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VOLUME 2

TECHNICAL PROPOSAL
SYSTEM 2
FIELD-STATION EQUIPMENT

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1. Scope

A proposal is presented for the adaptation of the existing System 2 airborne equipment to a field-station communications equipment. Since there is no longer a need for the System 2 navigation features, this proposal provides for the removal of these features from the System 2 base-station receiving equipment.

2. Description of the Existing System 2 Equipment

a. System 2 is a long-range digital communication system and ground-based navigation system operating in the high-frequency band and includes both airborne and ground-based equipments. An air-to-ground or ground-to-air message consists of a group of four decimal digits transmitted as a short burst of frequency-shift coded pulses. Received messages are automatically printed out by a small tape printer in the receiving equipment. The system employs automatic message recognition features which provide discrimination against the effects of atmospheric noise and interfering radio signals. The ground-to-air communication function includes a discrete address function by which a given airborne equipment prints only messages addressed to it. The meanings of the decimal digit message units sent and received are contained in code books held by both parties and a given decimal digit group may be assigned any desired meaning.

b. The System 2 airborne equipment was designed for maximum simplicity of operation. The controls consist of an off-on switch, frequency-channel selector switch, three 10-position message-selection switches and a press-to-transmit button which causes the selected message group to be automatically encoded and transmitted. A fourth decimal digit, which identifies the originating aircraft, is automatically inserted in messages transmitted by the airborne equipment.

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c. Each base-station equipment consists of a transmitting and a receiving equipment designed to operate at separate sites. The base-station receiving equipment is housed in a double cabinet which contains electronic assemblies for both communication and navigation functions plus a small cabinet containing power supplies.

3. General Requirements

A requirement exists for a field-station communication equipment for use between fixed field stations and base stations. This equipment must be packaged so that it can be broken down for shipment in packages no larger than an ordinary communications receiver and which when assembled and adjusted by trained technicians can be operated by untrained personnel. The equipment must be flexible with regard to the layout of the particular installation and with regard to use of whatever antenna is available. Unattended reception of incoming messages is required. In addition, early availability of equipments for operational use is an important requirement.

4. Structure of the Proposed Field-Station Equipment

a. The System 2 airborne equipment possesses many of the features required of the field-station equipment. The units of the airborne equipment are packaged in extremely compact form using miniaturized electronic circuits. The operating controls are extremely simple and are designed for the use of a pilot of a single-place aircraft. Unattended reception of messages is provided.

b. The proposed field-station equipment is based on the maximum use of existing System 2 airborne equipment designs and concepts to minimize development costs, to provide earliest possible delivery of equipments, and to utilize System 2 electronic and fabricated parts in production surplus to the greatest possible extent.

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- c. This equipment consists of three separate packages. The main cabinet contains the major electronic assemblies, a table-top control box at the operator's position, and the antenna coupler which will be placed at the antenna terminal.
- d. The control box is a new design in which message selection is accomplished by a four-column, 10-row keyboard housed in a sloping-front table-top cabinet which will also contain the printing unit, channel-selector switch, and press-to-transmit bar. The System 2 printing unit will be modified to facilitate loading, permit the tape to feed out, and increase paper capacity.
- e. The main cabinet contains the following units:
- (1) Receiver -- present System 2 design.
 - (2) Communication Unit -- present System 2 design modified to permit operator selection of all four transmitted message digits and to improve circuit performance. These modifications are based on field experience with the System 2 equipment and consist of changes to the counter and gating circuits which will make switching-pulse amplitude less critical, eliminate base-clamping diodes, and combine supply voltages for flip-flops and their associated emitter followers.
 - (3) Exciter -- present System 2 design.
 - (4) Transmitter -- present System 2 circuit repackaged to use conventional panel and chassis structure, which permits replacement of the servo-tuned plate network with a band-switched arrangement. The present 400-cycle input high-voltage power supply will be replaced by a 45/70 cycle, 115/230 voltage \pm 10% input power supply.

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(5) Power Supplies -- new design to provide the necessary operating voltages from 45/70 cycle, 115/230 volt \pm 10% primary power instead of 400-cycle primary power.

(6) Main Cabinet Assemblies -- new design to provide the necessary mounting structures, air cooling system and interconnection of units in a customer-furnished demountable rack.

f. The antenna coupler will be the present System 2 design modified by replacing the complex pressurized structure with a simple weatherproof case.

g. Cables will be provided as required for interconnecting the major units and for primary power. Twelve feet of cable will be provided between the main cabinet and control box and, fifty feet of cable between the main cabinet and antenna coupler. Twenty feet of primary power cable will also be provided.

5. Base-Station Receiving Equipment Modification

a. The elimination of the requirement for navigation service permits removal of electronic assemblies in the base-station receiving equipment associated with the navigation function and their replacement by an additional set of communications chassis to provide a dual communication receiving equipment. Operating controls for this equipment will be brought down to seated height as part of this rearrangement and digital circuit modifications, similar to those to be made in the field-station communication unit, will be made to provide improved performance. The remote operation unit, which provides control of the transmitting equipment from the base-station receiving equipment, will be equipped with a 10-key message selection panel to facilitate operation.

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6. Project Program

- a. Preliminary design of the new units and modifications covered in this exhibit have already commenced under a previous authorization.
- b. Two deliverable prototypes of the field-station equipment will be constructed as part of the engineering effort. The first prototype will be available for field testing on 30 December 1957. Production assembly beyond the two prototypes of the redesigned transmitter, new control box and new cabinet and cable assemblies will not commence until prototype evaluation has been completed on 1 February 1958. Production assembly of the other equipment units and purchase of electronic and fabricated parts for the redesigned and new units must commence about 1 December 1957 to meet the delivery schedule indicated in Volume 1 of this proposal.
- c. A prototype of the base-station dual receiving equipment utilizing electronic chassis in production for the two guard-band receiving equipments, will be constructed as part of the engineering program. As indicated above, this prototype equipment will be available for delivery and evaluation on 30 December 1957.
- d. Modification of the base-station equipments presently in the field will be accomplished by producing and delivering two field modification kits which will include completely wired double cabinets to which existing chassis will be transferred. Printed circuit assemblies will be returned to the factory for modification. As an alternate approach, complete base-station receiving equipments may be returned to the factory for modification.

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