churned out of the bay to Biak, where additional communications were needed. She arrived within 3 days.

At Biak, which we had taken on 27 May, a code room was installed in a supply compartment below decks, and put into operation the day after arrival, as a regular signal center. After 10 days, the shore installations had had time to expand, and again the crew, with its temporary signal center team, moved ashore, keying through the vessel's transmitters. The Biak phase ended 24 September, and the craft was ordered back to Hollandia.

FLOATING PRESS INSTALLATION

In the early part of 1943, SWPA public relations officer was beseeched by American network correspondents for some means to enable them to broadcast direct to the United States. He took his problem to the Signal Section, and found that the Seaborne Communications Branch already had been experimenting on long range maritime transmission. The PRO's assignment was undertaken, and out of the idea came a floating broadcast station and studio that could not only accompany the correspondents, but also house them.

This was the 55-year-old vessel that was to become best known of the CP fleet. Before the Leyte Gulf operation was over, she was described in magazine and radio broadcast, usually with more glamor than technical accuracy.

Back in the nineteenth century this ship was built as a revenue cutter, and used by the Coast Guard on the Atlantic Patrol. Just before the Second Great War, she was sold for junk and stripped to the hull. Then came the dire need for bottoms of every condition and description, and what was left of the ship was purchased by the Maritime Commission. She was used for a while by the Navy, then she was turned over to the Army.

The Army sent her to Australia. Under the guidance of the Signal Corps, the old cutter received a face lifting and a general rejuvenation. To work with, Signal Corps engineers had a 650-ton steel ship, 185 feet, 3 inches long, with a 29-foot beam and a draft of 12 feet, 2 inches. She was diesel-operated, with a single screw that gave a top speed of 13 knots.

Conversion began in July 1944.

Voice modulated, short-wave transmitters generally are designed for specific installations, and there were none available in Australia, nor was there any likelihood of obtaining any from the United States.

The Signal Corps was using a regular c–w short-wave transmitter, built by Amalgamated Wireless of Australasia, but it could not be voice modulated. The Postmaster General of Australia, on the other hand, was using a regular broadcast frequency transmitter that was incapable of utilizing shortwave. Signal Corps technicians combined the two into a transmitter plant that uses two 889–R air-cooled power amplifier tubes, each modulated by two water-cooled, 220–C modulator tubes, with a frequency range of 5 to 20 megacycles and an output of 10 kilowatts.

This was installed in the after one of the ship's two holds.

Aft of the transmitter equipment, separated by a soundproof door and bulkhead, two 50-kilowatt International Harvester diesels were installed for power, with a 5,000 gallon fuel supply. Either can operate the transmitter, and they are used alternately.

Two AMR–100 receivers were installed for receiving cues from San Francisco and broadcasts from shore for retransmission.

In a special v–h–f room on the forward hatch, an AN/TRC–1 was installed. A delta-matched doublet and one ordinary current-fed doublet for the high frequencies were rigged from the two masts as transmitter antennas. Lack of room forced the use of a doublet as receiving antenna, but despite this and the fact that it is in the field of the transmitting antennas, reception from San Francisco proved successful.

Most impressive installation was the studio and control room.

On the number 2 hatch a studio floating in rubber, to suppress the ship's vibrations, was built along lines identical with those used by the big network studios in the United States. The studio is a room within a room, separated from its outer shell by 2-inch rubber pads on all six sides, with soundproofing material in between. It is believed to be the first of its kind on shipboard.

It connects with the control room by a vault door and a vision panel. The control room has console type speech equipment, complete with rack and patch board, which were built by Amalgamated Wireless of Australasia. There are six input channels, including two turntables and full facilities for remote pick-ups by wire or radio.

For armament, two 20-millimeter antiaircraft guns were installed on topside forward. (After the Leyte operation, two 50's were added aft.)

The guns developed an unforeseen complication. They became so charged due to the radiation of the radio frequency current from the antenna just above them, that the gun crews were unable to touch them. On one critical occasion, the first man of the gun crew to touch one of the 20's drew an inch-long spark. The trouble ended when the guns were grounded.

This vessel was the first ship to incorporate all the improvements that had been developed by experience with the earlier craft.

Hitherto, all ships' generating motors, being direct current, were torn out and replaced with a. c. motors so as not to interfere with radio reception. It was not only a large job, but a. c. motors were difficult to procure. In this ship, an effective system for shielding and filtering d. c. was worked out, and they were allowed to remain.

The transmitter, v–h–f and generator rooms, the studio, signal officers' quarters and officers' and enlisted men's mess rooms, were air-conditioned.

All ships of the CP fleet boast of that rarity in the tropics, ice water and ample refrigeration, but this ship is the only one that offers its personnel fresh water showers as well.

A hand-picked Signal Corps detachment was placed aboard, consisting of 2 first lieutenants and a second lieutenant, all of whom were commercial broadcast engineers in civilian life, plus 11 enlisted men, 6 of them v–h–f specialists.

The ship's crew was made up of 7 Army Transport Service officers and an Army Ship and Gun Crew of 12 enlisted men who operate the same as on the communication ships.

By the end of September, work was still in progress and the time for her to go into action was drawing close. Although not fully completed, she was ordered to sail for Hollandia on the 28th. Work continued en route, and at Hollandia she was boarded by a technical expert who had been flown from Sydney to supervise the finishing touches. For 3 days work continued in Hollandia. and then she stood ready.

FIGHTING SIGNAL SHIPS

Until the latter part of 1944, every vessel ever used for SWPA Signal Corps communications had been selected from whatever was available in the Southwest Pacific and came nearest to meeting the requirements.

But out of Australia in September there sailed for duty three ships that had been ordered from the United States expressly for the CP fleet.

These craft were found to have both armament and room for radio installations. These vessels were designed to fight submarines and airplanes attacking convoys and to rescue survivors of any ship stricken. For this latter purpose, cabin space was provided to accommodate 86 passengers in addition to the crew. All of them were in production in the United States.

Three were requested for SWPA 4 January 1944. The first, after launching, shakedown cruise, and antisubmarine practice, arrived at Brisbane 17 June 1944; the second and third, the following week.

Each had an over-all length of 184.2 feet, a 30-foot beam, a draft of 9 feet, 5 inches, with twin screws operated by 900-horsepower General Motors 12–567 ATL diesel engines that would drive them ahead at 16 knots. Tonnage of each was between 700 and 900.

The ship was heavily armed for her size. The latest locator, firing and navigational devices were incorporated.

ACTION HIGHLIGHTS

Throughout the fleet's operations, Japanese air raids were a commonplace, although they interfered little with the work at hand. Even the press ship continued broadcasting through most of the raids.

With the same no table harmony that had existed between ships' crews and Signal Corps personnel on all ships through all their contacts, signalmen worked hand in hand with the crews at the battle stations, manning some of the guns, passing ammunition, and acting as talkers.

One of the communication ships participated in 40 raids the first month of the Leyte operation and 30 more in the following 2 weeks. Her record was typical of the fleet.

Although there were several casualties among other Signal Corps officers and men in the landing and afterward, the CP fleet remained unscathed until A-plus-5.

At 1000 of the morning of A-plus-5, four Japanese bombers began making circular bombing runs over ships in the harbor and land installations. The communication ships' guns opened up as the planes came within range. With the others, one of the communication ships was anchored about 800 yards off Red Beach.

I was watching one of the Japanese bombers that had been struck, as it went down off our stern, relates the Navy lieutenant in command. *Suddenly shells from other ships started flying through our rigging. I didn't realize they were firing at a plane that was over us. Just as I was scrambling down to my station on the bridge, the man who acted as talker for the 3-inch gun and the 40's came hurtling through the air in front of me. In all the racket I had heard no bomb hit, but we were struck on the starboard side of the navigation bridge by a missile from a heavy Jap bomber.*

The communication ship's guns went after her attacker and before the Jap had cleared their range, her 40's and 20's had found their mark. The Nip bomber crashed in flames 1,000 yards off the port bow.

On the communication ship there was scene of destruction. The missile had gone through the first superstructure deck, scattering fragments into the ward room, the captain's cabin and the combat information center. One sailor's head was blown off. Another's legs were blown off. Blood on the deck

Naval complement of each ship is approximately 9 officers and 95 enlisted men.

Conversion of the ships to CP boats was done by the Navy in Brisbane under the supervision of Signal Corps officers.

The after compartment of the boat deck was divided into a small compartment and a large compartment on the port side, and four small ones on the starboard side.

Eight AMR–100 receivers, with four operating positions, and two teletypes, were installed in a small portside compartment. Twelve bunks and a table were put in a large portside compartment for Army personnel. On the first, this is used by enlisted men and assigned signal officers. On the other two, it is the army officers' ward room, the enlisted men sharing the crew's quarters, below decks in the fantail. In the after starboard compartment of the second, across from the operations compartment, were placed four AT–20 transmitters. In the same compartment of the other 2 there are 3 AT–20's and 2 AN/TRC–1 sets and carrier equipment giving 3 voice and 4 teletype channels for a maximum of 16 teletype channels. This was the first v–h–f carrier to operate from ship-to-shore in the Southwest Pacific theater.

The next starboard room was outfitted as a general's quarters with bunk, desk and private toilet and shower. Forward of it, on two of the vessels, were the dispensary and the code room.

An SCR–284 and an SCR–300 were placed aboard each of the two vessels for ship-to-ship and ship-to-shore links.

Two were outfitted for use of General Headquarters, SWPA, and the third was assigned to Sixth Army, so its equipment varied to conform to requirements of the Sixth Army. No v-h-f and carrier equipment was installed, the after starboard compartment being used as a code room. The extra compartment that this left was equipped as a general's office adjoining his quarters. For ship-to-ship and ship-to-shore communications it has three SCR–610's, six SCR–300's and a teletype machine with a mile of rubber-covered cable secured on deck to be run ashore. One SCR–610 is located in the code room, one in the radio room and one on the bridge to afford a choice of best reception.

Antenna systems of all three ships are similar.

(*Continued on Page 6*)

was ankle deep. A sailor with a 2-inch shrapnel wound in his head, and wounds in his chest, was struggling to get back to his gun. He was quieted with morphine. A Negro steward's mate, second class, with a hole in his chest, ran to the first-aid room for treatment. The hole was so large that the doctor stuffed pieces of shirts and sheets into it, then the Negro had to be restrained from returning to his station. He was still protesting violently at leaving the ship when transferred later to a hospital auxiliary. Other casualties lay all about.

Luckily, the blast burst three bottles of extinguisher lashed on deck and they sprayed the whole area, effectively smothering incipient fires. A small fire broke out in the radar transmitter but was put out with a hand extinguisher.

Signal Corps men, who had been at their stations aft, suffered no casualties. They gave medical aid to the wounded and helped clear the wreckage. The signal officer had been operating the SCR–610 on the bridge, standing beside the talker who was blown in front of the captain. Just before the explosion, he took four or five steps to port to ascertain the code name of GHQ afloat and escaped injury. His only comment at the time was, *This is a helluva place for me!*

A half mile away was an LST that had been converted into an auxiliary hospital ship. The communication ship pulled alongside it. Railings were removed, planks lashed between the 2 vessels and the communication ship transferred its 2 dead and 10 wounded, 7 of them in serious condition.

Within a half hour after the ship had been hit, all casualties were off, wreckage cut away, wooden plugs driven into the holes, and the communication ship was ready for continued communications and more combat.

More combat came at 1300 when Jap planes attacked again. This time the communication ship's gunners were out for revenge. Into one of the attackers the 20's poured approximately 40 shots, then the 3-inch gun blew it into a fatal dive.

The second communication ship had a close call the same day. She was attacked by three waves of enemy bombers.

According to her commander, *They were coming at us from all sides. One, particularly, I was watching with my glasses and he seemed to be diving right into the lenses. I watched, fascinated. I kept waiting for the bomb to come out. But for some reason he didn't release his bomb until he was right over us and it landed 25 feet off the fantail.*

The day before the bombing of the first communication ship, the guns of the second claimed

Four transmitting antennas run from the yardarm of the foremast to a specially constructed aftermast, terminating in antenna tuning units for coupling coaxial cables on the aft boat deck. These boxes enable the antennas to be tuned to varying frequencies. Four receiving antennas run from the crow's nest to the flying bridge. On two of the ships, v–h–f antennas are on the aftermast.

All the transmitters use ship power.

Signal Corps personnel assigned to each of the two GHQ ships included a radio officer and a cryptographic officer, each second lieutenants; nine radio operators, three teletype operators, three v–h–f specialists, four signal center and code clerks, two transmitter maintenance specialists, and one teletype maintenance specialist. The Sixth Army used a warrant officer (j. g.) and 12 Signal Corps enlisted men on its vessel.

As fast as they were equipped and staffed, they were sailed north to Hollandia.

When the CP fleet rendezvoused at 1600 on 13 October 1944 off Hollandia, its ships carried a heavy passenger list in addition to the Army and Navy operating crews. In the general's cabin of one of the communication ships was the Chief Signal Officer, SWPA, and with him were a captain of his staff to handle General MacArthur's messages, a special v–h–f team, and an Australian Army Signals officer with nine Australian enlisted men. The added v–h–f team comprised a captain, three v–h–f specialists and two radio operators, to operate a land link for the CP fleet. The Australians, especially trained to intercept Filipino guerrilla and Japanese broadcasts, operated three Navy nonradiating receivers on the way up.

The second communication ship carried the assistant chief signal officer, four other Signal Corps officers and an intercept team of 12 Filipino Scouts and U. S. Army code clerks who operated the nonradiating receivers.

The press ship's personnel had been augmented with three public relations officers and five PRO enlisted men. The enlisted men operate steel wire, disc and film recording equipment the PRO had installed on the broadcast ship.

On the first and smallest CP boat were four public relations officers and two war correspondents.

the probable destruction of a Japanese plane, and on the day after, they scored a definite kill on a Jap bomber at dusk. Three days after that, the 3-inch gun brought down a Japanese Zeke.

Of the Signal Corps crew that manned the .50 calibre guns and passed ammunition during these attacks, one of the ship's officers said, *They are absolutely unflinching. I have seen them staying at their posts without showing a sign of fear when Jap planes were coming right at their guns.*

The third communication ship helped make the fateful day of A-plus-5 costly for the enemy. At 0844, one of her 40's shot down a medium bomber and two of the 20's hit the tail of a second bomber that disappeared in flames. The following day, two of her 40's hit a medium bomber which burst into flames before disappearing in some clouds. After the Leyte operation, this communication ship had three Jap flags painted on her bridge.

During the A-plus-5 attacks the lightly armed little press ship claimed a kill with its forward 20-millimeter gun. On A-plus-9 the crew of the aft 20 claimed another Jap plane brought down, entitling the junior-sized member of the fleet to two Jap flags painted on the bridge.

Shortly before dawn on the morning of 28 October, the captain in charge of the fleet's v–h–f installations on shore received a telephone call. The call was from the third communication ship and he recognized the voice of the Chief Signal Officer.

We've had some trouble, the chief signal officer told him. *Get doctors, blood plasma, and medical supplies out here.*

Those aboard never saw the enemy that bombed her. It was dark, 0415 hours, and the ship was anchored in San Pedro Bay of Leyte Gulf, about 2,000 yards off the south end of the Tacloban air strip. Shore batteries suddenly opened up, and a brilliant flash was observed in the direction of the strip.

The next thing the watch knew, the air was filled with the shrill scream of falling bombs.

The duty officer gave the order, *Clear the forecastle.*

Men were rushing on deck to battle stations as the stick of bombs struck. One hit 20 yards abeam of the bridge superstructure to starboard, another 50 yards abeam to port and a third 150 yards beyond in a line. They were believed to have been 500-pound antipersonnel bombs.

Shrapnel riddled the hull and superstructure forward, putting 80 holes on the starboard side and 20 on the port side, from 1 to 5 inches in diameter.

Fire started in an ammunition locker, but once

The third communication ship carried several Sixth Army staff officers.

Because of the magnitude of the operation, the communications ships had to be devoted exclusively to communications so that they were CP boats only in the sense that they accomplished the signal work of the command posts.

On GHQ afloat, a Navy warship, a section above the main deck, known as flag plot, had been converted into a broadcast room for General MacArthur's public statements. It was connected to a 96–C, 3-kilowatt transmitter with a range of 4 to 20 megacycles, and an SCR–284 was put aboard as a link to the other communications systems. A Signal Corps major, two lieutenants and eight enlisted men went along to handle the broadcasts, and a lieutenant and radio team to assist with the general's broadcasts ashore.

GHQ afloat, the Press ship, and two of the communication ships each carried an additional AN/TRC–1 with carrier and concommitant equipment. to be used as v–h–f land links.

Twenty-four hours before sailing, on receipt of word that General MacArthur would make a statement from the beach on A-day, a 6 x 6, 1½-ton truck was equipped with v–h–f equipment, antennas were mounted on the sides and it rolled aboard an LCM in the convoy.

THE PHILIPPINE INVASION

At about 0800 of 20 October 1944, the CP fleet picked its way through the maze of American shipping suddenly crowded into Leyte Gulf. Under the thundering guns the five little vessels anchored off the beach of Palo, known as Red Beach.

H-hour was 1000.

Radio silence was lifted at approximately 1100. On all five ships operators were poised at their keys. Each vessel began establishing its radio contacts.

The press ship promptly broadcast to the world—

In a major amphibious operation we have seized the eastern coast of Leyte Island in the Philippines. * * *

Messages sparked into and out of the three communication ships. The press ships' operators were pounding out a growing mountain of news

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again, as on the first communication ship, fragments broke an extinguishing agent, the sea-water pipes in the locker, which put out the blaze.

One piece of shrapnel pierced the code room, a chair, the code room desk and typewriter and burst into the general's quarters, which were occupied at the time by the chief signal officer.

The ship's captain was asleep in his quarters, which were riddled by shrapnel going in one side and out the other, tearing off doors and ripping bulkheads both there and in the ship's surgeon's quarters next to it.

He leaped out of bed, to find the shirt and socks he was wearing afire, as well as the mattress on which he'd been lying. He beat out the fires and started for the bridge, but was barely able to make the climb. His right foot squished inside his shoe as though he had stepped in water. When he painfully reached the bridge, another officer told him, *Your trousers are soaked with blood.*

The captain reached down and pulled two pieces of shrapnel from his right leg. A third piece was buried too deep and he refused to be treated or to leave the bridge until all casualties had been cared for and the wreckage cleared away. He directed the work while supporting himself on the bridge railing.

The casualties were heavy. Some men were struck as they were piling out of the forecastle. However, it was fortunate that only a few had had time to come out, because if all men had been at their battle stations there would have been nine on the 3-inch gun instead of the four who were cut down there. Three of the four were killed and the fourth was seriously wounded.

Another freak of the blasts saved additional lives. When the remainder of the 3-inch gun crew reached deck, they tried to put the gun in operation. That proved impossible because the trunnion controlling elevation had been put out of commission. It wasn't learned until afterward that shrapnel had also penetrated the heavy steel barrel to the extent of raising a quarter-inch and a half-inch constriction on the inside, which would have undoubtedly caused the gun to blow up if it were fired.

The wardroom and mess hall were converted for surgery as well as the operating room. Within a few minutes, all three of them were filled.

Doctors, pharmacist's mates, blood plasma and surgical supplies were rushed to the ship from nearby vessels.

Six men were dead and 23 wounded, 12 of them seriously. One of the dead was a Signal Corps code clerk, technician fifth grade, killed in his sleep.

from the correspondents' typewriters. Whaleboats banged up against the sides of each vessel long enough to pick up or deliver messages and news copy, then churned off to other ships or to shore.

H-plus-4. Over the landing gate of one of the hundreds of barges, the v–h–f truck bounced into the wheel-deep surf and crawled up onto the beach. Within 15 minutes its personnel was talking to GHQ afloat.

Then onto Red Beach waded General MacArthur. He walked over to the v–h–f truck, took the microphone and spoke—

I have returned. By the grace of Almighty God our forces stand again on Philippine soil—soil consecrated in the blood of our two peoples. * * *

Network correspondents then took over the shore truck's microphone. Their word stories went out to the world with Jap bodies strewing the beach around them, mortar shells bursting in the area, soldiers taking cover behind the truck, and the infantry, in the early stages, only 150 yards inland.

With the exception of the press ship, whose facilities cannot be duplicated on beachheads, the CP fleet was designed to be in full operation no longer than 5 days after a D-day, by which time shore installations ordinarily are fully functioning and the CP fleet can serve as a standby.

In the Leyte operation, rivers of rain, oceans of mud and Japanese infiltration made the job of ground signal troops a superhuman one. Besides, General MacArthur never returned to GHQ in Hollandia. He established headquarters on the scene, and GHQ later joined him. The CP fleet was there to fill the breach on land as well as on sea. The v–h–f truck was sent to Burauen to open two teletype and two telephone channels for Fifth Air Force. Personnel of the CP fleet echelon installed other v–h–f links throughout the area.

One communication ship handled a maximum of 10,000 code groups in 24 hours, mostly incoming messages, in addition to message traffic between war correspondents and their home offices that ran to a maximum of 500 words a day. She acted as a safe-hand courier center as well. Her cryptographic activities were not moved ashore until A-plus-7.

Among the wounded were two other Signal Corps enlisted men, a master sergeant radio technician, and another technician fifth grade code clerk.

The soldiers rendered first aid and helped clear the wreckage. One of them, a former medical student, *reported to the medical officer and at his direction aided in the treatment and care of the wounded and dying with a degree of skill, calmness and devotion meritorious of high praise and commendation for conduct beyond the call of duty*, according to the report of the ship's captain. He was recommended for the Bronze Star Medal together with a member of the Navy crew who ignored wounds of his own to give first aid to the more seriously injured.

The signal team investigated immediately after the bombing to determine that its transmitter had not been on at the time. Evidently the enemy did not home on the ship's radio. The radio officer made prompt repairs on radio equipment damaged on the bridge.

Within 20 minutes after the chief signal officer's phone call, the v–h–f captain was back at the beach in a truck containing two doctors, five first-aid men and a couple of bales of dressings and medical supplies, following a wild ride to an Army hospital over difficult roads. But so fast had the ship's complement coped with the emergency that the chief signal officer was able to advise him over a portable radio to merely stand by.

The communication ship drew alongside the LST hospital auxiliary, put a gangway across and transferred the dead and seriously wounded.

By 0900, all casualties had been cared for, all wreckage cleared away, the ward room and mess hall cleaned up, and breakfast was being served.

Holes in the ship were stopped with wooden plugs. Four bags of outgoing safehand documents that had been put aboard the previous evening were pierced by a single piece of shrapnel and the fragments had cut down one of the transmitting and two of the receiving antennas, but messages could still go through.

Three other vessels of the CP fleet had close escapes the same night, apparently from the same stick of bombs. A line of explosions stopped 100 yards from the bow of the already wounded first communication ship causing no damage. One bomb hit off the stern of another communication ship, showering it with ineffectual shrapnel, another hit close to a third communication ship and a Liberty ship, nearby, was struck.

The other GHQ communication ship served throughout the operation as a monitor ship and a standby in case of trouble on the other, also handling overflow traffic.

The famous Voice of Freedom broadcasts, set up on Corregidor and interrupted with The Rock's fall, was resumed. The new Voice of Freedom station was the press ship. The program was on the air for 30 minutes daily.

Besides that, between A-day and A-plus-10, the press ship put out 212 broadcasts to coast-to-coast networks of America and in the first month after A-day transmitted by voice more than a million words of news copy to the United States and 350,000 words to Australia and London. Since its first connection with RCA in San Francisco, not a single schedule was missed.

The press ship, her forecastle covered with cots, became a home for many of the correspondents as the Leyte operation progressed.

The other press ship had planned to relay its press transmissions through Hollandia, but when she went into operation her signal crew discovered that she was being received even better in Sydney. Until A-plus-10, the vessel handled both Australian and American press copy, delivered to the ship by courier. The two radio circuits to Hollandia were kept open around the clock at first. The average traffic was 7,000 to 10,000 groups a day. After a while the volume of copy slacked off to the point where the 24-hour schedule could be eased, and after A-plus-10 the ship handled only Australian news copy, operating one circuit to Sydney and one to Hollandia.

The Sixth Army communication ship's powerful equipment operated in all Sixth Army nets, particularly the command net, acting as a relay for Army and the various corps and other units that were frequently unable to communicate with each other direct. Her record was 25,000 code groups in a single day.

COMMUNICATIONS BARGES

In the story of seaborne communications, plans have outraced the power of accomplishment in the face of shortages of manpower, shipping and equipment. But as early as November 1943, the waste of building and rebuilding the elaborate

(*Continued on Page 10*)

The press ship's gunners claimed one probable Jap plane during the Leyte operation. The ship itself remained unscathed, however, until the night of A plus-14 when a 20-millimeter shell from an attacking plane struck the ventilation shaft outside the signal officer's quarters and exploded. The shrapnel scarred the ship, and the shell's glancing blow dented the shaft, but it caused no wounds and took no lives.

TYPHOONS

Two days after the bombing just related, a typhoon struck the waters off the Philippines. Handicapped by loss of so many key personnel, the communication ship which had undergone the bombing began dragging her anchors. Suddenly at 0100, 31 October, all hands felt, rather than heard, unmistakable crunching. They had struck a reef. Although both propellers were bent, one tail shaft sprung, a strut bent, and there were dents in the hull, she managed to pull herself off and rode out the storm.

The other damaged communication ship was struck by a PT tender unable to control itself against the caprices of the typhoon. Its degaussing cable was cut and her hull stove in at the waterline. A temporary bulkhead of mattresses and other ready material was constructed and enabled the communication ship to ride out the storm successfully.

The press ship was struck lightly by an unidentified vessel. All the CP craft lost small boats, which hampered courier service but not communications.

On shore, where the v-h-f equipment had been installed in the Leyte Capitol Building, the detachment operating it received orders to keep channels open at all costs because the typhoon was taking serious toll of land lines. The signalmen climbed to the roof of the building, and, buffeted by the wind and drenched through, held their antennas up by ropes, every other reinforcement they could find, and their bare hands. The v-h-f links never went out, even on the ships where v-h-f antennas were blown down.

About a week and a half later, another typhoon struck. Less violent, but of longer duration than the first, it raged for 40 hours. No serious damage to CP fleet resulted, however.

The two damaged communication ships returned to Hollandia for major repairs, returning to Leyte on 26 December 1944.

signal installations required for an advancing General Headquarters, came under discussion.

The little communications boats had been a success, and the CP boats more than fulfilled their promise. But small models do not always work on the grand scale. Could all the powerful equipment of GHQ Signal Center, traditionally sprawled over wide areas of the countryside, be floated into mobility?

The Signal Corps planners went to work. They figured, experimented, drew plans and redesigned them. Finally, they had worked out all the preliminary knots of a project that they were confident from the first could be brought to reality.

Then they went shopping for ships. After several types had been ruled out, they decided upon ocean-going lighters, known in Army nomenclature as OLs.

Seven were acquired in April and May 1944, and there began the most drastic job of reconversion the Signal Corps had yet undertaken.

The extent of the operating installations on the lighters required every foot of available space, so an eighth ship was converted into a quarters vessel to house the operating personnel.

Four of the Signal Center ships and the quarters ships have been completed, and at this writing are on their way to GHQ in the Philippines.

They have been rechristened with Signal Corps nomenclature as CBT–1 and CBT–2, CBR–1 and CBR–2, and CSQ. The first initials stand for Communications Barge, and the T for transmitter, the R for receiver and the CSQ for Communications Ship Quarters.

Even before this article is generally read, the *Grand Fleet* of the Signal Corps in the Southwest Pacific will be ready to take over the burden of communications for allied staffs wherever they may go, in no longer time than it takes to raise its folding aerial masts.

MORTAR FIRE DIRECTION

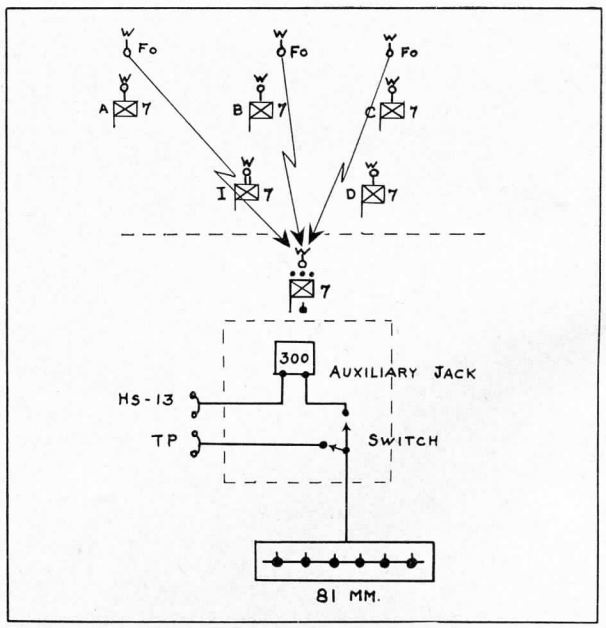
GREATLY IMPROVED freedom of movement for mortar observers and more dependable communications from observer to gunner by the use of Radio Set SCR–300 in combination with sound power telephone equipment is reported from the 7th Regiment, 3d Infantry Division, European Theater of Operations.

Two Radio Set SCR–300 were used; one at the OP and the other at the mortar platoon CP. Operation of this set-up was performed as follows:

The FO transmitted fire missions by SCR–300 on the battalion command channel. Reception by the second SCR–300 at the mortar platoon CP was heard directly by all gunners through the sound-powered telephone circuit; sound-powered telephone being plugged into auxiliary jack of the radio set.

Circuit was monitored at mortar platoon headquarters and recorded so that instructions could be repeated to gunners who failed to understand FO's transmission.

Range of the SCR–300 was increased by elevating it to a roof or hilltop and operating it by means of remote control hook-up.



REPRESENTATION OF SET-UP FOR USE OF SCR–300 IN MORTAR FIRE DIRECTION.

TROUBLE-SHOOTING ON THE FLY

3d Armored Division Maintenance Crews Perform Successfully During Compaign in Europe

MORE THAN 10,000 jobs involving more than 1,700 radio sets were performed by radio maintenance personnel of the 143d Armored Signal Company for the 339 days, 24 June 1944 through 28 May 1945, during the historic drive across Europe by the 3d Armored Division. How this job was approached and what it consisted of is the subject of a report recently received by the Chief Signal Officer, from which the following is taken.

GENERAL POLICY

There were three general radio maintenance policies of the 143d Armored Signal Company. Keep all sets operating at all times. Use replacement sets where necessary to insure operating radios in all vehicles. And repair every set and every component part to the extent available with the parts and the tools on hand.

Seven major maintenance categories, established by actual requirements, were performed by radio maintenance section of the 143d. They consisted of:

1. *Inspections.*—In addition to continual inspection of radio equipment, it was necessary to inspect signal equipment installed in new vehicles in order to make sure that it was in proper working order. In addition, before important operations or during rest periods it was SOP to have all radio sets checked to insure their being tuned to maximum efficiency and to detect any faulty operation or need for repair or replacement.

2. *Preventive Maintenance.*—Regular routine maintenance tests to correct or catch faults that might impair the effectiveness of radio communications was a routine that was followed throughout the campaigns in which the 3d Armored Division participated.

3. *Operational Maintenance.*—This policy was based on the need for a qualified radio repairman to be on hand for emergency repair work at all times at all units. The moral support to commanders and operators in having a qualified technician present when anything happened to the radio equipment was inestimable.

4. *Corrective Maintenance.*—This was a constant day-in and day-out job which insured having not only a qualified technician present but also the necessary test equipment and tools for servicing and correcting troubles which occurred quite often during the operational employment of radio equipment.

5. *Installation and Removal of Equipment From Vehicles.*—An ever present requirement was that of installing radio equipment in vehicles or changing them from one vehicle to another or making a special installation to suit the desires of a commander. Other aspects of this requirement was that of removing radios from damaged vehicles and also a large amount of cordage replacement. Many times complete interphone systems had to be replaced due to combat destruction.

6. *Improvement of Application of Electrical Equipment.*—To make signal communications more reliable, flexible and safe, there was a constant requirement for remote control devices, special antenna hookups, modification of enemy equipment, modification of U. S. equipment, provision for a different method of interphone operation and other odd jobs having to do with the electric lighting system, special service radios, movie projectors, etc.

7. *Maintenance of Records of Work and Adequate Supply of Replacement Parts.*—Proper records in order to maintain the proper stock of parts was essential in order to provide a wide variety of replacement components in minimum quantity based on actual use. Properly handled, this paper work allowed many repairs to be made which otherwise would have had to have been performed back at the depot.

ORGANIZATION OF MAINTENANCE TEAMS

The radio repair section of the 143d Armored Signal Company was divided into seven separate radio teams. A team was attached to each of the three letter companies of the maintenance battalion, to each of the three combat commands (Combat Command A, Combat Command B and Combat Command Reserve) and to Division CP, forward. The teams attached to the three maintenance companies consisted of six men with a T/3 or a staff sergeant as crew chief. They were supplied with a modified Signal Corps shop truck,

a PE–95 power unit, hauled by the shop truck, and a quarter-ton, 4 x 4 truck with trailer. The shop truck contained replacement parts, tools, and test equipment and parts supply. The quarter-ton truck provided personnel with transportation and carried personal equipment. Thus each team was capable of performing all maintenance up to third echelon repair and if necessary could be sent to assist rear repair companies, other divisions, and to reinforce each other when work piled up at one place more than at another.

The teams at Combat Commands A and B consisted of four men with a T/3 or staff sergeant as crew chief, equipped with an M3 half-track and a quarter-ton, 4 x 4 truck with trailer. To provide power, a small 500-watt, 110-volt, a. c. generator was installed on the back of the half-track. Test equipment included tube checkers, alignment meters and necessary tools to perform third echelon repair within the limits of the parts carried. The major job of these teams consisted of preventive maintenance, operational maintenance, corrective maintenance, and the improvement of the application of electrical equipment. Operational maintenance, however, was their main job and although they were equipped to make radio installations, they usually referred this type of work to the shop truck crews. The teams made thorough checks of equipment during rest periods and were especially concerned with the tuning, frequency, and general operation of v–h–f sets. It was also the function of these teams to inspect the radio equipment of units attached to the respective combat commands and assist lower unit technicians whenever possible. The main advantage of these teams was in providing complete second echelon maintenance well forward where the service was of utmost value at critical times.

The team at Combat Command Reserve consisted of two men equipped only with a quarter-ton, 4 x 4 truck with trailer. Since headquarters of Combat Command Reserve was usually the staff of the armored infantry regiments, maintenance personnel from the regiment was available for most of the maintenance work. Also the signal company maintenance team was present.

The team at Division CP, forward, consisted of three men also only equipped with a quarter-ton, 4 x 4 truck with trailer. Their main concern was in keeping radios of the Division CP in working order.

All these teams carried replacement sets.

RECORDS AND PARTS SUPPLY SYSTEM

Every signal company technician filled out a simple work repair record slip for each job he performed. These records showed the sets repaired and the parts used. They also showed sets tuned, aligned or installations made. These reports were consolidated to show parts that had been used and the type of work that had been done. A running account was kept of these records which gave a complete history of maintenance work done by the division signal company from the inception of this program.

A file card was maintained for every radio part. The card contained the maintenance factor for the part, the set in which the part was used, the number of parts kept with each team or in each tool kit, the number used listed by maintenance, the number on hand, the number on requisition at all times. Periodic requisitions were prepared from the data on the cards. Parts kept in stock were in proportion to the actual amount used over a given period. This permitted the stocking of a wide variety of parts in a small but representative quantity.

Each shop truck maintained an inventory of parts. This inventory was taken at least once each month, but when stocks were moving fast, the inventory was taken bimonthly. These inventories and the work repair records were inspected and consolidated by the supply corporal who distributed the parts as required to the shop trucks. Maintenance teams not equipped with shop trucks maintained their parts to the required level by drawing on shop truck stock.

Once the records were started, they were simple to maintain and were kept up to date at all times.

CREW ACTIVITIES

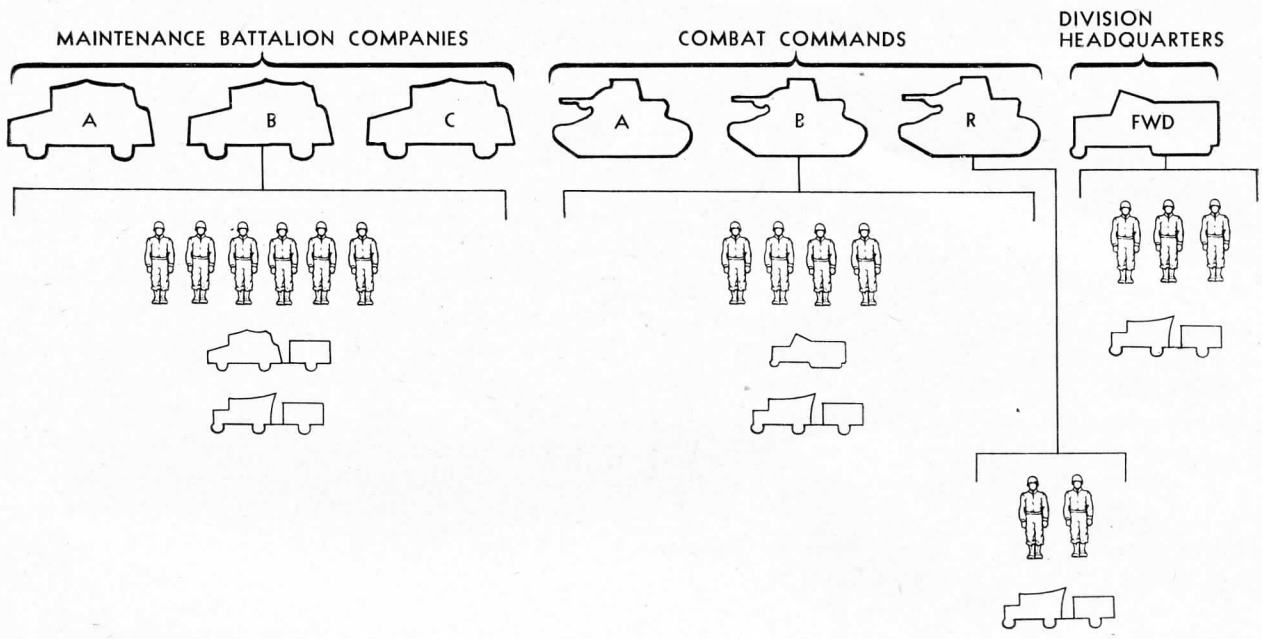
The crew attached to Company A, Maintenance Battalion, landed in Normandy with the company in support of Combat Command A. Little work was necessary until 29 June, when the Division was committed to combat, at which time damaged equipment began to come in for repair. At the same time, many repairs were made for other First Army units, as this team was the only third echelon shop available in the area.

Of great value in maintaining communications was the practice of replacing defective radio sets with spare operating sets. This eliminated the

MAINTENANCE TEAM ORGANIZATION

3d ARMORED DIVISION

143d Armored Signal Company



necessity of waiting for the defective unit to be repaired.

During the fight in the hedgerows of Normandy, it was found necessary for infantry and armor to work in closer coordination. This lead to the issue of Radio Set SCR–536. Repair of these sets was an added responsibility due mostly to shrapnel damage resulting in broken antennas and switches and later to broken studs holding the cases together.

The night before the drive to Coutances, antipersonnel bombs caused one casualty (a T/5 who eventually returned to the crew in Germany) and damage to vehicles. Vehicles were repaired in time to start on the following afternoon. Following the St. Lo break-through it became possible to complete repairs only during a few hours of the day, as it was necessary to drive most of the night to keep up with the task force. After the Falaise Gap operation, a 48-hour maintenance period was spent with the armored regiment conducting third echelon inspection of all radio equipment and another two days repairing equipment found defective.

Moisture became a problem in the area near Breinig, Germany. The best cure was found to be a thorough baking of the set for one or two hours behind the radiator of a power unit. During a two-and-a-half-month stay in Stolberg, third echelon inspections were made of all radio installations in Combat Command A units and discrepancies corrected.

During the Battle of the Bulge, an unusual amount of trouble was experienced because of shrapnel damage to interphone cable in tanks. Aid was also given at this time to the radio maintenance unit of another division. Radio Set SCR–300 was introduced within the 3d Armored Division at this time. After the German break-through had been stopped, there was a general maintenance period with the PE–95's sometimes running merely to dry defective sets.

Company B Crew

The crew attached to Company B, Maintenance Battalion, landed on Omaha Red Fox Beach 4 July 1944 with Signal Company, rear echelon. The day after rear echelon joined the rest of the Company, this crew was attached to Company B, Maintenance Battalion, then supporting Combat Command B. In the vicinity of Ariel, this team rewired its first knocked-out tanks and at St. Jean

de Daye it provided radio work on tanks equipped with hedge cutters. In the latter part of the Normandy Campaign, this team and Company B, Maintenance Battalion, were transferred to Combat Command A. After the crossing of the Seine River, two members of this team participated in the capture of nine German soldiers.

During a victory parade in Liege, many burned-out radios occurred when the tanks' antennas struck live trolley wires. On the evening of 15 September this team moved into Germany when the Division operated in the siege of Aachen. VT–164 tubes for the BC–604 transmitter (SCR–508) became critically short here. The continuous combat operation of the transmitter shortened the normal life of the tubes. This shortage was finally relieved by C–47 planes flying tubes to signal supply sources.

In Breinig this team was rotated to support Combat Command Reserve. Repair work began to flood in. Radios had been operating twenty-four hours a day for more than three months, many under conditions which made maintenance nearly impossible. Trouble due to moisture began to develop. A dryer was improvised. This consisted of the warm air blast from the power unit's radiator. A critical shortage of batteries BA–39 and BA–40 for SCR–509 was overcome by fabricating substitute batteries composed of BA–2's and BA–30's to make BA–39's and BA–2's and BA–23's to make BA–40's.

During the Battle of the Bulge this crew completed more than 120 work orders within five days. Many of these repairs were complete tank rewiring jobs. All radio equipment for one unit of the Division had to be replaced, having been lost during the German counterattack.

Company C Crew

The crew attached to Company C, Maintenance Battalion, landed on Omaha Beach with Signal Company, rear echelon, 4 July 1944 and two days later were attached to Company C, Maintenance Battalion. Company B of Maintenance Battalion was attached to Combat Command B. On the dash across France and Belgium, working time was limited because of the long and many moves. This crew often had to drive a vehicle that they were working on to two or three bivouac areas before work was finished on it. While at Walheim, Germany, this crew in addition to its own duties handled repairs for a tank destroyer battalion stationed nearby. Remote control cords for SCR–506 and SCR–508, so that radio operators could operate their radios from indoors, were made. The BC–728 receiver (SCR–593) was modified for an antiaircraft battalion eliminating the need for wet batteries and permitting the set to be operated from either 6 or 12 volts. A third echelon inspection for two armored regiments was made. Once when Combat Command B had approximately 20 tanks knocked out by mines and bazookas, the team repaired or replaced interphone systems, replaced complete installations and repaired defective radios.

On 29 December this crew was ordered to assist a signal repair company in removing British radio installations from M4 medium tanks and installing SCR–528's. Men of this team worked three days from 0700 to 2300 hours and on the fourth and last day from 0700 to 0430 hours the next morning. This was necessary because of the urgent need for these tanks to counter the German break-through.

Combat Command A Crew

The crew attached to Combat Command A landed at Omaha Beach and after several days it became evident that radio repair facilities were adequate. Responsibility was assumed for all Command Post lighting maintenance, all news radios and other electrical equipment.

The need for remote control equipment was met by devising a small kit containing speakers, keys, switches, indicator lamps and so forth as a master control unit for a vehicle.

The break-through at St. Lo and subsequent long marches resulted in a change in general servicing methods as the roads were often very narrow or crowded. It was decided to monitor from the half-track all traffic on the channels used in the column. Any irregularity observed involving a Combat Command A set caused a crew to be dispatched to the vehicle in trouble. Usually the defect was cleared without stopping the vehicle. This procedure proved so valuable that it was continued on all marches.

Upon reaching Germany house lighting became the biggest time-consuming task. Fourteen buildings were included in the Command Post system. Domestic radios were serviced along with military radio sets. It was also at this time, after three months of sustained operations, that an inspection plan was instituted for all radio sets. The plan was designed to fit the requirements of individual

sets and peak performance was exacted by a close watch of stage alignment and dynamotor conditions.

Combat Command B Crew

The crew attached to Combat Command B landed at Omaha Beach 21 June. The first job in France was wiring a handset with a 30-foot cord into the interphone circuit of 50 tanks. This was to allow infantry platoon leaders and tank commanders to coordinate their movements.

A few miles west of the Seine River during a stop for a few hours, an emergency call brought the maintenance crew to an armored regiment. A quick check revealed that a shorted power amplifier tube had burned out the transmitter and dynamotor of the commander's v-h-f set. A fast trip was made to Combat Command A where a spare dynamotor was borrowed and brought back to the armored regiment and installed before the task force moved back into action. It was necessary, however, to tune the set while the tank was moving up to the front.

Vehicles of this team were equipped with SCR–510 and operated in the Combat Command command net. In many instances repairs were needed while on the move. The quarter-ton, 4 x 4 truck would pull up beside the vehicle experiencing trouble and a technician would swing over and either repair or replace the faulty component. Radio repairs were often executed in the back of the half-track while on the move and in the few short hours at night. Replacement sets were found to be indispensable. In Germany in addition to its own maintenance jobs this team performed about 30 separate jobs for one of the armored regiments whose electrician had been seriously injured. Much time was spent in November drying and aligning SCR–608's which had been thrown out of alignment by the combination of moisture and cold.

The Battle of the Bulge was a combination of icy roads, night moves and stiff fingers frozen to sets being repaired. A German trailer was picked up and made into a heated shop; a German foxhole stove served as the heater.

Trouble with a v-h-f set at a reconnaissance battalion sent the crew out with a replacement set. However, a blown bridge prevented the crew from getting to the reconnaissance battalion. The two men of the crew left their quarter-ton, 4 x 4, with an infantry patrol, crossed the stream on foot, located the reconnaissance battalion, brought its vehicle to the opposite edge of the stream and then carried over the replacement set and installed it. During this time, too, the crew wired many houses occupied by the CP. During the advance into Germany, sets were repaired at night in the

Work Summary for BC–603 (508 Series) Receiver from June 24, 1944 through May 28, 1945

Total jobs, 938

Type work	Work done by crews at—							Work done for units—																							
	CCA	CCB	Mtc A	Mtc B	Mtc C	Fwd Ech	CCR	CCA	CCB	143	Hq	Trn	Mtc Bn	Sup Bn	45 Med	32 AR	33 AR	36 AIR	54 FA	67 FA	391 FA	23 Engr	83 Rcn	703 TD	486 AAA	Div Art	Stock	Div Sig	87 FA	CCR
Alignment	4	12	83	37	57	1	11	4	7	1			3		1	31	20	13	5	2	5	1	4		2		25	78		3
Alignment and tuning adjustment				2														2													
Alignment—tuning—repaired part		1		2													1					1	1							
Alignment—replaced part	2	2	36	35	34	3	1	1	1		1		3			8	6	7	4		1	4	5	1	7		22	41		1
Alignment—repaired—replaced part		3	11	7	3				1							4	3	1							1		4	9		1
Alignment—repaired part		1	9	4	6											6	4	2		1							3	4		
Tuning adjustment	16	73	10	8	78	24	9	9	39	12	9		3		2	2	34	2			1	10	13		3	3	7	59		7
Tuning adjustment and repair		11	2		9	2			9								4		1			2			1	1	2	3	1	
Tuning adjustment and replaced part	1	5	5	3	40	2		1	3		1	1			1	1	11		3			1	1		3	1	8	17	3	
Tuning adjustment and repaired and replaced part.		1	3		6	1			1				1														4	5		
Repaired part	3	4	13	4	4	2		3	4	1	1		1			3	3	2			1			1			2	8		
Replaced part	5	32	13	12	13	5		6	18	1	1				4	9	9	1	1			6	1		1	1	12	8	1	
Repaired and replaced part		7	1	5	2	9			3					1			5	1			1	1	2		2	2	1	6		
Checked operation	4	1	19	1		1	2	3								4	1	1				2						16		1
Replaced bad set	3	1	13	16	42	3		3	2				1			22	18	4	2		2	1	10	1	1	3			8	
Bad SPKR (turned into DSS)			5																									5		
Dried set			3																								1	3		

blacked-out half-track and trailer. House lighting details kept the crew busy as the Command Post moved from town to town.

Combat Command Reserve Crew

The team attached to Combat Command Reserve received its baptism of fire in Belgium repulsing the German counteroffensive. This team was with the forward CP when it was almost surrounded, the road between it and rear echelon being practically cut. Many tanks were knocked out and were replaced with new ones, radios of which had to be given operational checks and set on proper channels. Airborne infantry reinforcing the near-encircled U. S. troops were assisted by this team in the maintenance of Radio Set SCR–300. On one occasion the team was sent to check a v-h-f set at a reconnaissance battalion. Following directions, the team traveled on a road that lead through a small pocket of German infantry and tanks. Unaware of this, the night being dark, the team drove through the pocket unalarmed, believing that the tanks they saw were knocked-out German tanks and that the infantry was American.

From the Roer to the Rhine intercommunications between air force and armored vehicles were used to a great extent. The team found it necessary to devote most of its time to maintaining v-h-f radio equipment.

Division Headquarters Crew

The crew attached to Division Headquarters, forward, was assigned to Division Headquarters in England. Its first major job was the inspection of all radio equipment, setting up of frequencies and the checking of waterproofing.

After the breakthrough at St. Lo, the CP moved almost daily. Light repairs were made on the fly, others at the first halt or at night when the CP was settled down. In Belgium, the CP was often infiltrated by enemy vehicles and personnel. In one instance the maintenance team, while changing a transformer in one of the radio sets SCR–399, was so ingrossed in the work that they were totally unaware that enemy half-tracks were passing just six feet from their vehicle. Division headquarters moved to an estate at Stolberg in Germany and for a month and a half the CP was subjected to frequent shellings necessitating much of the radio repair work to be done in dugouts. During the stay in this area the crew maintained lighting systems, repairing of electrical appliances and so forth. Also during this time this crew modified an EE–89 line repeater for use as a telephone amplifier. This was necessary since wire lines were too long for conversations at good level. The crew managed to thoroughly inspect all radio equipment in the CP with special emphasis on the inspection of dynamotors. This inspection and servicing paid dividends when the Division went into action, for few dynamotors failed.

During the Battle of the Bulge the radio maintenance crew had a problem getting repairs accomplished since the CP did not stay at any location for any period of time. Bitter weather conditions added to the difficulty of making repairs. A man's fingers were soon stiff from the cold and he had little control of his tools. Many troubles were caused by antennas touching live electric power wires. Snow coated the antennas of the high-powered stations with ice which proved quite troublesome. This crew also handled Command Post lighting during this period and also had its first experience with RC–58 tape facsimile. It installed and put in operation two of these machines. During the encirclement of the Ruhr Valley, the crew utilized civilian receiver antennas and troubles in equipment had to be cleared on the move. The radio repair crew usually was in column among the high-powered stations and monitored the channel used in the column. When radio trouble was reported or when a station did not answer when called, the crew would drive up to the station in trouble and through an immediate repair or replacement put the station back into operation. Major repairs were made at night during halts.

During the period of this report members of the radio maintenance section of the 143d Signal Armored Company received two Purple Hearts and eight Bronze Stars.

Expansion of operations means the thinning out of spare parts, tools and other equipment. Shortages can be kept down by persistent first and second echelon maintenance.

ENGINE-GENERATOR SUPPRESSION

Interference From Power Units Can Be Reduced by Proper Methods of Suppression

ALL COMMUNICATION personnel are familiar with engine-generator units, commonly known as power units. They form a component part of, and supply the power for, many radio, relay, radar, and other equipment. While radio operators and maintenance personnel are well acquainted with the functions of power units, they are not always too well aware of the fact that these units can be a source of seriously disturbing radio interference.

Power units cause radio interference because of the fundamental principle that an electric spark occurring at any breaking point in a circuit containing inductance and capacitance will create high-frequency oscillatory currents. These high-frequency currents are radiated from the circuit wiring and components and will be picked up by radio equipment within receiving range. In its normal functioning, a power unit produces such sparks in ignition spark plugs, distributors, generator brushes, exciter brushes, relay contacts, etc. The associated wiring forms the oscillatory circuits and radiators. The resulting miniature radio transmitters create communication interference which may extend over most of the normally used radio frequency spectrum.

In order to prevent the radio energy thus produced from being radiated and interfering with radio communication, power units must be *suppressed.* Most of the Signal Corps power units now in use in theaters of operation have been equipped with the components necessary for the suppression of such radio communication interference.

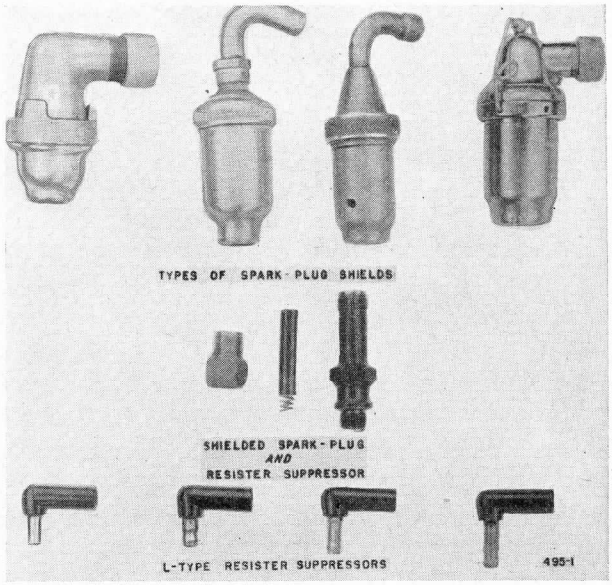
An effective suppression treatment of radio interference generated by the sparks occurring in the ignition spark plugs and distributor consists of installing 10,000-ohm resistor-suppressors at the spark plugs, placing one suppressor in series with the high-voltage lead to each plug, installing another 10,000-ohm suppressor at the center contact of the distributor in series with the high-tension lead from the spark coil, and inclosing in shielding the spark coil, distributor, and all spark-plugs, suppressors, and high-tension wiring.

Radio interference from other noise sources in power units is suppressed by means of low inductance, metal-cased, by-pass capacitors. Such capacitors are connected from generator and exciter brushes, and other points where sparks occur, to the machine frame (*ground*). The capacitors are mounted as close as practicable to the noise source. In addition, it is the usual practice to connect a capacitor from the output circuits of the generator to the machine frame. These capacitors are either mounted on the control panel or, if no control panel is used, close to the output receptacle. The interfering currents produced by the spark are thus effectively by-passed directly to *ground* through the capacitors.

To further prevent possibility of radiation, all separate metal surfaces and major units are bonded to the framework, and the shaft or other openings in the end-bell of the generator and exciter are shielded.

Although the by-pass capacitor-to-*ground* is the most frequently used suppression device for low-voltage circuits, effective suppression for these circuits is sometimes accomplished with grounded-case filters connected in series in the generator to regulator circuit, regulator to battery circuit, primary of the ignition circuit and/or the generator power line circuit.

All radio men are familiar with the filter prin-



DIFFERENT TYPES OF SPARK PLUG SUPPRESSORS ARE SHOWN IN THE PHOTOGRAPH ABOVE.

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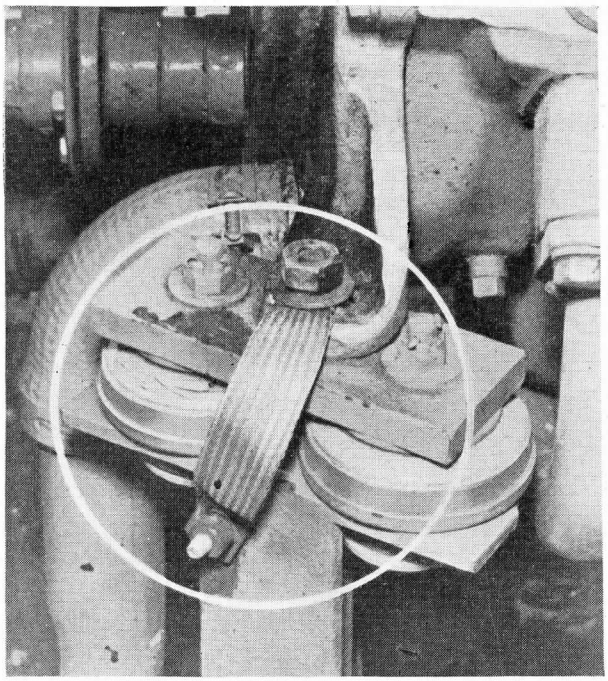


BOND ACROSS ENGINE MOUNTING IS SHOWN IN THE ABOVE ILLUSTRATION.

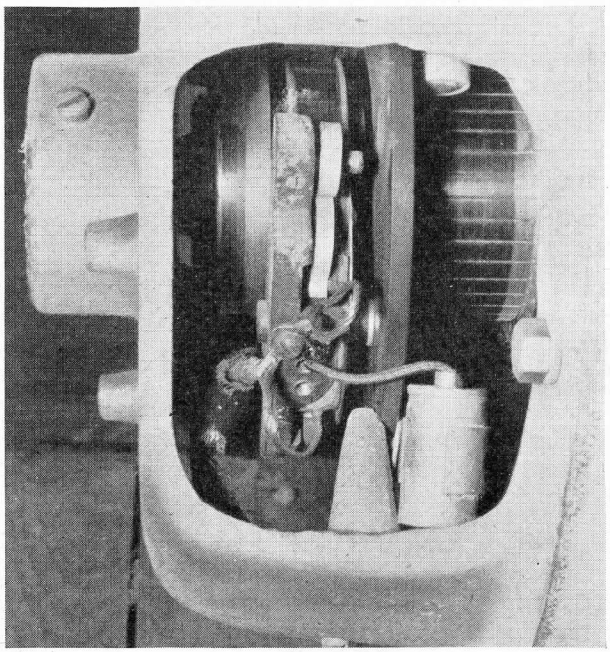
ciple. The filters used for power unit suppression consist of a few turns of wire inclosed in a metallic case and connected to terminals on the case, with a capacitor within the container connected from each terminal or coil-end to the metallic case. With the terminals, and hence the inductance coil, connected in series with the circuit near a noise source, and with the filter case mounted on the machine frame (*grounded*), the high frequency oscillatory currents causing the radio interference are held back by the coil inductance and are by-passed to the machine frame and back to their source by the condensers in the filter.

In the event a power unit is furnished with no suppression, or if the engine or other components have been replaced without suppression treatment, careful investigation of all radio interference noise sources is necessary. Modification work orders have been prepared on some power units, listing kits and detailed instructions for installation of the suppression system. Information can be obtained from the signal supply officer of the *next higher echelon* on the availability of a kit for the specific power unit concerned.

When no kit or detailed information is available, suppression components can usually be obtained from the nearest depot. A brief list of suppression components with stock numbers and application points is given on the next page.

Capacity across the breaker points in the ignition circuit should not be added. Capacitance higher than shown in the above table should not be used from relay contacts or from generator output terminals to frame. Large values of capacity across contacts may change required voltage values or cause the flow of excessive currents that will burn and pit the contacts and cause them to stick. Increasing the capacitance from the generator out-put terminals to the frame may dangerously increase shock hazard from the power line to ground, especially if one side of the line should be in contact with the earth.

Many radio men do not realize that at certain frequencies, the inductance present in the capacitor lead and element acts as a very effective choke to prevent the free passage of the interfering currents to *ground*. The perfect arrangement would be a radio-frequency by-pass to ground with no inductance in the capacitor and associated connections. However, by making the capacitor leads as short as possible and mounting the capacitor close to the noise source, an effective low impedance path for interfering radio-frequency currents is formed which is as nearly perfect as it is possible to attain.



TYPICAL APPLICATION OF BY-PASS CAPACITOR ON GENERATOR OF POWER UNIT ENGINE.

Item	Stock No.	Point of installation
Suppressor, elbow type	2Z9054	At each spark plug.
Suppressor, elbow type	2Z9054.6	At distributor center terminal.
Suppressor, straight type	2Z9054.1	At distributor center terminal.
Capacitor 0.01 mfd—metal cased, 200 V [1]	3DA10–164	Exciter brushes to frame. Relay contacts to frame.
Capacitor 0.1 mfd—metal cased, 200 V [1]	3DA100–143	Generator output circuit terminals to frame. Changing circuit relay contacts to frame.
Capacitor, 0.1 mfd—metal cased, 500 V ac/dc	3D473	Relay contacts, etc.
Capacitor, 0.1 mfd—metal cased, 500 V ac/dc	3D483	Generator output circuit, etc.
Tooth-type lockwasher, 5/16"	6L71005–4C	Place under bolts and screws securing components or bonds to insure a good conductivity between metal surfaces.
Tooth-type lockwasher, #10	6L72210–14	
Tooth-type lockwasher, 1/4"	6L72214–20	
Bond braid 1/2" wide	1A1015	For bond straps from generator and/or exciter to block, etc.
Bond Braid 3/4" wide	1A1016	
Terminal for bond strap 1/2"	6Z3815	
Terminal for bond strap 3/4"	6Z3817	

[1] Obviously not suitable for outputs above 125 V. For higher output voltages, higher voltage capacitors must be used. Avoid molded micadielectric capacitors because they do not stand up under the extreme vibration conditions experienced in engine generators. It is preferable to use the 500 V ac/dc capacitors on all power unit applications.

The method of attaching capacitors will be obvious. Keep connecting leads as short as possible. Resistor-suppressors are attached by simply screwing the ignition cable into the open end of the suppressor. Be sure that the wood screw of the suppressor bites into the conductor.

Bond large metal surfaces together with tooth-type lockwashers and bond straps. Make certain that generator and exciter frames are well *grounded* to the frame. (Use bond straps, if necessary.)

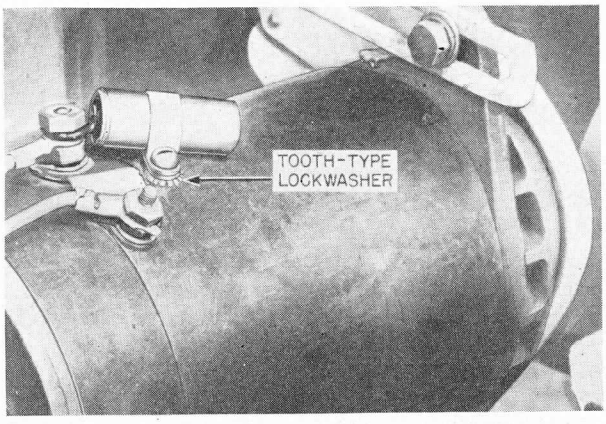
One of the most effective methods of reducing ignition interference is a metal box enclosing all of the high-tension wiring, the high-tension coil, the spark plugs and distributor or magneto. This can be fabricated in the field with any available suitable material. Care must be used to allow ample clearance from live parts to prevent flash-over and shorts. The metal-shield *must* be well grounded to the block or frame. Clean the points of contact until the metal shines. If separate shields are used for the magneto, etc., they must be bonded together by straps or other means.

Check each suppression application by means of a radio receiver, so that the effect and efficiency of the suppression installation can be determined. Use a receiver with a separate power supply, if possible, as suggested below.

The proper maintenance of the suppression system on a power unit is vitally important to radio communication in the area where such a unit is supplied. Scheduled and preventive maintenance is a responsibility of the using organization and, as any operator who has stood a watch trying to copy signals through heavy man-made static, or trying to detect echoes through excessive *grass* will testify, is very much worthwhile.

A scheduled routine should be established that will include all suppression items in the preventive maintenance of the power unit. Use the maintenance section of the power unit TM, if available, as a guide. Check all items carefully and apply corrective measures where necessary. Check capacitors and filters when inspecting the part on which they are mounted. Tighten any loose connections or mountings. When inspecting the high-tension circuit, check the resistor-suppressors and shielding. Test the leads at the body of the resistor-suppressors for looseness. Make sure all shields are well grounded and make good contact at couplings. Go over the unit and check all bonds. Try the bolts with a wrench to be sure they are tight. Clean all dirty or corroded connections.

When, in spite of careful maintenance, interference is received on equipment utilizing an engine generator as a power source or operating in the vicinity of such a unit, it will be necessary to do some *trouble shooting*. A receiver, covering the same range as that on which the interference has been noted, is essential. Usually it is possible to locate, in the area, a vehicle with radio equipment installed that can be used for checking the effect of changes made. Tune the receiver to the frequency on which the greatest interference was observed and drive the vehicle close to the installation until the interference is heard. Shut down the power unit. If the noise ceases or appreciably diminishes, obviously the power unit is at fault.



PHOTOGRAPH ABOVE ILLUSTRATES USE OF TOOTH-TYPE LOCKWASHER FOR INSTALLATION OF A POWER UNIT ENGINE SUPPRESSOR

(When no separate receiver is available, a cut and dry procedure must be used. That is, changes and/or additions made and the improvement or lack of it checked on the station receiver.) The following table will be helpful in locating the actual *source* of the trouble.

Noise heard	*Circuit or device causing trouble*
Regular clicking, sharp, and distinct which ceases the instant the ignition is cut.	Ignition circuits.
A whine or buzz that changes in pitch with engine speed and continues, with ignition off, a second or so.	Generator or exciter (either charging or main generator).
Intermittent, irregular clicking	Relays - regulator and similar contacts.

When the circuit causing the difficulty has been determined, an examination of the particular elements will usually disclose the *cause* of the objectionable interference. The following table lists the most likely causes:

Source of noise	*Circuit or device causing trouble*
Ignition Circuit	Poor adjustment or poor condition of breaker or spark plugs, loose bond straps, broken suppressor, *loose-shielding*, defective capacitor.
Generator	Loose connections, worn brushes, dirty commutator or slip rings; loose mounting, bond, or *shielding;* defective filter or capacitor.
Relays, etc	Loose suppression component mounting or connections, defective capacitor.

The remedy for any of the preceding conditions is obvious. Connections should be tight and clean. Worn bonds, broken or questionable suppressors, defective capacitors should be replaced. Numerous points are bonded by tooth-type lock washers which bite through the metal. These must be tight. In replacing any capacitor, filter, or bond, a tooth-type lockwasher should be placed under the head of the mounting bolt.

Common sense must be used when *shooting* trouble on a noise-suppression system. It should not be expected that the interference can be reduced to a point where it cannot be heard or detected on a radio receiver with the volume control wide open and with no signal coming in. Rather, the interference should be reduced so that it does not interfere with the weakest signal that can be heard or seen above the background noise of the receiver.

Suppression is important. Its importance cannot be overemphasized. An ineffective suppression system may prevent the reception of an important message or the detecting of a target and thus initiate a train of circumstances having disastrous consequences.

For previous articles on suppression principles, the reader is referred to the following publications:

Suppression of Radio Noise.	TM 11-483.
Suppression	P. 65, Army Motors, June 1942.
Suppression	P. 104, Army Motors, July 1942.
Clearing Up Static	P. 289, Army Motors, February 1944.
More on Taming Wild Static.	P. 76, Army Motors, June 1944.
Suppressing Interference	P. 27, SCTIL No. 33, August 1944.

THE HEADQUARTERS of the Mediterranean Theater of Operations uses "Signal Information Letters" to inform the field that parts referred to in recent modification work orders and technical bulletins are available in theater depot stock. For the purpose of information, parts are grouped according to intended use, a description of each use serving as a heading over a related list of modification work orders and signal bulletins.

LONG LINES RADIO RELAY

ETO Communication Zone Circuit Links Paris With Normandy Base Section Headquarters

IT HAS frequently been necessary to provide radio relay circuits using Radio Relay Set AN/TRC–3 and Radio Terminal Set AN/TRC–4 to newly established base section headquarters or other locations in the European Theater of Operations where urgent communications requirements, exceeding wire capabilities, would suddenly arise. Radio relay has proved unusually adaptable to such situations, and circuits providing facilities for three telephone and four teleprinter channels have been installed over distances varying from 50 to 250 miles within periods of 12 to 72 hours.

Such rapid installation necessitates careful planning of the circuit route prior to actual movement, and to expedite this initial planning, a well-stocked map room, complete with provisions for developing accurate contour profile studies, is maintained. The contour graphs employed can be accurately read to 5 meters, and in all planning maps of 1 : 25,000 or 1 : 50,000 scale are employed. The care exercised in planning is considered extremely worthwhile, since experience has shown actual operating characteristics of the completed link can be predicted in advance by examination of the profile study. Every effort is made to secure radio line-of-sight between individual installations as intervening terrain inevitably creates fading and noise difficulties that become cumulative on long circuits. To overcome possible siting problems, alternate routes are provided. This is a necessary practice for in many instances high points providing excellent siting for relay stations have been found to contain enemy installations which were booby-trapped or heavily mined.

PROFILE MAP IS BEING PLOTTED FOR INSTALLATION OF RADIO RELAY EQUIPMENT.

(Action is under way to include, in future editions of TM's pertaining to radio relay equipment, several blank sheets of *profile paper* to facilitate circuit planning.—Ed.)

A typical circuit installed under such conditions is the link existing between Headquarters, Communication Zone, at Paris and Headquarters, Normandy Base Section, at Deauville. This link was planned, sited and turned over for traffic within a period of approximately 60 hours. Total distance covered is 135 miles. A résumé of the installation follows:

The initial circuit request came through at 0900 hours 23 —. A tentative target date for activation was set at 2400 hours 25 —. As soon as termination details were known, work commenced on circuit planning, and as in previous instances, a series of route possibilities were selected from 1 : 250,000 scale maps. Then two of the more promising possibilities developed into full-scale studies utilizing the more accurate maps. Both of these studies developed along similar lines, and in the final analysis, there was no outstanding reason to favor either one. Since all v-h-f terminals in Paris are operated from a central high-point with the resultant possibility of securing excellent distances on the first signal path, it was decided to make this first path approximately 40 miles; the second and third, 35 miles, and from the last relay to the far terminal, approximately 25 miles; this latter distance being dictated by unfavorable terrain features. None of these signal paths was excessive, and from an examination of the completed profile study, a confident prediction of a quiet circuit, free of fading could be made.

The Signal Center at Normandy Base Section was located in the downtown section of Deauville, and some 3 miles inland a mountain range of 100–125 meters was encountered. This range prevented locating the carrier and radio equipment together, so the radio terminal was sited on a point

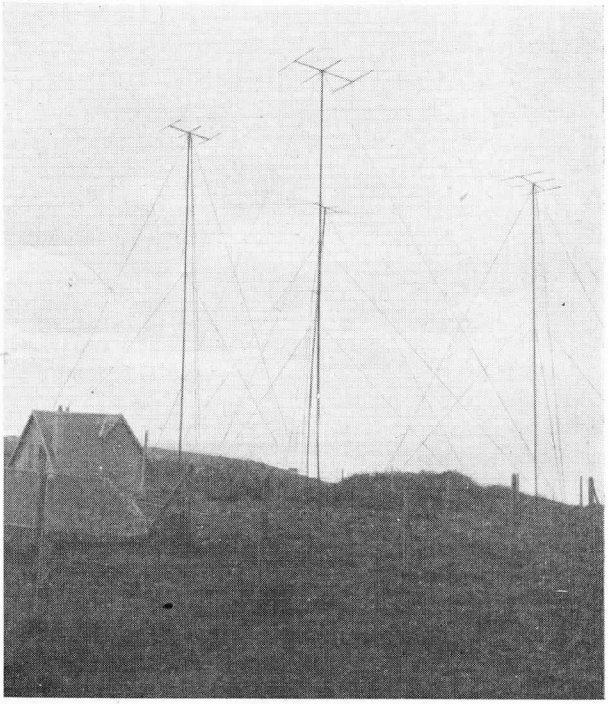
slightly more than 100 meters high and approximately 2½ miles from the carrier equipment located in the Base Section Signal Center. Two runs of spiral-four were installed to provide normal and emergency operation between radio and carrier terminals. The site selected for the radio installation was not the highest available point, but was chosen because it provided more suitable living conditions for the operating personnel—the entire surrounding area having received attention from Allied bombers and heavy guns to such an extent that few places were habitable.

As soon as circuit planning was completed, relay and terminal teams were dispatched to their various locations, sufficient transportation being provided from other sources to permit moving in convoy. Equipment was checked prior to departure, and operating crystals issued—each installation being supplied with a normal and alternate set of frequencies. Initial set-up was according to a standardized SOP, relays checking in to the Paris terminal and then standing by for the next station. On this circuit, the first relay checked into the Paris terminal at 1900 hours, 24 —, and the next two at 0900 and 1400 hours of the following day. At 1900 hours, 25 — no signal had been received from the far terminal; this seemed to indicate that equipment or siting problems had occurred. However, at 2200 hours the same night, the far radio terminal established contact, and the circuit was completed. Signal levers were very good at all locations, and the link was extremely quiet. At 0930 hours of the following morning, carrier installation was completed and a few minutes later, four voice channels were through to Paris. These four channels were terminated on a four-wire basis at Communication Zone and Normandy Base Section switchboards, and at both headquarters Channel 3 of the CF–1 output was routed to provide CF–2 facilities if, and as, required. Normal practices in Communication Zone areas where v-h-f radio relay equipment is operated in conjunction with the long lines wire network is to handle the teletype over package telegraph carrier operating on cable circuits with provisions made to patch these teletype circuits into the radio relay if the wire lines fail. This patching follows a definite procedure to insure that classified traffic is not placed on unclassified channels. Army groups and armies do use extensively the teleprinter facilities provided with the v-h-f radio relay equipment.

At Paris, all v-h-f carrier equipment is located in the radio control center. Personnel from the v-h-f operating team work regular shifts there, handling circuit line-ups and coordinating other problems that arise in connection with the numerous v-h-f systems operated from this headquarters. All circuits receive a daily line-up between 0600 and 0700 hours, and prior to turning a circuit back to traffic each individual channel is checked through to the switchboards to insure they are actually available for subscriber use. Average circuit line-up time varies between 15 and 30 minutes.

As of this date, operating personnel have had almost 11 months' experience with Radio Relay Set AN/TRC–3 and Radio Terminal Set AN/TRC–4 equipment, and all factors considered, performance has far exceeded expectations. No real problems have been encountered, but a few informal comments based on field experience may prove of interest to other users.

It is to be noted that all channels are utilized for traffic. Experience has shown it unnecessary to retain Channel 1 for technical supervision. Retention of this channel for circuit personnel consumes a large percentage of the available facilities and tends to increase breaches of security by operators. All Headquarters, Communication Zone,



EXTERIOR VIEW OF A RELAY STATION IN THE ETO COMMUNICATION ZONE SYSTEM.

links are operated on the basis that Channel 1 can be taken from the subscriber at any time if actually required for engineering use. In practice, such instances have been very few. Operating personnel are not permitted to converse over Channel 1 without first securing consent of the control terminal. To secure this consent, they must present evidence that their conversation is necessary.

All installations are required to maintain a standardized station log, and weekly reports are submitted by team officers for review by staff personnel.

Gasoline, oil, lubricants, and rations are drawn, where possible, from nearby sources. When this arrangement is impracticable, a gasoline, oil, lubricants, and rations run is operated from the terminal installations.

Careful circuit planning on multiple-relay links is extremely important. Poor siting of installations will result in noise, severe fading, and inability to handle teletype without serious garble.

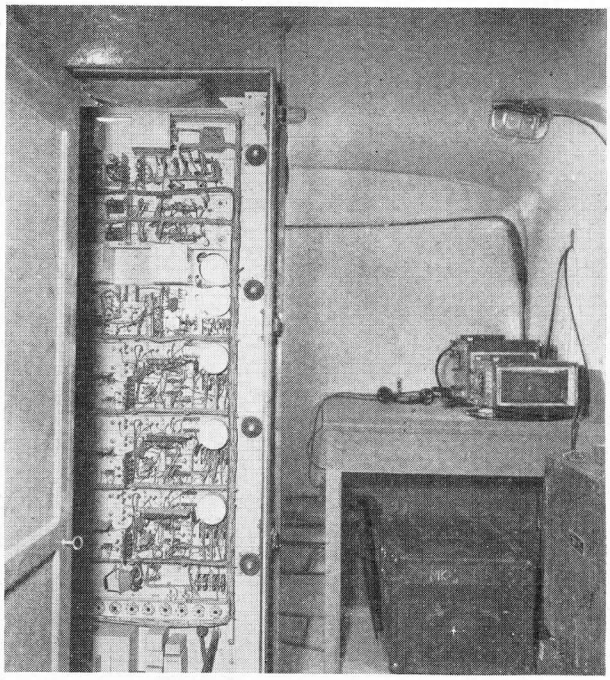
Terminal-to-terminal installations over distances not exceeding 25 miles can be expected to provide reliable results over even extremely bad terrain.

Individual signal paths of 50 to 75 miles are satisfactory and will provide reliable multi-channel results if radio line-of-sight is maintained.

Careful selection of operating frequencies will permit placing antennas in close proximity to each other. Often, the four antennas at a relay station have been located together on the top of windmills, water-towers, or other high structures of small area. Undoubtedly, severe distortion of the antenna radiation pattern results, but the increase in height has always more than compensated for this apparent fault.

Amplifier AN/TRA–1 has been found superfluous. Its use imposes a heavy load on PE–75's, thus materially increasing trouble experienced from these units. The increase in circuit reliability through use of the amplifier has not been marked.

Rigid maintenance on PE–75's is essential. Experience has demonstrated the necessity of delegating this responsibility to a single individual on each operating team. These individuals have then received additional training in care and maintenance of small power units.



THIS TYPICAL TERMINAL INSTALLATON IS INSTALLED IN AN OVERSIZED HO–17.

(TB SIG 55 outlines general preventive maintenance procedures for power unit engines.—Ed.)

To reduce circuit interruptions created by changing power units, the control terminal sends three short tone pulses (from the CF–1 oscillator) over Channel 1 at the end of each 3-hour operating period. This is a signal for all installations using PE–75 power to switch units. This systematic method of operating PE–75's plus a rigorous maintenance schedule has resulted in very satisfactory service from these power plants.

(This procedure will no longer be necessary when Junction Box J–85/G—now in production as a component of AN/TRC–3 and 4 becomes generally available. J–85/G comprises a quick-acting DPDT transfer switch, together with appropriate cordage and plugs and permits transferring the load from one PE–75 to another without interrupting the radio circuit.—Ed.)

Realizing the isolated existence most relay teams undergo, every effort has been made to provide personnel with recreational facilities such as broadcast receivers and accumulated supplies of magazines, newspapers, etc. These factors contribute materially to the over-all efficiency of the completed circuit.

TWO SCR–300'S IN USE IN A JUNGLE CLEARING ON A PACIFIC ISLAND. A BULLDOZER, IN REAR, TIDIES UP THE AREA.

SIGNAL NOTES—PACIFIC

Comments on Tactical Communications Culled From Pacific Operational Reports

THE FOLLOWING notes are from various reports received recently by the Chief Signal Officer on communication problems in the Southwest Pacific Area and the Pacific Theater of Operations:

A communications officer of infantry regiment stated that Radio Set SCR–300 had done remarkable work in inter-battalion and inter-regiment communications during the Goodenough Island, Hollandia, Biak, and Leyte operations. Frequently, where Radio Set SCR–284 failed because of interference or jamming, communication was maintained by establishing an SCR–300 relay station on high ground. In one instance on Leyte, regiment and battalion were 25 miles apart but constant communication was maintained via such a relay station. It was also discovered that, frequently, moving the set just a few yards remedied failure of communication in a particular area.

During a typhoon, a Radio Set SCR–300 was exposed for 12 hours and continued to operate. The hand set, however, was protected during this time.

A field artillery officer with an infantry division related how Radio Set SCR–609 was carried by forward observers. Three packboards were used. One packboard was used to carry the set itself, the second to carry the battery and case, and the third to carry extra batteries and tubes. These were strapped on with rope or leather straps, depending on which were available. When the forward observer team reached the OP position, the men slipped the packboards off their backs, leaving the radio and equipment still secured to them. Batteries were connected to the radio set which was then ready for use. This method enabled the team to carry the radio and equipment over terrain which was impassable to jeeps. This method also provided for setting up radio communications at a moment's notice.

The communications chief of a reconnaissance company attached to tank destroyer battalion which operated in the Southwest Pacific from April 1942 to October 1944 stated that although Radio Set SCR–193 was designed for use in command cars, it was used in a jeep by putting the transmitter in the place of the rear seat, placing the receiver in a cabinet which was attached by bolts to the top of the tool compartment and welding the dynamotor to a piece of angle iron screwed

into the floor of the vehicle between the two front seats. The battery was changed from a 6- to a 12-volt supply and the set operated efficiently.

Two speed nets were used, one from 10 to 15 words a minute and the other from 15 to 20 words a minute.

Jungle blackouts were sometimes overcome by changing location of radio sets. Sometimes a change of merely 10 feet would remedy the blackout condition, while at other times it was necessary to move as far as a quarter of a mile from the original location.

Radio stations were well camouflaged and were maintained in deep foxholes along jungle trails in dense thickets. During two landings in which source participated, complete radio silence was maintained and no efforts were made to operate radio nets until second wave was on shore.

The communications officer of a cavalry division squadron which participated in the Oro Bay, Admiralties, and Leyte invasions stated that Radio Set SCR–300 performed excellently. In companies one spare battery was issued with each set. In the initial stages of the Leyte campaign the cavalry squadron was placed on the Island of Samar, equipped with 6 SCR–300's, with 2 batteries for each set and 16 spares. The squadron was on the island for 2 weeks and used all the batteries in that period. The sets were used continually and each battery lasted about 18 hours. An additional 5 hours were squeezed from each battery by letting it *rest* for a few hours and then putting it back into the set.

In order to have available a substitute for the handset, the squadron secured a microphone which was kept in the spare parts kit. In some instances when the handset failed to function the microphone was used in its place.

The importance of radio for maintaining continual communications in initial phases of such operations was stressed in the report. One move of 8 miles was made where radio was the sole means of communication because not enough personnel was available to lay wire.

ARMED GUARDS PROTECT WIRE LAYERS IN THE JUNGLES OF A PACIFIC COMBAT ZONE.

The wire teams consisted of four men, two of whom acted as guards while the other two laid wire. The guards were supplied with carbines or tommy guns while the linemen carried pistols because they interfered less with their movements.

At squadron headquarters there were about 40 men from whom replacements could be drawn. Under combat conditions, 2 operators were on the SCR–284 (1 for the generator and 1 on the key) and 1 man on the SCR–300. Since the T/O allotted but 6 operators, this meant 12-hour shifts without replacements. This crew, however, was supplemented by screening the command for men with communication experience and at one time the communications crew was 10 men over strength.

Jap snipers tried to pick off men seen carrying radios openly. This was overcome by placing SCR–300's in jungle bags (waterproofed clothing bags). Ponchos were used to protect SCR–284's from the weather.

PIGEONEERS SCORE KILL

The 278th Pigeon Signal Company of the Ninth United States Army got a very special message through on the morning of 1 January 1945—to a Focke-Wolf German airplane. The message was sent, not by pigeon but by 150 rounds from 2 caliber .50 machine guns. Results: The Focke-Wolf blew up.

For this unorthodox accomplishment a Category I certificate of the Ninth United States Army was awarded to the 278th by the antiaircraft officer of the IX Tactical Air Command. It was the first known pigeon company to receive such an award.

Chaleon Castle, where the plane was destroyed, is located approximately 10 miles east of Maastricht, Holland.

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MAINTENANCE LISTS

Parts Needed To Keep Up an Item of Equipment Enumerated for Repair Sections

A SIGNAL Corps maintenance list for a given item of Signal Corps equipment contains all of the repair parts, subassemblies, cords, cables, accessories, etc., required to keep the equipment in good working order. The maintenance parts shown on the list are selected by maintenance activities during early stages of manufacture and the first edition list is completed by the time delivery of the equipment by the contractor to the Signal Corps begins.

The items on the list are stock numbered as follows: (1) The list is processed through a screening operation in which all items on the list already stocked by the Signal Corps are identified and given the existing stock number, and (2) the remaining items are assigned new Signal Corps stock numbers.

All Signal Corps equipment and spare parts stored and issued by the Signal Corps have stock numbers. These items are listed in a master catalog known as SIG 5. The present catalog contains more than 240,000 stock-numbered items listed in stock number sequence. An alphabetical listing of Signal Corps maintenance parts for each equipment is obviously necessary for all echelons of supply and maintenance. The Signal Corps maintenance lists serve this purpose. These maintenance lists are published as Army Service Forces Catalog sections as shown below:

1. SIG 7—(*Type No.*) is a list of parts authorized for using organizations (1st and 2d echelons).
2. SIG 8—(*Type No.*) is a list of items needed for 3d and higher echelons of maintenance and supply.
3. SIG 10—(*Index No.*) is a list of items required for maintenance of Army Communications Service equipment. (Equipment handled by Plant Engineering Agency, usually fixed installations.)

A sample page from a composite maintenance list sheet is shown. This form is used as a basis for SIG 7 and SIG 8 Catalog sections. Use of these lists in overseas supply and maintenance organizations is explained below:

Nomenclature Column.—This column contains a list of all items required for maintenance of the equipment. A repairman working with actual equipment will refer to this column first to locate the part requiring replacement. The stock number of the item can then be obtained from the stock number column. If the part required is not stocked by the local echelon, the stock number and sufficient description to visually identify the items should be listed on the requisition to a higher echelon.

Supply Column (Army and Base Depot).—These columns are for use of supply personnel as a guide to the quantity and variety of items required for stock. The first step in setting up the required stock is to make a list of all Signal Corps equipment that will be supplied from the Depot.

This list should also show the total quantity of each equipment serviced by the depot. The stock level of each item required can then be computed, using quantities shown in the supply columns as a basis.

Example:

Base Depot.—It is assumed troops in the area serviced by the Base Depot have been issued 350 Plate Supply Units PE–97–A. It is also assumed the theater is authorized a 90-day level of maintenance parts. Particular reference is made to Item 33 of the sample table (3Z6150–32 Resistor, fixed wire wound 1,500 ohms). The quantity of 20 shown in the Base Depot column is the actual number of failures of this item expected in 100 equipments over a period of 1 year. Another conception is that one failure of this item is expected annually in a group of 5 PE–97–A's. The maximum stock level of this item for conditions assumed above is calculated as follows: 3.5X20=70; 3/12X70=18. The maximum quantity would therefore be 18. The minimum quantity will be established in accordance with theater practice. If two-thirds maximum stock is used for a minimum, 12 would be established as a minimum and the item would be replenished by requisition when the stock on hand dropped to 12 or below.

Army Depot.—It is assumed two Army Depots are to be established, Depot *A* to service an area having 200 PE–97–A's, and Depot *B* to service the remainder of 150. Army Depot *A* would receive 8 resistors and Depot *B* 6 resistors for a total of 14. If 1 of the 2 Army Depots has a difficult supply line to the Base Depot while the other is relatively good, a 3–1 or 2–1 distribution of the 14 resistors to Army Depots may be preferable. The Army Depot quantity shown on the maintenance list does not have a time factor. The quantity of parts shown in Army Depots and all lower echelons are small optimum working stocks, estimated as sufficient to service the normal flow of defective equipment without exhausting the stock of an item before it can be replaced from a Base Depot as higher echelon. The list for third and higher echelons is an initial guide to working stocks and should be modified if necessary in accordance with usage expe-

rience. Modification based on usage experience should include decreased quantities wherever possible and increased quantities wherever necessary. The maintenance list is based on average conditions for all armies. If necessary increases in one army are not balanced by possible decreases in another, USA depot stocks may be exhausted before deliveries of increased quantities can be obtained from manufacturers.

Fourth Echelon.—Assuming these are two fourth echelons having same distribution as previously shown for two Army Depots, the quantity of parts would be six for Fourth Echelon *A* and five for Fourth Echelon *B*.

Third Echelon.—Three columns showing different quantities of equipment are shown on the list. A Third Echelon responsible for servicing 45 equipments should carry three items No. 33 on hand. However, if a Third Echelon serviced 90 equipments, the quantity on hand should only be four. The reason a direct proportion is not used is that electrical failures occur at random, and quantities shown on the list are based on statistical theory. The *probability* of exhausting on hand stock quantities before replacement can be made is approximately equal for the several columns. If quantities of 2, 6, and 8 based on direct proportion were shown in the three Third Echelon columns, the probability of exhausting a stock of 2 in the 16–30 column would be several times as great as the probability of exhausting the stock of 8 in the 71–130 column before replacement could be made.

First and Second Echelon.—No quantities of item No. 33 are authorized for these echelons as maintenance of the PE–97–A requiring such parts as resistors and capacitors is not ordinarily practical by using organizations. Using organizations do not ordinarily have sufficient time, tools, test equipment, and skilled personnel to perform such maintenance. The organizations' mechanic may happen to be a well-qualified maintenance man and the organization may be in a staging area, rest area or port of embarkation with considerable time available for maintenance of its equipment. When such special conditions exist using organizations should be issued any third or higher echelon parts required for the work at hand. Control should be exercised by local Commanding Officers in the issue of such parts to prevent equipment being damaged by unqualified personnel. The Army Ground Forces has recognized the advantage of organizational service work beyond the scope of fixed maintenance policy when special conditions exist and has authorized such work in Army Ground Forces weekly directives from Headquarters, AGF.

If the item needed for repair is not shown on the maintenance list, one or more of the following methods should be used to service the equipment:

1. Replace the assembly on which the item is a part.
2. Cannibalize another defective equipment to obtain the part.

EQUIPMENT PLATE SUPPLY UNIT PE-97-A DATE 11 April 1945 SHEET 5 OF 5 SHEETS

ITEM NO	REFERENCE SYMBOL	ILLUSTRATION FIGURE NUMBER	MODELS	STOCK NUMBER	NOMENCLATURE	UNIT OF MEASURE	QUANTITY PER EQUIP	MAINTENANCE (INITIAL WORKING GUIDE) 3RD ECHELON 16-30 EQUIP	3RD ECHELON 31-70 EQUIP	3RD ECHELON 71-130 EQUIP	4TH	SUPPLY (INITIAL STOCKAGE GUIDE) ARMY DEPOT	BASE DEPOT 1 YEAR	ORGANIZATION (AUTHORIZED ALLOWANCE) 1ST POWER UNIT	2ND ECHELON 1-2 EQUIP	2ND ECHELON 3-7 EQUIP	2ND ECHELON 8-10 EQUIP	INITIAL ISSUE PROVISIONING FOR 100 EQUIPMENTS
32	R-10	11		3Z6003-62	RESISTOR, fixed: wire wound; 30 ohms ±5%; 10 w; 1-27/32" lg x 7/16" diam; Sprague "Koclohm" type 10K; Galvin #17K47606 (Replaces R6 after serial #675 on order #19912-P-43	ea	1	2	3	4	3	4	12	20	-	-	-	-	31
33	R-7	11		3Z6150-32	RESISTOR, fixed: wire wound; 1500 ohms ±5%; 10 w; 1-27/32" lg x 15/32" diam; Sprague type 10K; Galvin 17K31434	ea	1	2	3	4	3	4	12	20	-	-	-	-	31
34				2Z667A.146	SOCKET, tube: 4 cont; black bakelite; 2" lg x 1-1/4" wd x 1" d; Amphenol #1P-4M; Galvin #9A31234	ea	1	1	2	3	-	3	8	12	-	-	-	-	18
35				2Z8654	SOCKET, tube: octal black bakelite; 1-3/16" thk x 1-1/16" diam; Amphenol #88-8-N; Galvin #9A31229	ea	3	2	3	5	3	6	18	30	-	-	-	-	44
36	T-1	11		2Z9979-2	TRANSFORMER, power: plate & fil; pri 6-12 v; secd 145 v, 5.8 v; enclosed steel case; 3-7/8" h x 3-1/8" wd x 3-1/2" d; Chi Trans # 10008; Galvin # 25B31296 (includes change-over links for 6 or 12 v operation)	ea	1	2	4	7	3	7	21	35	-	-	-	-	52
37	V-3	11		2J0B3/VR-90	TUBE, electron: JAN-0B3/VR-90 (VT-194)	ea	1	2	5	10	3	10	60	120	2	-	-	-	
38	V-2	11		2J1006	TUBE, electron: JAN-1006 (VT-195)	ea	1	2	5	10	3	10	60	120	2	-	-	-	
39	V-1	11		3H6707	VIBRATOR VB-7: non-synchronous; input 7.5 v DC, 3.5 amp; tubular aluminum case; 3-3/8" lg x 1-1/2" diam; 4 prong base; Galvin #48A31519	ea	1	17	35	70	35	70	210	350	2	-	-	-	525
					ESTIMATED WEIGHT	lbs		30	55	90									
					ESTIMATED VOLUME	cf		1.2	2.2	3.6									

3. Fabricate the part in a repair shop.

4. Obtain parts from another arm or service (most gasoline engines used by the Signal Corps are also used by Ordnance, Engineers or Quartermaster. Many radio components are common for Army, Navy and Marines.

5. See maintenance lists for ME–9 and ME–10 (standard hardware for radio and wire equipment).

6. Select substitute item from a maintenance list for similar equipment (SIG 8 or SIG 10).

7. Initiate a special requisition.

Maintenance lists are printed and distributed by the Adjutant General's Office. New lists are distributed automatically to theaters by the Adjutant General's Office and distribution of lists within the theater may be through Signal Corps or Adjutant General's Office channels at the discretion of the theater commander. An index to maintenance lists (SIG 2) is also published and distributed as above. A key to the distribution code printed on each maintenance list is shown in FM 21–6. Establishment of adequate maintenance and supply in theaters without benefit of maintenance lists is extremely difficult. Many requisitions not based on maintenance lists are unidentifiable when received in the United States. Every possible effort should therefore be exerted by Signal Corps and using organizations to get a complete file of maintenance lists covering equipment for which these organizations are responsible. Requisitions for maintenance lists should be made by organizations referred to above. A tabular list of all equipment and major components including nomenclature for which maintenance lists are needed will be sufficient for requisition purposes, if a SIG 2 index is not available.

CARBINES ARE HANDY

A battalion wire chief describes in his own words an engagement with the Germans where his section was called upon for the first time to use weapons they had been carrying for months.

NORMALLY, BATTALION wire section personnel are not called upon to fight because we usually just had the job of laying wire to the companies and to the division and we let the rifle companies do all the fighting. We were supposed to carry M1's but they were too heavy and cumbersome so we all managed to get carbines. Once we really had to fight to protect ourselves and that was the only time I fired a weapon all the while I was in Europe.

Early this year, the 4th Division had taken the German town of Branscheid and elements of the 90th went in at night to relieve the 4th so they could move on up. There were a helluva lot of pill boxes all around the town and the men from the 90th started to occupy them. I was ordered to take 11 men and go into town to find a good spot to set up our battalion CP and start laying wire.

We got in there about 0530 when it was still dark and decided to wait in our jeep until it got light. While we sat there in the street I heard a lot of rumpus and jabbering down the street and after listening for a while I decided they were Jerries. We ducked into a small stone house that had a good view of the street and waited. The jabbering continued and then it got light enough to see. It sure was a funny sight. There was about a company of Jerries with a captain in the lead walking in a column of threes, just like on a parade ground, coming up the street. I guess they didn't know we had taken the town.

The men in the pill boxes couldn't shoot because the ports all faced toward the outside of town so we were the only ones that could fire on them. I told my wire men to open fire with their carbines. We picked off several of them before they could take cover. They started sneaking up on us and a few got way up to the door of the house before we knocked them off. The Jerry captain began hollering in English, *Come out with your hands over your head.*

I told him to go to hell and we kept on potting at them. We must have got about 20 and then 2 tank destroyers came down the street spraying with their .50's. That was all they could take and the captain came out with his hands over his head, followed by the rest of the company. The captain told me half of his company were casualties and it was useless to go on. I guess there were about 60 of them who surrendered to the 11 of us and they sure looked mad when they saw how few we were. They were good-looking Jerries, too, none of these Russian or Czech forced fighters. Anyhow, after that we never did complain because the Old Man made us carry carbines.

INCREASING EFFICIENCY

Proper and Planned Working Conditions Raise Efficiency of Signal Personnel in Field

The article below deals with some of the factors affecting the efficiency of signal personnel in the field. It was written by a British medical officer and was based on a survey made in the Signal Section, 21st Army Group.

IN ORGANIZING the operational role of the Army Group headquarters' signal section, it was felt that sufficient emphasis had not been laid on the scientific aspect of the factors affecting personnel efficiency. Several questions arose regarding the work done by signal personnel, and no answers could be given from a medical point of view. It was to clear up this difficulty that this survey was made. It must be appreciated, however, that in many cases the complete answer has not been obtained and that further critical investigation of the practical application of these pointers is necessary.

A headquarters signal unit cannot be treated as a whole. Thus the problems which affect dispatch riders (motor messengers) are entirely different from those of signal office personnel. Even further than that, teleprinter (teletypewriter) operators have quite different problems from switchboard operators. The scope of this survey is extended beyond the confines of the men's work. In the Army, a man's whole life is directed for him and an excellent opportunity is offered for leading his feet, both physical and mental, in the paths they should go.

Stress must be laid on the maintenance of morale, since it is the foundation of any efficient work. In signal work, every man has a job to do and bears responsibility. If he is uninterested, has worries, feels no one is taking an interest in him or his work, the quality of his work falls straight away. Whatever changes are made and whatever conditions are imposed, the good will of the men must first be obtained. Change is invariably resented, and if changes are made for the well-being of the men, these must be explained to them.

SHIFT WORK

The problem of the operation of the shift system at its optimum efficiency is exceedingly complex. Numerous factors are involved and it is doubtful if a complete answer can be given. Any advice on shift systems can only be taken as a pointer to what is required, and carefully observed trial must be given to any system employed. Hard and fast rules cannot be laid down and are in fact most undesirable.

The problems arising in connection with night work in the Army are different in many ways from those in civil life. For the civilian, the problems are largely domestic—night work involves the rearrangement of his household—and by virtue of this, it is desirable that night work should continue, if once started, for at least a fortnight, preferably longer, in order to prevent too frequent a domestic upheaval. In the Army, a man's life is regulated for him; he does not have to fend for himself and he is much more concerned with the fairness of his treatment in relation to his fellow soldiers—the soldier is very jealous of what he considers to be his rights. Accordingly the problem of arrangement of night shift work must have emphasis on the fair distribution of work and conditions.

Individual variation is a very large factor in night shift work; some men prefer to work by day, while there are others who enjoy working by night. This is not a mere fad, but largely a matter of physiological adaptation. Doctors attending large organizations where shift work is done have arranged working hours for personnel who show a definite preference for one or the other—in particular a marked ability for night work on the one hand or marked inability on the other. This is rather impractical in the Army—a soldier of average honesty has no objection to evading unpleasant tasks if this is made easy for him. In practice, this problem has not proved important; during 6 months no genuine cases of inability to work at nights have been reported and no gross evidence of lowered efficiency has been observed.

Acclimatisation to night work depends very largely on the ability of the individual to reorganize his sleep rhythm; i. e., to change over from sleeping by night to sleeping by day. Controlled research has shown that it takes about 4 days to

achieve this. Since, therefore, efficiency is diminished during the first 3 days, it is desirable that a fair spell of night work be carried out after acclimatisation has occurred. It is obviously bad to change operators every night, thus completely disorganizing the sleep rhythm, though other points do arise here. For example, some night shift workers do have the opportunity to sleep. This will be considered later.

The two main factors which effect the efficiency of workers are fatigue and boredom. Thus a peak period of work occurs when a man has got into his stride; this takes about an hour on an average. After this, efficiency gradually falls due in part to boredom and in part to fatigue. About one-half hour before the end of a shift a rise in efficiency occurs since the prospect of finishing is an incentive which overcomes boredom.

The effect of this is shown in curve A, figure 1.

Since fatigue and boredom increase with the duration of the shift, efficiency will fall progressively during the course of the shift and it is therefore undesirable for the shift to continue for too long a period. Taking this point of fatigue further, the heavier the work, the greater the effect of fatigue, and therefore the duration of the shifts should be graded as far as possible according to the load of work the shift has to deal with. Thus the heavier the load of work, the shorter the shift should be.

The effect of a break in the middle of the shift is to produce a fresh peak of efficiency which occurs after the restart, just as it did at the beginning of the shift—curve B, figure 1.

The break should be ten minutes in duration: this in practice means 15 minutes; it should not be given sooner than 1½ hours after work has begun since there is the original peak of efficiency in this period, nor during the last 1½ hours of the shift, since the effect of prospect of finishing is becoming operative.

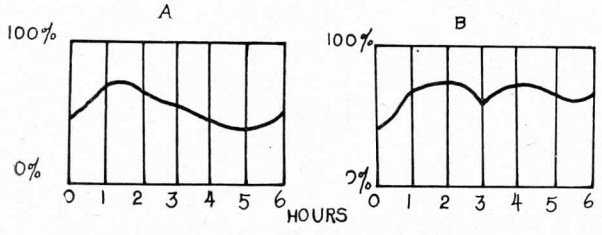


Fig. 1—ILLUSTRATING THE RISE AND FALL OF EFFICIENCY DURING SHIFTS ARE THE CHARTS ABOVE. PERCENTAGES ARE NOT ACCURATE BUT ARE USED SOLELY AS GUIDES.

PRACTICAL APPLICATION

In applying the principles already laid down, it must be clearly appreciated that the conditions in a headquarters at war are variable and that no hard and fast rules can be made. The changing situation must be constantly watched and alterations made as required. Further main and rear headquarters provide two different problems, since main headquarters is relatively mobile, or should be prepared to be mobile, whereas rear headquarters is relatively static. Since sections have different problems, shift work can best be considered by taking the sections separately.

The problem of dispatch riders is fundamentally different from that of signal office personnel and most of the factors already discussed are not applicable. The chief difference is that if a dispatch rider is called during his shift, he has to do his run irrespective of when his shift finishes. This may involve a run of 200 miles and take him 1 or 2 days in some circumstances. Thus the actual shift bears no relation to the work involved and accordingly the arrangement of the shifts is purely an administrative matter to distribute work fairly. In point of fact, the following scheme is used and works out quite well.

Shifts are from 0830–1300 hours (shift M); 1300–1800 hours (shift A); 1800–0830 hours (shift N). These are done by three sections X, Y, and Z in the following rotation—X Y X; Y Z Y; X Z X. Thus on day 1; X does shifts M and N; on day 2 he has no shifts, but may be out on a run after the night shift; on day 3 he does shifts M and N followed again by a day with no shifts. Y does the afternoon shift A on day 1; the morning and night shifts on day 2 and rests on day 3. This gives a satisfactory system in practice and adequate time off is provided.

Conditions of work among telephone switchboard operators are very different from other signal office personnel and must be considered separately. The traffic load is of prime importance here in considering the times of shifts.

The load of telephone traffic varies directly with the working hours of staff officers. Thus there is practically no traffic between midnight and 0800 hours. The load rises rapidly after 0900 hours and is maintained at a high level until 1900 hours, with the exception of the hours 1300–1400 hours. A slight diminution in traffic occurs between 1600 and 1700 hours. If staff work becomes heavy it is rea-

sonable to suppose that the 1600–1700 hours diminution will be lessened and that the peak period will continue later than 1900 hours.

The hours of shifts for switchboard personnel have been arranged as follows: 0830–1300 hours; 1300–1800 hours; 1800–2230 hours; 2230–0830 hours. From the data already given, it is advantageous to change shifts when work starts to decline from a peak, since the last half hour of the shift has a peak of efficiency and the first half hour of the oncoming shift shows lowered efficiency while the men get into their stride. At the midday change and afternoon shift change this does in fact occur, while the morning shift takes over before the traffic becomes heavy. The duration of the morning shift is four and a half hours and this is the hardest shift. The afternoon shift of 5 hours also has heavy traffic. The evening shift is lighter and lasts only 4½ hours. This is so arranged because after 2230 hours traffic is so small that only a half shift is required. There are three sections doing the four shifts, and this means that each section is responsible for the switchboard 1 night in every 3. Since only half the section is required on the night shift however an operator is on duty only 1 night in 6. Further, since traffic is negligible between midnight and 0700 hours, only one operator is required during this period. A certain amount of sleep is therefore possible during the night shift. Following a night shift, the section does not come on duty till the evening shift the following day, and can thus sleep during the day if it so desires. Shifts have been so arranged that each section has 24 hours off shifts every 3 days; when an operator finishes at 1300 hours 1 day, he is not on duty till 1300 hours the following day.

The system is as follows:

G	H	F	H
F	G	H	G
H	F	G	F
G	H	F	H

This system adds variation and is acceptable to the men.

It was shown that a break in the middle of the shift increased the efficiency of the shift. This is a most important point with switchboard operators, particularly if they are having a heavy load of traffic to deal with. A break of 10 to 15 minutes is most essential, and this should be as near the middle of the shift as possible. With the overloading of the switchboards that has occurred at present, resting of operators becomes all the more important.

The problems of wireless, teleprinter, and cipher personnel are similar and can be considered as a whole, since the general traffic of messages varies proportionately with all three concerns; the essential difference is that before lines are laid, wireless and cipher bear the brunt of the traffic, whereas after lines are laid, teleprinters take over.

The system of shifts outlined here has been organized for main headquarters; the problem at rear is somewhat different and will require reconsideration separately. The scheme arranged has been designed to meet operational demands and has borne in mind the medical aspects of the work.

The old system need not be recapitulated in detail; it involved operators working 1 night in 3, with sleep the following day before the evening duty. From the point of view of sleep rhythm, this system was obviously bad.

The aims of the new system have been stated as follows:

1. To relieve the monotony of the present system.
2. To reduce the time spent by each relief on signal office duty when static by 25 percent, so that men may be fresher when the strain of move is imposed.
3. To insure for every man 3 full weekdays off in every 4 weeks with no duties or fatigues. This will *not* affect entitlement to 48 hours and other leave.
4. To form teams including teleprinter, wireless, and cipher sections, who will work together and get to know each other intimately. It is proposed that, when moving, one complete team will be sent forward to open the new headquarters. A second will follow with the first staff officers, giving two teams on each end. A third team will come on after command passes to the new location, leaving the fourth to maintain communications in the old location as long as may be necessary.
5. To allow, under static conditions, a week end every 4 weeks for each team to carry out mobile training.

Each team is to be allotted rooms in the same part of the barracks and this will avoid disturbance of those sleeping after night duty. Uninterrupted sleep should therefore be possible. Hitherto, operators sleeping after night duty have been awakened at about 1300 hours by personnel walking about their rooms and along the corridors after coming off the morning shift.

Night duty is to continue for a week at a time. This allows for acclimatization of the sleep rhythm. It is possible that acclimatization might take place more quickly in a soldier than in a

civilian on account of his more ordered and disciplined life. Seven days seems to be the longest period that night duty can be continued conveniently, since there are administrative difficulties in a longer period. The change over after 7 days has been arranged to take place in the midweek; this has a psychological value, since the soldier can then take advantage of any local entertainment organized in both weeks.

The hours of the shifts are the same as those for the switchboard operators, except that the night shift starts at midnight instead of 2230 hours. This lengthens the evening shift to 6 hours and shortens the night shift to 8½ hours. The heavy period for these operators is the evening shift and the first part of the night shift up till 0300 hours. The reason for this is that departments start to send in their messages about 1800 hours and those are not cleared until this hour. When the work is done, some operators can snatch a short period of sleep, though this is not reliable and clerical personnel can seldom manage this.

The relief system for the four shifts has been laid down as follows:

Wed	C	D	C	A
. . . . .	.	.	.	.
Thurs	D	C	D	B
Fri	C	D	C	B
Sat	A	C	A	B
Sun	C	A	C	B
Mon	A	C	A	B
Tues	C	A	C	B
Wed	D	A	D	B
. . . . .	.	.	.	.
Thurs	A	D	A	C

For any one section this gives the following monthly program:

7 days—night shift.
2 days—no shifts; 1 day off; 1 day maintenance.
7 days—day shift.
4 days—no shifts; these days mobile training; 1 day off.
7 days—day shift.
1 day off.

This provides a varied program helping to combat staleness and boredom. Variation is also added in the alternative morning and evening, and afternoon duties during the spell of day shifts. To combat the rather long spells of duty when both morning and evening shifts have been done, the section finishing at midnight is allowed a late breakfast. This system is something quite new and ambitious and unforeseen difficulties may occur in its operation. It will require careful observation and a review of its efficiency will be required after a fair trial.

LIGHTING

Little attention has been paid to lighting in signal office work in the past and the attitude has been to make the best of whatever conditions are present. This unsatisfactory state of affairs was clearly demonstrated in September 1944, when numerous cipher operators complained of eyestrain—this was cleared up by a general improvement in the standard of lighting. This is merely an example of gross mal-illumination; on a more critical level, experimenters have found that efficiency is markedly affected by lighting. The importance of *good* lighting cannot be overstressed as a contributing factor to signal office efficiency. What, in fact, constitutes good lighting will be considered later.

The psychological factor is most important. Bad lighting is necessarily an obstruction to normal visual activity and, for this reason, occasions disagreeable feeling. The restriction imposed on visual experience produces a feeling of strain due to the ineffectual efforts to overcome the impediment. This in its turn produces annoyance and bad temper which causes further strain—the vicious circle is established.

Furthermore, good lighting produces a sense of well-being. The excitation of the senses is pleasurable up to a certain point and the degree of pleasure increases with the strength of the stimulus. Sight is no exception and the most familiar demonstration of this truth lies in the feeling of *being on top of the world* on clear bright days and the feeling of subnormal vitality on cloudy and dull days.

Experimenters have shown that visual acuity; i. e., the ability to see clearly and rapidly, increases with increased illumination. In point of fact, visual acuity is proportional to the logarithm of the brightness of the object, up to a level of illumination of 1,200-foot candles, providing the surroundings are adequately illuminated.

If illumination is poor, persons engaged on fine work will have to view the work so closely that accommodation and convergence of the eyes are greater than can be sustained with comfort—10 inches is about the shortest comfortable distance of the eyes from the work. From a practical point of view, an increase of 40 percent in illumi-

nation is required to increase the viewing distance from 9 inches to 10 inches. This would mean replacing a 60-watt lamp by one of 75 watts (giving about 30 percent more light) and placing it a little nearer the work.

Different standards of illumination are required for different tasks. Thus, prolonged critical visual tasks, such as are involved in teleprinter and cipher work, require a standard of 15- to 25-foot candles. Machine work such as switchboard operating requires a standard of 10- to 15-foot candles. These are standards for *average* persons; individual variation occurs and this has been shown to be of considerable importance where fine work is concerned. The relative efficiency of individual workers doing the same job; i. e., their value as producers with reference to the best of them, is, in part, a function of illumination. This means that as the level of illumination is raised, the efficiency of the workers improves, and the proportional gain is greater for the inferior than the superior workers, so that the former tend to catch up with the latter.

Glare is always present when there are areas within the field of view, whose brightness greatly exceeds the average brightness of the field; e. g., the filament of an electric light bulb causes glare. It has been shown by experiments that glare reduces the effectiveness of a given illumination, since sensitivity of the eye to contrast is reduced. Thus a higher standard of illumination is required than when glare is absent. This effect is produced by *discomfort glare* which is unpleasant but does not grossly affect the performance of the eye. There is also *disability glare*, which temporarily impairs vision, and reduces efficiency by more loss of time.

Flourescent lamps produce light which is very similar to the natural light available on a summer day. The color of the lamp is very satisfactory: the brightness relatively low, so that glare is less likely to be experienced and the tubular form of the lamps helps to prevent shadows. Though theoretically there is no disadvantage in ordinary artificial lighting, there is for most people a psychological value in natural or simulated natural lighting. However, there is unanimous agreement among those who have worked in it that it is far preferable to ordinary artificial lighting.

Lighting has to be considered from the point of view of both the static signal offices and also the mobile signal trucks. The essential points that emerge from the theoretical discussion are that lighting should be adequate; that glare must be avoided and that where practical, fluorescent lighting is an advantage.

The 80-watt fluorescent lamp will produce the standard of light required for any signal work. It should be placed 4 or 4½ feet above the operator's desk. It must not be pushed too far forward else glare results, nor too far backwards producing shadow. The ideal position is directly above the head of the operator. This is simple in signal offices established in buildings, since the component part are suspended from the roof by a chain.

The lamps give good service—some last 3,000 hours. They give more illumination for power available than do filament bulbs.

Fluorescent lighting is a practical proposition for signal truck work, and in fact, certain RAF trucks have been fitted with such lamps. Two lamps should provide adequate illumination. Two factors require attention. In the first place, in their optimum position directly above the head of the operator, they are in danger of being broken if the operator inadvertently rises too quickly from his seat. This can be overcome by protecting the lamp with a wire mesh. Such an installation would only project 4½ inches below the roof of the truck, far less than the ordinary filament bulb which may project up to 8 inches. The second difficulty is that the lamps are suspended from two points on the roof as opposed to one point in the case of the filament lamp—springing will be necessary to prevent damage when moving trucks over very rough ground.

The color of the inside of signal trucks needs attention. In most cases, the color is brown. There is no reason why cream paint should not be used—this would make the trucks brighter both physically and psychologically.

NOISE

The influence of noise on work has been made the subject of careful investigation and conclusions have been varied.

However, the two following conclusions are regarded as established: (1) loud noise is in general prejudicial to efficiency and its harmfulness is roughly proportional to the difficulty of the work involved, and (2) nevertheless the psychological and physiological effects due to noise have been, and constantly are, greatly exaggerated in more or less popular writing.

Noise influences work since it is a source of irri-

tation. The noise distracts attention from the work to itself and the efficiency is diminished depending on how far the individual allows his attention to be so distracted. Adaptation to noise is not so much a physiological process, but rather a psychological one since the individual learns to resist the distraction. Thus it is clear that if the noise is a constant meaningless noise such as that of a motor or a machine, acclimatization will be easy, since that type of noise has little to attract the conscious mind.

The above considerations suggest that if noise can be cut down simply, this is most desirable; but extravagant, large scale or expensive changes are not justified.

Teleprinter work is a process requiring careful and accurate attention, and diminution of noise is desirable. Teleprinters are supplied with a soundproof cover, but this is badly constructed. The keyboard is, of course, exposed and the sound of the keys is not obliterated but nevertheless sound is cut down to an appreciable degree. The mistake in construction is due to the fact that the front of the cover is built so high that an operator sitting in a comfortable position cannot view the message being typed. To do so, he has to strain forward in his seat. As a result, operators prefer not to use the covers.

The post office (British) type cover has not this draw back and covers have also been designed for these particular machines, obviating the difficulty. The possibility of substituting the present covers should be investigated.

(This does not apply in its entirety to U. S. teletypewriter machines. Copy is in plain view of the operator and it is not necessary to remove the soundproof cover. The operating noise level of American machines is also considerably lower than British Creed teleprinters.—Ed.)

Ear plugs diminish the appreciation of noise but operators do not like to use them, since they tend to isolate the wearer.

The noise in a room can be diminished by lining the walls with *acoustic celatex*. This is made in panels with a broken up surface and this breaks up the sound and prevents sound reflection. It is expensive and the small advantages gained by it do not justify its adoption. For soundproofing to be effective, it must be applied close to the source of sound, as in the case of a machine cover.

Individual telephone operators can be isolated by *boxing* them with acoustic celatex and this will cut down external noise. However, the operators themselves do not like to be so confined. Adoption of this should not be undertaken.

Wireless operators should not increase the volume of the reception signals above that which can comfortably be heard. Sound becomes irritating if the volume is increased too much and no improvement in efficiency results.

MEALS

The problem of feeding the men doing shift work requires consideration particularly regarding the night shift meals. Four good meals can be provided out of the ration scale: breakfast, dinner, a high tea, and a snack supper. Meals for the day shift provide no special problems. For the night shift, the following scheme is thought to be the best:

Breakfast 0900 hours after returning from night shift, dinner 1700 hours before going on night duty and a snack at 0300 hours on night duty. This has advantages over the old scheme of giving the night shift a meal at 0030 hours, since this interrupted work shortly after it had begun; if a snack is given at 0300 hours, the bulk of the work has been cleared by this time. Frequent hot tea during night shifts is a great boon and helps to keep operators alert and awake.

The irregular hours of dispatch riders makes their feeding problems difficult. Hot tea is laid on when drivers arrive at this headquarters and our own drivers are provided with flasks of tea. It is not practicable to arrange hot meals for all incoming drivers, though this is obviously desirable. The adequacy of haversack rations must be noted and on long runs reserve rations must be carried.

Seating must provide a comfortable support whatever position is adopted. This matter is important, since fatigue results if adequate support is not given to the body in the sitting posture. Good seating must provide the following points:

1. The seat must support the buttocks and back of the thighs in a comfortable position.
2. Adequate support must be provided in the hollow of the back—the placing of this support is important; so many chairs give one support at the level of the shoulder blades—this is too high.
3. The height of the chair must be such that the feet can be properly rested on the ground.

The inadequacy of the present seating can be seen in some of the telephone switchboard rooms. Op-

erators are sitting on the edges of their chairs, their weight being taken by the middle of their thighs, while their legs are curled underneath them.

VENTILATION

This is important as a general hygienic measure. Lack of ventilation increases the carbon dioxide content of the air, and also its general foulness. Sleepiness and lack of concentration result. Furthermore, if operators are allowed to smoke, the thick atmosphere irritates the eyes and causes minor degrees of conjunctivitis.

Signal trucks are well ventilated, but Belgian buildings are constructed on the *all or none* principal of ventilation. The fixing of chains on the windows at main headquarters has helped to solve the problem. Stress must be laid on insuring adequate ventilation in the blackout.

HEATING, SPACING, FATIGUE

When a man is cold, he cannot raise enthusiasm for work of a static nature, and efficiency drops. The optimum temperature for offices is 60° F. With the shortage of fuel, the difficulties of heating are appreciated, but the importance of this point must be stressed.

Since the signal office must be made to fit the accommodation available, it is obvious that careful planning is necessary in order to make the most of a given space. Much wasted labor can occur through bad planning. The rearrangement of the main signal office has been undertaken with this point in view. When moves of the headquarters occur, adequate room must be given for a good signal office layout. From a psychological point of view, cramped spacing always leads to flurry and waste effort.

Avoiding fatigue is a most important point in the lowering of the accident rate among drivers. Adequate time must be allowed for night runs, bad conditions such as fog and icy roads, and unforeseen delays. Less fatigue occurs if a run is taken at a comfortable pace than if a shorter time is taken on forcing the pace.

Jeeps are less fatiguing than motorcycle. Fifteen cwt. trucks now issued in lieu of *written off* jeeps slow down the pace and are more tiring to the drivers. Right-hand drives increase the difficulty in continental driving, and therefore increase the fatigue.

The importance of feeding has already been stressed.

Minor sickness among drivers must be treated more seriously than among other signal personnel. It is obvious that an unfit man is more prone to accidents than a fit man.

ARMY PUBLICATIONS COMBINED

COMMENCING WITH the April edition, the Army combined its two major publications indexes to provide a more complete and efficient listing service for the field. The new field manual, known as FM 21–6, is entitled *List and Index of War Department Publications*. As heretofore, it will be published monthly and distributed down to companies.

The consolidated list and index of publications contains all the listings that formerly appeared in War Department Pamphlet 12–6 and Field Manual 21–6. Of special interest to maintenance personnel is the fact that they can now find complete listings of manuals, circulars, bulletins, orders, forms and the like between the covers of a single, up-to-date, monthly manual. Among the many publications listed in the new FM 21–6 are field manuals, technical manuals, technical bulletins, supply bulletins, lubrication orders, modification work orders and maintenance forms.

An important feature of FM 21–6 is that new publications are indicated by an asterisk (*). This makes it easy for an organization to make a quick check once a month to assure that it has on hand, or receives, the latest authorized publications.


FIG. 1

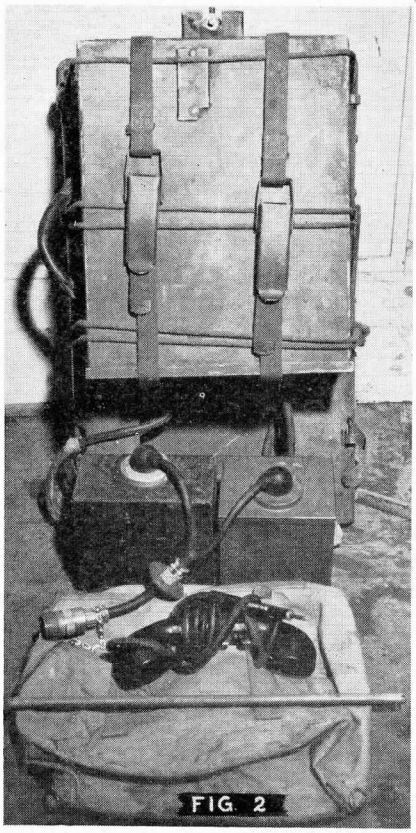


FIG. 2

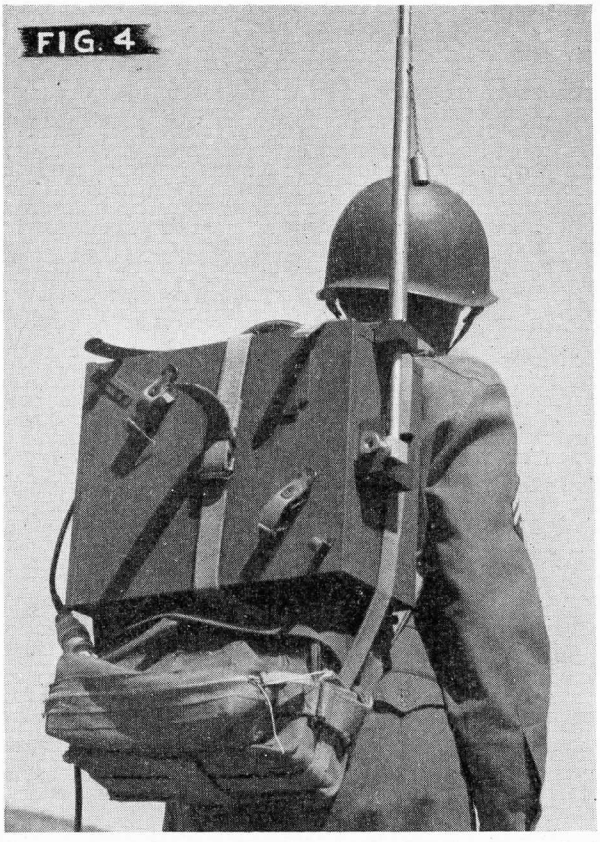

FIG. 3

MAN PACKING THE SCR-509 AND 609

THE PHOTOGRAPHS shown (figs. 1, 2, and 3) indicate a method of man-packing Radio Set SCR–509 devised in the European Theater of Operations. The receiver-transmitter is carried on a standard packboard and the batteries are carried in a musette bag. The total weight of the set and pack equipment is approximately 60 pounds.

A similar method of man-packing Radio Set SCR–609 was developed by Camp Coles Signal Laboratory and was tested by the Mountain and Winter Warfare Board. Photographs (figs. 4 and 5) show this pack arrangement. In this arrangement a wooden pack frame was provided on which was mounted the receiver-transmitter and a canvas bag in which were placed the batteries, and accessories. With this arrangement the operator, while walking, could operate the radio. However, the pack was uncomfortable and was determined to be unsatisfactory for tactical use. Tests were also conducted of this equipment mounted on a standard packboard. This method was more comfortable than the wooden frame and on level ground the operator could keep up with the rest of the pack battery but on slopes about 300 yards was all that each of several men could carry the load before he was exhausted.

As a result of tests described above the Mountain and Winter Warfare Board concluded that Radio Set SCR–609 was too heavy for one man to carry and remain in the column with the rest of the battery. The number of times when this radio will be used while the operator is walking are few and it was decided that the handles and straps provided for carrying the set by two men were adequate. The conclusions reached by the Mountain and Winter Warfare Board are believed to apply to Radio Set SCR–509 as well as to Radio Set SCR–609 as the weight of the receiver-transmitter and batteries of the sets are substantially the same. However, the illustrations show means for manpacking the sets which might be desirable for use in special cases. Attention is invited to the fact that in each of the pack arrangements shown it is necessary to modify the antenna mounting stud of the receiver-transmitter to permit the antenna to be extended vertically.



USE OF ENEMY STOCKS

MAIN TOLL underground cable, used to rehabilitate civilian telephone lines for American armies in Germany, was manufactured from captured copper at a signal repair plant in the steel center of Charleroi, Belgium. This copper, seized when the First Army advanced into the industrial city of Munchen-Gladbach, Germany, was smelted and reprocessed into cables.

The signal plant was taken intact when the armies swept through Charleroi. The plant faced a shortage of coal. Several hundred tons were procured through military purchasing channels. In March when the First Army dashed across the Rhine, Advance Section Communications Zone signal reconnaissance patrols discovered the copper ingots and wire. This was routed back to Charleroi immediately and production started.

Approximately 385 tons of copper, found in the area, was comprised of nearly 165 tons of scrap, 55.5 tons of wire bars, 58 tons of drawn copper, and 109.5 tons of laminated copper.

When ADSEC signal units strung communications across the Rhine a rush order was placed for 52-quad, 19-gauge cable. Nearly 10 miles of this was supplied by the Belgian plant.

It has been said that 10 percent, or approximately 500 miles, of the 104-copper wire used in the Normandy campaign was from captured stock. In the cathedral town of Chartres, several hundred tons of 104 and 080-copper wire was found in underground caves. This was used to string lines from the battered rail center of Le Mans to the French capitol. Galvanized iron, left by the Germans in the Belgian health resort of Verviers, was converted into 134-iron wire for lines in the Reich.

Principal underground routes in France and Belgium were restored by ADSEC signal units, working deep in Army territory.

Equipment Notes

COMMUNICATION EQUIPMENT

TESTBOARD BD–101

Testboard BD–101 (Signal Corps Stock No. 3F4480–101) is a testing, patching and simplex coil housing unit for use at army or other similar size communication centrals, normally in conjunction with Telephone Central Office Sets TC–1 or TC–10. This testboard will provide a convenient means for selecting and testing wire line facilities to analyze and locate faults thereon.

The use of testboards has been a part of commercial practice for many years. Until the standardization of Testboard BD–101, no equivalent Signal Corps standard test facility was available for tactical telephone exchanges. It was necessary for the using forces to improvise equipment to provide the functions of a testboard.

Testboard BD–101 includes a case as an integral part and contains the following equipment:

Sixty test jack circuits for non-simplexed lines. Each circuit includes monitoring, line and drop jacks.

Forty test jack circuits with repeating coils for simplexed lines. Each circuit includes monitoring, line, drop, simplexed line, simplexed drop and telegraph jacks.

Five call-in trunks for patching a line to a drop.

Five ringdown trunks, for communication.

One operator's circuit for talking, dialing, monitoring, and signaling.

Twelve miscellaneous jack circuits for miscellaneous tests and interposition trunks.

One test bridge for fault analyzation and location.

One volt-milliameter for current, voltage, and resistance tests.

Twenty patching cords.

Ten dummy plugs.

Testboard BD–101 is arranged for line and trunk termination by means of binding posts in the rear. The testboard will normally be used at the telephone central office and will be connected between the protector side and the switchboard side of the distributing frame. The testboard is 25¾ inches wide, 21¾ inches deep, and 4 feet 9 11/16 inches high; it weighs approximately 700 pounds.

Power source consisting of 48 volt d. c., 20-cycle ringing current and 110-volt, 60 cycle a. c. supply (for heater units) will be furnished from the associated telephone central. Six each Battery BA–8 (for testing and plate supply), one Battery BA–23 (for filament) and 4 each Battery BA–45 (for grid bias) will be used with the testboard.

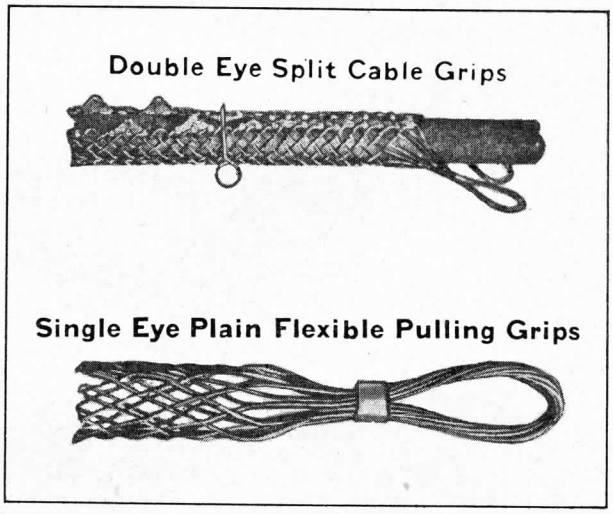
Testboard BD–101 is now under production. It is anticipated that deliveries will start in September 1945. Issue will be in accordance with T/O and E's.

GRIPS FOR AERIAL CABLES

The following kits, which contain various sizes of cable grips for pulling lead-covered aerial cable, have been recently standardized:

Cable Grip Kit TK–46( )/T.—This kit consists of two each of four sizes of woven wire, single weave, split type grips with two eyes and belt lacing. These grips are for use in tensioning ¾" to 2⅜" diameter lead-covered cables where the end of the cable is not accessible. They are not suitable for pulling through cable support rings and installation accessories.

Cable Grip Kit TK–47( )/T.—This kit consists of two each of four sizes of woven wire, single



CABLE GRIPS CONTAINED IN RECENTLY STANDARDIZED KITS USED FOR PULLING DIFFERENT TYPES OF LEAD-COVERED AERIAL CABLE.

eye, single weave grips. These grips are for use in the installation of ¾″ to 2⅜″ diameter lead-covered cables where the end of the cable is accessible. They are suitable for pulling through cable support rings and installation accessories.

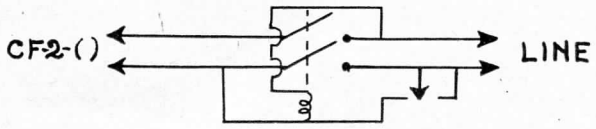
These kits are being included in T/O and E's for issue to signal light construction companies, signal heavy construction companies, light wire construction teams GT, heavy wire construction teams GS, ASF training centers and Signal Corps schools.

AUTOMATIC POWER CUT-OFF

It has been found by XII Fighter Command, AWS, that many of the 394A rectifier tube failures in carrier telegraph terminals are caused by power *surges* in addition to the failures caused by the application of plate voltage prior to the filaments coming to complete temperature. Surges in power have been noticeable when operating on commercial mains. Here the power failures may extend from ½ to 10 seconds or more. Quite obviously a failure of less than 2 seconds will not allow the reset timer to function because of the mechanical delay involved.

In order to provide an immediate drop out of power, an ordinary power relay, two pole, single throw, with 110-volt, a. c. coil was connected between the input of the telegraph terminal CF–2–( ) and the mains as shown.

When the button was pushed the relay closed and remained closed after the button was released. When an interruption of power or a considerable drop in line voltage occurred, the contacts opened and remained open until the button was again depressed thus restoring the power to the load.



POWER RELAY CIRCUIT DIAGRAM USED TO OVERCOME RECTIFIER TUBE FAILURES.

Since the installation of the above relay, abnormal tube failures have been completely eliminated. Prior to the installation of the relay, tube failures had been excessively high even though the maintenance section had been instructed to check the reset timers prior to restoring the mains. Power failures had been too rapid to enable them to remove the mains from the set. At the present time any failure removes the power and the reset timers have adequate time to open. They are checked though, since the timers have failed to operate.

Comments from the Radio Division, Signal Section, MTOUSA, state that while the above item is excellent its use will depend upon an alert man on duty to reset the relay after 2-second interval, or as soon as power returns to normal. Also, it is pointed out that this idea is successful in application where line voltage difficulties are encountered.

MAINTENANCE

BASIC DIFFERENCES IN SCR–608 AND 628'S

The major difference between Radio Set SCR–608–A, and SCR–628–A, and Radio Set SCR–608–B and SCR–628–B is in the incorporation of an interphone circuit in Radio Transmitter BC–684–B, while Radio Transmitter BC–684–A has none. There are no major differences between Radio Receiver BC–683–A and BC–683–B.

The major difference between Radio Transmitter BC–684–B and BC–684–BM, part of Radio Set SCR–608–B and SCR–628–B, is in the incorporation of the modification for automatic receiver disabling in Radio Transmitter BC684–BM. The same condition holds for Radio Receiver BC–683–B and BC–683–BM. Field modification data are being assembled to apply the modifications for automatic receiver disabling to Radio Transmitter BC–684–B and Radio Receiver BC–683–B.

Radio Transmitter BC–684–A cannot be substituted for Radio Transmitter BC–684–B or BC–684–BM for use in installations which require integral interphone facilities. Radio Transmitter BC–684–B cannot be substituted for Radio Transmitter BC–684–BM for use in installations which require automatic receiver disabling facilities.

The use of the table below will help to indicate the possible substitutions of the various issues of Radio Transmitter BC–684–( ) and Radio Receiver BC–683– ( ).

When the component, mentioned below, is needed, but not available:	*The following components may be substituted:*
BC–683–A	BC–683–B, BC–683–BM
BC–683–B	BC–683–A, BC–683–BM
BC–683–BM	None
BC–684–A	BC–684–B
BC–684–B	BC–684–A [1]
BC–684–BM	None

[1] Radio Transmitter BC–684–A may be substituted only when there is no need for interphone operation.

Radio Set SCR–608–A or SCR–628–A should be requisitioned, or issued, only where there is no need for interphone operation as long as any of these radio sets are available. When the supply of Radio Set SCR–608–A or SCR–628–A is exhausted, requisitions should be made for, or filled with, Radio Set SCR–608–B or SCR–628–B, respectively.

Further information regarding Radio Sets SCR–608–B and SCR–628–B may be had by referring to Supplement to Technical Manual TM 11–620, dated 5 December 1944, subject: *Radio Sets SCR–608–A and SCR–628–A*. This supplement is in process of being reprinted as Change 1 to TM 11–620.

AUDIO OSCILLATION IN SCR–508/528 AND SCR–608/628

Audio oscillation has been encountered in vehicular installations of Radio Set SCR–508/528 and SCR–608/628. The principal cause for this oscillation has been found to be the increased gain in the modulator-interphone amplifier section of Transmitter BC–604 and BC–684, which was in turn, caused by the modification of the transmitters for improved interphone audio power output as outlined in Modification Work Order MWO SIG 11–600–6, dated December 1944.

In addition to the increased gain in the modulator-interphone amplifier, a condition which caused feedback from the output to the input of the amplifier was found to be the inter-conductor capacitance of the input and output leads in Cordage CO–213, or the accepted substitute for Cordage CO–213. As a result of this capacitance, enough feedback was present to cause audio oscillation.

Investigation has shown that the audio oscillation occurs only under the following conditions:

1. Transmitters modified per *MWO SIG 11–600–6*.
2. Interphone-radio switch in *radio* position.
3. Complete radio system actually mounted in vehicle.

The audio oscillation can be eliminated by removing and taping the red and green wires from Terminals 4 and 5 of Terminal Strip TS–401 in Mounting FT–237.

ELIMINATION OF KICK-OFF TROUBLE WITH TG–31

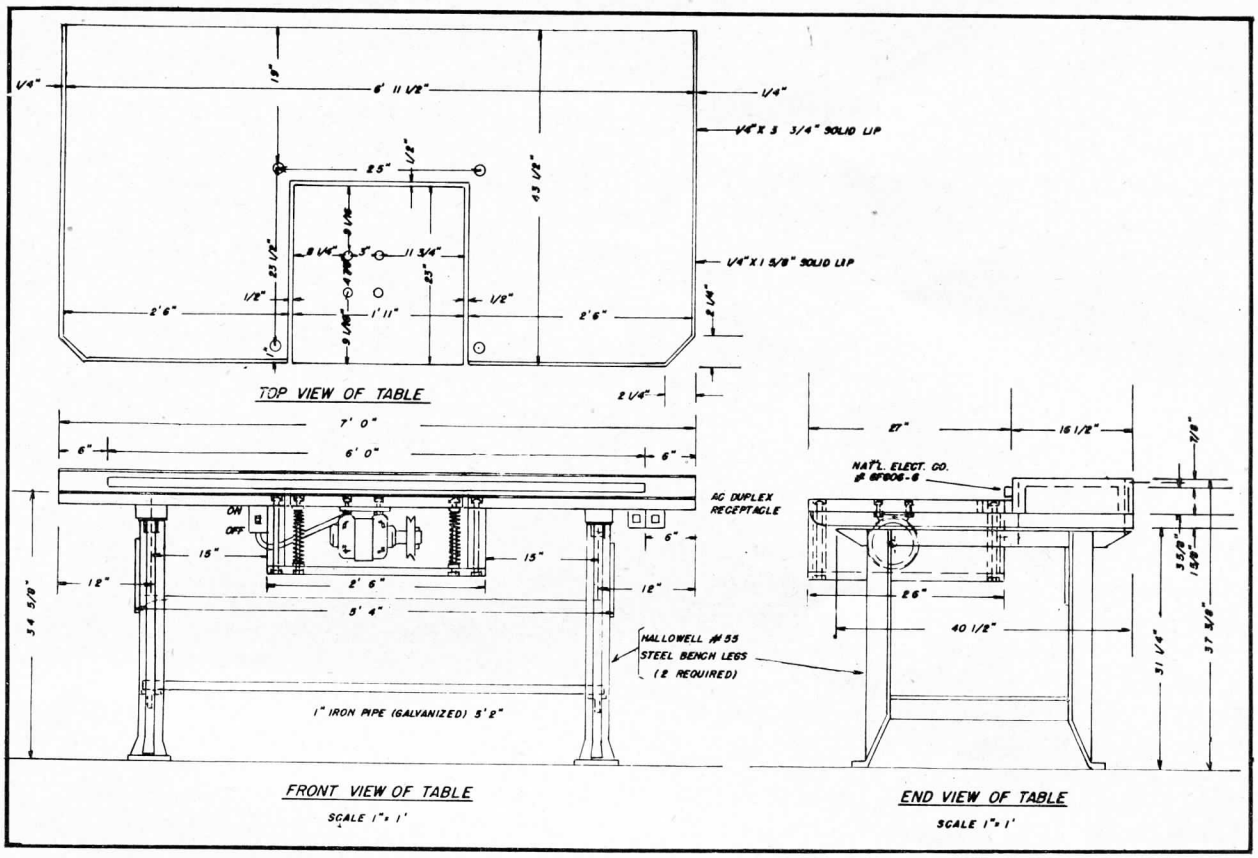
It has been noted that the line relays A and B (D–164816) of telegraph Repeater TG–31 (Intermediate), part of Repeater Set TC–19 (Intermediate), have a tendency to kick-off and cause errors when the repeater is operated on line sections of 20 to 30 miles of simplexed field Wire W–143. This false operation of the line relay on the line side to which the repeater is transmitting is caused by the discharge of the line capacity through line relay winding when line current changes from spacing condition to marking condition.

The above condition may be eliminated by short-circuiting the 400-ohm sections of resistors A and B (D–161700–TN) in the anti-kick circuits for the line relays. These components may be identified by reference to wiring diagram and schematic circuit of the repeater in TM–11–2005. The detailed procedure involved in this modification is as follows:

1. Remove repeater from carrying case after loosening the four large round head mounting screws, and rest repeater upside down on its two handles.
2. Loosen the four fasteners and remove cover which conceals wiring to relay connecting blocks and resistors.
3. Solder a strap between middle terminal of resistor A and the end terminal to which the brown-red wire is connected.
4. Solder a strap between middle terminal of resistor B and the end terminal to which the brown wire is connected.
5. Reassemble cover and repeater.

NOTE.—Resistors A and B are located underneath cover removed in paragraph 3b, on left-hand subpanel as viewed from back edge of repeater.

Repeaters modified as described above will function satisfactorily on all types of line facilities specified in TM 11–2005 except composited open-wire lines having a resistance, exclusive of repeater and composite sets, of less than about 550 ohms. For these infrequent cases, the strap connections should be removed.



BLUEPRINT OF SHAKE TABLE USED TO GIVE VIBRATION TEST TO REPAIRED SIGNAL CORPS RADIO SETS

SHAKE TABLE FOR TESTING

The purpose of the shake table is to provide a vibration test for repaired Signal Corps radio receivers so that loose connections or microphonic conditions may be detected. All repaired radio receivers should be given at least a thirty-second test on this table.

A section of an inspection bench should be cut out and mounted on four helical springs. Motor should be mounted on underside of spring-supported section of bench top. Unbalanced flywheel on motor shaft causes vibration of spring-supported section of bench top. A switch controlling motor is placed conveniently for use by operator's left hand. See blueprint sketch.

Inspector places radio receiver in operation, on spring-supported section of work bench, applies signal to input of receiver at proper frequency so that output may be observed on output meter. Input to be low enough so that receiver is not overloaded.

Motor is turned on with left hand while right hand fingertips rest lightly on top of receiver to avoid receiver *walking* off table. Motor is allowed to run for thirty seconds or more and output reading observed during this time; output should not vary. Audible indication of loose connections or microphonics sufficient also to cause rejection of set is observed.

VHF EQUIPMENT TROUBLES AND REMEDIES

Radio Transmitter T–14( )/TRC–1

Fan Switch TD–2 is a source of noise at times. The diaphragm fails to buckle completely, causing points to burn from arcing. The remedy is to replace the Fan Switch TD–2, if possible. If this is not practicable, the small screw through the diaphragm should be adjusted away from the movable point until the diaphragm snaps to open and close points (points must seat flush).

An unbalanced condition often exists in the grid circuit of the PA stage of Radio Transmitter T–14/TRC–1. At certain frequencies the grid voltages (if measured from grids of 829 tube to

ground) will be greater on one grid than the other. This unsatisfactory condition has been corrected in present production by the incorporation of fixed bias for the final amplifier tube. An MWO is being prepared that will include this modification. However, a temporary field modification may be effected to equalize the voltages at both grids by adding small capacitors of from 5 mmfd to 50 mmfd between the center tap of Transformer T–5 and the ground point of 829 tube socket (between the two socket connections 1 and 7, which are grounded on each side). A ground wire from this point to the top of case of capacitor C50 will also help.

Amplifier AM–8/TRA–1

Antenna relay RL–201 of Amplifier AM–8/TRA–1 will chatter due to AC component developed across exciter coil of RL–201. This pulsating current in the B-supply is present only when the voltage regulator tubes VR–150–30 are conducting. The remedy is to install a 25 mfd, 50-volt capacitor across relay coil. Capacitor C–156, used in Receiver R–19/TRC–1, is suitable, if a spare is available. Be sure to observe polarity of capacitor.

Power Unit PE–75–( )

The PE–75 generator armature will develop end play that will cause ball bearings to wear excessively. This is caused by the bore in the commutator end frame into which the outer race of the bearing fits, which is too deep. Due to vibration, centrifugal force, and magnetic attraction, the armature tends to shift endwise, moving the bearings in and out of both end frames and wearing the bore oversize. Bearings will turn in end frame and if this condition is allowed to exist the armature will foul the pole and be ruined. In order to eliminate this trouble, a thrust bearing and suitable space washer should be installed in commutator end frame.

Piston rings of the PE–75 have been found with their butt ends in line and over wrist pin hole. This causes loss of compression. In order to remedy this, piston rings should be staggered around the piston.

In order to eliminate loss of spark to spark plugs, remove shield from high tension lead, wrap tightly with narrow strip of rubber tape, replace shield with pig-tails already soldered to shield. (If pig-tails are soldered on after the shield has been installed the heat will break down the insulation.) Suppressors may be removed for hotter spark. (Some later PE–75's do not have suppressors.)

Blocked gas lines can be remedied by removing sediment bowl assembly, inserting small tube screen up through pipe in bottom of tank approximately 1 inch above bottom of tank. This will keep large pieces of foreign matter out of the gasoline line.

BC–611 ANTENNA SUPPORT

The purpose of the tool shown in figure 1 is to facilitate performing Modification Work Order Sig 11–235–2 where large quantities of Radio Set SCR–536–( ) are involved. The tool should be fabricated in accordance with figure 2.

This tool should be used as follows:

1. Fasten tool securely to work bench.
2. Insert a No. 2–56 nut in slotted portion of retaining bracket shown at A and B, figure 1.
3. Place a No. 2 lock washer on top of nut.
4. Place antenna support on radio receiver and transmitter chassis.
5. Place radio and transmitter chassis as shown at B, figure 1.
6. Using steel strip on side of tool as a guide for the edge of the chassis, slide chassis forward until bracket hits crystal socket.
7. Make sure that nut and lock washer are aligned with holes in chassis and antenna support.
8. Insert a No. 2–56 machine screw in antenna support; tighten screw securely and withdraw set from tool.

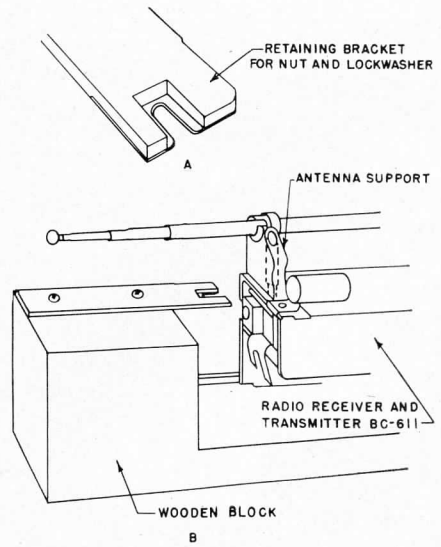


FIG. 1
TOOL FOR INSTALLING ANTENNA SUPPORT

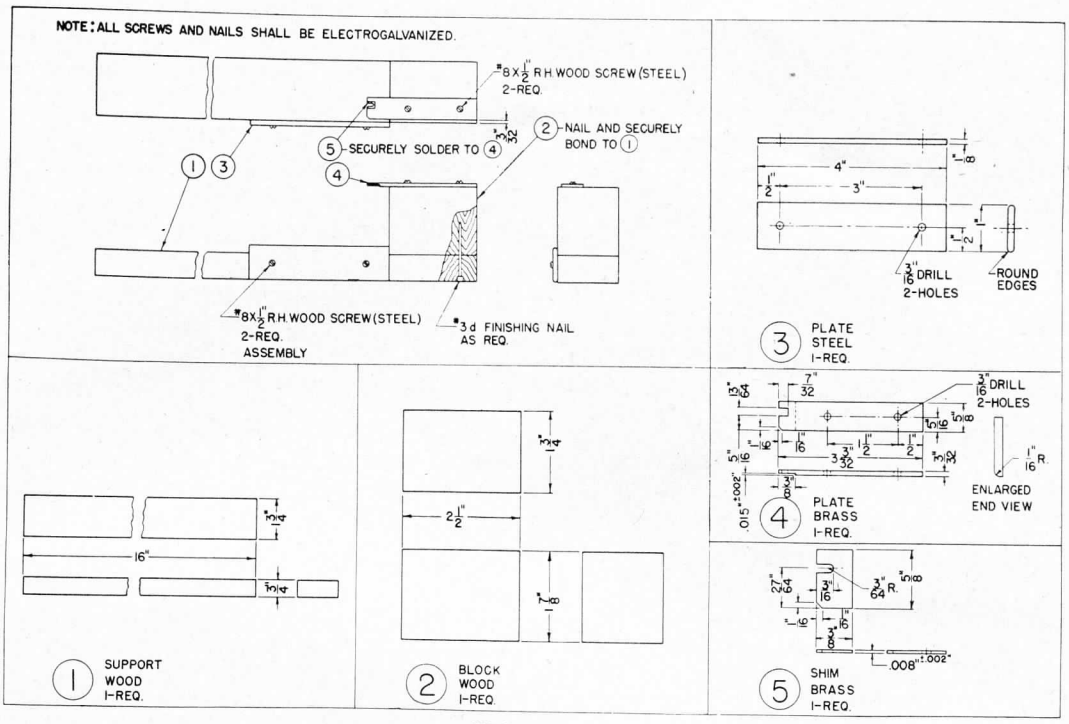


FIG. 2
TOOL FOR INSTALLING ANTENNA SUPPORT ON RADIO TRANSMITTER BC-611

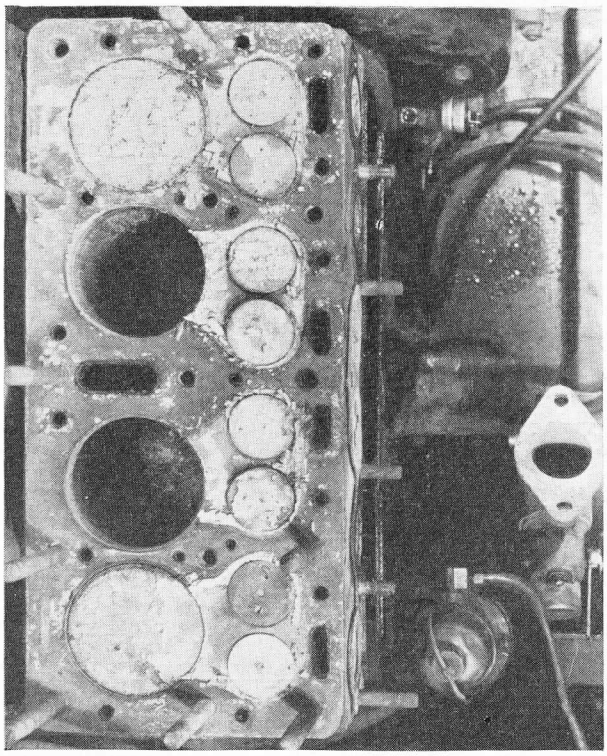
USE OF STELLITE VALVES

The following is published to acquaint operating personnel with the results of a test conducted at the Signal Corps Ground Signal Agency to determine the value of stellite-faced valves when used in gasoline engines.

A standard Power Unit PE–95, equipped with a Willys engine, was utilized for the test. Actual field conditions were simulated as closely as possible. Standard GI gasoline with a lead content of 2.88 cc. per gallon was used. The engine was equipped with standard Willys intake and exhaust valves which were treated with No. 6 stellite facing. The power unit was operated at rated speed (1,800 r. p. m.) and an average load of 9.66 kw. was maintained throughout the test.

After 571 hours of continuous operation, interspersed with periodic shut-downs for routine servicing and minor adjustments, it was noted that the engine had developed a slight knock and was stopped for routine service. At this interruption, the engine crank case oil and the spark plugs were changed. An attempt to restart the unit disclosed that the engine had *seized*. A subsequent investigation to determine the cause of engine failure revealed that an excessive amount of deposits had formed within the combustion chamber of all cylinders. The amount of deposits formed within No. 4 cylinder was such that the piston was striking the cylinder head. This caused breakage of the piston. To recondition the unit it was necessary to replace the one broken piston and all piston rings. In addition, the valves were lapped to seat properly. The valves were not burned and none needed replacement.

The conclusions arrived at as a result of the test are that stellite faced valves are *definitely superior* to the standard untreated engine valves. However, if the engine is allowed to operate long enough without cleaning the deposits from the combustion chamber, failure of the engine will occur from other



AFTER 571 HOURS OF OPERATION THIS IS HOW THE CYLINDER HEAD OF A PE–95 ENGINE LOOKED.

reasons than burned-out valves. This fact should serve to impress all operating personnel of the value of preventive maintenance programs as outlined in existing technical manuals and publications for power units.

When stellite faced valves are used, all deposits should be removed from the engine cylinders at 200-hour intervals to insure protection of the engine. Also, as a precaution to prevent valve burnouts and reduce the need of their replacement, the valves should be ground at 500-hour intervals.

(See *Gasoline Engine Driven Power Units*, SCTIL No. 30, May 1944.—Ed.)

SOLDERING IRON FOR INSTRUMENT WORK

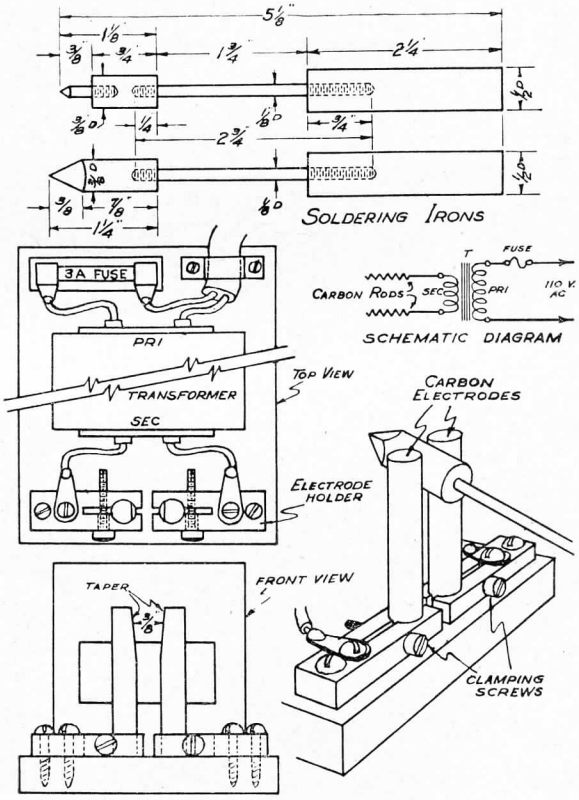
A small, lightweight, quick heating soldering iron for use in instrument repair work where delicate work is required has been developed at an overseas Signal Corps repair shop. This type of soldering should prove very useful in a third echelon repair shop for small work.

The main advantages possessed by these small irons are light weight and quick heating (45 seconds from cold). It is small enough in size to reach a *hard-to-get-to* place and to perform delicate soldering jobs in meters, with fair heat retention to perform a good soldering job.

The diagram illustrates the construction details of the soldering irons, heaters, and transformer. Some individual ingenuity may be used in the construction of the iron itself.

The heater assembly consists of a transformer having an output of 6 to 12 volts with a current capacity of 10 to 30 amperes. The power source can be 110 or 220 volts depending upon the transformer available. Those normally used are of 6.3-volt filament transformer variety. The carbon electrodes can be obtained from a standard flashlight cell (BA–30). A suitable fuse should be placed in the primary circuit of the transformer for protection against accidental shorting of the secondary.

The basic principles of operation are that with the soldering iron tip inserted between the two carbon rods a current is permitted to flow in the secondary circuit. At the point of contact between the soldering iron tip and the carbon rods a high resistance contact results, forming a small electric



CONSTRUCTION DETAILS OF SMALL SOLDERING IRON USEFUL FOR DELICATE WORK IN HARD-TO-GET-TO PARTS OF COMMUNICATION EQUIPMENT.

arc. The heat developed at these points of contact heats the iron. There may be an occasion to place the iron tightly in between the carbon rods and no definite arc will result; accordingly the iron will be very slow in heating, if at all, and may result in short circuiting the transformer's secondary.

FLASHLIGHT AND ELECTRIC LANTERN REPAIR

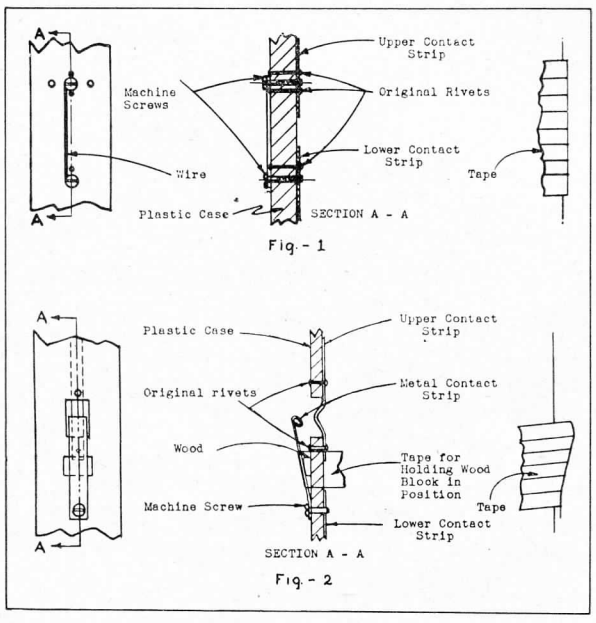
Many complaints have been received from troops in the tropics that Flashlight TL–122–B goes out of commission very rapidly. Studies have shown that the present switch on this particular model of flashlight corrodes easily and the contact springs either corrode or become loose; so the following expedients, using only materials readily available, have been determined:

Repairs to Switch on TL–122–B

File off the rivets holding switch, discard the switch, then employ one of the following procedures:

1. Short out the switch connections by some method as shown in figure 1, and operate the flashlight by screwing the head in or out.

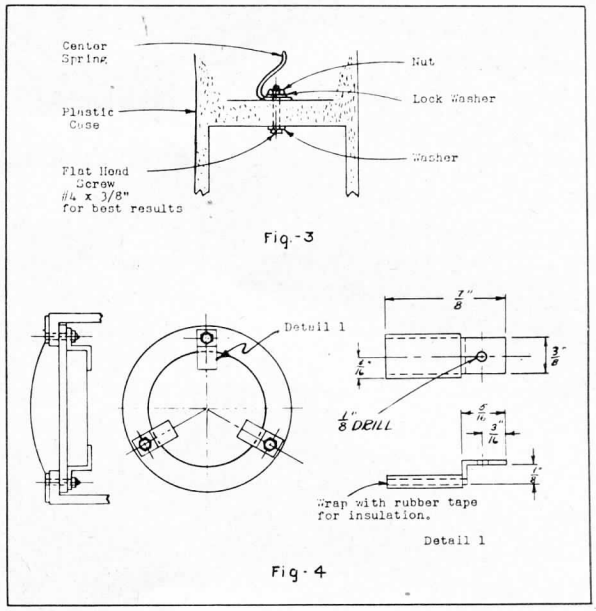
This method is based on the fact that shorting between the upper and lower contact strips will allow the flashlight to operate. The wire used can be any kind of conductor. The machine screws are tapped into the contact strips after holes have been bored through the plastic case and inside metal strip. After the shorting wire has been installed, the entire switch is covered by rubber tape, overlapping onto the case so as to cover all visible rivet holes.



2. Improvise a temporary switch by some method, such as is indicated in figure 2.

This method also utilizes the fact that shorting across the inside contact strips will turn the flashlight on. The metal contact strip can be made from any flexible steel or copper strips (example: the bands used during shipping of supply boxes). The wooden plug is used to keep the metal strip from making contact continually, and can be held in place by glue or a tight piece of rubber tape. After the contact strip is installed, the entire switch should be covered by rubber tape, adjusting tension so that contact is not made continually, but only when the contact strip is depressed.

Attention is called to the fact that while one model of flashlight may have no holes in the switchplate, another one may have a single hole just above the switch. In the latter case, either of the above modifications may be made.



Repairs to Center Contact Spring in Head of TL–122–B

This spring is held in place by a rivet and frequently becomes loose. This can be corrected by filing (not chiseling) the rivet head off and replacing with a nut and bolt as shown in figure 3. (Flashlights TL–122–C and D have improved switches which are corrosion resistant and the complete flashlights are waterproof.—Ed.)

Repairs to Switch of Lantern, Electric (Stock No. 6Z6915)

Remove the switch by drilling out the rivets holding the top of reflector, using 1/8" drill. Pry up the metal lugs that clamp the switch to the switch plate, remove the switch, and clean the contacts. Reassemble the switch by bending down the lugs and replace, using three No. 4 x 3/8" flat-head machine screws with nuts and lock washers, heads of screws outside. If the metal lugs break during reassembly, the switch can be held together by making brackets as shown in figure 4 which are held by the No. 4 x 3/8" machine screws, and extend inward to support the switch; they must be insulated. This can be done by wrapping with rubber tape, as shown in figure 4.

Technical Bulletin TB SIG 15 outlines general policies for the repair of flashlights, and should be referred to when other deficiencies develop.

REPAIRING CONVERTER M–209

A number of Converters M–209 have been received with the key wheel bearing screw broken.

This screw is made of very soft metal which is broken easily; therefore, when tightening this screw, too much pressure should not be used.

An improvement in design of this screw has been recommended to the Office of the Chief Signal Officer, but no field expedient is suggested beyond the exercising of caution when the screw is being tightened.

DEFECTIVE VIBRATORS

It has been determined that certain Vibrators VB–13 are incorrectly wired. All Vibrators VB–13, received either as components of Radio Set SCR–510 and SCR–610, or as end item, bearing the marking TYPE 1619, ORDER NUMBER 597–Phila–45–10, ELECTRONIC LABORATORY INCORPORATED on both vibrator can and container, should be salvaged if possible.

MAINTENANCE HINTS

Removal of red card from the hinged lid of the BC–611 prevents the collection of moisture with consequent damage to the rivets holding the jumpers for the batteries BA–37 and BA–38. Power leakage from the positive terminal of the BA–38 to ground through the wet paper is eliminated.

Servicing of the BC–728 is facilitated by modifying the charging cord CD–618 so that two volts may be applied to the set from an external source. The jumper wire is removed from the plug and the two wires connected to the opposite small holes. Polarity can be determined with a continuity meter. In an emergency such as failure of the internal charging circuit, this modified cord can be connected across one cell of a vehicular battery and operation resumed. The cord should be clearly marked as to polarity and voltage.

A hint to trouble shooters when looking for a cross to the shielding on spiral-four circuits. When you have disconnected two sections to test to the wire chief, you may have removed the cross by your movement of the cable. If the circuit tests good to you then wiggle the cable near the stub and also twist the plug itself while the wire chief tests for the trouble. This wiggling the cable may save lots of time and effort.

WRITING SURFACE

The lamicord writing surface supplied with Switchboards BD–71 and BD–72 may become scarred and soiled excessively. A new surface can be provided by removing the 10 flat-head wood screws which secure the lamicord plate to the writing shelf and turn the plate so that the unused undersurface is exposed. The holes in the plate must be countersunk carefully for the flat-head screws as the material may chip or break. The plate may be resecured to the writing shelf by using the original screws and holes.

MORE THAN 500 officers have completed the required courses and training at the Holabird Signal Depot, the only training center for Signal Supply Officers, since its establishment in October 1943. The course lasts 12 weeks, with 4½ devoted to academic classroom training, 1 week to working in a miniature field depot, and 6½ weeks to on-the-job training. The last period consists of doing the actual work of supply in the depot's offices and warehouses.

57TH SIGNAL BATTALION

Communications for VI Corps Maintained During a 400-Mile Advance in Six Weeks

ADVANCING 400 miles in 6 weeks and maintaining unbroken communications between VI Corps and its three divisions, the latter often being as much as 50 miles distant, is the record achieved by the 57th Signal Battalion in the campaign of Southern France.

Activated in February 1941 and immediately assigned to VI Corps, the Battalion came overseas in February 1943, and was ashore at Salerno and Anzio on D-Day for each landing. St. Maxime on the Riviera was the third amphibious assault for the unit. H plus 2½ found the first wire teams ashore laying spiral-four cable for the VI Corps' three assault divisions, the 3d, 36th, and 45th.

By 2100 Hours on D-Day, 15 August 1944, when the Corps CP opened ashore, wire communication was established with the center division, and radio and radio-teletype contact had been made with the two flank divisions, still separated from Corps by pockets of German resistance.

As the campaign developed and it became apparent that the enemy was fleeing from the Rhone Valley to the escape route of the Belfort Gap, the divisions increased their speed of advance to the point where they were often 50 miles from the Corps CP and occupying as many as three CP's a day.

The 57th Signal Battalion worked at top speed to keep communications intact. During those 6 weeks message center personnel received, serviced and delivered a total of 33,084 messages, piling up 54,449 road miles with their messenger jeeps; they transmitted 258,719 radio groups, and 249,066 teletypewriter groups. For wire communication, the 2 construction companies laid 554 miles of spiral-four cable, 467 miles of field Wire W–110–B and 130 miles of long-range Wire W–143. Due to the rapid advance and the extremely critical supply of spiral-four cable, it became impractical to lay all lines. A total of 2,145 miles of French PTT open wire was taken over and rehabilitated. This open wire had been poorly maintained over the space of the 4-year German occupation which made rehabilitation doubly difficult.

To accommodate VI Corps' frequent moves, message center, radio teletype and telephone teams operating at the Corps CP were divided into two echelons, one or the other standing by at all times to jump ahead to the next CP. The construction companies placed at least two wire teams and a construction officer on detached service with each of the divisions, their job being to keep divisions in wire communication with Corps and also to build ahead for the next CP. Considering that some of these moves were often 30 or more miles and were sometimes made twice daily, the construction teams were called upon to work unusually long hours. Also on detached service with the various divisions were mobile radio teams, and carrier men equipped to provide up to four talking or three talking and four teletype circuits over the spiral-four cable laid to each division in accordance with Corps SOP.

Two factors which greatly increased the efficiency of communication were a captured German section car used by the wire teams to follow open wire leads along the railroads through isolated sections of country, and four mobile radio-teletype installations, built on 1½-ton, 6 x 6 cargo trucks by the Battalion while preparing for the Southern France invasion. One of these sets was at the Corps CP, while the other three were with the divisions to insure teletypewriter communication when wire circuits were cut by shell-fire, or were otherwise inoperative.

At the end of September 1944, the Vosges Mountains and the Moselle River, natural defensive barriers, were reached and the drive slowed down sufficiently for the Battalion to handle easily all communication demands and devote some of its time to recovering and servicing old circuits. This was done during the slow, steady push through the mountains to St. Die and Strasbourg, after which the Corps broke out into flat country again and pushed forward to cross the German border between Bitche and the Rhine River. During this last drive the Battalion continued to maintain unbroken communications with its divisions and several newly assigned units, among them the 79th, 100th, and 103d Infantry Divisions, and the 14th Armored Division.

Operations reports of the Battalion for the last 4½ months of 1944—the period covering D-Day at

St. Maxime to the German border and the Rhine—reveal the following:

Wire:

Spiral-four cable installed_____miles__	1,511
Field Wire W–110–B installed_____do____	879
Long range field Wire W-143 installed_____do____	451
PTT open wire rehabilitated_____do____	2,614

Teletypewriter and radio:

Teletypewriter groups transmitted_____	2,273,836
Radio groups transmitted_____	574,254

Message center:

Messages serviced and delivered_____	91,749
Miles traveled by messenger_____	129,867

The recovery of wire circuits resulted in a recovery percentage of 75 percent for cable, 75 percent for W–110–B and 26 percent for W–143. The small amount of W–143 recovered was due to the fact that this type of wire was used to span *shot-out* sections of open wire, hence could not be recovered when the circuits were turned over to Army and other units in the rear.

VEHICULAR MAINTENANCE

WHEN A football team slips and loses a couple of games in succession, the wise old coach will turn back for a complete rehearsal of fundamentals. Back to fundamentals also turns the commanding officer when he sees his deadlined vehicles take on a little spurt. His fundamentals in this matter are preventive maintenance measures.

If automotive equipment appears to be taking a beating over and above fair wear and tear, it is a sure sign that all personnel, officers and men, need some shaking up in preventive maintenance. A refresher course as long as 2 weeks should put those who handle vehicles back in the habit of taking proper care of them.

Drivers should review the use of W. D. Form 48 and technical manuals for the various vehicles should be gone over thoroughly. A new driver's manual, TM 21–305, should also be studied carefully.

It should be emphasized that maintenance is a command responsibility. Proper application through command channels of approved maintenance procedures prescribed by the technical services can reduce deadlined vehicles.

Some organizations in the field assign a staff officer each day as motor officer. He follows up results of daily preventive maintenance services. Vehicle checks are made before operation, at halt and after operation. The commanding officer should make spot-check inspections at frequent intervals, in accordance with W. D., O. O. Form 7353.

Responsibility for holding rolling stock down to normal wear and tear goes right to the top.

Tires, critical as ever, should come under close scrutiny. Again, the commanding officer goes back to fundamentals. Drivers must be drilled in keeping tires at normal pressures, avoiding curbs, stones and holes in the road, proper wheel alignment, and no overloading.

Proper lubrication means long gains for mechanical equipment. The right lubrication orders should be used.

Clean bearings are the very heart of proper maintenance. One speck of sand and grit can ruin a bearing. Lack of lubrication will kill bearings and the wrong kind will harm them. Bearings must be lubricated correctly, cleaned thoroughly, installed, and properly adjusted.

Drivers must be cautioned and cautioned again on maintaining proper speeds. The dash on nearly all cars and trucks carry correct maximum speed figures for the various gears. Speeding in lower gears downhill does much harm to vehicles. Throwing out the clutch while going down hill and then suddenly letting back the clutch pedal will ruin an engine, especially in the lower gears.

Drivers should memorize permissible speeds on their respective vehicles.

MILITARY PERSONNEL

FIRST ARMY AWARDS

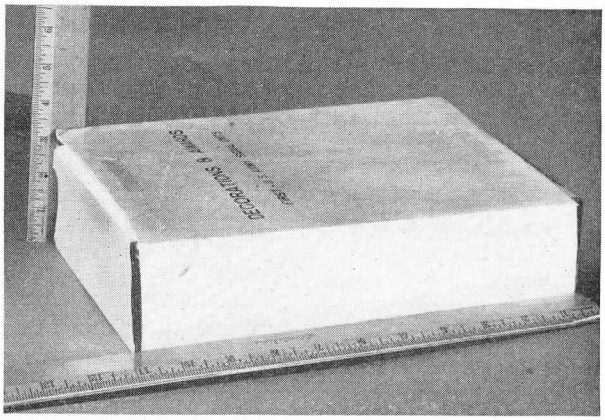
A more than 3-inch thick folder of First Army decorations and awards, ranging from Certificates of Merit to the Distinguished Service Cross, for the period from D-Day to 1 February 1945 has been received by the Chief Signal Officer from First Army Headquarters in the European Theater of Operations. Although the folder's hundreds of pages reflect the valor and accomplishments of Signal Corps units with the First Army, the record cannot be considered complete since many divisions that fought with the First Army were transferred to other armies before their awards and decorations could be compiled.

A summary of the folder reveals that 759 decorations and awards were made to the officers and men of 28 Signal Corps organizations of the First Army. The figure 759 is 9.5 percent of the total authorized strength of 7,977 for the 28 units. Enlisted men received 646 decorations and awards, or 8.5 percent of the total authorized enlisted strength of 7,573, while officers were presented with 113 awards, or 28 percent of the total authorized officer strength of 404.

Of the 28 units, the 56th Signal Battalion garnered 121 decorations and awards for the first place. However, on the basis of the percentage of awards to authorized strength the division signal companies and the 165th Signal Photo Company lead the field, exclusive of the V and VII Corps signal sections. On this percentage basis, the first 5 units were:

Unit	*Number of awards and decorations*	*Authorized strength*	*Percentage*
1st Signal Company	96	239	40
30th Signal Company	63	239	26. 3
165th Signal Photo Company	37	148	25
2d Signal Company	57	239	23. 8
9th Signal Company	46	239	19. 2

Highest ranking among the 759 awards and decorations was the Distinguished Service Cross given to a sergeant of the 165th Signal Photo Company for extraordinary heroism in action in Normandy on D-Day. The sergeant was moving forward with an assault group in an attempt to obtain photographs when his camera was knocked from his hands and smashed during a deluge of German artillery shells. Still moving forward, the squad ran into a storm of machine gunfire. At this point, the photographer-sergeant took the rifle and hand grenades of a casualty and charged the machine gun nest. As he approached the position he hurled several of his grenades at the gun and silenced it.



THIS IS THE VOLUME THAT CONTAINED FIRST ARMY SIGNAL UNIT AWARDS.

In addition to having on its roster the man who was awarded the only Distinguished Service Cross of the 759 decorations, the 165th Signal Photo Company was given the only meritorious Service Unit Plaque presented and was awarded four of the five Battle Honors won by the First Army Signal Corps units. The fifth Battle Honor went to the 82d Airborne Signal Company.

Types of awards and decorations made were as follows:

Award	*Officers*	*EM*	*Total*
Distinguished Service Cross	---	1	1
Legion of Merit	1	1	2
Silver Star	5	40	45
Soldiers Medal	---	1	1
Bronze Star	90	373	463
Bronze Star Cluster	5	2	7
Purple Heart	10	220	230
Purple Heart Cluster	1	4	5
Certificate of Merit	1	4	5
Total	113	646	759

Equipment is wearing out and sometimes lack of transportation adds to shortages. Battle damage at times can not be avoided, but wear and tear can—by more emphasis on preventive maintenance.

BATTLE PARTICIPATION AWARDS

GERMANY

1st Signal Battalion
1st Signal Center Team
2nd Signal Battalion
2nd Signal Center Team
3rd Signal Company
3rd Signal Center Team
4th Signal Battalion
4th Signal Center Liaison Team
5th Signal Center Team
6th Signal Center Liaison Team
17th Signal Operations Batalion
26th Signal Construction Battalion
27th Signal Construction Battalion
28th Signal Construction Batalion
29th Signal Construction Battalion
35th Signal Construction Battalion
36th Signal Company
38th Signal Construction Battalion
40th Signal Construction Battalion
41st Signal Construction Battalion
43rd Signal Construction Battalion
45th Signal Company
53rd Signal Radar Maint Unit
54th Signal Battalion (less Co C)
56th Signal Battalion
57th Signal Battalion
59th Signal Battalion
60th Signal Radar Maint Unit
61st Signal Radar Maint Unit
62nd Signal Radar Maint Unit
65th Signal Battalion
72nd Signal Company (Special)
79th Signal Company
97th Signal Battalion
100th Signal Company
103rd Signal Company
113th Signal Radio Intelligence Co.
114th Signal Radio Intelligence Co.
116th Signal Radio Intelligence Co.
117th Signal Radio Intelligence Co.
137th Signal Radio Intelligence Co.
163rd Signal Photo Company
165th Signal Photo Company
167th Signal Photo Company
175th Signal Repair Company
177th Signal Repair Company
178th Signal Repair Company
206th Signal Depot Company
207th Signal Depot Company
208th Signal Radar Maint Unit
209th Signal Company
214th Signal Radar Maint Unit (Type "C")
215th Signal Depot Company
215th Signal Radar Maint Unit (Type "C")
216th Signal Radar Maint Unit
217th Signal Radar Maint Unit
226th Signal Operations Company
229th Signal Radar Maint Unit
236th Signal Radar Maint Unit
238th Signal Radar Maint Unit
239th Signal Operations Company
250th Signal Operations Company
255th Signal Constr Company
257th Signal Constr Company
259th Signal Constr Company
260th Signal Radar Maint Unit (Type "C")
262nd Signal Constr Company
268th Signal Constr Company
269th Signal Constr Company
270th Signal Constr Company
278th Signal Pigeon Company
282nd Signal Pigeon Company
286th Signal Radar Maint Unit
287th Signal Radar Maint Unit
288th Signal Radar Maint Unit
296th Signal Installation Company
297th Signal Installation Company
302nd Signal Operations Battalion
303rd Signal Operations Battalion
305th Signal Operations Battalion
310th Signal Operations Battalion
535th Signal Constr Company
577th Signal Depot Company
578th Signal Depot Company
3103rd Signal Serv Battalion
3112nd Signal Service Battalion
3137th Signal Motor Messenger Co.
3138th Signal Motor Messenger Co.
3201st Signal Intelligence Det
3202nd Signal Service Section
3210th Signal Service Section
Hq/Hq Det, 3215th Signal Service Battalion
3250th Signal Service Company
3251st Signal Service Company
3252nd Signal Service Company
3254th Signal Service Company
3257th Signal Service Company
3264th Signal Service Company
3284th Signal Service Det
3285th Signal Service Det

NORMANDY

303rd Signal Company Wing
332nd Signal Company Wing
334th Signal Company Wing
395th Signal Company (Aviation)
433rd Signal Heavy Construction Battalion
438th Signal Heavy Construction Battalion
555th Signal Aircraft Warning Battalion
564th Signal Aircraft Warning Battalion
566th Signal Aircraft Warning Battalion
877th Signal Company Depot (Aviation)
895th Signal Company Depot (Aviation)
900th Signal Company Depot (Aviation)
926th Signal Battalion (Separate)
1012th Signal Company, Service Group
1028th Signal Company, Service Group
1053rd Signal Company, Service Group
1071st Signal Company, Service Group
1074th Signal Company, Service Group
1091st Signal Company, Service Group
1106th Signal Company, Service Group
1109th Signal Company, Service Group
1147th Signal Company, Service Group

NORTHERN FRANCE

990th Signal Port Service Company

MERITORIOUS SERVICE UNIT PLAQUE AWARDS

EUROPEAN THEATER OF OPERATIONS

137th Signal Radio Intelligence Company
990th Signal Port Service Company
3rd Radio Squadron Mobile (G)
438th Signal Heavy Construction Bn.
35th Signal Construction Battalion

MEDITERRANEAN THEATER OF OPERATIONS

985th Signal Service Company
3156th Signal Service Company
3154th Signal Service Company
849th Signal Intelligence Service
3356th Signal Service Bn., Plant Engineering Agency, Army Communications Serv.

AFRICAN-MIDDLE EAST THEATER OF OPERATIONS

3357th Signal Service Bn., Plant Engineering Agency, Army Communications Serv.

AMERICAN THEATER OF OPERATIONS

3359th Signal Service Bn., Plant Engineering Agency, Army Communications Serv.

INDIA-BURMA THEATER OF OPERATIONS

3362d Signal Service Bn., Plant Engineering Agency, Army Communications Serv.

ZONE OF THE INTERIOR

3364th Signal Service Bn., Plant Engineering Agency, Army Communications Serv.

9440th Technical Service Unit, Signal Corps, Signal Corps Photographic Center, Army Pictorial Service

9555th Technical Service Unit, Signal Corps, Enlisted Detachment, Storage and Issue Agency, Procurement and Distribution Service

JAPANESE SIGNALING PANEL

SEVERAL JAPANESE mechanical signaling panels have been recovered during various operations in the Pacific. The panel is used for point-to-point visual communication using light reflected from cloth surfaces.

The unit consists of a panel of cloth to which are fastened a number of reinforced cloth flaps. These flaps are black on one side and white on the other. They are arranged so that in normal position only the black side of all flaps is visible. Transmission of intelligence is accomplished by moving a slide which reverses the position of the flaps exposing their white sides, thus when the slide is moved down the unit appears as a panel of light-colored cloth and when the slide is released it appears as a dark panel. It is used in the same manner as a signal lamp.

The panel is usually about 14½ inches long and 13 inches wide with six flaps. Another unit was about twice this size, employing flaps which were red on one side and yellow on the other. Both collapse into small lightweight bundles.

This device was tested in SWPA at ranges up to 4 miles under light conditions varying from bright sunlight to dusk. Operation through smoke was also attempted.

The unit operated satisfactorily in bright sunlight over a range of 4 miles when viewed through field glasses or 1 mile using the naked eye. When working against the sun this range was decreased by approximately one-half as was the range on dull days or at dusk. Speed of transmission was up to 12 words a minute. Operating through smoke or hazy conditions was possible only when the operator was discernible.

PERMANENT TACTICAL NET

★

ON ADAK, the wire installation and maintenance section, 14th Signal Service Company, set up a *permanent tactical net.* The tactical net was considered an innovation, proved successful, and was gratifying to everybody.

Adak is a rainy, windy, snowy, mountainous island about 30 miles long and 15 to 20 miles wide. It is located about 200 miles from Kiska. On it, there were about 6 outposts and about 30 different units. The main telephone communications system was maintained according to SOP. Wires were carried through a few cables which branched from a main cable. Part of the main cable lay, of necessity, under an aircraft runway. Should the enemy bomb the runway, the main cable could be destroyed and the entire telephone communications system disrupted.

Normally, on combat islands air warnings and alerts are sounded either through the radio system or the main telephone communications system. If the radio contact is ineffective or the main telephone system is disrupted, the island may be in great danger.

The *permanent tactical net* was simply an alternate telephone communications system to be used solely for alerts, bombings, and attacks. It was set up independently of the main telephone system, and if the main system was completely destroyed or radio failed, the tactical net could still be operated to sound the warnings.

A tactical net switchboard was located at Force Headquarters. From the switchboard, a telephone line extended to each outpost and to the orderly room of each unit. These lines were, as indicated, entirely distinct from the lines of the main telephone system. The tactical net lines were not cabled except for a short distance from Force Headquarters. In the vicinity of Force Headquarters they were cabled merely to keep them from dangling. A short distance away the cable was broken, and the lines set up so that they ran as loose, individual lines to the appropriate outposts or units. The lines were strung on telephone poles or, where poles were lacking, they were laid on the surface of the ground.

At the other end of each line; that is, at the unit orderly room, was a telephone and a powerful siren, both connected to the tactical net line. Whenever radar units picked up something, they notified the Commanding General who in turn notified the tactical net switchboard where 24-hour service was maintained. The switchboard could then telephone instructions on the tactical net phones to each unit. If necessary the switchboard operator could set all the sirens in motion, or he could instruct the unit commander who could set his own unit siren in motion by throwing a switch set up for that purpose in the orderly room.

There were test stations along the course of the lines so that tests could be made in the event a wire went out. Because of the test stations and because the wires were in the open, the tactical net was easily maintained and serviced.

Some of the outposts and units were reasonably close to Force Headquarters, others 5 to 6 miles away. To service the entire island and make the tactical net SOP, about 15 men worked for 2 weeks; this established the tactical net as a permanent set-up. It was felt, however, that in an emergency the tactical net could be set up in an hour. The central consisted of 1 Switchboard BD–72 and 2 Switchboard BD–71. About 65 miles of Wire 110–B were used. In the unit orderly rooms were several Telephone EE–8. For the test stations Terminal Strip TM–184 was used.

U. S. GOVERNMENT PRINTING OFFICE: 1945

HAVE YOU SEEN THESE?

FM 21–6, 20 May 1945, "List and Index of War Department Publications."

ASF Signal Supply Catalog, SIG 1 "Introduction."

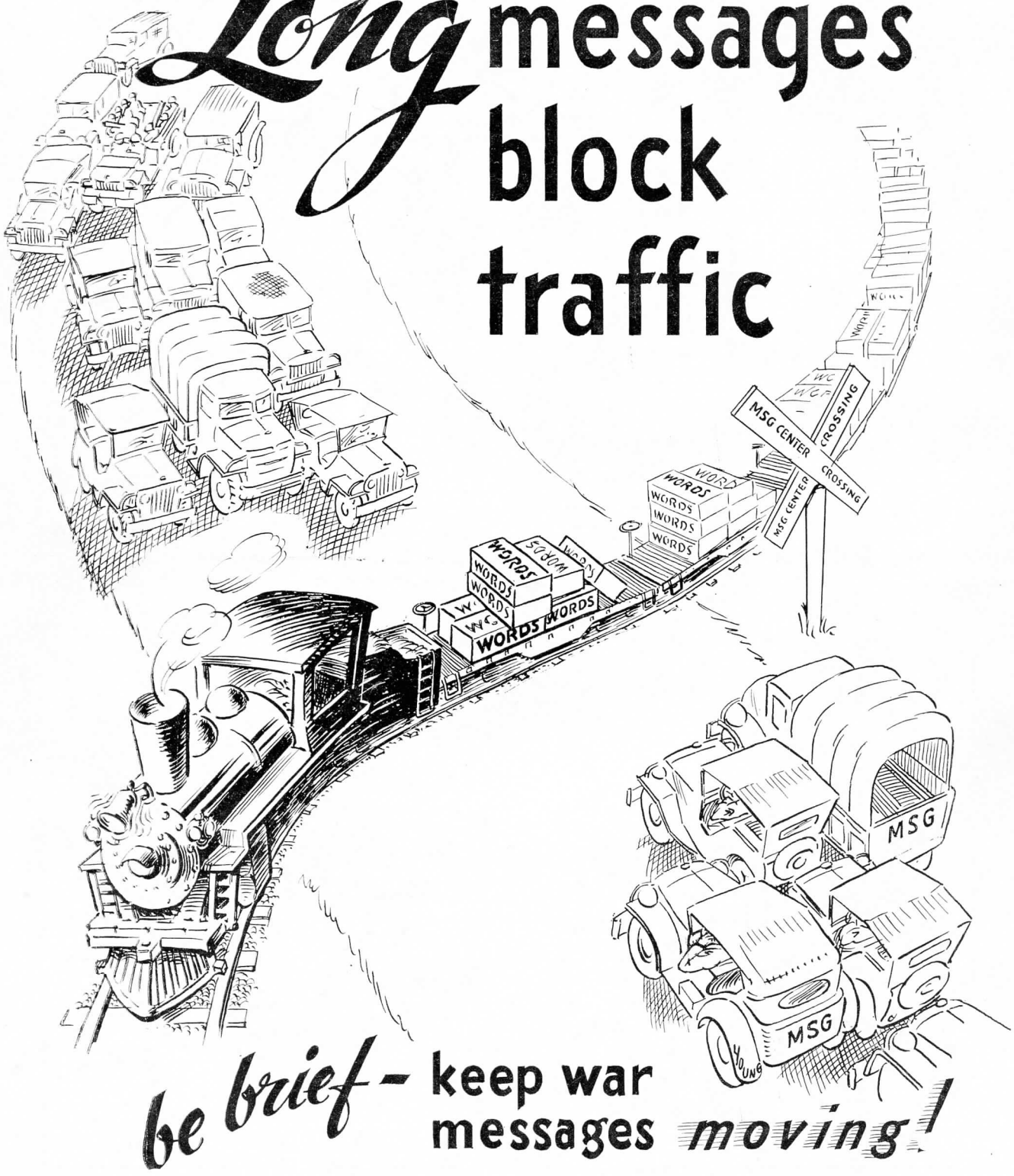
ASF Signal Supply Catalog, SIG 2, "Index."

SB 11–26, "Initial Issue and Authorized Replenishment of Signal Equipment Including Spare Parts and Expendable Supplies."

SB 11–36, "Requisitions for Items Specified on Modification Work Orders and Items Not Listed in Army Service Forces Catalog Sections SIG 7, SIG 8, and SIG 10."

TO MAINTAIN SIGNAL EQUIPMENT PROPERLY YOU MUST HAVE THE NECESSARY INFORMATION. REVIEW THE PUBLICATIONS LISTED ABOVE TO DETERMINE YOUR NEEDS. SUBMIT PUBLICATIONS REQUISITION AS PRESCRIBED BY THEATER COMMANDER. *THEN FOLLOW UP.*

Long messages block traffic



be brief – keep war messages *moving!*