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**EXTRACT FROM: HEADQUARTERS
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY**

**STOUSA REVIEW OF
-ARMY GROUND FORCES, EQUIPMENT REVIEW BOARD,
PRELIMINARY STUDY-**

SECTION XVIII, COMMUNICATION EQUIPMENT

Section XVIII is concurred in with the following exceptions and additions:

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Concur

3. In Lieu of second sentence of par 89b, substitute: "However, differentiation between speech security equipment for use on radio or wire circuits should be contemplated."

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9. Add to par 89n: "In addition to greater sensitivity, newly developed direction finding equipment should have antenna patterns giving greatly improved azimuth accuracy. Research should be continued to provide means to counteract the azimuth errors caused by surrounding objects such as trees and overhead lines. This equipment should not be further complicated by elaborate apparatus for determining sense."

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13. Add a par 89s: "Cryptographic Equipment. (1) The SIGARA should be redesigned to permit the cutting of tape simultaneously with the printing operation.

(2) A compact, simple and secure device for use by front line units, to replace the M-209, is required.

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(3) There is a need for a high grade device, similar in principle to SIGGUM for use by headquarters down to and including division."

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SECTION XVIII - COMMUNICATION EQUIPMENT

from Army Ground Force, EQUIPMENT REVIEW BOARD, Part I.

105. General. a. Future development of military communication equipment must keep in mind the complete system, extending from the highest to the lowest echelons, and with lateral extensions to include all components of the fighting team. In the attainment of this integrated communication system, the foundation stone should be the establishment of a completely integrated system within the front line units.

b. Deficiencies in the system, attributable in a large measure to the weaknesses of branch guidance, wherein intro-communication was stressed and inter-communication largely overlooked, should be corrected by future development.

c. The need for integration and the technical complexity of modern communication equipment warrants the adoption of a policy wherein the installation and maintenance of this equipment is performed by personnel trained by a common agency. The operation of the more complex equipment should be a function of this communication agency while the operation of the simpler equipment should be a function of using personnel.

106. Guides for development. Future development should be guided by the following:

a. Integration of wire and radio systems. (1) The ground force communication system must be so integrated as to permit interchangeable use of wire or radio channels or give combinations of the two without the user being necessarily aware whether he is talking over wire or radio or over both,

(2) The design of such an integrated system is inseparably linked with the design of radio, wire, speech security, and radio relay and carrier system equipment. Development of each of these items must be guided to insure not only improvement of the equipment itself, but also improved adaptability of that equipment for use in an integrated system.

b. Speech security equipment. The development of speech security equipment suitable for use of ground forces on radio circuits is of paramount importance. A corresponding, but less imperative, requirement exists for speech security equipment for use on telephone circuits.

c. Radio relay systems. Present development in radio relay systems should be continued and extended in order to provide a number of reliable communication channels as far forward as battalion with a minimum of labor and time

in a moving situation. Simplification and reduction in size and weight are particularly desirable.

d. Carrier systems. Existing carrier systems should be simplified and reduced in size and weight to permit utilization farther forward.

e. Radio equipment. (1) Radio equipment must be engineered to fit into the integrated communication system of the ground forces, and where necessary, of the Air Forces.

(2) Research and development in the radio field should be continued in order to:

(a) Arrive at a means of relieving the present overcrowded condition of the frequency spectrum.

(b) Provide appropriate overlapping of frequencies between different radio sets, thus permitting liaison channels between different formations without adding to the number of types of sets.

(3) The use of pulse transmission of a means of increasing the reliable distances over which communication is possible without increase in power requirements, should be investigated.

(4) A broadening of frequency coverage for medium frequency radio sets and provision for appropriate antennas is necessary in order to permit utilization of sky wave transmission.

f. Wire equipment. (1) Smaller, lighter weight, more portable switchboards for use by forward elements are necessary. Switchboards for use in large headquarters and fixed installations need simplification, reduction in weight, increase in flexibility, and increase in speed of handling calls.

(2) Investigation of new field wires and cables should be continued to provide greater conductivity, lighter weight, and better handling qualities.

(3) Improvements in power reels for handling wire and cable are necessary to alleviate present problems in maintenance of engines, clutches, brakes, and bearings.

g. Teletypewriters. (1) The difficulties of weight, bulk, and lack of ruggedness presently inherent in this equipment should be overcome in order to make this instrument useable as far forward as the Infantry battalion commander.

(2) Further research is necessary to evolve a keyboard type, page-printing teletypewriter which can be operated in a moving vehicle, over radio, and incorporating a security device.

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h. Authentication equipment. Present systems of authentication are too cumbersome, slow, and difficult to learn to use. A requirement exists for a small mechanical authenticator approximately the size of a watch. The authenticator must be provided with a variable key so that capture by the enemy will not completely compromise the authentication system.

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i. Air-Ground identification and communication equipment. Basic integrated planning for Air-Ground identification and communication is essential. Development of methods and equipment must be continued.

j. Radar equipment. See Section XX.

k. Survey equipment. See Section XIX.

Security?

l. Television equipment. Development of television equipment should be continued.

m. Modulated light beam equipment. The modulated light beam may provide additional means of communication between front line formations, particularly between armored vehicles for close-in communication, without using up critically needed channels of the seriously crowded radio spectrum. Development of modulated light beam communication for this purpose should be continued.

n. Direction-finding equipment. Current direction finders have proven inadequate due to lack of sensitivity, the time and labor involved in their installation, or their size and bulk. Development should be continued to provide suitable equipment covering the known usable frequency spectrum.

o. Dry batteries. Basic research and development should be continued to provide increased shelf life and ratio of output to weight.

p. Power units. A fundamental research project should be established in order to evolve a series of dependable power units of light weight and long life.

q. Miscellaneous. In order to take full advantage of technological progress, future development of military communication equipment should parallel closely the developments of commercial equipment.

107. For complete discussion of communication equipment, see Annex "R", Communication Equipment.

ANNEX "R" - COMMUNICATION EQUIPMENT

from Army Ground Force, EQUIPMENT REVIEW BOARD, Part I.

SECTION I - GENERAL

1. General. a. While the performance of signal communications equipment during the current war is satisfactory generally, the communication systems within which this equipment is used are unsatisfactory. Future development of military communications equipment must keep in mind the complete system, extending from the lowest to the highest echelons, and with lateral extensions to include all components of the fighting team. In the attainment of this integrated communication system, the foundation stone should be the establishment of a completely integrated system within front line units. Failure to provide such a system for front line troops will only result in continued useless casualties being suffered by these troops.

b. The signal communication equipment development agency must recognize the needs of the commander and devote its efforts to devising more complete and satisfactory integrated systems through better equipment and organization. The predominant need, in this respect, is adequately secure speech security equipment for radio and wire channels. Additional equipment, or changes in organization, to accomplish the demands of the user, must be provided when it is obvious that the system in effect is producing unsatisfactory results. The increased traffic load on the military telephone system is cited as an example. The telephone occupies a unique place in the life of the average American. It is our daily primary means of communication. Commercial companies have placed telephones everywhere. This practice has been carried into the service. Commanders and members of their staffs habitually use the telephone and consistently avoid writing messages for dispatch through routine message center facilities. Time required for routine processing of messages through staff sections and message centers, encoding, transmission, and decoding is considered an unnecessary evil. Therefore this unsatisfactory situation must be corrected by some means other than training. The secure speech security equipment is one solution.

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e. Equipment must be provided that will enable the commander to control subordinates, and no matter in what direction or to what particular place

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the situation dictates that the commander proceed on duty, it is mandatory that he be able to talk from that point to any area within his command and to or through such command echelons as may be necessary.

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SECTION II - ELECTRICAL COMMUNICATION EQUIPMENT

2. Integration of Wire and Radio Systems. a. In the past, under the system wherein the various branches set up military characteristics for development of equipment, primary attention was given to obtaining equipment satisfactory for intra-communication. Too little consideration has been given to inter-communication, between the various components of the task forces. Future developments must give emphasis to providing integrated communication equipment for use within the combined arms and must be so engineered as to permit interchangeable use of wire and radio channels or any combination of the two without the user being necessarily aware of whether he is talking over wire or radio or both. This will permit use of radio between terminals in a rapidly moving situation with subsequent replacement of radio by wire when the situation becomes sufficiently stabilized.

b. The equipment necessary to permit interchangeability in use of wire and radio, as outlined in par. a, above, has become so complex that the use of personnel trained by different agencies to operate the several sections of the system is impractical and inefficient. It is proposed that all communication personnel, including replacements, in all command echelons, be trained by a common agency and that they then be assigned to infantry, artillery, and other units as organic personnel. The responsibility for signal communication within organizations remains with the commander thereof.

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c. With new developments in radio relay and speech security equipment an integrated system approaches realization. This system follows the pattern of the present wire system with radio relay channels replacing the wire itself as far forward as battalions. Communication from battalion forward may be carried on using voice radio nets. Speech security equipment to provide the necessary security on these radio nets and on radio channels is the key to a successful integration of the army's communication system. A sketch of one solution to an integrated system is given in Inclosure No. 1-R.

d. The design for an integrated system of wire and radio is inseparably linked with the design of radio, wire, speech security, radio relay, and carrier system equipment. Development of each of these items must be kept under careful observation to insure that all improvements are directed towards increasing the adaptability of that equipment for use in the integrated systems. Branch control of the military characteristics provides only for those characteristics which affect a signal branch without providing the necessary inter-relation to assure adaptability to the overall integrated system. Appropriate

control can best be secured by the establishment of an Army Ground Forces Communication Board for the purpose of integrating the communication system of ground forces, correlating the communication needs of the elements of ground forces, functioning as a service testing agency for communication equipment, and guiding development trends in communication equipment for ground forces.

3. Speech Security Equipment. a.

b. The indiscriminate use of voice transmissions by wire and radio has caused our lack of signal security to be termed "The enemy's Secret Weapon". It is mandatory that the highest precedence be assigned the development of a speech security equipment suitable for use in ground forces on radio circuits. A corresponding, but less imperative, requirement exists for a speech security equipment for use on telephone circuits.

c. Military characteristics for speech security equipment have been processed for development. Copies of these characteristics are given in Inclosures No. 2-and 3-R.

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GSD-5

4. a.

b.

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6. Radio Equipment. a.

b.

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d. The incorporation of keyboard sending, page-copy receiving, and a built-in security device in a radio set with a reliable range of 50 miles, and capable of mobile operation in a 1½ ton truck, will serve to bridge the present difficult gap between elements of ground forces which must operate while in motion and over distances too great for reliable voice communication using present vehicular sets.

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8. Teletypewriters. a. Lighter weight teletypewriters operable over either wire or radio and capable of use as far forward as the infantry battalion will provide commanders with one of the fastest, most accurate means of communication currently known. The difficulties of weight, bulk, and lack of

ruggedness presently inherent in this equipment should be overcome in order to place this instrument as far forward as the infantry battalion commander.

b. Further invention is necessary in order to evolve a keyboard type, page-printing teletypewriter which can be operated in a moving vehicle, over radio, and incorporating a security device.

9. Authentication. Present systems of authentication are too cumbersome, slow, and difficult to learn to use. The result is widespread flagrant violation of signal security so far as authentication is concerned. Field units simply do not authenticate or else they devise and use a system so insecure as to be worthless. The unwillingness of troops to use present authentication systems can be overcome in one or two ways. The first is to insist on proper training and drills in the use of secure authentication systems so that proper systems are used; the second is to provide a mechanical contrivance. The first method has failed, leaving the second as the only practicable solution. This creates a requirement for a small mechanical authenticator approximately the size of a watch. The authenticator must be capable of being worn on the wrist, legible at night, suitable for one-handed operation, and so arranged that by setting up the challenge on the device the correct answer is shown. The authenticator must be provided with a variable key so that capture by the enemy will not completely compromise the system. This key must be capable of being easily changed in the field under combat conditions. The entire operation of setting up the challenge and reading the authentication should not require more than three seconds.

- 10. a.
- b.
- c.
- d.

SECTION III - RADAR ANT SURVEY EQUIPMENT

- 11. a.
- b.
- c.

12. Survey Systems.

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b. In any survey system consideration must be given to the communications equipment necessary to establish rapidly survey control, to function during movements of the fixed equipments, and to report locations. Security provisions must be inherent in the equipment in order to prevent enemy employment of the systems. This security equipment must be so arranged that enemy capture of the equipment will not compromise the system or permit enemy use thereof.

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- 12. c.
- d.

SECTION IV - MISCELLANEOUS

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18. Direction Finding Equipment. Current direction finders have proven inadequate due to lack of sensitivity, the tremendous amount of time and labor involved in their installation, or their size and bulk. Improved equipments are under development. Future development must provide equipment capable of giving bearings on all known usable frequencies, with portability appropriate for getting the direction finding equipment within good reception range of the transmitter on which bearings are desired. This will require lighter weight and more portability for the higher frequency sets because of the "line of sight" propagation characteristics of these frequencies. Airborne direction finders must be utilized to locate ultra high frequency transmitters and relay systems within enemy territory.

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EXTRACT FROM MEMORANDUM FOR THE ASSISTANT CHIEF OF STAFF, G-4,

WAR DEPARTMENT GENERAL STAFF:

Subject: Preliminary Report of the Army Ground Forces Equipment Review Board.

SECTION XVIII, COMMUNICATION EQUIPMENT

89.b. - Speech security equipment for wire and radio circuits is currently under development. Pilot models of equipment for Army, Corps and Division nets are expected within two years. Equipment for Regimental, Battalion and Company nets will require a long term project. There will be a continuous requirement for more secure, smaller and lighter weight equipment.

89.g. - Service test models of a lightweight portable teletypewriter are expected to be available in December of 1945. Military characteristics are now being coordinated for a large capacity teletypewriter switchboard central made up of lightweight components for use in all echelons. No long term fundamental research is anticipated.

89.h. - Development has not been initiated for a small authentication equipment. It is estimated that pilot models may be produced on a long term basis. Military characteristics should be submitted by the using forces.

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89.n. - Several radio direction finders having improved characteristics are under development covering a combined frequency range of 0.1 to 156 mcs. Pilot models of most of these equipments can be produced on an intermediate term basis.

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