THE SIGNAL CORPS BULLETIN

WAR DEPARTMENT
OFFICE CHIEF SIGNAL OFFICER
WASHINGTON

L CORPS BULLETIN NO. 24. FEBRUARY 1, 1924.

RADIOGRAM

Form No. SC 1164	R E C E I V E D	To: The Signal Corps	
SIGNAL CORPS U. S. ARMY		Place : Everywhere	
MESSAGE		From: Chief, Signals	
Received at War Dept Message Center Room 3433 Munitions Bldg		Place: Washington, D. C.	
		Date January 1, 1924	Time Filed 12:00 M.

On taking charge of this office at the beginning of this new year, I wish to take this means of sending this message to the Signal Corps.

The Corps enters 1924 with most excellent personnel, with a remarkable record of past achievement, with a high morale and a clear, well defined mission.

Our mission is to provide signal communication for the Army. Some of our personnel is occupied in designing and developing equipment, some in procuring or issuing it, some in operating it, and some in teaching others to use it, but all are involved in carrying out the mission of providing the most excellent signal communication for the Army.

The success of the Signal Corps for 1924 depends on how you carry out your part of the mission.

If you carry out your part of this mission to the complete satisfaction of the officer or non-commissioned officer immediately over you, the success of the Signal Corps for this year is assured.

SALTZMAN,
Chief Signal Officer.

MAJOR GENERAL GEORGE O. SQUIER RETIRES.

To those of us who for the last few years have been intimately associated with and have followed the leadership of General Squier, his request for retirement was something of a surprise; his years of service in the Signal Corps from the lowest commissioned rank to the pinnacle of seven years as Major General, the Chief Signal Officer of the Army, and in the later years, the senior Major General of the Active Service, had unconsciously created in our minds an indefinite atmosphere of permanence and of continuity; we thought of the man as a soldier; his scientific ability and accomplishments were of course known to all of us; we rejoiced with him in his various honors and recognitions from nations, scientific societies, and individuals, but always there was a proprietary feeling existing, unexpressed, perhaps, but nevertheless a vivid permanent back-ground, General Squier of the Signal Corps, and in that relationship, we revelled in a sort of reflected glory.

As a soldier, a scientist, a man, he has left the imprint of his personality, his individuality upon the Corps and the Army, and while laying down the authority and sceptre of "The Chief", he retains the respect, loyalty and regard of the entire personnel of the Service.

The bogey of retirement has no terrors for him. In the prime of life, with his physical and mental capabilities at their zenith, the future cannot be but the realization and fruition of his efforts with us. His activities are transferred from the comparatively narrow sphere of the Army to the broad forums of the entire world, in which we wish him Health, Long Life and Success in all that he may attempt.

THE NEW CHIEF SIGNAL OFFICER OF THE U.S.A.

The announcement of the appointment of Colonel Charles McK. Saltzman as Chief Signal Officer of the Army with the rank of Major General was accepted and acclaimed by the entire personnel of the Signal Corps, as a fitting and currently just tribute to his ability as a soldier and a leader of men.

The new Chief Signal Officer was appointed a captain in the Signal Corps in 1901, and later assigned to duty in the Philippines as Signal Officer on the staff of Major General Wood.

Returning to the United States in 1905, he was assigned to the Army Signal School, Fort Leavenworth, Kansas, as senior instructor. From 1908 to 1913 he was in charge of the Electrical Division of the Signal Corps in the War Department, in charge of the important development and procurement work of the Corps.

In 1915 General Saltzman was ordered to Panama, as Signal Officer and rendered conspicuous service as Officer in Charge of the installation of the Radio, Telegraph & Telephone Systems of the Canal Zone.

Prior to the outbreak of the late war, he was recalled to Washington and made executive officer in the Office of the Chief Signal Officer of the Army. The stupendous expansion of the Signal Corps and its then subsidiary branch - the Air Service - required the services of an Executive Officer who could combine vision and foresight with the practical requirements of the Corps. General Saltzman met all the requirements in a manner that denoted him an executive and administrator of the highest order. In recognition of his conspicuous and meritorious services, he was awarded the Distinguished Service Medal in 1919.

Throughout his exceptionally brilliant years of service, General Saltzman has always placed loyalty to the Signal Corps and to the Army above any thoughts of personal aggrandizement. The officers and men of the Signal Corps render tribute to the quality of the man, the ability of the soldier, as exemplified in our new "Chief", and we pledge the loyalty and support of all ranks in the accomplishment of General Saltzman's ideal - a loyal, efficient and progressive Signal Corps.

PROCUREMENT PLANNING IN THE SIGNAL CORPS.

It has been proposed to include under the above heading a series of articles on various phases of planning for procurement to be contributed by persons well acquainted with the Signal Corps problem. The initial article most appropriately comes from the Chief Signal Officer of the Army.

PROCUREMENT PLANNING

"For many years prior to the World War, the Procurement activities of the Supply Branches of the Army had been devoted to the purchase of a small quantity of supplies for the maintenance of a small Army. Annual appropriations and the personnel available for procurement duties were small and only adequate for current routine operations. The branches had repeatedly asked Congress for increased appropriations with which to lay by reserve supplies and for increased personnel which could have prepared industrial plans for war but these requests were not granted. As a result, the Supply Branches entered the war in 1917 with practically no reserve supplies, plans or procurement personnel.

"The outbreak of the war placed stupendous responsibilities on the five Supply Branches then existing. Their small organizations had to be immediately expanded many hundredfolds to enable them to commence procurement operations on an immense scale. In the cases of at least two branches their expenditures in the next eighteen months were to involve billons of dollars - a bigger task than that of the U.S. Steel Corporation, Standard Oil, and several other big companies combined and the most remarkable condition was that this gigantic task had to be done by a suddenly formed organization of strangers unacquainted with government procedure.

"At the beginning, there was a lack of control over Procurement. Although the General Staff had exercised a wise control over the issue and distribution of supplies, little supervision had been exercised over the procurement of supplies, which is the most difficult feature of Supply. This lack of control in the earliest stages of the war resulted in the five Supply Branches, then existing, acting each on its own initiative to fulfill its particular mission regardless of its neighbor. Lack of control did not require team work.

"The Supply Branches deserve the greatest credit for their wonderful achievements under the conditions confronting them in 1917, but three of the existing conditions, i.e., lack of trained personnel, lack of plans, and lack of control greatly handicapped their operations at the beginning of the war when time was very precious.

-2-

"After the War, Congress gave serious consideration to the lessons learned during the emergency and as a result enacted the provisions concerning procurement in the National Defense Act of 1920 which will do much in a future emergency toward obviating or mitigating difficulties encountered in 1917. The first provision designated the Assistant Secretary of War as the head or chief of the Supply Branches in all matters pertaining to procurement. This provision enables the Chiefs of Supply Branches to report direct to one common head and authorizes that head to maneuver the seven Supply Branches as a team pulling together. The second provision directed the Assistant Secretary of War to have plans made in time of peace for the industrial operations of the Army in time of war.

"In connection with the supply of the Army for any emergency, it is the function of the General Staff, G-4, to provide answers to the following questions:

What do we want?
When?
Where?

This data having been given to the Assistant Secretary of War, it becomes the function of the Supply Branches

(a) To have trained personnel to purchase the supplies.
(b) To purchase the supplies.
(c) To deliver the supplies at the proper place and time.

"The Supply Branches are now actively making peace time plans to meet these problems in time of emergency. It is realized that no plans made in time of peace will be 100% perfect in time of a future war, but it is also realized that if these plans are even 40% perfect, they will save great delay, immense sums of money and contribute greatly to the success of the campaign.

"To make these plans as valuable as possible, three fundamental points must be borne in mind -

(a) To build up in the various procurement districts, organizations of reserve officers who are "business men" conversant with the production, purchase, inspection, etc. of supplies.

(b) To make the plans general and simple. If the plans are worked out in great detail with many blank forms and multitudinous computations, they will be quite useless in the excitement on "D" day.

(c) To make plans for the production or purchase of any commodity after consulting the industry that produces that commodity. It will be their job in time of war and they know best how it can be accomplished.

-3-

"The success achieved in making these industrial war plans will largely determine the size of the income taxes after the war."

C. McK. SALTZMAN,
Major General, U.S. Army,
Chief Signal Officer.

MONTHLY REPORT OF ACTIVITIES OF PLANNING AGENCIES.

Narrative reports of the activities of the planning agencies of the three Signal Corps Procurement Districts, New York, Chicago, and San Francisco, are now compiled into a monthly digest for distribution to other agencies for the use of the Assistant Secretary of War and the various supply branches, etc., etc. The first "Activities" compilation was prepared for the month of November 1923.

DETAIL FOR COMMAND & GENERAL STAFF SCHOOL, LEAVENWORTH, KANSAS.

The following Signal Corps officers have been tentatively selected to attend the Command and General Staff School, Leavenworth, Kansas, beginning September, 1924: -

Major Francis G. Delano, Signal Corps.
Major Ray M. Coles, Signal Corps.
Major George L. Van Deusen, Signal Corps.
Major Spencer B. Akin, Signal Corps.
Major Charles N. Sawyer, Signal Corps.

ANNUAL REPORT OF THE COMMANDING GENERAL, EIGHTH CORPS AREA.

The following extracts from the annual report for the Fiscal Year 1923 of the Commanding General, Eighth Corps Area, are furnished for your information:

"Due to the efforts of the chiefs of supply branches at these headquarters and the Depot Supply Officers, Eighth Corps General Area Depot, the supply of troops has been very satisfactory; each post, camp and station having had available at all times adequate stockages to promptly meet the requirements of the troops.

"This Depot (Eighth Corps General Area) in all of its supply sections is functioning very satisfactorily; requisitions are given careful and immediate attention and supplies promptly dispatched to destination. The method of storage applied at this depot is excellent; indicative of the great care exerted by those responsible therefor."

By order of the Secretary of War:

(Signed) H. H. TEBBETTS,
Adjutant General.

PROGRESS IN THE NEW
WASHINGTON-ALASKA MILITARY CABLE & TELEGRAPH SYSTEM

The United States Army cableship "Dellwood" is now being fitted out in Seattle for the trip to England to procure the new cable for the Washington-Alaska Military Cable & Telegraph System. She will sail about January 22, 1924, by way of the Panama Canal and should arrive at the Siemens Brothers plant at Woolwich on the Thames, about 12 miles below London, on or about, March 2, 1924.

Major Alfred E. Larabee is now in Seattle and he, with 1st Lieutenant H. F. Hubbell, Signal Corps, will be on board throughout the trip during the subsequent laying of the cable.

Colonel George S. Gibbs will sail from New York about February 1, 1924, for England to supervise the procurement of terminal apparatus and to be present on the arrival of, and during the loading of the cableship "Dellwood," after which he will return with the ship and remain on board during the cable laying operations.

Some new and rather unusual decisions have been made on the routing of the cable system after the original procurement of same in London was consummated. Upon the return of Colonel Gibbs from England and his subsequent arrival in Seattle, the following determinations had to be made in preparation for laying the cable which included:

(a) The final routing of the cable sections that would best handle the traffic.

(b) Determination of routes that, from an engineering standpoint, would result in a lasting and dependable cable.

(c) Determination of the kind of terminal apparatus best adapted for the particular circuit lay out of the system.

(d) What the cableship "Dellwood" needed to fit her to undertake the long and arduous task of steaming 41,000 miles and laying 2000 miles of cable before next October or November.

Instead of routing the cable via Sitka, as originally planned, decision was made to lay the cable to Ketchikan via Boorrelli Bay to the head of Trocadero Bay, thence, by a portage of 7 miles, to the head of Twelve Mile Arm, forming the head of Kasaan Bay, and through the Kasaan Bay into Ketchikan. From Ketchikan, the route above will double back to Boorrelli Bay, and thence, direct to Seward. The basis of this decision can be readily understood when it is observed that the first Alaskan terminus will be at Ketchikan, which is now the largest and busiest city in Alaska and located directly on the interior cable line of [illegible], which reaches Juneau, the

capital of Alaska, as well as Orangell, Petersburg, Haines, and Skagway. Heretofore, when messages were sent via Sitka, they merely reached a relay point, which was 200 miles by branch cable from the nearest station Petersburg, on the above mentioned interior line. Petersburg, when reached, is still over 100 miles, in two directions, from Juneau and Ketchikan where the volume of the telegraphic business is filed and delivered. In the original plan, replacements of the two mentioned lengths, Seattle to Sitka, Sitka to Valdez, and replacing the additional length, Seward to Valdez, was contemplated. It soon became apparent that if this plan was adhered to, the whole interior system would be dependent upon old cable. It was then decided to lay the cable from Seattle to Ketchikan and Ketchikan to Seward. It was then necessary to make an extensive and complicated change in the amount of various types of cable in order to adequately cover the changed routing. Fortunately, the manufacture of the cable in England had not proceeded to a point where it was impossible to change the order. The necessary changes have been made successfully and without any serious hitch or jar, to either the manufacturing or engineering program, and the change will result in an arrangement of circuits in the cable system that will increase its traffic capacity tremendously.

Notes in Changes in Signal Corps Personnel.

Announcement has been made of the promotion of 1st Lt. Edward F. French, S.C., OCSO., to captain, with rank from Nov. 27, 1923.

Major Gen. George O. Squier, Chief Signal Officer, upon his own application, was retired from active service to take effect Dec. 31, 1923, under provisions of Act of Congress approved June 30, 1882, after more than forty years' service.

Leave of absence for 1 month and 20 days has been granted Lt. Col. Allan L. Briggs, S.C., with permission to leave the continental limits of the United States.

1st Lt. Don McNeal, S.C., is relieved from duty in OCSO., Washington, and will sail about March 20, 1924, from New York City, for San Francisco; to sail April 8, 1924, for Hawaii.

1st Lt. John J. Downing, S.C., has been assigned to duty at Camp Vail, N.J., effective upon completion of his present tour of foreign service in the Hawaiian Department.

1st Lt. Floyd T. Gillespie, 29th Inf., Ft. Benning, Ga., was relieved from that regiment & was detailed in the S.C. effective Jan. 1, 1924. Report to C.O., Ft. Benning, for duty as post signal officer.

1st Lt. Riley V. Carter, S.C., Ft. Benning, Ga., will proceed to Ft. Sam Houston, Texas, reporting to C.O., 8th V.A., for duty with the S.C.

2nd Lt. Hayden P. Roberts, S.C., has been relieved from duty at Fort Bragg, N.C., effective Jan. 24, 1924, and will proceed to Camp Vail, N.J., reporting to C.O. for duty.

1st Lt. Duncan Hodges, S.C. (CAC) has been relieved from duty with the 1st Signal Co., Camp Vail. He will report to C.O., Camp Vail, for duty.

2nd Lt. Henry J. Hunt, Jr., S.C. (Inf.) has been relieved from duty at Camp Vail and will report to C.O. for duty with the 1st Signal Co.

1st Lt. John R. Thornton has been relieved from duty at Fort Bliss, Texas, and will report as Instructor, N.C. National Guard, at Raleigh, N.C.

2nd Lt. Waldemar F. Breidstar, S.C., was relieved from duty at Hq. 3rd Corps Area, Baltimore, Md., Jan. 8, 1924, and has proceeded to Ft. Dustis, Va., for duty in connection with Signal Corps activities.

Major Alfred D. Lordbee, S.C., was relieved from duty in OCSO., and is stationed at Seattle, Wash., for duty in connection with replacing of the worn-out portions of the Washington-Alaska submarine cable system under instructions of the Chief Signal Officer of the Army.

1st Lt. Harold F. Mitchell, S.C., was relieved from the 3rd Sig. Co., Camp Lewis, Wash., and has proceeded to Seattle, Wash., and reported to the O.I.C., Wash-Alaska Military Cable & Telegraph System, for duty.

1st Lt. Arthur E. Nicholsen, S.C., is assigned to duty at Camp Alfred Vail, N.J., effective upon completion of his present tour of foreign service, and will join that station in accordance with orders to be issued by the C.G. Panama Canal Department.

1st Lt. Carter B. Clarke, S.C., is relieved from duty with the general area depot, 8th Corps Area, Ft. Sam Houston, Texas, and will report to C.O., 2nd Div. for duty with the S.C.

Appointment of Col. Charles McK. Saltzman, S.C., as Chief Signal Officer, with rank of major general for period of four years beginning January 9, 1924, with rank from Jan. 1, 1924, is announced.

Capt. James C. Van Ingen, S.C., is relieved from temporary duty at McCook Field, Dayton, Ohio, and will proceed to Scott Field, Ill., for station and report to C.O. for duty in connection with Signal Corps activities thereat.

Capt. John A. Pierce, S.C., is relieved from duty at Fort Bliss, Texas, and will proceed to Albuquerque, N. Mex., for duty with the Organized Reserves of the 8th Corps Area.

Col. George S. Gibbs, S.C., has been relieved from duty in office of Assistant Secretary of War, and has reported to the Chief Signal Officer for duty in his office, in connection with the Washington-Alaska Military Cable & Telegraph System.

Capt. Frank W. Brown, S.C., has resigned, effective Jan. 31, 1924, and the resignation has been accepted by the President.

Office of the Officer in Charge,
Washington-Alaska Military Cable And Telegraph System
3113 Arcade Building
Seattle, Washington

January 15, 1924.

Subject: Rescue of Private 1st Class Edgar B. Murphy, R-3474954, Service Company No. 1, Signal Corps, U. S. A.

To: The Officer in Charge, Second Section, W.A.M.C.A.T. System, Valdez, Alaska.

1. The undersigned takes great pleasure in commending in the highest terms the conduct of the relief party organized to find Pvt. 1st Class Edgar B. Murphy, Signal Corps. This party composed of Pvt. 1st Class John H. Baker, R-1976784, and Pvt. 1st Class Clark A. Carey, R-861840, both of Service Company No. 1, Signal Corps, and civilians De Hart and Sitts, left Valdez at 4 P.M., December 21, on snow shoes, and arrived at Wortman at 4 A.M., December 22, there they were joined by Corporal Ralph Mitchell, R-1081355, and Pvt. Leo J. Borzinskie, R-2004774, both of Service Company No. 1, Signal Corps. The party started for the Summit of Thompsons Pass where Pvt. Murphy's tracks in the snow had been last seen, and from which point he had last reported.

2. Pvt. Murphy was found near Icy Point, about three miles distant from Wortman, in an exhausted condition, partially snow-blind, without snowshoes, with two of his fingers and a toe frozen, after having been lost for forty-seven hours, and without food or drink for fifty-two hours. The weather was stormy with the thermometer hovering around zero. It is certain that had the rescue been delayed but a few hours Pvt. Murphy could not have survived.

3. It is with pride that the service of these men is hereby made of record, and I desire to thank them individually and collectively for their strenuous efforts in saving the life of Pvt. Murphy, and in conducting him in safety to Valdez, where proper medical attendance could be administered.

J. D. L. Hartman,
Colonel, Signal Corps.

The Application of Meteorological Information to Problems of the Ordnance and Artillery
As presented in lecture in the Office Chief Signal Officer
by
1st Lieut. Don McNeal, Signal Corps.

- - - - - - - - -

It shall be my purpose at this time to endeavor to tell somethings of the application of meteorological information to the problems of the Ordnance and Artillery. To state fundamentally that artillery must be accurate is merely repeating an axiomatic truth. Nevertheless, the reasons for accuracy are so paramount that they will bear mention.

Cost:

Before the war a 14 inch gun cost $50,000. The cost of firing one round was about $1000. With the transportation and increased cost of production added it would cost about $3000 to fire this gun one round in France.

Transportation:

Every gun, projectile and powder can takes up room in a freight car, boat and motor truck. Every wasted round means double the space for one projectile and the necessary powder.

Accuracy Life:

The life of a gun is limited, due to the high temperatures incident to firing. Due to increase in accuracy now demanded of all pieces a 14 inch gun, after firing 250 rounds, can no longer be used.

Manufacture:

It requires skilled labor in special factories to convert the raw product into a finished piece of ordnance. Sixty-five expert watch-makers are used in the manufacture of a clock fuse, which, in order to fulfil its purpose, must be in a projectile that hits.

Protection:

Accuracy is the best concealment of a battery. Fewer shots mean fewer flashes and less chance of being observed.

Time:

Accurate fire executed in the shortest possible time conserves energy of aviators, observers and other personnel, and decreases the enemy's chances of getting away before the damage is done.

Morale:

Success inspires confidence. It improves the morale of infantry and artillery and commands respect from the enemy. And so if we can, in any way, assist toward the realization of the advantages of accuracy, and we believe positively that we can, then meteorology finds a place in the work of the Ordnance and Artillery.

To begin with each gun must be subjected to a variety of tests and its count ascertained for behavior with different angles of

evation, different powder charge, different form of projectile, different weight of projectile and different atmospheric conditions. It is of course this latter factor, the atmospheric conditions, with which the Meteorological Section of the Signal Corps is concerned and through which it establishes a very vital contact with the two branches of the Army just named.

It is, as you all know, the function of the Ordnance Department to assign values to these various constants and, since the condition of the atmosphere exercises such a large control in exterior ballistics, their work could be but incomplete and inconclusive without adequate means of determining the condition of the air as regards, temperature, density, wind direction and wind velocity throughout the trajectory of the projectiles and guns to be studied. For this purpose then the Signal Corps has established and operates a very efficient two-theodolite meteorological station at the Ordnance proving ground at Aberdeen, Md.

Perhaps there is no better way of illustrating the effect of the air on the projectile than to point out the difference between the trajectory in a vacuum and in air. A projectile starting from rest in vacuo with no force other than the initial force acting upon it would continue indefinitely along the line of departure. But in vacuo another force, that of gravity, is acting. Experiments have determined that a freely falling body will fall in any time a distance equal to $\frac{1}{2} gt^2$, g being the normal acceleration of gravity and t the time. The projectile in question would therefore fall away from the line of departure 16 ft. the first second, 64 ft. the first two seconds, ft. the first three seconds, etc., and the path of the projectile departs from the straight line and becomes a parabola such as we may illustrate:

The general problem of the trajectory in vacuo and the evaluation of its equation may be briefly stated. Assume a gun fired in vacuo with a muzzle velocity of V and an angle of departure of ϕ. Let V_x and V_y be the components of the velocity in the x and y directions respectively. $V_x = V\cos\phi$ and $V_y = V\sin\phi - gt$. Now since the distance traveled after a time t will equal the product of the velocity and time, the distance traveled in the x and y direction after time t will be:

$$X = V t \cos\phi$$
$$Y = V t \sin\phi - \tfrac{1}{2} g t^2 \qquad A$$

Dividing one equation by the other and substituting $\frac{X}{V\cos\phi}$ for t we obtain the general equation for the trajectory which is $\frac{Y}{X} = \tan\phi - \frac{gx}{2V^2\cos^2\phi}$. This being an equation of the second degree is of the general form of a parabola. Without going further into the process of substitution and evaluating the maximum ordinate, the range, time of flight, it is sufficient for the purpose in hand to point out the outstanding

features of such trajectory. It will be noticed that this trajectory is symmetrical in all respects to the maximum ordinate, i.e. the time consumed in the ascending branch is exactly the same as that in the descending branch; the angle of fall is the same as the angle of departure; the velocity of fall is the same as the muzzle velocity; and in all cases the horizontal component of the velocity is the same for equal time intervals before and after reaching the summit.

The trajectory in air is quite different. Here we find there is no longer that symmetry of parts. The ascending branch is longer than the descending branch; there is a marked loss in velocity as successive points distant from the muzzle are considered; the angle of fall is greater than the angle of departure and the velocity of fall is less than the muzzle velocity.

Now these same departures will be found no matter what factors other than air are considered. What is to say this same difference in trajectory will be found no matter what powder charge is used; what form of projectile; what weight of projectile; what angle of departure or any other variable within our control we may change. So it is the presence of the air which creates the problem and it is indeed a factor no good artilleryman will lose sight of and disregard.

We have said that the meteorological elements which most directly enter into a problem of exterior ballistics are temperature, density, and the wind.

It is true that from the formula temperature exercises an indirect effect through the density, but there is another and very interesting way in which this element influences the flight of the projectile. This may be termed the elasticity effect. Now we find that in any fluid (and air is of course a fluid) if we were able to displace any portion without involving a change of pressure there would be no force acting tending to restore this portion to its original position. This is merely equivalent to saying that such vibrations as are observed in a violin string, elastic band, or swaying branch cannot be induced among the particles of the air by the mere structure of the air itself. However, a quantity of air at uniform temperature will not be in equilibrium if different free portions are at different pressures, but if time permit, motion will take place in the nature of expansions and contractions until the pressure is uniform throughout, before final stability is secured. But a change of volume is accompanied by a change in temperature, and if the difference in temperature is sustained for a sufficient length of time, heat will flow from the hotter to the colder portions. Thus there are elastic forces tending to keep the pressure constant throughout, and compressional or so-called longitudinal waves are possible in the air. Within certain ranges of frequency, trains of air waves are intercepted by the senses as sound. Any disturbance at a point in uniform air, starts a spherical compressional wave and if the disturbance is vibratory in nature, a train of waves will be generated. A wave once started will travel in widening spheres without requiring fresh access of energy just as may be noticed in the lateral waves on the surface of a calm pond when a stone is thrown into the water. To start a wave requires energy, the energy being then carried along by the wave with slight dissipation in the form of heat. Any mechanical action which continually generates waves will be continually expending energy. The projectile in its motion through the air keeps up a wave formation requiring energy which is expended out of the kinetic energy possessed by the projectile and therefore the projectile is continually being retarded on this account.

The spherical wave undulations or intervals set radially in all directions from the origin of disturbance. An individual wave of this sort does not move its particles with respect to the medium, but any particular portion of the wave front is built outward at uniform velocity, through the air. This velocity is called the velocity of sound. The velocity of sound is not a constant but depends upon the temperature of the air although for a given temperature, it is largely independent of the pressure and hence of the density. The velocity of sound varies as the square root of the absolute temperature.

Now in the case where a projectile is moving faster than the velocity of sound there will be no projection of waves outward and in front and consequently no subtraction from the kinetic energy of the projectile. All the retardation will be found to be chiefly traceable to the viscosity of the air and to skin friction, which latter is much reduced by the design of the modern shell to stream line form. On the other hand when the projectile is moving slower than the velocity of sound, there is the additional expenditure of energy in the propagation of the sound waves and the two forms of retardation just mentioned. While it is to be noted that in so far as the temperature of the air affects the velocity of compressional waves in air, it will operate to influence the air resistance to projectiles. This effect is small, but nevertheless interesting and is one of the latest additions to exterior ballistic factors.

For the ability of a projectile to penetrate the air, conveniently referred to as the ballistic coefficient, may be expressed $C = \frac{W}{i d^2}$. The reciprocal of this value, or the retardation, will $= id^2$, introduce for use a consideration of air density which is a second meteorological element which to some extent influences the flight of projectiles. The experimental values of retardation were all determined for a standard density of the air which is considered as existing with 780 m.m. pressure, 15°C. temperature, and 78% saturation. The general formula for the retardation then becomes $R = i\delta d^2$ in which δ = percentage of standard density.

The Meteorological Station determines this percentage at Aberdeen Proving Ground through the use of temperature aloft, taken by the use of airplanes at altitude intervals of 500 or 1000 ft, as indicated by the altimeter on the instrument board. This altimeter, being an aneroid barometer with the dial in feet of altitude instead of millimeters or inches of mercury, provides a convenient means of arriving at the pressure aloft. Solving the equation $\delta = \frac{0.0012930b}{760} \cdot \frac{(b-.378e)}{1+0.003670t}$ we find that the factor e is the only one for which we have no direct observation. This humidity factor is extremely small and it is sufficiently accurate to take the curves representing the decrease of vapor pressure aloft, as determined by observation for the various seasons, as representative of current conditions. This enables us to arrive at values of density at the various altitudes and for different zones of the maximum ordinate.

For proof firing this comparative laborious method is satisfactory because the results are not required until the data [illegible] are ready for study, which may be several days after the [illegible] tion has been made. Such methods obviously would not be satisfactory for field use by the artilleryman because he must know the atmospheric conditions before firing in order that he may apply the necessary corrections in laying the gun. Accordingly a somewhat simplified method has been devised for this purpose. The essence of this method is that use is made of the usual decrease in density aloft as determined by numerous computations made from direct observations at Drexel, Nebraska and at Mt. Weather observatory. In other words we have a sufficiently large amount of this work done so that if we know the surface density is, say, 2% above normal that at any selected altitude there will be a definite departure in one direction or the other from the values of the standard structure. This matter has been reduced to the form of tables whereby it is only necessary to know the surface density and the ballistic density for any given maximum ordinate of firing is read off. This value is given in percentage of the standard and is so incorporated in the meteorological message to the artillery. This latter method is employed at our stations at Ft. Eustis, Ft. Bragg, Ft. Sill and Camp Lewis and would very probably be used for all field use in time of war.

The final remaining meteorological element that supplies one of the controls in ballistics is the wind. And while this to us has perhaps grown to appear the most obvious, yet it is only within recent years that it has been applied at all correctly. Prior to the issuance of the new range tables as they have appeared in the last 2 or 3 years, it had been customary to correct for the range wind effect by changing the value of the ballistic coefficient. There was introduced into the formula for finding this corrected coefficient a term f_w which involved assumption as to the increase of wind with altitude. Present day development in upper air work has shown such assumptions to be of doubtful value. Briefly stated these assumptions were that the direction did not change with altitude but that the velocity would be twice as great at 1000 feet altitude as at the surface. To quote from the Journal U.S. Artillery of 1905 we find; Captain Hamilton, C.A.C., saying: "That the wind velocity at the ground is merely a guide to the mean velocity in the trajectory in an established fact. Prof. Greenhall states that as a rule about double the wind at the surface should be allowed for. This is of course traceable to friction experienced by the air near the ground and is dependent upon the conformation of the terrain. This rule would probably obtain for a flat seacost or, as the guns occupy in general a high point, it could probably obtain generally, where the maximum ordinate was 1000 ft. or more."

And again in 1909 we find this same publication with an article by the same officer in which he proposes a slightly different formula for the correction to the ballistic coefficient and yet which includes this same wind assumption.

But today we can point out the folly of such assumptions use we are equipped to measure wind speed and wind direction at all altitudes required. We could find almost any number of observations showing not only marked changes in wind direction with altitude but equally as great and quite frequent changes in wind speed. While it is true that a large percentage of the time the velocity increases with altitude it is not true that we can accept any such factor as 2 for each increase of 1000 feet. Indeed it is not at all uncommon to find marked decreases in speed with increase in altitude. As a matter of fact such projections may, under certain conditions, be forecasted with reasonable assurance of verification.

And so with our present day equipment and methods the Signal Corps is able to give to the Ordnance and to the Artillery very accurate determinations of wind speed and direction so that they need no longer depend upon estimates or forecasts. This of course, as you all know, is accomplished by use of small pilot balloons, inflated with hydrogen and followed by observation with a theodolite. The immediate result gives a horizontal projection of the path of the balloon as it ascends thru the air, and from this true wind speed and direction are obtained. But this is not yet available for the Ordnance or Artillery. True winds are used by the Air Service but we must go farther and reduce this to a ballistic wind before it is available to the two branches of the service above. This ballistic wind we mean a fictitious or average wind, expressed both in direction and speed, that would produce the same effect upon the projectile as the sum total of all the true winds throughout the various zones acting separately. Obviously to accomplish this we must know the relative times spent by the projectile in traversing the various zones. When this is known we have the weighting factors necessary to reduce the several true winds to one ballistic wind. Briefly stated the method of arriving at this reduced value is to first divide the maximum ordinate into convenient zones. From the percentage of the maximum ordinate represented by each such zone the proper weighting factors are determined. The true wind for each zone is now determined from the horizontal projection and successive vectors laid off, starting from any given point, each parallel to the true wind of the zone which it represents and in length governed by the velocity of the true wind and the weighting factor. After all vectors are plotted, the polygon is completed and the resultant is the ballistic wind. For field use all of our Army artillery meteorological stations this value is inserted into the meteorological message giving both its direction and velocity.

Ballistic winds are computed for a number of standard ordinates and in the form of the message may be used either resolving the value into its components, parallel to and perpendicular to the line of fire by use of the wind component chart which is now incorporated into all range tables. At the moving ground, however, the meteorological station is provided with the azimuth of the line of fire and the polygon plotted from this line so that the resultant when drawn automatically shows the two components. This latter method of course would not be practicable on the battle front as often use there would be so many varying lines of fire sent it would be impossible to compute and transmit the message in such time.

Now we have spoken of what we might call the fundamental meteorological problems of interest to the Artillery of the Line. But after all the diversity of activity [illegible] provides a ready application for almost all forms of meteorological information. In my experience at Aberdeen Proving Ground as chief of the meteorological station there we were providing not only basic data as to temperature, ballistic density and ballistic wind, but we were observing both heavier-than-air and lighter-than-air activities; we were protecting quartermaster supplies by warnings of unsafe storage temperatures, etc.; we were consulted by the Utilities Department in the distribution of working parties over the reservation; the disposition of gun crews and the particular firing programs to be conducted was selected almost wholly upon early morning forecasts issued by the meteorological station. No program of firing was ever started without Signal Corps balloons being in the air for the conduct of wind aloft observations. Indeed, so vital has accurate meteorological information become to Ordnance and Artillery work that I believe if the Meteorological Section for any reason ceased to function there the proving ground would cease to operate as such until other adequate meteorological service was organized.

PREPARATION OF LEASES AND LICENSES.

The following correspondence will be of interest to all Signal Officers:

June 11, 1923.

Subject: Preparation of leases and licenses.

To: The Adjutant General of the Army.

1. Under date of October 31, 1921, AG file 680.4, subject, same as above, attention of this office was invited to the fact that leases for Government telegraph lines and revocable licenses for telephone pay station leases had been prepared in this office contrary to Section 9, National Defense Act, as amended June 4, 1920, which charges the Quartermaster General's office with the duty of issuing licenses in connection with Government reservations.

2. The last paragraph of Section 9, National Defense Act, reads as follows:

> "Provided, further that utilities pertaining to any branch of the Army may be operated by such branches."

As the administration of telephone communication systems is a function coming directly under the jurisdiction of the Chief Signal Officer of the Army, the preparation and issuance of such licenses incident to the use of any surplus lines of communication, or other equipment used in the furnishing of communication service, should be handled in its entirety by the Chief Signal Officer of the Army.

3. The American Telephone & Telegraph Company and its subsidiary [illegible] connecting companies have expressed the desirability of conducting all telephone business through one representative of the Army and this principle the Chief Signal Officer is thoroughly in accord. The interpretation which has been put upon Section 9 of the National Defense Act precludes any such possibility of transacting telephone business of the Army without the intervention of a third bureau of the War Department and has more or less confused Commercial companies as to the division of responsibility.

4. At the present time it is necessary for this office to refer all matters pertaining to the licensing for use of a pair of wires: installations by commercial companies of pay stations on Government reservations, rights of way under railroads and similar transactions, to the Quartermaster Corps. This office is thoroughly in sympathy with the policy that all leases or contracts pertaining to real estate power are functions placed with the Quartermaster General and that from every angle he is vitally interested therein. This office, however, sees no difference in the procedure of renting a pair of wires, or other apparatus to the telephone company on account that of renting a similar pair of wires, or other equipment, from the telephone company.

5. Therefore, it is strongly recommended that the administration of telephone service to the Army, which is a utility complete within itself, be confined exclusively to the Signal Corps for the following reasons:

a. It is the belief of this office that the latter paragraph of Section 9, of the National Defense Act, as amended June 4, 1920, substantiates this procedure.

b. Additional work and loss of time incurred by reference through a second bureau, entirely unfamiliar with telephone and telegraph procedure and practice, would be largely eliminated.

c. The commercial companies would understand thoroughly that all telephone and telegraph matters should be handled with one agency and that they would look to that agency for all instructions, orders, and contracts other than those pertaining to real estate.

d. Under the present procedure this office is unable to carry out all the terms of contracts which have been drawn by the Chief Signal Officer and approved by the Secretary of War until such contracts have been referred to the Quartermaster General.

e. The annual appropriation Act specifically charges the Chief Signal Officer with the administration of communication service for the Army.

C.A. SEOANE,
Lieut. Colonel, Signal Corps,
Acting Chief Signal Officer of the Army.

9th Ind.
War Dept., O.Q.M.G., Wash., D.C., December 6, 1923 - To Chief Signal Officer of the Army.

1. In order to clarify the situation with reference to contract covering the installation of pay stations upon Government Reservations, circuits in cables or on aerial lines or attachment on poles belonging to telephone companies, the securing of pin space or attachment privileges or rights of way along the lines of telephone companies or railways and rights of way for telephone calls over or under tracks of railroad companies, the Chief Signal Officer or such officer under him as he may designate is authorized as the agent of the Quartermaster General to negotiate, prepare and consummate such leases, licenses or other appropriate instruments as are necessary in order to secure such facilities as are especially required in connection with the operation of the activities of the Signal Corps and which are by Army Regulations placed under the general jurisdiction of the Quartermaster General. In all such cases the correspondence, documents and other papers will be forwarded through the office of the Quartermaster General for record, transmission to and from higher authorities and necessary action, and all matters will be handled in compliance with existing regulations.

For the Quartermaster General:

John T. Knight,
Assistant.

10th Inf. [illegible] OCP-JSH
W.D., OCSO., Wash., December 13, 1923 - To The Adjutant General of the Army.

The plan as outlined in 9th indorsement meets with the approval of this office and its adoption will, in the opinion of this office, eliminate needless steps in the negotiation, preparation, and completion of the necessary documents.

For the Acting Chief Signal Officer:

C. A. SEOANE,
Lieut. Colonel, Signal Corps.

THE DEVELOPMENT OF SIGNAL CORPS RADIO EQUIPMENT

SCR-131 Continuous Wave Field Radio Telegraph Set: Some circuit development has been done on this set since the last report, but active work on this development is suspended pending definite determination of service requirements. Two Signal officers conferred during the month of August with the Infantry, Field Artillery and Coast Artillery Boards, and reached virtual agreements with them on the main points at issue. The reports of the Service Boards have not yet however, received approval of their respective chiefs. A higher frequency

and the originally planned will probably be used, extending from [illegible]00 Kc., to 3540 Kc., and providing thirty-six (36) non-interfering channels separated by fifteen kilocycles. A survey of all ground radio [illegible] requirements indicates that [illegible] power can be sacrificed to obtain less interference; fifteen miles is now considered the maximum necessary range for all Divisional or Corps combat use. In view of the foregoing conditions it is quite possible that a standard design of field set may be developed for Infantry Division, Corps and Army Artillery use, the only difference in the sets being their wavelength bands. The proposed SCR-131 will be the Infantry Division set and the first of this closely related series.

SCR-132 [illegible] Radio Telegraph & Telephone Set: The second model transmitter (type [illegible]-227) was delivered by the contractor to the Radio Laboratories [illegible] the [illegible] of [illegible] 10th, 1923. Several changes have been made in the design [illegible] the last report. This latest model transmitter includes the following features:

Method of Communication: Three methods of communication are provided:

Telephone
Continuous Wave Telegraphy, key modulated
Continuous Wave Telegraphy, audible modulation
(by motor alternator instead of buzzer.)

Remote control of all three means is provided by suitable relays and transformers [illegible] a part of the transmitter design.

Type of Circuit: The transmitter uses the master oscillator, power amplifier circuit (similar to the SCR-127 – 130) with plate modulation of the main power amplifier for telephony and tone telegraphy. A total of seven vacuum tubes are used as follows:

1 Master Oscillator, type VT-4-B
1 Intermediate Power Amplifier, type VT-4-B
1 Main Power Amplifier, type VT-22
2 Modulators, " VT-22
2 Speech Amplifiers, " VT-4-B

The intermediate power amplifier is used for the purpose of preventing any variations in the antenna or main power amplifier circuits from reacting on the master oscillator.

Receiving Equipment: The receiving equipment for the SCR-132 will consist of a 1-20-L Receiver, 104-A Heterodyne, SC-118 Amplifier (Navy SE-1[illegible] with some modifications) and the necessary batteries. The receiving instruments will be contained in a carrying chest in which the units will be permanently wired and arranged. The cover of the case will serve as the operating table.

Antenna Equipment: Field antenna will consist of a modified 60 foot mast equipment with suspended counterpoise, tools, etc.

Transportation: The SCR-132, unlike the SCR-97, will not be permanently installed in a truck. The apparatus is portable, however, and may be carried in any cargo truck. The parts, with the possible exception of the PE-[illegible], may be easily handled by two men. The present model equipment will be put into service at Fort Monroe, Va., for intensive trial in cooperation with the Air Service at Langley Field, for about a month before proceeding to quantity production.

SCR-133 Airplane Radiotelephone Set: The SCR-133 is a five (5) mile interplane set for radiotelephone use only. The transmitter and receiver amplifier are installed in the rear of plane and controlled by two small transmitter and receiver control boxes mounted in front of the pilot. Very satisfactory and successful tests were conducted at McCook Field during the month of August, on the first model transmitter, made by the Wireless Improvement Co. Two complete transmitters, transmitter control boxes and power units are now in production and will be delivered about December 15, 1923. Drawings are being delayed until the production models are given further trials and passed as satisfactory. It is hoped to put the transmitter equipment in production about February 1, 1924. See "SCR-134" for receiver development progress.

SCR-134 Airplane Radiotelephone and Telegraph Set: The SCR-134 is rated as a thirty (30) mile radiotelephone, airplane-to-ground set. The ranges for continuous wave and interrupted or tone telegraphy will be considerably in excess of this range.

The SCR-134 transmitter employs the master oscillator or power amplifier circuit utilizing four (4) vacuum tubes as follows:

Speech Amplifier,	Vacuum Tube,	type	VT-2	
Master Oscillator,	"	"	"	VT-[illegible]
Power Amplifier,	"	"	"	VT-[illegible]
Modulator,	"	"	"	VT-[illegible]

The output of this transmitter with the normal antenna over the entire frequency range (856.6 to 339.8 Kilocycles) equivalent to 350-7[illegible] meters is about 2 amperes.

The receiving equipment used with the SCR-134 employs the Armstrong Super-heterodyne circuit which has undergone many refinements and changes during the course of development. The equipment is [illegible] into two units, the SC-11[illegible] Tuner and the SC-116 Amplifier. The radio controls for the SCR-134 transmitter and receiver are effected by the Transmitter Control Box BC-11[illegible] and Tuner BC-115 which are mounted in front of the pilot. The balance of the apparatus, i.e., Transmitter, Receiver, Amplifier, Power Equipment, are installed in the rear of the plane. The control of the transmitter is effected by two adjustments, - the Antenna Output Variometer and the three-way switch which operates the "Transmit Off and Receive" positions. The Receiver Tuner has but two controls, consisting of the "Wavelength or Frequency" setting which operates in super-heterodyne oscillator, and the "Antenna Tuning" adjustment which adjusts the circuit to the wavelength to be received. A filament rheostat will be provided in the Tuner Box, but this adjustment is incidental to the general operation of the receiver as it is adjusted for the proper value of filament current only upon the initial [illegible] of the receiver.

Flight tests of the SCR-134, complete, have been made recently at McCook Field and at Bolling Field. The tests at Bolling Field were made for the purpose of demonstrating the new equipment and consisted of flights from Bolling Field to Quantico, Va., a distance of thirty miles, using telephone transmission only. Reports of amateur listeners were [illegible] surprising in view of [illegible] of [illegible].

[illegible]orts were received from listeners at Gettysburg, Pa., (93 miles) and Germantown, [illegible]., (107 miles), stating that they heard the plane clearly during its flight over [illegible]. Flight tests at [illegible] Field thru interference from other sets on the ground have resulted in good transmission from plane to ground of distances about 80 miles. The frequency range of the receiver is 1499 to 249.9 kilocycles (200 to 1200 meters.)

The receiving equipment development is about 95% complete and will be ready for production about February 1, 1924.

It has taken considerable time and effort to bring the receiving equipment to the standard desired, due principally, to the fact that military airplane requirements demand the utmost economy of weight and space. The development of the BC-115 and 116 has resulted in one of the most comprehensive standardization efforts undertaken by the Signal Corps. The BC-115 - 116 will be used in ALL AIRPLANES, i.e., Pursuit, Observation and Bombing Planes. It will also be used on the Ground at Airdromes and Control Stations.

SCR-135 Airplane Radiotelephone and Telegraph Set: The SCR-135 is rated as a 100 mile airplane-to-ground radiotelephone set. It is built [illegible] in the same general design features of the SCR-134 for control and operation and the circuit is of the power amplifier or master oscillator type. The [illegible] ranges of this set are considerably in excess of 100 miles.

The transmitting frequency of the set is from 372.7 to 249.9 [illegible]cycles or 800-1200 meters. Vacuum tubes used in the transmitter are as follows:

Speech Amplifier	1 Type	VT-2 Tube
Master Oscillator	1 "	VT-4 Tube
Power Amplifiers	2 "	VT-4 Tubes
Modulators	2 "	VT-4 Tubes

The average antenna current over the frequency range is about four (4) amperes.

Since the report of February 1st, the development of all parts incidental to this set has been completed and put into production, except receiving equipment.

The receiver equipment for the SCR-132 was described under the report of SCR-134.

SCR-136 Ground Radio Telephone & Telegraph Set: The electrical development of the transmitter for this set was completed by the Radio Laboratories during the summer of 1922, but due to shortage of personnel the development of the mechanical model was let to the General Electric Co., Schenectady, N.Y. This development contract required, in addition to the transmitter, a suitable gasoline-engine-driven generator, which could be easily packed or on animal for transportation.

The initial model of the generator unit has been completed at the Lynn Works and shipped to the Works at Schenectady for test with the transmitter which will be completed about December 1st, this year. The development of this equipment, as in the SCR-132 and SCR-133, will include detailed production drawings of the apparatus. It is probable that the transmitter will be ready for production the first of the year. The gasoline-engine generator unit will be given a severe and exhaustive test in the hands of the Artillery units in order to work out details of packing, distribution of loads, etc., before final design is made. An interesting feature of the engine equipment is the use of standard, commercial, Indian Motorcycle parts.

The SCR-136 will be used for ground-to-plane use and has a telephone range conservatively rated at thirty (30) miles. It has a frequency range of from 856.6 to 333.1 kilocycles (350-900 meters) and has an average antenna current out-put, over this range of frequency, of about 3½ amperes. It employs four vacuum tubes as follows:

Speech Amplifier	1 VT-2 Tube
Master Oscillator	1 VT-4 Tube
Power Amplifier	1 VT-4 Tube
Modulator	1 VT-4 Tube

The circuit is in general the same as the SCR-134 Airplane Transmitter except that the arrangement will provide for a "Break-in or Duplex" method of transmission and reception.

The receiver now being developed at the Radio Laboratories will probably be a double-circuit regenerative type using low filament energy consumption tubes. The circuit will employ means to prevent re-radiation in the antenna circuit.

The Transmitter and Receiver equipment will be carried in two strong fibre cases of equal weight and size, in order that a well balanced pack-load may be secured. The Receiver chest will contain auxiliary equipment such as spares, cords, etc.

Details of the antenna equipment have not been fully worked out. It is probable that for pack purposes a "V" or "[illegible]" type of antenna will be employed. For Railroad Artillery or Air Service purposes the umbrella type will probably be used. Both types of antenna will use a suspended counterpoise instead of ground.

IMPROVEMENT OF SCR-77-A LOOP TELEGRAPH SET: Considerable improvement in the SCR-77-A circuit has been made during the last few months at the Radio Laboratories. A good "stand-by" position has been worked out which will result in a more efficient operation of these sets in a larger net than heretofore possible. A canvas cover for the protection of the set during inclement weather has been designed which will [illegible] carrying receptacle for the loop, as well as [illegible] attachments, carrying straps, etc.

500 WATT SELF RECTIFYING SET: Research and development is being conducted with a view of utilizing about 230 VT-6 (250 watt), power tubes in a circuit which may use alternating current as a source of power. The chief aim is to produce a very cheap set which may be economically operated in Army Communications sub-nets. The VT-6 tubes were originally intended for SCR-132 use but were superseded by the VT-22 and are therefore surplus.

NOTES CONCERNING ARMY RADIO NET.

1. The two 10 KW continuous wave tube transmitters will go into operation at Leavenworth about January 1st, and at Fort Douglas December 1st. These two stations, together with the Washington and Fort Sam Houston station, will constitute the primary distribution system of the War Department radio net. The two new transmitters at Fort Leavenworth and Fort Douglas will each radiate approximately forty-five amperes and will furnish reliable communication between Leavenworth and Fort Douglas, Leavenworth and Fort Sam Houston, and Leavenworth and Washington.

2. Meantime, direct communication between Washington and Fort Sam Houston was established about November 1st, using the 6 KW, 500 cycle modulated tube transmitter at Arlington, and the 30 KW arc at Fort Sam Houston. This communication has been very satisfactory and a large saving in telegraph tolls has been effected.

3. Radio traffic handled by the War Department net continues to increase monthly, having reached the total for this net alone of $8,000 for the month of October, 1923. This figure represents the amount which would have been paid, at Government rate, for the traffic handled.

4. High speed transmitting equipment, of the Kleinschmidt type, has been provided for both Fort Leavenworth and Fort Douglas, and is already installed at Washington. It consists of a key board perforator which perforates the tape, and a transmitter, which when operated by the tape, operates the radio transmitter at any speed up to 150 or 200 words per minute.

5. There has also been furnished at Washington, Fort Leavenworth and Fort Douglas high speed tape recorders.

6. An additional item at Washington, Leavenworth and Douglas is the Creed relay, which operates from the same source as the tape recorder, and will not only give very satisfactory operation of the tape recorder, but will be used by Washington and Fort Douglas to control the Fort Leavenworth transmitter. In this way, Washington high speed signals will be simply relayed automatically by the Fort Leavenworth transmitter and received at Fort Douglas. Fort Douglas will also be able to transmit at the same time that reception is being accomplished. Through a secondary Creed relay at Fort Leavenworth, reception of the Fort Douglas signals can be accomplished in this manner at Washington. Obviously, the same procedure will be followed in connection with Washington traffic for Fort Sam Houston.

7. The placing in operation of the Fort Leavenworth and Fort Douglas semi-high power transmitters will very materially speed up the handling of radio traffic over the War Department net, eliminating, so far as the War Department net is concerned, at least five relay stations in the net.

Sir John Mandeville, in his "Travels," published in 1356, said:

"The people of Syria and the adjacent countries had a strange custom in the time of war and siege, for when they dared not send off messengers with letters to ask for help, they wrote their letters and tied them to the neck of a Culver, (carrier), and let the Culver free. The Culvers immediately sought the places where they had been brought up and nourished, and were at once relieved of their messages by their owners, who immediately sent the desired aid to the besieged."

Use in Modern Times, Prior to the World War.

In 1572 and 1573, pigeons were used by the Dutch in the wars in the Netherlands. William the Silent made extensive use of homing pigeons as messengers, during the siege of Haarlem.

In the year 1849, Reuter built a telegraph line between Berlin and Aix-la-Chapelle but none from the latter place to Brussels. To fill the gap, a pigeon messenger service was established, three birds being used to carry each message. This messenger service was very satisfactory and did much to help establish the reputation of Reuter's telegraph company.

In the Franco-Prussian war of 1870, pigeons were used extensively and to great advantage by the French. Pigeons were taken out from Paris in free balloons and used to carry messages and dispatches back. By means of micro-photographs of military dispatches, private messages and even newspapers, being printed upon films of collodion, the letters were so reduced in size that as many as thirty thousand words were carried by a single pigeon. When received, these films would be enlarged by photography and become legible.

From the time of The Franco-Prussian war on, practically all of the European countries have realized the value of the homing pigeon as a messenger in time of war. The government of France, Belgium, England, Germany, Russia and Turkey have long encouraged and lent aid in developing pigeons to be used for military purposes.

Experiments with Pigeons in the United States.

The United States Army tried an experiment with pigeons in the year 1878, when some pigeons were purchased and sent to General Nelson Miles, (Then Colonel of the 5th Infantry), in Dakota. General Miles tried to train and use the birds as message carriers but without much success. General Miles reported that [illegible] failure was due mainly to the fact that the [illegible] infested [illegible] a species of hawk which bothered and killed many of the pigeons.

In 1888 a pigeon loft was established by the army at Key West, [illegible] a number of experiments were carried out. While the experiments [illegible] partially successful, the results were not wholly satisfactory so the loft was discontinued and the experiments dropped.

During the year 1897, many trials were made with homing pigeons in the United States Navy, especially by Admiral Sicard, and considerable success was attained.

When the Punitive Expedition went into Mexico in 1916, the use of pigeons was attempted but failed due to the inexperience of the personnel handling the birds and the fact that the pigeons were bred in the east and never became acclimated on the Mexican border.

Use in The World War.

Pigeons were extensively used by all the nations engaged in the World War. Germany had a very efficient pigeon service which was used by all arms. Prior to the war the Germans had established many lofts in England and in the early stages of the war, birds from these lofts were used to carry messages from Germany to their agents in England. This fact was first discovered when a passenger on a suburban train was seen releasing a pigeon, which he had had concealed under his coat, out of a car window. The man, who proved to be a German agent, was followed and through the incident, many lofts were discovered which were being regularly used by the Germans.

The Belgian, French and English armies also had highly [illegible] efficient pigeon services which played an important part in the communications system of the Allies.

When the United States entered the World War, our army had no pigeon service. In July 1917, the Chief Signal Officer of the A.E.F. recommended that a pigeon service be established as a branch of the Signal Corps. His recommendation was as follows:

> "Careful investigations have been made of the carrier pigeon service of the French and British armies in France. Access has also been had to some of the material and documents captured from the Germans which indicate the uses they have been making of carrier pigeons. There is no longer any doubt of the immense importance of this service, and the necessity of the immediate action of the United States to provide similar service for our armies."

On July 17, 1917, General Pershing called the War Department requesting that two pigeon experts be commissioned and that twelve enlisted experts be chosen and that they be sent to France immediately to put in operation a pigeon service.

Acting upon the above recommendation and request, two pigeon experts were commissioned and pigeoneers were selected. A mobile loft was designed and large quantities of grain for pigeon feed were purchased. Young birds and birds for breeding purposes, totalling about [illegible] were secured. During the latter part of October, the first contingent of the pigeon section, consisting of one officer and six enlisted pigeoneers, together with a number of pigeons, were sent to France. The balance of the detachment followed in a short time.

In November a pigeon service was authorized. The first tables of organization prescribed: 1 major, 1 captain, 1 first lieutenant, 6 second lieutenants and 631 enlisted men. Major Frank S. Griffin was placed in charge of the service. By February, 1918, 3 officers and 147 enlisted men of the pigeon section were in France. The section in the United States had expanded rapidly and in March the tables of organization were changed so that 1 major, 2 captains, 5 first lieutenants, 4 second lieutenants and 324 enlisted men were authorized. The cut in the enlisted strength from 631 to 324 was due to the fact that it was found that the number first authorized was excessive.

Operations of the Pigeon Section in the United States.

In the United States, the duties of the pigeon section were to provide personnel, pigeons and equipment for the training of all arms of the service, to conduct this training at the different camps and stations, to coordinate pigeon activities with the other branches of the Signal Corps, to procure personnel and equipment for the oversees forces and to furnish information concerning pigeons and the training of pigeons.

In pursuance with the above policy, stationary lofts were established at a hundred and ten army posts throughout the United States. These lofts were stocked with birds purchased from civilian pigeon fanciers in the United States at an average cost of two dollars each. Every military camp in this country was equipped with a pigeon loft. In addition to the above, lofts were established at twenty-two aviation camps; ten on the Mexican border; nine in the Panama Canal Department; two in Hawaii and fifteen at coast defenses on the Atlantic and Pacific coasts. At the time of the signing of the Armistice, there were a hundred and ten lofts in operation in the United States with a total of ten thousand pigeons.

In the United States the personnel of the pigeon section were not assigned to units but were carried on the rolls of the Signal Corps service company of the Department in which they were serving. Fourteen pigeoneers were allotted to each loft in a division camp, three to aviation lofts and three to lofts on the Mexican border. The reason so many men were assigned to lofts in camps, was in order that these men could be used as instructors in pigeon activities. After the signing of the Armistice, the demobilization of the pigeon section in the United States was rapid. Most of the lofts were abandoned and their personnel discharged by March, 1919, the number of lofts remaining in operation at that time being thirty-five. The surplus pigeons were sold at public auction and good prices obtained for them.

Operation of the Pigeon Section in France.

In France, the duties of the pigeon section were to furnish the personnel, equipment and birds necessary for the training of all arms in the training areas and to maintain a pigeon service in active operations at the front.

Upon the arrival of Lieutenant Duncall in France, (He was the officer of the pigeon section, first sent to France), he was sent to British front to investigate the use of pigeons. After his return, he and another officer, Lieutenant Carney, were sent to the French front to study the use of pigeons there. All phases of the pigeon activities were carefully investigated and the types of equipment necessary were determined. In a short time after this our own pigeon service was put in operation and functioned well.

The principal operations in which our pigeons did notable work were the St. Mihiel drive and the Meuse-Argonne offensive.

In the St. Mihiel drive 567 birds were available for use by the troops. 202 of those were assigned to the tanks and 364 were used by the line troops of the First and Fourth Corps. Of those used by the tanks, twenty-four were lost or killed in action. Most of these losses were caused by the birds being kept too long in small assault baskets and to the inexperience of those handling them. The report on the work of the pigeons in this operation was highly commendatory, stating that though the weather was the worst possible for pigeon flying, many important messages were delivered bydpigeons and that the average time of flight of the birds was excellent, in many cases averaging more than a kilometer a minute.

In the Meuse-Argonne offensive, 442 American pigeons were used and 403 important messages were delivered by them. The distances that these birds had to fly varied from 20 to 50 kilometers on account of the rapid changing of positions by the American troops. It was estimated that not more than ten percent of the birds used failed to return to their lofts and it is believed that no important message went astray. The report on the use of pigeons in this operation stated that in spite of the fact that only five days were available in which to condition the birds, that frequent changing of loft positions made training problems difficult and weather conditions were extremely unfavorable for the use of pigeons, the work performed by the American birds was more than satisfactory and in some cases nothing short of marvelous.

One incident recorded was as follows:

> On October 21st, at 2:35 P.M., a pigeon was liberated at Grand Pre with an important message. During intense machine gun fire and artillery action, the bird delivered its message to the loft at Rampont, a distance of forty kilometers, in twenty-five minutes. When the bird was examined, it was found that one leg had been amputated and that its breast had been pierced by a machine gun bullet, but the message tube, with its contents intact, was hanging by the ligaments of the torn leg.

At the time of the signing of the Armistice, our troops were beginning to realize the vast importance of the pigeon service and the reliability of the pigeon as a messenger under all conditions. It is believed that had the war lasted longer, pigeons would have been more generally used by our armies and that even better results would have been obtained from their use than had been up to the time of the Armistice.

Use for Military Purposes in Time of Peace.

The most important use of the pigeon by the army in peace time, is by the Air Service, especially in starting where flights are made over sections of the country where commercial communication lines are few. Examples of such flights are: over the Mexican border, in the Canal Zone, and in the Hawaiian and Philippine islands.

The following are a few of many instances where pigeons have proven to be of value:

> In 1921, an airplane was lost along the Mexican border. Several other planes were sent out to search for it. One of the searching planes was forced to land in the mountains in Mexico about a hundred and twenty-five miles below Douglas Arizona, many miles from human habitation. Part of the equipment of the plane was a basket of pigeons from the loft at Douglas. Several pigeons were released, carrying messages, giving the location of the lost plane and stating that they were famishing for water and needed oil gauges and other material with which to repair the ship. The pigeons traversed the distance of a hundred and twenty-five miles to Douglas in good time , (about three hours), and the messages were delivered. Another airplane was sent to the aid of the stranded party, with the needed water and supplies. The rescue plane being unable to land in the wilderness, dropped water kegs and the materials requested to them, enabling them to repair their ship and proceed back to Douglas.

In his report of the above episode, Lieutenant Colonel C. O. Thomas Jr., 12th Cavalry, said:

"Of the pigeons I would like to say a few words. They did their work remarkably well. Of the twenty taken out only one was lost, all others returning. To No. 71--U.S. 20, the pigeon delivering the message asking for water, and to No. 2019--U.S. 20, the one delivering the message asking for oil pressure gauges, is accorded the honors, both after being cooped up in their basket for nine days, delivered their messages in record time over a distance of 125 miles air line. This is efficiency and it is to be regretted it cannot, in some way, be recognized."

The incident below was reported from the Canal Zone.

On July 16th, 1922, the launch "Crowl," with eleven persons on board started for a trip to the Pearl islands. The next day when about ten miles from their destination, the motor became disabled. Repairs were made and the launch managed to get to the Pearl islands. Shortly after they had started on the return voyage, the motor quit and the boat made no headway whatever. The party had on board a basket of pigeons from the Quarry Heights loft, some of which were released, carrying messages requesting aid. All of the birds returned to their loft, the messages were delivered and a tug was sent out to tow the disabled launch in.

This was reported from Hawaii:

In May 1925, two [illegible] officers were out for a flight in a D. H. 4, airplane, when over the water several miles from land, the propellor shaft on the plane broke and they were forced to land on the water. Having a basket of pigeons with them, they immediately sent a message telling of their plight. The birds flew in at a rate of more than a mile a minute and a speed boat arrived to rescue them in less than forty minutes. If these officers had not had pigeons with them, they would have lost their lives and their ship as the plane would not have floated for more than an hour, and they were much too far from land to swim in.

In the Hawaiian Department, all airplanes which leave their field to go more than three miles are required by orders to carry a basket of pigeons. Similar orders obtain in many Air Service stations.

Operations of the Pigeon Section since the World War.

Learning from past experience that birds must be very carefully bred from the best stock obtainable to secure a good type of homing pigeon for military use, the United States government, in the summer of 1919, commissioned Colonel Osman, a pigeon expert of the British army, to purchase in England, a hundred and fifty pairs of pigeons of the best stock in Europe. These birds were purchased for the sum of five thousand dollars [illegible] were received in November, 1919, at Camp Alfred Vail, N.J., where [illegible] were kept for breeding purposes under the direct supervision of the [illegible] of the pigeon section. The stock of the various pigeon lofts in the service is gradually being replaced by the offspring of these imported pigeons.

In the Army, at the present time, pigeon lofts are being maintained at twenty-four posts and stations as follows: 18 at Regular army stations, 4 at National Guard stations, and 2 lofts for R.O.T.C. units at universities. These lofts are located: 11 within the continental limits of the United States, 3 in the Canal Zone, 3 in Hawaii and 1 in the Philippine islands.

Mr. Fay R. Delhaur, pigeon expert, (who was one of the officers first commissioned in the pigeon section, Signal Corps, and who served in the section during the war with Germany), is at the head of the pigeon section with headquarters at Camp Alfred Vail, N.J., where the records of the section are kept and where the main breeding and experimental lofts are maintained.

At present there are twenty-three enlisted men authorized in the pigeon section. These men are distributed among various active lofts in the service. Most of the personnel used at the lofts is furnished from troops at the station where lofts are located.

[illegible] pigeon.

[illegible] value of the homing pigeon as a messenger in our future [illegible] officers and other personnel of the army be- [illegible] fully acquainted with their capabilities and reliability [illegible]. It is hoped that the pigeon service will not be further [illegible] that a small pigeon section will be maintained, for [illegible] shown that pigeons play an important role in the [illegible] time of an army in both peace and war.