Badges of Rank and Achievement

SIGNALING

BOY SCOUTS OF AMERICA

TWO PARK AVENUE
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SIGNALING

PREPARED BY

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REQUIREMENTS

To obtain a Merit Badge for Signaling, a Scout must:

1. Make an electric buzzer outfit, wireless, blinker, or other signaling device.
2. Send and receive in the International Morse Code, by buzzer or other sound device, a complete message of not less than 35 words, at a rate of not less than 35 letters per minute.
3. Demonstrate an ability to send and receive a message in the International Morse Code by wigwag and by blinker or other light signaling device at the rate of not less than 20 letters per minute.
4. Send and receive by Semaphore Code at the rate of not less than 30 letters per minute.
5. Know the proper application of the International Morse and Semaphore Codes; when, where, and how they can be used to best advantage.
6. Discuss briefly various other codes and methods of signaling which are in common use.

INTRODUCTION

This is one of a series of pamphlets known as the Merit Badge Library. The pamphlets cover all kinds of hobbies, activities, and vocations, and are prepared by experts and frequently revised and brought up-to-date.

This pamphlet does not attempt to give complete information on every requirement, so you will need to use your own initiative in digging out further information to meet some of the requirements. The pamphlet, however, does tell you how you can secure added information from books on the subject, or from your Counselors and other experts.

Your Merit Badge Counselor is appointed by your Local Council Committee on Scout Advancement. Talk with him before you begin to work on the requirements. He will get you started right. When you and your Counselor are satisfied that you are fully prepared, the Board of Review of your Local Council (or, in larger communities, the District Board of Review) then makes a final check-up—not an examination—to make sure that you have complied with all the requirements. After this, you will receive your Merit Badge at the Court of Honor ceremony. If there is no Committee on Scout Advancement in your community, an Examining Committee of at least three members supervises the Merit Badge requirements.

In meeting the requirements, do more than merely follow the requirements technically. Show that you have a real knowledge of the subject. As you know, this knowledge should be practical rather than just "book-learning," and a Scout is ready at any examination to answer questions on previous tests given him, and to show that he is putting the Scout Oath and Law into daily practice.

To increase the value of these pamphlets to you, there is vocational information in connection with many of the subjects. If you have any suggestions on the treatment of any of the Merit Badge subjects, write to the Boy Scouts of America, 2 Park Avenue, New York, N. Y.

CHAPTER I

A BRIEF HISTORY OF SIGNALING

ALTHOUGH THE HEIGHT OF THE STORM was twelve hours passed, the marsh grass of that low shore country still lay crushed to the ground by the endless buffeting of sheets of wind-driven rain. The wind velocity had dropped from the terrific force of the storm's center, but spindrift, flicked from the crowns of breakers roaring shoreward two hundred yards away, still filled the air.

Through the dunes and along what had been a highway, a small group was laboriously forcing its way through the blackness. They were the rescue unit of a local Boy Scout Troop who had volunteered to reach an outlying house, where long hours ago, before the telephone lines had collapsed, a frantic voice had sent a message of falling trees and water and broken bones.

In a few moments they were wading, wading knee-deep in a place where no water should be. Reasonable caution would have told them to stop, but out ahead, somewhere in that mad, whirling blackness that had been a highway, there was urgent need for the First Aid knowledge that was theirs and the stretcher they were bearing. They had to go on! The pencil point of their powerful flashlight was swallowed in the night as it swung to and fro over the water, attempting to fathom its torn surface. How deep is it? Can we wade it safely?

They were up to their waists when they saw the flash! Hundred of yards away a powerful torch was winking.

A long series of short flashes! And then—"STOP GO BACK DANGER AHEAD GO 200 YARDS TO THE RIGHT WATER SHALLOW THERE."

Their flash winked back its glad "R R R," the change in direction was made, and within the hour the group was back in town, their patient safely under medical care. On the other side of that wind-torn water gap, there had been a lone Boy Scout, marooned by the storm. He had seen the helpless searching of their light, and with the desperate hope that whoever it was might understand, he had sent forth his message of warning on the wings of the General Service Code. Once more, the intelligence of man had conquered nature.

* * * *

Have you ever stopped to think how all this was possible? How could a man, by merely blinking a light, send the ideas of his brain through storm and rain over a half mile of seething water, and have those ideas received and acted upon by another human being? It is a long story, as are all stories of human progress, and now after thousands of years, we are perhaps at the end of the third chapter and can't even guess at the conclusion.

Maybe it all began when some Old Stone savage sat down on a rock, tired of yelling and thoroughly exasperated because he could see his companion on the trail below him moving in the wrong direction, and there was no way of calling his attention without going all the way down again. Suddenly he banged on the tree beside him with the head of his stone axe, and the tree was hollow and gave forth a dull booming sound which rolled down the valley. He was pleased and kept it up. His friend heard and looked towards him. He beckoned and the friend changed direction. The Old Stone savage had signaled! He had made his mind conquer space, and his idea had been received. Crude perhaps, but in simple form and with simple instruments, do the fundamentals differ very greatly from radio which circles the

world in a fraction of a second? Does it differ very much from the hand signals of those of you who drive automobiles, or the swinging lantern of the railroadman, or the mysterious wiggles of a score card from within the cavern of a baseball dugout?

How Did Signals Originate?

Let's stop for a minute and look back at a few of the steps that were necessary before the magic of radio could grow out of the booming of a tree trunk drum.

The first efforts occurred before the dawn of history and we can only guess what they were. Probably they were without instruments of any kind, merely the movement of a hand or an arm, beckoning someone to approach or go to the right. These were, of course, limited in the distance over which they could be observed. Then man discovered the secret of fire, and making it do his will, and with this the whole realm of light signaling was opened. A fire suddenly bursting forth of a hillside, became a prearranged signal of danger. Man soon found that sound could be utilized, and from a hollow tree trunk, the whole technique of drum signaling evolved, just as we know it today in the African Congo or wherever primitive men still beat out a call to assembly or to eat or to war.

All these methods were limited to the range of the human eye or ear, and man had need to cover greater distances. We know that by the time Greek civilization was flourishing, man had developed a crude method of crossing that barrier. Both the Greeks and the Persians had arranged systems of signal fires over long distances by which simple messages could be sent. In 429 B.C., when the Spartan confederacy made a night attack on Salamis, we know that the warning was flashed to Athens by a long chain of beacons, each signal crew lighting its flame as soon as a flicker was seen on the other horizon. The Greek armies also discovered that the brightly polished surface of their shields blazed with a glare that could be seen for tens of miles, when the rays of the sun

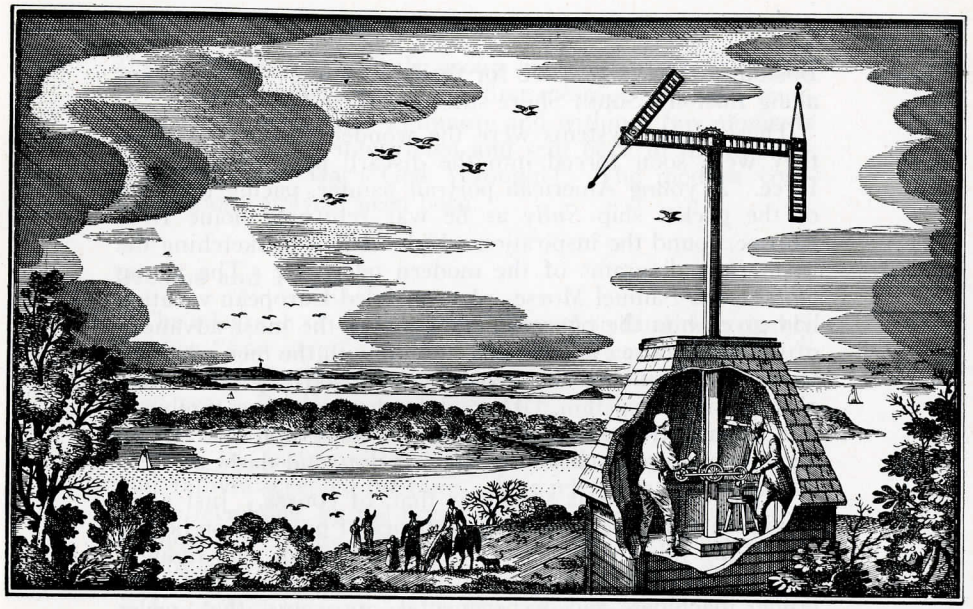
were caught at the proper angle, and thus the heliograph sprang into being. There were countless other forms—the huge mirror heliograph on the island of Capri by which the Emperor Tiberius governed Rome in the last years of his life; the unique voice telegraph of Julius Caesar where an endless relay of sentinels shouted messages for hundreds of miles.

Think of our own United States, with the elaborate smoke signal code of the Indians, the smoke caught in a blanket and sent into the air in definite puffs; their tom-toms; and the unique method with which news of the opening of the Erie Canal was sent from Buffalo to New York in eighty minutes, by a booming line of cannon spaced within hearing distance of each other.

Origin of Codes

It was not until the 18th century, shortly after the outbreak of the French Revolution, that any signal code as we know it today, was devised. Until this time, with the exception of shouting the message, everything had been done by means of a prearranged code. "One light means to attack. Two lights will mean to turn back and wait." There had been many attempts to work out a suitable code, starting as far back as the early days of Greece. Many great minds had toyed with the idea, but nothing of a practical nature was accomplished until the widespread use of the telescope again focused attention on the possibilities of visual signaling.

Three French boys, the Chappe brothers who were still in boarding school at the outbreak of the Revolution, invented the first practical semaphore system! Claude, the eldest, was in a school a mile or so distant from his brothers and they wanted some method of daily communication. Their first semaphore was no more than an upright to which was attached a movable arm, operated by means of levers from the ground. Two more arms were soon added, and before long a code had been devised with 192 different signal positions. They attracted considerable attention, and soon the government had seen the possibilities of this code. Several learned men were assigned to help them simplify their code, so that certain positions of the arms would stand for an entire phrase or a



COURTESY OF THE FIRST NATIONAL BANK OF BOSTON

Jonathan Grout's "telegraph line," a series of sixteen hand-operated semaphores perched on hilltops, carried the news of incoming ships to Boston from Martha's Vineyard in a "breath-taking" six minutes. Built in 1801, it served nobly until the arrival of telegraph and wireless

word. The government financed the erection of a test line, and in 1794 the first "telegramme" in history creaked over the "windmills" of the Chappe system from Quesnoy to Paris. One station would receive the message, and relay it to the next by duplicating the signals, until it was finally "read" at the last station. The code was more and more simplified until finally the plan of sending merely the letters of the alphabet was settled upon.

Other signal systems sprang up, in Great Britain, Denmark, Russia—and in the United States. The first record we have of such a system in this country is that of Jonathan Grout who was in charge of building a series of semaphore relays from Martha's Vineyard to Boston, so that news of the incoming ships observed in Nantucket Sound might reach

Boston in time to prepare for their unloading. Many towns along Boston's South Shore still have their Signal Hill.

These signal systems were the wonder of their day, but they were soon forced into the discard by a strange new force. A young American portrait painter, pacing the deck of the packet ship *Sully* as he was returning home from Europe, found the inspiration which set him to sketching the first crude diagrams of the modern telegraph. The young painter was Samuel Morse. An extended European vacation had given him the opportunity of seeing the most advanced of the semaphore systems, and talking with the men who had worked deepest into the mysteries of electricity which had always fascinated him. That night the two were combined into the hastily drawn diagram for the telegraph instrument, together with a tentative alphabet of dots and dashes.

It was not quite as simple as that, of course. Just as in any invention there were long centuries of preparation before him, years filled with the story of patient men who thought and struggled with ideas that just wouldn't come right, with crude machines and experimental apparatus that never seemed to work as well in practice as they did in dreams, men like Leyden who captured the infant electricity in a jar, Galvani, Volta, Joseph Henry who invented the magnetic coil, Wheatstone, Daniell and many others. They were all part of the long chain of which Morse was merely the final link. Indeed that chain could well go back to our Old Stone man and his hollow tree . . . . but we cannot even hope to touch briefly on the history of electrical invention, without which our modern communications systems would have been impossible. That fascinating story you must have for yourself.

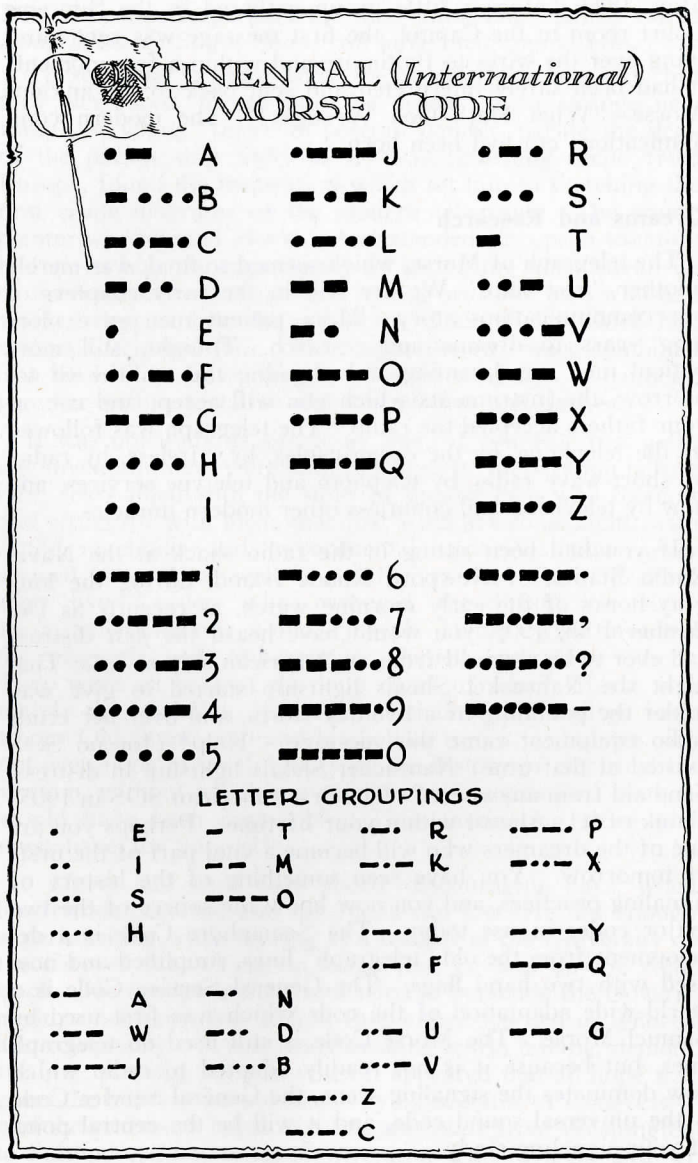
Morse had hard days ahead, discouraging days, when his friends deserted and his funds ran low. He did enough experimenting while serving as a teacher at the University of the City of New York to know that he was on the right track. He needed money, and tried to persuade the Government to help him, but at first they either scorned or ignored him completely. It was heartbreaking work, talking, demonstrating, praying, but just when it appeared that all hope was gone, the bill was passed in the dying minutes of Congress—and the real work began! A line was built from Washington to Baltimore, forty miles of wire, in a year. On the 24th of

May, 1844, before a little group gathered in the Supreme Court room in the Capitol, the first message was sent humming over the wires to Baltimore and within a few moments it had been safely interpreted and sent back to the anxious Morse—"What Hath God Wrought!" The modern communications era had been born.

Dreams and Research

The telegraph of Morse, which seemed so final, was merely another "first step." We are still in the early chapters of our communications story. More patient men gave more long years to dreams and research. Tonight, still more patient men are dreaming and planning the realities of tomorrow, the instruments which you will accept and use, as your fathers accepted the radio. The telegraph was followed by the telephone, by the ocean cables, by wireless, by radio, by short-wave radio, by telephoto and teletype services, and now by television and countless other modern miracles.

If you had been sitting in the radio shack at the Naval Radio Station of Newport, Rhode Island, during the long gray hours of the early morning watch, as recently as December 10th, 1905, you would have heard the *first* distress call ever to be received from an American ship at sea. That night the Nantucket Shoals lightship started to give way under the pounding of a five-day storm, and over her crude radio equipment came this message—"Help! (for no SOS existed at that time) Nantucket Shoals lightship in distress. Send aid from anywhere." The first American SOS in 1905! Think of it! Almost within your lifetime. Perhaps you are one of the dreamers who will become a vital part of the firsts of tomorrow. You have seen something of the history of signaling practices, and you now know the source of the two major codes in use today. The Semaphore Code is a development from the old "telegraph" lines, simplified and now used with two hand flags. The General Service Code is a world-wide adaptation of the code which was first used by Samuel Morse. The Morse Code is still used on telegraph lines, but because it is not readily adapted to radio which now dominates the signaling scene, the General Service Code is the universal sound code, and it will be the central point of your signaling study.



CHAPTER II

THE GENERAL SERVICE CODE

THE INTERNATIONAL MORSE or General Service Code is the one method of communication which is understandable by the signalmen of all nations, and which may be used effectively by every type of signaling device, by day or by night, by flag or by lantern, by sight or by sound. It should become the base of your signaling equipment.

The countless millions of words which pour through the heavens each day on the wings of code radio are transmitted through the dots and dashes of the General Service Code. The antenna of the Naval station in Washington crackles—and a message is pouring into the earphones of a naval operator on shipboard in the China Sea. A message is handed to an Army signalman in Boston—and the staccato burst of the dots and dashes are being taken off the air in San Diego. Each night the vast network of amateur radio operators springs into life—and the General Service Code becomes their language.

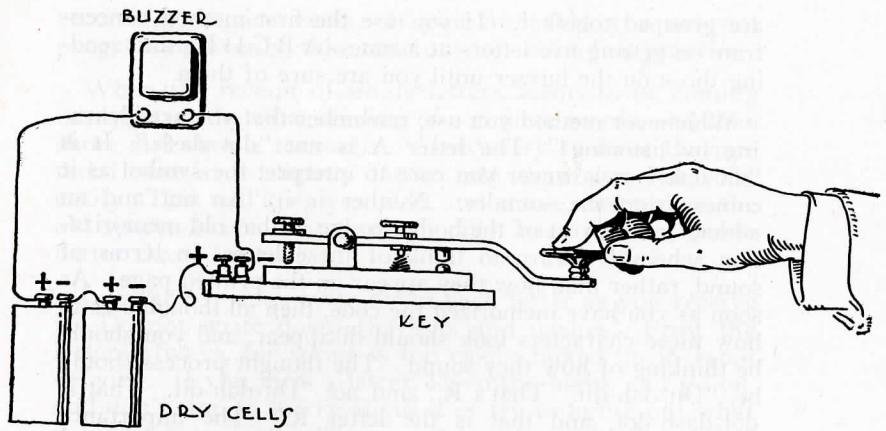
Radio and telegraphy is not all. In a clearing halfway up a green mountainside, the slow steady sweeps of a large flag in the hands of a surveying party signalman tells their base camp that the party will remain on the mountain for the night. A ship has been driven hard and fast on a treacherous shoal, but a powerful light in the hands of a group of Coast Guardsmen flashes forth its message of hope. A diver stands on the deck of a sunken submarine, and the iron bar in his hands thumps salvage instructions through the steel shell to the trapped men within. The code can be used any time, anywhere, as long as there is someone to receive, and because of this adaptability, you should first focus your attention on it. With it, there will never be a time when you cannot spring into instant action, under any conditions. There will merely be a choice of the most effective method to use at that moment. There are other codes which are adaptable

to particular situations and should be learned as part of the equipment of a Scout signaling expert; situations where additional speed over a short distance is desirable; situations where elaborate equipment is already available and can be used; situations where custom demands the use of a traditional code, but there will never be a time when the General Service Code can not be used to establish signaling contact.

Learn by Listening

The first job that you must tackle is to memorize the code. Before wireless or code radio reached its present high state of development, the beginner always learned the code as if the most important method of using it was by flag, or Wig Wag, and consequently soon found that he was badly handicapped and had a great deal to "un-learn." This is no longer true. The majority of times that you will use the General Service Code, you will be using it as the code was originally intended to be used, as a sonic or sound signaling system. The radio, field telegraph, buzzer or whistle will be the instrument. The fastest and most effective means of transmitting the code is by sound, so let's learn it that way! All other methods of sending the General Service Code are merely outgrowths of the original. Actually with radio now all about us, facilities for both practice sending and receiving by sound are easier to find than those of Wig Wag or any other method.

The first step should be the building of a simple buzzer. If you already have access to a code radio, this will serve the purpose, but from the very beginning, all practice should be done by sound. A diagram for a very simple buzzer is included in this pamphlet, and there are many other equally good and inexpensive designs which can be found in any book on elementary electricity. All you have to purchase will be sounder or buzzer and some dry cell batteries. Larger batteries which have been discarded from heavy duty work, will usually have enough juice in them to operate a small buzzer. You should buy or acquire a regulation telegraph key. A door bell button makes for sloppy work as it is hard to operate properly. Amateur radio operators many times have keys which they have discarded for one reason or another, and these can often be utilized. For your early



practice work, the set may be left open, but eventually you will find it more convenient to have it built into a simple light box.

After you have the buzzer or practice equipment, the code itself comes next. There are two methods of approach. One is to grasp the bull by the horns and sit down to two or three evenings of diligent work, memorizing in alphabetical order, and keeping at it until you have it. Or you can learn by the so-called "memorization groups," which appear in the diagram. Letters which are built in a similar manner

MEMORIZATION GROUPS

E .
I . .
S . . .
H . . . .

A . —
W . — —
J . — — — —

U . . —
F . . — .

R . — .
L . — . .
P . — — .

V . . . —

T —
M — —
O — — —

N — .
D — . .
B — . . .

G — — .
Q — — . —

K — . —
Y — . — —
X — . . —

C — . — .

Z — — . .

are grouped together. If you use the first method concentrate on getting five letters at a time—A B C D E—and sending those on the buzzer until you are sure of them.

Whichever method you use, remember that you are "learning by listening!" The letter A is not "dot dash." It is "dit-dah," or however you care to interpret the symbol as it comes from the sounder. Neither is it "An ant and an adder," or the rest of the hodge-podge in that old memorization scheme! Learn to think of these letters in terms of sound, rather than how they appear on the printed page. As soon as you have memorized the code, then all thoughts as to how these characters look should disappear, and you should be thinking of how they sound. The thought process should be, "Dit-dah-dit. That's R," and not "Dit-dah-dit. That is dot-dash-dot, and that is the letter R." The importance of this method may not be apparent at once, but as you gain skill, you will find that you are not conscious of the groups as such, but that you are thinking of the letters in terms of the code, just as you now read print.

Numerals

After you have memorized the alphabet, turn to the numerals. You will find them easy, as they follow a definite system and can be learned quickly. The numerals should be followed by the punctuation marks, and when you are sure of these, in addition to the alphabet itself, you are ready to start developing speed.

If possible you should start practice with another person, preferably a Scout who is in the same stage of code work that you are. The two of you should have your buzzers, and if you want to make the practice more interesting, a little time can be spent in hitching two unwanted earphones into your buzzer hook-up so that you will have a rudimentary field telegraph system. It is not necessary, however for the simple buzzer will serve admirably.

Send single letters at first. Send them slowly so that the listener may learn to recognize each character quickly, and without hesitation. Always remember to divide the work evenly! It is only too easy to become lop-sided, that is, having a great deal more proficiency in sending than in

receiving, or vice versa. If you find that you are not progressing evenly, take time out for individual practice.

When the receipt of single letters seems to be coming easily, start the slow sending of complete words, and then short and simple messages. Always try to have the material sent at a slightly faster rate than you can copy easily. This will keep you alert and active, and proves the old sports adage, that you can only learn from someone better than you are!

In your copying, write down each letter as you receive it. Do not write down the dots and dashes! Print the letters always, for script is too easily mixed up in rapid copying. If you miss a letter, leave the blank and go on, and don't stop to worry about it or try to figure out **what** it might have been! There will be time enough for that when the message is complete, and in the meantime the "miss" may cause you to lose several characters that you might otherwise have received.

Don't practice too long at one session, half an hour a day on a regular schedule is far better than craming too much exhausting work into one evening. You will find that in a suprisingly short time you are both sending and receiving well above the required rate of seven words a minute (approximately 35 letters).

For additional practice after you have obtained a reasonable degree of proficiency, try tuning in on the radio. Even though you do not have access to a short wave code radio, most modern commercial sets have a short wave receiving attachment by which you can tune into the lower bands which carry the code work. Find someone who is sending at a slightly faster rate than you have been used to receiving, and practice copying. It won't be long at this higher rate before you find yourself recognizing word groups, and copying them as a group, such as the words "and," "the," "right," and "left." Try to read the whole of short words before writing them down. Do the writing while listening to the first part of the next word. You will soon find that it is quite easy and far more restful, to listen and write at the same time. Good operators are usually copying several words "behind" the signals to which they are listening. There are also special

training sets being sold which are very valuable if you can find one to use. They send code automatically, at any speed you wish.

How to Use the Key

The buzzer which you have been using is equipped with a regular sending key. To use the key properly, which is the secret of high speed sending, it is necessary to have the hand, arm, and body in a comfortable, relaxed position. The feet should be flat on the floor and the key placed so that the entire forearm rests on the desk, or on the same level with the key. Grasp the key lightly but definitely with the thumb and the first two fingers of the hand. The thumb is not under the knob, rather on the side. Adjust the key so that there is an up and down motion of about one sixteenth of an inch. The elbow becomes a pivot and the entire forearm, flexing at the wrist, is used to send the characters. This allows the muscles of the arm to do most of the work, and it is less tiring than if the wrist alone were used. Allow the spring to bring the knob back into position, and don't pull it back with your thumb or your sending will be "choppy." If you feel your arm and body tightening up, sit back and rest for a moment, because your sending will become an unintelligible mess, if you continue in a nervous tense state. A talk with a local telegraph or radio operator may produce some very valuable tips on sending technique.

Correct Way to Send a Radio Message

Largely through the work of those organizations which have regular message routes such as the military services and the commercial telegraph companies, a regular message procedure has been established, with certain definite terms. Although for ordinary Scout work, you may find it convenient to shorten this plan of signaling activity, perhaps eliminating some of the phases, it is a good idea for you to know how a message is properly handled, because there are many times when you may be called on to cooperate in some emergency communications route, where this procedure will certainly be used. The general terms and the message procedure follow.

Station: One or more signalers operating as a unit (or the unit itself), on the march or stationary, and prepared to send or receive messages.

Home Station: The station to which an individual is assigned.

Sending Station: The station sending the message.

Receiving Station: The station receiving the message.

Message Number: Each message handed in at a station is given what is known as a serial number which is used as a means of identification. The number can be chosen from any convenient plan. The American Radio Relay League begins originating numbers at the first of each calendar year, or you may adopt a monthly or daily plan. In addition to identifying the message, the number also serves as a check on the number of messages sent or received to other stations. Thus if Station B received a message from Station M, Number 5, with an error in the fifth word of the body of the message, B would then send a message to M saying, "See your Number 5 repeat fifth word." Or if B found that no Number 5 message had ever been received by them, they would inform M of that fact requesting the message in which there was supposed to be an error.

Call: Each station must adopt a call letter consisting of one or two letters if no assigned call letter already exists. This call is repeated to gain the attention of the station.

Personal Signature: Each signaler may adopt a personal signature of one or two letters such as BG if his name should happen to be Bagot. This information is not always needed but may be included in more important messages.

Check: The check of the message consists in counting the number of words between the two break-signs (BT).

All words, figures and letters in the body of the message should be counted; all signatures where there are more than one, except the last signature; all words after the last or only signature; all extra words in the address (alternative names, street addresses, etc.); the words "report delivery" and "report back."

Dictionary words taken from one of the following languages, namely, English, German, French, Italian, Dutch, Portuguese, Spanish and Latin; initial letters, surnames of persons, names of countries, counties, cities, towns, villages, States or Territories, or the names of the Canadian Provinces will be counted as one word. Abbreviations will be counted the same as if written in full.

Abbreviations of weights and measures in common use will be counted each as one word. Figures, decimal points, punctuation marks, and bars of division will be counted, each separately, as one word. In groups consisting of letters and figures each letter and figure will be counted as one word. To reduce liability to error, numbers and amounts should be written in words, but the message will be accepted as written if the sender refuses to make the change. The sender's attention should be called to any punctuation marks appearing in the body of the message, and told that if he desires them transmitted they will be included in the count. In ordinal numbers the affixes st, d, nd, rd, and th, will be counted as one word.

All groups of letters, when such groups are not dictionary words or combinations of such dictionary words, will be counted at the rate of five letters or fraction of five letters to a word. When such groups are made up of combinations of dictionary words each dictionary word so used will be counted as one word.

Class of Message: Messages are usually classified to show the relative order in which they should be transmitted. Routine messages require no symbol, but the letter "O" indicates an "urgent" message, and "P" is applied to those messages which should be given priority.

Place of Origin: The city or place of origin appears here for identification purposes. Messages originating in one place may not necessarily be from a station in the

same location. Messages mailed from one city, to a station in another locality will carry in the "place of origin" the name of the city from where the originating party lives, or mails the message from, but will carry the serial number and call of the station who first handles the message by radio.

Time Filed: The time filed is the time at which the transmitting station receives the message.

Date of Origin: The date of origin is the day of the month on which the message was filed.

Address: The address may contain the name of the addressee in full, the street number, street, city and state, and any other pertinent information which will add in the delivery of the message.

Text: This consists of the body of the message. Words having unusual combinations, proper names, and other combinations of letters or figures should be repeated to insure accuracy.

Break Sign: The break sign (BT, —...—) is always sent between the address and text and again between the text and signature to indicate the beginning and ending of the text.

Ending Signal: The ending signal may include the end of message signal (AR) which always terminates each message, and if it is not the last message to be sent it may be followed by the procedure signal K to indicate to the receiving operator what to expect or to do. If it is the last message and no answer necessary, the end of communication signal (SK) may follow.

How to Handle the Message

When a message is handed in to your signal station, you should be careful to check the following items. Read the message and make sure that it is legible. See that all information as to who is sending it, the organization and

person, is included on the message blank or sheet of paper on which it is written. Enter the hour and minute at which you accept it. All these things should be done before the person leaves your station. Then give the message the proper serial number, and enter at the right of the serial number, the call letter of the station and at the right of the call letter, the personal signature of the signaler who will handle the message if you are to use it. Again, at the right of the personal signature, enter the letters "CK" (the abbreviation for "check") followed by the number of words in the message, and finally the class of the message.

If you are working as a regular "traffic" unit with regularly assigned call letters, and want to send a message, the proper method is to make the call letters of the station with whom you wish to communicate three times, and after each third repetition of that call, make the call letter of your own station. Continue this until your call is answered. If you don't know the call letters of the station, make the letter "A" three times, followed by your own call letters until you are acknowledged.

After contact has been established, send your message in the following order.

Part	Example	When Used
(1) Number	NR 5	Always
(2) Call (of originating station)	W9DOU	Always
(4) Class	O (or P)	Urgent or Priority Messages Only
(5) Check	(CK7)	Always (if official business—AARS use CK7 AARS)
(6) Place of origin (city and state)	Oak Park, Ill.	Always
(7) Time filed	635P	Usually
(8) Date of origin	Jan. 20	Always
(9) Address (name, address, City and State)	Mr. John Doe, Nine Nine Utah Ave., N. W., Washington, D. C.	Always
(10) Break sign	BT	Always
(11) Text (in plain or cipher)	The message in clear text or cipher	Always
(12) Break sign	BT	Always
(13) Signature	Joseph Roe	Always, unless signature is included in the text, then the words "NO SIG" will be substituted
(14) Ending signal	AR (followed by K, SK, etc.)	

Then stop and wait! The receiving station should count the words received to make sure that the message checks with the number given by the sender. If the check is correct, the receiving signaler sends "R," followed by the call letter of his station, and his personal signature. The sending station should then add this information to its original message blank, including the time at which it was sent, send the acknowledgment signal "R" itself, and the message is complete. The receiving signaler will also add the hour and his signature, and his part in the message transaction is also complete.

You have been told that a signal station consists of one or more signalmen operating as a unit. An ideal signal unit should have at least three men, especially if you are to transmit by wigwag. If there are three, the first or "caller," should take charge of the messages, check them and make the proper entries. He should call the words or groups to the second Scout or "sender" who does the actual message transmission. The third Scout should keep his eyes focused on the receiving station to watch for any interruptions. If you are sending your message by wire or by radio, two, or even one man will be sufficient. If there are two signalmen available, one should be assigned to the clerical work.

Conventional Signals and "Q" Code

A special set of abbreviated signals has been arranged for use when the General Service Code is transmitted sonically (that is, by sound). These signals are used frequently, and form a major time-saving device. Some of

Conventional Signals

Error	.....(Series of E's)
Wait	.—...(AS)
Received O.K.	.—.(R)
End Message	.—.—.(AR)
Invitation to Start Sending	—.—(K)
End Transmission	...—.—(SK)

them are used whenever the General Service Code is used, but another paragraph appears on page 26, to include those conventional signals used by wigwag. This is not a complete list, but it does include the more common signals. It should also be noted that Amateur Radio has developed an extensive "Q" code for their own use, as well as the general "Q" code used by all radiomen. It would be well worth while to obtain a copy of these codes.

The following are signals from the International Radiotelegraph "Q" code which are in common use, and which you will find convenient. This is not the complete "Q" code. When an abbreviation is followed by the interrogation mark, the signal is in the form of a question. If it is used alone, it is an affirmative statement. Thus if you send "QRL, ..——.." , you are asking the question "Are you busy?" If just the signal "QRL" is used, it means "I am busy. Please don't interfere."

QRJ? Do you receive me badly?	QRJ Your signals are too weak to receive.
QRL? Are you busy?	QRL I am busy. Please don't interfere.
QRQ? Shall I send faster?	QRQ Please send faster.
QRS? Shall I send more slowly?	QRS Please send more slowly.
QRT? Shall I stop sending?	QRT Please stop sending.
QRV? Are you ready?	QRV I am ready.
QRX? Shall I wait?	QRX Please stand by.
QSZ? Shall I send each word or group twice?	QSZ Please send each word or group twice.
QTB? Do you agree with my number of words?	QTB I agree with your number of words.

Abbreviations

After you have become proficient, and in situations where you are sure of the ability of the receiver, you will find that work can be speeded up still more by abbreviation. Don't try to do it, however, if there is any danger of the receiving signalman becoming "lost," and unless you can abbreviate the words intelligently. The following table gives some of the standard abbreviations, but most work of this sort, is done by the expert signalman on the

spur of the moment. It is best to work out the message and the abbreviations you are going to use on paper, before you start sending, so that you are sure they can be interpreted correctly. Don't abbreviate too many words in succession.

OK	All Right	SIG	Signature
ANR	Another	BK	Break
ANS	Answer	TU	Thank You
GA	Go Ahead	MSG	Message
GN	Good Night	FM	From
NIL / NM	No More	GM	Good Morning
OB	Official Business	C	Yes
OFM	Official Message	TFC	Traffic
OPR	Operator	WA	Words After
QK	Quick	WB	Words Before

WIGWAG

The General Service Code is also commonly transmitted by the use of a single flag. This method is called wigwag signaling, and although it is limited in use by distance and by weather and visibility conditions, it is a valuable application of the General Service Code.

The United States Army has developed several standard flag kits, each one differing in the size and number of flags which they contain. For general Scout use, the Combination Kit of two 2′ wigwag flags and staff, and two Semaphore flags complete with staff, is recommended. However, a signal kit is not at all difficult to make, and you may want to construct your own kit which will fit your own uses and local conditions.

How to Make These Flags

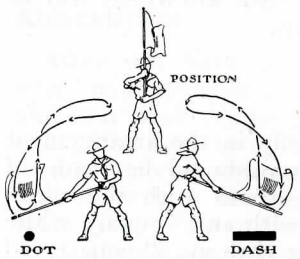
The two wigwag flags differ only in the arrangement of their color combinations. They should be made of galatea or calico, in two foot squares with the edges hemmed. One will be a red flag with an 8″ square white center, and the other a white flag with an 8″ square red

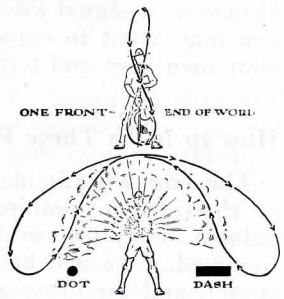
center. (A different flag is used with varying background conditions.) Each flag should have three tie strips along one edge, by which it is tied to a five and a half foot staff. This staff may be one solid piece, built as light as possible without sacrificing strength, or it can be jointed for easier packing by means of small brass ferrules which you can purchase in any hardware store.

The Semaphore flags are 18″ square, divided diagonally into two parts, one red and the other white. The red portion is the upper part of the flag on which the two or three tying loops will be sewn. The staffs for these flags should be 24″ long. A carrying case of stout canvas with a strap so that it may be slung over the shoulder, completes the kit. Eventually you may wish to add a 4 foot square wigwag flag with a 12″ center. This larger flag will be used in the greater distances where it can be seen more easily, but one flag will be sufficient. The ten foot staff which is necessary to swing it properly, makes it an awkward flag to use!

The Position

Wigwag is merely a visual application of the same General Service Code which you learned with the buzzer. The "dot" is a motion of the flag to your right, and the "dash" a motion to your left. There are really three motions and one position. The "position" is with the flag held vertically, facing directly towards the station to which you are sending. To make the dot the staff is moved to your right and down, through an arc of 90°, starting with the vertical and returning to it. The movement is made in a plane at





The "front" motion used between words and to end sentences

right angles to the line between the two stations. The dash motion is exactly the opposite.

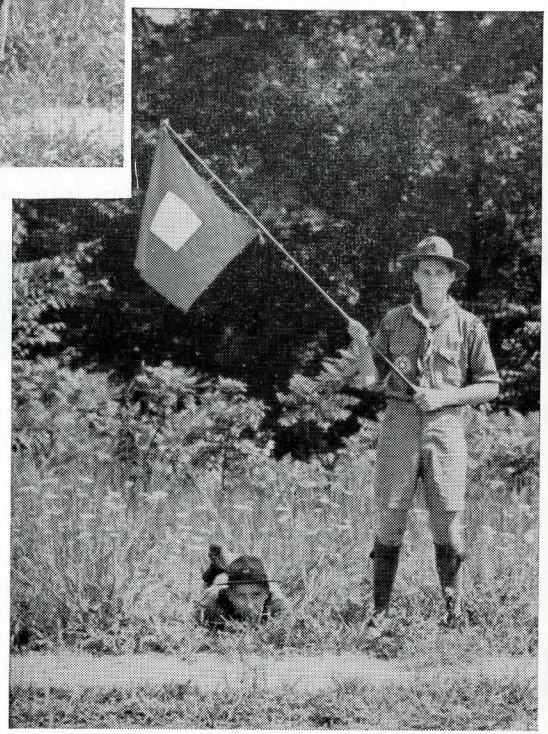
Fouling the flag, getting it twisted around the staff so that your exact motions become hard to interpret, is the chief cause of poor wigwag transmission. You can avoid this by observing the following technique. If there is a wind blowing, make your down stroke four inches *into* the wind. By doing this, you are taking advantage of the wind to blow your flag to full size and keep it flowing. Use the same looping motion if there is no wind, so that the downstroke and return are never in the same line. If the wind is blowing from side to side, sending is more difficult, but make the best of even this condition by either quartering slightly into or away from the breeze. Be careful not to get too far out of line, for the receiver needs the fullest possible view of your flag at all times.

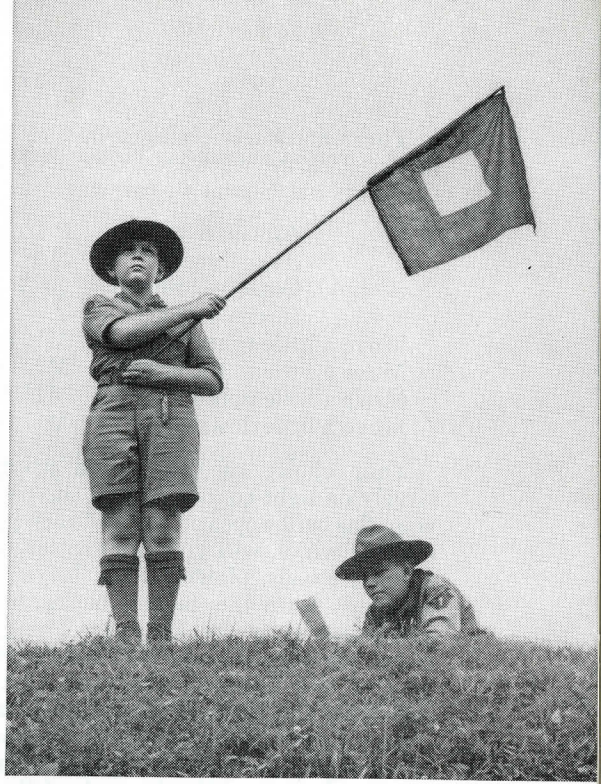
The third motion is the so called "front," which is a movement of your flag from the vertical, down directly in front of you, and back to the vertical. The same looping motion is used. One front indicates the end of a word; two fronts in succession indicate the end of a sentence, and three fronts indicate the end of a message.

WHAT'S BEHIND YOU?

Are you sure the other fellow can see your signals plainly? The dominant color of your flag and the character of your background make a great deal of difference in signaling visibility. Note the contrasts pictured here.

Against a dense, dark background you see how much more plainly the white flag stands out than the red flag. The same conditions hold true against shadowed sides of buildings and dark skies





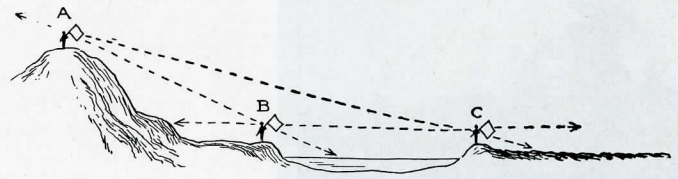
The red flag, you see here, stands out best on the horizon against a daylight sky. The red flag is also best to use when the background is snow, water or the brighter faces of rocks and of light-colored buildings

There are a few changes in the Conventional Signals to be used with wigwag. One front always follows any Conventional Signal by wigwag.

Affirmative	P front
Annulling	N Front
Cease sending	QRT front
Interrogatory	..—.. front
Move a little to the right	MR front
Move a little to the left	ML front
Move a little uphill	MU front
Move a little downhill	MD front

Your choice of flags when using wigwag will depend largely on light conditions and the background against which your flag will appear. At all times you will be trying to use the flag which will give the greatest possible contrast. Pine forests, woods, plowed fields, large rocks, and gray colored buildings form the darkest background and skyline. Snow and water form the lightest. The greater the distance between the observer and the background, the lighter the background will appear. Therefore, the less distance between the signal and the background, the sharper the contrast. The expert signalman must also understand that the appearance of the signals and the background changes with the clearness of the atmosphere, the strength of the light, and the direction in which it strikes the signal.

There is only one way to understand this and that is to go out and try it! To get the greatest contrast between a dark background and a light signal flag, the flag should be in strong light and the background in shadow. When there is any doubt regarding the nature of the background, the white flag with its greater reflecting power, is the more easily read. The diagram below may help you to visualize the theory of backgrounds.



"A" viewed from stations "B" and "C" would be silhouetted against the sky and would consequently use a dark or red edged flag.

"B" signaling to "A" would be silhouetted against bright water surface and would use dark flag.

"C" signaling to "A" would have dark ground behind and would therefore use a light flag.

"B" signaling "C" would use light flag.

"C" signaling "B" would be silhouetted against sky and would use dark flag.

Flags would vary according to light conditions. Should a dark cloud appear behind "A", he would use a light or white-edged flag signaling to both "B" and "C." A dark cloud might also cast its shadow on the water, in which case "B" would use a light flag when signaling "A."

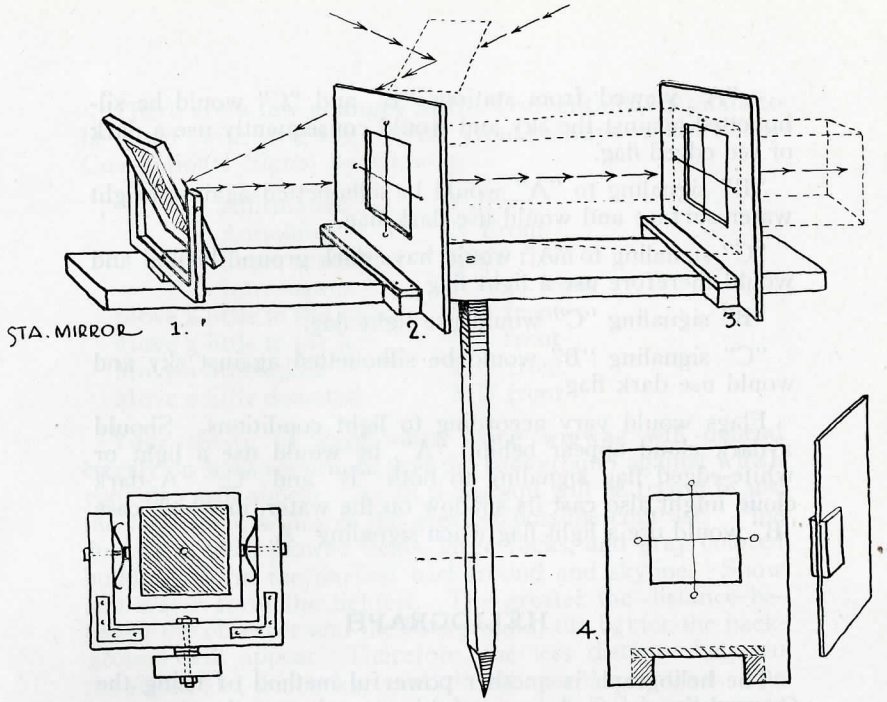
HELIOGRAPH

The heliograph is another powerful method of using the General Service Code, powerful because it uses the strongest source of light on earth, the rays of the sun. Its flashes are visible for unbelievable distances. In the rarified atmosphere of the western United States, signals have been transmitted by the heliographs of Government surveying parties for sixty to one hundred miles!

At one time or another you have fooled with the simplest form of heliograph, a small hand mirror. You caught the rays of the sun and flashed them onto the wall of a house. Do you remember how difficult it was to keep the spot in one place? That's exactly why signalmen have had to devise an instrument which can direct that spot in one direction and control it.

Making a Heliograph

Any Scout can make a simple and inexpensive heliograph out of scrap lumber. Study the illustration on page 28 and make any changes that you want in the design to take advantage of material that you may have at hand.



The upright can either be a piece of 2 x 4 or 4 x 4, sharpened at one end so that it can be driven into the ground. A piece of 2 x 4, six or seven feet long is fastened through the flat side to this upright, by a large screw, so that the horizontal piece can be turned in any direction. The "station" mirror (so called because it is permanently attached and is the final source of light) should be a good piece of plate glass mirror, four inches square. It is set in a frame made of picture moulding. This framed mirror is then mounted in a U-shaped easel, made of 1 x 1 lumber, and strengthened at the corners by small angle irons. The mirror frame can be suspended in the easel by attaching it to large size nails which have been inserted through holes drilled in the center of the upright ends of the easel.

Some spring arrangement should be worked out so that the mirror could be set rigidly at any angle. The easel is then bolted to one end of the heliograph frame, using several washers on the bolt between the 2 x 4 and the easel. The diaphragms, No. 2 and No. 3, can be made of tin, cardboard or light wood. Both of them can be made the same size,

8" by 12", with the 8-inch side at the top. The diaphragms are cut out so that they may slide along the heliograph frame. They are balanced and supported by a piece of wood to which several blocks are nailed on each side, as shown. The diaphragm is of course tacked to the wood support to allow the entire piece to slide along the frame. No. 2 has a square hole cut exactly in the center, 3 inches square, and rigged with accurate cross wires. Diaphragm No. 3 is treated in the same manner, except that the hole is 2 inches square.

The diaphragms serve to cut the beam of light to a direct flash. The cross wires are used in sighting the instrument, for in the exact center of the station mirror, you must scratch away enough silver to make a small peep hole, not more than ⅜ of an inch in diameter. By looking through this peep hole and centering the receiving station on the cross wires of the two diaphragms, your instrument will then be directly in line. A sheet of paper held over the first diaphragm will tell you when you have twisted the station mirror to the proper angle, for the dark spot formed by the peep hole should come to rest exactly on the cross wires.

In order to signal you must break the ray of the sun by the use of a shutter held beyond the No. 2 diaphragm. A sheet of cardboard, a hat, or anything that is handy will serve. A permanent shutter which will slide up and down can easily be installed. Don't try to go too rapidly! If you count three while making a dot and count six while making the dash, you will be sending at about the right speed.

If the sun is behind you when you are sending, you will need an additional mirror. One member of the signal party can hold this mirror and reflect a beam onto the station mirror. A properly equipped heliograph should have a flexible arm attachment, so that this second "sun" mirror can be clamped on to the heliograph frame when needed.

Emergency Heliograph

There are, of course, many other other heliograph designs, some far more elaborate, with adjustable tripod bases so that they may be set up on rocky terrain, but they remain the same in principle to the one described above. A crude emergency heliograph can be set up by driving two spikes into a plank in order to obtain the proper direction, holding

Heliograph signaling in the field

a hand mirror with a peep hole in one hand, and breaking the flash with the other. The sighting device is important because the flash of a heliograph is visible in only one direction. If there is any difficulty in locating the person receiving, make a systematic search of the horizon with your instrument, swinging it in broad slow circles, gradually narrowing the range until you obtain an answering signal on which to focus permanently.

You must remember that the sun will be changing position throughout the message, and if the message is a long one or if you are sending a series, your instrument will need adjustment. If you see that the sender's mirror is out of focus, turn on a steady flash until the adjustment is made. A heliograph is best operated with two signalmen, one to watch the mirrors constantly and adjust them, and one to handle the shutter and do the actual sending. The use of dark glasses is recommended to reduce eye strain in reading.

Although the heliograph is useless on a cloudy day, its comparative mobility and great range make it a valuable instrument. It is also the only method of visual signaling which cannot be intercepted, except by someone on a direct line between the two stations. The same message procedure applies to the heliograph and the same general code of Conventional Signals.

THE BLINKER

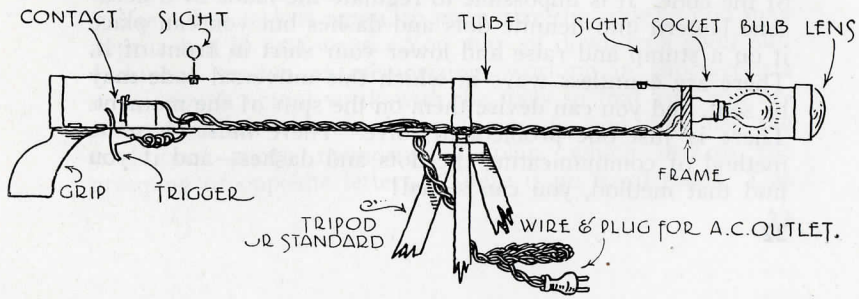
The blinker or searchlight is the standard means of sending the General Service Code at night. There are all sorts and sizes of blinkers, ranging from the flashlight that you used at camp, to the polarized blinker which the Navy developed for uses which demanded the utmost secrecy. The beam of that blinker was sent through a lens of polarized glass, and was invisible except to a person in direct line with the beam and equipped with another piece of polarized glass held at the proper angle. Such a blinker is a bit beyond your needs.

An ordinary flashlight will serve admirably. It is only when the range is great, when the receiving station is in a confused area such as a well-lighted shoreline, or when a great many messages will be transmitted by night, that you will have to devise something else.

There is no standard blinker. They vary chiefly in range and in the intensity of their flash. The blinker should be wired so that the control of the flash is through an ordinary telegraph key such as you used on your buzzer set. It should be equipped with some sort of sighting device, for although the heliograph is far more delicate as far as "aiming" is concerned, the flash of the blinker should be directed exactly on the receiving station. The powerful ship searchlights which the Navy uses as long distance blinkers, are equipped with sights and are controlled by telegraph keys which make the sending far more accurate and smoother.

If your blinker is a permanent affair, the problem is easy. A long tube for sighting, the bulb and lens inserted in the end of the tube, the wires coming to a telegraph key as a circuit breaker, the whole connected to an ordinary A. C. outlet—and you have your blinker complete.

A portable blinker is inadvisable because you will be using battery power, and unless you have an extensive hook-up of



batteries which would make your equipment too bulky, you cannot find a more effective instrument than a good flashlight.

Remember that night sending is apt to be confusing, so slow down, especially if you are operating a telegraph key. If you attempt to go too fast, your light will become merely a wavering blur with no clear cut signal.

Another method of using a powerful searchlight, one that may have no control which functions easily enough to make the dot and dash breaks, is to train the beam of light directly overhead and swing it far down the horizon to the right for a dot, return to the vertical, and swing it far down to the left for a dash. The Navy uses this method often for a group signal when it is desirable that more than one signal station receive the message. The method is limited to the most powerful lights, which cast a distinctly visible beam.

* * * *

The standard methods of using the General Service Code are divided into two groups: the *Sonic*, or those received by ear—buzzer and radio; and the *Visual*, or those received by the eye—wigwag, heliograph, and blinker. But the picture isn't complete!

Suppose you wanted to communicate between two rooms and you were locked in. There seems to be nothing that you can use except the steam pipes in the corner. Could you send your message over those pipes? With a light tap for the dot, and a heavy, slower tap for the dash, so that "L" would sound like this—"bang BANG bangbang"? Of course you could! If you are caught without signal flags, a shirt tied to a stick will serve the purpose. Or you can hold both hands over your head and drop the right for the dots and the left for the dashes. Or use just one hand, and swing it in slow half circles to the right or left. You have your whistle, and long and short blasts on it fit the requirements of the code. It is impossible to regulate the flame of a kerosene lantern into definite dots and dashes but you can place it on a stump and raise and lower your shirt in front of it. There are countless ways in which this universal code may be sent, and you can devise them on the spur of the moment. There is just one problem to solve. There must be some method of communicating the dots and dashes—and if you find that method, you can signal!

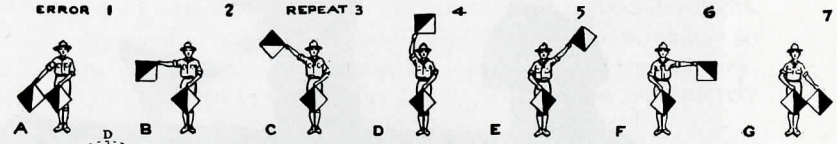
CHAPTER III

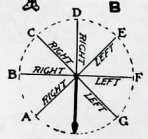
THE SEMAPHORE CODE

THE SEMAPHORE CODE, which is a development of the old land "telegraph" lines is limited to visual signaling, and over comparatively short distance. It is however the fastest method of flag signaling, and is an important companion code for wigwag. It has been a traditional code in the Coast Guard, the Army and the Navy. It was in this latter branch of the service that it reached its highest point of development because of its rapidity and simplicity in the exchange of messages between ships of the fleet when they were in close formation. The extreme range of the 18 inch flags with the naked eye, is not more than a mile under perfect conditions, but this distance may be increased by the use of a telescope or field glasses. Just as in wigwag, the visibility is dependent on the light and weather conditions and on the background. A Semaphore signalman should select his background in exactly the same manner as a wigwag background is chosen.

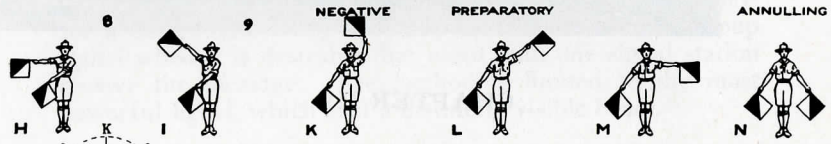
Your first task is again, to memorize the code! You may approach it in two ways. You may sit down to a good old-fashioned session of memorizing, working in short spurts with enough actual work with the flags so that you will become familiar with the letter forms, or you may use the traditional group memorization plan, which utilizes the grouping of opposite letters. There is no royal road! Use

SEMAPHORE CODE

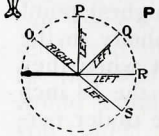




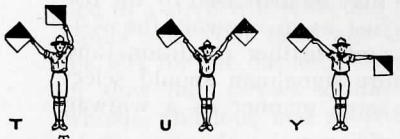
A to G are made with one flag, with the other flag held at the bottom or "interval" position. Practice them forwards and backwards, with additional practice in word combinations which can be made from them: cab, bad, bed, deaf, etc.

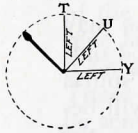


H to N, with the exception of the letter J, proceed like a clock with one flag in the lower right position. Practice these letters, reviewing A to G, and then do some work in word combinations using both groups: ham, gale, male, fade, maid, hill, etc.

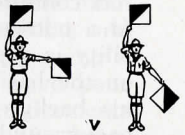


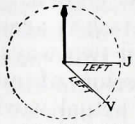
O to S are made with one flag in the 9 o'clock position, and the other moving through the circuit. Continue the same practice schedule, adding new words such as pair, quail, shore, etc.



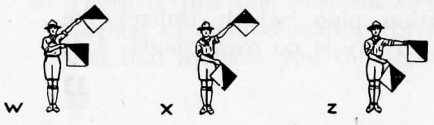


T, U, and Y are made with right hand flag in the 10:30 position and the left hand moving through the circuit

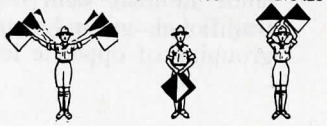




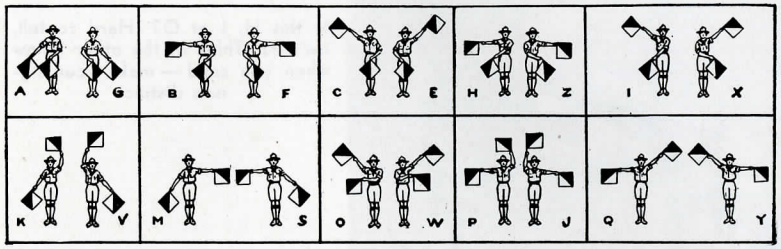
J and V require only one flag change, when placed in this grouping



W and X require but one flag change, while Z is a complete group in itself



SPECIAL SIGNS



whichever one you think fits your individual needs. The chart shows the groupings, which you may find convenient.

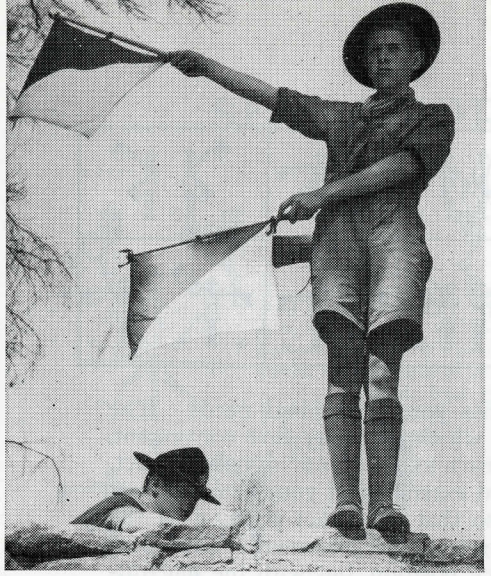
From the very beginning learn to make your signals distinct. The flag must become a rigid extension of your arm, and not allowed to move sloppily, so that the exact position of the flag is a matter of guesswork to the receiver. Your arm might be held in the 9 o'clock position, but with the flag jutting out at an additional angle, it might well be read in the 10:30 position.

Start slowly with the emphasis on distinctness. If possible, practice continually with another Scout in the same stage of development as yourself, so that your receiving ability will progress at the same rate as your ability to send. Remember—"It is much easier to Send than to Receive!" Always move crisply from one position to the next, with a definite pause when the new letter is made.

The large diagram of the complete Semaphore Code includes the conventional signs. The "interval" sign is used by Scouts to indicate the end of a word. It may be held slightly longer than a letter. Two intervals indicate the end of a sentence, and three intervals in succession, the end of a message. However, it is well for you to know that the Navy and other signal units use the so-called "chop chop" in place of the interval sign. The chop chop is made with the flags held together at either a right or left horizontal, and chopping them up and down twice. One chop chop indicates the end of the sentence, and two chop chops, after which the flags are withdrawn from view, indicate the end of the message.

Numerals

Numerals are formed by first making the numeral sign, and then using the first ten letters of the alphabet in their



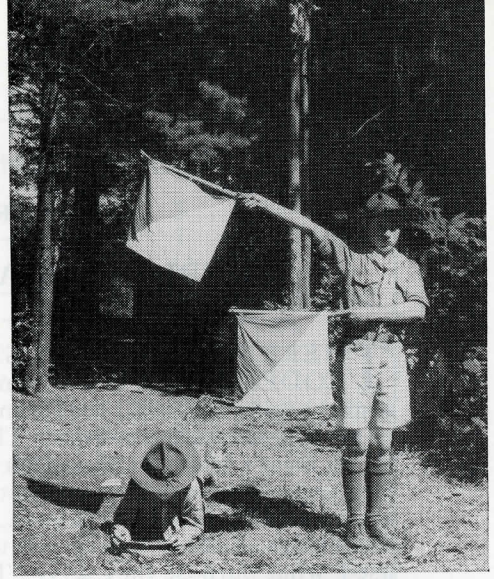
Is this H, I or O? Hard to tell, isn't it? Think of the other fellow when you send — make your signals distinct

proper order. The conventional signs are properly made when they are preceded and followed by the interval signal. Thus, if you make a mistake in the transmission of a word—stop, make the interval sign, make the letter "N", repeat the interval sign, and then repeat the word.

No punctuation marks are given in the Semaphore Code and when they are needed they must be spelled out. The Navy also requires that all numerals transmitted by their signalmen should be spelled out.

When you have developed a reasonable degree of speed and wish to increase your rate of sending, without losing the important element of accuracy—try this method. Don't remain flat-footed, but swing your body, balanced on the toes, to each side as you make the signal. You are then facing your flags, and no matter what your rate of speed, you can check them to make sure that you are in the proper position. Be careful not to become so absorbed in sending that you "lose" your receiving station and turn at a bad angle.

When you are satisfied that you have increased speed without sacrificing accuracy, and have mastered this rhythmic swaying motion, you are ready for the final "expert" step! The expert Semaphore signalman will often deviate from the regular motions. Let's explain this in a practical



This is plainly O. The Scout's left arm is being held perfectly horizontal. A little more lift on the right arm would improve the position

way! Spell the word MANILA without moving the right arm after making the first letter. Did you notice that in making the letter "I", your arms were exactly reversed from the regular position you learned as a beginner. And you saved time! Make the letter "Z". Now swing on your toes to the opposite side, without changing your arms, and you will have a perfect letter "H". Your arms may be in a different arrangement, but the letters are perfect, and you have saved several motions. Try this and discover the number of time-saving shifts and combinations which you can make.

Formal written messages are seldom transmitted by Semaphore Code, because its speed and flexibility make it more adaptable to "conversation" between stations. If a formal message is transmitted by Semaphore, the regular message procedure is followed.

There are a few Semaphore machines in use today, but their bulk and clumsiness is making them more and more obsolete. There are so many signaling methods which are easier to use, faster and more effective. The machines that are still active are exactly the same in principle as the ones that wobbled out news of incoming ships along the New England coast, a hundred years ago, a large upright with two mechanically controlled arms.

CHAPTER IV

SUPPLEMENTARY CODES

THERE HAVE BEEN A GREAT MANY SIGNAL CODES devised at one time or another to answer some specific signaling requirement, or to take advantage of an unusual local condition. The use of of these codes is by no means widespread and they are not an integral part of a signalman's equipment, but since you are to qualify as an expert Scout signalman, you should have some knowledge of these codes—what they are, where they are used, what purpose they serve. There are many situations where you may meet one of these specialized codes in use and you should be able to recognize them so that you can act intelligently.

The American Morse Code

This code still has a wide use at the present time, although limited almost entirely to the commercial telegraph lines. If you become a commercial operator on a so called "land line," this is the code which you will use. It is formed by the original set of symbols with which Morse sent the first message from Washington to Baltimore, and for many years it was the only sonic code.

When radio came into the picture, the American Morse Code was adopted by the radio technicians for use on the air, but in a short while it became evident that certain changes were necessary. There were several "land line" symbols which were too easily lost in radio reception, especially when the receiver was bothered by static. In the accompanying chart you will see that such letters as "C," "O," and "R" are made by use of a timed pause. When this signal was coming only from a telegraph sounder, all was well, but when the squawk of static broke in, the pause might be lost entirely or interpreted as the break between two letters. "C" might be received as "I E." The telegraph sounder was needed for proper

AMERICAN MORSE CODE

A . —	J — . — .	S . . .
B — . . .	K — . —	T —
C . . .	L ——	U . . —
D — . .	M — —	V . . . —
E .	N — .	W . — —
F . — .	O . .	X . — . .
G — — .	P	Y . . . .
H	Q . . — .	Z . . . .
I . .	R . . .	& . . . .

Figures

1 . — — — .	6 . . . . .
2 . . — . .	7 — — . .
3 . . . — .	8 — . . . .
4 . . . . —	9 — . . —
5 — — —	0 ——

Punctuation

(.) . . — — . .	(') . . — . . — . .
(,) . — . —	(/) . . — —
(?) — . . — .	(. . . . . — .
(:) — . — . .	) . . . .
(;)	("") . . — . — .
(-) . . . . — . .	(") . . — . — . — .
(!) — — — .	

transmission of this code, where the key pressed down briefly for the dot brought forth a "click-click," and the dash, with the key held down for twice the period needed for the dot, came forth as a "click.....click." Timing was the essential element. Radio then went to work and developed its own code which we now know as the General Service Code.

The Ardois System

This method of night signaling makes use of the General Service Code, in which the characters are made by a display of red and white incandescent lamps. The lamps

are arranged in four units, each unit consisting of a white and a red lamp. The units are usually suspended vertically from a yard arm in which case they would be read from top to bottom, or they may be placed horizontally where they would be read from right to left.

A red lamp indicates a dot, and a white lamp a dash. "A" would thus be made by lighting the red lamp of the top unit and the white lamp of the second unit.

The Ardois system requires exactly the same message procedure and symbols as wigwag. In the case of letters which are being used as Conventional Signals, the upper light is pulsated. The last ten letters of the alphabet are exceptions to this rule, for they form the numerals in this code. If their top light is pulsated, the sign is then a numeral. To make a Conventional Signal, the entire letter is flashed several times.

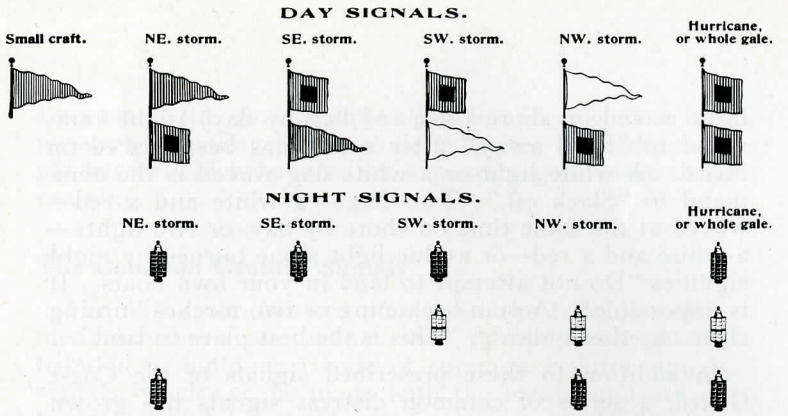
While this code is still authorized for Coast Guard, Army and Navy use, it is limited to permanent stations, because the electric requirements, the lights, and the control panel where a key must be arranged for each light, make the equipment bulky.

The International Code of Signals

Flag signaling at sea is divided into two branches. The navies of each nation have developed their own flag codes and systems. The United States Navy has such a system. These codes are so varied that you should not attempt to learn them unless you are specifically interested in marine signaling and the sea. There is, however, the International Code of Signals which was developed after a series of conferences following the World War, when it was discovered that the merchant ships of different nations had a great deal of difficulty in conversing with each other by flag. The present code is universally adopted.

There are 26 flags, one for each letter of the alphabet, and a code pennant. This code pennant is flown when a signalman wishes to convey a Conventional Signal by the use of a signal flag. Otherwise messages are spelled out by the use of the flag alphabet.

It is slow work even when done by experts, for the flags have to be attached to signal hoists and hauled to



WEATHER SIGNALS. (Shaded portions of flags and dark lanterns in first and third rows are red)

the top of the signal mast or yard. As soon as a reasonable amount of time has been given for reception (the flags are read from top to bottom) they are hauled down, and a new hoist goes up.

The Navy has a series of specially designed "call flags" and "call pennants", one of which utilizes the General Service Code translated by the use of color to the flags. There are also a series of individual flags for such signals as "affirmative" and "quarantine". These can be found completely listed in any Navy signal manual.

Weather Signals

The United States Weather Bureau has arranged a code of flag signals to be flown from their weather stations to indicate the probable weather conditions for the next 24 hours. They should always be read from the top of the signal mast downwards. At night, red and white signal lamps are substituted for the flags. If you are on the water, you will soon learn that paying strict attention to these signals is the safe and intelligent thing to do!

Conventional Life Saving and Distress Signals

The Coast Guard has adopted a series of life saving signals. Upon the discovery of a wreck at night, a red light on shore or a red rocket indicates "You are seen" and that assistance will be given as soon as possible. A red

light waved on shore (or a red flag by day) is the command to "Haul away," after a line has been placed on board. A white light or a white flag waved is the command to "Slack off." Two flags—a white and a red—waved at the same time on shore by day, or two lights—a white and a red—or a blue light alone burned by night signifies "Do not attempt to land in your own boats. It is impossible." A man beckoning or two torches burning close together indicates "This is the best place to land."

In addition to these prescribed signals of the Coast Guard, a series of common distress signals has grown from various sources in the past. There is no apparent order to these signals, and it will be well to remember that any unusual sound or light, particularly one that is repeated, is worth investigating.

1. A gun or other explosive, fired at intervals of one minute, or a gun fired in groups of three shots. (Three of anything is always a distress signal!)
2. Flames of a burning tar or oil barrel.
3. Rockets or shells throwing stars at short intervals.
4. The International Code letters N C.
5. The United States flag flown upside down.
6. Fog horn or sound apparatus sounding steadily in an unusual place.
7. The Numeral 9 on land telegraph lines.
8. The call SOS by ships at sea, and at all other times, except—when used by an Amateur Radio Relay League operator in ARRL traffic when it will become QRR.
9. The discharge of a gun, followed by a smoke bomb by day, or a red rocket by night.
10. The rapidly repeated strokes of a bell, or drum, blasts of a whistle or bugle.

The Very System

This system is also used by the military services, and is confined largely to night signals of extreme importance. The signals are made by firing red and green stars into the air by means of a special pistol which has a .12 gauge barrel. The system is based on the General Service Code with a red star representing a dot and a green star a dash. Each letter is prepared in a cartridge ready for firing.

Because of the obvious difficulties in carrying on a long message, signaling by this code is limited to sending single letters which have either a prearranged or universal meaning.

The Common Gesture Signals

The Army, the western plainsmen, the Indians, policemen, surveyors, and many other groups have all contributed to building a code of common gesture signals, signals which can be made with the hands, and are extremely useful for rapid communication at short range. Except those which have official Army approval, most of these signs exist as an unwritten code!

Move Faster: the doubled fist of the right hand, pumped vigorously up and down over the head.

Dismount or Lie Down: two hands extended in front of the body, arms bent, elbows at the sides, hands motioning downwards by moving the forearm from the elbow.

Go Back: a hand whirled over the head in a horizontal position.

Halt: a hand held up, palm out.

What Do You See?: a hand held in front of the face with the palm in and the fingers spread, and moving the hand a few inches from right to left in front of the eyes.

It Is In Sight: a staff, stick, or gun held horizontally in two hands over the head.

It Is Not In Sight: a staff, stick or gun held vertically in one hand.

You Have Nothing To Fear: both hands extended over the head and then brought down to the level of the shoulder.

Advance: an arm extended high above the head with the fist doubled, then brought down stiffly to the front at a level with the shoulder.

I Have Found It: picking up a handful of dust or other material and tossing it in the air.

Move To The Right: the right hand raised to the shoulder and pushed several times to the right. (The opposite is true for the command to move to the left.)

Stay Where You Are: both hands raised over the head and dropped several times to the side.

Assemble: a hand raised vertically to its full extent and moved in slow, horizontal circles.

Whistle Signals and Bugle Calls

The following whistle signals and bugle calls, although used chiefly by military units in drill or formation maneuvers, may also prove valuable for short range communication.

1. One long blast means "Silence," "Attention." "Look out for my next signal."

2. Two short blasts mean "All right."

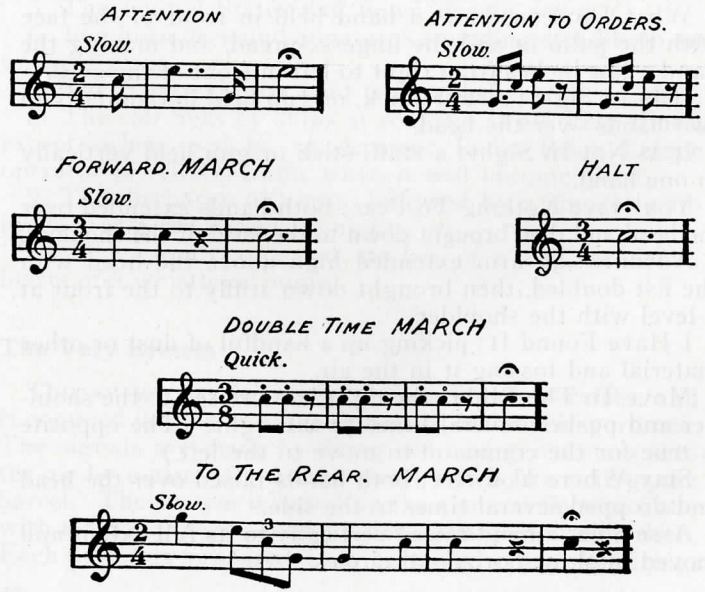
3. A succession of long, slow blasts means "Go out," "Get farther away," or "Advance," "Extend," "Scatter."

4. A succession of short, sharp blasts means "Rally," "Come together," "Close in."

5. Three short blasts followed by one long one means "Leaders, come here."

6. Three long blasts mean "Danger," "Alarm," "Look out."

7. A succession of alternating long and short blasts means "Mess call," "Grub."



FROM TELEGRAPHER TO R.C.A. HEAD

David Sarnoff

IN THE YEAR 1900, a nine-year-old boy arrived on the shores of this country with his mother and two brothers, unable even to speak the language of his new home. Today he is the president and directing genius of one of the biggest corporations in the United States, the Radio Corporation of America.

David Sarnoff was born in Uzlian, Minsk, Russia, on February 27, 1891. Six years after coming to America, he entered the employ of the newly organized Marconi Wireless Telegraph Company as an office boy, and since that time, his rise through positions of increasing responsibility and prominence has been as steady as it has been spectacular.

After his day's work as office boy was finished, young Sarnoff would sit down to the supper which he had brought with him, and then doggedly pick up a set of headphones for a long, hard evening of practice and listening and still more practice. Within a year his work was rewarded, and he began to serve as a Junior Operator. From 1907 to 1912 he moved from one operator's post to another, each one another step up the ladder.

Two experiences during these years are worthy of note. It was Sarnoff, then an operator at the Wanamaker station in New York City, who stood by his instrument for three full days and nights without sleep, occupying continually, handling all the traffic coming from the *Titanic* disaster. Many writers have made it appear that it was Sarnoff who heard the first SOS and directed all the communications with the rescuing ships. This is not so, but he did get the first full list of survivors, and the first information as to what actually happened to the *Titanic,* when other stations were unable to copy because of interference, or because they were not David Sarnoff!

In 1911, when serving as operator on the sealer *Beothic* in the Arctic ice fields, Sarnoff became a part to another radio "first." In a casual chat (now illegal!) with the Canadian Marconi operator at Belle Isle, he learned that the Junior Operator was ill and that there was no medical assistance available. Sarnoff relayed information to the *Beothic's* doctor, and when an operation became imperative, persuaded the *Beothic's* captain to turn off his course and bring aid to the isolated radio station. This was the first of the thousands of Medico Service messages which are now so common.

Soon, however, it became apparent that Sarnoff's ability was needed elsewhere, and in 1914 he was removed from a position as an actual operator to become contract manager for the Marconi Company. In 1917 he was elevated to Commercial Manager, and a year later was serving in the same position with the new Radio Corporation of America. In 1921, he became General Manager. 1929 found him as Executive Vice President, and in 1930 RCA called him to the presidency, which position he has held ever since. In 24 years' service in radio, David Sarnoff had risen from office boy to the presidency of one of the most complex corporations in the United States, a place in domestic and world affairs which brought grave responsibilities.

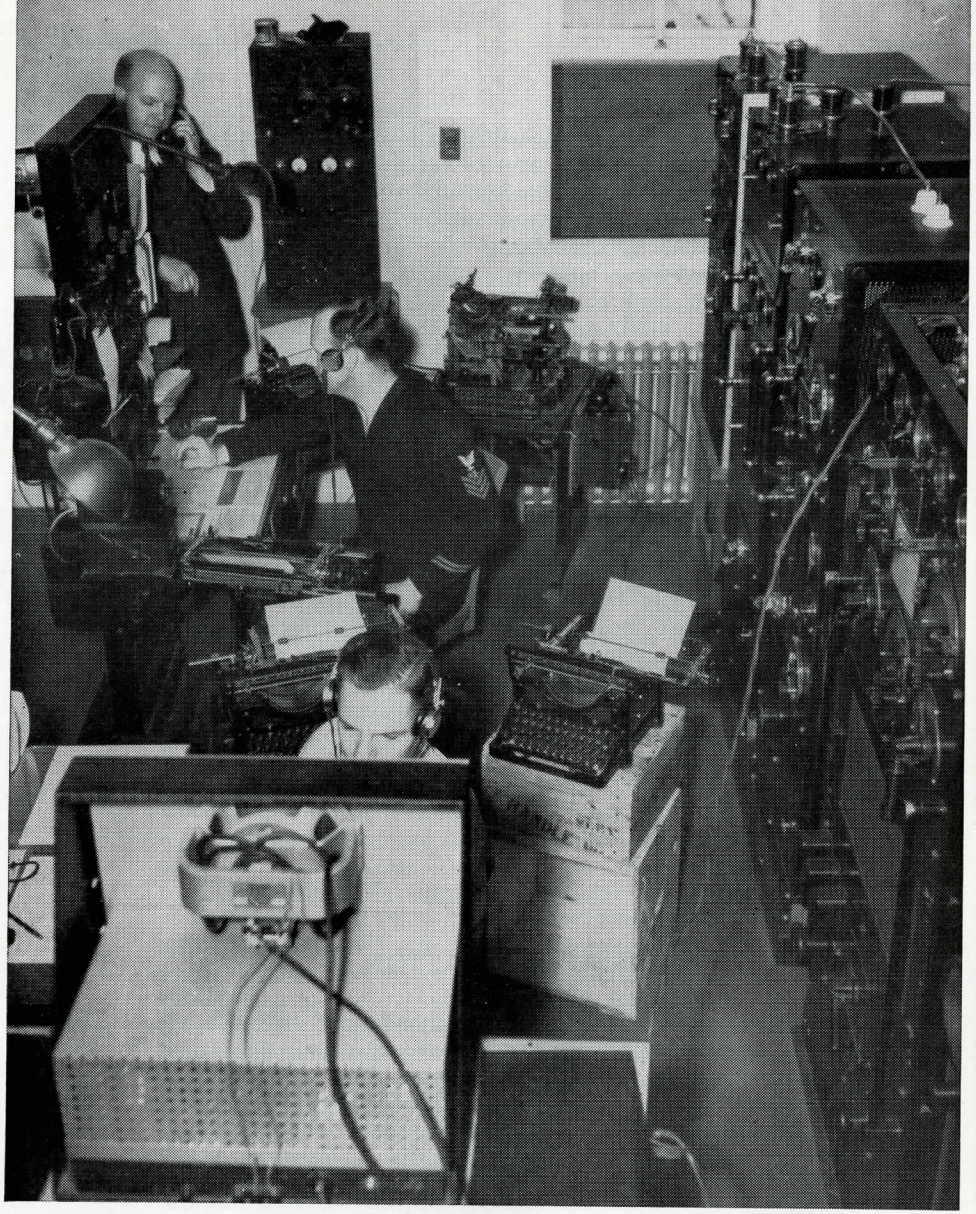
Perhaps these snatches, gleaned from the tributes on famous men at the celebration of his thirtieth year in radio, will serve to show what the world now thinks of the immigrant boy whose name, and that of Guglielmo Marconi, will always mean Radio.

"Few runners in Life's handicap have ever entered the race with more burdens and fewer advantages than he. He had, however, that background of poverty without which few can hope to succeed in this land of short memories and brief regrets. And with it he had indomitable perseverance, honesty, untiring industry, boundless ambition and a racial heritage of great business ability." . . . "His handling of the wireless key while he was on duty on land and on sea will always be remembered by operators of that era. Today he is a director of the world's most potent binding force." . . . "I am delighted at that tribute to a man who has devoted thirty years unexampled work and ability to the building up of this great art. It is elusive, incomprehensible; it is one of the mysterious things of the world, and although I have studied this art for thirty years, I am bound to say that all I do not know about it, David Sarnoff does. . . ." "Energetic, thorough and resourceful, he was even at this early date showing the power which later developed into his rarest accomplishment, that of being able to express himself tersely and clearly. From the first he exhibited the rare faculty of alert preparedness. This faculty pushed him in the forefront of wireless. He was always caught up with it. Wireless never caught up with him."

IN APPRECIATION

We take this means of saying "thank you" to the many sincere friends of Scouting who have contributed of their time and talent to make this booklet possible. Among them are William Brimelow, Raymond Flood, Clarence Greene, F. E. Handy, Hall L. Hardy, Major John W. S. Hoppough, Earl C. McKinstry, R. G. Smith, Ralph A. Sherwin, Major Frank Stoner, Glen S. Waterman, H. W. Yahnel, and Lee Galvin.

The author of this pamphlet who, as a Scout, earned his Eagle Rank, has since served as Assistant Scoutmaster.



PICTURES, INC.

Any Coast Guard communications room is a scene of intense activity when trouble rules at sea. Here are a communications officer and two operators at work

SIGNALING AS A VOCATION

Signaling as such does not offer you a great deal in the way of possibilities for a life work. It has yielded to the inevitable in recent years, and as each scientific advance removes more and more technicians from the field, radio becomes the increasingly dominant force.

The various Government services are practically the only outlet for flag signaling ability, or the various specialized applications of the General Service Code. The services are the United States Army, Navy, Coast Guard or Coast and Geodetic Survey, but even in these fields the signaling ability has to be combined with something else necessitating additional training. These services operate Signal Schools which applicants enter through the usual recruiting routine.

The place of the actual telegrapher, the man at the key, in the commercial telegraph companies is rapidly becoming less important. These men have been supplanted by teletype machines. As an illustration, recent years have seen additional technical improvements eliminating many positions in the great routing offices. Messages are now taken from one trunk line and switched to another automatically, whereas formerly they had to pass through human hands. The use of the old telegraph key and sounder is limited to the railroad lines, and to special events such as a prize fight or baseball games where the instrument is more compact and more easily transported.

Radio offers the greatest possibilities for future work as an operator. There are certainly more positions available, and radio as an industry is still growing. But the competition is keen! Mr. F. E. Handy, Communications Manager of the American Radio Relay League has this to say: "The highest paid operating jobs appear to be those with the airways and a knowledge of continental code is necessary and desirable, as well as good health and physique and a college education if possible!"

Certainly the thing to do is to follow your study of signaling technique through to its logical conclusion—a study of Radio. It is the greatest modern application of signaling and offers by far the greater vocational possibilities.

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