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UNITED STATES GOVERNMENT

Memorandum

STATSPEC

TO : Chief, Operations Group, [ ] DATE: 15 July 1971
STATSPEC

FROM : Chief, Engineering Staff, [ ]

SUBJECT: Technical Report on Collins Remote Receiving System

1. Since 27 January 1971 the Collins Digital Remote Receiving System has been under test between [ ] Headquarters and the [ ] receiving site, utilizing the rhombic antennas located there. Over the twelve-month period prior to the tests, development of the Collins Equipment was monitored by the [ ] Engineering Staff and with the cooperation of Collins Radio Company, unique requirements for [ ] operations were designed into the system at no cost to [ ]

2. The system as tested between FBIS Headquarters (primary site) and the [ ] (remote site) consisted of the following equipment:

a. 2 each, 651S-1 Collins, Solid State Receivers with direct electronic frequency read-out at the remote site.

b. 1 each, 8311B-1 Collins Processor for controlling and tuning receivers at the remote site.

c. 1 each, Crown Tape Recorder with special control interface located at the remote site.

d. 2 each, Model 33 Teletype machines, with appropriate modems, one located at the remote site and one at the primary site.

e. 1 each, Control Head, 514S-1, located at the primary site.

f. To simulate a field bureau monitoring installation a FSK converter, model 28 KSR teletype machine, monitor amplifier control panel and IBM recording equipment were installed in the primary site location in the Key Building.

3. The system is designed to remotely control receivers, antenna matrices, audio lines and recording equipment from a distant point. The control commands are relatively simple functions from the model 33 teletype

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keyboard or digital commands generated by movement of the control knobs on the remote control head (514S-1) and transmitted to the 8311 processor at the remote site. The processor in turn controls the devices comprising the system. Digital control information between the primary and remote sites is transmitted in the form of eight-level ASCII code characters at a bit-rate of 110/BPS. This relatively slow bit-rate requires no special conditioning of the control line and use of a standard telephone circuit is more than adequate as verified in the test. The audio intelligence from the receiver is returned to the primary site via a voice-quality circuit. During the tests, a 5-kHz voice-quality circuit was utilized between STATSPEC and Headquarters, however tests verified a 4-kHz circuit would be more than adequate for returning the voice information.

4. The 651S-1 is a completely solid state, triple-conversion, superhetrodyne receiver which provides coverage from 400-kHz to 29.999 MHz. Primarily the 651S-1 receiver is a general purpose instrument however, for remote operation, features are provided in the receiver for the installation of two additional printed circuit cards. For STATSPEC operation, in addition to the existing bandpass filters, a 2.7 kHz iflter was installed to improve the performance of the receiver for standard AM-voice reception. Experience gained by STATSPEC during the past years has shown that optimum bandwidth for short-wave voice monitoring is approximately 3 kHz. The use of the 651S-1 receiver's 2.7 kHz bandpass filter completely fulfills this requirement and simultaneously restricts the bandwidth to permit multiplexing of the control circuit on a 4 kHz voice circuit. During the tests, the performance of the receiver exceeded specifications and no failures were noted. A detailed technical manual on the 651S-1 receiver will be available from Collins Radio in the near future.

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5. TECHNICAL TEST RESULTS. Evaluation of the Collins remote equipment has been beneficial to both [redacted] Engineering Staff and the manufacturer. Considerable experience in the operation of a remote system, the equipment required, reliability and programming possibilities was collected during the tests.

a. One major design fault in the construction of the processor power supply and a minor problem with the end-of-tape sensing device caused ninety-five percent of the malfunctions in the equipment during the test. On eight separate occasions the 8311B-1 processor went into a locked condition and failed to control the receivers and other equipment at the remote site. This condition could be rapidly rectified by momentarily removing power from the processor and then restoring it. A complete investigation of the problem revealed transient voltages were reaching the processor power supply from the communications lines and electrical power system. The sensing circuits in the power supply detected these transients as over-voltages or under-voltages and in turn attempted to sequence the power supplies off. The processor supply was redesigned by Collins Radio and an improved power supply installed in the processor on 6 July. The lock-up condition has not occurred since the new power supply was installed.

b. On several occasions, the magnetic tape on the recorder was completely rewound onto the start reel during the rewind cycle. The problem occurred because the end-of-tape sensing device failed to detect the specially treated end-of-tape section. Investigation revealed that one adjusting screw had been omitted during fabrication or had been lost during shipment. Replacement of this screw and adjustment corrected the malfunction.

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c. During the technical tests it became evident that one major system improvement could be made to drastically reduce the cost of communications lines for the system, especially when long distances are involved between the primary and remote sites. The present system requires one full-duplex line between the two sites which serves as a control line between the teletype machine, control head and the processor at the remote site. Only one control line is required regardless of the number of receivers being controlled. However, over long distances, the cost of the control line can be substantial because it must be assigned at all times in the event a command is required between the two sites. Preliminary tests and calculations indicate the control pulses can be transmitted to and from the remote processor on the same line used to return the audio intelligence from the receiver. The system of Speech-Plus is commonly used to transmit at least one teletype circuit, in this case the control pulses, and a voice transmission over the same circuit. Tests to confirm the operation of the system using one line for both voice and control pulses were under way when it became necessary to release the equipment for operational use. These tests will be continued when the equipment is again available for experimental work. The problem of a separate voice line and control line is not a critical one when short distances are involved between the two sites. Anticipating that remote equipment will be very useful for covering denied areas via satellite communications and with the advent of the assign-on-demand system presently being installed in the INTELSAT common carrier circuits, efforts to combine the voice and control information into one circuit is a worthwhile approach. The primary advantage of the assign-on-demand system is the subscriber pays for the circuit only during the time it is being used. The assign-

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STATSPEC on-demand system as it affects [redacted] operation will be covered in a separate paper in the near future. This assign-on-demand system is considered by many in the communications field as a revolutionary step towards reducing communications costs.

d. Because of a critical requirement to operationally monitor a Time Division Multiplex circuit, all tests and reconfiguration work on the Collins Remote System were terminated on 1 May 1971. However it is anticipated that additional technical tests and modifications will result in additional price reductions and a system which meets the specific STATSPEC requirements of [redacted] However, the system in its present configuration STATSPEC is well adapted for [redacted] use.

e. During the operational tests a number of programming improve- STATSPEC ments were suggested by [redacted] and Engineering personnel. The programming changes are being studied and where practical without major software changes which would result in a large expenditure of funds, the changes will be incorporated in the system intended for use at the [redacted] STATSPEC

STATSPEC f. After a short training session for [redacted] personnel, a concerted cruising program was conducted until mid-March. At that time experienced voice monitors were instructed in the operation of the equipment. These monitors made use of the equipment for several weeks in a live monitoring experiment. During late March and early April 1971, numerous demonstrations were held for members of the intelligence community, including DIA and NSA as well as components of the Agency. The equipment STATSPEC was demonstrated to more than 100 [redacted] employees, many of whom were not acquainted with the equipment and techniques involved in voice monitoring.

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6. The [redacted] Engineering Staff extends its sincere appreciation to Collins Radio personnel for their complete cooperation during the tests. Also, personnel in the Office of Communications contributed to the test by making available to [redacted] the two 651S-1 Collins receivers used in the system.

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7. A block diagram of the system configuration is attached.

[redacted]

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Attachment - 3 pages

Distribution:

Ch/Ops - 2
O/Dir - 1
O/Commo - 1
Collins - 1
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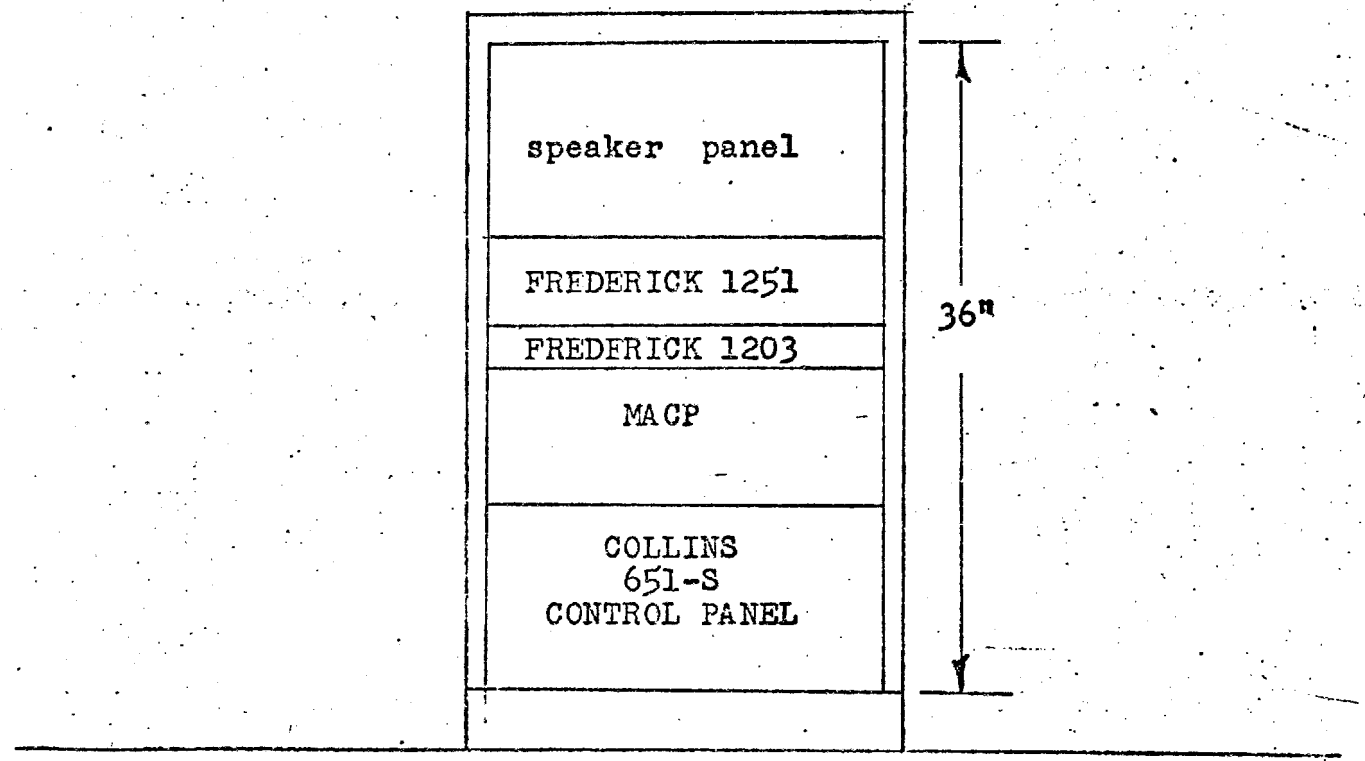

RACK EQUIPMENT CONFIGURATION

KEY BUILDING TERMINAL

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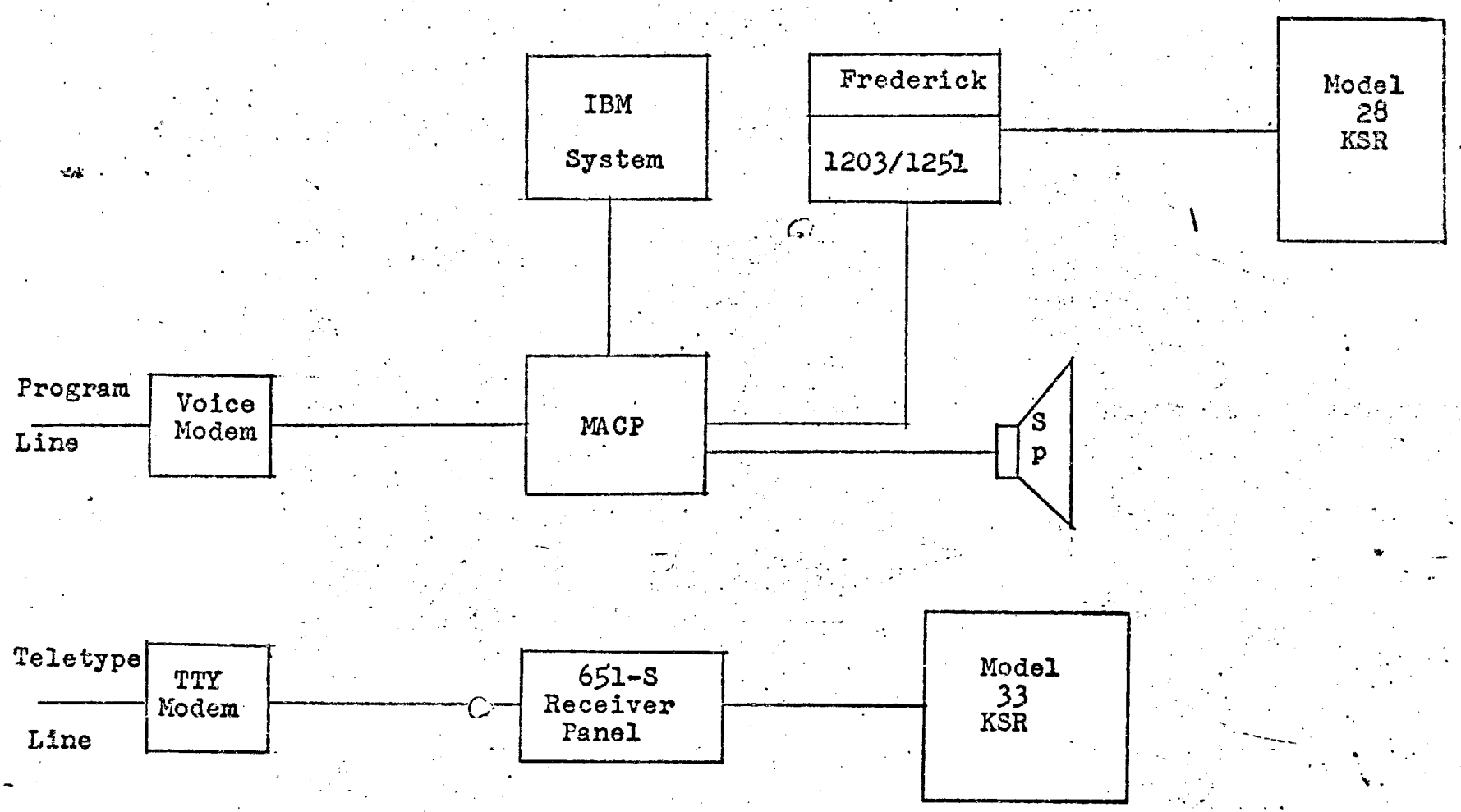

BLOCK DIAGRAM

KEY BUILDING REMOTE CONTROL RECEIVER SYSTEM

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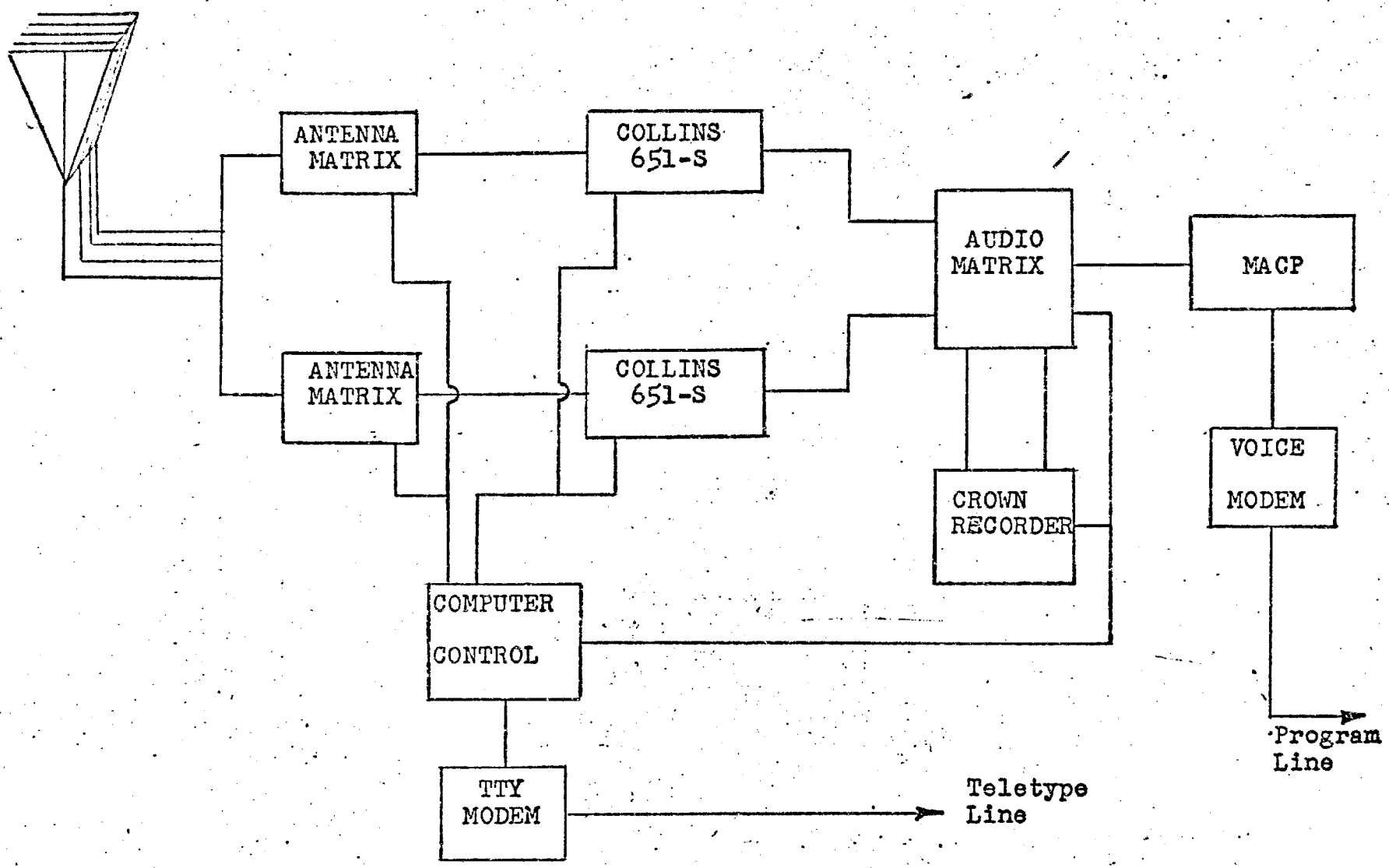

BLOCK DIAGRAM

REMOTE CONTROL RECEIVER SYSTEM

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