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THE COMMUNICATION INDUSTRY OF THE UNITED STATES  
by  
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The Army Industrial College  
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Gentlemen:

After that very nice introduction by the Colonel, I am more than embarrassed at not having a prepared talk. When the Colonel asked me a number of months ago to come and make good on a promise which I made to the group last year when Mr. Gifford talked, I had in mind doing a really first-class job at preparing something which might serve as a record. I did set down some notes, but in this hectic life that I lead I found that I had very little time to devote to writing things down. The result was that when, a week or so ago, I said: "Now, its about time to get down to brass tacks", I found myself not subpoenaed, but called in an anti-monopoly investigation, where I have got to go and testify. So I said, "I am just going to talk informally about a subject which I know a good deal about, having spent my whole life in it, and trust to luck that I will do a fair job and that the questions which may be asked will give these men what the Colonel really had in mind."

The electrical communications system in America as we have it is really an industry. It is more than just a service as it is set up here as nowhere else in the world. It is truly an industry. Most of you, I think probably all of you, have a pretty

good picture of what the setup is, but in order to be sure that we are all approaching things from a common standpoint, let me review briefly what is the arrangement here and how it differs from the communications setup anywhere else in the world. Of course, we have telephony here mainly by wires, with radio adjuncts like the transoceanic services and services to ships and airplanes and what-not, but principally wire communications of one sort or another.

There is no competition in the ordinary sense in telephony. That is true not only in the United States but it is true everywhere in the world. It is the result of a realization in most countries brought about through a trial of the competitive system, that in telephony, because it is a personalized service where the customer, the original customer, wants to reach a definite party at a definite time, it is not a type of service which can best be served through a competitive setup. What we found in this country and what they found everywhere else is that when you had two or more, I guess there never were more than two competing units, you did one of two or three things, you either paid double for complete service, and that is what the merchants were doing--it was a kind of racket--you either paid double for your service or you got a half service at a normal price, or you got a very inferior grade of service. It is a rather interesting thing, in this country at any rate, that the pressure of the public for the elimination of this bad situation under competitive telephony should have arisen at exactly the time when there was the greatest outcry against monopoly in this country, at the time the Sherman Anti-Trust Law was brought

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into being. You had the same public at that time doing two diametrically opposite things. They were for breaking up monopolies generally, but they were insisting that something be done to do away with this competing telephone service. While telephony is a monopoly here, as it is everywhere in the world, that does not mean that all of the service is given by a single agency. Of course, in this country, the biggest unit is the American Telephone and Telegraph Company and its subsidiaries, the Bell System, but between a quarter and a third of all the telephones in the United States are not owned or in any way connected with the American Company. There are vast areas of this country out in the West and Middle West where service is given by so-called independent telephone companies, but they are all intertwined with the Bell System. The Bell System is all interconnected with them so that when you put in a call from Washington for a subscriber somewhere in this United States you pay no attention or you don't know what system he is connected with. For a subscriber in San Francisco, for one, the line connecting you originally is under the Bell Telephone and you end up on an independent telephone. Everywhere else in the world it is also noncompetitive. In most countries, of course, it is a Government function. Not in all countries but in most, particularly in Europe, it is a Government function, but as a monopoly it is a single thing.

Here in this country also we have telegraph services. They are, despite the fact that it is a very much smaller industry, of course, --the telephone business is many times greater than all the other

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communications services put together--but in the telegraph field, for historical reasons and because it is a type of thing where competition, in the ordinary sense, can take place, we have the peculiar situation of a competing telegraph service. Principally, it is a competition between the Western Union and Postal, essentially wire services, but to some extent there is, even on land service, a bit of competition from the radio, and when you come to overseas services you do have real competition between the wire cable services of Western Union and Postal and the radio services of the radio companies. In general, I should think, when you come to the telegraph side you find that on the transoceanic stuff the cable companies have the great bulk of the business which flows between the big centers of population, New York to London, Paris, or Berlin, for example, where there is a vast volume of traffice to predetermined points and where extreme reliability and uniformity of service is required. Stuff like operations of financial markets--that goes, in the main, by cable. When you come to services which are essentially broadcast in nature, where you want to reach Buenos Aires one minute and Capetown the next, there is the field where radio fits in particularly well from its very nature and because most of those sporadic services do not have the same rigid economic forces bearing on reliability they can be done with a reasonable degree of satisfaction by radio, despite the fact that even at its best today radio is subject in the main to more frequent and more erratic troubles than our cable circuits. Of course, when you get a cable break, an actual disruption of cable service, there you have a type

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of disruption of service that is very great, very different from that of radio, because complete disruption to any point may last for days. It operates with great reliability when it is operating.

Those, in the main, are the two big divisions of the communications industry in this country. Of course, they are the big divisions in any country. The situation, however, in which the American communications system differs from any other is in the way it is set up as within the operating agencies and the suppliers of the things which go into the plant which we are operating, in all other countries that I know of.

To a considerable degree what I am going to say applies to all communications agencies in the United States. It applies completely to the whole Bell Telephone System. The scheme which I am going to describe to you has influenced all the telephone companies and the radio companies. Let me first describe what is the normal setup the world over, so far as I know, as between operating agencies and their suppliers. In this country the railroads are a good example of it, the electric light and power people are a good example of it. In the main the instrumentalities with which service is given are the result of the development work of manufacturers. It was very true with the railroads. It was very true with things like the electric light and power people. The great manufacturing industries in the electrical field like General Electric and Westinghouse, with vast reserve laboratories, develop mechanisms which are applicable in the operating field. The result is, of course, they are influenced in what they do by the requirements which are passed to them by the

operating people. The operating people say, "We have got to have this". The things the operating people find necessary in production are the research and development details of the manufacturing industry. In other words, they are not masters in their own houses. That is true in the communications field everywhere outside the United States. For some reason, it goes way back before my time, either by good luck or good management, over fifty years ago in the very early days of the Bell System, in the days when the first companies were being formed, the group who were in charge, who controlled the Bell System had a very wise idea. They said this business--they had great visions, and if you read the charter of the American Telephone and Telegraph Company you will see they were Jules Verne people in the setup of what they visioned they were going to do, because there is a clause which contemplates the connection of anyone, anywhere in the United States, to anyone anywhere else in the world by wires or other appropriate means. They had a Jules Verne vision, but connected with that Jules Verne vision they had this kind of thing which was very real. They said, "We never will be able to do that unless we are masters of our own houses. We must do the development work. We must determine what instrumentalities we have and not let somebody else tell us what kind of instrumentalities we have got to use." The result was that way back in 1882 or 1883 a manufacturing department became a part of an operating unit which is now the Western Electric Company; became a part of the operating agencies, the telephone companies and took its orders from its customers and was not allowed to be in a position of giving

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orders to the customers. At the present time the thing has gone even farther. In those early days the Western Electric Company had an engineering department and it took its orders from the operating people in a general sort of way and tried to carry them out with its own development department, but, as time went on and the control of the operating people became more certain and the virtues of this system became more apparent, the setup in the Bell System was changed thirteen or fourteen years ago, and you have the peculiar situation in the Bell System at the present time of a great manufacturing industry comparable with General Electric and Westinghouse, with no engineering department. It has a general engineers' methods department, but the things which it manufactures are solely the things which are developed in the Bell Telephone Laboratories, which is the research and development department of the Bell System. In other words, <sup>goes</sup> everything ~~that~~ to the Bell Plant is determined from the standpoint of the user and not the producer and that general idea to a greater or less extent has permeated into all the rest of the American communications field, and nowhere else in the world that I know of does that thing exist.

Now, I think, Colonel, some time back, you people here were shown a picture of the hurricane disaster up in New England. That picture is, in a way, illustrative of one of the greatest advantages of the setup which we have had here in the United States for our communications business, because the thing which I have described to you as the setup in the Bell System and as more or less the setup in other companies, has tended to a uniformity and standardization of materials and methods and processes throughout the entire United States. When I

say standards I don't mean standards which are rigid like the laws of the Medes and Persians, once set and never changed. In the communications field a standard is nothing but the current best established method of doing a thing or requirement. It is subject to change at any given time whenever a new or better way has been fully established, but so long as it exists it is the yardstick by which you measure things. Telephony requires standardization because you have got to be sure, if you are going to give universal service, what you do in Portland, Maine isn't going to affect the ability of anyone in Portland, Oregon to get the kind of service he wants. The normal advantages which you see of standardization are operational, simply a question of the uniformity of supply, the reduction of the number of things which you call upon manufacturers to make, and all that sort of thing. When the hurricane came along we had another illustration. It is a kind of thing which is of particular interest to the Army, of the values of standardization, properly carried out, to handle emergencies. We had this vast destruction in the most densely populated part of the country. I have forgotten now what the total bill was, but it cost twelve or fourteen million dollars to repair the physical damage and connect the telephone plants. Here is what was required. Here were more than half the telephones in New England out of commission due to the fact that the physical plant was destroyed or badly wrecked in one way or another. How are you going to get that stuff back? What they did, as that picture probably showed you, they brought line gangs in here from as far West as Omaha and as far South as Atlanta, I think. They had I don't know how many of these trucks. The Western Electric Company, the big supplier for the Bell System, had stocks of

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standard materials all over the United States. They shipped train-loads of that supply into New England, so you had your men and the material that was required there but, if we hadn't had standardized equipment we never could have done the job because there wasn't supervision. The supervisors had to come from local forces in the area. They were the only ones who knew the local situation. If they had had to take an expert gang from Omaha and turn them loose in the New Hampshire hills and tell them how to go about their job, we never would have gotten that thing finished. But they said: "Get a gang. We are going to take this bunch of boys from Omaha and we are going to put them in Keene, New Hampshire." They put them on a special train, took them up there, unloaded them, followed them with trucks of material from Western Electric and said: "Boys, there she is. Go to it." Well, once they know where they are going to work and they have got the material to work with, the cleaning up of a disaster situation in Keene, New Hampshire is no different from cleaning up a disaster in Omaha, Nebraska. They had to have the material and know where it was they were to work and they didn't require any supervision. The result was that we got that situation cleaned up in ragtime in contrast to what it would have been if we had/had a standardized thing and a system by which the necessary materials which could take care of even a major disaster were available even though scattered over a wide area of country, so that it seems to me that it was one--it was a terribly harrowing thing, but it was a very dramatic illustration of the advantages to a nation, whether in peacetime or wartime, of a

unified system of electrical communications, unified not only as to its operational features, but unified as to the general types of material which are used in it.

Now a word as to what the industry--if I talk primarily from the standpoint of the telephone business, please realize that I am not consciously trying to do that, but I am doing that because that is the thing I know the most about and because it is vastly greater than the other things and practically all I say about that applies to the other things too. What is the goal of the communications business as represented by the telephone in this country, both from the standpoint of the organization and the standpoint of the country? Well, the goal is a very simple goal. The goal is and always has been ever since I have known anything about it, to provide a no-delay telephone service on demand of the subscriber at any time to any place any where in the United States and, as far as you can, to any place in the world, but primarily our job is here in the United States. Now that has been the goal for a long, long time. We are still far from the goal, although we have made a lot of progress in the last ten or fifteen years. In the main, you have in any big city area essentially a no-delay service. You never in a local service do anything other than put in your call and wait until your called subscriber answers or you receive a report of busy, or don't answer, or what not. You never think of doing anything else. But, up until recently, of course, on longer distance services you gave the order of what you wanted and you then waited until the distant party was found, if circuits were available and connections finally established.

The delay might have been anywhere from ten minutes to four or five hours. In most parts of the world, when you get above forty or fifty miles you have this delayed type of service. I tried to call up one of my friend in Oxford from London last Spring. Normal service, no trouble at all, about sixty miles I think it is, fifteen minutes delay to get the circuit. Of course, if I had to wait five minutes to get a call through from New York to San Francisco I would think there was something rotten with telephone service, and there would be. What is required to give this no-delay type of service and how is it particularly of interest to you people here in the Army in so far as you are interested in communication? Well, in order to give a no-delay service of this random kind that I have indicated on demand, it is obvious that you have got to have circuits available, spare circuits available at the time that the subscriber puts in his call. Now if human life was organized on a twenty-four hour a day basis, with uniform activity throughout the twenty-four hours, that wouldn't be a very serious matter. You could figure out pretty easily how many circuits you were going to want. If you were going to use them in the same amount between ten and eleven in the morning as you do between ten and eleven at night, you would have a pretty easy kind of problem. But human life isn't organized that way. We have got to sleep a certain amount of time; we eat part of the time; we loaf; we do a lot of things; and in the main we use the telephone between ten and twelve in the morning, with somewhat of a peak in the early evening hours, but mainly between ten and

eleven in the morning. In other words, there is not much use of the plant for twenty-two hours in the day, but if you are going to give a no-delay service, if that is going to be the basis of the stuff, it isn't going to be between twelve and one in the morning for two hours and hold the fellow up/between ten and twelve in the morning. What you have got to do is to provide enough circuits to have spares, or to all intents and purposes to have spares, at the peak hours. You are going to have idle plant, eating its head off for the major part of twenty-four hours, as long as the plant is very expensive. It costs a lot of money for copper wire as big as lead pencils for giving long distance service. You can't afford to do that because of this idle plant which can only be paid for by the business of a couple hours a day, which made the charges sufficiently prohibitive so that you were chasing yourself around in a circle. It was perfectly clear that if we were ever going to meet this goal it was up to the research and telephone people to produce a transmission circuit so cheap that they could be provided in profusion. They had to be adequate for service and so cheap that they could be provided in profusion so that you would have nine tenths of your plant lying idle twenty-two of twenty-four hours of a day without providing a prohibitive charge on the few hours that you could use the service. Now, fortunately for us, certain things came into the picture of it, distortion amplifiers, and the development of a very accurate filtering device which enables us to send bands of frequencies packed close together over these wires, with the result that instead of having circuits now where a given

pair of wires carry one message of voice frequency, we have the ability to put on to that same ordinary type of circuit fourteen or sixteen simultaneous telephone messages over this single pair of wires. On a single pair of wires we couldn't possibly have given a no-delay service a few years ago. You don't get that for nothing, that carrier current, but you get a heap sight less charge than you would have to pay to put in sixteen or eighteen more copper wire circuits. Of course, as you all know from having read in the papers, the thing has gone even farther than that in prospect. They have an all steel cable that carries an unlimited number of voice frequencies. We have a steel cable on trial between New York and Philadelphia on which the number of simultaneous telephone messages is practically unlimited. It runs up into the hundreds. Now, of course, these all steel cables are not likely to be very much used except on heavy trunk routes. They have got such an enormous capacity on these.

There is also this thing called television which may come into the picture as a commercial thing. If it ever does, in which event the only known way, aside from theoretical radio, of transmitting the television band is over a thing like the coaxial cable. The coaxial cable isn't likely to be very much used except on heavy trunk routes where new circuits are required, because in the process of building up over the last couple of decades the United States has been pretty well covered either with cable circuits, under ground cable circuits and aerial cable circuits, or, in the far western and southern parts of the country, with very heavy construction open wire lines. All of these circuits, either

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in cable or open wire are susceptible to the application of the carrier current method, this broad band of transmission whereby you can multiply the transmitting facilities of existing circuits many fold without stringing additional wire, so it looks as though we are on our way toward pretty nearly reaching the goal which we have had before us, of a really no-delay service where nobody, except in the case of an occasional catastrophe, will ever have to wait any time to get anybody anywhere that he may want to talk to.

Now, because of this thing, because of the unified character of our communications plan in this country, and the unification goes farther because all of the ordinary telephone plant can be used for telegraph,-- you can't create a telephone circuit by wire, radio, <sup>or</sup> carrier current without automatically creating one or more telegraph circuits. However, you can't create a telephone circuit on a telegraph circuit. The Lord didn't will it that way. So that the whole telephone plant is a vast potential telegraph network, mostly unused. It is used to some extent. Practically all newspaper reports come over the telegraph circuits, AP and UP and the rest of them, provided by the telephone company. A good deal of the telegraph companies' service, particularly in time of emergency, is routed over circuits released from the telephone company. We have got in the United States a completely integrated wire and radio network than which there is nothing like in the world, which is primarily to serve the civilian needs of the population, but it is available in time of war for anything which you military people may want to do in the way of communications to facilitate military functions. I think General Mouborgne has tried out one or two odd and ends of usage of this service

in the last few years to see just how they would fit in with prospective plans. I hope we did what may be in wartime some of the real trials of the United States. Our communications system is here as a help to making whatever plans you military people may want to make, handle whatever emergencies arise.

Now, I am going to get back down and harp on a thing--I don't think I'll tread on General Mouborgne's toes--but it is a thing--a view I have held ever since I was in the Army with regard to what, in my judgment, the Army ought to give very great consideration to in the development of its own peculiar communications devices. Of course, the problems of the military, the detailed problems as they are exemplified in apparatus and equipment, are quite different from those of the civilian people, although the fundamentals which underlie them are exactly the same. Our problem, of course is a problem--our civilian problem is a problem of getting things with the highest degree of reliability to do their job with the greatest degree of efficiency at the lowest possible cost. In general, the things which we use are installed in such a way that they are not subject to great vicissitudes of shock and whatnot, and they are under specially trained observers all the time; as against <sup>although</sup> that/your military problems involve the fact of great rigidity, cost is a secondary factor, if, by spending more money, you can get a thing more reliable under the conditions you want to use it. There are a lot of difficult things. This fact can't be blamed. Of course, in the last analysis, the military requirements as they effect design must control. That goes without saying. But it has always seemed to me that if we are going to have the greatest assurance that we can get the

maximum number of things which the military requires when the time of stress comes, when the biggest load is put on industry, we are going to serve ourselves best if, in the preparatory period beforehand, we were designing the things which we think we are going to want to use; if we utilize just as far as possible the things or the elements which the civilian industry uses, because those are the things which in time of stress can be most easily jacked up into quantity production without any material change. Just let me give you an example. Take the Western Electric Company for instance at the present time. Take radio apparatus. That is a simple kind of stuff. They make two kinds of thing in the main. They make the kind of radio apparatus which we want for our communications business or which the broadcasting people want in connection with broadcasting, and they also make a certain amount of special stuff for the military, the Army and the Navy. Now the elements which go into those condensers, coils and switches and vacuum tubes and whatnot are all the same, but the way in which they are put together is different depending upon the requirements and, in many cases, the sizes and the mounting plants and whatnot, which are specified by the military are just a little bit different than what they are in the civilian use. Now, you come along to a period of great stress. They don't work any better electrically or mechanically. They may suit the situation a little better but when you come to a period of great stress, if the design is one which permits of the use of the thing which is already being furnished in large quantities to the civilian population, you can jack that production up. That simply

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means running your tools in the factory at a higher rate or longer hours and you can do that even though your men are taken away, but if you suddenly have to jack up from a few little specialty things for which you are insufficiently tooled up, where you have got to build tools and indoctrinate people into a new technique, you will get the answer sooner or later, but you put a tremendous handicap on the ability to supply the military with a vast quantity of stuff which they require in time of stress. I don't want to urge this point too far and I think, from talks I had with General Mouborgne, we see almost eye to eye. I am using this communication thing as an illustration which I think applies everywhere in industry that is involved in supplying the Army and the Navy with equipment in time of need. I think the same principle should apply there. I won't urge the point too far. As I say, in the last analysis the requirement of service under the conditions which you have to use them must prevail, but it is a human tendency, I have found, when you are designing, to look at it purely from your own standpoint. I have done it myself. I would like to use left-handed screws for some reason, but everybody else uses right-handed screws. If I suddenly wanted to get a hundred thousand or more of the left-handed screws in a world producing right-handed screws, I am up against a hard problem. So I won't urge my point too far, but I do think it is a matter of considerable importance to the military and the civilian industry which must supply the military in time of stress if that proposition of trying to adapt your peculiar needs as far as legitimately possible to what industry is commonly geared up to do is

carried out. I think in times of stress we would find it would pay dividends in a large measure.

Now, I have taken a lot of your time, but I have one or two more things to show what we in the communications industry think we can do for the military if and when we are required to do it. We have got an enormous trained personnel trained in the field in which they work, and in the main a large part of that training is directly applicable to the problems of the military requirements in time of stress. All you have got to do, as we found out during the Great War when we had these signal battalions, is to give these boys that small modicum of military training which is required to make them fit into a military rather than a civilian machine. So far as details of their job were concerned, they were thoroughly trained. They didn't require any training and because the problems of civilian communication are so varied, it is possible to pick up from the civilian trained staffs practically everybody that you need in connection with the military establishment. Much of the material which we use is, while not just what has been thought best for military, obviously usable in times of emergency, and was used, and, as we found out at the time our troupes went abroad to France at the time of the World War, as General Mouborgne knows, we Americans were able to take a lot of civilian stuff like telephone repeaters, printing telegraph and a lot of things like that, never thought usable for military before, and actually, through the Signal Battalions, put it into military service with very little trouble. We were able to do that back twenty odd years ago and in looking over the situation today, when the art has progressed very

much farther than it had, I think the same situation exists. I don't know of any nation anywhere, which, in its communication field, has as great potential resources for the application of civilian communication knowledge to military problems as we have here in the United States. We haven't used it all and there probably is no occasion for using it at the present time, but if stress should come again as it did in 1918, I think we would be in a position over here, if we have got any wisdom between the military and civilian people, I think we have got the capacity to do a job similar to the one which was done by the Signal Corps in 1918, and to bring in a lot of things which are now looked upon as highfaluting civilian stuff as very potent military tools, and I think that you can be sure that the personnel of the communications industry here in the United States, whether it is Bell System, Independent Telephone, Western Union, Postal Telegraph, Radio Corporation, or what have you. In the last analysis they are just about half military minded and very desirous of being helpful, so I don't think you need hesitate in calling on us if you want to. I am only sorry that I didn't do a better job for you, but I will try to do better next time.

Colonel Miles: We find invariably that the man who comes here unprepared does a better job unprepared than he does prepared and I think that is exactly true this morning.

Dr. Jewett: Now I haven't attempted to touch on any technical things, partly because I don't know what will interest you. If it is part of your program and you want to ask questions, don't hesitate to shoot them at me.

"The Communication Industry of the United States"

Doctor F. B. Jewett, Vice President

The American Telephone and Telegraph Company

Discussion

January 17, 1939

Q -Colonel Jewett, would you care to discuss the wire photo and facsimile and their possible applications in military communications?

A -- Well, I am an amateur on that last thing because my work isn't with it a great deal. There has been a great deal done along that line. Of course, as you say, facsimile and photo transmission is not very new. It's an old idea and has been tried for many, many years. It has had some considerable showing in the last few years because the machinery for doing a decent job has come into the picture. Every day in your papers you see these reprints of pictures marked A.P. or radio photo or what not. Most of these are domestic in origin and come by wire. That is the most reliable way of doing this to get a higher percentage of good pictures by wire transmission than by radio because you can maintain the wire circuits without interference. All the trans-oceanic stuff comes by radio and if you are willing to set up the right kind of apparatus you can do a swell job transmitting photographs. You can do a swell job in transmitting facsimile printed matter if you want. There is a very considerable question

commercial-wise as to how far facsimile transmission is of any great value. Of course, if you want to get a facsimile at the distant end there is only one way of doing it and that is by facsimile. If you are interested in merely content and don't care what form it comes to you in then it's a very grave question as to whether facsimile has much of a field for a number of reasons. In the first place, as the telegraph business is set up, the Western Union and the Postal Telegraph and what not, some of the telegrams are written out on forms by the customer and taken to the telegraph office and are sent by telegraph to the distant point, put on forms and delivered to the recipient on a sheet of paper. He doesn't get it in the form that the customer sent it but he gets it directly that way. But in many cases you telephone your telegram in and at the distant end it is telephoned. But in facsimile transmission you have physically got to carry the thing to the place where there is a transmitter and at the distant end you have got to carry the thing in the form from the receiver to the recipient. So the distribution costs run up enormously. It takes ten times as much time to send a facsimile as it does to send it by printing telegraph. In the printing telegraph a combination of five impulses will print a perfect "h". But to do a facsimile you have to scan the space where the "a" is and send ten times as many impulses to print a decent "a" at the other end. In addition to that, of course, since you don't know where the "a" is going to appear on the you have to scan an enormous

nous amount of paper. So that the linotype costs are enormously more than with the telegraph. You do have this difficulty of the pick up and delivery of your messages. You can no longer use the machinery which we now use in our telegraph business - a combination of telephone and telegraph. You can use the equipment the other way. When it comes to military applications I don't know so much about it. It has some considerable usage but one thing is true in both facsimile and picture transmission - if you are going to get good and reliable results, you must safeguard the line whether it be a wire line or a radio line from electrical disturbance. Every disturbance registers as a permanent record on your picture. I have never forgotten the first trans-Atlantic radio picture that I ever saw. It was a pretty poor picture, as present-day standards go, but it was recognizable - a picture of D'Arbenzeau. The whole thing was covered with a lot of wavy lines. "Do you know what he is saying?" I was asked. "It doesn't look to me as if he's saying anything," I replied. So he read it to me. It was a ship's message that had been picked up by this picture transmission and appeared as a permanent record on this picture.

Q -- In the last war toward the latter part of it - around August or September of 1918, the government took over control of all communication systems - telephones and telegraph. Do you think that any such control of the communications system in this country would be necessary in a future major emergency or do you think that

there is sufficiently enough organized and coordinated with the government to such an extent that they can be handled by private industry.

A -- I think in time of war the military has to take command. They have to be sure things are run the way they want them I can't conceive of the thing running without some coordination between them. I don't think you'd have to go as far as they went at that time. You have to know a lot of ancient history - labor trouble and so on - to understand that. But with the proper liason between them I think the civilian thing is hooked up so that even when depleted of the people taken away from it to serve the military needs whether signal corps or what and I think with the proper liason it can be done better by leaving it where it is than by bringing it into the hands of outsiders who don't and can't know as well as people who have been living in this thing what can and what can't be done. During the war when it was taken over it was to a large extent except when it came to rate matters a gesture actually run by the civilian population. I have forgotten who the board was but Mr. Vail and Mr. Carlton were on the committee with one or two added from the post office who ostensibly were the managers for the government. There wasn't very much difference. The postmaster general slapped on a lot of rates. He used the authority of government ownership to slap on a lot of rates which the civilian people would never have been able to do even if they had wanted to. Things weren't much changed in regard to the operation

of things. I do think you'd have to have, in order to insure the military that everything was being worked the way it ought to be worked from their standpoint, some liaison of the thing. My feeling is that whenever you get things tied up with the government you tend to make things very much more rigid and less flexible than if you can maintain them in a civilian status. Just take the simple thing of some of my men wanting to go somewhere - travel orders and a million and one things. It's far more flexible and so it is with the operation of things. Now we have to have in this country a body of the government to make sure that the thing isn't being misused. But some of the things that the present law requires of the Federal Communications Commission to do, I think, are personally not in the best interests in the development of communications in this country. If the traffic picks up over a given route which is an interstate route and if we need a new route, we have got to prove it to a lot of clerks over here that you ought to put up this type of circuit, that you need it, then prove that it should be this type of thing. There is the case of an open wire that is pretty well ended. A storm comes up, the pole comes down. You plan that four or five years from now you will put up a cable. What are you going to do? You can go ahead and restore this thing exactly as it was but the same thing to do is to put the cable in now and not waste your money. If they put the cable in, the delay in getting the thing through may hold up the service. Nobody's trying to 'old

things up - it's just the inertia of the machine. The delay may be so great that the necessity for restoring service will require you to put back the old obsolete junk. So philosophically it seems to me that in time of stress the army and the navy would be well advised to go no further than the absolute necessity to insure doing the things they are supposed to do. In the way of taking command away from civilian groups doing those kinds of things. This world is just such a complicated thing that you push in on this side of the balloon and you don't know where it's going to pop out on the other side. Mr. Kettering and I had a session with the air corps people a while back on some problems they were interested in two or three weeks ago. One of the problems was one in which if you spent more money and put on more money on the thing you couldn't speed the thing up and Kettering said "No, you can't speed it up. Why? It's like this. You take a hen - she takes 21 days to hatch a clutch of eggs but if you put two hens on the clutch of eggs can you hatch them in 11 days?"

Q -- In the breakdown mentioned, you meant put down the cable?

A -- No, it may be an aerial cable.

Q -- You say you spent about \$12,000,000 in this disaster in New England. Would it have been practicable to have put underground cable in instead of the overhead lines?

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A -- That disaster was so vast and the necessity of getting service back was so imperative not only in our standpoint but from the standpoint of serving the population in this endeavor to clean up the rest of the mess that there wasn't enough time to nor enough material to have replaced even if we had had the open wire stuff. They had done what they could but in that case with half the telephones in New England down it was a disaster of the first order and the only thing to do was to get service back.

Q -- Would it be practicable to do that in areas where you have forests to go through to prevent such a thing as that? Would the expense be greater than installing the cable?

A -- I don't know how far it's going to go but there are two things being tried out quite extensively in the Bell system, which may tend to solve this kind of a problem. One is buried cable. Armored cable is quite largely used in the middle west where you have reasonably rock-free soil. That cable is plowed in to the ground. If it isn't over private right of way, it's along the bank of the road. How far that can be applied in a rock area area like New England I don't know. At the moment it practically requires a rock-free country. Otherwise you have to go digging. In extension of that there is the so-called buried wire proposition. This takes the place of farmers' lines and of the great difficulties in the rural areas -- the very considerable distances apart which the houses are, the very low rates which the farmers could justify being paid, and the relatively excessive cost of the line

construction to reach those people. Following this buried cable type of thing we have developed and are trying out buried wires, one pair or two pairs of wires plowed in like this cable is plowed in and which can be loaded and a great many thousand miles of that have been used for rural line distribution. But we are not yet sure that we have got all the bugs out of it. We found out that about two or three kinds of troubles in certain localities showed up we'd never thought of. In Maryland there was a lot of this stuff used in dry soil. A lightning storm punctured it in an entirely different way from what they ordinarily do - puncture, the lightning hit the ground, and this wire inside of this rubber insulation was the wet spot and the thing punctured from the outside in. Ordinarily lightning goes the other way around. So in certain areas we have had to put in a shielding wire of some sort. Then we ran into the proposition of the country down south

(At this point my Stenotype machine locked and I lost part of the discussion while I got another machine. G.E.W.)

Q --

There is one

factor in here which is reputedly applicable to the communications industry may be used more and more in another war than it was in the last war. That was the element of censorship. Can you indicate how that problem might be handled?

A -- I really don't know. I served after the war. I was an officer in the signal corps after the war and I was in the Intelligence Service of the Navy. I had a commission in the Navy until I got to the point where it was important to the interest of the Navy that I be available as a civilian and not a military man. It was quite embarrassing to go abroad and be treated as a civilian. But at that time I had occasion to look into this question of censorship. Personally, I don't know just how you would set it up. Knowing how vast the telephone is even in peace times, in war times it would be even greater. I just can't conceive of any scheme of censorship which wouldn't so hamper the legitimate use of it that the price you pay <sup>be</sup> won't/more than the thing you have gained. When you're trying to do a censorship job on a hundred million conversations a day you've got a man-size job on your hands. It recently occurred to me to wonder how the industry got along so well in peace time traffic as to international traffic. The international traffic is so small relatively that you can handle it most any way you want. We actually do have justification for operating reasons on the trans-oceanic rays that is censored of all the time censor of all the services. The operators who run everything here are going over

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there. They may not know what they are saying but they know they are getting a local right. That sort of thing I think you can do in the foreign service. A proper censorship is necessary. If you had a military rate in the establishment you could turn that thing over. You can take that thing quite satisfactorily to the organization, the heads of the organizations, to set up a proper censorship fee they will pay. They knew what it was you wanted to censor. In addition to that, of course, if you might you should read the military and intelligence service or any books you can. It looks suspicious of certain material or certain kinds of things. Take the telephone companies. They are of complete capacity to localize that sort of stuff up here. You're suspicious of Bill Jones and you have to tell the telephone people who to suspect.

General Mauborgne. -- I wonder if I might say a few words. If it hadn't been for Colonel Jewett this organization just wouldn't have had any successful conclusion from the communication standpoint. The debt the government owes the A.T. and T Company and the Bell Companies for the communication work during the last war is something that can't be over-estimated. The signal corps as you know is a very small body and we have to have the same kind of assistance when we go to war. This time we have to have the same kind we had last time and brings up the question of whether or not we'd be able to do as good a job next time as last time. Colonel Jewett has brought out the important point in this case

of the A.T. and T. Company having uniformly trained personnel, uniform equipment, uniform methods. It goes without saying that we can do in the next war, so far as we are concerned, just exactly what we could in the last war. What they actually did was to put in the equivalent of a 400-mile line in France which is about the equivalent of the New England telephone company in this country. The entire thing was engineered and everything was the last word - of course it was. Today we are still in the position where we have got one battalion in the time of peace. It behooves us to see first of all that the equipment line construction that we give those people is the same as the A.T. and T. Company. If any fellow gets up in my organization and tells me we should have special equipment different from a construction truck or something else different from the A.T. and T. Company is going to handle this job. Why not take along the tools they use in time of peace? That is the way we are trying to equip our veterans. During the last war we sent men to these countries. Give us officers, put them in uniform, then who are specialists. To a certain extent they can during the next war but the strange jobs in the whole thing is that we have set up a reserve officer system. We've got more signal corps officers than we can use. Young officers are being commissioned - they go through certain colleges of training and they come out and for all the organizations to be raised as far as the planning is at present we've got enough officers. Where do I get my trained personnel for the Bell Company?

Any thing you can do is only to take a lot of fellows out of the civilian corps and leave holes for the specialization which the companies can give us when war comes along. These young men know to do things. What we need is men right out of the Bell Company to go to war as officers and go as senior technical men. It's all right but we can't get the officers. I ran across that the other day when a representative of the Bell Telephone Company came down and talked to me about this thing. One of the things that struck me was can you do as I did in the last war - get these highbrow specialists and put them in and first it looked as if you had a list of reserve officers. It's absurd to have such a policy and as a matter of fact as things stand we can put in reserve people of high standards when the time comes. Now as to the colonel's remarks about standardization of equipment. I have been studying this for many years. You see, I was ambitious. Engineering during the war we had it happen that many times the same problem came up. It looked very simple to copy a copy of radio equipment. The results were rather astonishing. As a matter of fact, if you weren't a victim nothing could come of it. To go to that, the Western Electric Company paid another type of tool - the electric tube - taking more current. That was all there was to it. I have have no fight with the colonel on this matter of standardization. Take commercial pairs and use them in sets. That's fine. But what happens? Those manufacturers have dies and fixtures all their own. You'll understand if you can't get anybody to manufacture something else. So it's not as easy as

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th t to equip. I am perfectly in agreement with Colonel Jewett whenever we can, anyplace we can, we do use the equipment. All their equipment for carrier current and everything under the sun can be used. Take a border line case. You would think you could take a teletype machine with you. Have you gentlemen ever been in the dust picked up by the mechanized forces? Have you ever been down in Texas where the sand storms are so terrific? Can you take one of those teletype machines and have it operate? They have got to re-vamp it for use in the field. The signal corps has to have it. I think that the point is clear, Colonel Jewett. That's the reason I went and joined the Air Force for a while. Why can't they use the same stuff the Navy does? All I had to do was get into an airplane, fly an hour or while and I could see why they had to have special equipment. I'm always of the idea that since there are so many radios being developed for the use of the civilian air corps for the population. These days it would cost us less when we could have it the more readily. Any time any number of radio compasses have deemed it foolish to set up military requirements only the man in the air knows how difficult his job is. So while I'm looking, I see some difficulty. The Colonel didn't mention one little thing brought up as the result of that little thing now being handled by his very interesting method. They developed a radio transmitter and receiver which is more or less automatic when wires go down in a certain place, stick on this radio set, it produces a telephone conversation and

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goes on the wires on the other side. We won't have had all the difficulties. It's a very interesting piece of apparatus. Another thing is the device for sticking conversation on top of an existing pair of wires by means of this carrier current, a little gadget which is in the signal corps today. We're not missing any bats; we expect them during the next war to help us just as much to use their equipment as possible. We had a demonstration of the teletype conference the other day and tried to get all the staff talking to everybody else. It made a very fine showing. You think the telephone conference idea has come to stay so possible results may come from the teletype conference.

Colonel Jewett. - I want to say one thing more. I think I made my point of view on standardization. I don't think we're at the point where we'd be the last person in the world to urge standardization beyond its legitimate end. In peace time preparations there is time to come when you simply learn that the question of the utilization of existing standards as far as they fit in with your needs be considered as a major factor in your problem. I'd like to make the short comment to back up what Colonel Jewett has said and extend his remarks just slightly, and illustrate with a story. When I was here in 1917 we had a need for a great number of telephones and I was one of the signal corps men who went to the air corps. We went out and placed the order with the Western Electric. If you've got to buy telephones, buy them from the telephone companies. We went to the Western Electric and got them and we pretty well filled them up and then we had another demand

for telephones and I discussed the matter with our new purchasing officers and they said, "Well, have you been reading these independent telephone companies' magazines. They've been raising hell about the trust. So I looked at one - it was put out by Kellogg of Cleveland. So I got Kellogg Company on the phone and asked them to send their president down with their treasurer and we had a meeting the next day. They got there at 9 o'clock and we had an order for 25,000 or 30,000 telephones we wanted to place with them. He stalled all morning and we couldn't get anything moving and we went out to lunch and agreed to come back at 1 o'clock to discuss the matter further. He came back at one and the lunch must have had something to do with it because he said, "There's no use discussing this matter. You have a good idea of the thing. But our factory is so filled up with Western Electric we couldn't take an order from you." So don't be misled by the ranting and raving of an independent company. You get good service from the A.T. and T. Company, not from the independent company. By telephones from a telephone manufacturing company and not from a beer brewery.

Colonel Miles. - Gentlemen, I think we<sup>are</sup> all greatly indebted to Colonel Jewett not only for his exposition of the intricacies he represents but for the very fine spirit which he has shown. We hope that in the next war we shall have the same fine type of telephone, telegraph, and radio. I want to thank you in behalf of the class and staff of the college.