NRL Instruction Book No. 25
Addendum I

DESCRIPTION AND MAINTENANCE INSTRUCTIONS FOR MODERNIZED RADIO RECEIVING HUTS

June 1961

U. S. NAVAL RESEARCH LABORATORY
Washington, D.C.

Addendum 1 to NRL Instruction Book No. 25

DESCRIPTION

AND

MAINTENANCE INSTRUCTIONS

FOR

MODERNIZED RADIO RECEIVING HUTS

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SECTION 1

INTRODUCTION

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In the spring of 1960 the U. S. Naval Research Laboratory (NRL) equipped a number of aluminum huts with radio receiving and recording equipments intended for the reception and recording of signals from earth encircling satellites. These were installed in various parts of the world in order to provide for the maximum effectiveness compatible with the expected orbits of the satellites involved. A complete description of these huts and their equipment, as well as operating and maintenance instructions is contained in NRL Instruction Manual IB-25, dated April 1960 and titled, "Instructions for Assembly, Installation and Maintenance of Radio Receiving Huts".

After these huts had been in operation a reasonable length of time it became apparent that certain improvements, modifications and additions would be highly desirable, if not essential, in order that they be able to operate effectively and efficiently and furnish the collating and correlating agency with recordings that would contain the very maximum of useful information.

Accordingly, additional equipment and facilities were obtained and installed in the various huts by Field Parties from the Naval Research Laboratory. Because this modernization program was carried on in the field on a semi-crash basis, it is impossible to provide this Instruction Manual with the usual and desirable completeness and nicety of information expected of such a Manual. However, a very large part of the information contained in IB-25 will still be applicable to the Modernized Huts and should be referred to in company with this Manual for the complete picture.

SECTION 2

PURPOSE OF THE MODERNIZATION

- 0 -

2.1 GENERAL

There were two major deficiencies that developed with the operation of the huts as originally equipped and installed. These were:

(a) Unsatisfactory habitability.
(b) Unsatisfactory tape recordings.

2.2 HABITABILITY

Originally, only the one hut which was definitely destined for a known torrid location was provided with facilities to cope with excessive ambient temperatures. It soon developed however that because of the relatively large amount of power dissipated by the electronic equipment, even those huts installed in temperate locations became unbearably warm and would require special treatment to overcome this deficiency. Excessive temperatures will be further aggravated under modernized conditions, with the additional equipment provided appreciably increasing the heat dissipation into the huts. In three cases where huts are installed in an arctic or quite temperate location, the natural cooling and ventilation has been found satisfactory and no special treatment of these huts has been made.

2.3 TAPE RECORDINGS

The Magnecord tape recorders installed in the huts, while of high quality for recorders of this type, still possessed sufficient "flutter" to make the interpretation and analysis of certain of the data unsatisfactory with respect to accuracy. It further became apparent that the dual tracks provided by these recorders were insufficient in many cases to record the various items of data desired and that a multi-track recorder would be necessary.

SECTION 3

NATURE OF THE MODERNIZATION

- 0 -

3.1 GENERAL

In general the modernization of the huts involves the following:

(a) Providing sun protection and air conditioning (where necessary) to improve habitability.
(b) Providing a highly stable and accurate seven (7) track tape recorder as the basic unit, retaining the Magnecord recorder as a "back-up".
(c) Providing a highly accurate 10 kc oscillator to provide timing waves on the Magnecord tape if or when this unit is used.
(d) Providing facilities to permit simultaneous recordings on the main and back-up recorders.
(e) Providing an additional receiver for use at present in obtaining and recording standard time broadcasts (time ticks) or for other uses at a later date.
(f) Providing an installed high-quality cathode-ray oscilloscope for more ready and accurate adjustment and operation of the equipment.
(g) Providing additional test equipment to facilitate maintenance and servicing. This involves furnishing:

    (1) A high impedance ac/dc voltmeter.
    (2) A 20 cycle to 1 Mc oscillator.
    (3) A VHF Signal Generator (to certain stations only. All stations will be furnished this item as soon as they are available).

SECTION 4

MATERIAL FURNISHED

- 0 -

The modernization program involves the furnishing of the following equipment, all of which has been installed by an NRL Field Party mentioned previously. It should be noted that all the items listed below are in addition to those originally furnished with the huts and listed in IB-25, none of which has been removed, with the exception of the two exhaust fans which it was necessary to remove but which were left on the station. Accordingly, for any possible inventory or accounting purposes, the following list together with the similar lists from IB-25 will be accurate for each hut as modernized.

4.1 BASIC MATERIAL FURNISHED

1 - Aluminum Sun Canopy with all necessary supports. (Not applicable to certain huts.)
1 - Two HP (15,000 BTU) Air Conditioner, G. E. 190, 220 V, 60 cycle with mounting brackers. (Only applicable to huts receiving canopies.)
1 - Transformer for Air Conditioner 208/220 volts, G.E. Model 9T51Y5406. (Applicable only to huts receiving air conditioners.)
1 - Radio Receiver R-391/URR (Similar to R-390A/URR)
1 - DATATAPE 7-Channel Tape Recorder, Consolidated Electrodynamics Corp. Type GR-2500
1 - Cathode-Ray Oscilloscope, Tektronics, Type RM-16
1 - Hand Microphone, high impedance, Shure Type 405C.
1 - Signal Panel (for patching 'scope), NRL manufacture.
1 - Mixer Unit (containing 10 kc oscillator) for Magnecord Recorder, NRL manufacture.
2 - Receiver Audio Distribution Panels, NRL manufacture.
2 - Mounting Rack Extension Frames, NRL manufacture.

Interconnecting cables with terminal fittings.

4.2 SERVICING EQUIPMENT

1 - Audio Oscillator - WAVEFORMS, Inc., Type 510B
1 - Voltohmist - RCA Type WV-77E
1 - Signal Generator URM-26 (To certain stations only. All stations will receive this item at a later date).

4.3 MAIN RECORDER SPARES AND ACCESSORIES

1 - Analog Record Amplifier
1 - Analog Reproduce Amplifier
1 - FM Record Amplifier
1 - FM Reproduce Amplifier
5 - Capstan Drive Belts

4.4 SPARE TUBES AND FUSES

Spare Tubes	Spare Fuses
5 - 5R4WGA	4 - 1/4 amp
1 - 5654 (6AK5)	5 - 1 amp slow blow
2 - 5751 (12AX7)	2 - 1 amp quick acting
4 - 5784WA	5 - 10 amp slow blow
5 - 5614A (12AU7)	5 - 10 amp quick acting
4 - 6005	5 - 15 amp quick acting
1 - 6072 (12AY7)	
2 - 6080	
2 - 6112	
2 - 6146	
4 - 6336	

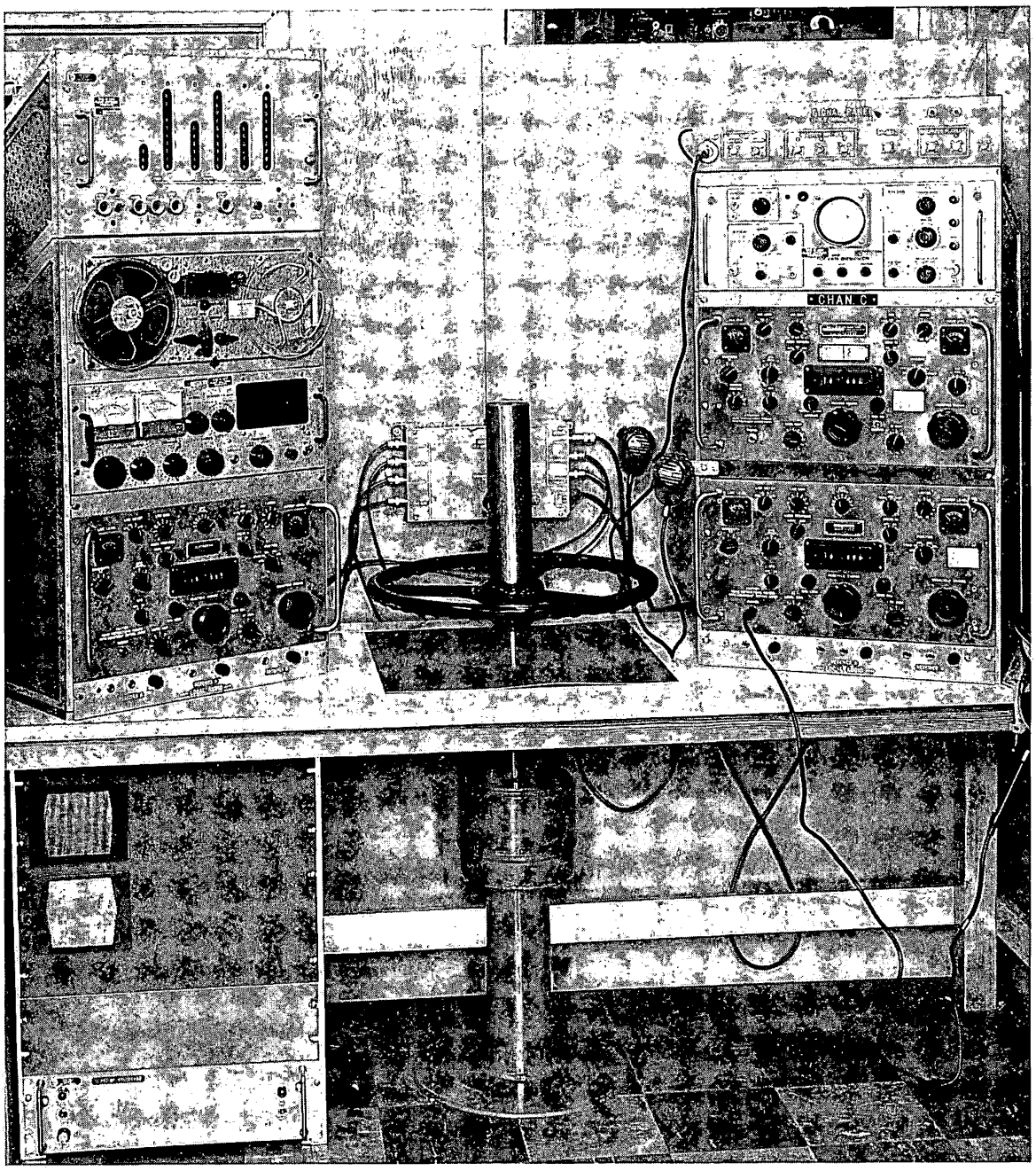


Figure 1 - Mock-up of Modernized Operating Table

SECTION 5

THE INSTALLATION

- 0 -

As has been previously stated, all the equipment entering into the Modernization Program has been installed by an NRL Field Party. Consequently, no installation instructions are necessary or would be pertinent in this Manual. Similarly, it is impossible to include herein any authentic photographs of a Modernized hut.

However, Figure 1 shows a mock-up of the receiving equipment as rearranged and installed. This, together with Figure 2 of IB-25 and a few explanatory notes will paint a fair picture of the modernized installation.

(a) The air conditioner has been installed through the rear bulkhead over the operating table, close to the overhead and directly behind the antenna shaft.

(b) In all the huts, because of the increased height of the extended racks, there was interference between the two exhaust fans in the rear bulkhead and the upper units in the racks. Positive interference existed in the case of the left hand fan and the Time Code Generator while there was small clearance between the right hand fan and the Signal Panel. This condition was treated differently in different huts. In those not receiving air conditioning, both fans were replaced with more shallow muffin type fans. In certain of the huts receiving air conditioners, both fans were removed and the holes blanked off by plates, while in others, only the left hand fan was removed and the hole blanked.

(c) The racks have been extended in height to accommodate the additional equipment. The swivel has been removed from the right hand rack; both racks being now secured to the table.

(d) The Mixer Unit is located on the bulkhead just above the operating table and behind the antenna shaft, substantially as shown in Figure 1.

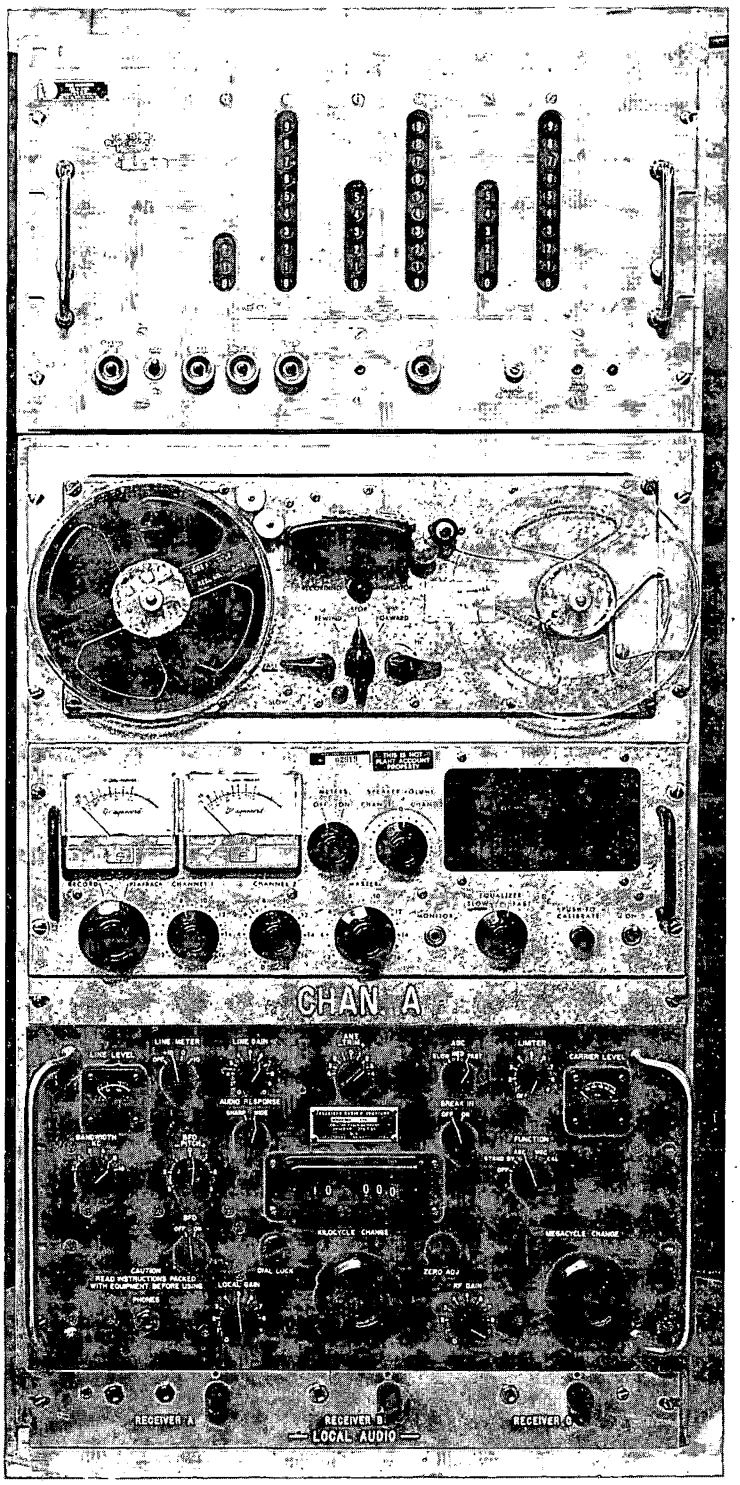


Figure 2 - Mock-up of Modernized Operating Position #1

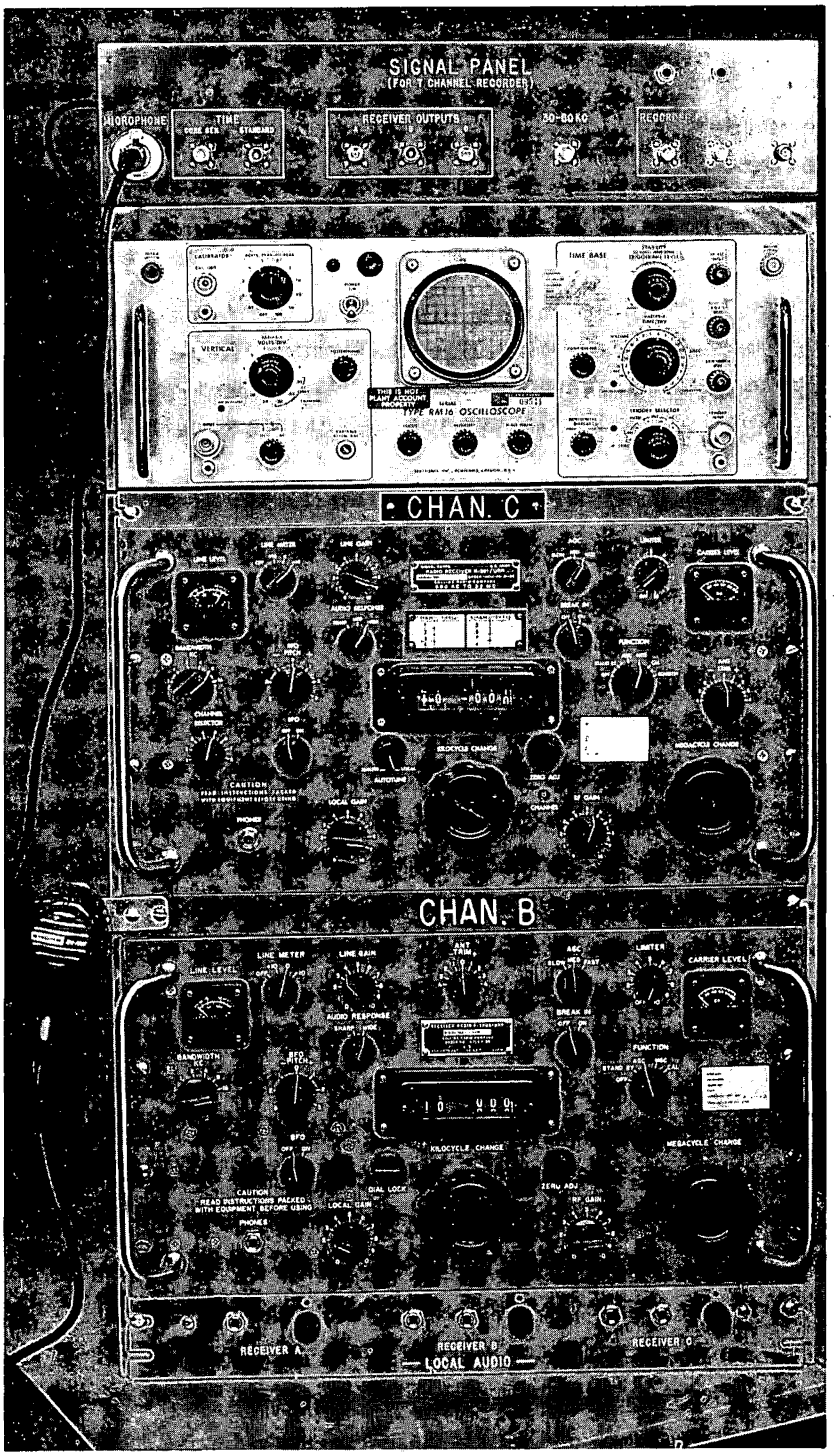


Figure 3 - Mock-up of Modernized Operating Position #2

Figure 2 is a close-up of the modernized Operating Position #1(on the left of the operating table). The upper unit is now the Time Code Generator. Below it is the Tape Transport unit of the Magnecord Recorder, below which is its Amplifier-Power Unit. The lower main unit is the R-390A/URR Channel "A" receiver, while the lowest unit is a Local Audio distribution panel.

Figure 3 is a close-up of the modernized Operating Position #2 (on the right of the operating table). The upper unit here is the Signal Panel for monitoring the various inputs and outputs to and from the Main Recorder. Below it is the monitoring oscilloscope. Next is the R-391/URR Channel "C" receiver while below it is the R-390A/URR Channel "B" receiver. The lowest unit is an additional Local Audio panel, identical to that provided for Position #1.

The DATATAPE recorder is quite a large and heavy unit (750 pounds) occupying all the space between the deck and overhead of the huts. In the modernized installation it is mounted behind the right hand operating position, close to the side bulkhead, facing the back of the #2 operator and approximately 29 inches from the table, requiring this operator to sit between it and the receivers.

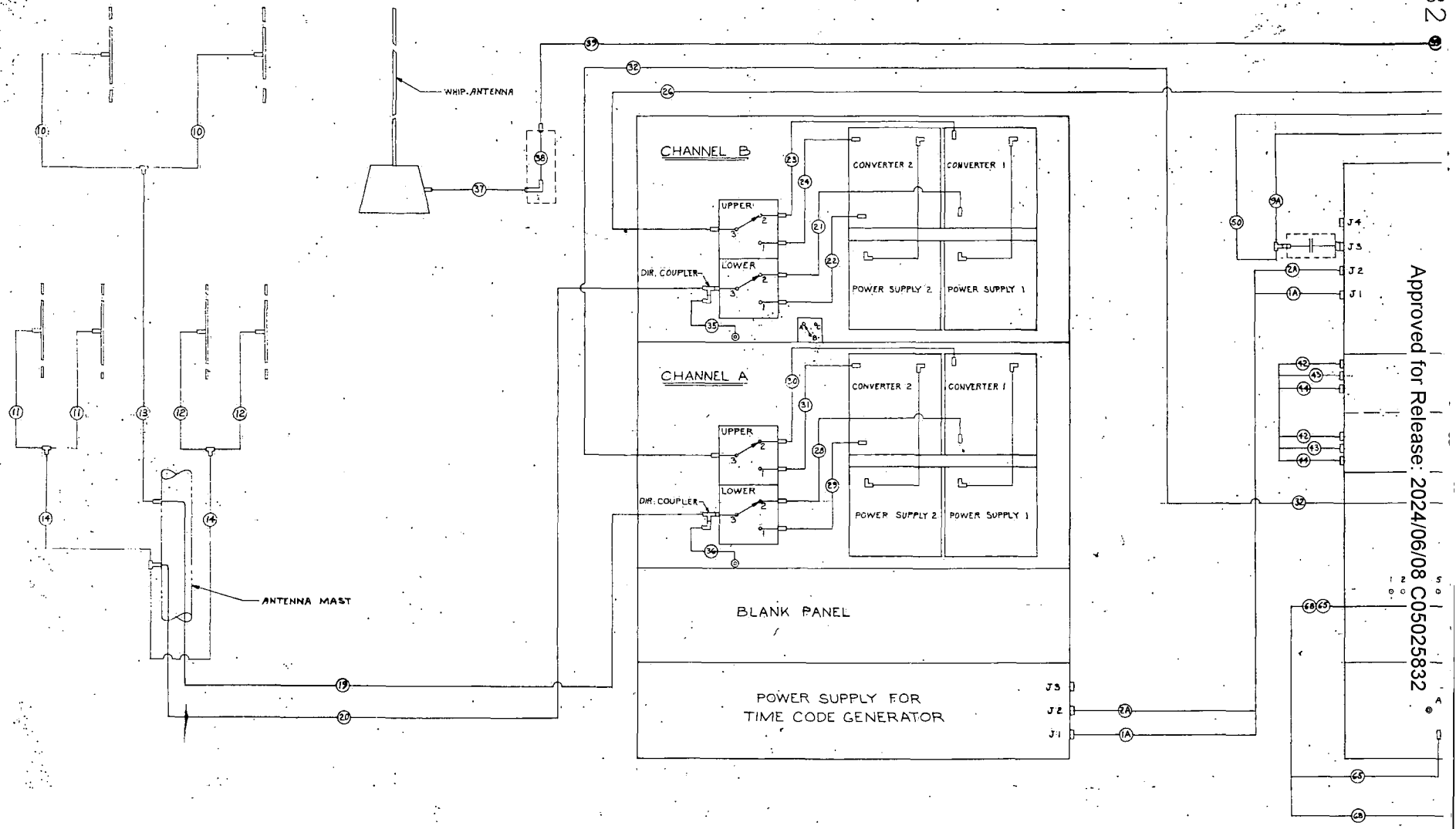
SECTION 6

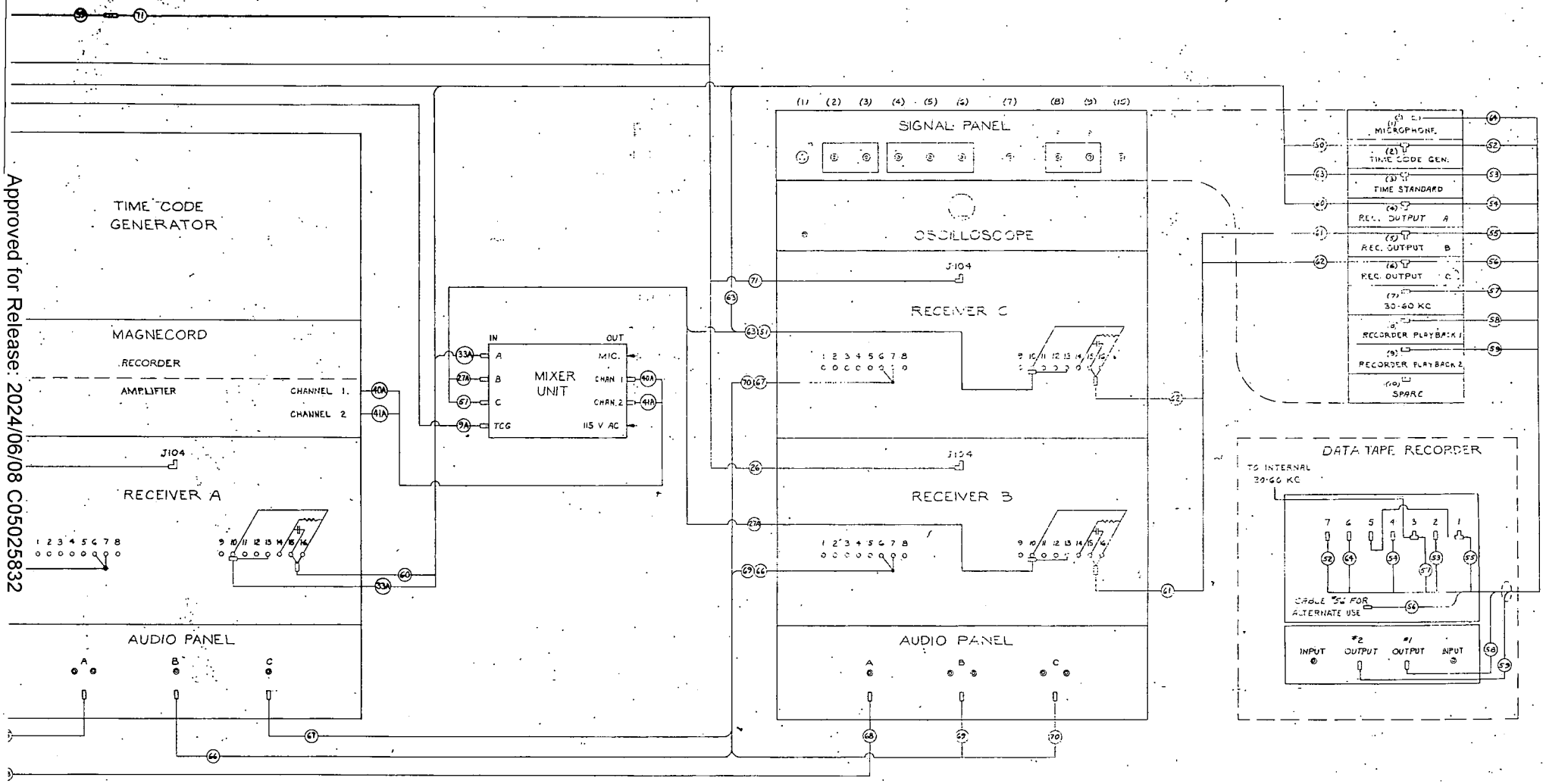
INTERCONNECTIONS

- 0 -

All the various items of the equipment in the modernized huts are, for the most part, interconnected by coaxial cables provided with BNC terminal fittings. All cables are clearly marked near their ends with designating symbols for easy identification.

Figure 4 is a cabling diagram showing the various cable runs and their points of connection. It is believed that this is sufficiently clear as to require no additional explanation.





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However, it will be noted that in order to simplify Figure 4 and make it more readable, all references to the types of the cables and their respective terminal fittings has been omitted and these data presented in TABLE 1 against cable numbers.

TABLE 1

CONNECTING CABLE TYPES, LENGTHS AND END CONNECTORS

Number	Type	Length Inches	Connectors and Remarks
1A	Special power	102	3106A-14S-6S one end 3108A-14S-6S other
2A	Special power	102	3106A-14S-6S one end 3108A-14S-6S other
3			Local connections on each Yagi ant. bay
4			" " " " " " "
5			" " " " " " "
6			" " " " " " "
7			" " " " " " "
8			" " " " " " "
9A	RG-58C/U	84	UG-88D/U both ends
10	RG-11/U		UG-21B/U on ends, UG-28A/U in middle
11	"		" " " " " " "
12	"	94	" " " " " " "
13	RG-9B/U		UG-21D/U on ends
14	RG-11/U		UG-21B/U on ends, UG-107B in middle
15			Not furnished
16			" "
17			" "
18			" "
19	RG-8A/U	180	UG-21D/U one end, UG-23D/U (mod) other
20	"	"	" " " " " " "

TABLE 1 (Cont'd.)

Number	Type	Length Inches	Connectors and Remarks
21	RG-58C/U	16	UG-88C/U one end, UG-536/U other
22	"	13	" " " " "
23	"	22	UG-88C/U both ends
24	"	18	" " "
25			Not used in Modernized Huts
26	RG-58C/U	132	UG-636A/U one end, UG-88C/U other
27A	"	60	UG-88D/U one end, Lugs on other
28	"	16	UG-536/U one end, UG-88C/U other
29	"	13	" " " " "
30	"	22	UG-88C/U both ends
31	"	18	" " "
32	"	84	" " "
33A	"	48	UG-88D/U one end, lugs on other
34			Not used in Modernized Huts
35	RG-9B/U	13	UG-21D/U one end, UG-27B/U other
36	"		UG-21D/U one end, UG-22D/U other
37	"	600	UG-21D/U both ends
38	"	6	UG-21D/U one end, UG-22D/U other
39	"	204	UG-21D/U both ends
40A	RG-58C/U	72	Cannon XL-3-12 one end, UG-88D/U other
41A	RG-58C/U	72	Cannon XL-3-12 one end, UG-88D/U other
42	Special		Jones P2406 CCT one end S2410 CCT other
43	"		Cannon XLR-3-11C one end, XL-3-12 other
44	"		Cannon XLR-3-11C one end, XL-3-12 other
45			Not furnished
46			" "
47			" "
48			" "
49			" "
50	RG-58C/U	198	UG-88D/U both ends

TABLE 1 (Cont'd.)

Number	Type	Length Inches	Connectors and Remarks
51	RG-58C/U	66	UG-88D/U one end, lugs on other
52	"	240	UG-88D/U both ends
53	"	240	" " "
54	"	240	" " "
55	"	240	" " "
56	"	240	" " "
57	"	240	" " "
58	"	240	" " "
59	"	240	" " "
60	"	162	UG-88D/U one end, lugs on other
61	"	72	" " " " " "
62	"	60	" " " " " "
63	"	60	" " " " " "
64	"	240	UG-88D/U both ends
65	"	36	UG-88D/U one end, lugs on other
66	"	132	" " " " " "
67	"	144	" " " " " "
68	"	144	" " " " " "
69	"	36	" " " " " "
70	"	60	" " " " " "
71	"	96	UG-88D/U both ends

SECTION 7

DESCRIPTION OF NEW EQUIPMENT

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7.1 THE MAIN RECORDER DESIGN

The Main Recorder is of the magnetic tape type and includes both recording and play-back facilities. All the component units are housed in a sturdy steel cabinet designed for deck mounting. This cabinet is 68 1/2 inches high, 24 inches wide and 28 inches deep. Its installed weight is approximately 750 pounds. It operates from a 105-125 volt, single-phase power line and consumes approximately 720 va. Because of its large size and weight, it was necessary to install these recorders in the Huts between the entrance door and the operating table, close to the right hand bulkhead (as one enters the hut). This places the front of the units some 29 inches from the edge of the table, facing the back of the operator in Position #2.

The Main Recorders were manufactured by the Consolidated Electrodynamics Corporation of Pasadena, California, under the general designation of DATATAPE but specifically designated as GR-2500.

These recorders are high precision instruments and are designed to record seven channels of data simultaneously, with a maximum of bandwidth and fidelity and a minimum of flutter.

They are of "unit" design and construction, it being possible to change to various methods of recording and reproduction merely by changing plug-in units. Similar flexibility is provided in many of their other features, such as recording speed. For example, it is possible to employ six different recording speeds between the limits of 1 7/8 inches per second (ips) and 60 ips.

Because of this extreme flexibility, the Instruction Manual prepared by the manufacturer and supplied to all stations is extremely comprehensive and covers all possible modes of recording, tape speeds, etc. MUCH OF THESE DATA WILL NOT BE PERTINENT TO THE EQUIPMENT AS INSTALLED AND SHOULD BE IGNORED WHEN NOT APPLICABLE OR CONSIDERED IN THE STATUS OF GENERAL EDUCATION. It should be noted that the designation GR-2500 is more or less generic and does not describe all the features of the equipment as furnished and adjusted.

7.2 DETAILS OF MAIN RECORDER PROVIDED

Specifically the Recorders installed in the Huts have the proper units provided and are adjusted to operate with the following characteristics:

RECORDING MODES: Provisions are made for the recording of three (3) channels by Frequency Modulation (FM) techniques and four (4) channels by Analog methods.

REPRODUCTION MODES: Provisions are made for the reproduction of any one of the FM channels and any one of the Analog channels simultaneously. This is to say that seven reproduction heads are provided but only one FM and one Analog Reproduction Amplifier.

REPRODUCTION LIMITATIONS: Inasmuch as separate heads and Amplifiers are provided for Recording and Reproducing, it is possible to reproduce any one channel while recording but because of the spacing between the two sets of heads there is a time lag between the recorded and reproduced signal. The mount of this lag is obviously a function of tape speed, but in the equipments as adjusted for a tape speed of 30 ips, it is approximately 150 milliseconds.

TAPE SIZE AND SPEED: The equipments as furnished and installed are intended and have been adjusted to employ 1/2 inch one mil tape on 10 1/2 inch reels with a tape speed of 30 ips.

RECORDING TIME: The recording time is a function of the tape speed, tape thickness and reel size, but for 1 mil tape on 10 1/2 inch reels it is approximately 24 minutes, recording at 30 ips.

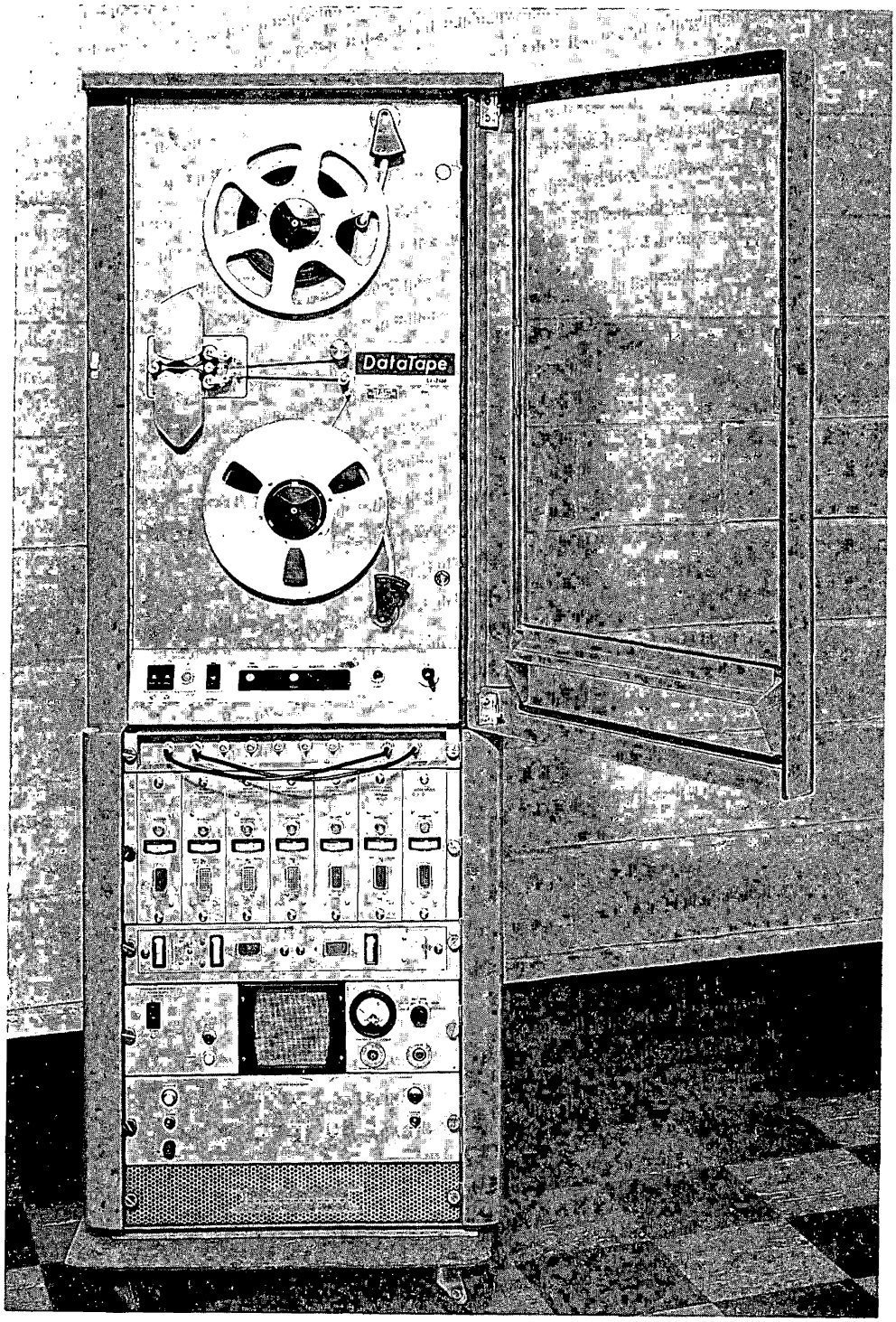

Figure 5 - Front View of Main Recorder

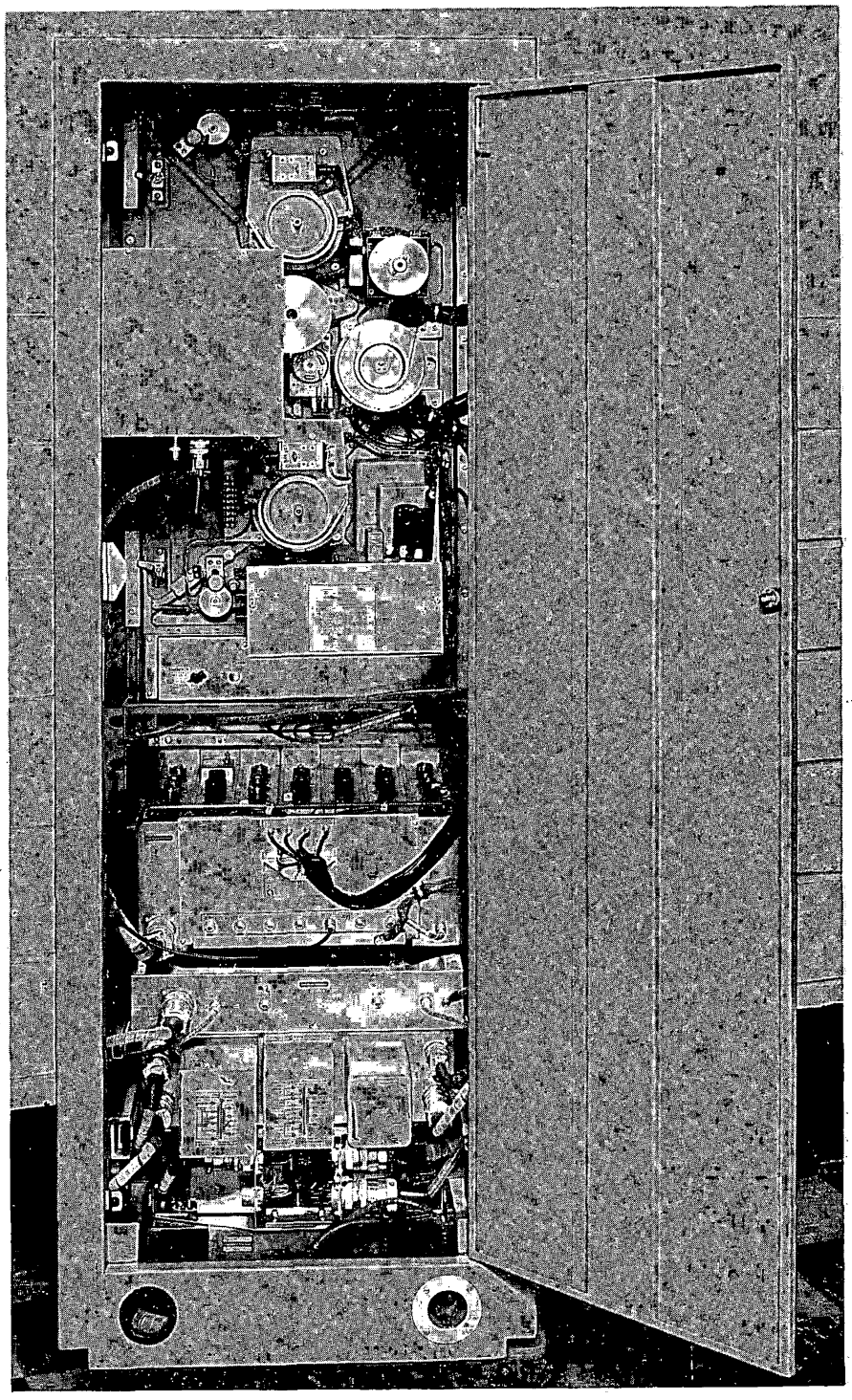

Figure 6 - Interior View of Main Recorder (from rear)

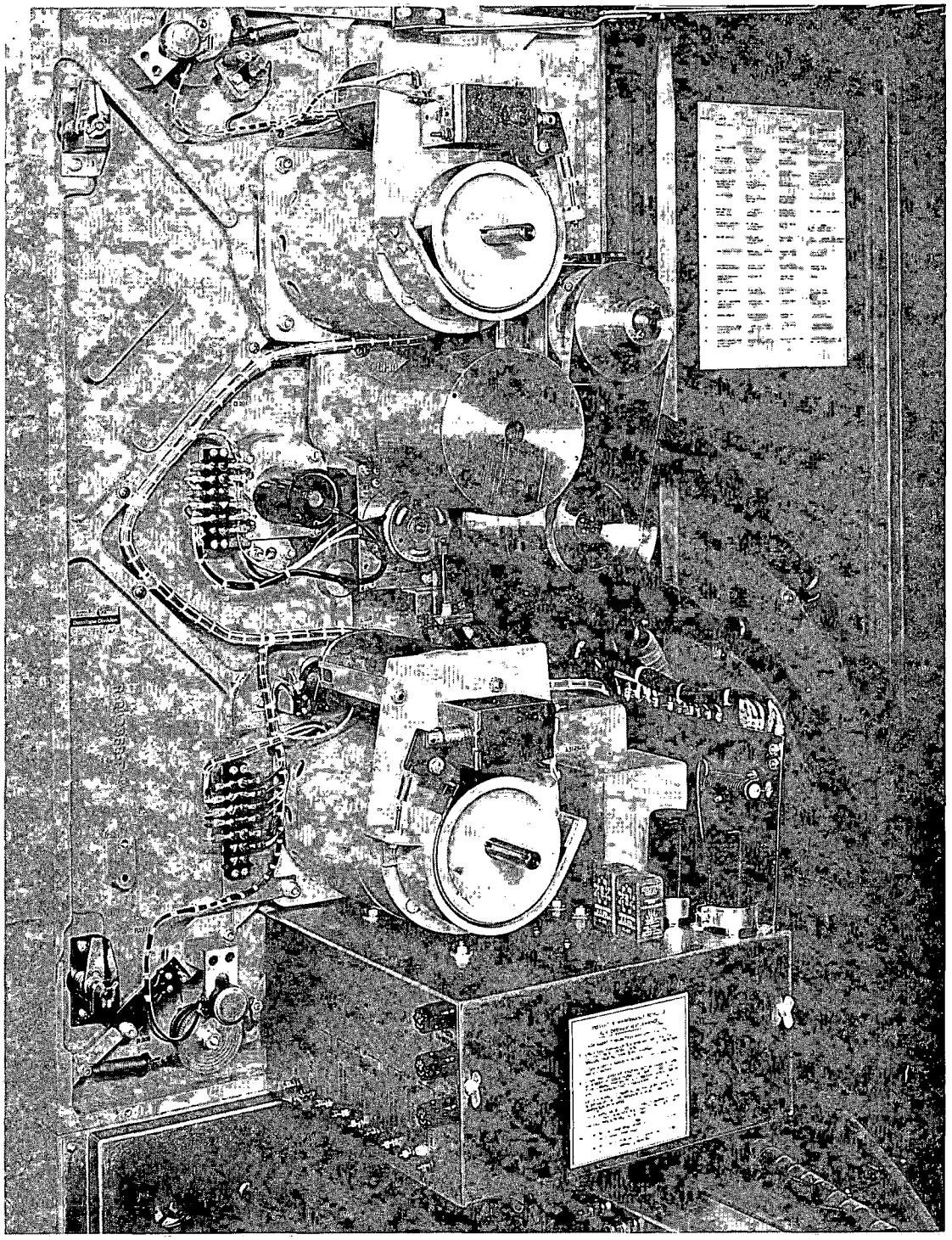

Figure 7 - Close -up of Interior of Tape Transport Assembly

TIMING MARKS: A precision (.002%) Oscillator is provided that will permit the recording of sine waves of either 30 or 60 kcs. Either of these frequencies can be selected by an internal switch marked 30-OFF-60 but as installed and adjusted the 60 kcs oscillator is connected and should be used unless otherwise directed.

POWER FREQUENCY VARIATIONS: All the equipment except the tape drive is capable of operating satisfactorily over rather wide frequency variations. To render the tape speed independent of such variations, a tuning-fork-controlled Precision-Frequency Power Supply is provided for driving the capstan motor.

Figures 5 and 6 are front and interior rear views of the Recorders furnished.

The upper third of the assembly is the TAPE TRANSPORT UNIT (the interior of which is shown in Figure 7) readily identified by the two tape reels. To the left, midway between the tape reels, is located the recording and reproducing head assembly. The Tape Transport Unit is provided with a clear plastic dust shield (shown open in Figure 5) which is equipped with slip hinges so that it can be completely removed if desired.

The sloping shelf at the bottom of this unit contains all the basic operating controls, the five large square buttons at its center (containing pilot lights) being (from left to right) for effecting the following: FAST FORWARD - REWIND - STOP - REPRODUCE - RECORD.

Below the Control Panel is a narrow Patch Panel to permit any of the seven Reproduce Heads to be patched to the inputs of either the FM or Analog reproduce amplifiers.

Below this patch panel are the seven Record Amplifiers, three FM and four Analog. While substantially similar in panel appearance, the Analog amplifiers can be quickly identified by the small toggle switches near their center. These amplifiers all individually plug into a filing cabinet type of drawer which can be rolled part way out without disengaging any of the connections, to permit the making of certain adjustments with the units activated.

Below this unit is a similar drawer-type assembly housing the two Reproduce Amplifiers, also plug-in units. The FM amplifier, on the left, can be readily identified by the two meters on its panel.

Below this is the Precision-Frequency Power Supply, which is in two sections with an extra fan mounted (by NRL) between them. This was installed to improve the ventilation. This was found desirable, particularly under conditions of high ambient temperatures.

The lowest unit is the main power unit for furnishing power to the amplifiers and other components of the equipment.

7.3 THE R-391/URR RECEIVER

This receiver is similar in design, appearance and operation to the R-390A/URR receivers. The main difference between these two receivers is that the R-391/URR equipment contains an Autotune system to permit it to be remotely controlled when installed with certain auxiliary units. However, as installed in the modernized huts, no remote control equipment has been provided, so that, as far as operation is concerned, it may be employed in exactly the same manner as the R-390A/URR receivers. However, for servicing information, it is suggested that its own Instruction Manual be referred to rather than attempting to use the R-390A/URR books.

7.4 THE MIXER UNIT

The Mixer Unit that is mounted on the rear bulkhead of the hut just above the operating table is shown in close-up in Figure 8, while its internal wiring is shown in Figure 9. This unit is in reality a combined connection, switching and test unit as well as a Mixer. The Mixer designation arises from the fact that it contains a crystal-controlled precision transistorized oscillator operating at 10 Mc and a power supply unit for its operation. The output of this oscillator is mixed with the data signal being fed to channel 2 of the two-channel Magnecord recorder for the purpose of simultaneously recording timing marks.

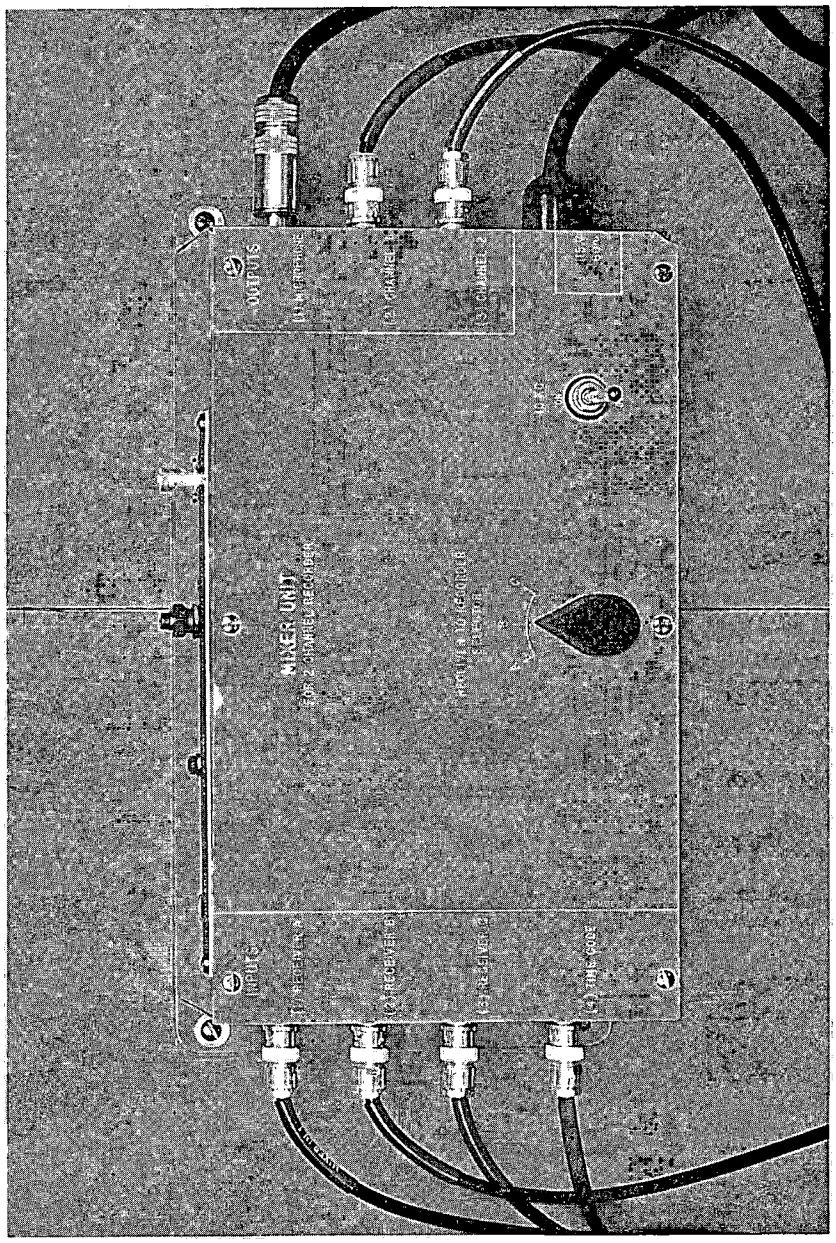

Figure 8 - Close-up of Mixer Unit

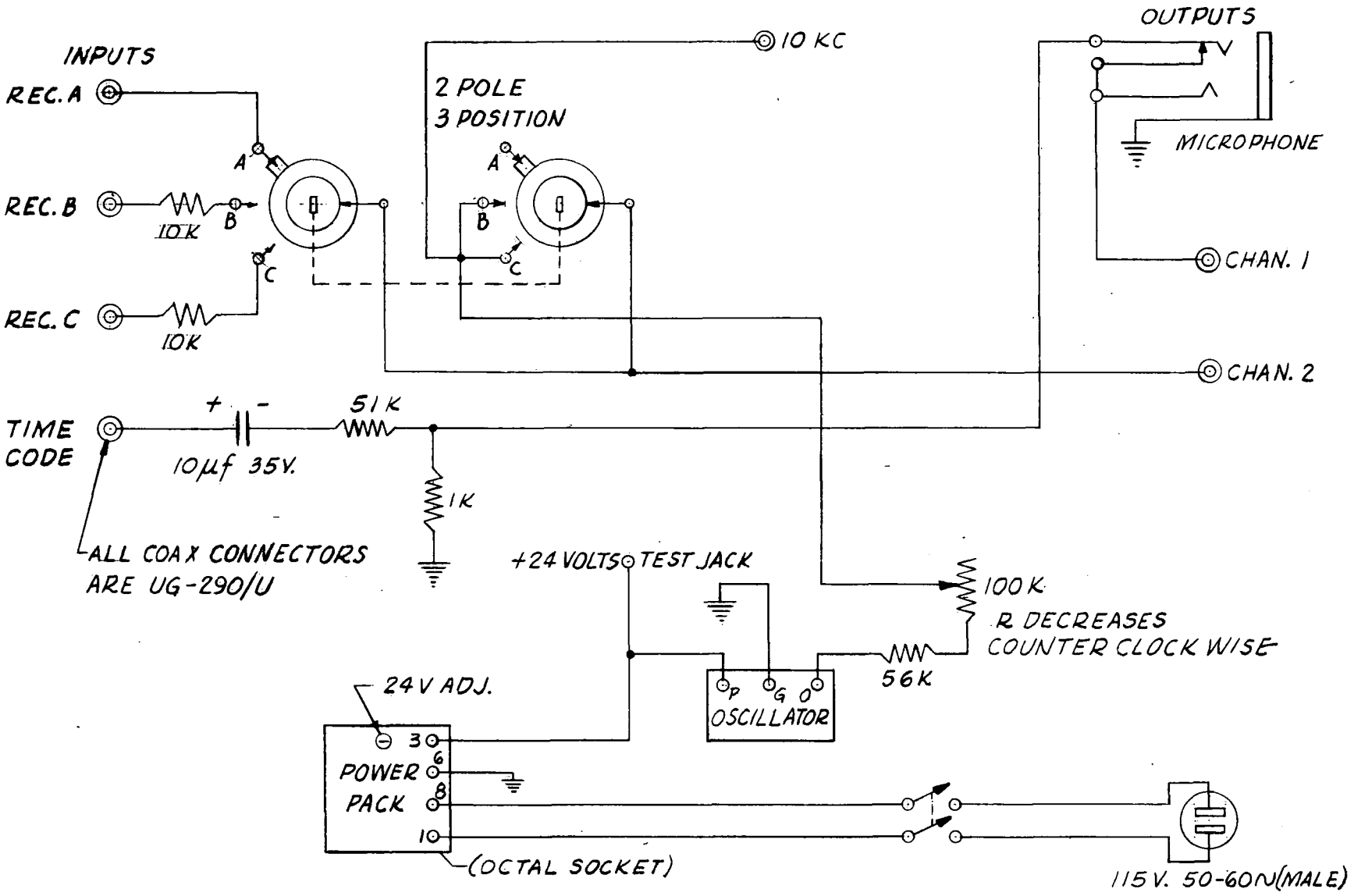

Figure 9 - Wiring Diagram of Mixer Unit

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Referring to Figure 8, the Line Audio Outputs of the three receivers (Channels A, B and C) and the output of the Time Code Generator plug into the four BNC receptacles on the left hand side of the unit. The Magnecord Recording Amplifier inputs for the two recording channels, as well as the low impedance microphone input, plug into the right hand side of the unit, as does the 115-volt, 60-cycle power input for the oscillator.

On the front panel of the unit is a three-position switch identified as RECEIVER TO RECORDER SELECTOR. This switch permits the Line Audio Output of any of the three receivers to be fed to Channel 2 of the Magnecord Recorder with the 10 kc time marking signal mixed with either the Channel B and C signals but never with Channel A.

The output of the Time Code Generator feeds to the input of the Magnecord Channel 1 recorder amplifier through a 10 mfd dc blocking capacitor and the microphone telephone jack. The tip and ring of this jack are so connected within the microphone to its PUSH-TO-TALK switch that the output of the Time Code Generator is normally being fed to Recorder Channel 1 but is interrupted while making and recording oral comments with the TALK switch depressed.

On the upper edge of the unit are located four adjustment and test facilities. The BNC fitting on the right is in parallel with the Channel 2 output and is for the purpose of connecting a test or monitoring 'scope or meter to any of the three receiver Line Audio Outputs as determined by the position of the Selector switch. Next is a potentiometer for adjusting the level of the 10 kc marker signal. Next is a test jack for checking the dc voltage being applied to the 10 kc oscillator, while to the extreme left is a hole through which a potentiometer control in the power supply unit may be reached with a screw driver for adjusting the level of this dc voltage to its proper value of 24 volts.

7.5 THE OSCILLOSCOPE

The Oscilloscope, mounted above the Channel C receiver in the #2 operating position, is a standard 3 inch commercial unit, manufactured by

Tektronics, designated as their RM-16, and has an upper frequency range of approximately 10 Mc. There is nothing special or unique about this 'scope and inasmuch as such instruments are so common and their operation so well known, there is little additional information required in this Manual.

However, there may be a temptation to temporarily (?) remove this 'scope from its rack for general use around the station. If at all possible it is strongly recommended that this impulse not be obeyed, inasmuch as this 'scope will be required for set-up and actual operation of the equipment as covered by the SOP and frequent removal and replacement of electronic units such as oscilloscopes can do them no good.

7.6 THE SIGNAL PANEL

The Signal Panel mounted above the Oscilloscope in position #2 rack and shown in Figure 3 is basically a Monitoring facility for the Main 7-channel recorder, but serves secondarily as a junction block between the cables from the receiving equipment and those from the recorder.

Referring to Figure 3, the extreme left hand jack receives the output from the high impedance microphone used for making oral comments during recording. Next, in the engraved block marked TIME is the output of the Time Code Generator on the left and the Line Audio Output of Channel C receiver, used (for the present) for receiving Time Ticks on the right. The three BNC fittings in the block engraved RECEIVER OUTPUTS and marked A, B and C connect to the detector outputs of the three receivers, through blocking capacitors. The next outlet marked 30-60 kc connects to the output of the precision oscillators in the DATATAPE recorder and on it will be either 30 or 60 kc according to which oscillator has been activated in the recorder. Normally this will be 60 kc. The next two BNC fittings in the block engraved RECORDER PLAYBACK and marked 1 and 2 permit connection to the outputs of the FM andAnalog Reproduce amplifiers respectively. The final BNC fitting on the right is a spare provided for possible future expansion. The two phone jacks above the two Recorder Playback fittings are in parallel with these fittings and are for the purpose of listening to the outputs of any of the seven recording channels (as selected by the patch board on the recorder).

Low impedance phones may be used in the Playback #2 jack, (the Analog amplifier) as its output impedance is low. However, it is unwise to use any but crystal headphones in the #1 jack as the output of the FM Reproduce amplifier is and must be terminated with a resistive load of 10,000 ohms. Reducing this resistance, such as by low impedance phones, will compromise the performance of the amplifier.

The Signal Panel was intended primarily as a ready means of monitoring the various signals on the 'scope and was placed close to the 'scope for this reason.

Parenthetically, all the BNC fittings on the Signal Panel are of the feed-through type. Their ends behind the panel are equipped with "T" fittings to which, as mentioned above, the respective cables from the receiving equipments and the recorder connect, thus serving as junction points.

7.7 LOCAL AUDIO PANELS

At the very bottom of each rack is located a Local Audio Panel. These may be seen by reference to Figures 2 and 3. They are functionally identical, differing only with respect to the number of phone jacks provided. Fundamentally they are intended to permit either operator to listen on any receiver he desires or, by the use of split phones, to listen on two receivers simultaneously. At the same time, individual Volume Controls are provided for each receiving channel to permit either operator to adjust his headphone level or levels without affecting the level(s) of the other operator's phones. These "pots" are connected across the Local Audio outputs of the respective receivers with their wipers connected to the respective jacks. In operation, the Local Audio Gain controls of the three receivers are maintained "full on" which normally would produce excessively high phone levels, the final adjustments being done by the "pots" provided on these panels. It will be noted that, inasmuch as operator #1 would always be primarily listening to Channel A and similarly operator #2 to Channel B, the A and B jacks on racks 1 and 2 respectively are in duplicate to permit supervisory listening without disturbing the operation.

SECTION 8

PRINCIPLES OF OPERATION

- 0 -

Because of the inclusion of a seven-channel recorder in addition to the original two-channel Magnecord recorder and the addition of a third receiver, there are certain operating differences between the modernized and the original equipment. An attempt will be made to clarify these by individual treatment, with discussion as to possible ramifications as might be directed in the future by specific instructions.

8.1 RECEIVER INPUTS

The inputs to the Channel A and B receivers connect directly to their respective Converter Units as in the original installation. However, the input to Channel C receiver connects directly to the whip antenna. Thus the receivers for the respective channels are connected to their respective antennas (through converters for A and B) at all times.

8.2 RECEIVER OUTPUTS

Because of the provision of two separate and distinct recorders and the desirability of providing for their independent or simultaneous use without interaction, as well as the desirability of providing the highest possible fidelity of the signals feeding the Main recorder, two separate and distinct outputs are taken from each receiver. The receiver outputs feeding the Main Recorder are taken from the diode detectors through capacitors to block the dc components, whereas the outputs feeding the Magnecord recorder are taken from the receivers Line Audio Outputs as in the original installation. Inasmuch as but one track on this recorder is to be used for received data (Channel 2), (Channel 1 is being used for the timing signals from the Time Code Generator) a switch is provided on the Mixer Unit whereby Channel 2 of the Magnecord recorder can be switched to the output of any one of the three receivers.

8.3 VOICE RECORDINGS

Because the inputs of the Magnecord recorder is of low impedance while those of the GR-2500 are of high impedance, two separate microphones are provided, one for each recorder, the 405B low or 405C high impedance units respectively. Obviously they should never be interchanged such as by changing plugs, etc.

8.4 NORMAL RECORDING

As has been previously explained, the Main or GR-2500 Recorder should be used for all recordings unless a failure occurs (or as a result of specific direction). This recorder provides for seven simultaneous recordings, three by FM techniques and four by Analog methods. The seven channels, as installed, provide for the following recordings on the respective tracks:

Track 1 (FM) - Channel B receiver diode output
Track 2 (AM) - Channel C receiver line audio output
Track 3 (AM) - 60 kc standard frequency
Track 4 (AM) - Channel A receiver diode output
Track 5 (FM) - Channel B receiver diode output (Paralleled with Track 1)
Track 6 (AM) - Microphone
Track 7 (FM) - Time Code Generator output

It will be noted that tracks 1 and 5 are paralleled across the output of Channel B receiver. This has been done to add to the surety of recordings from this receiver in the event a dirty head or similar malfunctioning should ruin the recording on one track or recordings should be compromised by too weak signals or overloading and saturation. To assist in the latter protection, the gain of the #1 and #5 amplifiers are adjusted at different values one amplifier to handle low-level signals and the other high.

8.5 EMERGENCY RECORDING

In the event it is necessary to record on the Magnecord recorder, it will be found that this operates exactly as in the original installation, one

receiver output (normally Channel B) on Recorder Channel 2 and the Time Code Generator signals on Channel 1 except when interrupted by the pushing of the "push-to-talk" button of the hand microphone for voice comments. The only difference in the Modernized installation over the original is that Channel 2 of the recorder may now be quickly switched (at the Mixer Unit) to the output of any of the three receivers and that a low-level 10 kc timing signal is superimposed on the Channel 2 recordings.

SECTION 9

ADJUSTMENTS

- 0 -

Because of the fluidity of the missions in which the modernized equipment might be employed, both pre-operational and operational adjustment techniques may vary from time to time. For this reason, details of such adjustments will be included in Standard Operating Procedures that will be issued at suitable dates.

SECTION 10

MAINTENANCE

- 0 -

All the basic equipments included in the installation are provided with comprehensive Instruction Manuals, sections of which cover both routine and preventive maintenance. These, coupled with good electronic practices, should be followed in maintaining the installations.

SECTION 11

OPERATING PROCEDURES

- 0 -

Instructions and procedures for operating the modernized huts are comprehensively covered in a STANDARD OPERATING PROCEDURE that will be issued at an early date.

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