DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL

RADAR TRAINER AN/ULT-T5

HEADQUARTERS, DEPARTMENT OF THE ARMY
10 APRIL 1963

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Do not change tubes or make adjustments inside the equipment with the high-voltage supply on. Dangerous potentials may exist in circuits because of charges retained by capacitors even though the OFF-STANDBY-TRANSMIT switch is set to OFF. Always discharge and ground circuits before touching them. Be careful when working on the 115-volt ac line connections and the 300-volt circuits.

DON'T TAKE CHANCES!

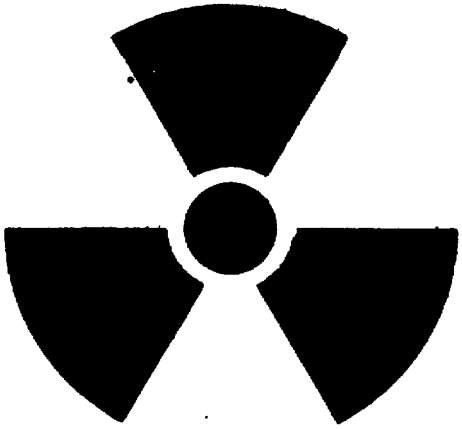
EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING UNIT:

Transmitter, Radar T-818/ULT-T5 2,000 volts

RF BURNS

Do not stand in front of the radiating horn while the radar trainer is transmitting.

RADIATION HAZARD



Co 60

Tube type 5651 used in this radar trainer contains radioactive material. These tubes are potentially hazardous when broken; see qualified medical personnel and the Safety Director if you are exposed to or cut by broken tubes. Use extreme care in replacing these tubes and follow safe procedures in their handling, storage, and disposal.

- **Never place radioactive tubes in your pocket.**
- **Use extreme care not to break radioactive tubes while handling them.**
- **Never remove radioactive tubes from cartons until ready to use them.**
- **Refer to paragraph 53 on handling, storage, and disposal of radioactive material.**

Changes in force: C 1, C 2, and C 3

CHANGE

No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 11 October 1973

Operator's Manual

RADAR TRAINER AN/ULT-T5

TM 11-6940-209-10, 10 April 1963, is changed as follows:

Page 3, paragraph 2. Delete paragraph 2 and substitute:

2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

Paragraph 3. Delete paragraph 3 and substitute:

3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army)/NAVSUP PUB 378 (Navy) /AFR 71-4 (Air Force) /and MCO P4030.29 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38 (Army) /NAVSUP PUB 459 (Navy) /AFM 75-34 (Air Force) /and MCO P4610.19 (Marine Corps).

3.1. Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-S, Fort Monmouth, NJ 07703.

Page 5,. paragraph 6. Delete paragraph 6 and substitute:

6. Items Comprising an Operable Radar Trainer AN/ULT-T5

The components of the AN/ULT-T5 are listed here and illustrated in figure 2. Component dimensions are listed in paragraph 20.

FSN	*Qty*	*Nomenclature, part No., and mfr code*
		NOTE **The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency, etc.**
6940-889-1274	1	Cable Assembly, Power, Electrical CX-8673/U: 25 ft lg
6940-889-1264	1	Cable Assembly, Special Purpose, Electrical CX-8703/U
6940-889-1266	1	Cable Assembly, Special Purpose Electrical CX-8703/U

FSN	Qty	Nomenclature, part No., and mfr code
6940-889-1265	1	Cable Assembly, Special Purpose, Electrical CX-8703/U: 200 ft lg
6940-889-2021	1	Control, Trainer C-3671/ULT-T5
6940-987-9863	1	Drive, Transmitter TG-88/ULT-TS
6940-066-4110	1	Foot, Assembly: Sig Dwg SM-C-439790
5965-504-6370	1	Headset, Electrical H-113/U
6940-987-9882	1	Mounting MT-2519/ULT-T5
8130-656-1090	1	Reel, Cable RC-435/U
6940-952-3388	1	Transmitter, Radar T-818/ULT-T5, SM-D-439601, 80063
6940-987-9881	1	Tripod, Electrical Equipment MT-2520/ULT-T5

Page 41, appendix II. Delete appendix II and substitute:

APPENDIX II

BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

1. Scope
This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Radar Trainer, AN/ULT-T5.

2. General
This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

a. Basic Issue Items List-Section II. A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.

b. Items Troop Installed or Authorized List-Section III. Not applicable.

3. Explanation of Columns
The following provides an explanation of columns found in the tabular listings:

a. Illustration. Not applicable.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 708-42.

e. Description. Indicates the Federal item name and a minimum description required to identify the item.

f. Unit of Measure (U/M). Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, (e.g., ea, in., pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. Quantity Furnished with Equipment (Basic Issue Items Only). Indicates the quantity of the basic issue item furnished with the equipment.

Section II. BASIC ISSUE ITEMS LIST

(1) Illustration (A) Fig. No.	(1) Illustration (B) Item No.	(2) Federal stock number	(3) Part number	(4) FSCM	(5) Description Usable On Code	(6) Unit of meas	(7) Qty furn with equip
		6940-952-3389			CASE, CONTROL, CY-3149/ULT-T5	EA	1
		6940-082-3243			CASE, TRANSMITTER, CY-3148/ULT-T5	EA	1

By the Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

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MICOM (2)
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USASTRATCOM (4)
MDW (1)
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Corps (2)
HISA (ECOM) (21)
Svc Colleges (1)
USASESS (5)
USAADS (2)
USAFAS (2)
USAARMS (2)
USAIS (2)
USAES (2)
USAINTS (3)
WRAMC (1)
USACI)CEC (10)
ATS (1)
USASATC&S (10)
Instl (2) except
Fort Gordon (10)
Fort Huachuca (10)
WSMR (1)
Fort Carson (10)
Ft Richardson (ECOM Ofc) (2)
Army Dep (2) except
LBAD (14)
SAAD (30)
TOAD (14)
ATAD (10)
USA DEP (2)
Sig Sec USA Dep (5)
Sig Dep (5)
Sig FLDMS (2)
USAERDAA (1)
USAERDAW (1)
MAAG (1)
USARMIS (1)
Units org under fol TOE:
(1 copy each unit)
11-158
11-500(AA-AC)
29-134
29-136

NG: None

USAR: None

For explanation of abbreviations used, see AR 310-50.

☆U.S. GOVERNMENT PRINTING OFFICE: 1973-768110/465

Changes in force: C 1 and C 2

Operator's Manual

RADAR TRAINER AN/ULT-TS

CHANGE

No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY,
WASHINGTON, D.C., *30 September 1964*

TM 11-6940-209-10, 10 April 1963 is changed as follows:

Note. The parenthetical reference to previous changes (example page 1 of C 1) indicate that pertinent material was published in that change.

Page 3, paragraph 3 (page 1 of C 1) delete subparagraph c and substitute.

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this equipment manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA Publications) will be used for reporting these improvements. This form may be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to: Command General, U. S. Army Electronics Command, ATTN: AMSEL-MR-MOC, Fort Monmouth, N, J., 07703.

Page 41, Designate APPENDIX as APPENDIX I.

Add the following reference.

TM11-5965-231-15P, Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart, Headset, Electrical H-113/U.

Add appendix II after appendix I.

APPENDIX II
BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

2. Columns

Columns are as follows:

a. Federal Stock Number. This column lists the 11-digit Federal stock number.

b. Designation By Model. Not used.

c. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

d. Unit of Issue. The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

e. Expandability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

f. Quantity Authorized. Under "Items Comprising an Operable Equipment", the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spare Items" the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

g. Illustrations. Not used.

SECTION II FUNCTIONAL PARTS LIST

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
6940-952-3337		RADAR TRAINER AN/ULT-T5:		NX			
		ITEMS COMPRISING AN OPERABLE EQUIPMENT					
6940-889-1274		CABLE ASSEMBLY, POWER, ELECTRICAL CX-8673/U: 25 ft lg			1		
6940-889-1264		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL CX--8703/U:			1		
6940-889-1266		CABLE ASSEMBLY, SPECIAL PURPOSE ELECTRICAL CX- 8703/U: 200 ft lg			1		
6940-952-3389		CASE, CONTROL CY-3149/ULT-T5			1		
6940-032-3243		CASE, TRANSMITTER CY-3148/ULT-T5		NX	1		
6940-889-2021		CONTROL, TRAINER C-3671/ULT-T5		NX	1		
6940-987-9863		DRIVE, TRANSMITTER TG-88/ULT-T5			1		
6940-066-4110		FOOT, ASSEMBLY: Sig Dwg SM-C-439790			4		
5965-504-6370		HEADSET, ELECTRICAL H-113/U		NX	1		
6940-987-9882		MOUNTING MT-2519/ULT-T5			1		
8130-656-1090		REEL, CABLE RC-435/U			1		
6940-952-3386		TRANSMITTER, RADAR T-818/ULT-T5: Sig dwg SM-D-439601		NX	1		
6940-987-9881		TRIPOD, ELECTRICAL EQUIPMENT MT-2520/ULT-T5			1		
		RUNNING SPARE ITEMS					
5960-166-7667		ELECTRON TUBE: MIL type 6AH6			1		
5960-108-0263		ELECTRON TUBE: MIL type 6D4			1		
5960-262-0167		ELECTRON TUBE: MIL. type 12AT7			1		
5960-167-0389		ELECTRON TUBE: MIL type 5651			1		
5960-892-3420		ELECTRON TUBE: MIL type 5654			1		
5960-284-5842		ELECTRON TUBE: MIL type 5751WA			1		

SECTION II FUNCTIONAL PARTS LIST

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		AN/ULT-T5 (Continued)					
5960-262-0210		ELECTRON TUBE: MIL type 5814A			1		
5960-280-4020		ELECTRON TUBE: MIL type 5814WA			1		
5960-237-0077		ELECTRON TUBE: MIL type 5686			1		
5960-557-3087		ELECTRON TUBE: MIL type 5687			1		
5960-577-3078		ELECTRON TUBE: MIL type 5687WA			1		
5960-193-5145		ELECTRON TUBE: MIL type 5751			1		
5960-248-8502		ELECTRON TUBE: MIL type 5894			1		
5960-543-1001		ELECTRON TUBE: MIL type 6080WA			2		
5960-820-8717		ELECTRON TUBE: MIL type 6688			2		
5960-676-9016		ELECTRON TUBE: MIL type 6922			1		
5920-519-9722		FUSE, CARTRIDGE: MIL type MS90078-1			5		
5920-295-9074		FUSE, CARTRIDGE: MIL type F02D2R00B			5		
5920-199-9498		FUSE, CARTRIDGE: MIL type F02GR500B			10		
5920-296-0679		FUSE, CARTRIDGE: MIL type F0SG5R00A			3		
5920-519-7733		FUSE, CARTRIDGE: MIL type F03G8R00A			5		
6240-155-8707		LAMP, INCANDESCENT: MIL standard MS15571-6			1		

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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CofEngrs (1)
TSG (1)
CofSptS (1)
CC-E (7)
USAARMBD (2)
USAARTYBD (2)
USCONARC (5)
USAMC (5)
USAECOM (4)
USASMC (2)
USAMICOM (4)
ARADCOM (2)
ARADCOM Rgn (2)
OS Major Comd (3)
OS Base Comd (2)
LOGCOMD (2)
Armies (2)
Corps (2)
USA Corps (3)
11th Air Assault Div (3)
Instl (2) except Ft Gordon (5)
Ft Hancock (4), Ft Huachuca (10)
Ft Monmouth (63)
Svc Colletes (2)
Br Svc Sch (2) except USASCS (20)
USASA Tng Cen & Sch (40)
GENDEP (OS) (2)
Sig Dep (OS) (12)
Sig Sec, GENDEP (OS) (5)
Army Dep (2) except SHAD (3)
LXAD, TOAD (12), SAAD (28)
FTWOAD (8), LEAD (5), SVAD (5)
NAAD (6), CHAD (3)
USASCC (4)
USACDCEA (1)
USACDCBRA (1)
USACDCEA (1)
USACDCEA (Monmouth Ofc) (1)
USACDCMSA (1)
USACDCOA (1)
USACDCQMA (1)
USATCDCTA (1)
USACDCADA (1)
USACDCARMA (1)
USACDCAVNA (1)
USACDCARTYA (1)
USACDCSWA (1)
USASA 1st Fld Sta (5)
USARSOUTHCOM Sig Agcy (1)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC Int (2)
USASTC (2)
WRAMC (1)
Army Pic Cen (2)
USA Cold Rgn RE Lab (2)
USAERDL (2)
MADW (1)
Cia P Dt
Chicago Proc Dist (1)
AMS (1)
USAELRDA (White Sands) (13)
Army Tml (1) except Oakland (5)
POE (1)
Sig Fld Maint Shops (3)
WSMR (5)
Units org under fol TOE: (2 copies each except as indicated)
11-16
11-67
11-97
11-98
11-117
11-155
11-157
11-600 (AA-AE) (4)
11557
11487
11-692
11-97

NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 8200.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1964-754426/159

Operator's Manual

RADAR TRAINER AN/ULT-T5

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *30 April 1964*

TM11-6940-20910, 10 April 1963, is changed as follows:

Page 3, paragraph 3. Delete subparagraph c and substitute-

c. Reporting of Equipment Manual Improvements. The direct reporting of errors, omissions, and recommendations for improving this manual by the individual user is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. DA Form 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded direct to Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 4, paragraph 5. Make the following changes:

Subparagraph *a.* After "180°", add: (+90°, -90°). After "90°", add: (+45°, -45°).

Delete subparagraph b and substitute:

b. Jamming Signal.

Note. RF carrier frequency of the jamming signal is 12.5 to 17.5 kmc.

Continuous wave..... 12.5 to 17.5 kmc. May be externally modulated by signal applied to CW EXT MOD jack.

Amplitude modulation:

Sine ..... 0- to 100-percent modulation; 15 cps to 15 ke (variable), 50 kc or 100 ke (fixed).

Square ..... 15 cps to 15 ke (variable), 50 kc or 100 kc (fixed).

Pulse..... 15 pps to 15,000 pps (variable), 50,000 pps or 100,000 pps (fixed); pulse width is variable from 1 through 5 microseconds.

Noise . ..... 0 - to 100-percent modulation at 3-mc bandwidth.

Frequency modulation:

Sweep repetition frequency..... 15 cps to 15 kc (variable), 50 kc or 100 kc (fixed).

Carrier deviation ..... Variable, ±20 mc maximum.

Page 23, paragraph 24, chart, "Circuit" column, line 5. Change "(-28 volts dc)" to: (+28 volts dc).

Page 26, paragraph 29. Make the following changes:

Subparagraph *f.* Change "150 volts ±5" to: -150 volts ±5.

Subparagraph *n.* Change "+110 volts" to: -95 volts.

Page 28, paragraph 32. Make the following changes:

Delete subparagraphs c and d and substitute-

c. Set the MODULATION SELECTOR control knob at CW EXT MOD.

d. Rotate the RF FREQ control knob very slowly and listen carefully to the resulting noise in the headset. When the correct frequency is reached, a *click* will be heard in the headset. Slowly reverse the rotation of the RF FREQ control knob until a rushing noise heard in the headset is at its loudest. Adjust the AUDIO GAIN control for comfortable listening. Further peak the rushing noise at the headset by rotating the radar trainer antenna in azimuth and elevation to boresight on the associated radar set antenna.

Page 29, paragraph 32. Delete subparagraph e and substitute:

e. Set the MODULATION SELECTOR control knob to CW EXT MOD, SINE, SQUARE, PULSE, NOISE, and FM, and make the appropriate control settings in accordance with the chart in paragraph 38. Check the radar display as described in paragraph 13, and as shown in figures 3 through 8.

Page 30, paragraph 34, chart. Make the following changes:

"Control or indicator" column, next to the last item. Change "Connector J301" to: EXT MOD connector J301. "Function" column, first item. Delete "Applies to radar trainer." and substitute:

Sw pos	*Action*
OFF	No power is applied to the radar trainer.
STANDBY	Filament and blower motor voltages are applied to the radar trainer.
TRANSMIT	Filament and high voltage are applied to the radar trainer.

"Function" column, eleventh item, line 1. Add after "pulse": amplitude.
Add the following at the end of this item: Also determines sweep frequency when MODULATION SELECTOR control is set to FM.

Page 31, paragraph 36. Delete paragraph 36 and substitute:

36. Starting Procedure

a. Set the MODULATION SELECTOR control to CW EXT MOD.

b. Set the OFF-STANDBY-TRANSMIT switch to TRANSMIT. The STANDBY lamp will light and the blower fans will operate.

c. Allow 2-minute warmup period, indicated when the STANDBY lamp goes off, the TRANSMIT lamp lights, and the RF POWER meter pointer indicates.

Note. When operating at temperatures below 32°F., allow a warmup time of 5 minutes.

Page 32, paragraph 38, chart. Delete the last item and substitute-

Modulation selector	Mod freq sel	Var freq (15CPS-15KC)	Percent modulation	Pulse width	Remarks
FM	15CPS 15KC	Desired frequency	Desired level	N/A	
	50KC or 100KC	N/A	Desired level	N/A	

Page 37, paragraph 47*b*, chart. Delete the chart and substitute-

Action	Normal indication	Corrective measures
1. Set MODULATION SELECTOR control to CW EXT MOD.	None.	
2. Set OFF-STANDBY-TRANSMIT switch to TRANSMIT.	STANDBY lamp lights	Replace defective STANDBY lamp.
		Replace defective LINE fuses F101 and F102 (fig. 15).
		Check external power supply for failure.
		Check and tighten power cable connections.
	Control unit and transmitter fans operate.	Check and tighten all cable connections between control unit and transmitter.
		Replace defective +28V DC fuse F103.
	STANDBY lamp goes out after 2-minute warmup period, and TRANSMIT lamp lights.	Replace defective TRANSMIT lamp.
	RF POWER meter indicates	Replace defective DC ON fuse F105 or F106 (fig. 15), or transmitter fuse F101 or F102 (fig. 14).

Action	Normal indication	Corrective measures
3. Manipulate RF FREQ control knob	RF FREQ counter digits change	Higher echelon maintenance is required.
4. Manipulate LEFT-RIGHT switch to position transmitter yoke so that scribe mark on azimuth drive and scribe mark on the yoke are aligned.	BEARING meter on control unit control panel should indicate midscale deflection (0°).	Replace defective fuse F104. Higher echelon maintenance is required.
5. Set LEFT-RIGHT switch to LEFT, and hold.	Transmitter should turn left and BEARING meter should read -90° when azimuth drive stops moving.	Higher echelon maintenance is required.
6. Set LEFT-RIGHT switch to RIGHT, and hold.	Transmitter should turn right and BEARING meter should read +90° when azimuth drive stops moving.	Higher echelon maintenance is required.
7. Set elevation UP-DOWN switch to UP, and hold.	Transmitter should tilt up and ELEVATION meter should read +45° when elevation drive stops moving.	Higher echelon maintenance is required.
8. Set elevation UP-DOWN switch to DOWN, and hold.	Transmitter should tilt down and ELEVATION meter should read -45° when elevation drive stops moving.	Higher echelon maintenance is required.
9. Perform jamming procedures outlined in paragraph 38.	All signals available; radar trainer remains tuned.	Higher echelon maintenance is required.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
USAMICOM (4)
USAECOM (5)
USASMCOM (1)
USA CD Agcy (1)
USASCC (4)
MDW (1)
Armies (2)
Corps (2)
USA Corps (3)
Instl (2) except
Ft Gordon (3)
Ft Monmouth (65)
Ft Hancock (4)
USA Tng Cen (2)
Svc Colleges (2)
Br Svc Sch (2)
WRAMC (1)
AMS (1)
USASA 1st Fld Sta (5)
USA Mbl Equip Cen (1)
Chicago Proc Dist (I)
Army Pic Cen (2)
USA Elct Mt Agcy (12)
GENDEP (2)
Sig Dep (OS) (12)
Sig Sec, GENDEP (5)
Army Dep (2) except
Tobyhanna (12)
Lexington (12)
Sacramento (28)
Fort Worth (8)
USSOUTHCom Sig Agcy (1)
USAOSA (1)
POE (1)
Army Tml (1)
USA Tml Comd (1)
Sig Fld Maint Shops (3)
USA Elet RD Agcy, Ft Huachuca (2)
USA Elct RD Agcy, White Sands (13)
USAERDL Trp Comd (10)
Units org under fol Toe (2 cys ea UNOINDC):
11-7
11-16
11-57
11-98
11-117
11-155
11-157
11-500 (Tms AA-AE) (4)
11-557
11-87
11-592
11-597

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

☆U. S. COVERNMENT PRINTING OFFICE- 1964-700-547

Technical Manual
No. 11-6940-209-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *10 April 1963*

RADAR TRAINER AN/ULT-T5

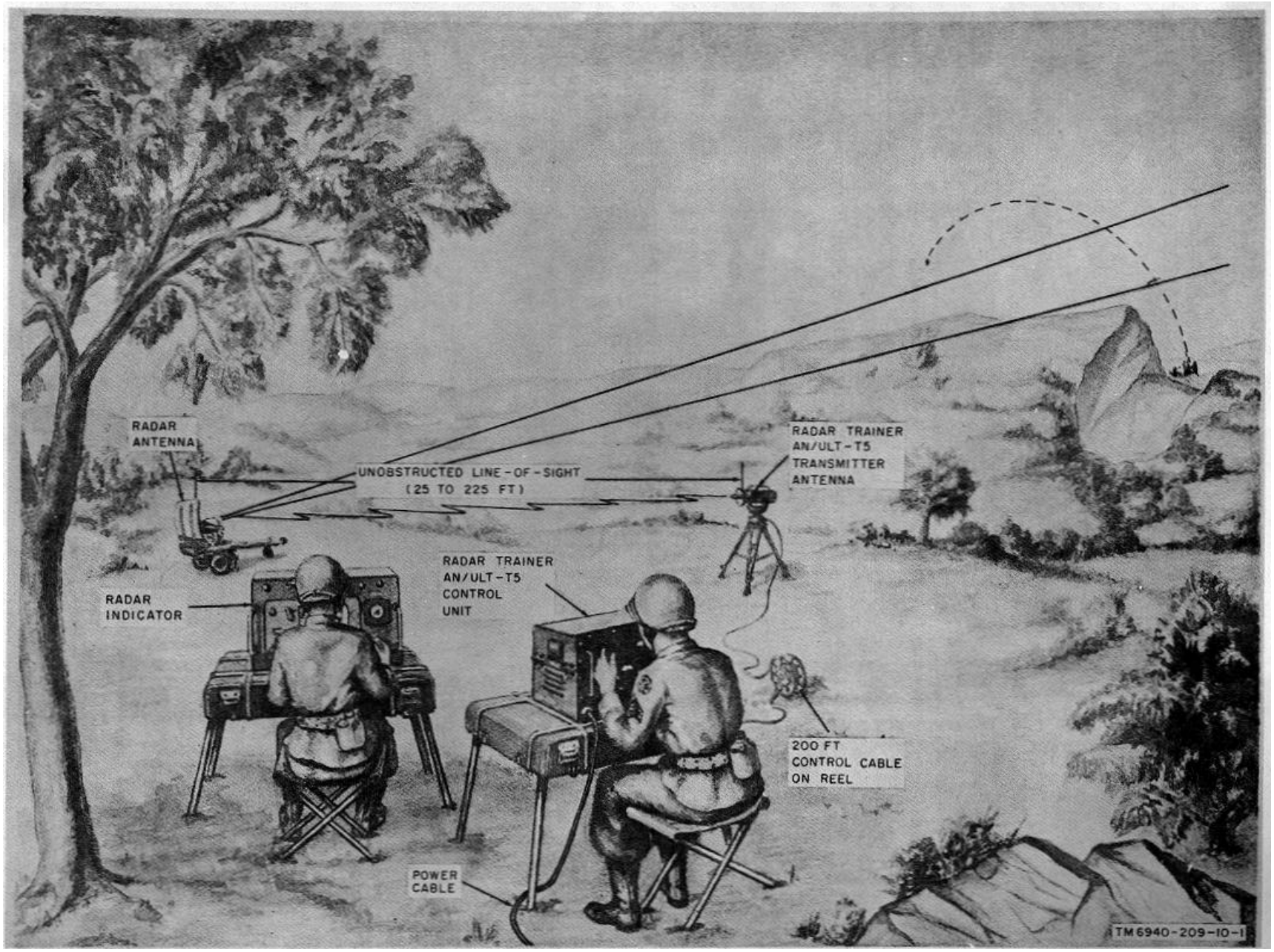

Figure 1. Radar Trainer AN/ULT-T5 in use.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This manual describes Radar Trainer AN/ULT-T5 and covers its installation, operation, and operator's maintenance. It includes operation under usual conditions, cleaning and inspection of the equipment, and replacement of parts available to first echelon maintenance.

2. Index of Publications

Refer to the latest issue of DA PAM 310-4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. Department of the Army Pamphlet No. 310-4 is an index of current Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders which are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes to and revisions of each equipment publication.

3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c. Comments on Manual. Forward all comments on this publication direct to: Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SEMLS-MP, Fort Monmouth, New Jersey. (DA Form 1598 (Record of Comments on Publications), DA Form 2496 (Disposition Form), or letter may be used.)

Section II. DESCRIPTION AND DATA

4. Purpose and Use

Radar Trainer AN/ULT-T5 (radar trainer) (fig. 1) is a transportable, low-power radar transmitter primarily designed for use in conjunction with a K-band radar set (Radar Trainer AN/ ULT-T5 may be used with Radar Set AN/MPQ-4) for training of radar operations in antijamming techniques. The radar trainer generates end transmits five types of jamming signals in the 12.5to 17.5-kilo-megacycle (kmc) radar band. The transmitted jamming signal characteristics can be selected at Control, Trainer C-3671/ULT-5, to provide mod7latinsf frequencies from 15 cycles per conk (cps) to 15 kilocycles (kc), a fixed frequency of 50 kc or 100 kc, and variation of the signal in modulation frequency, percent of modulation, pulse width, etc, as desired.

a. Use as Trainer. The selected jamming signal is displayed on the scope of Radar Set AN/MPQ-4 simultaneously with the target signal. The radar operator attempts to read through the jamming and practice corrective antijamming action for the various types of jamming signals produced as instructed. The radar trainer can be utilized for classroom use or in the field.

b. Use as Radar Checkout Equipment. A secondary function of the radar trainer is to provide controllable input signals of

precisely known characteristics for radar system checkouts.

c. Limitations. Radar Trainer AN/ ULT-T5 provides five different types of modulation for a continuous-wave (cw) jamming signal: sine wave, square wave, pulse, noise, and frequency modulation (fm). Additional types of modulation for jamming may be simulated by the radar trainer when an auxiliary signal generator is used as an external modulator for the radar trainer. The modulating equipment is plugged into the EXT MOD jack on the C-3671/ULT-T5 (fig. 15). In use, the radar trainer is operable when located at a distance up to 225 feet from the AN/ MPQ-4; however, it must be set not closer than 25 feet from the radar antenna.

5. Technical Characteristics

a. General.

Jamming signal transmission range:
- Maximum.....225 ft.
- Minimum.....25 ft.

Rf (carrier) emission:
- Source.....Backward-wave oscillator.
- BWO output.....20 to 100 millivolts.
- Frequency.....12.5 to 17.5 kmc.

Antenna positioning:
- Azimuth.....180°.
- Elevation.....90°.

b. Jamming Signal.

Unmodulated continuous wave:
- Frequency (fixed).....Externally modulated.

Modulation frequency characteristics:
- Frequency(variable).....15 cps to 15 kc
- Frequency (fixed).....50 kc and 100 kc.

Modulation modes:
- Sinusoidal amplitude.....0 to 100%
- Pulse rate (variable).....15 pps to 15,000 pps.
- Pulse rate (fixed).....50,000 pps and 100,000 pps.
- Noise (amplitude), at 3-mc bandwidth 0 to 100%.
- Frequency modulation, sinusoidal (fixed) Carrier devia
- Frequency modulation, sinusoidal (variable) Carrier deviation ±20 mc.

c. Power Supply Output.

- Low voltage.....+300 volts (500 milliamperes) regulated, -150 volts (200 milliamperes) regulated, +28 volts unregulated (4 amp).
- High voltage.....1,700 volts.
- Filament voltage.....6.3 volts ac.

d. Rf System.

- Transmission line.....Waveguide (1/3-cm).
- Radiating element.....Horn, truncated rectangular prism.
- Reflector.....Parabolic disk.
- Horizontal beam width.....Approximately 8.0°.
- Vertical beam width.....Approximately 8.0°.
- Antenna gain.....26 db minimum.
- Voltage standing-wave ratio.....1.8 maximum.
- Attenuation of horizontal and vertical side lobe levels.....Greater than -20 db.

e. Power Requirement.

Input (regulated) 115 volts ac +5, -10 volts, 50 through 400 cps, 8 amperes, single phase.

f. Radioactive Material.

Tube type 5651 Isotope Co60, 0.0067 micro-curies.

6. Table of Components
The components of the AN/ULT-T5 are listed in paragraph 20 and illustrated in figure 2.

7. Common Names
A list of nomenclature and common name assignments for the components of Radar Trainer AN/ULT-T5 is given in a below. A common name is given for each component. The common names of the equipment component assemblies and the listing of the units within these assemblies are given in *b* below.

a. Components.

Common name	Nomenclature
Radar trainer	Radar Trainer AN/ULT-T5
Azimuth drive	Drive, Transmitter TG-88/ULT-T5.
3-foot cable	Cable Assembly, Special Purpose, Electrical CX-8703/U (3 ft).
25-foot cable	Cable Assembly, Special Purpose, Electrical CX-8703/U (25 ft).
200-foot cable	Cable Assembly, Special Purpose, Electrical CX-8703/U (200 ft).
Control case	Case, Control CY-3149/ULT-T5.
Transmitter case	Case, Transmitter CY-3148/ULT-T5.
Control unit	Control, Trainer C-3671/ULT-T5.
Headset	Headset H-113/U.
Power cable	Cable Assembly, Power Electrical CX-8673/U (25 ft 3 in.).
Reel	Cable Reel RC-435/U.
Transmitter	Transmitter, Radar T-818/ULT-T-5.
Tripod	Tripod, Electrical Equipment MT-2520/ULT-T5.

b. Assembly.

Transmitter mounting.	Mounting MT-2519/ULT-T5 consisting of Tripod, Electrical Equipment MT-2520/ULT-5, Drive, Transmitter TG-88/ULT-T5, and yoke.

8. Description of Equipment
Radar Trainer AN/ULT-T5 (fig. 2) consists of two major operating components:
a control unit and transmitter, and minor components consisting of a transmitter mounting, a headset, cable reel, control case, transmitter case, and power and control cables. In addition, a suitable power source (not supplied) is required for operation.

a. The control unit contains all the operating controls and indicators of the radar trainer. The low-voltage power supply, contained in the control unit, provides -150, +300, and +28 volts to the transmitter through connecting cables.

The operator at the control unit control panel can turn the transmitter on, select the desired jamming signal, position the antenna, and monitor the antenna positioning, relative power, and related frequency indications.

b. Radiofrequency (rf) energy is generated by a backward-wave oscillator (VWO) tube in the transmitter. Depending upon the jamming signal mode desired, the rf energy is modulated and fed to a waveguide and directional coupler. The directional coupler feeds the signal through a waveguide and feedhorn to the reflector. A small portion of the signal is fed back for monitoring purposes. The transmitter unit, mounted on the transmitter mounting, is positioned in elevation and azimuth from the control unit control panel.

c. The control unit and transmitter unit may be direct-connected with a 25-foot cable, or with a 200-foot cable in addition to the 25-foot cable. The transmitter, is connected by a 3-foot cable, through connectors on the tripod to the cabling from the control unit. A 25-foot power cable is supplied for connecting the radar trainer to a 115-volt alternating current (ac) source.

9. Description of Major Components
(fig. 2)

a. Control Unit. Control, Trainer C3671/ULT-T5 consists of a control panel assembly, modulator, low-voltage power supply, and audio (monitor) amplifier. In use, the control unit is placed on the control case which, with its four case legs, forms a table.

b. Transmitter. Transmitter, Radar T818/ULT-T5 consists of a traveling-wave tube, functioning as a backward-wave oscillator (BWO), high-voltage power supply, and regulator, control and modulation amplifiers, antenna, waveguides, and elevation drive assembly. The elevation drive

Figure 2. Radar Trainer AN/ULT-T5, components.

motor, controlled from the control unit control panel, positions the antenna to any selected angle up to 45° above or 45° below horizontal.

10. Description of Minor Components

(fig. 2)

The minor components of Radar Trainer AN/ULT-T5 are: Mounting MT-2519/ ULT-T5, Cable Reel RC-435/U, Cable Assembly, Special Purpose, Electrical CX-8703/U (200 ft), Case, Control CY3149/ULT-T5, Case, Transmitter CY3148/ULT-T5, Headset H-113/U, Cable Assembly, Special Purpose, Electrical CX-8703/U (25 ft), Cable Assembly, Power, Electrical CX-8673/U, Cable Assembly, Special Purpose, Electrical CX8703/U (3 ft), and case legs.

a. Transmitter Mounting. Mounting MT-2519/UILT-T5 consists of a tripod with retractable legs, the azimuth drive and its base, yoke, and the associated hardware for assembling these items. Together, these serve as a mount for the transmitter. Anchor stakes, provided for the tripod feet, can be driven into the ground for greater support. The azimuth drive, controlled from the control unit control panel positions the antenna in azimuth over a 180° arc by-means of an integral drive motor. The azimuth drive is mounted between the yoke and the tripod.

b. Reel. Cable Reel RC-435/U holds the 200-foot cable and consists of two circular tubular frames with an inner tubular frame, which serves as a stationary spool for the cable. The cable is wound so that the inner end of the cable may be accessible for connection to the 25-foot cable. To pay out the cable, the outer end of the cable is secured and the reel is rolled by hand. When the cable is not used, straps permanently fixed to the hub secure the cable to the reel.

c. Headset. Headset H-113/U plugs into the AUDIO receptacle on the control panel (fig. 15). The headset is used by the operator for monitoring the radar signal and for tuning the radar trainer to the radar set in use.

d. Control Case. Case, Control CY3149/ULT-T5 is a watertight aluminum case for storage and transit of the reel, 200-foot cable, control case legs, control unit, headset, and all cables except the transmitter cable. In addition, a compartment is provided for the running spares.

e. Control Case Legs. The control case legs attach to the control case cover to form a table 34 inches high. In use, the control unit is placed on this table for convenience in operating.

f. Transmitter Case. Case, Transmitter CY-3148/ULT-T5 is similar to the control case and provides space for storage of the transmitter, transmitter mounting, transmitter cable, tripod, and running spares.

11. Additional Equipment Required

The following materiel is not supplied with, or as part of, Radar Trainer AN/ ULT-T5, but is needed for use with the radar trainer during operation and must be requisitioned separately.

a. Radar Set. A radar set operating within the K-band (12.5 to 17.5 kmc) is required for reception and display of jamming signals from the radar trainer (Radar Set AN/MPQ-4 may be used with Radar Trainer AN/ULT-T5).

b. Target. A moving target should be provided for the radar set, with a return signal to the scope, so that the radar trainee may evaluate the effectiveness of the jamming signal.

Section III. BASIC PRINCIPLES

12. Equipment Application

a. Equipment Function. Radar Trainer AN/ULT-T5 generates and transmits various types of interference signals utilized for jamming a radar set in use with the radar trainer. The signals, selected at the radar trainer control panel, are adjustable as to carrier frequency, type of modulation, percent of modulation, percent of fm deviation, and pulse width, to

provide the greatest possible variation in jamming signals produced. The radar trainer antenna is located 25 to 225 feet from, and aligned with, the radar set antenna. The radar trainer antenna may be positioned in azimuth and elevation by individual spring-loaded switches on the control panel, which function to drive the azimuth and elevation motors.- When the desired positioning is obtained, the switch is released and the radar trainer antenna remains in the selected position until the switches are again operated. The radar trainer operates in the 12.5- to 17-5-kmc band, and has two fixed-frequency modulation ranges: 50 kc and 100 kc, plus a variable modulation frequency from 15 cps to 15 kc. The operator at the radar trainer control panel manipulates the controls so that the desired jamming signal is transmitted to the radar set, while the radar operator, with the radar set antenna on target, attempts to read through the jamming.

b. Application. Radar Trainer AN/ ULT-T5 is designed primarily to teach, by actual appearance on the scope of a radar set, various types of jamming signals that the radar operator may encounter during operation. Usually, a group of radar trainers will observe the target displayed on the scope of the radar set. The instructor, at the radar trainer control unit, located behind the radar set, will select various types of jamming interference. Each selected jamming signal will be presented on the scope as a pattern which interferes with the observation of the radar set target signal. The trainees, by repeated example, learn to identify each type of interference pattern and associate it with a particular mode of interference signal. The trainees can then be taught specific corrective measures.

13. Jamming Effects

a. The radar trainer provides several types of jamming signals which may be variable over a 15-cps to 15-kcfrequency range and at a fixed frequency of 50 kc at 100 kc. Each type of jamming signal creates a characteristics pattern or, the 8 B-scope of the radar set. Typical jamming patterns are shown in figures 3 through 8. The patterns produced by applying a jamming signal to a radar set will vary slightly, depending on the age of the radar set and the condition of its signal blocking, or spurious signal rejection circuits.

b. The normal B-scan presentation contains rangemarkers and azimuth strobes (A, fig. 3 through 8). If the radar trainer overdrives or saturates a radar set, the display will appear mottled, and rangemarkers, range strobes, and azimuth strobes will be blanked out. Move the radar trainer antenna further away from the radar set antenna or point the radar trainer antenna in a direction opposite to that of the radar set antenna.

c. The jamming signals produced by the radar trainer fall into three general groups: amplitude-modulated signals, frequency-modulated signals, and unmodulated signals.

14. Amplitude-Modulated Jamming

Amplitude of the rf carrier wave is varied in accordance with the frequency of the modulating signal. The output of an amplitude-modulated signal from the radar trainer will be an rf signal contained in a *modulation envelope.* This means the rf signal will be varied in amplitude by the modulating signal and will be transmitted with the same overall shape as the modulating signal. If pulses are used for modulations, the radar trainer output will be a series of pulses of rf energy. If a sine-wave signal is used for modulation, the output will be an rf signal that will start at a given amplitude, increase in amplitude as the sinewave signal voltage increases (in the positive direction), return to the original level when the sine wave reaches its midpoint (zero point), decrease in amplitude as the sine wave voltages increases in the negative direction, and return to the original level when the sine wave once more returns to its zero point. The transmitted rf signal is shaped in amplitude by the applied modulating signal.

a. Sine Wave (fig. 3). sine-wave modulation of an rf carrier will produce, in addition to the carrier frequency, rf signals above and below the carrier frequency and separated from the carrier frequency by the frequency of the modulating signal. For example, if a 100megacycle (mc) carrier is modulated by a 1-mc sine wave, the transmitter output will consist principally of three frequencies: 100 mc (the carrier), 99 mc (which is 1 mc below the carrier), and 101 mc (1 mc above the carrier). In this example, the sine-wave modulated signal covers a bandwidth of 2 mc. When modulation is accomplished by more than one modulating signal, additional space in the frequency spectrum will be occupied by the transmitted signal. This bandwidth coverage is desirable in a jamming signal. As the modulating signal in a jammer becomes more complex, the frequency coverage of the jamming signal increases, thus increasing the jamming effectiveness; however, the original signal power is dispersed over a wide portion of the frequency spectrum, resulting in a decrease of the jamming signal power. Because of this reduction of the jamming signal power, there is a limit to the bandwidth that the signal can effectively cover. Beyond this limit, a bandwidth increase and a corresponding power decrease will result in a decrease of the jamming effectiveness. Aside from the strength of the jamming signal and the bandwidth coverage, there is another characteristic of the sine-wave modulated jamming to be considered. This characteristic is synchronization. The modulation may be considered to be synchronized or nonsynchronized as follows:

(1) Synchronized. Synchronized jamming refers to signals that are modulated at an exact multiple of the pulse-repetition rate of the radar set against which the jamming is being used. Thus, if the radar set is operating at a pulse-repetition rate of 1,000 cycles per second (a pulse-repetition frequency (prf) of 1,000) and the radar trainer is modulated at four times that, or 4,000 cps, the jamming is synchronized.

(2) Nonsynchronized. Jamming signals not modulated at an exact whole number multiple of the radar set pulse-repetition frequency are called nonsynchronized. There is also an intermediate condition known as semisynchronized where the jamming signal at times falls into synchronization with the radar set. Modulation of a sine-wave signal by the radar trainer is variable from 0 to 100 percent. Frequency can be varied from 15 cps through 15 kc. Percentage modulation can be varied at fixed frequency settings of 50 and 100 kc. If sine-wave jamming is used at low frequency (100 cps), darkened vertical bars will appear on the scope of the radar set. If 50kc jamming is used, dotted diagonal bars will appear together with faint vertical lines and the azimuth strobe will be blanked out. The angle of the diagonal bars varies with the degree of frequency synchronism between the jamming signal and the vertical sweep of the display.

b. Square-Wave Modulation Jamming (fig. 4). Square-wave modulation produces a jamming signal that occupies a wider portion of the frequency spectrum than the sine-wave modulated signal. Theoretically, a square wave is made up of a fundamental sine wave and an infinite number of harmonics of that sine-wave frequency. The signal resulting from square-wave modulation will be similar to one which would result from modulating with a very complex combination of sine waves. Square-wave modulation produces a very effective jamming signal; however, high transmission power levels are required to compensate for frequency dispersion and resulting power dispersion. The square-wave modulation may be produced by a continuously cycling square wave or by a pulse repeated at either a set or varying repetition rate. Whether continuous square wave or pulse, the

square-wave modulation may be made synchronized, nonsynchronized, or semisynchronized in the same manner as the sine- wave modulation. The square - wave jamming signals from the radar trainer are amplitude modulated and variable in frequency from 15 cps through 15 kc. Fixed-frequency settings are available at 50 and 100 kc. If square-wave jamming is used, the presentation will be similar to that caused by sine-wave jamming however, the vertical and diagonal darkened bars (100 cps and 50 kc respectively) will be more clearly defined. Faint vertical lines should begin to appear at 50 kc. The rangemarkers and strobes are almost blanked out and 100 cps and 50 kc (B, fig. 4).

c. Pulse-Modulation Jamming (fig. 5). Pulse-modulation jamming is very similar to square-wave modulation, but it is much more effective and efficient than sine-wave or square-wave modulation. In pulse modulation, a high power pulse is transmitted, and there is a relatively long waiting period before the next pulse is transmitted. In this way, high peak powers may be transmitted with the expenditure of relatively low levels of average power. A pulse-modulated jamming signal will cover a wider portion of the frequency spectrum than sine-wave or square-wave modulated signals. Pulse modulation has one serious shortcoming in common with the other types of modulation discussed above. The periodic nature of the modulating signal permits effective antijamming measures to be taken. Pulse-modulation jamming from the radar trainer is continuously variable from 15 pulses per second (pps) through 15,000 pps. Fixed pulse rate settings are available at 50,000 pps and 100,000 pps. Pulse width is continuously variable from 1 through 5 microseconds. At 15,000 pps (B, fig. 5), the radar set is filled with widely spaced carat-like figures. If the pulse rate increases, the carat-like figures will be closer together and a clearly defined diagonal line will be formed. Between 50,000 pps and 100,000 pps, the entire radar scope will be filled with small carat-like figures and the range and strobe will be blanked out.

d. Noise-Modulation Jamming (fig. 6). Noise-modulation jamming is considered the most effective type of modulation now used. The modulating noise signal is composed of sharp, narrow signal peaks of random frequency, phase, and amplitude. This type of modulation affords a high peak to average power ratio and very wide frequency spectrum coverage. Because normal antijamming measures are not very effective against high amplitude random-frequency jamming signals, it is very difficult to defend against noise-modulation jamming. It is probable that noise-modulation jamming will be encountered more often than any of the other types of amplitude-modulated jamming. Noise-modulation jamming usually will be employed in one of three ways as follows:

(1) *Spot.* In noise-modulation spot jamming, the carrier is set at the frequency of a particular opposed radar. An attempt is then made to limit the modulations so that the transmitted power is concentrated in a band of frequencies just wide enough to cover the receiver band-pass of the radar set.

(2) *Barrage.* Noise-modulation barrage jamming is used against a number of opposed radar sets at one time. The carrier is set to a frequency in a predetermined portion of the radar set spectrum. The modulation is then applied to produce a jamming signal that will cover as wide a band of frequencies as possible. In this way, all opposing radar sets operating within this wide frequency band will be affected by the signal from a single jamming unit. Several noise-modulation jammers tuned to adjacent frequencies may be used simultaneously to cover the frequencies of opposing radar sets.

(3) *Swept frequency.* Noise-modulation swept frequency jamming is actually a jamming combination. In this type of jamming, the carrier is swept through a portion of the radar spectrum (the same as in swept frequency cw jamming).

Wide band noise modulation is then

applied to the sweeping carrier. Swept frequency noise-modulation jamming produces a jamming signal, at relatively high power levels, that covers an extremely wide portion of the radar frequency spectrum. Noise-modulation jamming from the radar trainer is generated over a bandwidth of 3 mc. Noise-modulation percentage is continuously variable from 0 percent to 100 percent. If noise-modulation jamming is used, the radar scope will be filled with jagged dots which give the presentation a mottled appearance, and the rangemarkers and strobes will be blanked out (B, fig. 6).

15. Frequency-Modulated Jamming
(fig. 7)

a. Frequency modulation is the process in which the frequency of the rf carrier wave is varied in accordance with the frequency and amplitude of the modulating signal. The amount of the variation depends on the amplitude of the modulating signal, and the rate of variation depends on the frequency of the modulation signal. Consider the carrier, unmodulated, as the center frequency. A modulating signal is impressed on, or mixed with the carrier. The result of the modulation is as follows: When the modulating signal goes positive, the frequency of the carrier increases in proportion to the amplitude of the modulation signal. The maximum frequency change from the center frequency is called the deviation. The rate at which the modulating signal changes from a positive-going to a negative-going signal determines the rate at which the carrier varies about the center frequency.
b. Frequency modulation is well suited for jamming. The frequency-modulated jamming signals have some of the characteristics of both continuous-wave (cw) and amplitude-modulated (am.) signals. Normally, the carrier center frequency will be set at approximately the same frequency as the radar set. When the modulation is applied, the carrier is transmitted at constant amplitude but at frequencies varying about the center frequency. Thus, the transmitted signal covers a band of frequencies in the radar frequency spectrum. In this way, more than one radar set may l)e affected by the jamming signal. The bandwidth covered by the jamming signal depends on the carrier deviation (the amount of frequency change from the center frequency). Frequency-modulated jamming has the constant amplitude advantage of cw jamming, and the bandwidth coverage advantage of am. jamming. A combination of an am. carrier swept-in frequency by additional frequency modulation is one of the most effective types of jamming devised to date.
c. For the radar trainer, deviation from the carrier frequency of the fm sine-wave jamming signals is 20 me. The rate of frequency modulation is continuously variable from 15 cps through 15 kc. Fixed frequency settings are available at 50 and 100 kc. The presentation of B, figure 7, shows the effects of sine-wave, frequency modulated jamming. The rangemarkers, range strobes, and azimuth strobes are blanked out.

16. Unmodulated Continuous-Wave Jamming

a. Continuous-wave jamming is accomplished by the transmission of unmodulated rf signals at the frequency of an opposed radar set. The jamming is effective against one specific radar set. The cw jammer is intended to produce a signal strong enough to block a radar receiver. Because of its limited effectiveness, it is doubtful that cw jamming will be used to any great extent. There is no defense against cw jamming if it is produced at intensities strong enough to cause receiver blocking. At lower intensities, cw jamming is the least effective of the transmission types, and can be countered easily by applying the basic antijamming measures. Cw jamming may be used in three general forms such as spot, barrage, and swept frequency.

(1) Spot jamming is the basic

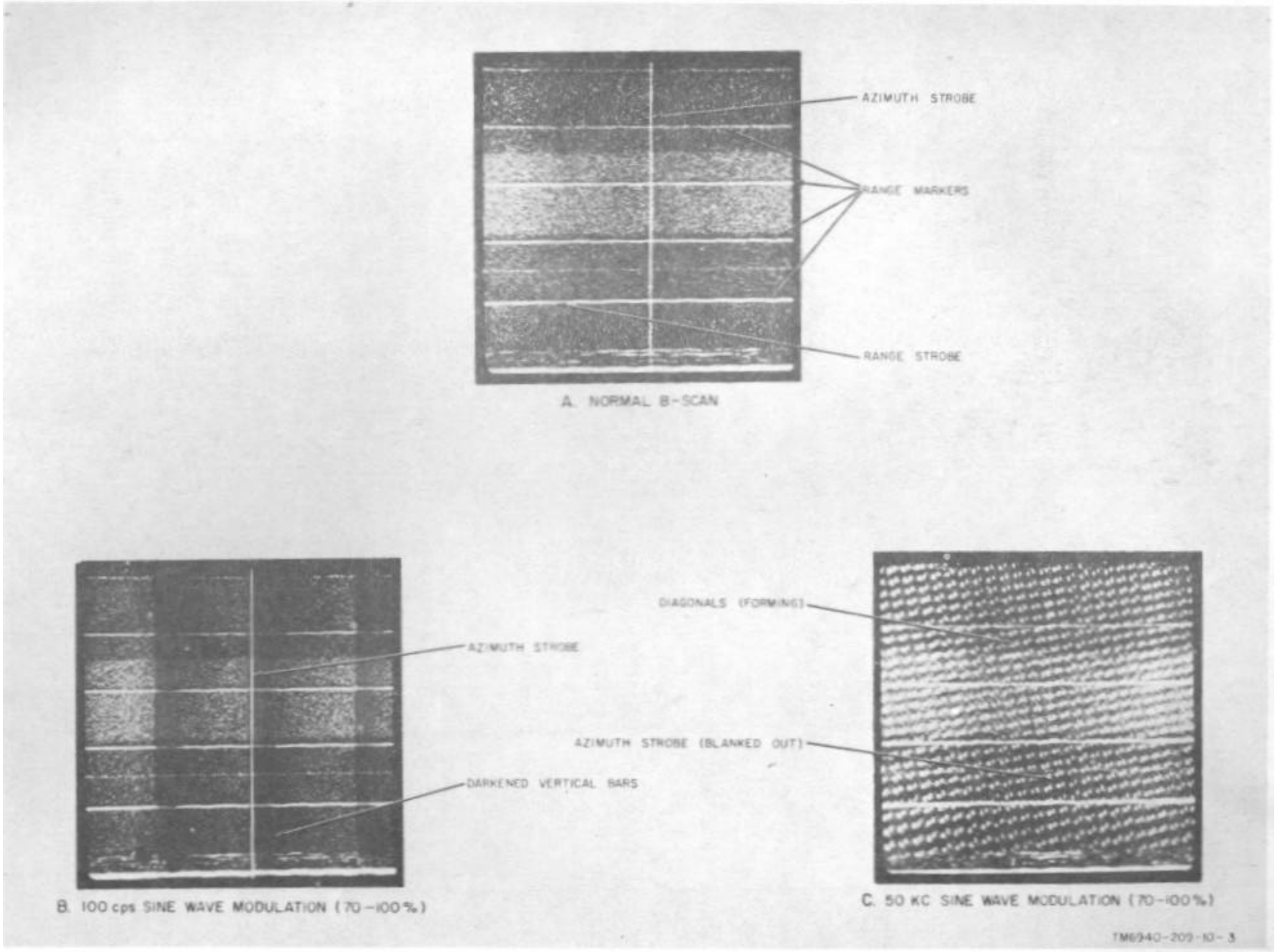

Figure 3. Normal B-scan and jamming by sine-wave modulation.

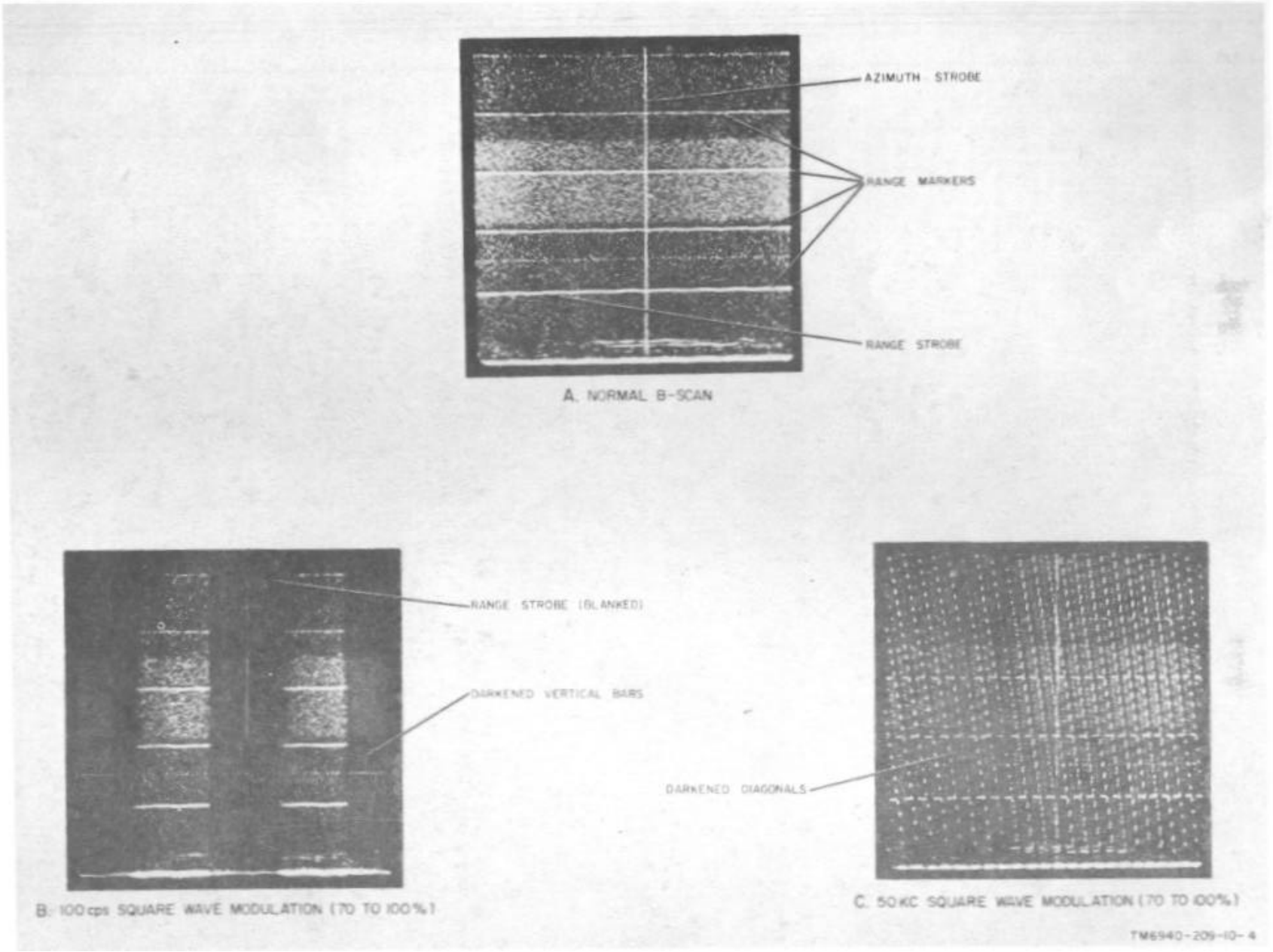

Figure 4. Normal B-scan and jamming by square-wave modulation.

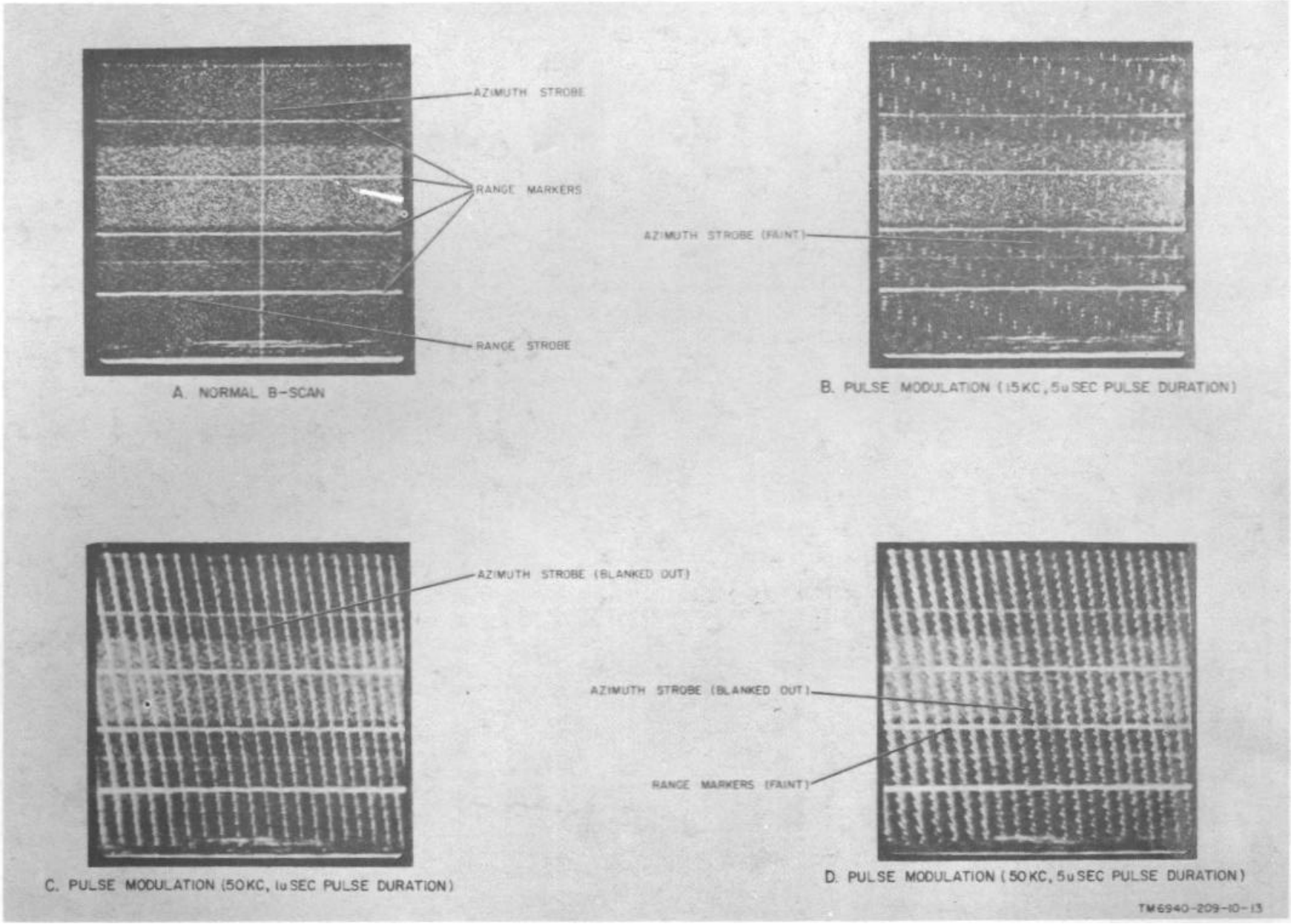

Figure 5. Normal B-scan and jamming by pulse modulation.

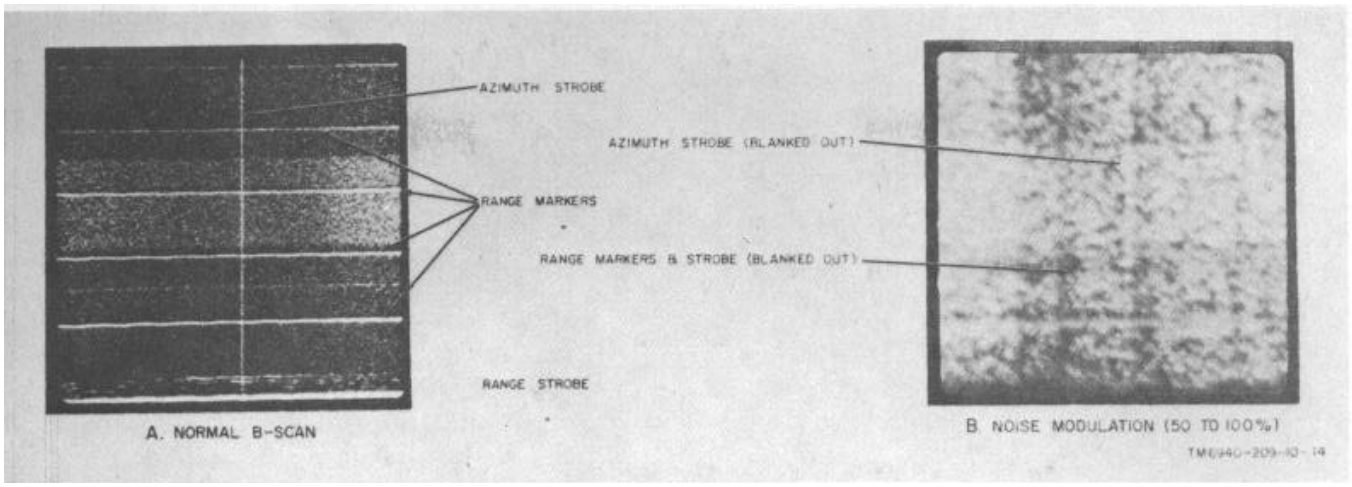

Figure 6. Normal B-scan and jamming by noise modulation.

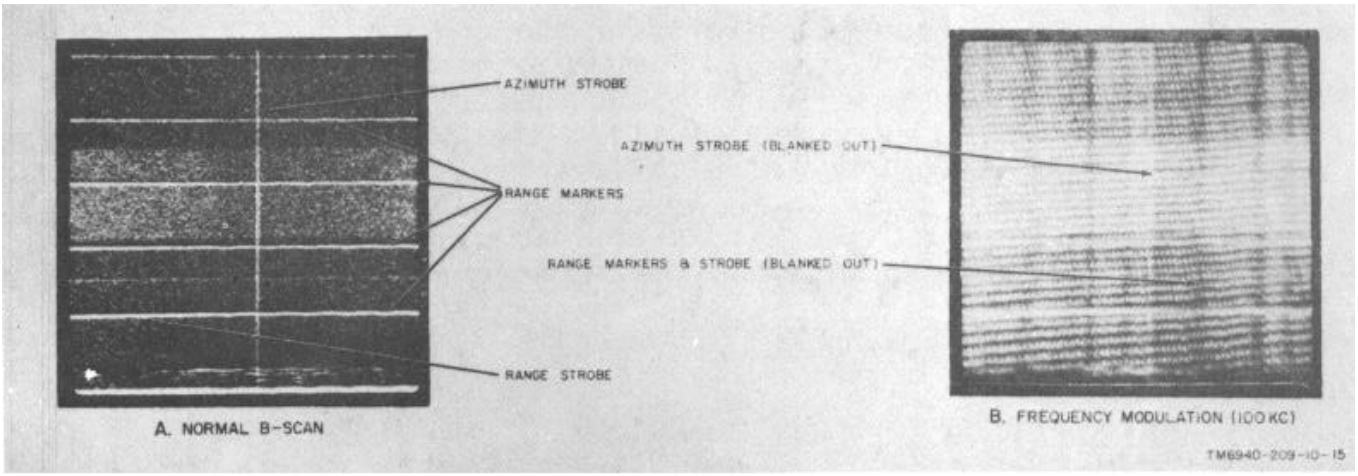

Figure 7. Normal B-scan and jamming by frequency modulation.

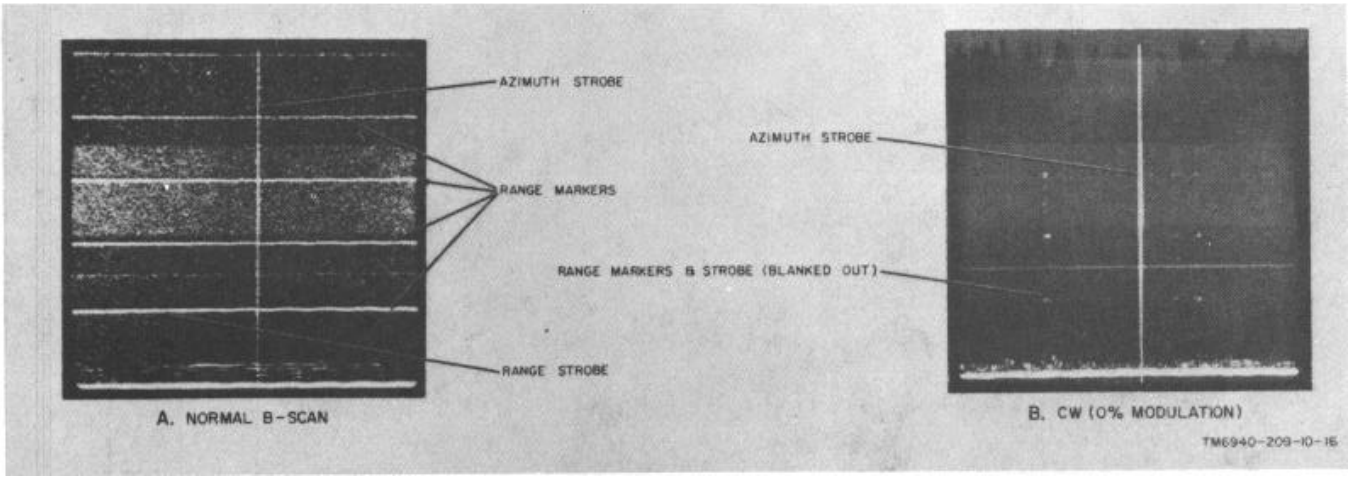

Figure 8. Normal B-scan and jamming by cw.

application of cw jamming. In a spot jamming operation, the cw jammer is aimed at one specific opposed radar. The jamming signal is intended to interfere with that one radar only; it is not intended to affect other radars that may be in the area. The bandwidth coverage of this type of cw jamming is negligible.

(2) Barrage jamming is accomplished by the combination of a number of cw jamming units. A series of cw jammers are individually tuned in the same manner as a spot jamming unit. These individual jammers are tuned to closely adjacent frequencies in the radar band. The output of the jammers covers a band of radar frequencies and affects any radars using frequencies within this band. Because cw barrage jamming requires a considerable amount of expensive equipment, it is doubtful that it will be used to any great extent. The equipments can be used to greater advantage as individual spot jammers.

(3) Swept frequency cw jamming is, in effect, similar to frequency-modulated jamming. The jammer employs a single transmitter that sweeps continually through a wide band of radar frequencies. In this way, a single jamming equipment can be used with some degree of effectiveness against a number of opposed radars operating at different frequencies. The bandwidth covered in swept frequency cw jamming will be much greater than that covered by frequency-modulated jamming.

b. The cw jamming signal is a very confusing jamming signal in that it presents no identifying feature to the observer unless he is familiar with its action and uses this knowledge to determine whether his set is being jammed by such a signal. This mode of operation makes use of the unmodulated trainer carrier. For external modulation, a modulator must be plugged into the EXT MOD jack on the front panel of the radar trainer control unit. The presentation illustrated in B, figure 8 shows the effect of unmodulated cw on a typical radar set. The rangemarkers and strobes are blanked out and the entire presentation appears dark.

CHAPTER 2
INSTALLATION

Section I. SERVICE UPON RECEIPT OF RADAR TRAINER AN/ULT-T5

17. Siting and Locating Equipment

An ideal operating site is one which provides maximum range-detection capabilities between the radar set and its target, and between the radar trainer and radar set antennas. Ground clutter (fixed targets), high-amplitude reflections from nearby structures, and ghost images should be at a minimum. The line of sight between the radar set antenna and the radar trainer antenna should be unobstructed. An area should be selected which will allow the equipment to be located as shown in figure 1.

a. Location of Control, TrainerC3671/ULT-T5. The distance between the instructor (at the control unit) and the trainee (at the radar set) is of great importance. Direct observation of the trainee's response to jamming signals is important to the instructor. Therefore, an effort should be made to locate the control unit at the radar site immediately behind the trainee's position.

b. Location of Transmitter, Radar T818/ULT-T5. The radar trainer transmitter is located between 25 and 225 feet from the radar antenna along an unobstructed line of sight. The closer the transmitter is to the radar antenna, the more effective the jamming signals will be. However, the transmitter must be no closer than 25 feet from the radar antenna.

c. Orientation of Mounting MT-.2519/ ULT-T5. A scribed mark on the azimuth drive indicates the center of the controlled azimuth motion. Align the tripod so that this mark points toward the radar antenna. Raise or lower the tripod legs and/or shift the position of the tripod as required.

> ***Caution:*** **Do not position or align the transmitter by grasping the mounting yoke or antenna horn. The antenna horn maybe moved from its focal point. Damage may occur to the azimuth bearing shaft.**

18. Unpacking

a. Packaging Data. When packed for shipment, the components of Radar Trainer AN/ULT-T5 are placed in cartons and packed in two wooden boxes. A typical shipping box and its contents are shown in figure 9. Box numbers, dimensions, and contents of the boxes are shown in the chart below:

Box No.	Dimensions (in.)	Volume (cu ft)	Unit weight (lb)	Contents of box
1	37 x 39 x 44	36.7	201	Transmitter case. transmitter, mounting, 3-foot cable and running spares.
2	37 x 39 x 44	36.7	223	Control case, control unit, headset, reel and 200-foot cable. case legs, power cable, 25-foot cable, technical manuals, and running spares.

b. Unpacking Procedures. Perform all the steps outlined below when unpacking equipment in wooden boxes.

(1) Cut and fold back the metal straps.

(2) Remove the nails from top and one side of box with a nailpuller. Remove the top and one side. Do not attempt to pry them off because this may damage the equipment.

(3) Open the moisture-proof barrier paper that covers the carton inside the box. Remove the carton.

(4) Open the carton and moisture-proof barrier within the carton. Remove the control and transmitter cases.

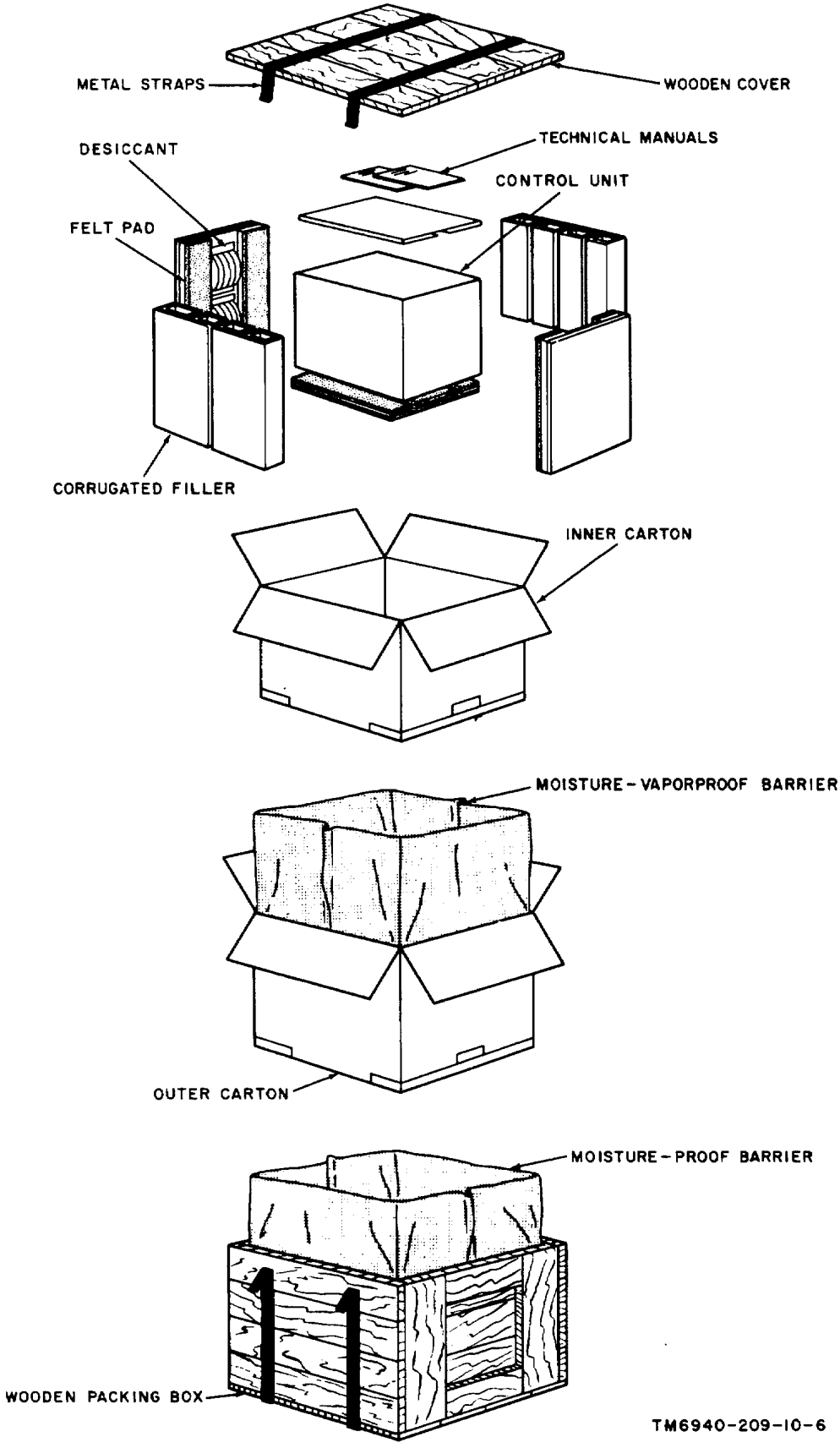

Figure 9. Typical packaging of Case, Control CX-3149/ULT-T6.

19. Checking Unpacked Equipment

a. Checking and assembly of the equipment are performed when the components are unpacked from the control and transmitter cases (para 21). This procedure is necessary because the units must be unpacked sequentially and assembled immediately upon removal from the control and transmitter cases.

b. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on the applicable form (para 3).

c. Check the equipment against the packing list. When no packing list accompanies the equipment, the chart in paragraph 20 may be used as a general check to indicate the equipment which probably has been packed.

20. Component Dimensions

Component	Overall dimensions (in.)			Unit weight
	Height	Depth	Width	(lb)
Case, Control CY-3149/ULT-TS containing:	20-3/32	32-3/4	38-1/4	64
Control, Trainer C-3671/ULT-T5	12-1/2	12-7/32	21	58
Headset H-113/U	7-1/8	4-1/4	6	2
Cable Reel RC-435/U	22-1/2 (dia)		7-3/4	16
Case legs (4)	31-5/16 (dia)		1-5/16	3
Cable Assembly, Special Purpose, Electrical CX-8703/U (25 ft).			3	
Cable Assembly, Special Purpose, Electrical CX-8703/U (200 ft).			24	
Cable Assembly, Power, Electrical CX08673/U (25 ft 3 In.)			2	
Case, Transmitter CY-3148/ULT-T5 containing:	30-23/32	32-3/4	38-1/4	64
Mounting MT-2519/ULT-T5 consisting of:	47-1/4		19-1/2	44-1/2
Yoke	7-17/32	3-1/2	19-1/16	6-1/2
Drive, Transmitter TG-88/ULT-T5	7-3/8		9 (dia)	7
Tripod, Electrical Equipment MT-2520/ULT-T5	29		6-31/32	26-1/2
Cable Assembly, Special Purpose, Electrical CX-8703/U (3 ft).			1/4	
Transmitter, Radar T-818/ULT-T5-	8-1/8	24	19-1/2	55

Section II. INSTALLATION PROCEDURES

21. Unpacking and Assembly of Equipment

a. General. The components in the control and transmitter cases must be unpacked sequentially and assembled immediately upon removal from the cases as outlined in c and d below. Three men are required to install the radar trainer. An experienced crew can unpack equipment from the cases, assemble the components, and install the cables in approximately 1 hour. No special tools or test equipment are required for installation of Radar Trainer AN/ULT-T5.

b. Cabling Precautions. Make sure that the correct mating receptacles are selected during cable installation. Careless forcing of a connector into a nonmating receptacle may seriously damage the connector and/or receptacle pins. The cable connectors are provided with captive protective caps to prevent corrosion and damage to the connector threads. When equipment is not in use, screw the protective caps in place.

c. Removing and Assembling Contents of Case, Control CY-3149/ULT-T5 (fig. 10). Remove and assemble the contents of the control case as follows:

(1) Move the control case as close to the desired operating location as possible.

(2) Carefully remove the control case cover and set it, hollow side up, alongside the bottom of the control case.

(3) Unfasten the three straps in the control case cover and remove the cable reel.

(4) Remove the 25-foot cable.

(5) Detach the four control case legs by pulling them from their spring-clip holders.

(6) Insert the four legs into receptacles provided in the control case cover and rotate each leg slowly to engage with retaining pin. Stand the control case cover on the legs to form a table.

(7) Unscrew the eight captive screws which secure the control unit to the control case. With assistance, grasp the control unit side handles and lift the control unit from the control case. Set the control unit on the table ((6) above).

(8) Remove the headset and technical manuals.

d. Removing and Assembling Content of Case, Transmitter CY-3148/ULT-T5 (fig. 11). Remove and assemble the contents of the transmitter case as follows:

(1) Move the transmitter case as close to the desired operating location as possible.

(2) Carefully remove the transmitter case cover and set it, hollow side up, alongside the bottom of the transmitter case.

(3) Unfasten the two tripod brackets by removing the four securing bolts; remove the tripod.

(4) Set the tripod in the desired location with the scribe mark on Drive, Transmitter TG-88/ULT-T5 (fig. 2) pointing toward the radar antenna.

(5) Unfasten the six straps which secure the three stakes and remove the stakes.

(6) Set each stake into the hole provided in the base of each tripod leg and drive the stakes into the ground to secure the tripod.

(7) Loosen the clamps on the tripod legs and the split clamp in the center of the tripod so that the tripod legs may be adjusted. Adjust the height of the legs to obtain a direct line of sight with the radar antenna. Tighten the tripod leg clamps and the split clamp in the center of the tripod.

(8) Loosen the three captive screws which secure the azimuth drive to the transmitter case. Remove the azimuth drive.

(9) Align the bottom center hole of the azimuth drive with the protruding pin on the base of the tripod.

Tighten the three captive screws, on the circumference of the azimuth drive, to the tripod base.

(10) Remove the hexagonal-head bolts which secure the two yoke brackets to the transmitter case and remove the yoke.

(11) Position the yoke over the azimuth drive shaft. Make sure the keyway on the yoke engages the key on the azimuth drive shaft. Tighten the yoke retaining cap on the azimuth drive shaft to secure the yoke to the azimuth drive shaft.

Note: The yoke retaining cap is physically attached to the yoke by a bead chain.

(12) Loosen four captive screws in the transmitter case cover enough to clear the transmitter mounting feet.

(13) With assistance, carefully lift the transmitter and position it on the yoke so that the shaft end of the transmitter engages the yoke retaining seat. Tighten the captive screws to secure the transmitter.

Caution: Do not attempt to move the tripod or rotate the transmitter or yoke by twisting the yoke or antenna horn because the antenna horn may move from its focal point.

(14) Remove the 3-foot cable from the transmitter case and connect the 3-foot cable to receptacle P101 in the transmitter unit and receptacle P102 on the azimuth drive unit (fig. 12).

22. Installation of Cables

The 25-foot cable may be connected direct from the control unit control panel to the azimuth drive if the 200-foot cable will not be used. The distance between the

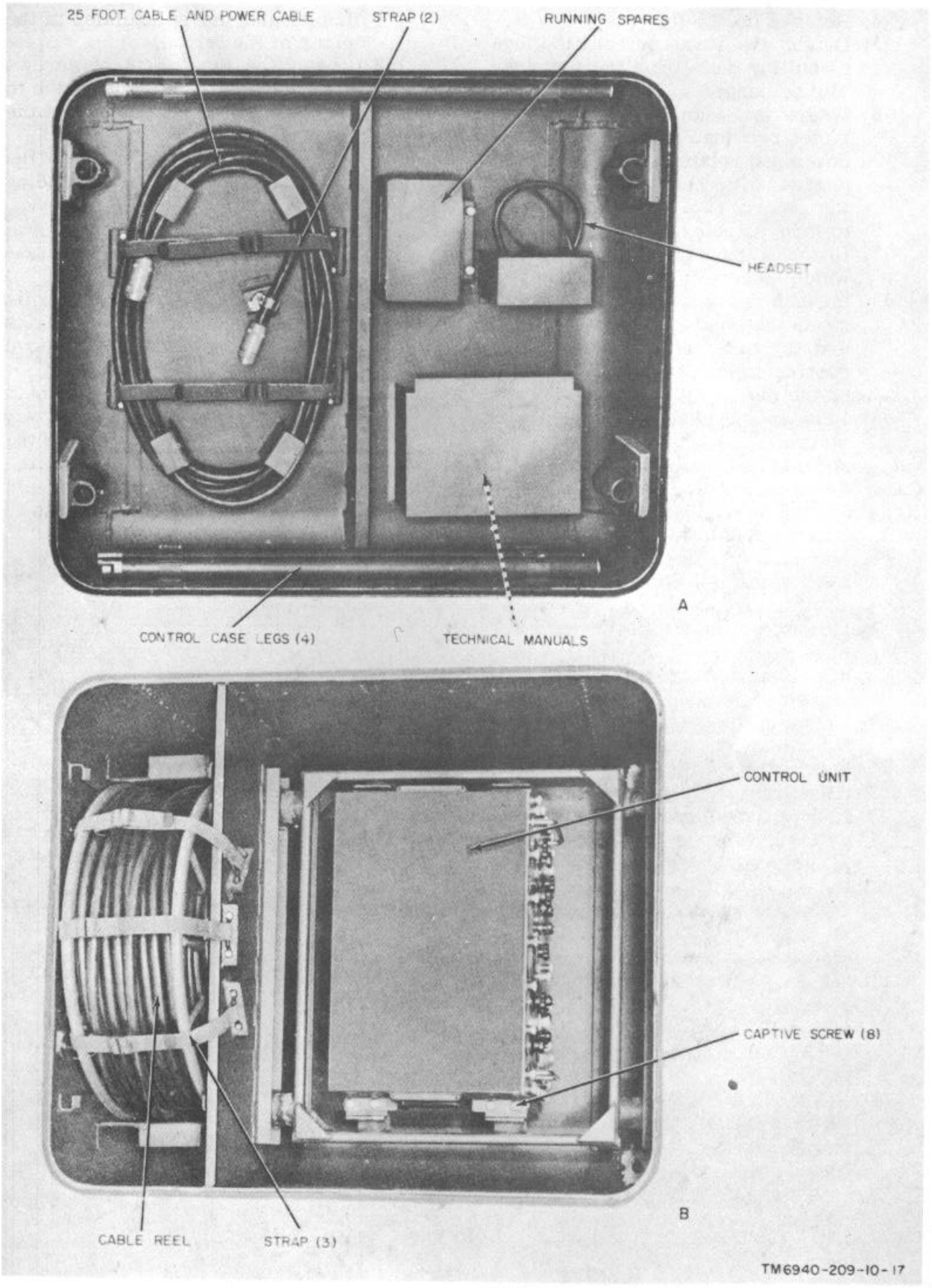

Figure 10. Case, Control CY-3149/ULT-T5 with contents.

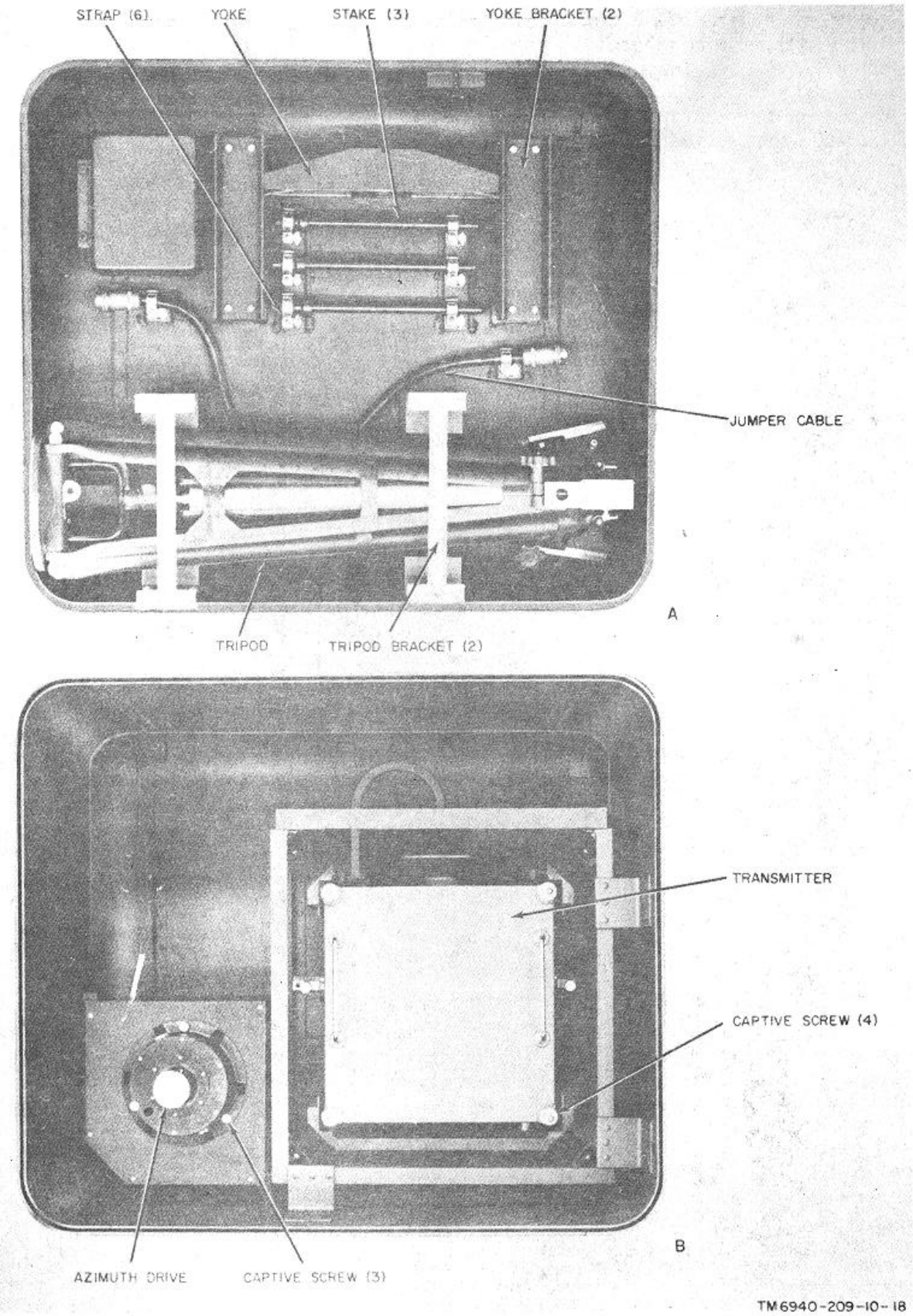

Figure 11. Case, Transmitter CY-3148/ULT-T5 with contents.

control unit and the radar trainer transmitter will determine whether the 200-foot cable will be used. Install the tables as shown on figure 12 in accordance with the instructions given in *a* through *h* below. If the 200-foot cable is not used, perform the procedure given in *a*, *b*, and *f* through *h* below. If the 200-foot cable is used, perform the procedure given in *b* through *h* below.

Note:
The 3-foot cable is connected between connector P102 on the azimuth drive and connector P101 on the transmitter during removal and assembly of transmitter case contents (para 21*d* (14).

a. Connect 25-foot cable connector J101 to connector P101 on the azimuth drive.

b. Connect the 25-foot cable connector to power output receptacle J102 on the control unit control panel.

c. If the 200-foot cable will be used, unwind it to a length required to extend from the transmitter to the desired reel location. Secure the reel position.

d. Connect connector J101 of the 200foot cable into connector P101 on the azimuth drive.

e. Connect 25-foot cable connector J101 to connector P101 of the 200-foot cable.

f. Plug the headset into AUDIO receptacle J104 on the control unit control panel (fig. 15).

g. If an external modulator will be used, connect the modulator cable to EXT MOD jack J103 on the control unit control panel.

h. Connect the power cable to POWER 115 VAC jack J101 on the control unit control panel.

Caution: Do not connect the power cable to a 115-volt ac power source until the initial checks outlined in paragraph 27 and the standby check in paragraph 28a through e have been performed. Damage to the BWO tube may occur.

23. Cabling Check

After installation, check to see that the radar trainer has been properly cabled for operation as follows:

a. Check to see that all cables are installed and connected to the proper connector on the components.

b. Make sure that the power cable is not connected to the 115-volt ac power source.

Caution: Do not connect the power cable to a 115-volt ac power source until the initial checks outlined in paragraph 27 and the standby checks in paragraph 28a through e have been performed.

c. At each component, check to see that all jacks, plugs, and connectors are connected securely.

d. Check to see that all cable runs are free from sharp bends and material damage.

e. Check to see that all cables are correctly placed to prevent them from coming into possible contact with oil or grease.

24. Installation of Fuses

The radar trainer is shipped with all fuses installed. Check to see that the proper value fuses have been inserted in the fuse holders. All fuses except transmitter fuse F101 (fig. 14) are available on the control unit front panel (fig.15). To gain access to transmitter fuse F101, remove 24 captive screws which secure the transmitter cover, and remove the transmitter cover. The following chart lists all the fuses used in the equipment, provides the rating of each fuse, and locate s the fuse by figure reference:

Ref Symbol	Fuse rating		Location		Fig. No.
	Volts	Amp	Component	Circuit	
F101	250	8	Control unit	Ac line -.....	15
F102	250	8	Control unit	Ac line -.....	15
F103	250	5	Control unit	Power supply, fan circuit (+28 volts dc).	15
F104	250	1/2	Control unit	Elevation and azimuth drive motors (-28 volts dc).	15
F105	250	2	Control unit	+300-volt dc supply -.....	15
F106	250	1/2	Control unit	-150-volt dc supply	15
F101	250	10 ma	Transmitter	Anode of V110 tube	14
F102	250	10 ma	Transmitter	Cathode of V110 tube	14

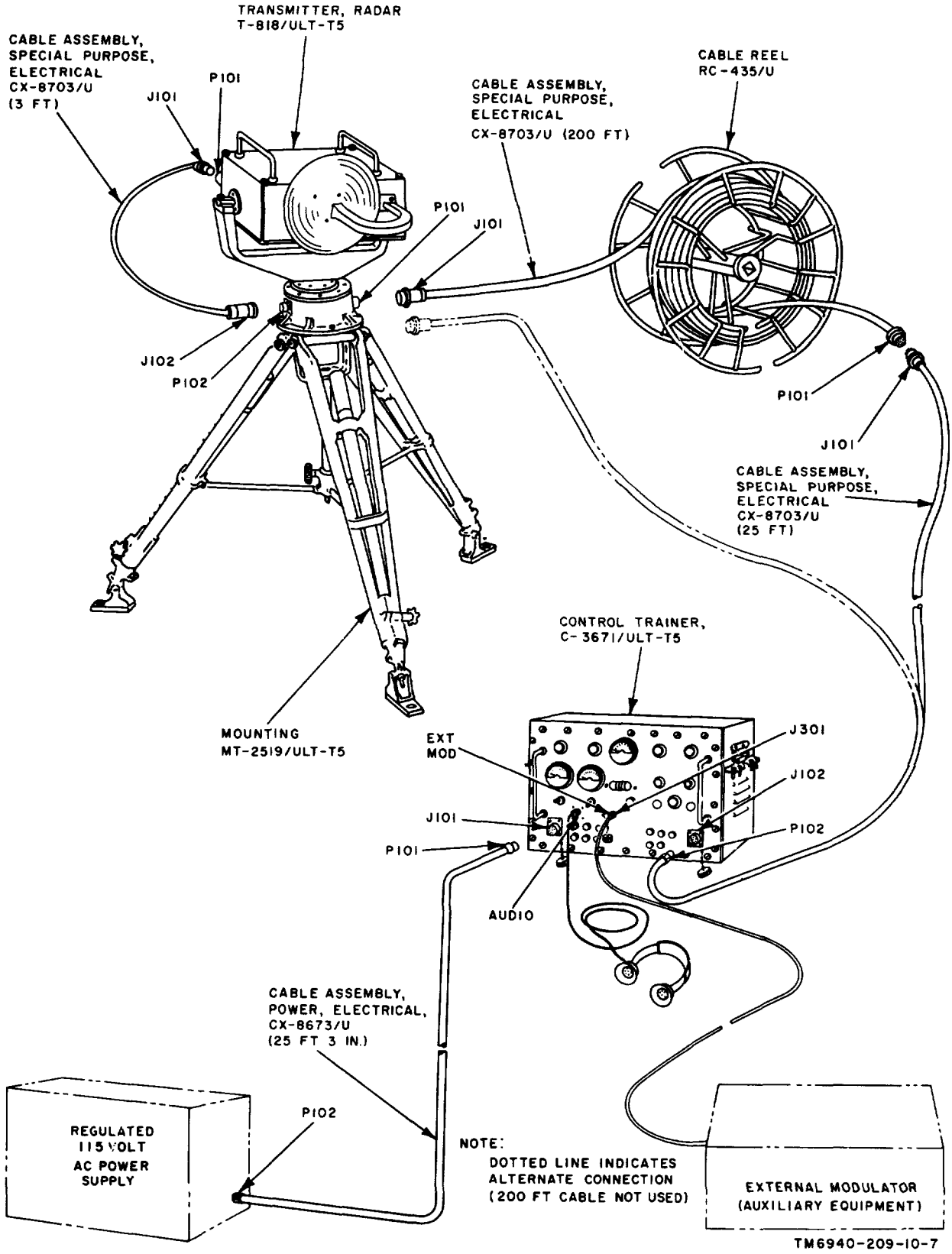

Figure 12. Radar Trainer AN/ULT-T5, pictorial cabling diagram.

Section III. INSTALLATION ALIGNMENT AND ADJUSTMENT PROCEDURES

25. General

a. This section covers the initial installation and operational checks, and alignment and adjustment procedures that must be performed on Radar Trainer AN/ ULT-T5 after installation and prior to initial operation of the radar trainer.

b. Before proceeding, carefully read all the alignment steps outlined in this section. Perform the procedures in the order in which they are presented. Be sure to make all the initial checks before applying power to the radar trainer.

26. Test Equipment Required

Multimeter AN/URM-105 is the only test equipment required for checking, aligning, and adjusting Radar Trainer AN/ULT-TS.

27. Initial Checks

a. Check to see that all cables are tightly connected to their correct respective components.

b. Check to see that the tripod legs and all other mechanical fastenings are secured.

c. Check to see that the OFF-STANDBY-TRANSMIT control on the control unit control panel is set to OFF.

28. Standby Power Checks

The units of Radar Trainer AN/ULTT5 are individually and collectively checked for proper operation before being crated and shipped. However, because of the possibility of internal equipment damage incurred during transit and installation, and because certain preoperational checks cannot be made until it is installed at the site, the equipment must be carefully turned on in stages, and various c i r c u i t s and components and devices thoroughly checked out and any faults corrected before energizing additional circuits. Failure to take the necessary precautions or failure to perform the required checks before the radar trainer is fully energized may result in damage severe enough to require depot maintenance. Perform the following checks:

a. Set the OFF-STANDBY-TRANSMIT power switch to OFF (fig. 15).

b. Loosen 24-captive screws on the control unit front panel and remove the control unit from its case.

c. Use the multimeter to make sure a short circuit does not exist between test points .TP208, TP202, and TP201 (fig. 13) and ground (chassis).

d. Remove jacks J103 and J104from the BWO tube (fig. 14).

Caution: Make sure jacks J103 andJlO4 do not make contact with the chassis because when power is applied to the radar trainer (*f* through *i* below), the jacks are at + 1,000 volts with respect to the chassis.

e. Check the 115-volt ac power source to see that the 115 volts ac does not vary more than + 5 or -10 volts.

f. Connect the power cable to the 115volt ac power source.

g. Set the OFF-STANDBY-TRANSMIT power switch to STANDBY.

h. Visually check to see that the STANDBY jewel on the control unit control panel glows.

i. Listen for operation of the fans in the control unit and transmitter.

j. Use the multimeter to make sure that the voltage at test point TP208 (fig.13) is +28 volts ±5 with respect to the chassis. If the voltage is not within the i 5-volt tolerance, higher echelon maintenance is required.

k. Set the OFF-STANDBY-TRANSMIT power switch to OFF.

l. Connect jacks J103 and J104 to the BWO tube (fig. 14).

29. Power Supply Checks

a. Set OFF-STANDBY-TRANSMIT switch to OFF (fig. 15).

b. Remove jacks J103 and J104 from the BWO tube (fig. 14).

Caution: Make sure jacks J103 and J104 do not make contact with the chassis because, when power is applied to the radar trainer, the jacks are at +1,000 volts with respect to the chassis.

c. Set OFF - STANDBY- TRANSMIT switch to TRANSMIT (fig. 15) and allow a 2-minute warmup period.

d. Use the multinieter to check that the voltage at test point TP202 (fig. 13) is + 300 volts ± 10 with respect to the chassis. If necessary, adjust variable resistor R226 to obtain the correct voltage reading.

e. Check to see that the voltage at test point TP201 is + 150 volts ± 5 with respect to the chassis. If necessary, adjust variable resistor R237 to obtain the correct voltage reading.

f. Check to see that the voltage at test point TP207 is 150 volts ±5 with respect to the chassis. If necessary, adjust variable resistor R265 to obtain the correct voltage reading.

g. Set MODULATION SELECTOR control (fig. 15) to all positions. Be sure that the switch detents properly when rotated and that no fuses blow when switching from one position to another.

h. Set MOD FREQ SEL control to all positions. Be sure that the switch detents properly when rotated and that no fuses blow when switching from one position to another.

i. Momentarily actuate elevation UPDOWN spring-loaded switch. Be sure the antenna moves in elevation and the ELEVATION meter indicates.

j. Momentarily actuate the azimuth LEFT-RIGHT spring-loaded switch. Be sure the antenna moves in azimuth and the BEARING meter indicates.

k. Set OFF-STANDBY-TRANSMIT switch to OFF and then to TRANSMIT. This action will place the system in a 2minute warmup period.

l. During the 2-minute warmup period, be sure the voltage at test point TP107 (fig. 14) is +28 volts with respect to the chassis. At the end of the 2-minute warmup period, the voltage should read zero, STANDBY light (fig. 15) should go off, and TRANSMIT light should go on.

m. Turn the RF FREQ control knob until the RF FREQ counter reads zero (0000).

n. Check to see that the voltage at test point TP102 (fig. 14) is approximately +110 volts with respect to the chassis.

o. Check to see that the voltage at disconnected jack J103 does not exceed +100 volts with respect to the chassis.

p. Measure the voltage at test point TP101. This voltage should be approximately the same as that measured at jack J103. If there is no voltage at jack J103, check fuse F101 (fig. 15).

q. Set OFF-STANDBY-TRANSMIT switch to OFF.

r. Raise the hinged. cover of the high voltage cage and remove the bar connection on top of tube V111 (fig. 14).

s. Remove tube V111.

t. Set OFF-STANDBY-TRANSMIT switch to TRANSMIT and allow a 2-minute warmup period.

u. Measure the voltage at test point TP102. The reading should be 0 volt direct current (dc).

v. Measure the BWO filament voltage at pins A and B on jack J104. This voltage should be approximately 6.3 volts ac.

x. Replace tube VII and the bar connection-.

y. Connect jacks J103 and J104 to the BWO tube.

z. Set OFF-STANDBY-TRANSMIT switch to TRANSMIT. After a 2-minute warmup period, observe the RF POWER meter on the control panel (fig. 15). If there is no indication, turn the RF FREQ control knob. If this does not produce a reading, set the OFF-STANDBY-TRANSMIT switch to OFF and request higher echelon maintenance.

30. Azimuth Antenna Positioning Check

a. Set OFF-STANDBY-TRANSMIT switch to STANDBY (fig. 15).

b. Momentarily hold the LEFT-RIGHT spring-loaded azimuth control switch at LEFT and then at RIGHT and, at the same *time, observe the azimuth motion of the transmitter. The azimuth motion of the transmitter should correlate with the -switch position.*

c. Manipulate the LEFT-RIGHT switch to position the transmitter yoke so that the scribe mark on the azimuth drive and the scribe mark on the yoke are aligned. Note that the BEARING meter on

the control unit control panel (fit. 15) should indicate midscale deflection (o0).

d. Set the LEFT-RIGHT switch to LEFT and hold. The transmitter should turn left and the BEARING meter should read -90° when the azimuth drive stops moving.

e. Set the LEFT-RIGHT switch to RIGHT and hold. The transmitter should turn right and the BEARING meter should read +90° when the azimuth drive stops moving.

f- If the transmitter positioning is not in agreement with the BEARING meter indication, higher echelon maintenance is required.

31. Elevation Antenna Positioning Check

a. Set the elevation UP-DOWN spring loaded switch to UP and then to DOWN and, at the same time, observe the vertical motion of the transmitter. The vertical motion of the transmitter should correlate with the switch position.

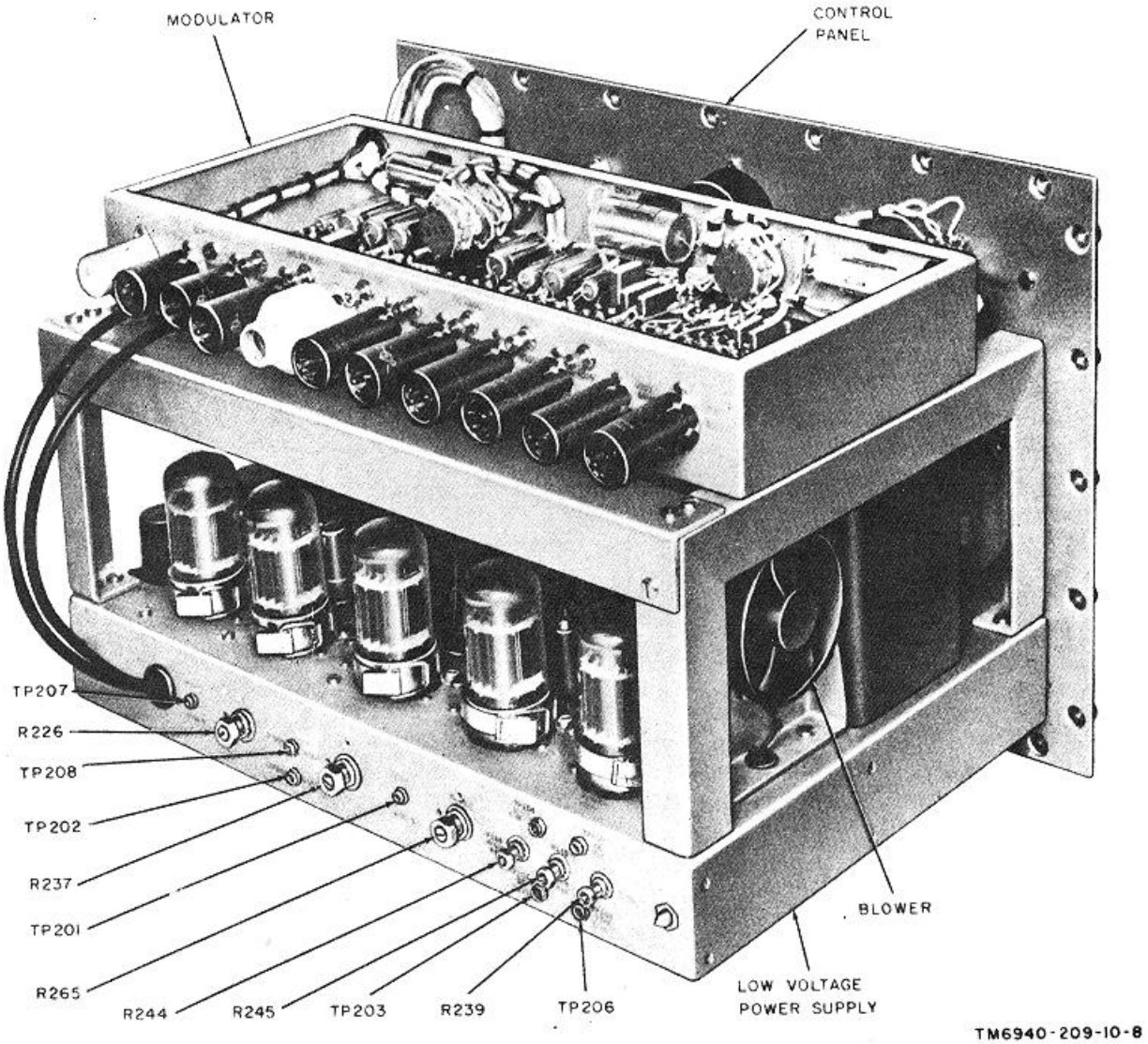

Figure 13. Control unit, cover removed.

b. Set the elevation UP-DOWN switch to UP and hold. The transmitter should tilt up, and the ELEVATION meter should read +450 when the elevation drive stops moving.

c. Set the elevation UP-DOWN switch to DOWN and hold. The transmitter should tilt down, and the ELEVATION meter should read -450 when the elevation drive stops moving.

d. If the transmitter positioning is not in agreement with the ELEVATION meter, higher echelon maintenance is required.

32. Signal Check

a. Set OFF-STANDBY-TRANSMIT control to TRANSMIT (fig. 15) and allow a 2-minute warmup period.

b. Connect Headset H-113/U to the AUDIO receptacle on the control panel.

c. Set the MODULATION SELECTOR control knob at SINE.

d. Vary the RF FREQ control knob and

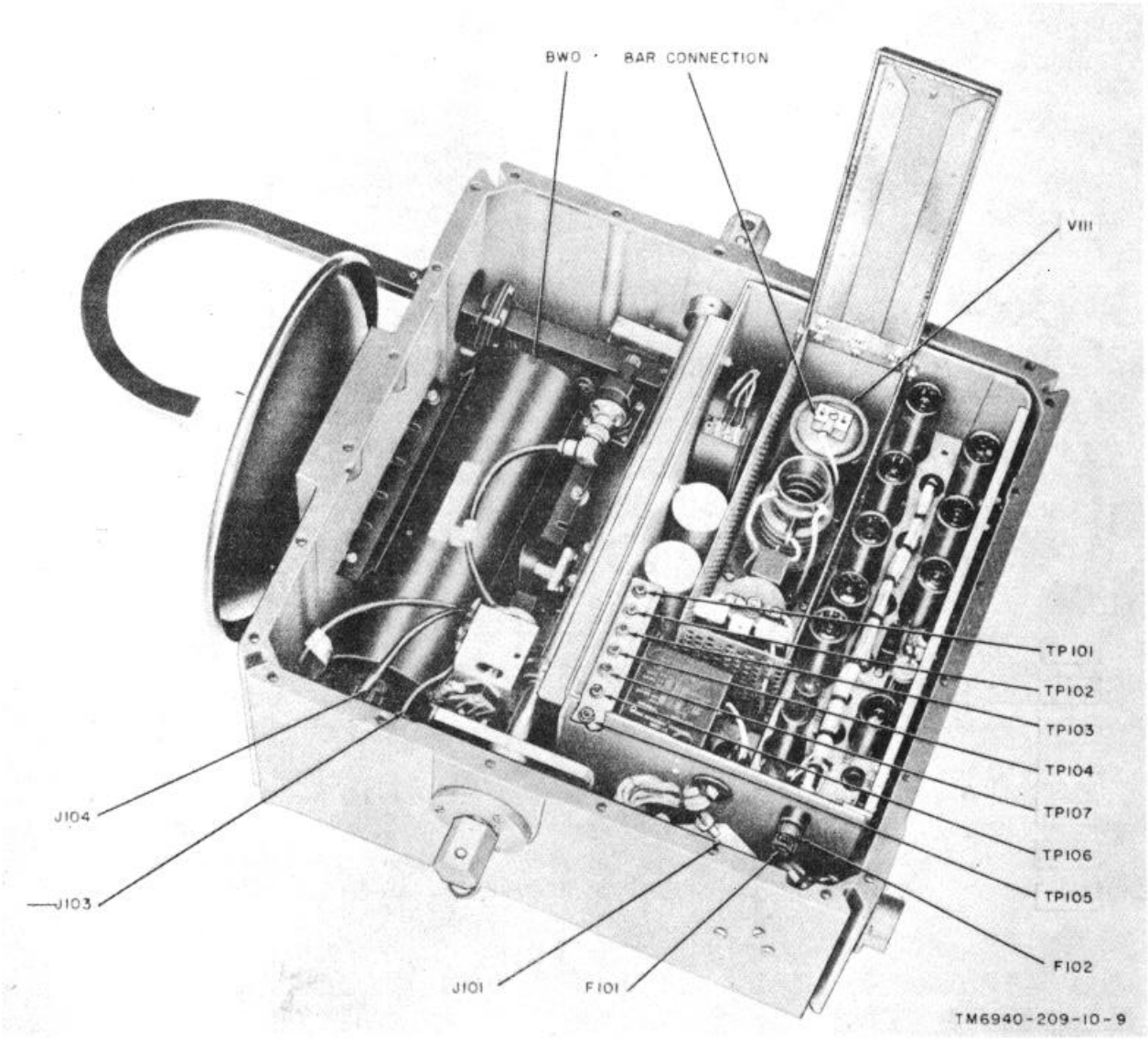

Figure 14. Transmitter unit, over removed.

observe the radar indicator for an effective jamming display (para 13 a). In addition, listen for a clicking in the headset; this indicates audio response is present.

e. Set the MODULATION SELECTOR control knob to SINE, SQUARE WAVE, PULSE, NOISE, and FM, and make the appropriate control settings in accordance with the chart inparagraph34. Check the radar display as described in paragraph 13, and as shown on figures 3 through 8.

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS AND INSTRUMENTS

Note: This section covers only items used by the operator; items used by maintenance personnel are covered in instructions for the appropriate maintenance echelon.

33. Damage from Improper Operation

Careless operation or improper setting of certain controls can cause damage to the radar trainer and injury to the operating personnel. Therefore, it is important to know the function of every operational control of the radar trainer. During operation of Radar Trainer AN/ULT-T5, observe the following precautions:

a. Make sure that the blower intake and exhaust ports, in the cover of the transmitter and control case (para 35), are not blocked because blocked ports may cause the components to overheat during operation.

Warning: High voltages exist in the radar trainer. Do not operate the equipment unless the transmitter cover is in place and the control unit is set in its cabinet.

b. If the radar trainer transmitter has been operating and is then turned off, allow 30 seconds to elapse before turning the equipment on again. This permits the interlocking circuitry to become deenergized before restarting. If this time interval is not allowed for, the STANDBY lamp will not light and the TRANSMIT lamp will light.

34. Controls and Indicators
(fig. 15)

Control or indicator	Function
OFF-STANDBY-TRANSMIT switch	Applies to radar trainer.
STANDBY lamp	Lights when radar trainer is in stand by condition.
TRANSMIT lamp	Lights when radar trainer is transmitting.
RF FREQ control)mob	Permits carrier frequency setting from 12.5 }mc through 17. 5 kmc.
RF FREQ counter	Indicates rf setting digitally. 0000 to 999 (the counter reading at any given frequency is for reference only).
RF POWER meter	Indicates the rf power being transmitted.
MODULATION SELECTOR control	Select. CW EXT MOD, SINE, SQUARE, PULSE, NOISE, and FM modulation.
PERCENT MODULATION control	Controls percentage of modulation for SINE and NOISE, and percentage of deviation for FM.
PULSE WIDTH control	Permits adjustment of pulse width from 1 to 5 microseconds of pulse type modulation.
MOD FREQ SEL control	Selects variable modulation frequencies from 15 cps to 15 kc and fixed modulation frequencies of 50 kc and 100 kIc.
VAR FREQ (15CPS-15KC) control	Varies frequency of sine wave, are wave, and pulse modulating signals when MOD FREQ SEL is set to 15CPS 15KC.
AUDIO GAIN control	Controls level of monitor signal to headset.
BEARING meter	Indicates antenna bearing in azimuth *90- from center.
LEFT-RIGHT spring-loaded switch	Operates azimuth drive to position in azimuthant
ELEVATION meter	Indicates antenna elevation angle *45- from horizontal.
UP-DOWN spring- loaded switch	Operates elevation drive to position antenna in elevation.
Connector J 101 I	Connects the control unit to the power cable to provide an input of 115 volts &c.
Connector J102	Connects the control unit to the azimuth drive to provide power for the transmitter and control voltages for the azimuth and elevation drives.
Connector J301	Connects the control unit to an external modulator (auxiliary equipment).
Fuses	Refer to paragraph 24.

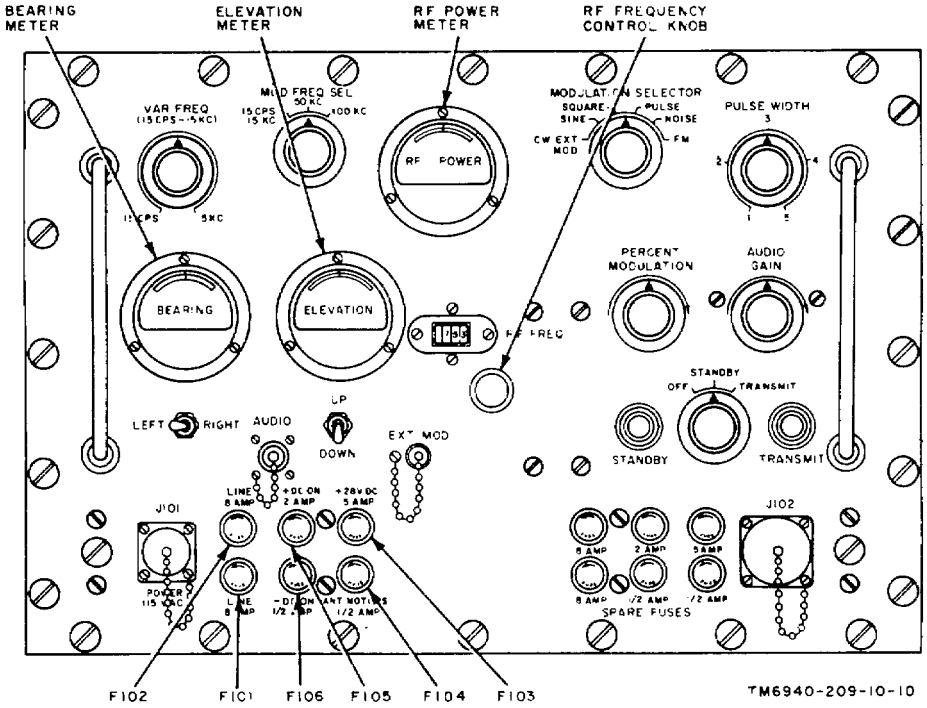

Figure 15. Control, Trainer C-3671 AN,/ULT-T5, control panel.

35. Blower Intake and Exhaust Ports

Blowers, located within the transmitter and control unit, are used to circulate cool air through the interior of the components. Each intake port is equipped with two removable air filters. The intake and exhaust ports on the control unit case are louvered. The transmitter blower ports are cutouts in the transmitter cover. The following chart lists the location of all ports:

	Intake ports		Exhaust ports	
Component	Quantity	Location	Quantity	Location
Transmitter	1	Right-hand aide of transmitter cover	1	Left-hand side of transmitter cover.
Control unit	1	Right-hand side of control case	1	Left-hand side of control case.

Section II. OPERATION UNDER USUAL CONDITIONS

36. Starting Procedure

a. Set the OFF-STANDBY-TRANSMIT switch to STANDBY. The STANDBY lamp will light and the fans will operate.

b. Set the MODULATION SELECTOR to CW EXT MOD. The RF POWER meter will indicate.

c. Allow 2-minute warmup period, indicated when the STANDBY lamp stays off and the TRANSMIT lamp lights.

Note:
When operating at temperatures below 32° F, allow a warmup time of 5 minutes.

d. Set the OFF-STANDBY-TRANSMIT switch to TRANSMIT.

37. Tuning

The radar trainer and associated radar set transmission frequencies must be synchronously tuned before jamming signals from the radar trainer can be applied to the r a d a r set. Two methods of radar tuning are possible, the preferable (audio) and the alternate (visual). The preferable

tuning method (a below) uses the noncoherent noise resulting from mixing the unmodulated radar trainer carrier (cw mode) and the associated radar set pulse as an indication of frequency synchronism. The preferable tuning method can only be used when the radar trainer carrier is unmodulated. If the preferable tuning method will not be practical because of operational conditions, use the alternate tuning method (b below).

a. Preferable Tuning.

(1) Start the radar trainer as outlined in the starting procedure (para 36).

(2) Plug the headset connector into the AUDIO receptacle.

(3) Adjust the AUDIO GAIN control for comfortable listening.

(4) Rotate the RF FREQ control knob very slowly and listen carefully to the resulting noise in the headset.

When the correct frequency is reached, a click will be heard in the headset. Slowly reverse the rotation of the RF FREQ control knob until a rushing noise in the headset is at its loudest. Adjust the AUDIO GAIN control for comfortable listening.

(5) Further peak the rushing noise at the headset by rotating the radar trainer antenna in azimuth and elevation to boresight on the associated radar set antenna.

(6) Note and record the setting of the RF FREQ digital counter.

b. Alternate Tuning Method.

(1) Start the radar trainer as outlined in the starting procedure (para 36).

(2) Observe the associated radar set scope and, at the same time, vary the radar trainer RF FREQ control knob until the radar set range markers are blanked out by overloading of the radar receiver.

38. Jamming Procedures

When the radar trainer and associated radar set carrier frequencies are synchronously tuned (para 37), modulation may be applied to the radar trainer carrier wave as follows:

a. Set the MODULATION SELECTOR switch (fig. 15) for the desired type of modulation.

b. Set the MOD FREQ SEL, VAR FREQ, PERCENT MODULATION, and PULSE WIDTH controls as shown in the chart below for each type of modulation selected. The remaining panel controls do not affect the operational jamming procedures.

Modulation selector	Mod freq sel	Var freq (15CPS-15KC)	Percent modulation	Pulse width	Remarks
CW EXT MOD	N/A	N/A	N/A	N/A	External modulation may be used if an association modulator output is connected to the EXT MOD Jack.
SINE	15CPS 15KC 50KC or 100KC	Desired level	N/A		
SQUARE	15CPS 15KC 50KC or 100KC	Desired frequency	N/A	N/A	
PULSE	15CPS, 15KC, 50KC, or 100KC	Desired frequency	N/A	Desired width Desired width	
NOISE	N/A	N/A	Desired level	N/A	
FM	15CPS 15KC	Desired frequency	Desired level	N/A	

39. Stopping

To turn off the radar trainer, set the OFF-STANDBY-TRANSMIT switch to OFF. If the radar trainer is to remain unused for a extended period of time, shut down the power source and disconnect the power cable from the power source.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

40. Scope of Maintenance

The maintenance duties assigned to the operator of Radar Trainer AN/ULT-T5 are listed below together with a reference to the paragraphs covering the specific maintenance function. The duties assigned do not require tools or test equipment other than those issued with the radar trainer.

a. Daily maintenance service and inspection (para 43).

b. Weekly maintenance service and inspection (para 44).

c. Cleaning (para 45).

d. Repairs.

(1) Replacement of defective fuses (para 48).

(2) Replacement of defective lamps (para 48).

41. Preventive Maintenance

Preventive maintenance. is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in this paragraph and paragraphs 42 through 48 cover systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. *Preventive Maintenance Checks and Services*. The preventive maintenance checks and services inspection chart (para 43 and 44) outline functions to be performed at specific intervals. These checks and services are designed to maintain equipment in a combat serviceable condition; in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the References column lists the illustrations, paragraphs, or manual that contains detailed repair or replacement procedures. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of these inspections must be made in accordance with TM 38-750.

42. Maintenance Service and Inspection Periods

Maintenance service and inspections of Radar Trainer AN/ULT-T5 are required on a daily and weekly basis.

a. Paragraph 43 specifies maintenance services and inspections that must be accomplished daily and under special conditions listed below.

(1) When the equipment is initially installed.

(2) When the equipment is reinstalled after removal for any reason.

(3) At least once each week if the equipment is maintained in a standby condition.

b. Paragraph 44 specifies maintenance services and inspections that must be performed once each week. If the equipment is being maintained in a standby condition, the daily (para 43) and weekly (para 44) services and inspections should be accomplished at the same time.

43. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	Reference
1	Exterior surface	*a*. Clean the azimuth drive control unit headset, transmitter and triped.	*a*. Para 45A.
		b. Inspect painted surfaces for bare spots, rust, and corrosion.	*b*. None

Sequence No.	Item	Procedure	Reference
2	Knobs, dials, and Switch	While making the operating checks (item 6), observe that the mechanical action of each k, dial. and switch in smooth and free of external or internal binding.	
3	Mounting	Check the stability of the tripod. Check the stability and seating of the transmitter. Check to see that all bolts, nuts, ad washers are present and properly tightened.	
4	Intercabling and connectors	Check all interconnecting cables (fig. 12) and connectors for cracks and breaks. Replace cables that have cracks or broken connectors. See that cable connectors are clean, intact, and not loose fitting.	Para 23.
5	Meter and indicator windows	- Inspect the control unit meters and indicator for damage.	
6	Radar trainer	See that the radar trainer operates normally an outlined in	Para 47. paragraph 47.

44. Weekly Preventive Maintenance Checks and Services Chart

Seq No.	Item	Procedure	Reference
1	Gaskets.	Check to see that waterproof gaskets are clean, flexible, and in apparent good condition.	
2	Air filter	Check the air filter for excessive dirt. If necessary, clean or replace.	Para 45b-.

45. Cleaning

a. Exteriors. Inspect the exteriors of the azimuth drive, control unit, headset, transmitter, tripod, control case, and transmitter case. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

(1) Remove dust and loose dirt with a clean soft cloth.

Warning: Cleaning Compound (Federal stock No. 7930-395-9542) is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame.

(2) Remove grease, fungus, and ground-in dirt from the case; use a cloth dampened (not wet) with cleaning compound.

(3) Remove dust or dirt from plugs and jacks with a brush.

(4) Clean the front panels, indicator glass, and control knobs; use a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; mild soap may be used for more effective cleaning.

b. Air Filter (fig. 16). The air filters in the radar trainer are metallic and contained in the cover of the transmitter and the control unit. Clean the air filters as follows:

(1) Loosen the screws which secure the cover to the transmitter or control unit cabinet and remove the cover.

(2) Remove the screws which hold the filters to the cover.

(3) Scribe a small identifying mark on the outer filter which will identify it as the outer filter. Scribe a mark identifying its outer edge and top edge.

(4) Remove the outer filter.

(5) Scribe a small identifying mark on the inner filter which will identify it as the inner filter. Scribe a mark identifying its outer edge and top edge.

(6) Remove the inner filter.

***Note*:**

Although the filters are interchangeable, an easier seating is effected on reassembly if all filters and screws are replaced in their original positions.

(7) Tap the edges of the filters sharply, with or against a malleable surface, to dislodge as much dirt as possible without damaging the filter frame.

(8) Wash the filters in soap and water.

Use a bristle brush to remove dirt from the mesh.

(9) Rinse thoroughly in clear water, place filters face down on supports and allow to drain and air-dry.

(10) Dip filters in a bath of Lubricating Oil, General Purpose: Preservative (PL SPECIAL). Allow filters to drain in a horizontal position by placing them top side down on the supports.

(11) Remount the filters in the cover. Make sure that the filters are positioned in accordance with the scribed marks ((3) and (5) above).

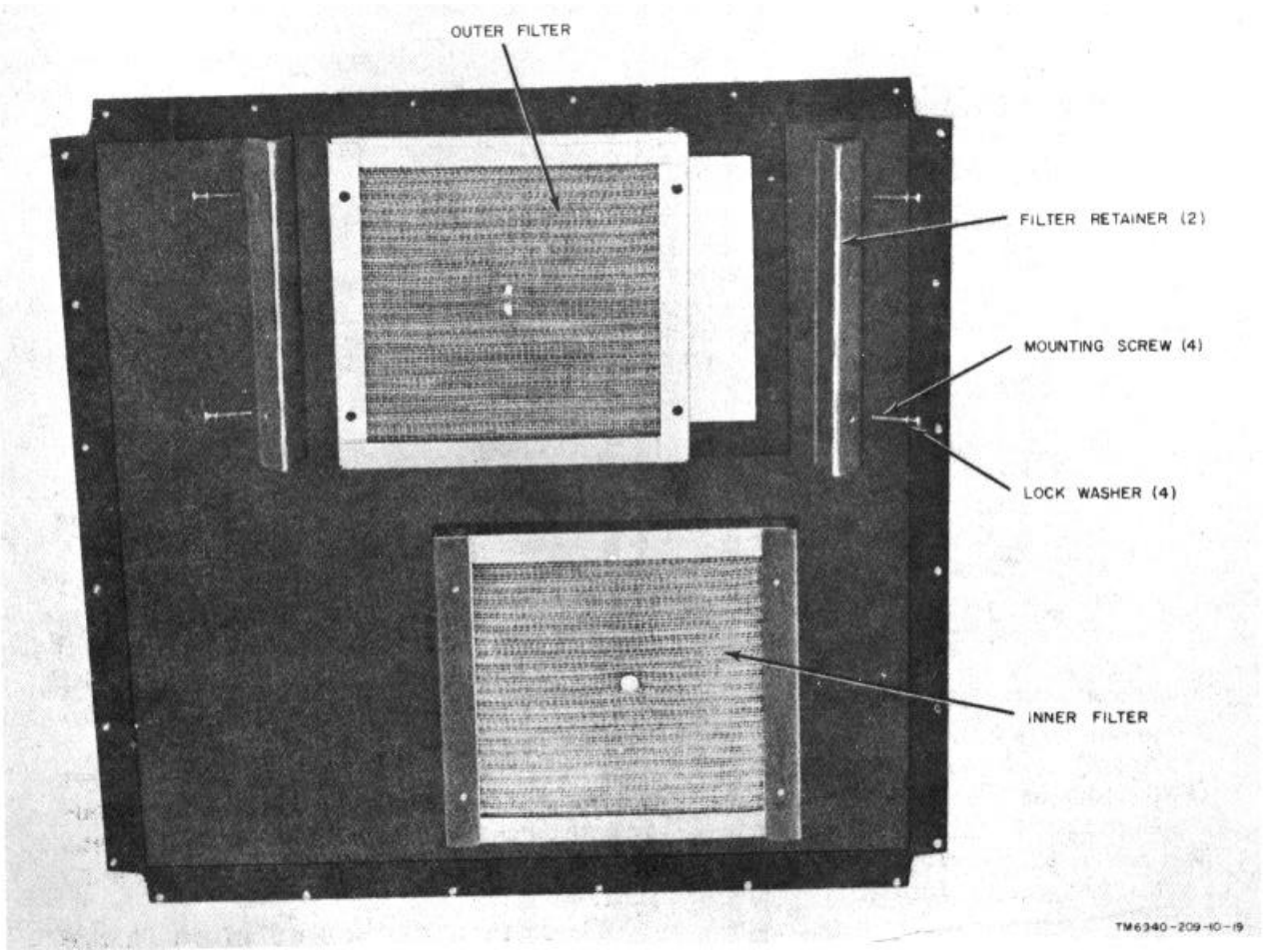

Figure 16. Air filters, exploded view.

46. Visual Inspection

a. When the equipment fails to perform properly, turn off the power and check the items listed in (1) through (5) below. *Do not check any items with the power on*.

(1) Wrong settings of switches and controls.

(2) Cables poorly connected.

(3) Physical damage to antenna dish and horn.

(4) Burned-out fuses or lamps. If the replacement fuse or lamp burns out again as soon as it is replaced, higher echelon maintenance is required.

(5) Mechanical damage to the radar trainer.

b. If none of these troubles ((1) - (5) above) are evident, proceed to the operational checklist (para 47).

47. Operational Checklist

a. General. The operational checklist will help the operator to locate the trouble in the r ad a r trainer. The corrective measures are used to repair the trouble. If the measures suggested do not restore normal equipment performance, troubleshooting is required by a higher echelon. Place a tag on the equipment, noting what corrective measures were taken and how the radar trainer performed up to the time of failure.

b. Procedure. Perform the operational checks in the sequence given below. If the indications are not normal, perform the corrective measures. If the corrective measures do not correct the trouble, or if higher echelon maintenance is required, troubleshooting by a radar repairman is necessary.

Action	Normal indication	Corrective measures
1. Perform starting and warmup procedures (para 36).	STANDBY lamp lights.	Replace defective STANDBY lamp. Replace defective LINE fuse. Check and tighten power cable connections. Check external power supply for failure.
	STANDBY lamp goes out after 2- minute warmup period, TRANS MIT lamp lights.	Replace defective TRANSMIT lamp.
	Control unit and transmitter fans operate.	Check and tighten a11 cable connections between the control unit and transmitter. Replace defective DC ON fuses (F105 or Flo).
	RF POWER meter indicates	- Adjust antenna position. Retune radar trainer (para 37).
2. Set LEFT-RIGHT azimuth switch to LEFT and then to RIGHT. required.	Antenna rotates horizontally; RF POWER meter indicates.	Replace defective fuse F104. Higher echelon maintenance
3. get UP-DOWN elevation switch to UP and then to DOWN.	Antenna moves vertically up and down; meter indicates.	Higher echelon maintenance required .
4. Perform jamming procedures outlined in paragraph 38.	All signals available; radar trainer remains tuned	Higher echelon maintenance required .

48. Replacement of Lamp and Fuses

a. Replacement of Control Panel Lamps.

(1) Unscrew the lamp lens to expose the defective lamp.

(2) Press in on the lamp and turn it counterclockwise to unlock.

(3) Pull out the defective lamp.

(4) Push the new lamp in place and twist it clockwise to lock.

(5) Screw the lamp lens back into place.

b. Replacement of Control Panel Fuses.

(1) Push the fuseholder cover in, and turn counterclockwise to unlock.

(2) Pull out the cover, the fuse will come with it.

(3) Remove the fuse, and push a new fuse into the cover.

(4) Replace the fuseholder cover.

CHAPTER 5

AUXILIARY EQUIPMENT

49. General

An external modulator, such as a signal generator, may be used in conjunction with Radar Trainer AN/ULT-T5 to obtain additional, more sophisticated types of jamming signals. The signal generator is not furnished with, nor is it a part of, the radar trainer.

50. External Modulator

An EXT MOD jack is provided on the front of the control unit panel to accept the output of an external modulator. The modulator functions to generate additional pattern variations for advanced jamming practice.

CHAPTER 6

CONVERSION FOR TRAVEL AND DEMOLITION TO PREVENT ENEMY USE OF EQUIPMENT

Section I. CONVERSION FOR TRAVEL

51. General

Before packing, all equipment and case interiors should be wiped with a damp cloth and dried with a clean, dry cloth to remove any loose dirt, sand, or gravel. Pay particular attention to the bearing mount shaft of the transmitter and the shaft mating surfaces inside the yoke. All dirt should be removed from these machined surfaces. Packing damp equipment can cause condensation after sealing the cases, with detrimental effects on the functioning and general condition of the units.

52. Procedure

After the equipment has been shutdown, and the external power source turned off, disassemble the radar trainer and secure its components in the control unit and transmitter cases as follows:

a. Disconnect the 200-foot cable, wind it on the reel, and strap the loose cable end to the reel.

b. Disconnect the power cable and all other interconnecting cables. Wind neatly, ready for storage in their cases.

c. Place the control case, with bottom down, near the control unit in readiness for packing.

d. With assistance, grasp the handles on the control unit and place it in the control case. Secure the control unit with eight captive screws (fig. 10).

e. Disassemble the four case legs from the case cover by rotating and disengaging the case legs from the retaining pins. Attach the legs to spring clamps inside the case cover.

f. With assistance, position the reel inside the control case and secure with three straps.

g. Secure the 25-foot cable and power cable to the inside of the control case cover.

h. Place the headset in its receptacle.

i. Place the cover on the control case and fasten securely.

j. Place the transmitter case, with bottom down, near the transmitter in readiness for packing.

k. Unfasten the captive screws which secure the transmitter to the mounting yoke. With assistance, remove the transmitter and secure it in the transmitter case with four captive screws (fig. 11).

l. Loosen the yoke retaining cap. Disengage the key on the azimuth drive shaft from the keyway on the yoke. Slide the yoke off the azimuth drive.

m. Position the yoke in the transmitter case and secure the yoke brackets with eight bolts.

n. Loosen the three captive screws which hold the azimuth drive to the tripod, disengage the protruding retaining pin, and lift the azimuth drive from the tripod.

o. Position the azimuth drive in the transmitter case and secure with the three captive screws.

p. Loosen the clamps on the tripod legs.

q. Loosen the split clamp in the center of the tripod and collapse the tripod.

r. Secure the tripod to the inside of the transmitter case cover with the two brackets.

s. Place the transmitter case cover on the transmitter case and fasten securely with the latches.

53. Handling, Storage, and Disposal of Radioactive Material

Follow the procedures for safe handling, storage, and disposal of radioactive materials as directed by:

a. TB SIG 225.

b. AR 40-580.

c. AR 755-380.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

54. Authority for Demolition

The demolition procedures given in paragraph 56 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon the order of the commander.

55. Destruction Plan

Field manuals direct that a destruction plan for equipment will be prepared. It is desirable that, in this plan, personnel be assigned specific tasks so that minimum time will be required should destruction become necessary. It is desirable also that all personnel concerned be familiar with all aspects of the complete destruction plan. The plan must be complete and easily carried out in the field and must provide for destruction as complete as the available time, equipment, and personnel will permit. Because the time required for complete destruction may not always be available, field manuals also direct that destruction priorities be established to insure that essential parts of equipment will be destroyed first. Priority in the following order is suggested for Radar Trainer AN/ULT-T5.

a. The BWO tube in the radar trainer. The BWO tube is under the cover of the transmitter unit. Destruction of the BWO tube will render the trainer useless.

b. The spare BWO tube normally stored in the spares compartment of the transmitter case.

c. The instruction literature.

d. The remainder of the equipment.

e. All remaining spare parts.

56. Methods of Destruction

Any or all of the methods of destruction given below may be used. The time available will be the major determining factor for the methods to be used in most instances when destruction of equipment is undertaken. The tactical situation also will determine in what manner the destruction order will be carried out. However, in most cases it is preferable to demolish completely some portions of the equipment rather than to partially destroy all the equipment units.

a. Smash. Use sledges, axes, hammers, crowbars, and any other heavy tools available to smash the BWO tube and interior units of the radar trainer.

*b. Cu*t. Use axes, hand axes, machetes, etc, to cut cabling, cording, and wiring. Use a heavy axe or machete to cut the cables. Cut these cables in a number of places. If time permits, open the units of the radar trainer and slash the internal cabling.

c. Burn. Burn as much of the equipment as is inflammable; use gasoline, oil, flame-throwers, etc. Burn the instruction literature first. Pour gasoline on the cut cables and ignite it. Use a flame-thrower to burn spare parts or pour gasoline on the spares and ignite them. Use incendiary grenades 'to complete destruction of unit interiors.

d. Explosives. Explosives may be used to complete demolition or to affect maximum damage, prior to burning, when time does not permit complete demolition by other means. Powder charges, fragmentation grenades, or incendiary grenades may be used. Incendiary grenades usually are most effective if destruction of small parts and wiring is desired.

Warning:
Extreme caution is to be observed in the use of explosives and incendiary devices. These items should not be used unless extreme urgency demands their use.

e. Disposal. Bury or scatter destroyed parts or throw item into nearby waterways. This is particularly important if a number of parts have not been completely destroyed.

APPENDIX

REFERENCES

Following is a list of applicable references available to the operator of Radar Trainer AN/ULT-T5.

AR 40-580	Medical Service, Control of Hazards Health from Radioactive Materials.
AR 755-380	Disposal of Supplies and Equipment, Disposal of Unwanted Radioactive Material.
DA Pamphlet 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TB SIG 225	Identification and Handling of Radioactive Signal Items.
TM 38-750	The Army Equipment Record System and Procedures.

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11-16
11-57
11-97
11-98
11-117
11-155
11-157
11-500 AA-AC
11-557
11-587
11-592
11-597

NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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