SOVIET CAPABILITY FOR WAGING ELECTROMAGNETIC WARFARE

I would like to discuss the Soviet capability for waging electromagnetic warfare. Let us first define what we mean by electromagnetic warfare. Electromagnetic warfare, sometimes called electronic warfare is the contest, through use, jamming, interference, and related measures, for the control and use of parts or all of the radio spectrum or the denial of use to others.

In the first general postwar international radio conferences held in Moscow and Atlantic City in 1946-47 the Russians were most cooperative and agreed to proposals that a new program for world wide use of radio frequencies should be established based on an engineering approach. In the 1948 and succeeding conferences the Soviet attitude changed completely and all their activity was directed towards "hamstringing" the establishment of a new list. They fought any proposal for developing an international frequency plan based on sound engineering and stated that the only correct approach was to hold to the 1939 Bern List under which the U.S.S.R. held some sort of priority to every communications channel in the frequency spectrum from the lowest frequency to 30 megacycles. This list of course would give them an advantageous legal position for using any of these frequencies to the detriment of other countries. Thus, Russia could resort to a form of international radio "blackmail" by refraining from the use of certain frequencies in return for which the country concerned would grant concessions to the U.S.S.R. in other fields. Additionally by refusing to honor their agreement to participate in the formulation of a new list they refrain from supplying technical information on present and planned future use of radio to other countries while at the same time getting such information. To reinforce

their position the Russians appear to have established and are operating stations, particularly in the broadcasting field, in excess of the number required for adequately fulfilling their legitimate needs, thus denying the use of the frequencies by other countries.

A more active phase of the electromagnetic warfare that the U.S.S.R. has been waging is that of jamming. The jamming has taken two forms, so called "polite" jamming in which an Orbit transmitter utilizes a frequency already in use by another country's transmitter thereby making it difficult to hear the non-orbit broadcast; and deliberate jamming where an orbit transmission with jamming modulation applied to its carrier is targeted on a western information broadcast. This latter form of jamming is one of great concern and the balance of this presentation will be largely devoted to a discussion of it.

Organized jamming of VOA-BBC programs began in 1948 and, by April 1949, developed into a concentrated, extensive and effective program of jamming all, or nearly all, Russian-language broadcasts. The Soviets not only jam at will Russian-language broadcasts but those in the satellite languages as well. A curtain of jamming exists from the Karelo-Finnish S.S.R. in the north through Western Russia, Poland, Czechoslovakia, East Germany, Hungary, Rumania, and Bulgaria. Broadcasts to the Far East are also jammed. Recently RIAS (Radio In the American Sector) broadcasts to Germany have been jammed and current information indicates that powerful transmitters being constructed in the Sov Zone of Germany will be able to further nullify RIAS and other broadcasts. In January of this year the U.S.S.R. jammed the internal broadcast system of Denmark when a program that the Russians considered objectionable was broadcast for Danish

internal consumption. In all cases, jamming takes place quickly and effectively whether the broadcasts are scheduled or non-scheduled.

I hope to emphasize the fact that today the Russians have the capability for completely disrupting our long range radio circuits. This means, that if the Russians so choose, they can completely isolate the continental U.S. from its overseas facilities from a radio communication point of view. This, therefore, is a potent weapon for use in either psychological warfare or in an active military situation, since today approximately 75% of our military and 40% of our commercial traffic to Europe is by radio and 100% of military and 81% of commercial traffic to the far east is via radio.

Polar chart of circuits

In order to better understand how electromagnetic warfare or jamming is carried out, we have prepared a pictorial representation of the transmission characteristics of radio waves. At the left is a transmitter in the U.S. sending messages to a receiving station located in Berlin. We have also shown two jamming stations; one located deep inside the U.S.S.R. and the other in the vicinity of the receiving station in Berlin. If you will consider first the transmitting station located in the U.S. you will notice two types of waves being sent out by this station. These are the ground wave which follows the surface of the earth and, depending on the frequency and power used, has a reliable range of about two to three hundred miles, and the sky wave which travels upward and is reflected back to earth by an ionized layer in the ionosphere. This path will permit reliable transmissions of several thousand miles. In the example we have used, you will note that the transmission to Berlin is entirely by the sky wave path.

Propagation of signals

Now in order for the signals transmitted from the U.S. to be received successfully in Berlin, the strength of these signals in Berlin must be greater than any other signals existing there on the same frequency. If such is not the case then interference will be experienced and if this interference is great enough then the desired signal will be unintelligible and jamming will have occurred. Let us look for a moment at the Soviet capability, from a propagation point of view, to cause such interference or jamming to our European receiving stations. Remember that geographically the U.S.S.R. is closer to our receiving locations than we are. Accordingly the Russians can utilize a jammer located adjacent to our receiving station and jam by ground wave or if this is not feasible that jammer can be located a distance away and jamming accomplished by utilizing the sky wave path. It is of importance to remember that for a fixed transmitter power output the closest transmitter to a given location will develop the greatest signal strength at that location.

Polar chart again

Let us now consider the frequency range over which jamming of Voice of America and British Broadcasting Co. has occurred. The red block on this chart shows that range, 200 kilocycles to 21 megacycles. We have also plotted on this chart those portions of the frequency spectrum utilized for both military and commercial long range communication and navigation circuits. It is obvious that these circuits utilize frequency ranges within the bands where the U.S.S.R. has already demonstrated they can conduct efficient jamming.

Freq. coverage of jamming

Let us now consider what is needed to conduct effective jamming operations and how well the Russians can today fulfill these requirements. The essential elements are: transmitting stations, monitoring stations, communications facilities

between the various stations, and trained personnel. First, we must recognize that any radio transmitter that can be tuned to the desired frequency is a potential jamming transmitter. If you have listened to the early morning news broadcasts where direct overseas pickups are used, you have at times heard jamming. In this case when code signals or voice transmissions interfered with your listening it was unintentional but nevertheless caused difficulty. More sophisticated types of jamming are being utilized by the Soviets which they can accomplish by merely connecting a noise generator to an already installed transmitter. In Russia radio and wire line facilities rather than just wire line as in this country are utilized to provide internal communications. On this map are shown some of the radio stations in Russia. Bear in mind that in addition to these stations there are also many more that are utilized for broadcast, marine, aviation, military circuits, etc., and that at many of these stations there are several transmitters. Any of these hundreds of transmitters can be utilized as jammers. A listening program was established by the State Department in an attempt to determine if any of the Russian high frequency broadcast transmitters were being utilized as jammers since defector interrogations had disclosed that this was being done in the satellite areas. The information thus obtained has been plotted on this chart. The red lines indicate the major periods of VOA Russian language transmissions. You will note that prior to origination of these programs the number of Russian high frequency broadcast programs on the air decreases and does not increase substantially until the conclusion of the VOA program. [redacted]

Map of Sov. basic tel & tel stns

Diversion of trans.

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the normal broadcast. It has been estimated that between 500 and 1000 transmitters are today being utilized for jamming of western orbit language broadcasts. A feature of transmitters, that improves the efficiency of jamming operations, is the ability to change frequency rapidly. This characteristic is increasingly difficult to achieve as the power output of the transmitter increases. Transmitters manufactured in the U.S. with outputs of 50 kilowatts require up to 15 minutes to retune to a new frequency. In contrast to this, a 100 kilowatt transmitter manufactured by Brown-Boveri in Switzerland can accomplish a frequency change in less than one minute. It is known that Czechoslovakia purchased two of these units in 1950 designed for operation together with a power output of 200 kw.

In addition to having transmitters available, a successful jamming operation requires a well integrated monitoring-control network. This network must monitor continuously the transmitter to be jammed as well as the jamming transmitter. From observation of the reaction of Russian jammers to changes in frequency of VOA stations it is known that such a network exists. Tests made with VOA [redacted] stations cooperating have failed to uncover any radio transmissions which could be associated with such a network. It is assumed that such transmissions are carried out by land line circuits. It is known however, that the Russians have monitoring networks devoted to other services which, if the need arose, could be used for jamming operations. [redacted]

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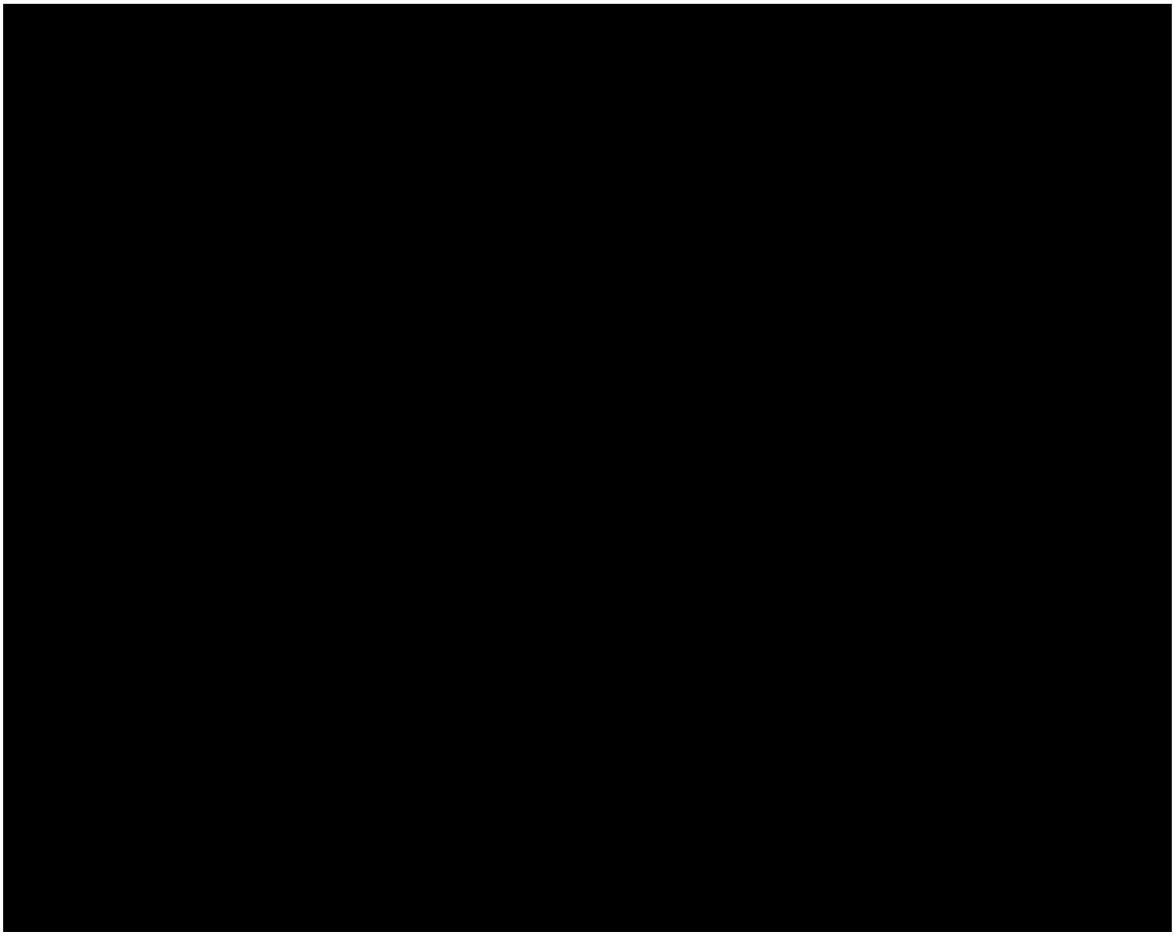

The remaining item on our list is the matter of trained personnel. It is obvious that from 1949, when jamming of VOA started, until today a great number of personnel could have been trained.

We have spoken a great deal about jamming and now suppose we listen to some of it. You will hear a recording of a transmission being jammed, the transmitting stations changing frequency to get away from the jamming, and the Russian jammer very rapidly coming up on the new frequency. (Play tape)

In conclusion, I would like to restate what we consider the present Russian capability and intent for waging electromagnetic warfare:

1. Through the position they take at International Radio Conferences they seek to disrupt orderly planning on a sound engineering basis of world radio usage, while at the same time maintaining some sort of

legal claim to every useful channel up to 30 megacycles. Accordingly, They are in a position to carry out international radio "blackmail" or engaged in "polite" jamming.

2. The jamming mechanism is of such a magnitude that they can interfere with many of the western nations internal broadcasting systems.

3. The high order of development of their jamming networks is such as to permit them to interfere with and completely disrupt our long range, military and civilian, communication and navigation circuits as well as broadcasting.

4. They will utilize any of the foregoing techniques whenever they consider it expedient.

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