CONFIDENTIAL

TM 9-1400-250-10/2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATORS MANUAL:
OVERALL SYSTEM DESCRIPTION
(IMPROVED NIKE-HERCULES AIR DEFENSE GUIDED MISSILE SYSTEMS AND NIKE-HERCULES ANTI-TACTICAL BALLISTIC MISSILE (ATBM) SYSTEMS) (U)

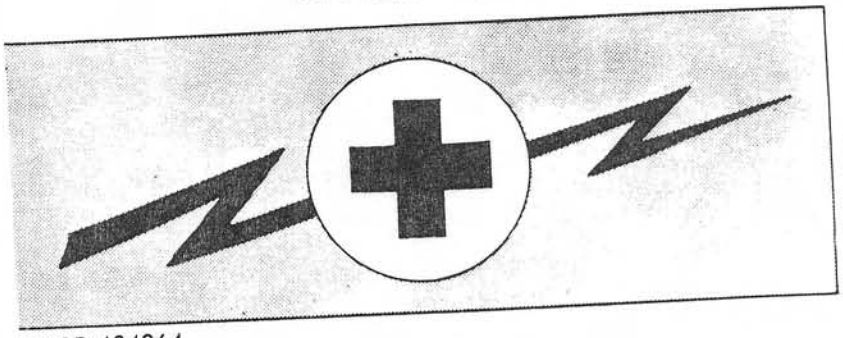
This copy is a reprint which includes current pages from Changes 1 through 11. Pages applying to all systems are inserted in proper numerical order in the manual. Pages which have different effectivities are inserted in the front of the manual. Read the instructions before using the manual.

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1960

CONFIDENTIAL

WARNING



RA PD 404264

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

EXTREMELY DANGEROUS POTENTIALS

greater than 500 volts exist in the following units:

Antenna coupler
Control-oscillator group
  Modulator power supply
  Pulse amplifier-modulator
  +250v, +170v, +120v, or –150v power supply
  –1000v power supply
Electron tube storage rack
  Spare klystron ion pump power supply
Electron tube truck
  Spare klystron ion pump power supply

High voltage power supply
High voltage pulse generator
  Amplifier power supply assembly
  Left-hand tube cradle
  Right-hand tube cradle
  Trigger pulse amplifier
Induction voltage regulator
Klystron amplifier
  Ion pump power supply subassembly
Mobile external antenna coupler and coupler extension kit
Power control-indicator
  Oscilloscope drawer
Receiver group
  HIPAR monitor PPI
  Keep-alive power supply
  Noise modulator-power supply
  Parametric amplifier
  PPI high voltage power supply
  Pump power supply
Step-up power transformer
Transmitter control-indicator
  Oscilloscope drawer

Warning: **Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.**

For artificial respiration, refer to FM 21–11.

TECHNICAL MANUAL
No. 9–1400–250–10/2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *29 December 1960*

OVERALL SYSTEM DESCRIPTION (U)

(Next numbered page is 9)

CHAPTER 1 (C)

INTRODUCTION

Section I (C). GENERAL

1 (U). Purpose

This manual presents a general overall description of the Improved NIKE-HERCULES Air Defense Guided Missile System and the NIKE-HERCULES Anti-Tactical Ballistic Missile (ATBM) System. This overall description is intended to provide information for personnel requiring a general knowledge of the system and to serve as indoctrination material for all personnel associated with the system.

2 (U). Scope

a. This manual describes the physical and functional characteristics of the Improved NIKE-HERCULES Air Defense Guided Missile System and the NIKE-HERCULES ATBM System. Included in this description are history of development, system capabilities, site layout, major areas of a site, physical description of equipment, functional description of subsystems, tactical operations during an engagement, and maintenance support.

a.1. This manual provides coverage for the following selected system modification work orders (MWO's).

(1) 9-1400-250-50/9 adds ATBM capability to the Improved NIKE-HERCULES ground guidance system (INH selected systems).

(2) 9-1430-251-30/8 provides facilities for adding radar bomb-scoring equipment to the trailer mounted director station (INH all systems).

(3) (Deleted)

(4) Field change 1003 provides facilities and adds functions for system compatibility with the electronic counter-countermeasures (ECCM) console and auxiliary acquisition radar (AAR) in Improved NIKE-HERCULES systems with dual direct view storage tube (DVST) console (selected systems).

b. This manual is technically correct for all Improved NIKE-HERCULES and NIKE-HERCULES ATBM Systems provided the pertinent MWO's listed in the remainder of this subparagraph have been incorporated.

(1) 9-1400-250-50/5 provides anti-jam display capabilities to the Improved NIKE-HERCULES acquisition radar systems (INH all systems).

(2) 9-1400-250-50/17 incorporates EFS in the HIPAR system (systems 502 through 537).

(3) 9-1400-250-50/28 provides facilities for connecting radar signal-simulator station AN/MPQ-T1 (T1 trainer) and adds functions for annual service practice to the Improved NIKE-HERCULES Systems. It also provides facilities and adds functions for system compatibility with the ECCM console on Improved NIKE-HERCULES Systems having AAR (INH suffix serial numbers 001 through 158, 162, 163, 169, 180, 181, 184, 185, 192, and 196 through 198; dual DVST consoles with suffix serial numbers 1 through 32).

(4) 9-1400-250-50/37 adds facilities for radar signal-simulator station AN/MPQ-T1 (systems 502 through 562, and 564 through 572); adds overcurrent protection to the power distribution unit (systems 502 through 537) and to the power control-indicator (systems 538 through 562); adds three-phase power to the MTI group (systems 538 through 562); relocates components to eliminate interaction (systems 502 through 572);

protects components against the loss of three-phase power (systems 502 through 562); adds a relief valve to the waveguide pressurizer (systems 502 through 562, and 564 through 572); corrects calibration of the noise figure meter (systems 538 through 548); and provides proper traveling-wave tube grid voltages (systems 538 through 549).

(5) 9-1400-250-50/48 replaces liquid cooler 9023721 with pumping unit 9999053 and liquid cooler 9999047 (systems 502 through 537) and refrigerant condenser 9994082 and liquid cooler 9994083 with pumping unit 9999053 and liquid cooler 9999047 (systems 538 through 583); provides for lubrication of the glycol pump motor (systems 538 through 583); adds an X-ray warning plate to klystron amplifier 9994076 (systems 502 through 588); facilitates the draining of the oil in the waveguide pressurizer (systems 502 through 583); eliminates the failure of control amplifier 9987373 (systems 502 through 594); provides positive electrical terminations for the antenna drive motor leads (systems 502 through 594); prevents unintentional misalinement of EFS receiver (systems 502 through 537) and EFS receiver group (systems 538 through 594); provides the proper voltage for the new klystron tube in the EFS receiver (systems 502 through 537) and EFS receiver group (systems 538 through 594); adds new receiver klystron tube filament transformer (systems 502 through 594); provides proper short circuit protection for power supply 9022872 (systems 502 through 537) and power supply 9994359 (systems 538 through 594); increases the effectiveness of decoupling in trigger pulse amplifier 9987106 (systems 502 through 594); prevents spurious outputs from control-oscillator group 9994063 (systems 502 through 594; adds facilities for RF grounding of EFS HIPAR (systems 502 through 537); adds overcurrent protection in power distribution unit 9023180 (systems 502 through 537) and in power control-indicator 9994075 (systems 538 through 594); removes the delay line driver from the moving target indicator group (systems 502 through 537); and changes the temperature regulating valve on pumping unit 9999053 (systems 584 through 594).

(6) 9-1400-250-50/53 incorporates the anti-jam improvement (AJI) capabilities into the HIPAR systems. (HIPAR systems 815 and below).

(7) 9-1430-251-30/37 relocates the ten EFS/HIPAR channel select switches and makes the director-computer group compatible with the AJI HIPAR, replaces power output meter in auxiliary HIPAR control-indicator, and adds AAR control panel to systems with AAR capabilities (INH suffix serial numbers 001 through 316; dual DVST suffix serial numbers 1 through 54).

(8) 9-1430-251-30/39 provides facilities for connecting the AN/GSA-77 battery terminal equipment (BTE) in the director station trailer (INH suffix serial numbers 001 through 316; all dual DVST kits with INH suffix serial numbers 001 through 316).

(9) 9-1430-254-30/2/1 provides additional anti-jamming capabilities to the HIPAR equipment (systems 502 through 514).

(10) Special purpose kit 1430-073-8880 prevents interference between the TD-2 communication system and the low power acquisition radar (LOPAR) (selected systems).

(11) Special purpose kit 1430-740-1500 eliminates television interference in the acquisition radar receiver-transmitter (selected systems).

b.1. For a complete list of MWO's applicable to the equipment, refer to DA PAM 310-7.

c. This is one of a series of technical manuals on operation, emplacement, and maintenance of the Improved NIKE-HERCULES System and the NIKE-HERCULES ATBM System. Refer to DA PAM 310-2 and DA PAM 310-4 for a listing of publications indexes, administrative publications, forms and records publications, supply publications, and NIKE technical manuals.

d. A cross-reference index of technical manual nomenclature and official nomenclature for items of the radar course directing central of the Improved NIKE-HERCULES System and the NIKE-HERCULES ATBM System is provided in TM 9-1430-251-12/3, TM 9-1430-255-12/1, and TM 9-1430-256-12/1.

3 (U). Forms, Records, and Reports

Refer to TM 38-750 for instructions on the use and completion of all forms required for operating and maintaining this equipment.

3.1 (U). Report of Equipment Publication Improvements

Report 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 DA Publications) and forwarded direct to: Commanding General, U. S. Army Missile Command, ATTN: AMSMI-SMPT (NMP), Redstone Arsenal, Alabama 35809.

4 (U). Function of Air Defense Guided Missile Systems

The function of air defense guided missile systems is to deter or minimize the effects of enemy attacks by detecting and destroying enemy aircraft and missiles approaching a defended area. These systems must be capable of effective action against targets operating at any altitude and velocity. The systems must also be capable of trajectory corrections after missile launch to permit interception of targets taking evasive actions. In addition, it is desirable that the systems be capable of self defense against tactical surface targets. The Improved NIKE-HERCULES System and the NIKE-HERCULES ATBM System can be used in support of other service groups. A bomb-scoring system incorporated into the Improved NIKE-HERCULES System and the NIKE-HERCULES ATBM System enables tracking a bomb-dropping aircraft up to the bomb release point. Then, using predetermined data, the theoretical impact point of the bomb can be calculated. Thus, bomb-drop accuracy can be measured without the actual expenditure of a bomb.

5 (C). Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES ATBM System

a. The Improved NIKE-HERCULES Air Defense Guided Missile System and the NIKE-HERCULES ATBM System use integrated radar systems to detect and track targets approaching its defended area. A radar system is also used to guide missiles to intercept and destroy hostile targets. Early warning facilities provide information of the approach of hostile targets, and either of two acquisition radar systems provides constant long-range detection and surveillance of the targets. The acquisition radar systems supply target azimuth and range data to the target tracking radar systems, which acquire and track the targets. A missile tracking radar system acquires a missile while it is still on the launcher, tracks the missile in flight, and transmits steering and warhead burst orders to the missile.

b. Target and missile position data are continuously supplied to a computer system. The computer system furnishes to the battery control officer the information necessary for determining the proper time to launch the missile, and sends steering and warhead burst orders to the missile tracking radar system for transmission to the missile during flight. Targets may be aircraft or missiles at speeds up to Mach 3 and altitudes up to 100,000 feet. Both high-explosive and nuclear warheads are employed. Nuclear warheads are for use against large formations of aircraft, tactical ballistic missiles, or surface targets.

6 (C). History of Development

a. The development of offensive missiles and the increases in the capabilities of modern aircraft have rendered conventional antiaircraft

weapons ineffective. The need for a new defense became apparent as fundamental changes in existing defensive weapons seemed unlikely. After an investigation program, it was decided that the most effective defense would be a guided missile system.

b. There were three types of missile guidance systems from which to choose: the homing system, the beam rider system, and the command guidance system. These are described briefly in (1) through (3) below.

(1) The homing system guides the missile by emissions or reflections from the target. The emissions may be light, heat, radio signals, or radar reflections. The accuracy of the homing system increases as the missile approaches the target.

(2) With the beam rider system, the missile must be launched and then captured by a radar beam pointing at the target. The missile must then follow the beam to the target. A number of missiles can be controlled at the same time with this system.

(3) The command guidance system guides the missile by steering commands transmitted from ground guidance equipment to the missile while in trajectory. Complex and precise ground guidance equipment is required for this type of guidance system. However, the expendable missile guidance equipment is less complex than that required for homing or beam rider systems.

c. After an analysis of the three missile guidance systems, it was decided that the command guidance system would best provide the needed defense. The command guidance system promised to be the most effective against fast and highly maneuverable aircraft and to have capabilities for greater range. A government research and development program was initiated that resulted in the NIKE-AJAX Air Defense Guided Missile System, utilizing a command guidance system. The NIKE-AJAX System proved capable of destroying aircraft at ranges up to 50,000 yards.

d. As the speed and maneuverability of modern aircraft increased, it became apparent in 1952 that the NIKE-AJAX System would soon cease to be an effective defense. A new guided missile system was needed which could destroy entire formations of high-altitude, high-speed aircraft at greater ranges with a single missile. After extensive studies, it was determined that this new system would require the use of a nuclear warhead in a new missile having greater range and speed than the NIKE-AJAX missile.

e. Studies were made concerning the feasibility of incorporating a nuclear warhead in the NIKE-AJAX missile to give it the greater destructive capabilities needed. Consideration was also given to changing the NIKE-AJAX ground guidance equipment to get the greater range and accuracy required. It became apparent that adaptation of the NIKE-AJAX missile would necessitate extensive missile redesign, but only relatively minor changes in the NIKE-AJAX ground guidance equipment would be necessary to produce the ground guidance equipment for the new system. In addition, it was determined that the ground guidance equipment could be changed so that it would be capable of launching and controlling the new missile and the NIKE-AJAX missile as well. This would permit retaining the NIKE-AJAX missile for use with the new system against single aircraft at shorter ranges.

f. Surface-to-surface capability for the new system was included as a secondary requirement. Engagement of surface targets at ranges up to 100 nautical miles was desired. Missiles used in the surface-to-surface mission were to be capable of delivering nuclear warheads.

g. In 1954, after studies were completed, contractors were authorized to proceed with development of the new system, designated the NIKE-HERCULES Air Defense Guided Missile System. This system provided the additional capabilities required, including an intercept range in excess of 150,000 yards, more than three times the range of the NIKE-AJAX.

h. In 1956, it became apparent that further improvement to the NIKE-HERCULES System would be necessary to keep pace with advancements in aircraft, air-to-surface missiles, and electronic countermeasures (ECM) tech-

niques. Extensions of NIKE-HERCULES capabilities were needed to maintain effective defense against smaller, faster targets operating at higher altitudes and equipped with improved ECM systems.

i. From inception, the design of the NIKE system was intended to afford maximum performance flexibility with minimum system modification. Studies showed that the basic NIKE-HERCULES System could again be improved to meet the anticipated post-1960 threat. Without changing the missile, effective range of the system could be increased by the addition of a new high power acquisition radar (HIPAR) system. The HIPAR system, plus a new target ranging radar system, could provide electronic counter-countermeasures (ECCM) capabilities to contend with anticipated enemy ECM techniques.

j. In 1958, after studies were completed, contractors were authorized to proceed with development of the new system, designated the Improved NIKE-HERCULES Air Defense Guided Missile System.

k. Later, studies were begun on the feasibility of adapting existing guided missile systems for use in countering the threat to the Field Army by enemy tactical ballistic missiles.

l. Studies of the NIKE-HERCULES System revealed that if changes were made in the HIPAR and computer systems, the Improved NIKE-HERCULES System could be used for defense against tactical ballistic missiles as well as manned aircraft and air-supported missiles.

m. After studies were completed, contractors were authorized to proceed with the development of the NIKE-HERCULES ATBM Air Defense Guided Missile System.

n. The auxiliary acquisition radar (AAR) is added to selected Improved NIKE-HERCULES sites and Improved NIKE-HERCULES sites with dual DVST console which are not equipped with HIPAR. The advantages of the added AAR over a basic radar system are twofold. The range of surveillance of the site is increased and the system is less vulnerable to ECM with the increase of frequencies available.

o. The T1 trainer provides facilities for operating the NIKE-HERCULES System in all tactical conditions by simulating targets, ECM, and system problems. The training of operating personnel is realistic and the status of the system can be accurately determined.

p. The recent development of a mobile HIPAR system provides increased mobility for the Field Army using the Improved NIKE-HERCULES System. The radar set, electrically similar to the EFS/ATBM HIPAR system, is mounted on five trailers and can be march ordered or emplaced within three hours. In addition, the radar set contains its own independent power source which is also capable of supplying the 400-cycle power required by the Improved NIKE-HERCULES System.

q. The AJI modification to the HIPAR system, developed to combat existing and anticipated ECM threats, provides improved ECCM equipment. Since the four AJI subsystems which complete this ECCM package do not reduce receiver sensitivity or degrade system video, they are used as inline fixes. These three AJI subsystems are explained below.

(1) *Automatic jamming avoidance circuits (AJAC).* Electronic programming provides automatic selection of the least-jammed channel as necessary to avoid enemy ECM.

(2) *Automatic cancellation of extended targets (ACET).* Targets which exceed 10 usec in duration (clutter or weather returns) are cancelled by amplitude suppression in these circuits.

(3) *Higher power.* An increase in power provides a higher burn-through capability for selected HIPAR systems.

Section II (CMHA). GENERAL TACTICAL CHARACTERISTICS

7 (U). Application

a. The Improved NIKE-HERCULES Air Defense Guided Missile System is primarily designed to combat air-to-surface missiles and fast, high-altitude formations of modern aircraft with electronic countermeasures (ECM) capabilities. It can be most effectively employed to defend military installations, industrial centers, large cities, and as a first line of defense in areas such as the DEW Line and the eastern and western seaboards of the continental United States.

b. An Improved NIKE-HERCULES battery can be employed as an individual defense unit or in combination with other air defense units. A number of Improved NIKE-HERCULES batteries can be employed as units of an integrated air defense system, with each system monitored and controlled by an Army Air Defense Command Post (AADCP).

c. The NIKE-HERCULES ATBM System is designed to combat aircraft, air supported missiles, and tactical ballistic missiles and can be conditioned to operate against surface targets.

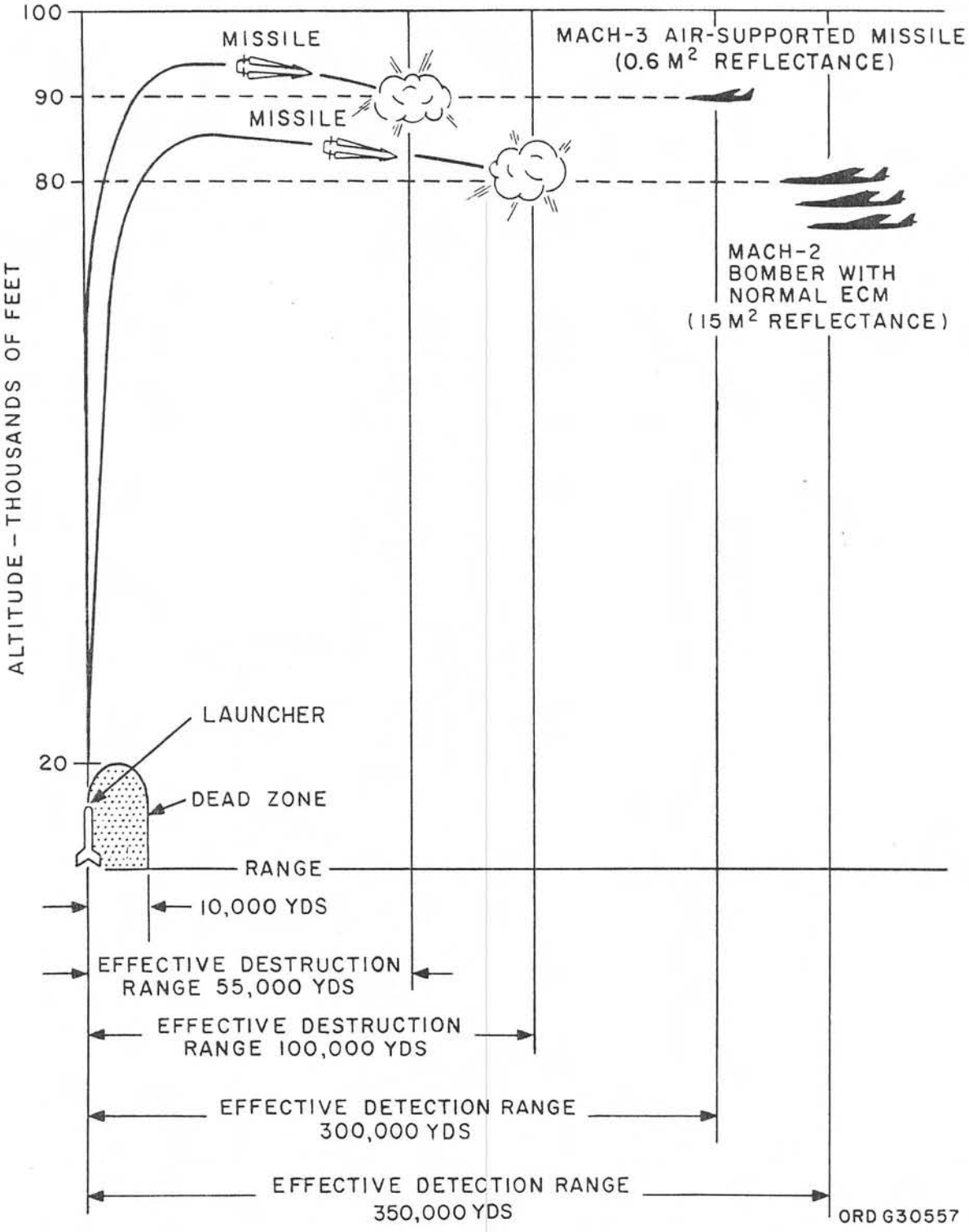


Figure 2 (CMHA). Surface-to-air mission capabilities (U).

8 (C). Capabilities

The Improved NIKE–HERCULES System is capable of performing two types of missions: surface-to-air and surface-to-surface. The system can also be used for radar scoring of simulated bombing runs. The general capabilities of the Improved NIKE–HERCULES System are described in *a* through *d* below.

a. Surface-to-Air Mission (fig. 2).

(1) The Improved NIKE–HERCULES System is designed to combat bombers or air supported missiles at altitudes up to 100,000 feet. The system can detect a missile traveling at Mach 3 with a typical radar reflecting surface of 0.6 square meter at a maximum range of 300,000 yards. Bombers traveling at Mach 2 with normal ECM capabilities and with a typical radar reflecting surface of 15 square meters can be detected at 350,000 yards. At 90,000 feet altitude, the air-supported missile can be destroyed at 55,000 yards range. At 80,000 feet, bomber formations can be destroyed at 100,000 yards. The NIKE–HERCULES missile can attain a maximum velocity of Mach 3.5 which surpasses the speed of known existing manned aircraft or aerodynamically supported missiles.

(2) When a missile is fired in a surface-to-air mission, an intercept cannot be made within a "dead zone" surrounding its launcher. This "dead zone" has a ground radius of approximately 10,000 yards and an altitude of approximately 20,000 feet. The dead zone is determined by the launch angle and the minimum turning radius of the missile.

b. (Deleted)

c. Surface-to-Surface Mission (fig. 4). The Improved NIKE–HERCULES System can deliver a nuclear warhead to a surface target at a maximum range of 100 nautical miles.

c.1. Radar Bomb Scoring Mission. The Improved NIKE–HERCULES System, when used in a radar bomb scoring mission, accurately plots the course of a bomber making a simulated bombing run and marks the point of the simulated bomb release. From this plot the theoretical impact point is calculated, and the accuracy of the bombing run is determined.

d. Operating Conditions. The Improved NIKE–HERCULES System is capable of operating 23 hours a day without impairment of performance, and at least 5,000 hours without major overhaul. The equipment operates efficiently over an ambient temperature range from −40° to +125°F and at relative humidities up to 100 percent. Rain, dust, snow, sand, salt air, and steady surface winds up to 60 miles per hour, and surface gusts up to 75 miles per hour will not interfere with normal operation. The equipment is designed to operate efficiently at altitudes up to 6,000 feet above sea level. The Improved NIKE–HERCULES ground guidance equipment with anti-jam display facilities can operate effectively in the presence of severe jamming.

8.1 (C). Capabilities of The NIKE–HERCULES ATBM System

The NIKE–HERCULES ATBM System is capable of performing three types of missions: Surface-to-air antiaircraft (A–A), surface-to-air anti-missile (A–M), and surface-to-surface. The system can also be used for radar scoring of simulated bombing runs as described in paragraph 8*c.1*. The capabilities of the ATBM system are described in *a* through *d* below.

a. Surface-to-Air Antiaircraft Mission.

(1) The NIKE–HERCULES ATBM System is capable of guiding a NIKE–HERCULES missile to intercept and destroy entire formations of high performance aircraft as well as air supported missiles. Intercept can be made at ranges in excess of 150,000 yards and at altitudes up to 100,000 feet. Targets can be detected at a range of 350,000 yards with the HIPAR/AAR system and 250,000 yards with the LOPAR system. The NIKE–HERCULES missile can attain a maximum velocity of Mach 3.5 and has a maneuverability advantage over all known tactical manned aircraft.

(2) When a missile is fired, intercept can-

Figure 3. (Deleted).

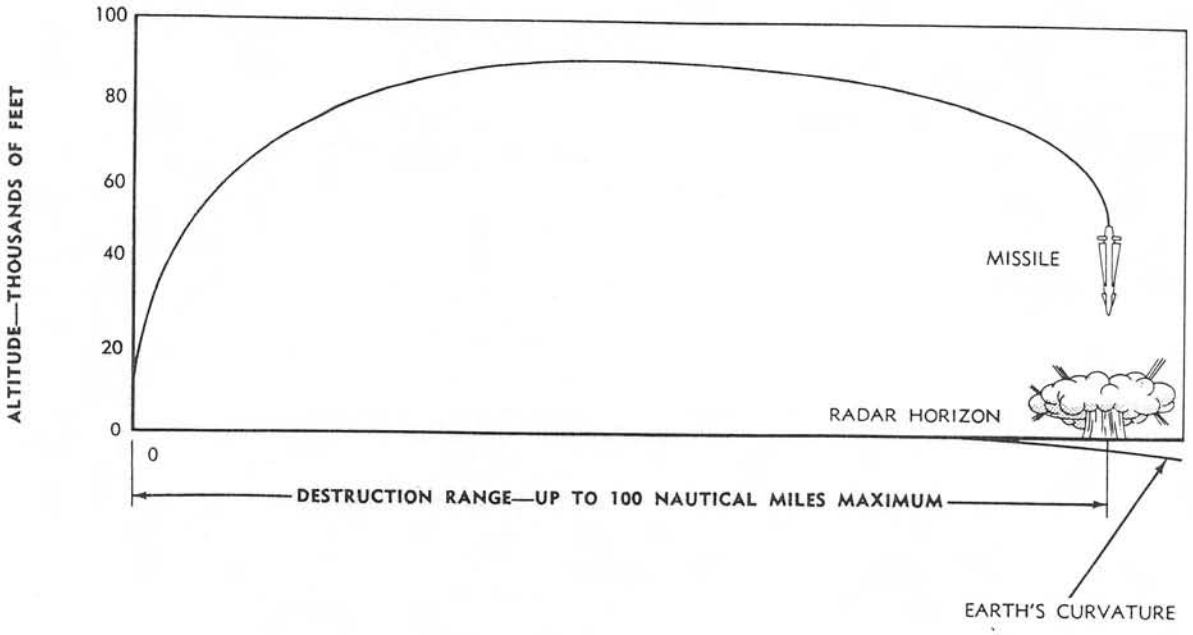


Figure 4 (C). Surface-to-surface mission capabilities (U).

not be made within a "dead zone" surrounding the missile launcher. This "dead zone" has a ground radius of approximately 10,000 yards and an altitude of approximately 20,000 feet. The dead zone is determined by the launch angle and minimum diving radius of the missile. Capabilities of the NIKE–HERCULES ATBM Systems during surface-to-air missions against manned aircraft and air supported missiles are shown in figure 4.1.

b. Surface-to-Air Anti-Missile Mission. When the anti-missile mission is selected, the computer is conditioned for ballistic prediction. The system can guide a NIKE–HERCULES missile to intercept and destroy a tactical ballistic missile traveling at speeds up to 2,380 knots. Figure 4.2 shows the intercept capability of the system during the anti-missile mission.

c. Surface-to-Surface Mission. The NIKE–HERCULES ATBM System can deliver a NIKE–HERCULES missile armed with a nuclear warhead to a surface target at a maximum range of 100 nautical miles. The capabilities of the system during surface-to-surface mission are shown in figure 4.

d. Operating Conditions. Operating conditions for the NIKE–HERCULES ATBM System are identical to those for the Improved NIKE–HERCULES System given in paragraph 8*d*.

9 (C). Technical Data

a. Missile.

Maximum speed	3650 feet per second at mean sea level.
Maximum altitude	100,000 feet.

b. Acquisition Radar Systems.

(1) *HIPAR.*

Maximum operating range	350,000 yards.
Peak RF power output	6 megawatts.

(1.1) *EFS/ATBM HIPAR.*

Maximum operating range	350,000 yards.
Peak RF power output	7.5 megawatts.

(1.2) *AAR.*

Maximum operating range	350,000 yards.
Peak RF power output	500 kilowatts.

(2) *LOPAR.*

Maximum operating range	250,000 yards.
Peak RF power output	1 megawatt.

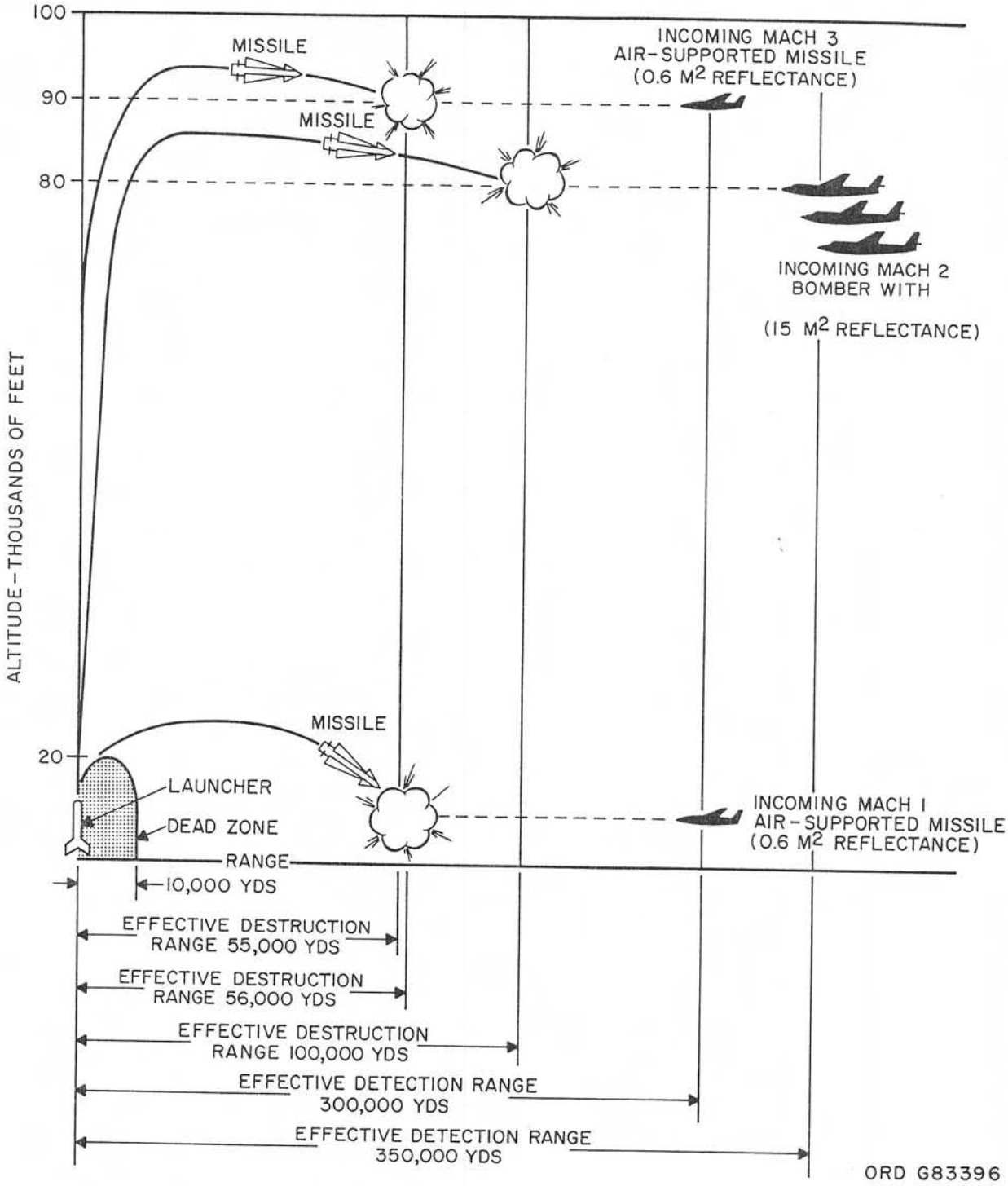


Figure 4.1 (C). Surface-to-air mission capabilities against manned aircraft and air supported missile (U).

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c. Target Tracking Radar System.

Maximum operating range ... 200,000 yards.
Minimum operating range ... Under 1000 yards.
Tracking rates:
- Azimuth ... 700 mils per second.
- Elevation ... 700 mils per second (automatic). 65 mils per second (slew).
- Range ... 2000 yards per second (automatic). 18,000 yards per second (slew).

Peak RF power output:
- Short pulse ... 201 kilowatts.
- Long pulse ... 142 kilowatts.

d. Target Ranging Radar System.

Maximum operating range ... 200,000 yards.
Minimum operating range ... Under 1000 yards.
Tracking rates:
- Azimuth ... 700 mils per second.
- Elevation ... 700 mils per second (automatic). 65 mils per second (slew).
- Range ... 2000 yards per second (automatic). 18,000 yards per second (slew).

Peak RF power output ... 125 kilowatts (min.).

e. Missile Tracking Radar System.

Maximum operating range ... NIKE-AJAX 55,000 yards. NIKE-HERCULES 200,000 yards.
Minimum operating range ... Under 1000 yards.
Tracking rates:
- Azimuth ... 750 mils per second.
- Elevation ... 700 mils per second.
- Range ... 1600 yards per second (automatic). 18,000 yards per second (slew).

Peak RF power output ... 140 kilowatts.

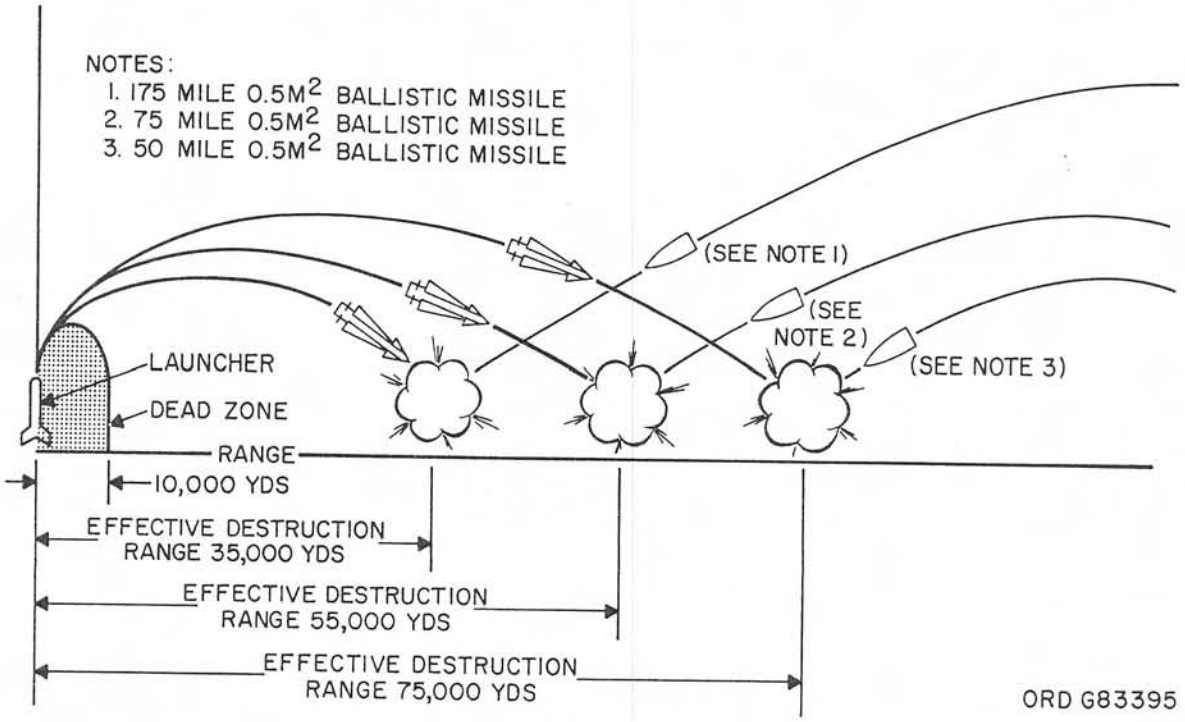


Figure 4.2 (C). Surface-to-air mission capabilities against ballistic missiles (U).

CHAPTER 2 (C)

GENERAL DESCRIPTION

Section I (C). OVERALL FUNCTIONAL DESCRIPTION

10 (U). Scope

This section contains an overall functional analysis of the Improved NIKE–HERCULES Air Defense Guided Missile System and emphasizes the functional relationships of the subsystems. This analysis covers separately the functional operation of the overall system during the two types of missions: surface-to-air and surface-to-surface. This section also describes briefly the relationship of the assembly and service area and the launching area to the battery control area.

11 (C). Surface-to-Air Mission

a. In a surface-to-air mission (fig. 5) the acquisition radar operator will use one of the acquisition radar systems (LOPAR or HIPAR/AAR) and the associated selective identification feature/identification friend or foe (SIF/IFF) system to detect and identify targets. After the target has been detected and identified, the target range and azimuth is electrically designated to the target-tracking radar (TTR) system. When the TTR azimuth operator receives an indication of target designation, he will immediately initiate action (acquire) to cause the TTR to electrically position itself to the designated range and azimuth. While the TTR is tracking the target, target-present position data (elevation, azimuth, and range) is continuously supplied to a computer system. The target ranging radar (TRR) is slaved to the TTR in elevation and azimuth. During enemy-countermeasure activities, target-range information is provided to the computer by the TRR and elevation and azimuth information is provided by the TTR. From the target position data, the computer system continuously calculates a predicted intercept point. The azimuth of the predicted intercept point is sent as gyro azimuth preset data by the computer system to the previously designated missile. This data orients a gyro in the missile so that, after launch, the missile automatically rolls to the correct attitude with respect to the predicted intercept point. A missile tracking radar system is electronically locked on the designated missile while the missile is still on a launcher so that, after launch, this radar system can supply uninterrupted missile position data to the computer system. The computer system continuously supplies data to two plotting boards which enable the battery control officer to determine the optimum time to launch the missile.

b. When the missile is launched, a rocket motor cluster provides the initial thrust and separates from the missile in approximately 3.3 seconds at approximately 3,500 feet. The computer system continuously calculates a proper missile trajectory, as determined by the target and missile position data being supplied by the tracking radar systems. The computer system then sends appropriate steering orders to the missile by way of the missile tracking radar system. At a predetermined time before intercept, the computer system automatically sends a burst order by way of the missile tracking radar system. The burst order causes the missile warhead to detonate within a lethal radius of the target. Detonation of the missile warhead shortly before intercept provides the most effective burst coverage.

12 (Deleted).

13 (C). Surface-to-Surface Mission

In a surface-to-surface mission (fig. 7), the acquisition radar systems are not used because the target position is known. The range, azimuth, and elevation coordinates of the target are calculated and manually set into the target tracking radar system. Therefore, the target tracking radar system supplies constant target position data to the computer system. The function of the computer system is similar to that described in paragraph 11 for a normal surface-to-air mission except that missile trajectory data is manually set into the computer system causing the missile to be guided toward

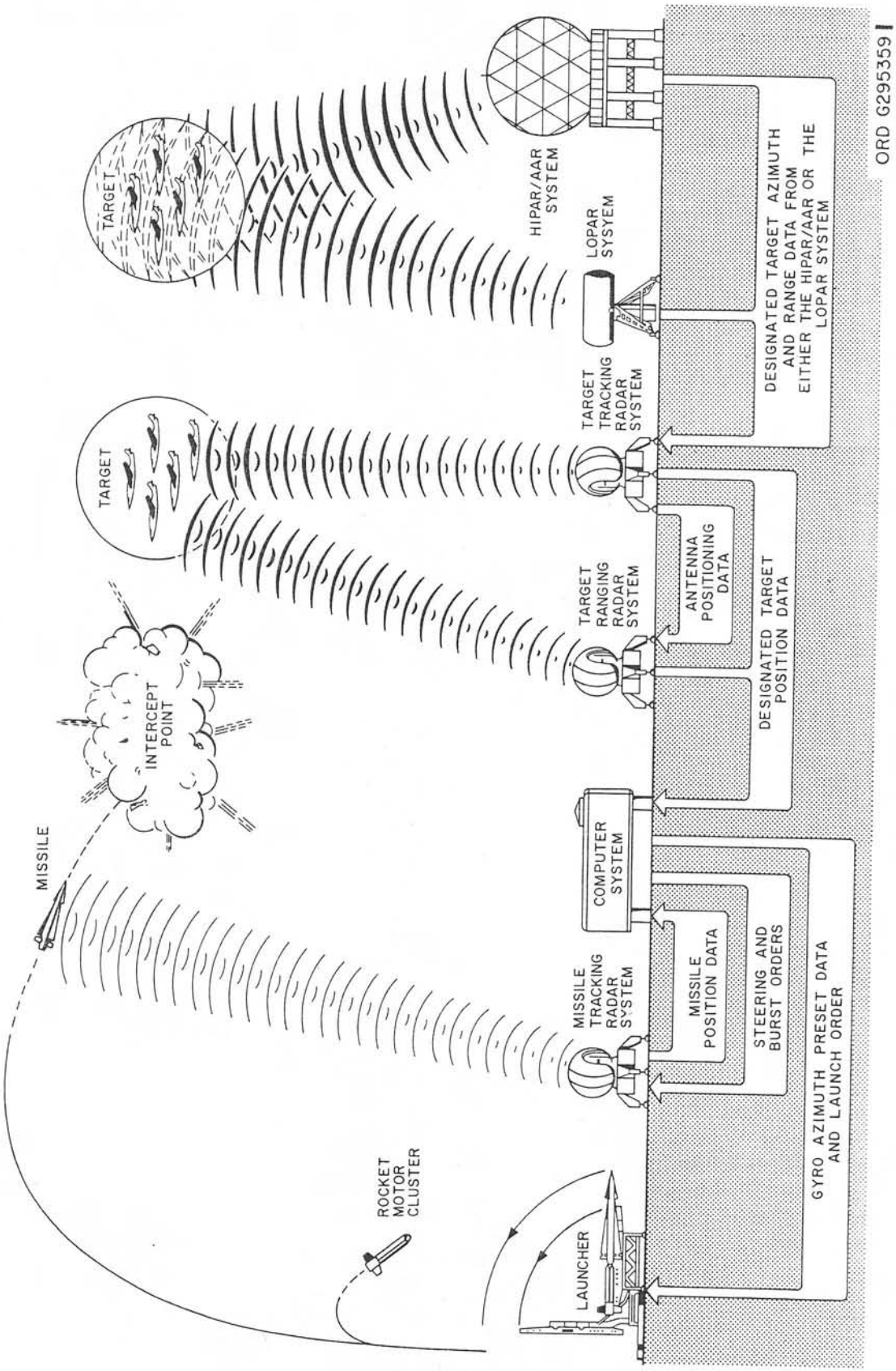


Figure 5 (U). Surface-to-air-mission—functional diagram (U).

Figure 6. (Deleted).

a point in space above the desired point of impact. At a predetermined time, this point in space is removed causing the computer to issue a dive order to the missile. The missile then approaches the ground target in a near-perpendicular trajectory. As the missile approaches the ground, the computer system sends a burst order to the missile. However, due to special preparation of the missile for a surface-to-surface mission, the burst order does not cause the missile warhead to detonate. Instead, the burst order disables the missile fail-safe mechanism and causes guidance cutoff by disabling the missile receiver. The burst order also arms a preset barometric fuze in the missile warhead, and rolls the missile 180 degrees to compensate for flight biases inherent in the missile. The missile then follows a vertical trajectory until the barometric fuze causes the nuclear missile warhead to detonate at a predetermined altitude above the target.

13.1 (U). Radar Bomb Scoring Mission

a. In a radar bomb scoring mission (fig. 6.1), as in a tactical surface-to-air mission, the acquisition radar system detects and identifies the bomber and supplies bomber azimuth and range data to the target tracking radar system. The target tracking radar system then acquires and tracks the bomber and supplies continuous bomber position data to the computer system. The computer system produces a plot of the bomber's course on a plotting board and indicates the bomber's altitude on a meter.

b. At the bomb release point the bomber transmits a bomb release signal by UHF radio to an Army Air Defense Command Post (AADCP). The signal is relayed automatically by wire or radio to the Improved NIKE–HERCULES battery and the position of the bomber at the bomb release point is indicated automatically on the plotting board. The theoretical bomb impact point is determined from the recorded data. This theoretical impact point is compared with the target position and a score is assigned for the bombing run. The score is sent to the AADCP by voice communication and relayed automatically to the bomber by UHF radio.

c. Auxiliary equipment, consisting of an RBS control unit, an RBS scale factor unit, and communication equipment, is added to the Improved NIKE–HERCULES System for bomb scoring missions only. The auxiliary equipment is Air Force materiel and is normally operated by Air Force personnel.

14. (U). Operational Areas

Equipment incorporated in the Improved NIKE–HERCULES System is located in three operational areas: the battery control area, the launching area, and the assembly and service area. The functions of these areas are described briefly in *a* through *c* below. Overall physical description and site layout are contained in Section II.

a. Battery Control Area. The battery control area contains the radar course directing central (RCDC) which consists basically of the acquisition radar systems; the target tracking, target ranging, and missile tracking radar systems; the computer system; and associated equipment. The purpose of the RCDC is to detect, acquire, and track the target; furnish information to the battery control officer so that he can determine when a missile is to be launched; track the missile during trajectory; and issue steering and burst orders to the missile. The battery control officer determines the type of mission, missile, and warhead to be used. The battery control officer also supervises selection of the target to be engaged and issues orders to ready the missile for launching and to fire the missile.

b. Launching Area. The launching area contains the guided missile launching set which consists of NIKE–HERCULES and NIKE AJAX launchers and launching control equipment, or of only NIKE–HERCULES equipment. Personnel in this area maintain a supply of ready missiles.

c. Assembly and Service Area. The assembly and service area is a support area that provides equipment and facilities for assembling, testing, fueling, and storing missiles

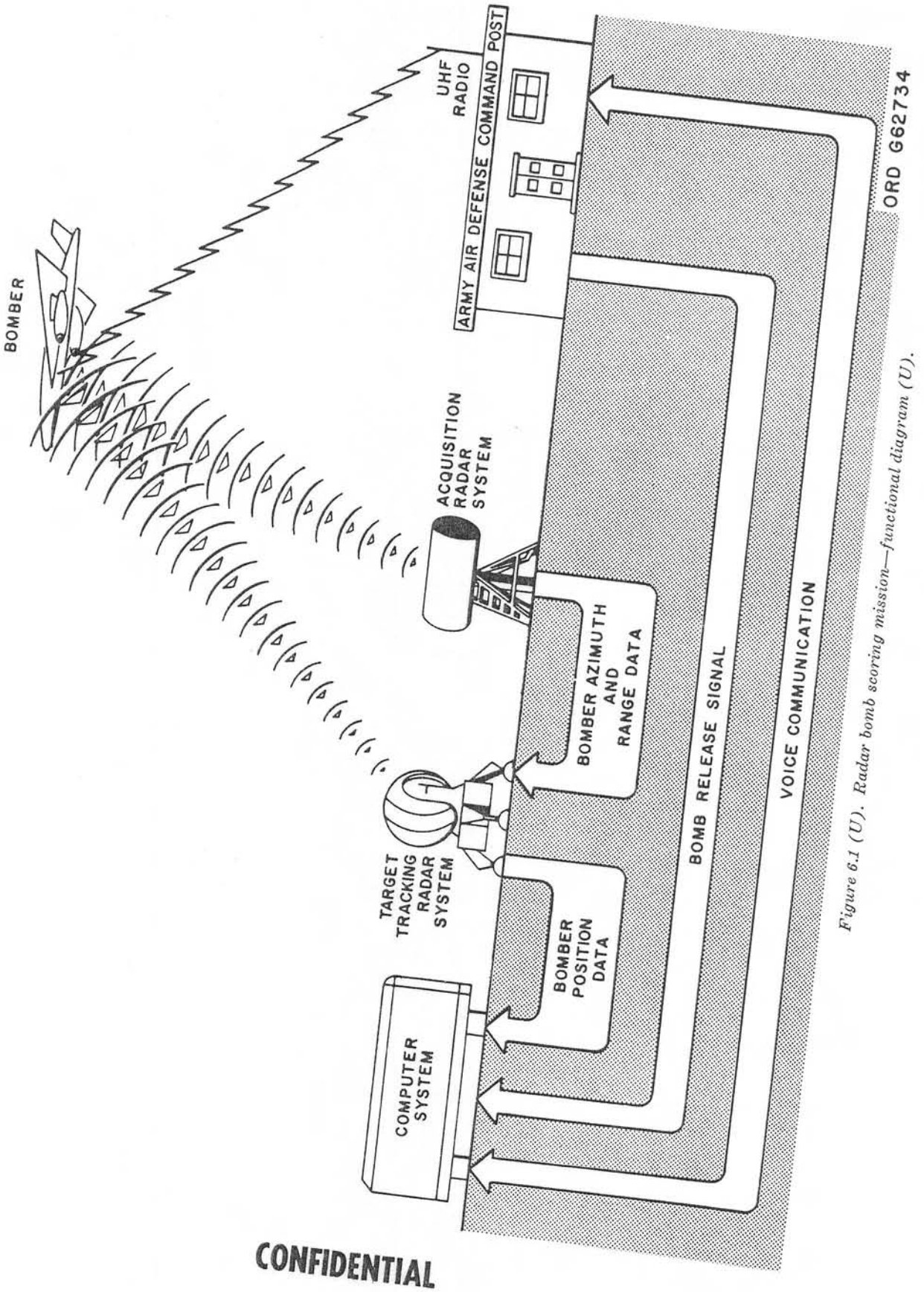


Figure 6.1 (U). Radar bomb scoring mission—functional diagram (U).

Section I.I (C). OVERALL FUNCTIONAL DESCRIPTION OF THE ATBM SYSTEM

14.1 (U). Scope

This section contains an overall functional analysis of the NIKE–HERCULES ATBM Air Defense Guided Missile System. This section covers both surface-to-air missions of the system and the surface-to-surface mission.

14.2 (C). Surface-to-Air Mission (Figs. 5 and 6.2)

a. In a surface-to-air antiaircraft or antimissile mission, either of the two acquisition radar systems can be selected for detecting and identifying oncoming targets although the HIPAR/AAR is preferred. Acquisition radar azimuth and range data of a designated target is electronically relayed from either system to a target tracking radar system. This data is used to acquire the target. After acquisition, target position data (elevation, azimuth, and range) is continuously supplied to a computer system by the target tracking radar system. When enemy countermeasures activity is adverse, target range data may be obtained from the slaved target ranging radar system, and azimuth data may be provided using the strobe line features of either HIPAR/AAR or LOPAR AJD. From the target position data, the computer system continuously calculates a predicted intercept point. The azimuth of the predicted intercept point is sent as gyro azimuth preset data by the computer system to the previously designated missile. This data orients a gyro in the missile so that, after launch, the missile automatically rolls to the correct attitude with respect to the predicted intercept point. A missile tracking radar system is electronically locked on the designated missile while the missile is still on a launcher so that, after launch, this radar system can supply uninterrupted missile position data to the computer system. The computer system continuously supplies data to two plotting boards which enable the battery control officer to determine the optimum time to launch the missile.

b. When the missile is launched, a rocket motor cluster provides the initial thrust and separates from the missile in approximately 3.3 seconds at approximately 3,500 feet. The computer system continuously calculates a proper missile trajectory, as determined by the designated target and missile position data being supplied by the tracking radar systems. The computer system then sends appropriate steering orders to the missile by way of the missile tracking radar system. At a predetermined time before intercept, the computer system automatically sends a burst order by way of the missile tracking radar system. The burst order causes the missile warhead to detonate within a lethal radius of the target.

14.3 (U). Surface-to-Surface Mission

For a functional analysis of the NIKE–HERCULES ATBM System surface-to-surface mission refer to paragraph 13, the Improved NIKE–HERCULES surface-to-surface mission.

14.4 (U). Radar Bomb Scoring Mission

Refer to paragraph 13.1 for functional analysis of the radar bomb scoring mission.

14.5 (U). Operational Areas

Operational areas for the NIKE–HERCULES ATBM System are the same as for the Improved NIKE–HERCULES System. Refer to paragraph 14 for a discussion of the operational areas of the Improved NIKE–HERCULES System.

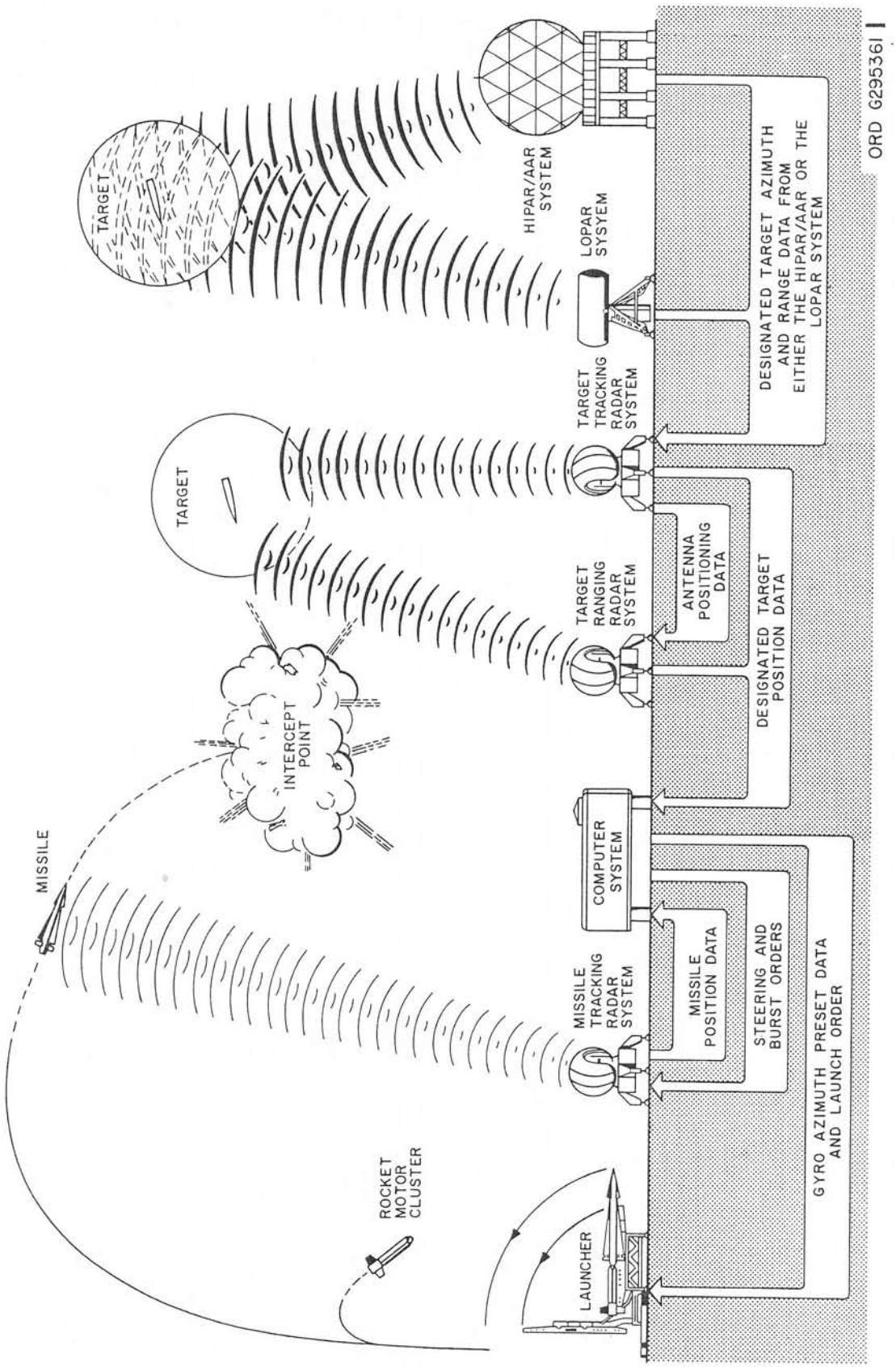


Figure 6.2 (U). Surface-to-air anti-missile mission—functional diagram (U).

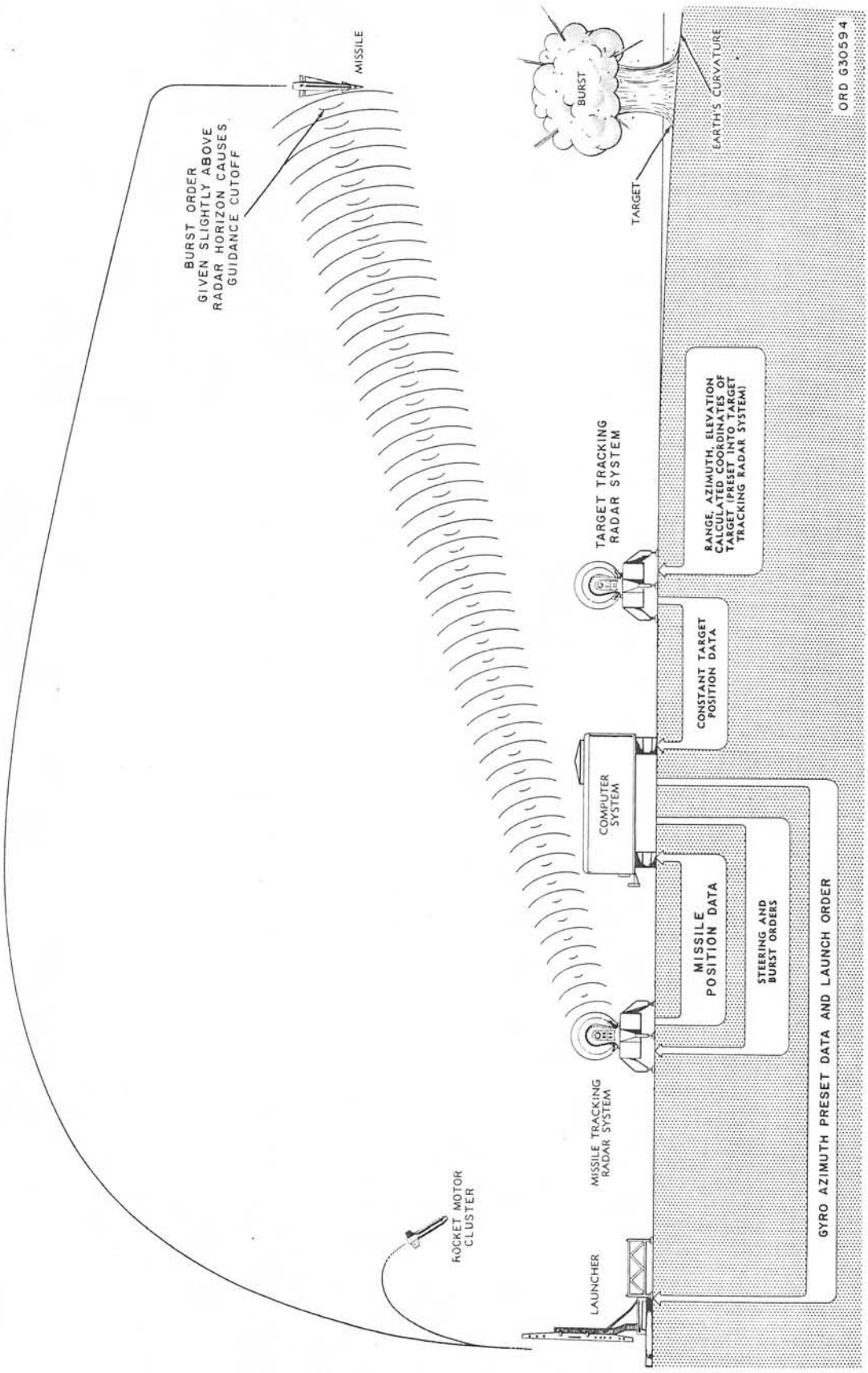


Figure 7 (U). Surface-to-surface mission—functional diagram (U).

Section II (U). OVERALL PHYSICAL DESCRIPTION AND SITE LAYOUT

15 (U). Scope

a. The three operational areas of the Improved NIKE–HERCULES System and the NIKE–HERCULES ATBM System are the battery control area, the launching area, and the assembly and service area. This section briefly describes the physical location of each area with respect to the other two areas. The locational requirements described are applicable regardless of terrain characteristics. Additional requirements vary as dictated by individual site characteristics such as terrain and real estate availability.

b. Details within any one of the three areas are given in this section only where these details affect the technical locational requirements which must be met when emplacing one area with respect to the other two areas. Internal arrangements of the equipment within the battery control area, the launching area, and the assembly and service area, are described in chapters 3, 4, and 6, respectively.

16 (U). Physical Layout

The Improved NIKE–HERCULES System and the NIKE–HERCULES ATBM System described in this manual is the Continental United States (CONUS) emplacement. Spacing and siting characteristics of a typical battery layout are described in *a* through *e* below and illustrated in figure 8. Emphasis is on the mandatory locational requirements.

a. The site for the battery control area requires a minimum area of 3.8 acres. This area is preferably situated on high ground so that the best possible radar coverage is obtained. The launching area is preferably located in front of the battery control area with respect to the primary target line. The primary target line is the direction in which most intercepts are likely to be made, although an intercept can be made in any direction from the battery. This location of the launching area is not mandatory; it may be necessary to locate the launching area behind or to the side of the battery control area because of terrain characteristics or real estate availability.

b. The launching area cannot normally be located further than 5,200 yards from the battery control area because of the interarea cable limits. However, if additional cables are employed, or if the system uses a radio-link instead of cables, the interarea separation can be extended to 6,000 yards. Separation distances beyond 6,000 yards are possible with modification of the computer system parrallax circuits. The minimum distance between the battery control area and launching area is 1,000 yards because of the angular tracking limitations of the missile tracking radar system.

c. The launching area must be emplaced so that a line-of-sight exists between the missile track antenna-receiver-transmitter group (6, fig. 8) in the battery control area and the flight simulator group and radar target simulator (2, fig. 8) in the launching area. Line-of-sight must also exist between the missile track antenna-receiver-transmitter group and each erected missile (1, fig. 8) in the launching area.

d. The launching area is approximately level and is easily accessible by roads from the battery control area and the assembly and service area. To minimize damage from expended rocket motor clusters, an unpopulated area forward of the launching area is required for a rocket motor cluster disposal area.

e. The assembly and service area is a support area that provides equipment and facilities for assembling, testing, fueling, and storing missiles. Therefore, it is located near the launching area. The minimum safety distance between the launching area and the assembly and service area is determined by Ordnance Quantity Distance tables (ORDAN 7–224). This distance varies with the explosives and revetments employed.

1—Erected missile on launcher
2—Flight simulator group and radar target simulator
3—Trailer mounted launching control station
4—Radar test set group
5—Lopar antenna-receiver-transmitter group
6—Missile track antenna-receiver-transmitter group
7—Target range antenna-receiver-transmitter group
8—Target track antenna-receiver-transmitter group
9—Trailer mounted director station
10—Trailer mounted tracking station
11—Hipar building
12—Power building
13—Hipar antenna radome-supported-tripod
14—AAR antenna
15—AAR shelter

Figure 8 (U). Battery layout—typical consolidated site—legend (U).

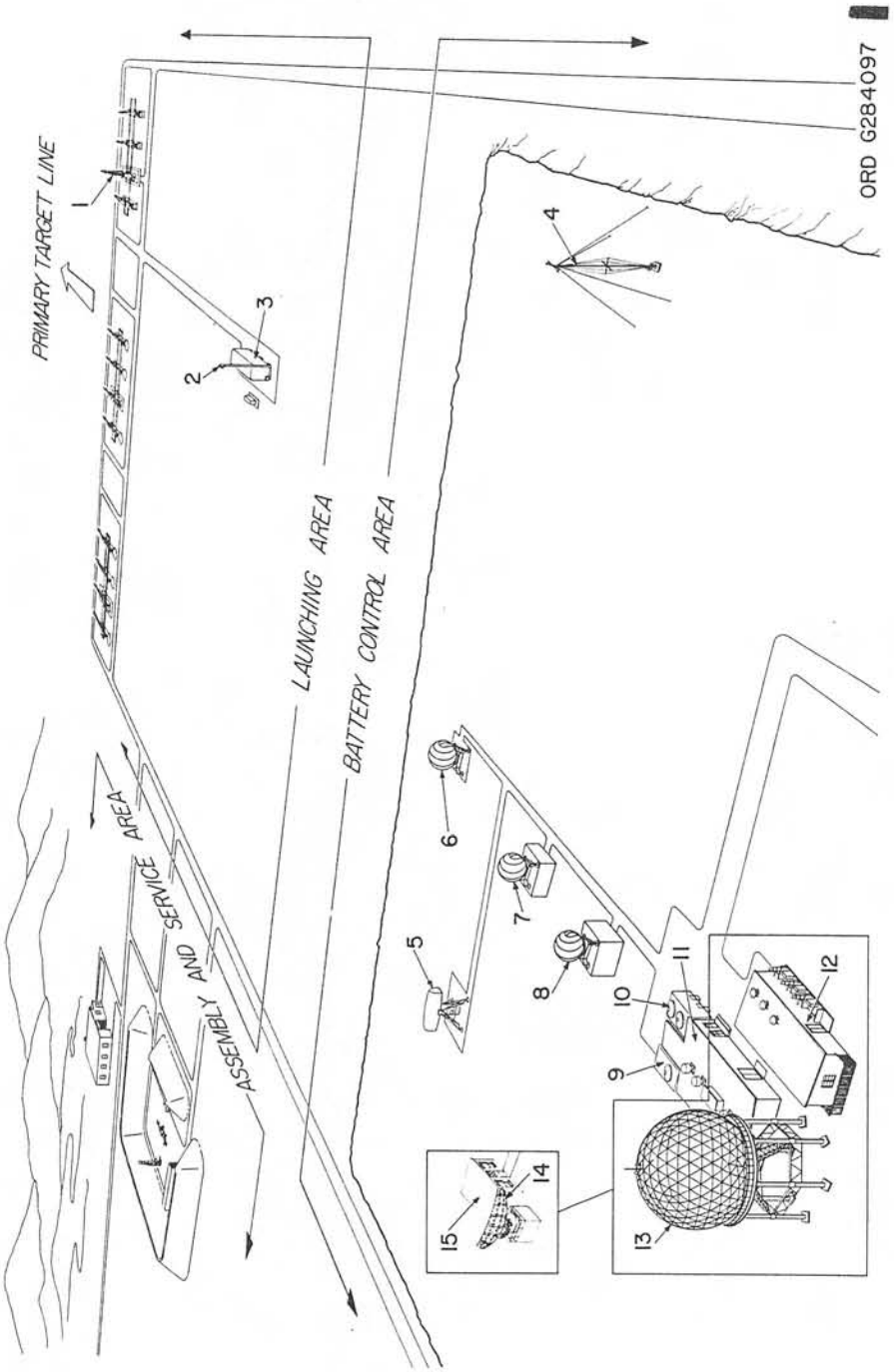


Figure 8 (U). Battery layout—typical consolidated site (U).

CHAPTER 3 (C)
RADAR COURSE DIRECTING CENTRAL

Section I (C). FUNCTIONAL DESCRIPTION

17 (U). General

The radar course directing central (RCDC) consists of the ground guidance equipment located in the battery control area (fig. 8). The functional relationships of the major subsystems of the RCDC are illustrated in figure 9. Each block represents a functional subsystem of the RCDC except the blocks that are shown with broken lines. The tactical control system relays tactical control data, consisting of information and orders, among all areas of the Improved NIKE–HERCULES System or the NIKE–HERCULES ATBM System.

18 (C). Functional Analysis

Note. The function of the RCDC in the NIKE–HERCULES ATBM System is the same as that of the RCDC in the Improved NIKE–HERCULES System.

a. In a surface-to-air mission, the high power acquisition radar (HIPAR) (fig. 9), the auxiliary acquisition radar (AAR), and the low power acquisition radar (LOPAR) transmit pulsed RF energy from a continuously rotating, highly directional antenna. An object in the path of the transmitted RF energy reflects a portion of the energy back to the antenna. The acquisition radar system converts the reflected RF energy into video for display on cathode-ray tube indicators. The radar select circuit permits selection of either HIPAR/AAR or LOPAR video for display.

a.1. Anti-jam display (AJD) facilities are provided for both the HIPAR/AAR and the LOPAR systems. In the presence of enemy jamming, the AJD allows the target to remain visible on the cathode-ray tube indicators.

b. An identification friend or foe (IFF) system also is associated with each of the two acquisition radar systems. When IFF identification of an unidentified object is required, the IFF system transmits IFF interrogation pulses to the unidentified object. If the object is a friendly aircraft with IFF equipment, IFF response pulses are transmitted by the aircraft and received by the IFF system. The IFF response pulses are converted into IFF video for display on the cathode-ray tube indicators.

c. Tactical control data from an Army Air Defense Command Post (AADCP) is supplied through either the fire unit integration facility (FUIF) or the battery terminal equipment (BTE) to the tactical control system. If the tactical control data received by the tactical control system from the AADCP or IFF indicates that the unidentified object is an enemy aircraft or missile, the object is designated as a target. Designated target position data, derived from the selected acquisition radar display, is supplied to the target tracking radar (TTR) system.

d. The designated target position data aids the target tracking operators in acquiring the target. The TTR system transmits a beam of RF energy to the designated target and receives the reflected RF energy. The reflected RF energy enables the TTR system to track the target and to provide continuous target position data to the computer system. The TTR system provides antenna position data to the target ranging radar (TTR) system. The TRR system, slaved to the TTR system, also tracks the target by transmitting RF energy and receiving the RF energy reflected from the target. The TRR system supplies range video to the TTR system. The continuous target position data supplied to the computer system consists of azimuth and elevation data from the TTR system and range data from either the TTR or TRR system. The use of two radar systems for range tracking provides advantages in combatting enemy electronic countermeasures (ECM).

e. Tactical control data, such as missile, mission, and warhead designation and the fire command, is supplied to the launching control group from the tactical control system. When a target is being tracked, the computer system continuously calculates a predicted intercept point, determined from the target position data supplied

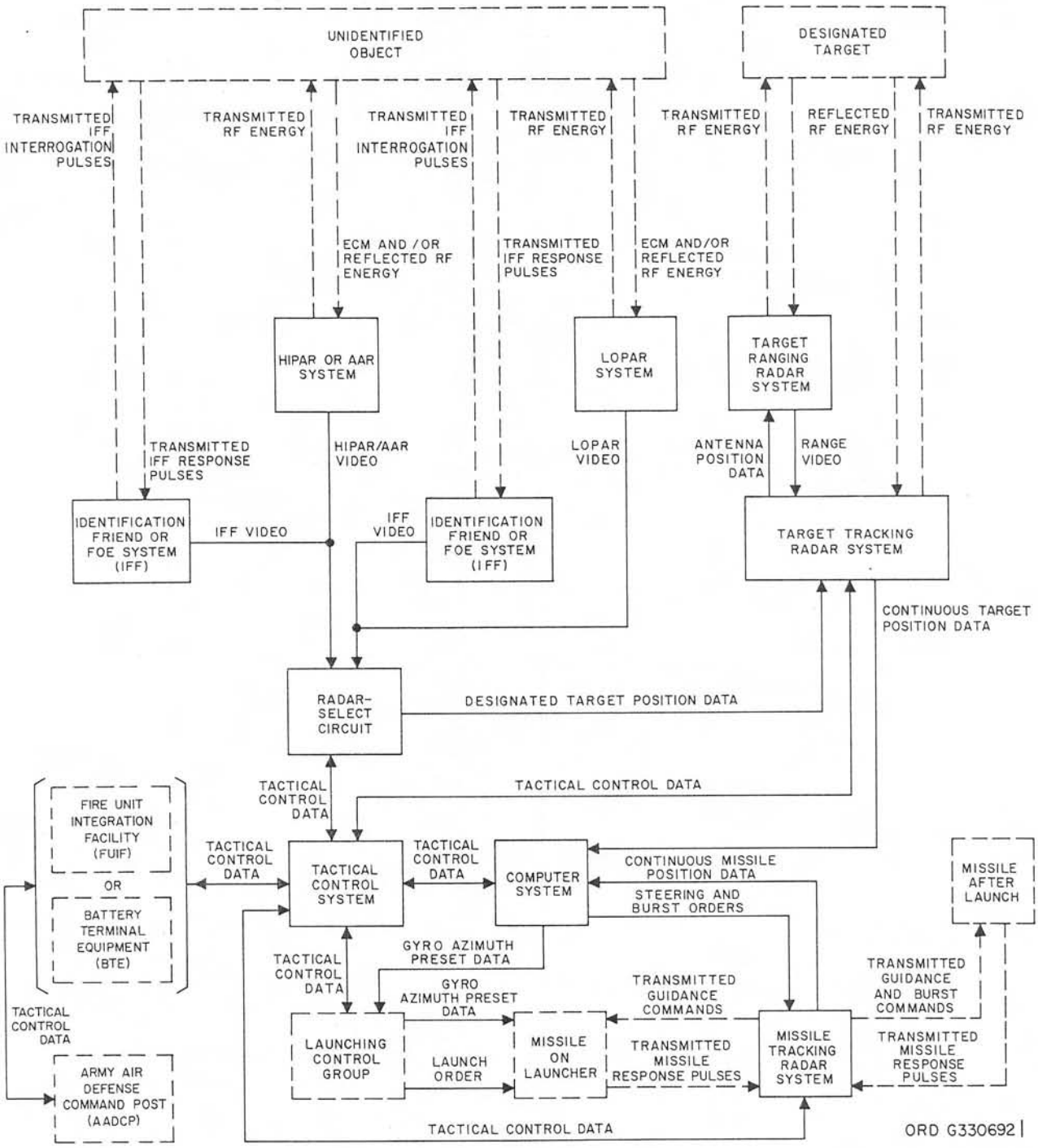


Figure 9 (U). RCDC—block diagram (U).

by the TTR system. The computer system sends gyro azimuth preset data through the launching control group to the designated missile on a launcher. The gyro azimuth preset data orients a roll amount gyro in the missile. This gyro provides a stable reference that enables the missile to roll automatically to a predetermined attitude, after launch, relative to the predicted intercept point.

f. While the target is being tracked, the computer system sends steering orders to the missile tracking radar (MTR) system. The MTR sys-

tem converts the steering orders to guidance commands, consisting of coded pulses of RF energy, that are transmitted to the designated missile on a launcher. A transponder in the missile responds to the guidance commands by transmitting RF response pulses. The transmitted missile response pulses enable the MTR system to "lock on" the designated missile prior to launch and to track the missile after launch.

g. The fire command is generated manually and sent from the tactical control system to the launching control group as tactical control data, and then to the missile on the launcher as the launch order.

h. After the missile is launched and has separated from the rocket motor cluster, the missile rolls to the attitude determined before launch by the setting of the roll amount gyro and heads in the direction of the predicted intercept point. The computer system, receiving continuous target position data from the TTR system and continuous missile position data from the MTR system, determines that maneuvers are necessary to cause the missile to intercept the target and sends the appropriate steering orders to the MTR system. The MTR system converts the steering orders to guidance commands that are transmitted to the missile.

i. The missile guidance set converts the guidance commands into control surface deflections that produce the required missile maneuvers. The missile continues to transmit response pulses which enable the MTR system to track the missile and to supply continuous missile position data to the computer system.

j. When the missile is within lethal range of the target, the computer system sends a burst order to the MTR system. The MTR system transmits a burst command that detonates the missile.

k. A designated missile on a launcher may be rejected either manually or automatically. If it is determined that a designated missile is incapable of completing a successful mission for any reason, a manual missile reject signal is sent from the battery control area. An automatic missile reject signal is sent by the computer system if a designated missile does not ascend from the launcher within 5 seconds after the fire command. When a designated missile is rejected by either method, another missile must then be designated.

l. The fire command is normally sent over the tactical control circuits to the launching control group, then to the missile as the launch order. In emergencies, if the tactical control circuits are disrupted, the fire command and other tactical control data can be relayed through the voice communication system to the launching control group or to the launching section. The firing circuit is then completed by an operator at the launching control group or launching section.

m. In a surface-to-surface mission, the RCDC functions are essentially the same as in a surface-to-air mission, except for the differences described in paragraph 13.

Section II (C). PHYSICAL ARRANGEMENT

19 (U). General

a. The radar course directing central (RCDC) described in this manual is emplaced as a fixed or mobile defense installation in the Continental United States (CONUS). Two general site configurations are used. These two configurations are the "inline," with advantages of minimum radar masking, and the "T", with advantages of equipment location and real estate economy. The RCDC for the Improved NIKE–HERCULES Air Defense Guided Missile System can be emplaced either with or without the high power acquisition radar (HIPAR) or auxiliary acquisition radar (AAR). The RCDC for the NIKE–HERCULES ATBM System shall be emplaced with the HIPAR/AAR.

b. Variations of the two general fixed site configurations are described in paragraphs 20 and 20.1. A typical site configuration for a mobile installation is described in paragraph 20.2. The orientation of the RCDC with respect to the primary target line should be as specified; however, this is not a mandatory requirement. In an individual site other considerations, such as real estate availability, may make a different alinement necessary.

20 (U). Inline Configuration (Fixed Site)

The inline configuration is preferred for Improved NIKE–HERCULES and NIKE–HERCULES ATBM sites where sufficient suitable real estate is available. The inline configuration can be either a consolidated or nonconsolidated site, as described in *a* and *b* below.

Note. The key numbers shown in parentheses in *a* below refer to figure 8.

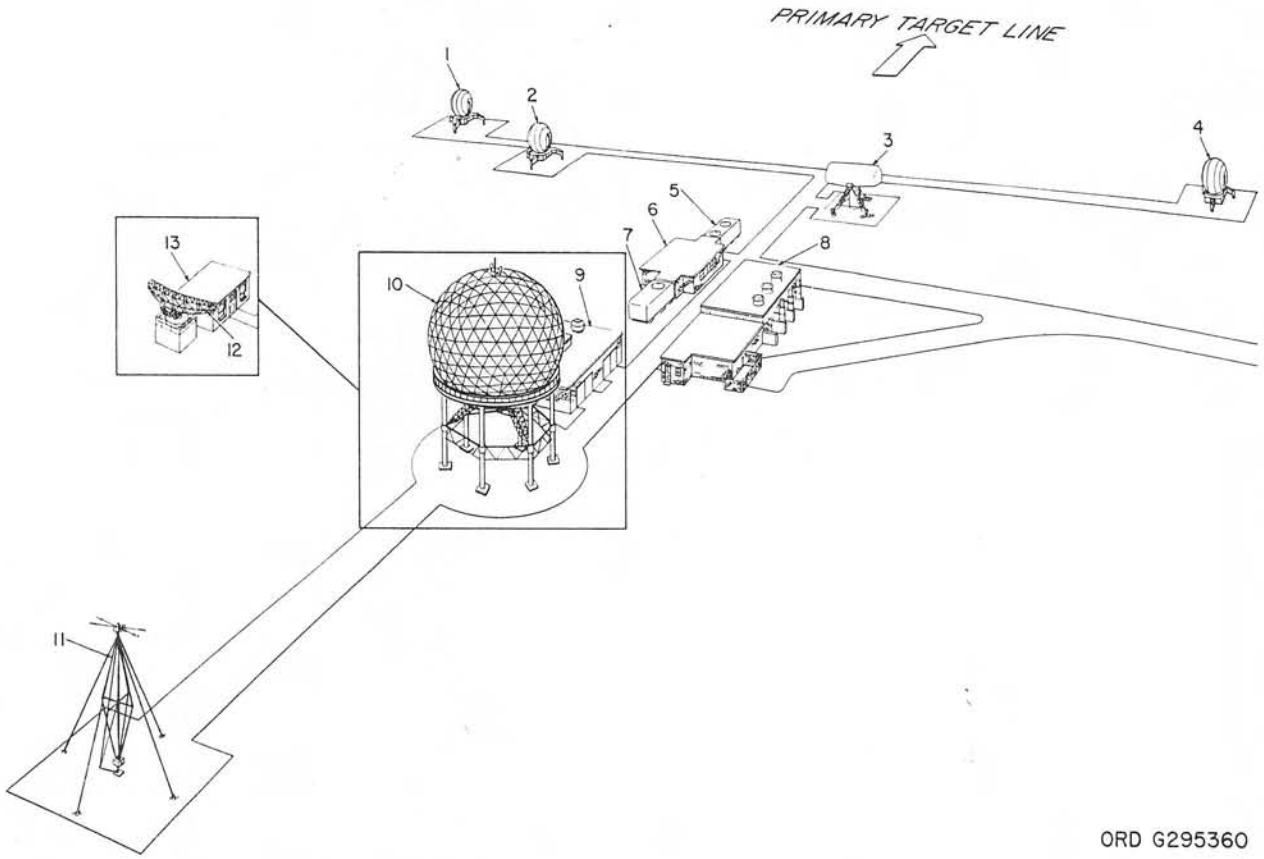
a. Consolidated Site. The consolidated inline configuration is preferred for new Improved NIKE–HERCULES and NIKE–HERCULES ATBM sites. A typical consolidated inline layout of the battery control area is shown in figure 8. The HIPAR antenna radome-support-tripod (13) or the AAR antenna (14), HIPAR building (11) or AAR shelter (15), target track antenna-receiver-transmitter group (8), target range antenna-receiver-transmitter group (7), and missile track antenna-receiver-transmitter group (6) are centered along a straight line parallel with the primary target line. The LOPAR antenna-receiver-transmitter group (5) is located to either side of the centerline, a minimum of 100 feet from the nearest track or range antenna-receiver-transmitter group (6, 7, or 8), and a minimum of 50 feet from both the trailer mounted director station (9) and the trailer mounted tracking station (10). The radar test set group (4) is located between 600 and 680 feet to either side of the centerline and within 80 feet of a line perpendicular to the centerline and midway between the target track antenna-receiver-transmitter group (8) and the missile track antenna-receiver-transmitter group (6). Unrestricted line-of-sight is maintained between the radar test set group (4) and the track and range antenna-receiver-transmitter groups (6, 7, and 8). The trailer mounted director station (9) and the trailer mounted tracking station (10) are joined to the HIPAR building (11). The power building (12) is located near the HIPAR building.

b. Nonconsolidated Site. The nonconsolidated inline configuration is employed at sites converted from NIKE–HERCULES to Improved NIKE–HERCULES or NIKE–HERCULES ATBM where relocation of equipment to an inline configuration is practical. This configuration makes use of existing NIKE–HERCULES buildings. The arrangement of the radar equipment (4, 5, 6, 7, 8, and 13, fig. 8) is the same as in the consolidated inline configuration. However, the arrangement of the trailer mounted tracking station and trailer mounted director station and the configuration of the HIPAR building are as shown in figure 10, which illustrates a nonconsolidated "T" layout. In a nonconsolidated site (either "T" or inline) the trailer mounted tracking station (5, fig. 10) and the trailer mounted director station (7, fig. 10) are attached to the existing electronic shop building (6, fig. 10) instead of to the HIPAR building (9, fig. 10).

20.1 (U). "T" Configuration (Fixed Site)

Note. The key numbers shown in parentheses in this paragraph refer to figure 10.

The "T" configuration (fig. 10) is nonconsolidated and is employed at sites converted from NIKE–HERCULES to Improved NIKE–HERCULES or NIKE–HERCULES ATBM where conversion to an inline configuration is not practical. The HIPAR antenna radome-support-tripod (10) or the AAR antenna (12), the HIPAR building (9) or AAR shelter (13), and the electronic shop building (6) are arranged on a line parallel to the primary target line. The radar test set group (11) is emplaced behind the HIPAR antenna radome-support-tripod (10), no more than 80 feet to either side, and with unrestricted line-of-sight to the target track, target range, and missile track antenna-receiver-transmitter groups (1, 2, and 4). The trailer mounted tracking station (5) and the trailer mounted director station (7), are attached to the electronic shop building (6). The power building (8) is located near the electronic shop building. The LOPAR antenna-receiver-transmitter group (3) is located at a minimum of 100 feet from the nearest track or range antenna-receiver-transmitter group (1, 2, or 4) and a minimum of 50 feet from both the trailer mounted director station (7) and the trailer mounted tracking station (5).



1—Target track antenna-receiver-transmitter group
2—Target range antenna-receiver-transmitter group
3—LOPAR antenna-receiver-transmitter group
4—Missile track antenna-receiver-transmitter group
5—Trailer mounted tracking station
6—Electronic shop building
7—Trailer mounted director station
8—Power building
9—HIPAR building
10—HIPAR antenna radome-support-tripod
11—Radar test set group
12—AAR antenna
13—AAR shelter

Figure 10 (U). Battery control area—typical nonconsolidated "T" layout (U).

20.2 (U). Mobile Installation

a. Either the inline or "T" configuration may be used for a mobile installation. The "T" configuration provides minimum equipment masking for emplacement on flat terrain. The inline configuration can be used to advantage only if the system is emplaced on sloping terrain. Figure 10.1 illustrates typical equipment locations for inline and "T" configurations of the Mobile NIKE-HERCULES ATBM System with the mobile AJI HIPAR system.

b. For both the inline and the "T" configuration, the AJI HIPAR system equipment vans are grouped around a line parallel with the primary target line. The tracking and director stations are located adjacent to each other at one end of the AJI HIPAR system power plant van. The electronic shop is located at the opposite end of the power plant van.

c. For the inline configuration, the target track antenna-receiver-transmitter group, target range antenna-receiver-transmitter group, and missile track antenna-receiver-transmitter group are centered along a straight line that is parallel with the primary target line and that extends through the center of the mobile AJI HIPAR system equipment grouping. The LOPAR antenna-receiver-transmitter group is located to one side of the center line, a minimum of 100 feet from the target range and

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missile track antenna-receiver-transmitter groups. The radar test set group is located 600 feet to one side of the center line that extends through the target range and missile track antenna-receiver-transmitter groups.

d. For the "T" configuration, the mobile AJI HIPAR system equipment vans, the tracking and director stations, and the electronic shop are located as described in *b* above. The target range, target track, and missile track antenna-receiver-transmitter groups are located on a line perpendicular to the primary target line. The LOPAR antenna-receiver-transmitter group is located a minimum of 50 feet from the tracking station and 100 feet from the missile track antenna-receiver-transmitter group. The radar test set group is emplaced behind the mobile antenna, 600 feet from the line on which the target track, target range, and missile track antenna-receiver-transmitter groups are located.

Section III (C). EQUIPMENT DESCRIPTION

21 (U). AJI HIPAR Building and Equipment (Systems 502 Through 537)

a. General. The HIPAR building (fig. 11) contains all the equipment for the AJI HIPAR system, except the HIPAR antenna and the antenna radome-support-tripod. The equipment is described in *b* through *p* below. In addition, storage space is provided in the HIPAR building for organizational repair parts, tools, and test equipment for the AJI HIPAR system. A work space is also provided for repair of equipment. In a consolidated site, the fire unit integration facility (FUIF) equipment is installed in the FUIF room (2, fig. 11) at one end of the HIPAR building. The layout of the HIPAR building in a nonconsolidated site is approximately the same as that of the consolidated site HIPAR building shown in figure 11, except that the FUIF room is omitted and the trailer mounted director station (3) and the trailer mounted tracking station (1) are not attached. In a nonconsolidated site, the FUIF equipment is installed in the electronic shop building (6, fig. 10), and the trailer mounted tracking station (5) and the trailer mounted director station (7) are joined to the electronic shop building instead of to the HIPAR building.

b. Antenna Coupler Group. The antenna coupler group consists of a system of waveguides and associated microwave components connecting the klystron amplifier (9, fig. 11) and the receiver group (16) with the HIPAR antenna (3, fig. 12). The components are the duplexer assembly (13, fig. 11), waveguide switch (12), dummy load (11), noise coupler and generator (14), and the airline support assembly (15).

c. Liquid Cooler. The liquid cooler (17) is used to remove and transfer to the atmosphere heat generated in the klystron amplifier (9) and the dummy load (11).

c.1. Pumping Unit. The pumping unit (8) circulates the glycol solution through the klystron amplifier (9) and the liquid cooler (17).

d. Control-Oscillator Group. The control-oscillator group (18) is used to provide system synchronization pulses and RF signals. During normal operation, the synchronizing pulses are distributed throughout the HIPAR system and the other radar systems of the radar course directing central as the basic timing pulses. The RF signals are used as the final RF drive for the klystron amplifier (9) and local oscillator signal for the receiver group (16). Pushbutton selection of any one of ten preset operating frequencies may be controlled from either the trailer mounted director station (3) or transmitter control-indicator (19).

e. Transmitter Control-Indicator. The transmitter control-indicator (19) is used to monitor and control the transmitter system.

f. Waveguide Pressurizer. The waveguide pressurizer (20) is used to provide a continuously controlled supply of pressurized dry air to the antenna coupler group (*b* above).

g. Induction Voltage Regulator. The induction voltage regulator (21) is used to control the level of 3-phase, primary voltage applied to the high voltage power supply (4).

h. Power Distribution Unit. The power distribution unit (22) is used to regulate and supply power to other units in the HIPAR building. It also contains a +28-volt dc power sup-

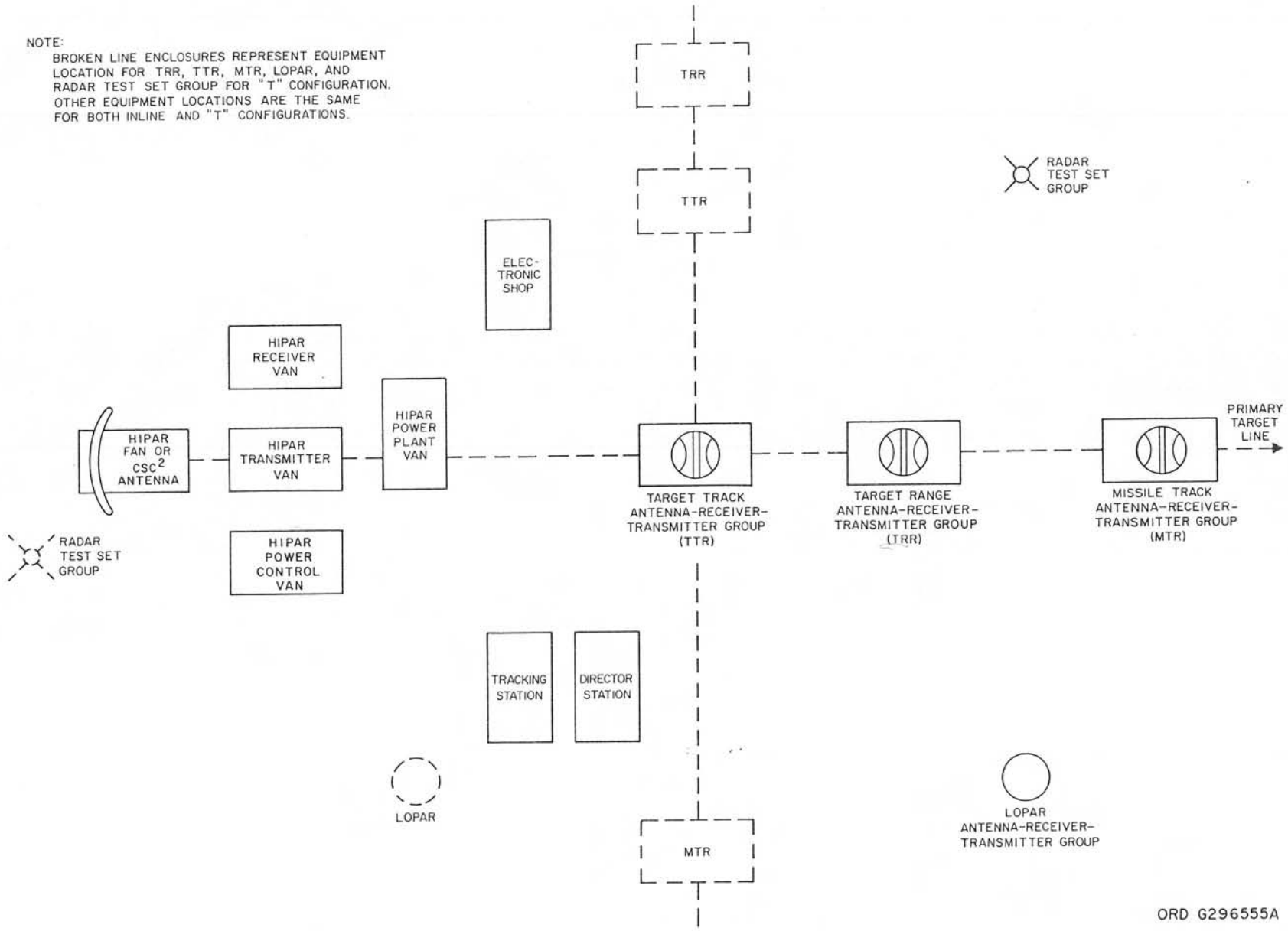


Figure 10.1 (C). Mobile installation—inline and "T" configurations (U).

ply for the low voltage control circuits of the AJI HIPAR system.

i. High Voltage Power Supply. The high voltage power supply (4) is used to supply high voltage dc to the high voltage pulse generator (5).

j. Air Conditioning Room. The air conditioning room (6) contains the heating and cooling equipment required to maintain a comfortable air temperature in the HIPAR building. In a consolidated site, the air conditioning equipment also controls the atmosphere in the trailer mounted director station (3) and trailer mounted tracking station (1) which adjoin the HIPAR building.

k. High Voltage Pulse Generator. The high voltage pulse generator (5) is used to develop the high voltage dc (modulating) drive pulse for the klystron amplifier (9).

l. Klystron Amplifier. The klystron amplifier (9) is used to develop final RF energy that is supplied by the RF harmonic filter (7) and the antenna coupler group (*b* above) to the HIPAR antenna (3, fig. 12).

m. Receiver Group. The receiver group (16, fig. 11), in conjunction with the moving target indicator group (10), is used to process target-return RF energy from the HIPAR antenna (3, fig. 12), and RF energy from the omni (1) and two auxiliary antennas (7). The four signals noted above are processed to obtain and supply video information to the HIPAR monitor PPI in the receiver group and the battery control console PPI's located in the trailer mounted director station (3, fig. 11).

n. (Deleted)

o. Moving Target Indicator Group. The moving target indicator group (10) is used to differentiate between fixed and moving targets detected by the receiver group (16).

p. Simulator Distribution Box. The simulator distribution box (23) is used for connecting the T1 trainer to the EFS HIPAR system.

21.1 (U). AJI HIPAR Building and Equipment (Systems 538 and Above)

Note. Information pertaining to AJI HIPAR systems 538 and above (except mobile systems) is contained in *a* through *o* below. Refer to paragraph 21 for information pertaining to AJI HIPAR systems 502 through 537.

a. General. The HIPAR building contains all the equipment for the AJI HIPAR system except the radar antenna support set and radome (fig. 12), the HIPAR antenna (3, fig. 12), and the liquid cooler (15, fig. 11.1.1). The building equipment is described in *b* through *o* below. Storage space for organizational repair parts, tools, and test equipment, as well as a work area for equipment repair, is provided in the building. At a consolidated site, the FUIF equipment is installed in the FUIF room (1) at one end of the HIPAR building. The trailer mounted director station (9, fig. 8) and the trailer mounted tracking station (10) are emplaced on each side of the FUIF room and connected to the HIPAR building. At a nonconsolidated site, the FUIF equipment is installed in the electronic shop building (6, fig. 10.) The trailer mounted director station (7) and the trailer mounted tracking station (5) are joined to the electronic shop building (6).

b. High Voltage Power Supply. The high voltage power supply (2, fig. 11.1.1) is used to supply high voltage dc to the high voltage pulse generator (3).

1—Trailer mounted tracking station
2—FUIF room
3—Trailer mounted director station
4—High voltage power supply
5—High voltage pulse generator
6—Air conditioning room
7—RF harmonic filter
8—Pumping unit
9—Klystron amplifier
10—Moving target indicator group
11—Dummy load
12—Waveguide switch
13—Duplexer assembly
14—Noise coupler and generator
15—Airline support assembly
16—Receiver group
17—Liquid cooler
18—Control-oscillator group
19—Transmitter control-indicator
20—Waveguide pressurizer
21—Induction voltage regulator
22—Power distribution unit
23—Simulator distribution box

Figure 11 (U). HIPAR building and equipment (AJI HIPAR systems 502 through 537)—consolidated—typical cutaway view—legend (U).

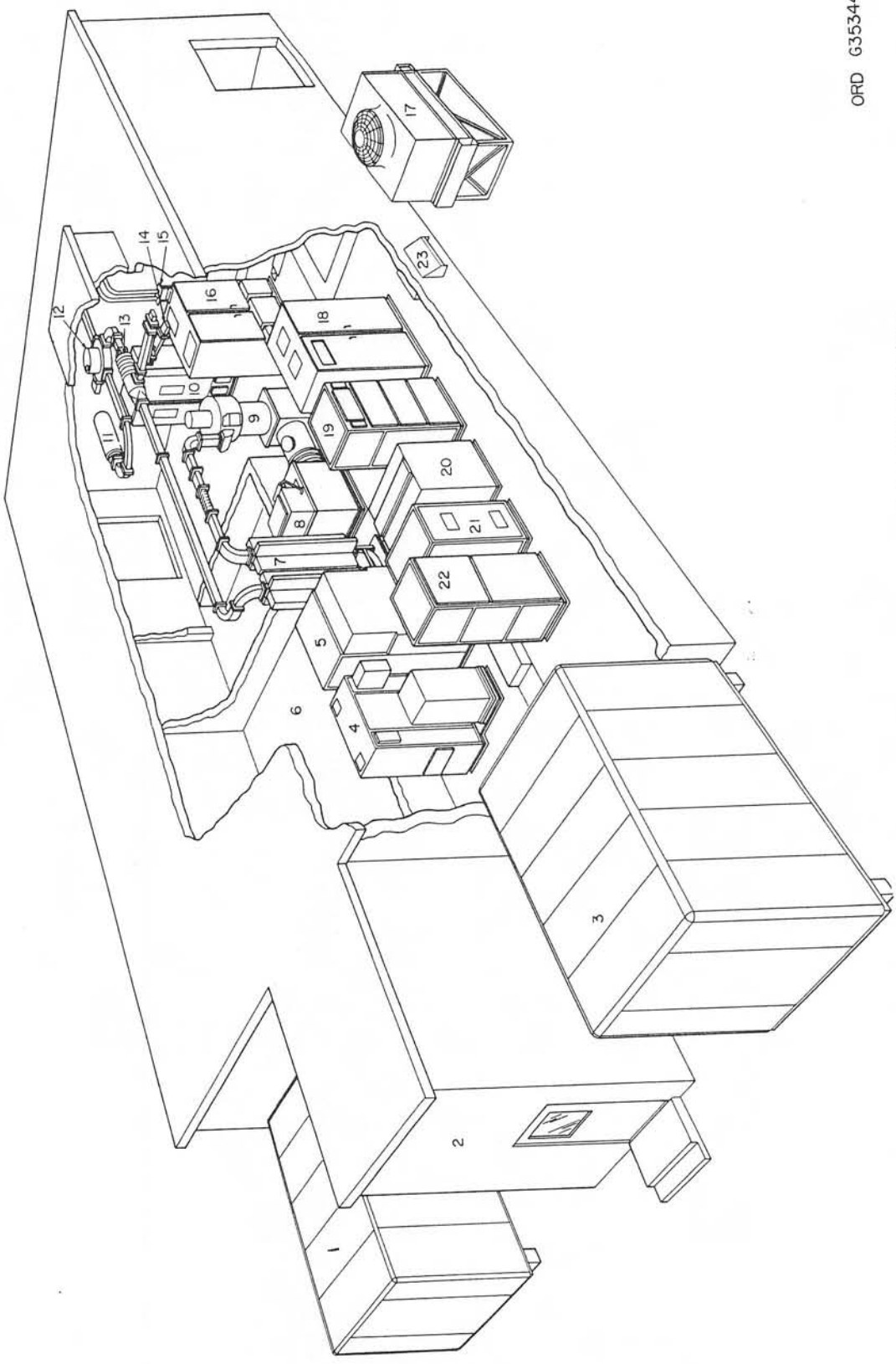


Figure 11 (U). HIPAR building and equipment (AJI HIPAR systems 502 through 537)—consolidated—typical cutaway view (U).

Figure 11.1 (Deleted)

c. High Voltage Pulse Generator. The high voltage pulse generator (3) is used to develop the high voltage dc (modulating) drive pulse for the klystron amplifier (7).

d. RF Harmonic Filter. The RF harmonic filter (4) is used to filter undesirable harmonic frequencies from the final RF energy.

e. Antenna Coupler. The antenna coupler consists of a system of waveguides and associated microwave components connecting the klystron amplifier (7) and the receiver group (13) with the HIPAR antenna (3, fig. 12). The components of the antenna coupler are the waveguide sections (6, fig. 11.1.1), dummy load (8), noise couplers and thermal noise generators (12), duplexer assembly (11), waveguide switch (10), and the airline support assembly (11.1).

f. Klystron Amplifier. The klystron amplifier (7) is used to develop the final RF energy that is supplied by the RF harmonic filter (4) and the antenna coupler (*e* above) to the HIPAR antenna (3, fig. 12). Input to the klystron amplifier is impedance matched by the pulse transformer (5, fig. 11.1.1).

g. Moving Target Indicator Group. The moving target indicator group (9) is used to differentiate between fixed and moving targets detected by the receiver group (13).

h. Receiver Group. The receiver group (13) in conjunction with the moving target indicator group (9), is used to process target-return RF energy from the HIPAR antenna (3, fig. 12), and RF energy from the omni (1) and two auxiliary antennas (7). The four signals noted above are processed to obtain and supply video information to the HIPAR monitor PPI in the receiver group and the battery control console PPI's located in the trailer mounted director station (9, fig. 8).

i. (Deleted)

i.1. Pumping Unit. The pumping unit (14, fig. 11.1.1) circulates the glycol solution through the klystron amplifier (7), dummy load (8), and the liquid cooler (15).

j. (Deleted)

j.1. Liquid Cooler. The liquid cooler (15), located outside the HIPAR building, is used to transfer heat from the glycol solution to the atmosphere.

k. Control-Oscillator Group. The control-oscillator group (16) is used to provide system synchronization pulses and RF signals. During normal operation, the synchronizing pulses are distributed throughout the HIPAR system and the other radar systems of the radar course directing central as the basic timing pulses. The RF signals are used as the final RF drive for the klystron amplifier (7) and the local oscillator signal for the receiver group (13). Push-button selection of any one of the ten preset operating frequencies of the control-oscillator group may be controlled from either the trailer mounted director station (9, fig. 8) or the power control-indicator (17, fig. 11.1.1).

l. Power Control-Indicator. The power control-indicator (17) is used to control and to monitor the distribution of primary power for the AJI HIPAR system. Transmitter controls, monitoring facilities, and test equipment are included in the power control-indicator that also contains the waveguide pressurizer and dehydrator unit. The waveguide pressurizer and dehydrator unit are used to provide a continuously controlled supply of dry air, under pressure, to the antenna coupler (*e* above) and the RF harmonic filter (4).

m. Induction Voltage Regulator. The induction voltage regulator (18) is used to control

1—FUIF room
2—High voltage power supply
3—High voltage pulse generator
4—RF harmonic filter
5—Pulse transformer
6—Waveguide sections
7—Klystron amplifier
8—Dummy load
9—Moving target indicator group
10—Waveguide switch
11—Duplexer assembly
11.1—Airline support assembly
12—Noise coupler and thermal noise generator
13—Receiver group
14—Pumping unit
15—Liquid cooler
16—Control-oscillator group
17—Power control-indicator
18—Induction voltage regulator
19—Step-up power transformer
20—Simulator distribution box

Figure 11.1.1 (U). HIPAR building and equipment (AJI HIPAR systems 538 through 594)—cutaway view—legend (U).

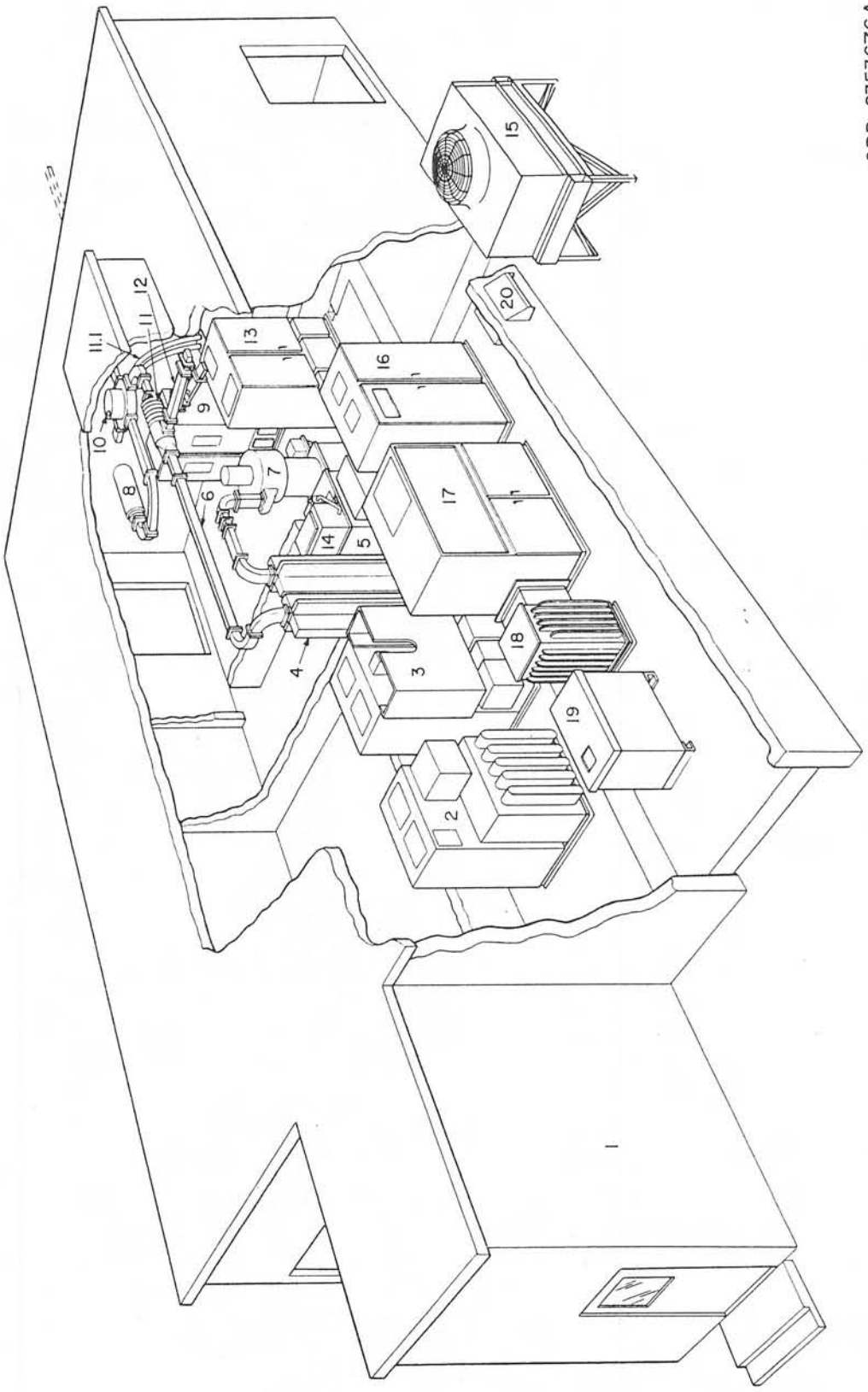


Figure 11.1.1 (U). HIPAR building and equipment (AJI HIPAR systems 588 through 594)—cutaway view (U).

the voltage level of the stepped-up primary voltage applied to the high voltage power supply (2). Operation of the induction voltage regulator (18) is controlled from the power control-indicator (17).

n. Step-up Power Transformer. The step-up power transformer (19) is used to provide stepped-up primary voltage to the induction voltage regulator (18).

o. Simulator Distribution Box. The simulator distribution box (20) is used for connecting the T1 trainer to the EFS/ATBM HIPAR system.

21.2 (U). AJI HIPAR Equipment (Systems 801 and Above)

a. General. The AJI HIPAR system (801 and above) is mounted on five semitrailers which are described in *b* through *f* below. Storage space for organizational repair parts, tools, and test equipment is provided in the vans mounted on semitrailers XM674. Space is provided in the transmitter van for SIF/IFF equipment. The trailer mounted director station and the trailer mounted tracking station are connected electrically to radar power control set AN/MJQ-7.

b. Mobile Antenna AS-1774/MPQ-43. The mobile antenna consists of the mobile FAN antenna or mobile cosecant squared (CSC^2) antenna, plus leveling and support equipment. The two antennas are discussed in paragraph 22.1.1. The leveling and support equipment maintains the mobile antenna level and rigid provided the terrain slope is not greater than 10 percent.

c. Radar Power Control Set AN/MJQ-7. The radar power control set consists of the power control van mounted on semitrailer XM674. The power control van contains the power control-indicator (para 21.1*l*), high voltage power supply (para 21.1*b*), induction voltage regulator (para 21.1*m*), and step-up power transformer (para 21.1*n*). In addition, the power control van is the distribution center for power to the AJI HIPAR system and signals to the trailer mounted director station and trailer mounted tracking station.

d. Radar Receiving Set AN/MPR-1. The radar receiving set consists of the receiver van mounted on semitrailer XM674. The receiver van contains the moving target indicator group (para 21.1*g*), control-oscillator group (para 21.1*k*), and the receiver group (para 21.1*h*).

e. Radar Transmitting Set AN/MPT-2. The radar transmitting set consists of the transmitter van mounted on semitrailer XM674. The transmitter van contains the internal antenna coupler, klystron amplifier (para 21.1*f*), and high voltage pulse generator (para 21.1*c*). The internal antenna coupler consists of a system of waveguides and associated microwave components connecting the klystron amplifier and the receiver group with the HIPAR antenna. The components of the internal antenna coupler are the waveguide sections, dummy load, noise couplers and thermal noise generators, duplexer assembly, waveguide switch, and RF harmonic filter subassembly (para 21.1*d*).

f. Electric Power Plant. The electric power plant consists of two diesel-engine generators, a motor-generator, a power switchboard, and a 90-kilowatt resistive load bank mounted on semitrailer XM674. The two engine generators provide primary 60-cycle power for the AJI HIPAR system. The motor-generator provides 400-cycle power to the RCDC. The power switchboard contains facilities for selecting a power source (commercial or generator) and commercial power monitoring equipment.

Note. There are two configurations of the HIPAR antenna, called the HIPAR CSC^2 antenna and the HIPAR FAN antenna. These antennas are used interchangeably with systems 538 through 594, and either antenna may be used with systems 502 through 537. However, the HIPAR CSC^2 antenna is normally used with systems 502 through 537. The HIPAR CSC^2 antenna is discussed in paragraph 22, and the differences between this antenna and the HIPAR FAN antenna is noted in paragraph 22.1.

22 (U). HIPAR Antenna Radome-Support-Tripod and HIPAR CSC^2 Antenna

a. HIPAR Antenna Radome-Support-Tripod. The HIPAR antenna radome-support-tripod (2, 4, and 5, fig. 12) supports and houses the HIPAR CSC^2 antenna. Major components of the HIPAR antenna radome-support-tripod are the radome (2) which encloses the HIPAR CSC^2 antenna, and the antenna tripod (5) and radome support (4) which support the HIPAR CSC^2 antenna. The antenna radome-support-tripod may be emplaced either with or without the radome support extension (6), depending upon the individual site requirements.

b. CSC² Omni Antenna. The CSC² omni antenna (1) is used to receive and supply a sample of the target-returned energy through the antenna coupler.

c. HIPAR CSC² Antenna. The HIPAR CSC² antenna (3) is used to transmit RF energy supplied from the antenna coupler. In addition, the HIPAR CSC² antenna receives and supplies target-return RF energy through the antenna coupler to the receiver group (16, fig. 11).

d. Auxiliary Antennas. The two auxiliary antennas (7, fig. 12) are unidirectional, fixed-type receiving antennas used to intercept interfering signals in the side lobes of the HIPAR CSC² antenna. Each antenna is mounted on a mast that is fixed to the back of the HIPAR CSC² antenna.

22.1 (U). HIPAR Antenna Radome-Support-Tripod and HIPAR FAN Antenna

a. HIPAR Antenna Radome-Support-Tripod and Auxiliary Antennas. The radome-support-tripod and the auxiliary antennas are identical in the cosecant squared and fan configurations. Refer to paragraph 22 for the description.

b. FAN Omni Antenna. The reflector of the FAN omni antenna is physically reversed from the reflector of the CSC² omni antenna (1, fig. 12), but the two antennas function in an identical manner. Refer to paragraph 22 for the description.

c. HIPAR FAN Antenna. The HIPAR FAN antenna reflector is reduced in height from the HIPAR CSC² antenna reflector. This reduction in reflector height provides a better high altitude coverage, but the fan antenna is more susceptible to high altitude jamming. With these exceptions, the HIPAR FAN antenna is physically and functionally similar to the HIPAR CSC² antenna. Refer to paragraph 22 for the description.

22.1.1 (U). Mobile Antenna, Leveling and Support Equipment, Omni Antenna, and Auxiliary Antennas

a. Mobile FAN Antenna. The mobile FAN antenna is functionally the same as the HIPAR FAN antenna discussed in paragraph 22.1*c*. It differs physically in that it consists of eight removable reflector sections and a fixed center section that can be folded down for marc orders. The mobile FAN antenna is mounte on semitrailer XM674 and is a self-containe mobile unit.

b. Mobile CSC² Antenna. When a lower altitude, long range antenna coverage pattern i required, the mobile FAN antenna may b converted into the mobile CSC² antenna. This is accomplished through the installation of the mobile CSC² antenna conversion kit which consists of five reflector panels, the mobile CSC² feedhorn, and the mobile CSC² omni antenna.

c. Leveling and Support Equipment. The mobile antenna is equipped with two outrigger and jack screw assemblies to maintain stability and level on terrain up to a ten percent slope. The support equipment consists of four leveling gears mounted on semitrailer XM674 and the mobile antenna pedestal. The mobile antenna pedestal contains the pedestal and reflector raising and lowering mechanisms.

d. Mobile FAN Omni Antenna and Mobile CSC² Omni Antenna. Target returns received by the omni antenna are compared with those received by the main antenna to determine the azimuth position of a jamming source. Physically, the mobile FAN or CSC² omni antenna is mounted on a mast at the top of the main antenna reflector. The mobile FAN or CSC² omni antenna element is covered with a weatherproof Fiberglas radome.

e. Auxiliary Antennas. The two auxiliary antennas are unidirectional, fixed-type receiving antennas used to intercept interfering signals in the side lobes of the mobile antenna (FAN or CSC²). Each antenna is fixed to the back of the mobile antenna (FAN or CSC²).

22.2 (U). Auxiliary Acquisition Radar

The AAR may be installed at selected sites for use with the Improved NIKE-HERCULES System. The AAR equipment is described in *a* and *b* below.

a. Antenna Group. The antenna group consists of the antenna (1, fig. 11.2), the antenna pedestal (6), a power cable (4), and the waveguide section (2) which connect the antenna pedestal to the duplexer in the AAR shelter (3). The antenna and antenna pedestal are mounted on a reinforced concrete base (5).

b. AAR Shelter. The AAR shelter contains all the equipment of the AAR operating group and the associated plan position indicator (PPI).

23 (C). Trailer Mounted Directed Station

The trailer mounted director station (fig. 14) contains the computer equipment, recording equipment, tactical control circuits, and voice communication equipment required for the operation of the tactical control system and the acquisition radar systems. Major units located within the trailer mounted director station are described in *a* through *g* below.

a. Director Station Group. The director station group (10, fig. 14) is located against the curbside wall of the trailer mounted director station. The director station group contains the primary power controls for the trailer lighting, heating, and ventilating equipment, and for the LOPAR system equipment.

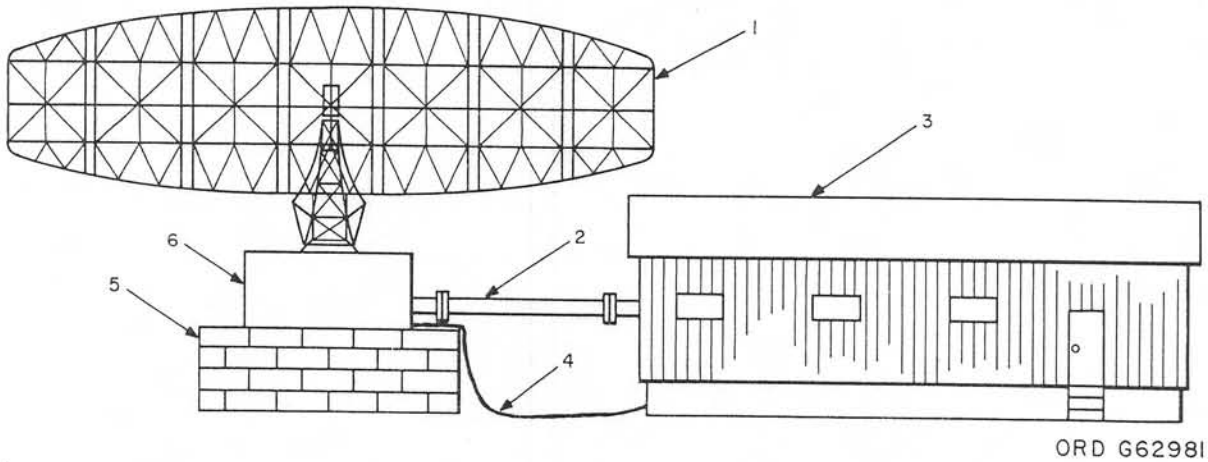
b. Recorder Group. The recorder group (9) is located against the curbside wall of the trailer mounted director station. The recorder group contains recording equipment and voice communication equipment. The recording equipment provides an automatic film record of equipment performance during a test or tactical engagement. The voice communication equipments consists of a switchboard and related equipment which provide two-way communication between all system telephone locations.

c. Battery Control Console. The battery control console (8) is located against the curbside wall of the trailer mounted director station. The battery control console contains controls, presentation indicators, automatic plotting boards, and other equipment associated with the acquisition radar systems (LOPAR and HIPAR/AAR), the computer system, and the tactical control system. Data used by the battery control officer during an engagement is displayed on the horizontal plotting board (1, fig. 15), altitude plotting board (2), PPI (3), and precision indicator (4). The displays on the plotting boards and indicators are described in (1) through (4) below.

(1) *Horizontal plotting board.*

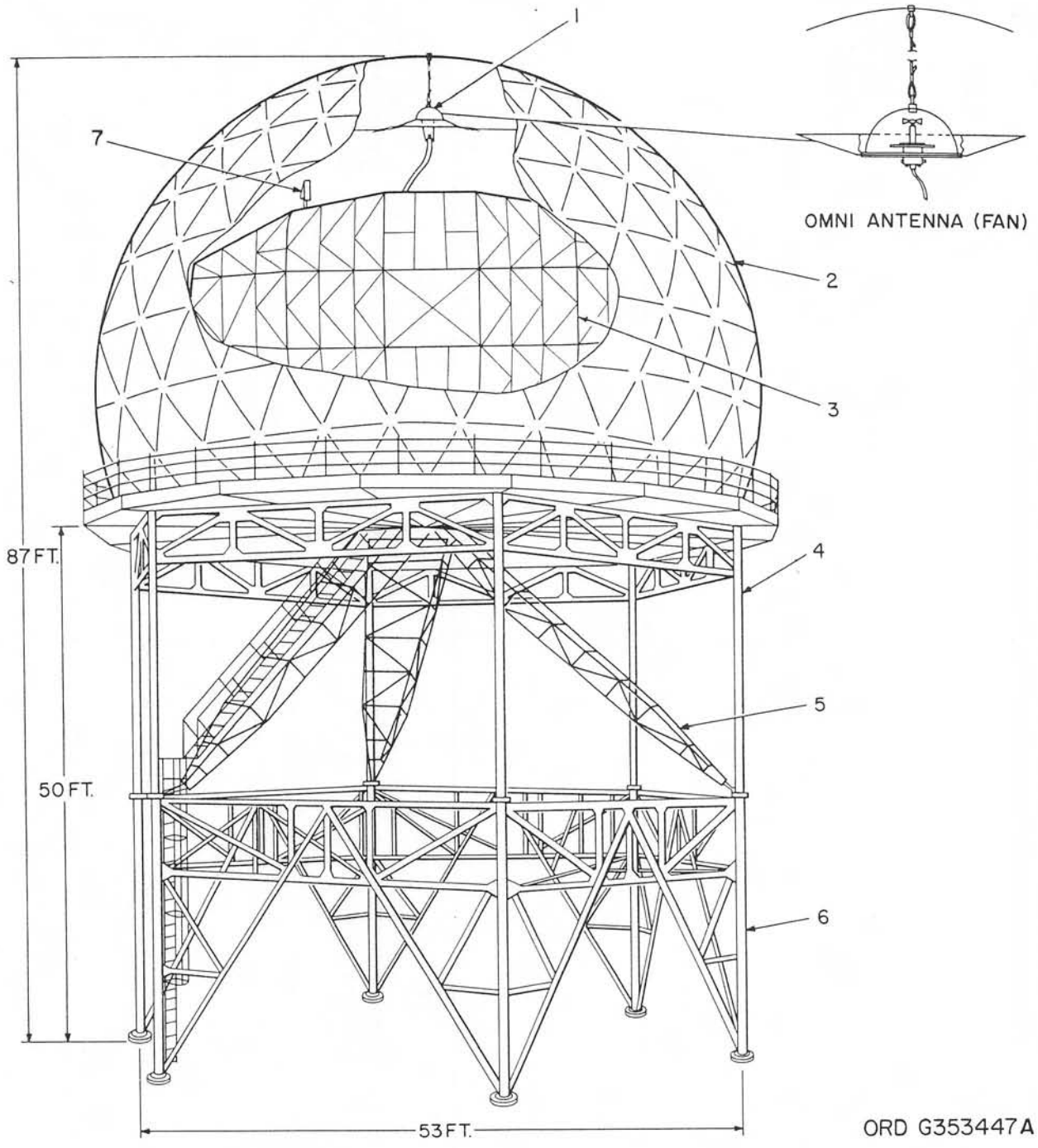
Note. The plotting display of figure 16 is described in (*a*) through (*c*) below.

(*a*) The horizontal plotting board (1, fig. 15) provides means for automatically plotting in range and azimuth a plan view of an entire engagement. A typical engagement plot by the horizontal plotting board is shown in figure 16. The plotting display is inked on paper and contains three plots in the horizontal plane: a plot showing position of



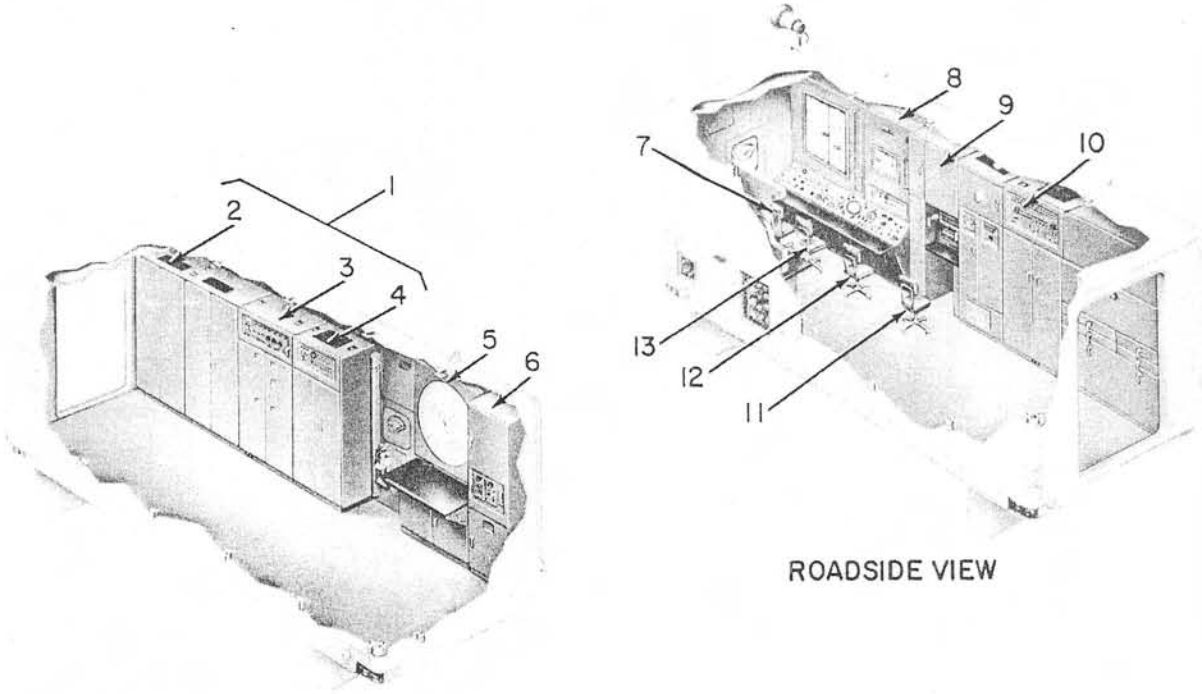
1—Antenna
2—Waveguide section
3—AAR shelter
4—Power cable
5—Concrete base
6—Antenna pedestal

Figure 11.2 (U). Auxiliary acquisition radar (U).



1—Omni antenna (CSC²) or (FAN)
2—Radome
3—HIPAR antenna (CSC²) or (FAN)
4—Radome support
5—Antenna tripod
6—Radome support extension
7—Auxiliary antenna (2)

Figure 12 (U). HIPAR antenna radome-support-tripod for HIPAR antenna (FAN) or (CSC²) (U).



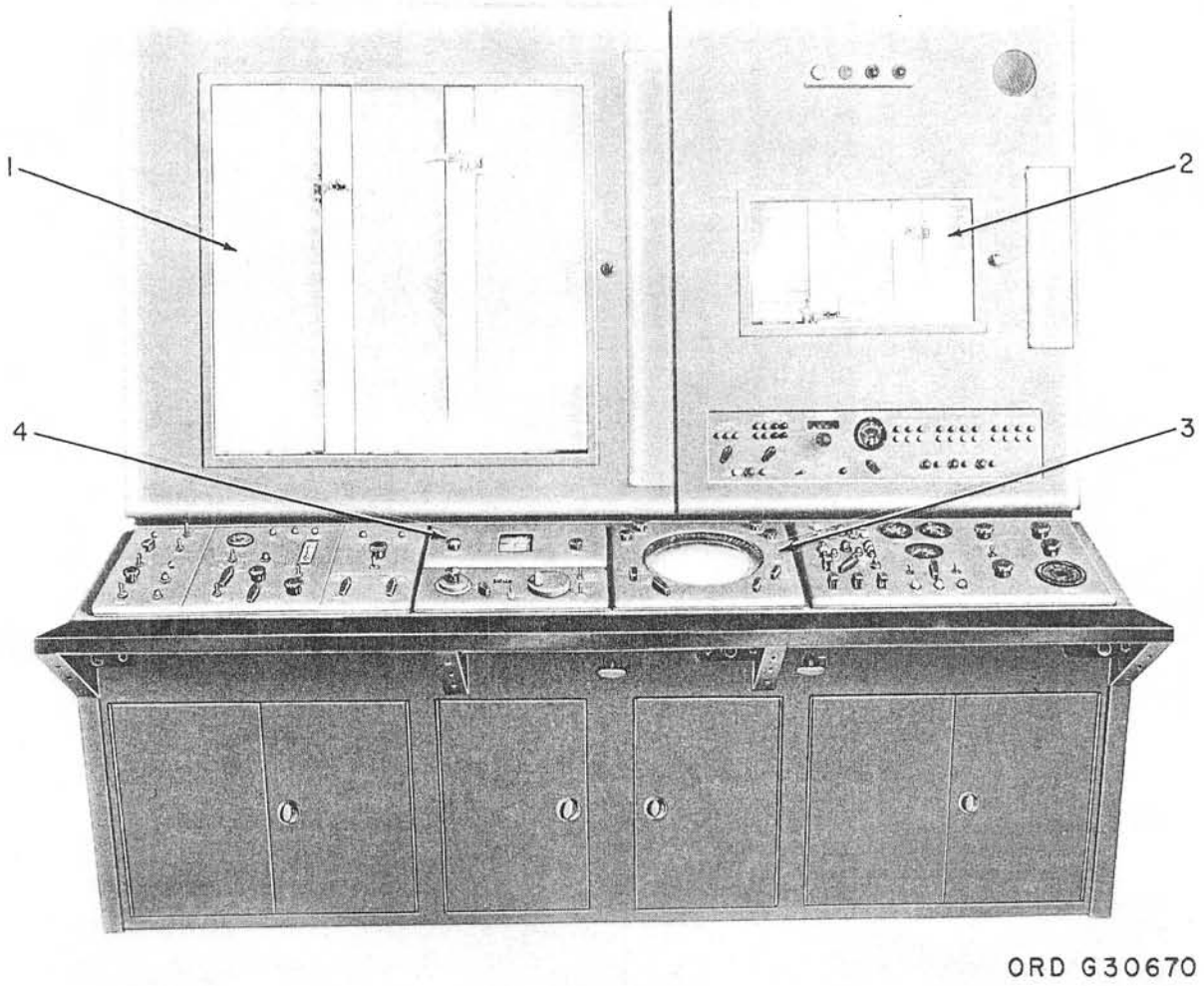
1—Computer group
2—Computer amplifier relay group
3—Servo computer assembly
4—Computer power supply group
5—Early warning plotting board
6—Auxiliary acquisition control interconnecting group
7—Acquisition radar operator's position
8—Battery control console
9—Recorder group
10—Director station group
11—Switchboard operator's position
12—Computer operator's position
13—Battery control officer's position

Figure 14 (U). Trailer mounted director station—cutaway views (U).

the target (point B to point C), a plot showing the predicted intercept point (point A to the fire mark at point E), and a plot showing present position of the missile (point D to point C). The center of the plotting board represents the position of the target track antenna-receiver-transmitter group. Range is represented by concentric circles marking 10,000-yard increments from the center of the plotting board. Azimuth is represented by radial lines that divide the plotting board into 200-mil sectors. Timing marks appear on each plot at about 10-second intervals. TARGET–MISSILE plot indicators at the lower left and right corners of the plotting board indicate which pen is plotting the target position and which pen is plotting the missile position.

(*b*) Before the missile is fired, the horizontal plotting board continuously plots the position of the target (point B to the fire mark at point A) and the position of the predicted intercept point (point A to point E). Location of the predicted point at any instant is based on the assumption of immediate fire.

(*c*) The fire order is transmitted, in this typical engagement plot, when the target is at a range of approximately 135,000 yards and the predicted intercept point is at a range of ap-



1—Horizontal plotting board
2—Altitude plotting board
3—PPI
4—Precision indicator

Figure 15 (C). Battery control console (U).

proximately 95,000 yards. Shortly after the fire order is transmitted, the pen plotting the predicted intercept point returns to approximately the center of the plotting board (point D) and begins to plot the position of the missile in the horizontal plane. The target and missile plots continue until target intercept occurs at the intersection of the two plots (point C).

(2) *Altitude plotting board.*

Note. The plotting display of figure 17 is described in (*a*) through (*c*) below.

(*a*) The altitude plotting board (2, fig. 15) provides means for automatically plotting target and missile altitude data against time to intercept data. A typical engagement plot by the altitude plotting board is shown in figure 17. The plotting display is inked on paper and contains three plots in the vertical plane: a plot of the altitude of the predicted intercept point by the right plotting pen before fire (point C to the fire mark), a plot of the altitude of the target by the right plotting pen after fire (fire mark to point B), and a plot

of the altitude of the missile by the left plotting pen after fire (point E to point A). Both plotting pens also simultaneously plot the time to intercept along the horizontal axis. The time scale for both plotting pens starts at zero and extends for about 200 seconds. The height scale extends from —5000 feet to 100,000 feet. Timing marks appear on each plot at about 10-second intervals. A fire mark (fig. 17) is made on the target altitude plotting board when the missile is fired.

(*b*) When the target enters the defense area (point C), in this typical engagement plot, the altitude of the predicted intercept point is about 53,000 feet. The plot of the predicted intercept point continues until the time to intercept decreases to about 125 seconds. At this time, the fire order is transmitted as indicated by the fire mark on the plot. Shortly afterwards, the right plotting pen begins to plot present target altitude against time to intercept. As the time to intercept decreases, the two plots move closer together. At zero time to intercept, or at burst time, the missile and target altitudes are coincident (points A and B).

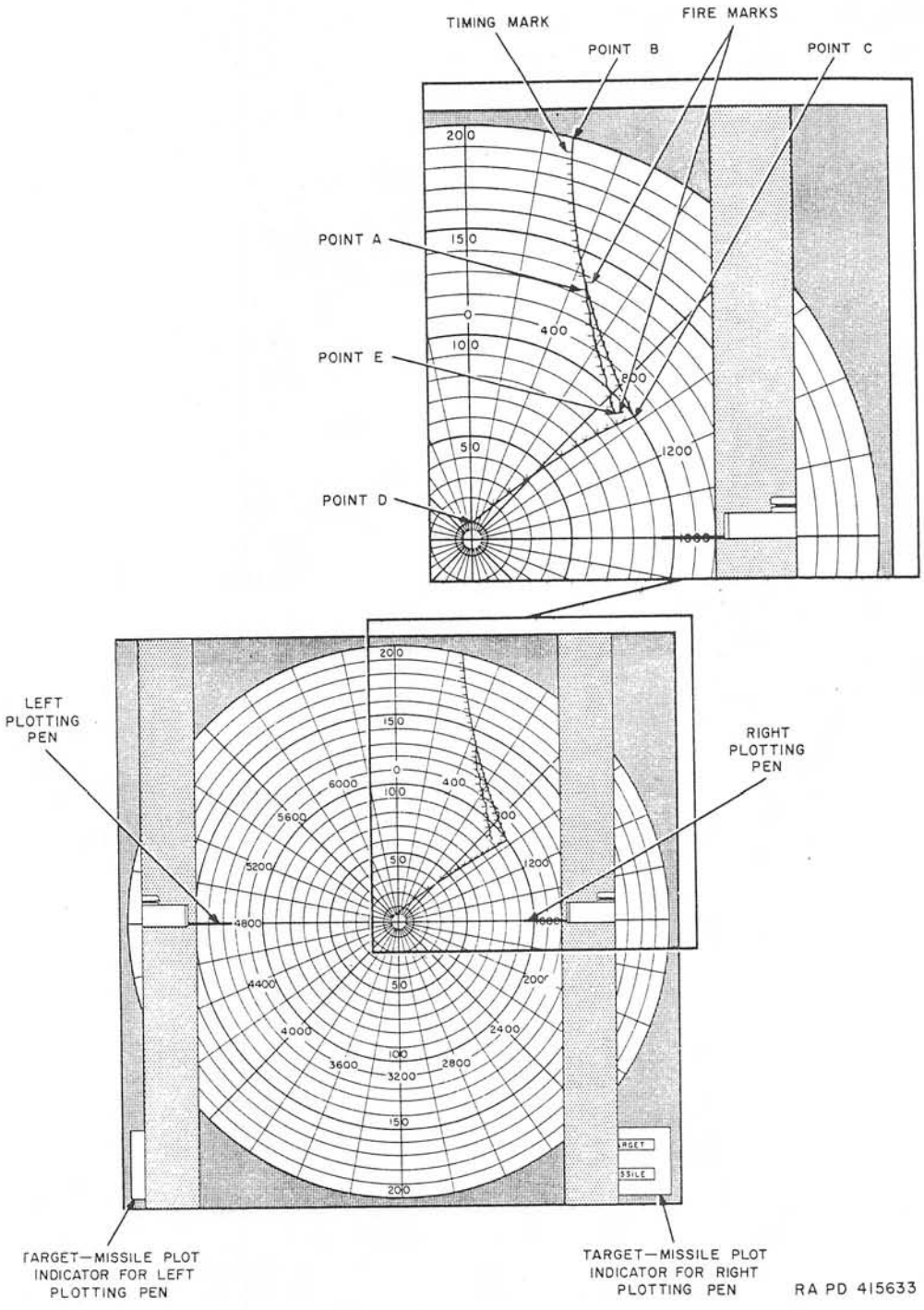


Figure 16 (CMHA). Horizontal plotting board — typical engagement plot.

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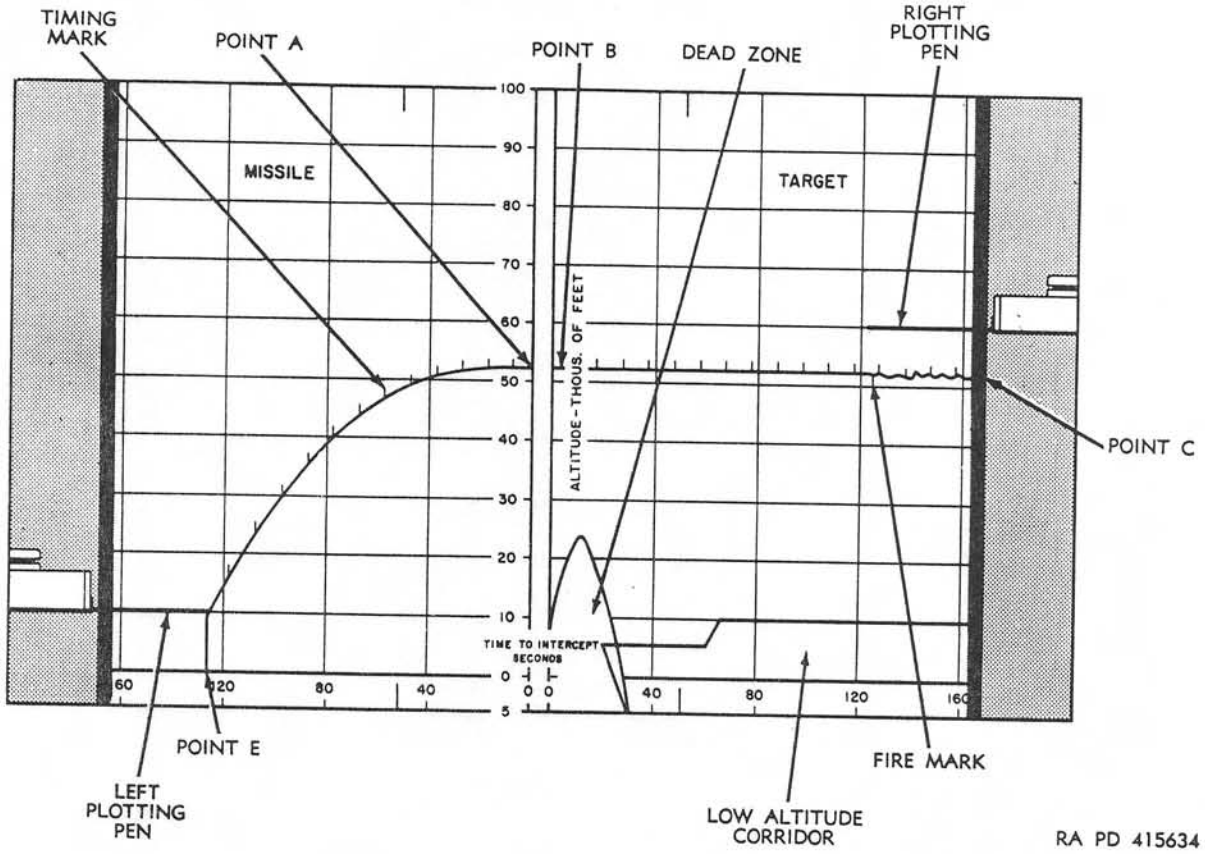
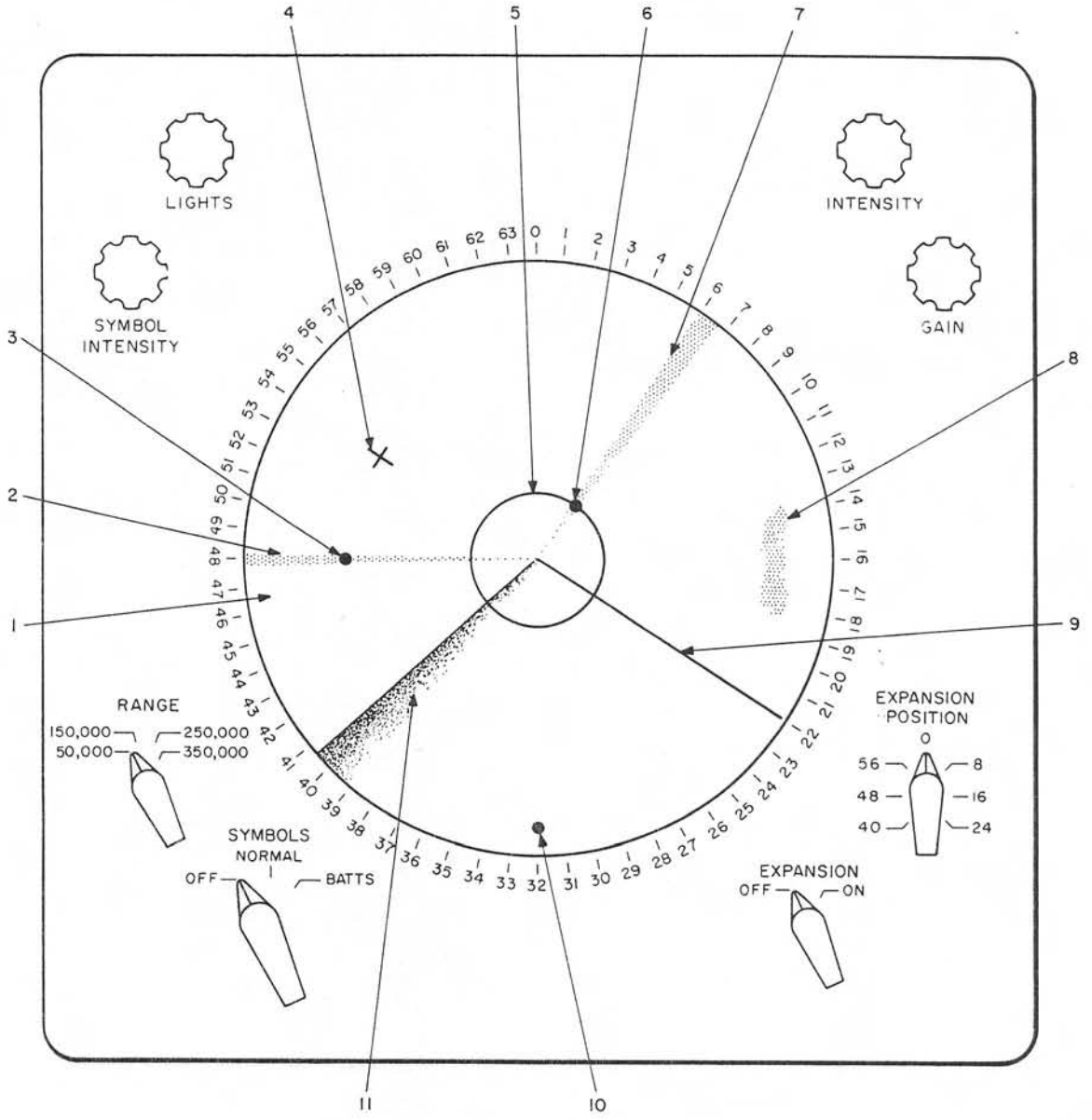


Figure 17 (CMHA). Altitude plotting board — typical engagement plot.



ORD G258222

1—Cathode-ray tube
2—Jam strobe No. 1
3—Jamming target No. 1 video
4—Electronic cross
5—Acquisition range circle
6—Jamming target No. 2 video
7—Jam strobe No. 2
8—Ground clutter video
9—Acquisition (flashing) azimuth line
10—Non-jamming target video
11—Rotating radial sweep

Figure 18 (C). PPI—basic presentation (U).

(*c*) The dead zone is an area in which an intercept cannot be made in the normal surface-to-air mission.

(3) *PPI.* The plan position indicator (PPI) (3, fig. 15) provides a visual means of detecting, observing, identifying, and designating return signals from moving objects and targets within range of the acquisition radar systems. Symbols appearing on the PPI display used by the operator to effect a successful mission are described in (*a*) and (*b*) below.

Note. The key numbers shown in parentheses in (*a*) below refer to figure 18.

(*a*) The basic presentation of the PPI is shown in figure 18 and described in *1* through *6* below. This presentation consists of the rotating radial sweep (11), acquisition range circle (5), electronic cross (4), acquisition (flashing) azimuth line (9), target return video signals (3, 6, 8, and 10), and jam strobes (2 and 7).

1. The rotating radial sweep (11) extends from the center to the outer edge of the face of the PPI. The radial sweep rotates clockwise around the face of the PPI in synchronism with the rotation of the selected acquisition radar antenna (HIPAR/AAR or LOPAR). The complete display is presented on the PPI once for each 360-degree rotation of the radial sweep.

2. The electronic cross (4) is illuminated on the face of the PPI once during each rotation of the rotating radial sweep (11). The two lines forming the electronic cross represent the azimuth and range settings of the target tracking radar system. When the electronic cross is centered on the designated target, the electronic cross provides an indication that the target is being accurately tracked in azimuth and in range by the target tracking radar system. The operator may switch the cross in or out of the display as required. The cross is normally used for test and maintenance alinement. During tactical operation, the cross obscures the target video and is, therefore, only switched on momentarily, as required to verify target tracking.

3. The acquisition range circle (5) is traced on the face of the PPI by an acquisition range dot that rotates with the rotating radial sweep (11). The radius of the circle is adjustable through a distance representing 0 to 250,000 yards in range for the LOPAR system and 0 to 350,000 yards for the HIPAR/AAR system. When the acquisition range circle is adjusted to coincide with the target return signals, it represents the range coordinate of the target.

4. The acquisition (flashing) azimuth line (9) appears on the face of the PPI as a brightened stationary radial line once during each rotation of the rotating radial sweep (11). The acquisition (flashing) azimuth line may be steered by rotating an azimuth knob.

5. Target return video signals (3, 6, 8, and 10) are displayed on the face of the PPI when the transmitted radio frequency (RF) pulses are reflected from moving objects or targets within the range of the selected acquisition radar system (HIPAR/AAR or LOPAR). The return signals are displayed as bright dots or irregular areas with each rotation of the rotating radial sweep (11). When a return signal is identified as hostile, the acquisition range circle (5) and the acquisition (flashing) azimuth line (9) are positioned to coincide with the target return signal, automatically providing azimuth and range infor-

mation to the target tracking radar system. Information that the target has been designated is sent to the trailer mounted tracking station, enabling the operator in the tracking station to slew the target track antenna to the target.

6. The jam strobes (2 and 7) appear at the exact azimuth of each jamming target video (3 and 6). The long persistence phosphor of the scope permits numerous jam strobes to be observed simultaneously. If the target is obscured, by the strobe line, only azimuth information is transmitted to the target tracking radar system during the target designate phase of operation. During HIPAR/AAR operation, the length of the strobes may be adjusted.

(*b*) The symbols of either the fire unit integration facility (FUIF) or the battery terminal equipment (BTE) are supplied by the Army Air Defense Command Post (AADCP). The AADCP symbols along with the selective identification facility/identification friend or foe (SIF/IFF) symbols are displayed on the PPI. Detailed information on tactical symbols is contained in chapter 7.

(4) *Precision indicator.* The precision indicator (4, fig. 15) displays an expanded sector of the PPI display covering 533 mils in azimuth (width) and 25,000 yards in range (height). The expanded portion is centered at the intersection of the horizontal and vertical cross hairs etched in the face of the precision indicator. These cross hairs represent the intersection of the acquisition range circle (5, fig. 18) and the acquisition (flashing) azimuth line (9, fig. 18) on the basic PPI presentation. The expanded display provides better target resolution and permits more accurate determination of the range and azimuth of the designated target. The basic presentation of the precision indicator is shown in figure 19 and described in (*a*) through (*e*) below.

Note. The key numbers shown in parentheses in (*a*) through (*e*) below refer to figure 19 unless otherwise indicated.

(*a*) The acquisition range line (1) is represented by a black horizontal line etched in the face of the precision indicator. This line represents an expanded portion of the acquisition range circle (5, fig. 18) displayed on the PPI.

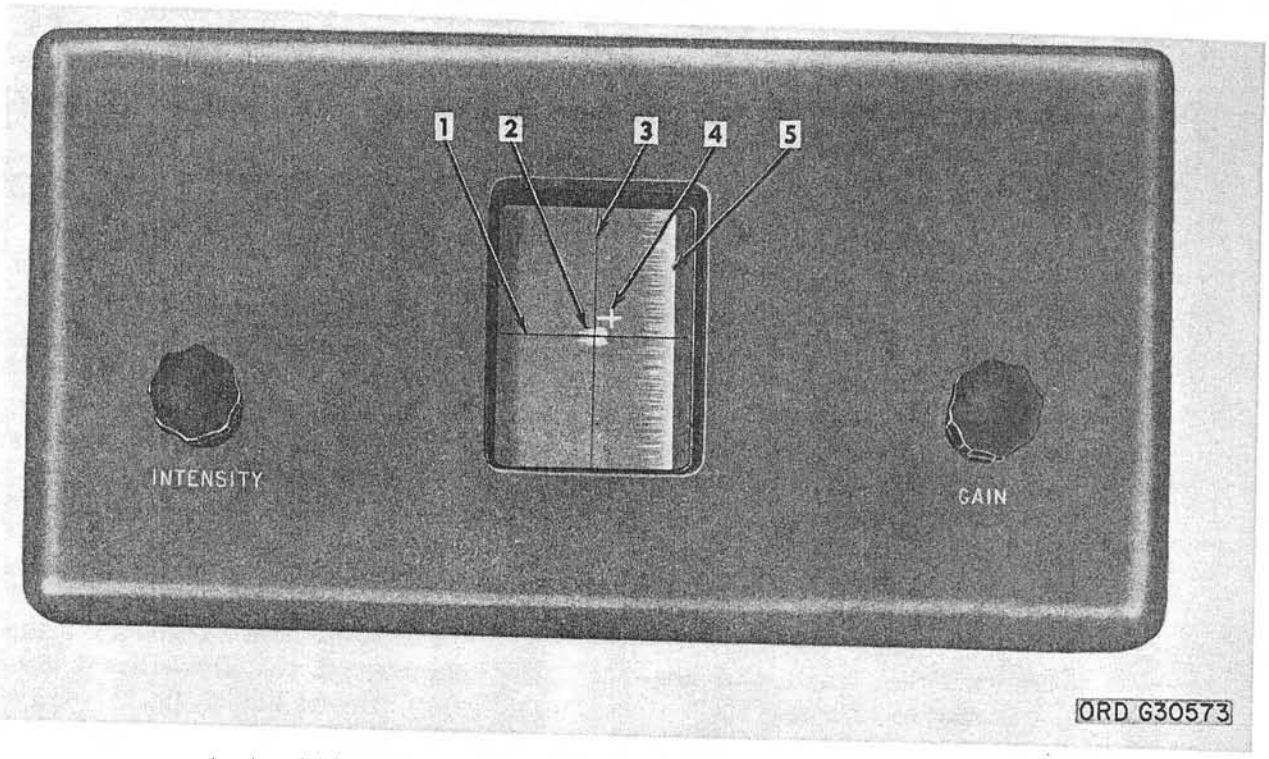
(*b*) The acquisition azimuth line (3) is represented by a black vertical line etched in the face of the precision indicator. The acquisition azimuth line represents a 25,000-yard range segment of the acquisition (flashing) azimuth line (9, fig. 18) on the PPI, 12,500 yards on each side of the acquisition range circle (5, fig. 18).

(*c*) The return signal (designated target) (2) appears as a brightened defocused spot on the face of the precision indicator each time the electronic sweep (5) travels across the face of the precision indicator. The target is centered at the intersection of the acquisition range line (1) and the acquisition azimuth line (3).

(*d*) The electronic cross (4) represents the azimuth and range settings of the target tracking radar system.

(*e*) The electronic sweep (5) is an illuminated vertical line that extends from the upper edge to the lower edge of the face of the precision indicator. The electronic sweep corresponds to the rotating radial sweep (11, fig. 18) on the PPI and travels across the face of the precision indicator from left to right in synchronism with the rotation of the selected acquisition radar antenna (HIPAR/AAR or LOPAR).

d. Auxiliary Acquisition Control Interconnecting Group. The auxiliary acquisition control



1—Acquisition range line
2—Return signal (designated target)
3—Acquisition azimuth line
4—Electronic cross
5—Electronic sweep

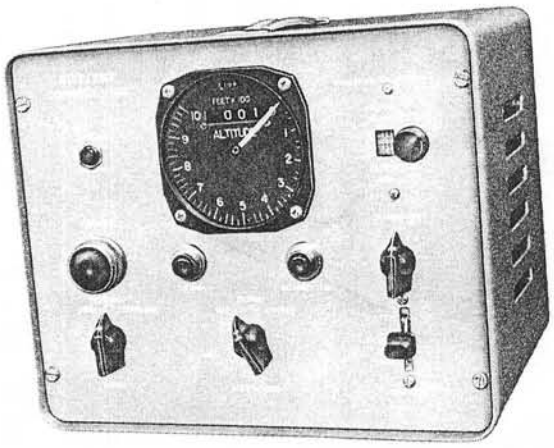
Figure 19 (U). Precision indicator — basic presentation (U).

interconnecting group (6, fig. 14) is located against the roadside wall of the trailer mounted director station. The interconnecting group consists of the HIPAR auxiliary acquisition control-indicator, LOPAR auxiliary control-indicator, IFF auxiliary control-indicator, fixed attenuator, PPI test panel, and anti-jam display (AJD) equipment. The controls and indicators on the auxiliary acquisition control interconnecting group provide remote control of the acquisition radar and SIF/IFF systems during test and setup operations and are not normally used during an engagement. The functions provided include selection of the transmitter frequency for the acquisition radar systems and setting of codes for the SIF/IFF system.

e. Early Warning Plotting Board. The early warning plotting board (5, fig. 14) is located on the roadside wall of the trailer mounted director station. The early warning plotting board provides the battery control officer with target early warning position information. The information is received over the telephone network from the Army Air Defense Command Post (AADCP) and manually plotted by the early warning plotting board operator.

f. Computer Group. The computer group (1, fig. 14) is located against the roadside wall of the trailer mounted director station. The computer group consists of the computer amplifier relay group (2, fig. 14), the servo computer assembly (3, fig. 14), and the computer power supply (4, fig. 14).

g. Radar Bomb Scoring Equipment. During radar bomb scoring missions, additional equipment is located in the trailer mounted director station to adapt the Improved NIKE–HERCULES System for bomb scoring operation. The equipment consists of an RBS control unit (fig. 19.1), an RBS scale factor unit, and communication equipment. This additional equipment is Air Force materiel which is connected to the Improved NIKE–HERCULES System during radar bomb scoring missions only. The equipment is normally operated by Air Force personnel.



ORD G62731

Figure 19.1 (U). RBS control unit (U).

23.1 (CMHA). Trailer Mounted Director Station NIKE–HERCULES ATBM System

a. General. The trailer mounted director station (fig. 19.2) used in the NIKE–HERCULES ATBM System is similar to that used in the Improved NIKE–HERCULES System. Refer to paragraph 23 for a description of the director station group (4, fig. 19.2), the recorder group (8, fig. 19.2), the auxiliary acquisition interconnecting group (3, fig. 19.2), the early warning plotting board (2, fig. 19.2), and radar bomb scoring equipment.

b. Battery Control Console. The battery control console (9, fig. 19.2) is located against the curbside wall of the trailer mounted director station. The battery control console contains the PPI's, the automatic plotting boards, the control indicators and other controls associated with the acquisition radar systems, the computer system, and the tactical control system. The horizontal plotting board (1, fig. 19.3), the altitude plotting board (2, fig. 19.3), and the two PPI's (4 and 8, fig. 19.3) display data used during an engagement.

(1) *Horizontal plotting board.* For a description of the presentation on the horizontal plotting board refer to paragraph 23*c* (1).

(2) *Altitude plotting board.*

(*a*) The altitude plotting board (2, fig. 19.3) provides means for automatically plotting target and missile altitude data against time-to-intercept data. The altitude plotting board (fig. 19.4) is equally divided into the separate surfaces. During an anti-missile (A–M) mission, the TARGET and MISSILE plotting boards provide an altitude coverage of 300,000 feet. During an anti-aircraft (A–A) mission, the TARGET and MISSILE plotting boards provide an altitude coverage of 100,000 feet. The MISSILE (right) plotting surface, graduated from 0 to 200 (center to right) represents time-to-intercept in seconds. The TARGET (left) plotting surface, graduated from 0 to 200 (center to left), represents time-to-intercept in seconds. Each plotting surface has ten horizontal lines and five vertical lines. Each of the ten horizontal lines represents 10,000 feet in altitude for the antiaircraft missile and 30,000 feet for the anti-missile mission; each of the five vertical lines for both plotting boards represents 40 seconds of time-to-intercept. Positions of points which fall between the lines must be estimated. Engraved on the transparent plastic backboard are two curved lines which represent the dead zones of the NIKE–HERCULES ATBM System. These curved lines are shown as part of the MISSILE plotting surface on the altitude plotting board. During an anti-missile

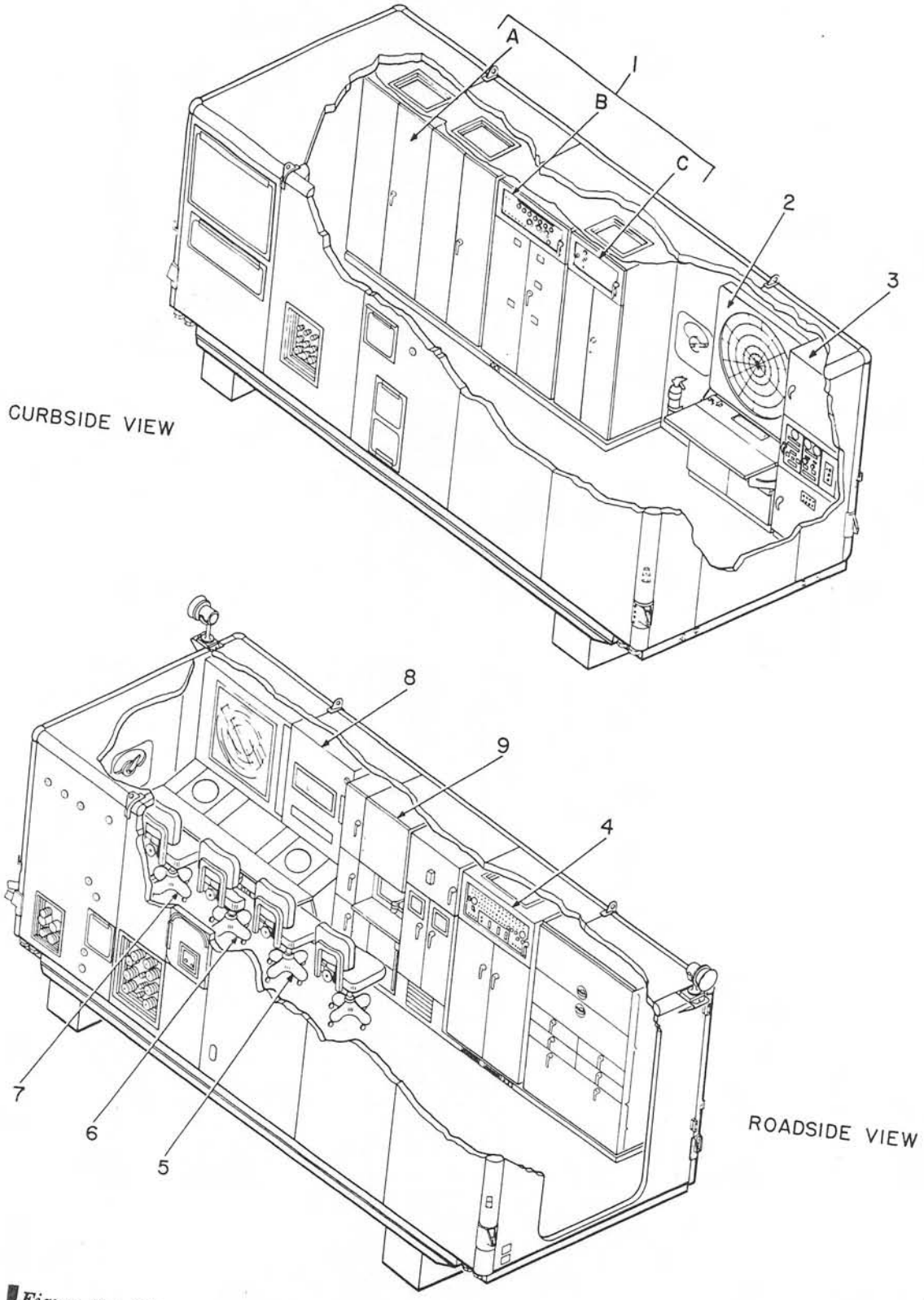


Figure 19.2 (U). Trailer mounted director station—ATBM system—cutaway view (U).

ORD G258940

1. Computer group
   A. Computer amplifier relay group
   B. Servo computer assembly
   C. Computer power supply group
2. Early warning plotting board
3. Auxiliary acquisition control interconnecting group
4. Director station group
5. Long range surveillance operator's chair
6. Battery control officer's chair
7. Short range surveillance operator's chair
8. Recorder group
9. Battery control console

Figure 19.2 (U). Trailer mounted director station—ATBM system—cutaway view—legend (U).

sion, the A–M mission dead zone is used, and during an antiaircraft mission, the A–A dead zone is used.

(*b*) A typical engagement plot by the altitude plotting board during an antiaircraft mission is displayed on figure 19.4. The display shows three plots in the vertical plane: plot of the altitude of the predicted intercept point by the MISSILE plotting pen before fire (point C to fire), plot of the altitude of the target by the TARGET plotting pen throughout the entire engagement (point E to point A), and plot of the altitude of the missile by the MISSILE plotting pen shortly after fire (point D to point B). Both pens also simultaneously plot time-to-intercept along the horizontal axis. Timing marks appear on each plot at approximately 10-second intervals.

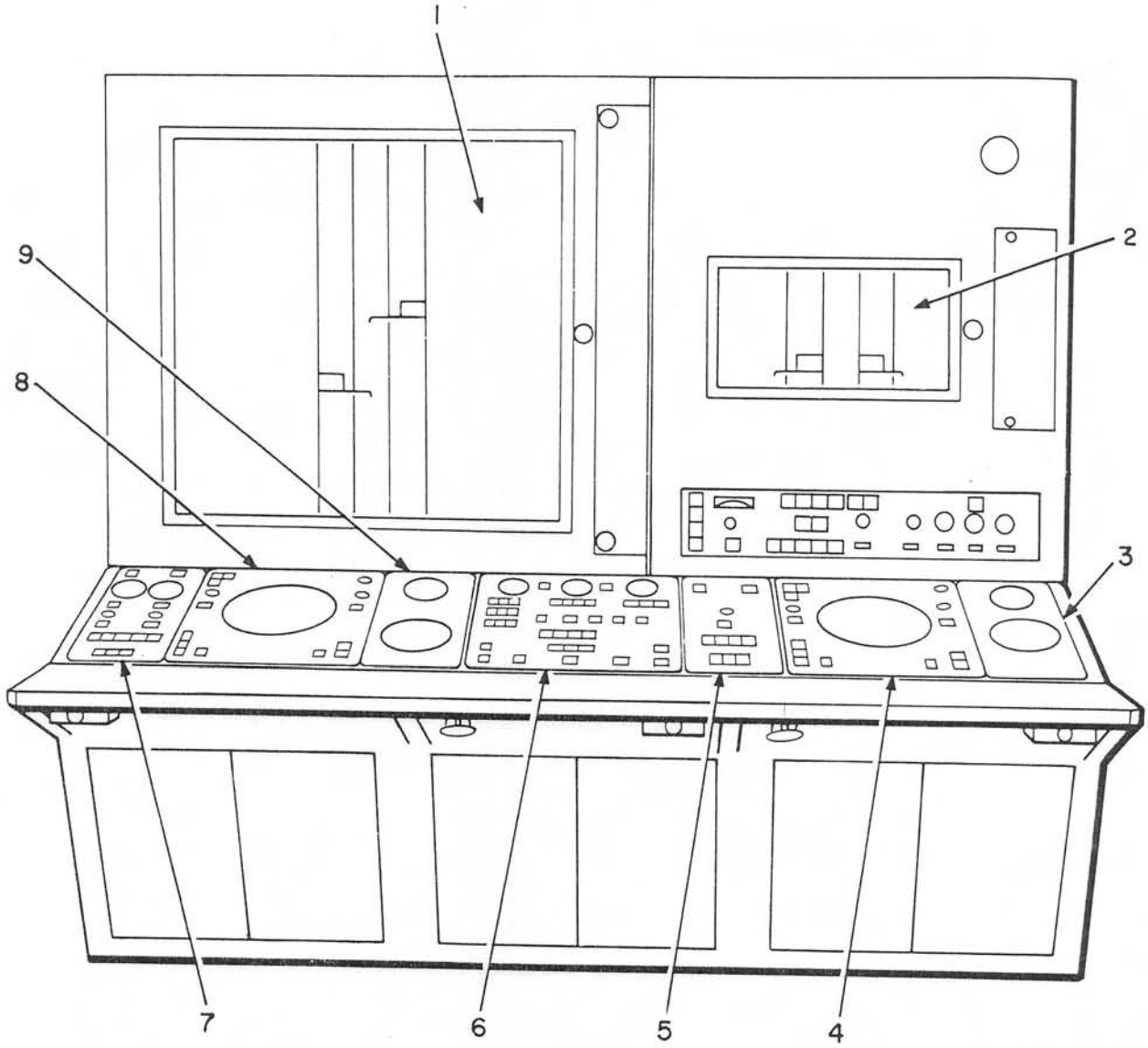
(*c*) When the target entered the defended area (point C and point E), the altitude of the predicted intercept point was plotted by the MISSILE plotting pen at approximately 53,000 feet. The plot of the altitude of the predicted intercept point continued until the MISSILE pen plotted approximately 125 seconds to time-to-intercept. At this time, the fire order was issued as shown by the fire mark on the TARGET plot. The TARGET plotting pen continued to plot present target altitude against time-to-intercept. The MISSILE plotting pen fire stopped plotting predicted intercept point and started to plot missile altitude against time-to-intercept (point D). As time-to-intercept decreased, the two plots moved closer together. At zero time-to-intercept, or burst, the missile and target altitude were coincident (points A and B).

(3) *PPI.*

(*a*) Two identical PPI's, both containing cathode-ray storage tubes, are used to display the acquisition presentation of the NIKE–HERCULES ATBM System. The long range PPI (4, fig. 19.3) has two range display modes of operation. When the LONG RANGE indicator light illuminates (blue), the range displayed is 350,000 yards. When the SHORT RANGE indicator light illuminates (green), the range displayed is 150,000 yards. The short range PPI (8, fig. 19.3) also has two range display modes of operation. When the LONG RANGE indicator light illuminates, the range displayed is 150,000 yards. When the SHORT RANGE indicator light illuminates, the range displayed is 75,000 yards. Except for the actual range coverage, the presentation seen on the short range PPI is the same as seen on the long range PPI. Since the presentation on both PPI's is the same, only the long range PPI will be discussed. The basic target video, reference marks and ECM effects appearing on the PPI are shown on figure 19.5.

Note. Key numbers shown in parentheses in (*b*) below refer to figure 19.5.

(*b*) The basic presentation is displayed on the cathode-ray storage tube (9). The presentation consists of a jamming target (3), quiet target (6), target and trace (tail) (8), designated target (11), target designate circle (1), jam strobe (2), chaff cloud or clutter (4), rotating radial sweep (5), target designate circle from other target designate control



1. Horizontal plotting board
2. Altitude plotting board
3. Long range target designate control
4. Long range PPI
5. HIPAR control-indicator
6. Fire control-indicator
7. LOPAR control-indicator
8. Short range PPI
9. Short range target designate control

Figure 19.3 (U). Battery control console—ATBM system (U).

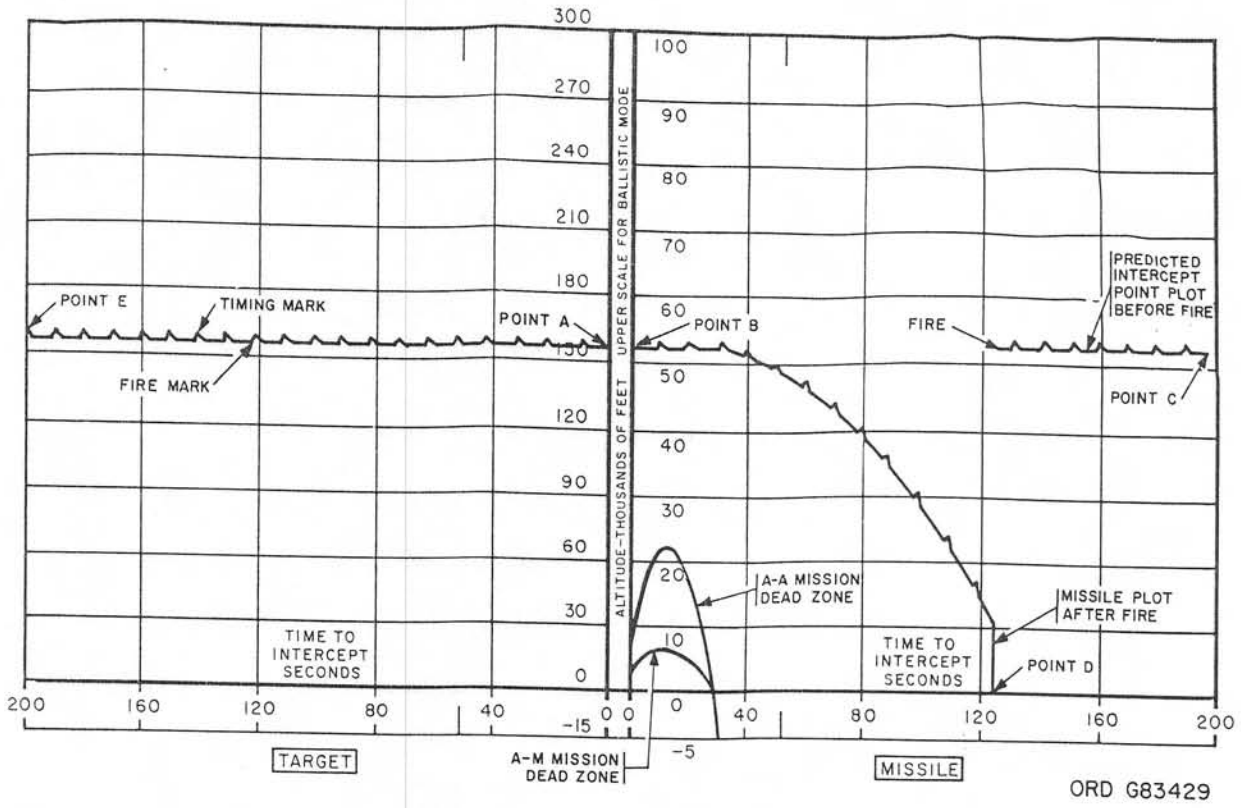
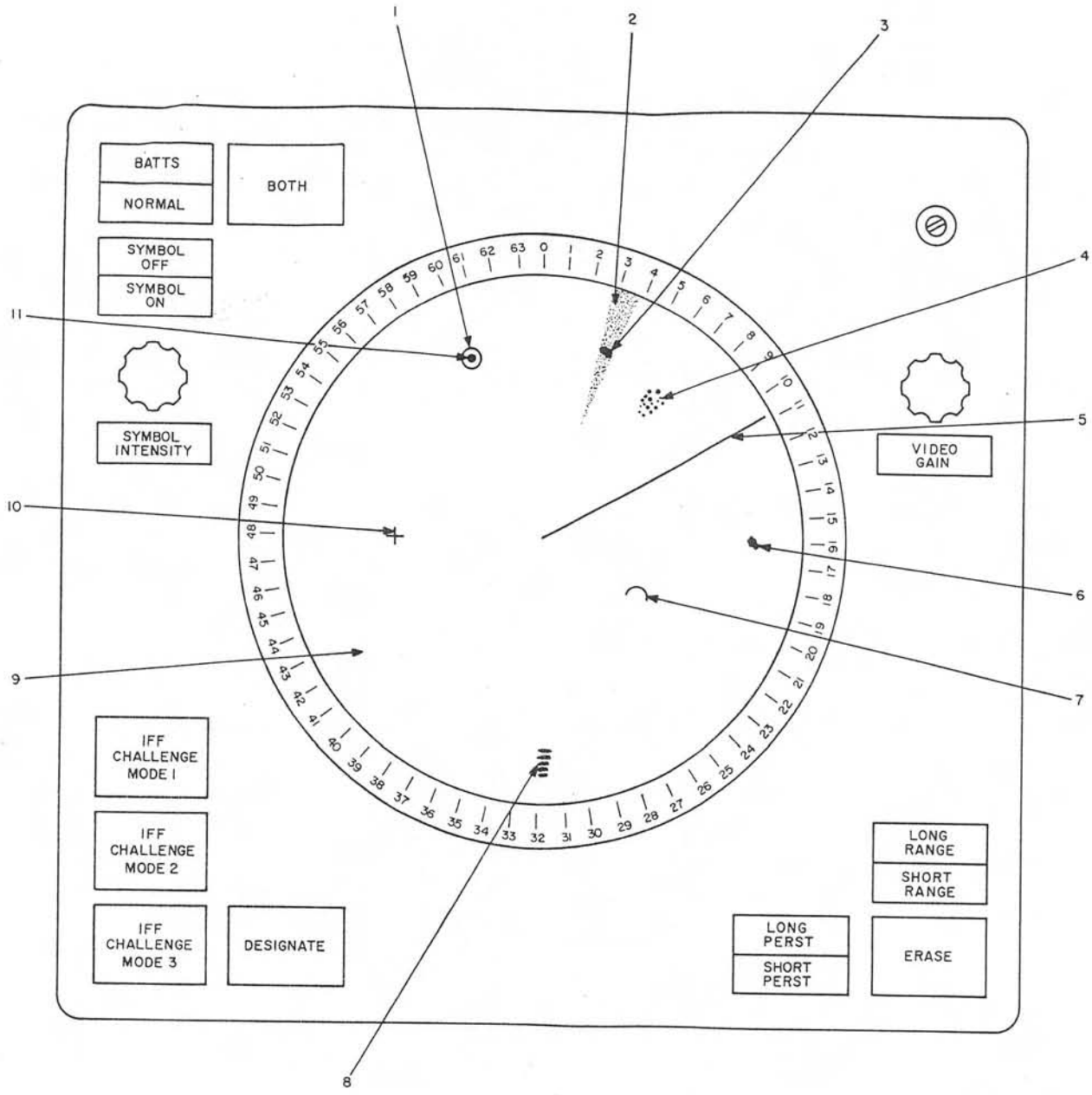


Figure 19.4 (C). Altitude plotting board presentation (U).

(7), and track electronic cross (10). These basic types of presentations are discussed in *1* through *8* below.

1. *Target video.* Target video becomes a part of the basic presentation when either the LOPAR or HIPAR/AAR system is operating and a target is present within the radar range. Target video appears as a bright spot or arc with each rotation of the rotating radial sweep. Different types of target video may be seen on the PPI. A jamming target may or may not appear in the jam strobe depending upon the output of the jammer and the magnitude of the reflected signal from the target. A quiet target is one not using ECM techniques. The designated target is encircled by the target designate circle.
2. *Jam strobe.* The jam strobe will be displayed if CW or noise jamming is present. The jam strobe appears at azimuth of an individual jamming target. If the jamming target is obscured in the strobe and is the target to be engaged, only azimuth information is transmitted to the target tracking radar during the designate phase of operation.
3. *Chaff cloud or clutter.* A chaff cloud or clutter will be displayed on the PPI, but due to the AJD capability of the HIPAR/AAR system, this effect will be greatly reduced.
4. *Rotating radial sweep.* The rotating radial sweep extends from the center to the outer edge of the cathode-ray storage tube. The sweep rotates clockwise around the cathode-ray storage tube in synchronism with the rotation of the acquisition antennas (HIPAR/AAR or LOPAR). Once during each revolution, the sweep brightens



1. Target designate circle
2. Jam strobe
3. Jamming target
4. Chaff cloud or clutter
5. Rotating radial sweep
6. Quiet target
7. Target designate circle from other target designate control
8. Target and trace (tail)
9. Cathode-ray storage tube
10. Track electronic cross
11. Designated target

Figure 19.5 (C). Basic PPI presentation (U).

all displays on the cathode-ray tube as the sweep coincides with each display.

5. *Target designate circle from other target designate control.* The target designate circle from the other target designate control appears as a semicircle, provided the range control is depressed and the range control is positioned in range. If this designate circle is tracking a target, target video will appear in the center of the semicircle.
6. *Target and trace (tail).* When the LONG PERST indicator light illuminates, the persistence of the cathode-ray storage tube is such that video, as well as ECM, remains on the face of the PPI. A trace (tail) will be left behind a moving target. To remove these traces the ERASE switch is depressed.
7. *Target designate circle.* The target designate circle appears as a circle on the PPI, provided the range control is depressed and is positioned in range to a point other than maximum range. The position of this circle is controlled by the range control and azimuth HUNDREDS OF ANGULAR MILS dial on the target designate control (3 and 9, fig. 19.3).
8. *Track electronic cross.* The track electronic cross appears once during each revolution of the rotating radial sweep when the sweep is coincident with the azimuth and range settings of the target tracking radar system.

c. Computer Group. The computer group (1, fig. 19.2) is located against the roadside wall of the trailer mounted director station. The computer group consists of the computer amplifier relay group (1A, fig. 19.2), the servo computer assembly (1B, fig. 19.2), and the computer power supply group (1C, fig. 19.2). The computer group contains circuits for computing predicted target and missile positions and generating data for orders to the missile for target intercept and burst. In the ATBM system, circuits within the computer group have been modified to permit the anti-missile mission.

1. Target ranging radar control
2. Missile radar control console
3. Radar set group
4. Elevation operator's position
5. Azimuth operator's position
6. Target range operator's position
7. Target radar control console
8. Radar power supply group
9. Radar coder set
10. Tracking supervisor's position
11. Missile tracking operator's position

Figure 20 (U). Trailer mounted tracking station—cutaway view—legend (U).

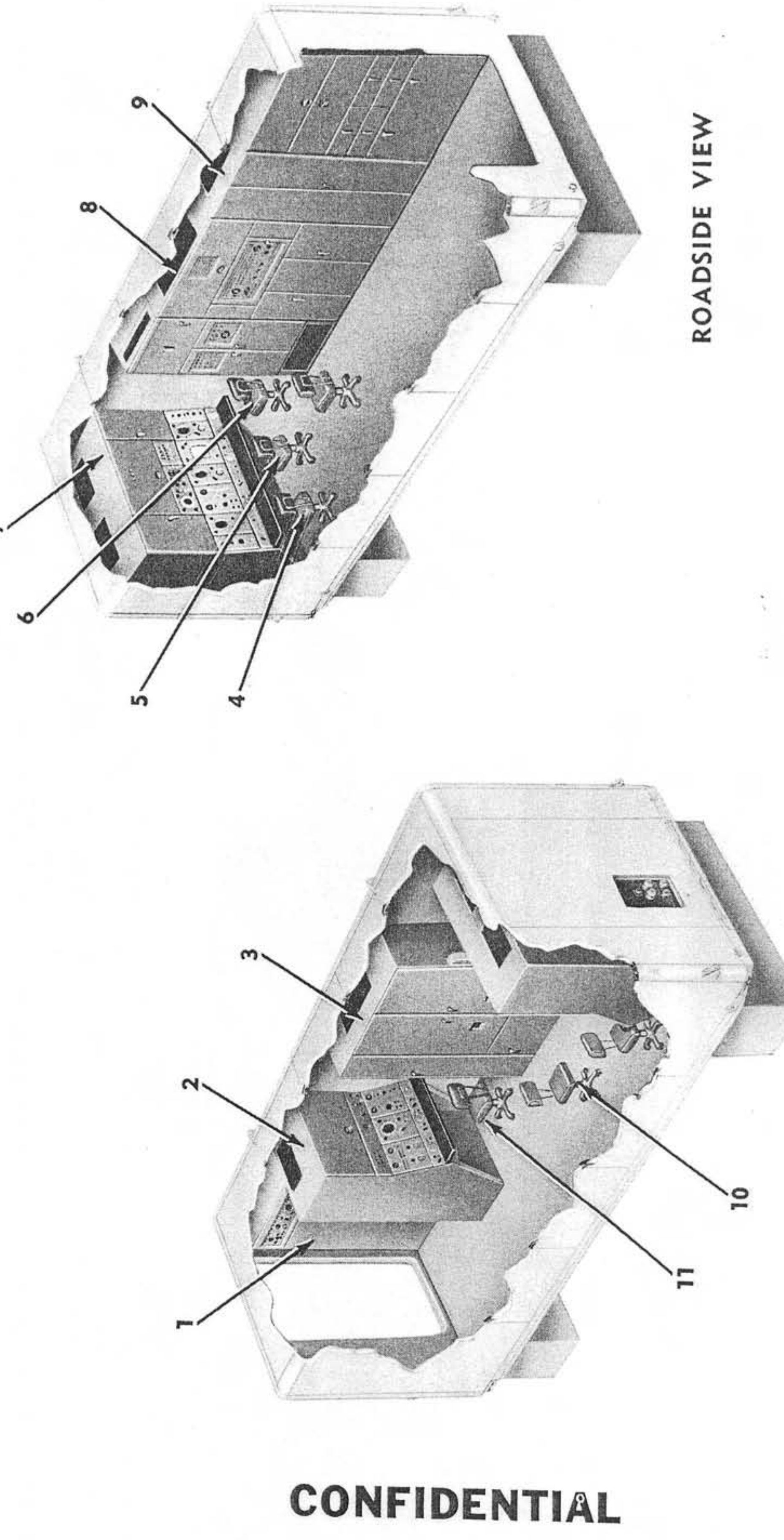
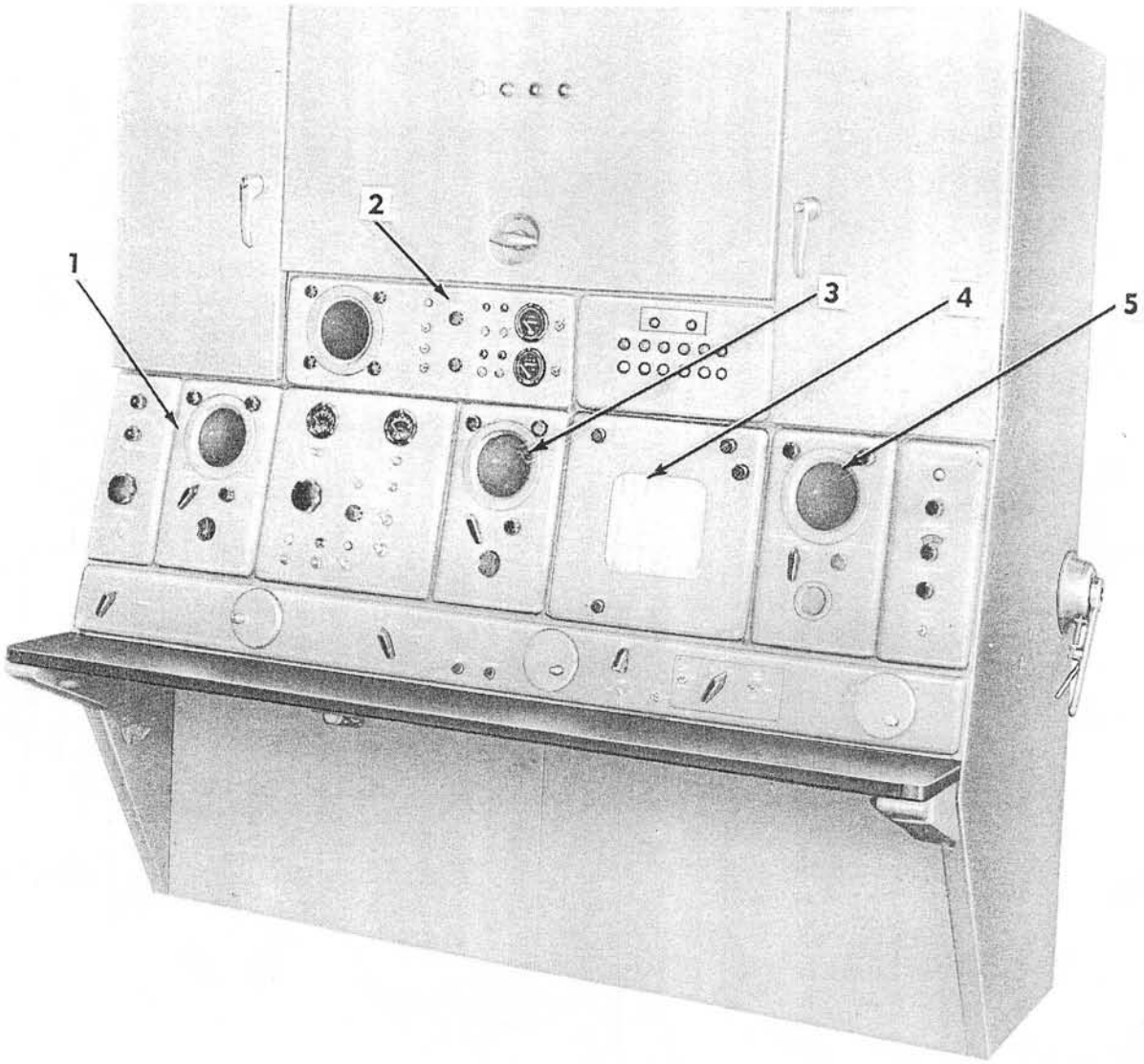


Figure 20 (U). Trailer mounted tracking station – cutaway view.



1. Elevation indicator
2. Countermeasures control-indicator
3. Azimuth indicator
4. B scope indicator
5. Target range indicator

Figure 21 (CMHA). Target radar control console.

24 (CMHA). Trailer Mounted Tracking Station

The trailer mounted tracking station (fig. 20) contains the equipment required for operating the target tracking, target ranging, and missile tracking radar systems. Major units located within the trailer mounted tracking station are described in *a* through *f* below.

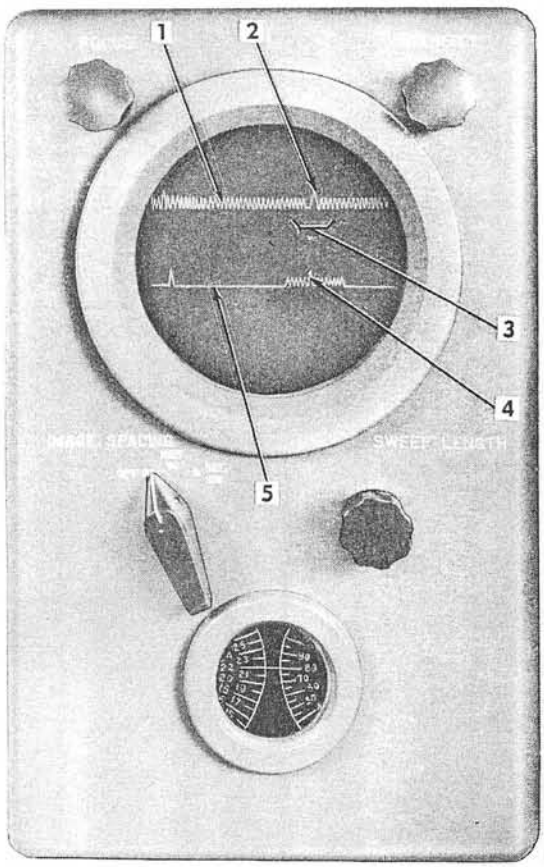
a. Radar Coder Set. The radar coder set (9, fig. 20) is located against the curbside wall of the trailer mounted tracking station. The radar coder set consists of equipment that converts computer data into steering and burst orders which are transmitted to the NIKE-HERCULES missile. Coding equipment used with NIKE-AJAX missiles is located in the upper part of the missile radar control console (2, fig. 20). The coding equipment used (NIKE-HERCULES or NIKE-AJAX) is automatically determined when the battery control officer selects the type of missile for firing.

b. Radar Power Supply Group. The radar power supply group (8, fig. 20) is located against the curbside wall of the trailer mounted tracking station. The radar power supply group consists of power equipment for the target tracking and missile tracking radar systems.

c. Target Radar Control Console. The target radar control console (7, fig. 20) is located against the front wall of the trailer mounted tracking station. The target radar control console contains controls, presentation indicators, and other equipment associated with the target tracking and target ranging radar systems. Data required by the tracking supervisor and the elevation, azimuth, and target range operators during operation is displayed on the elevation indicator (1, fig. 21), azimuth indicator (3, fig. 21), B scope indicator (4, fig. 21), target range indicator (5, fig. 21), and countermeasures control-indicator (2, fig. 21). The displays on the indicators are described in (1) through (5) below.

Note. The key numbers shown in parentheses in (1) and (2) below refer to figure 22 except where otherwise indicated.

(1) *Elevation indicator.* The elevation indicator (1, fig. 21) displays two traces (1 and 5) that extend across the face of the indicator. Each trace represents a maximum range of 40,000 yards or 200,000 yards. A range notch (3) appears on the upper trace (1). When



ORD G30676

1. Upper trace
2. Target pip
3. Range notch
4. Error pip
5. Lower trace

Figure 22 (CHMA). Elevation or azimuth indicator – typical presentation.

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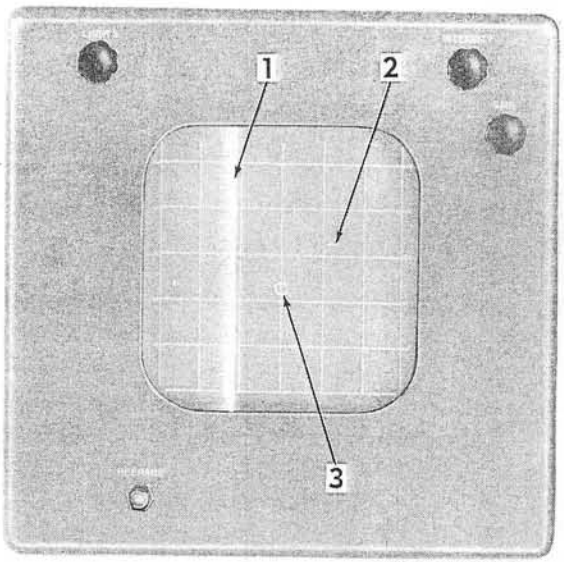
the target is being accurately tracked in elevation, the target pip (2) appears, centered in the range notch on the upper trace, and no error pip (4) appears on the lower trace (5). When the target track antenna is directed below the target, an error pip (4) appears below the lower trace; when the target track antenna is directed above the target, the error pip appears above the lower trace.

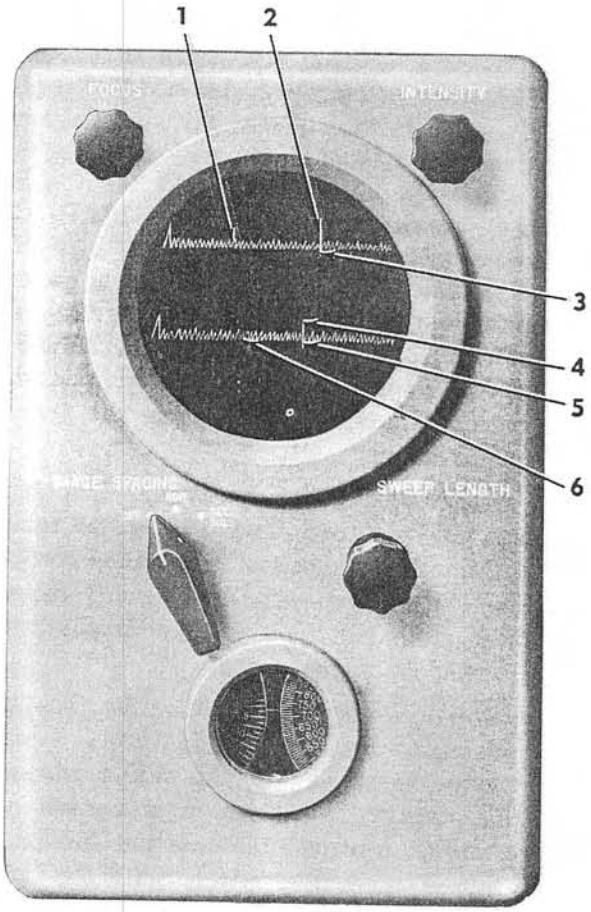
(2) *Azimuth indicator.* The azimuth indicator (3, fig. 21) presents a display similar to the display on the elevation indicator (1, fig. 21). However, the display is interpreted in terms of azimuth instead of elevation. When the target is being accurately tracked in azimuth, the target pip (2) appears centered in the range notch (3) on the upper trace (1), and no error pip appears on the lower trace (5). When the target track antenna is directed to the left of the target, an error pip (4) ap-



ORD G30572

1. Vertical sweep
2. Return signal (designated target)
3. Target track antenna position circle

Figure 23 (CMHA). B scope indicator – basic presentation.



ORD G30677

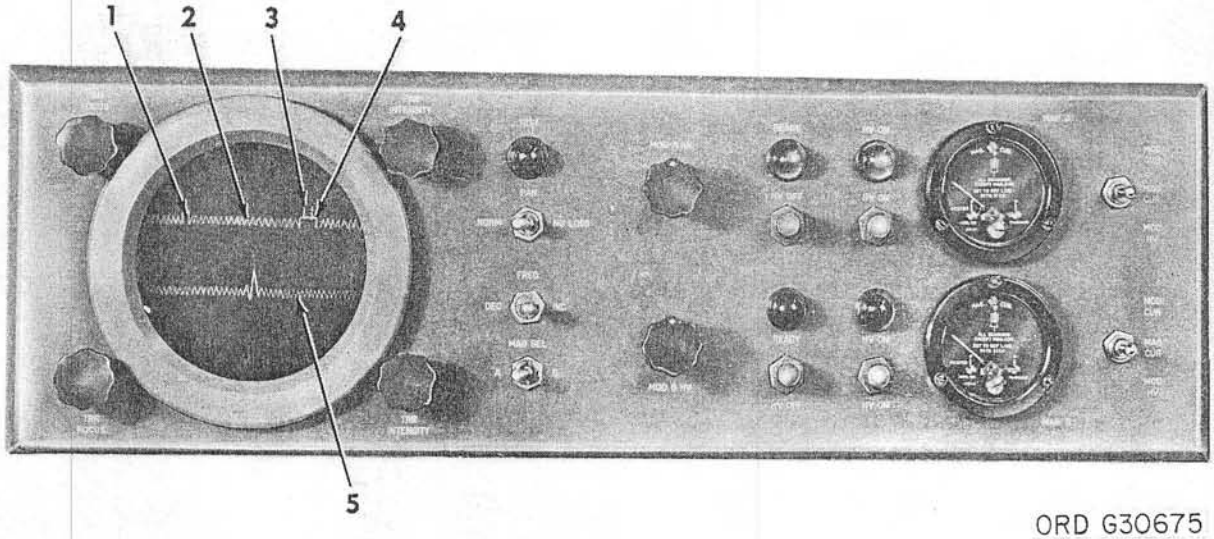
1. Upper trace (target track radar)
2. Target pip (target track radar)
3. Range notch (target track radar)
4. Target pip (target range radar)
5. Range notch (target range radar)
6. Lower trace (target range radar)

Figure 24 (CHMA). Target range indicator – typical presentation.

pears below the lower trace; when the target track antenna is directed to the right of the target, the error pip appears above the lower trace.

(3) *B scope indicator.* The B scope indicator (4, fig. 21) displays a sector of the PPI display covering 60 degrees (1066 mils) in azimuth and 220,000 yards in range. The vertical sweep (1, fig. 23) is an illuminated vertical line that extends from the upper edge to the lower edge of the face of the indicator. The vertical sweep corresponds to the rotating radial sweep (11, fig. 18) on the PPI, and travels across the face of the indicator from left to right in synchronism with the rotation of the selected acquisition radar antenna (HIPAR/AAR or LOPAR). The return signal (designated target) (2, fig. 23) appears as a brightened line on the face of the indicator. Because of normal B scope scan distortion, the return signal increases in length as it moves toward the lower edge of the face of the indicator, and decreases to a small dot when it moves to the upper edge. The target track antenna circle (3, fig. 23) represents the setting of the target track antenna in azimuth and range. For rapid acquisition of the designated target in azimuth and range, the operators adjust azimuth and range controls until the target track antenna circle coincides with the return signal. All displays on the face of the indicator brighten once during each revolution of the selected acquisition radar antenna except the target track antenna circle. During a jamming environment, the azimuth video contains strobe information. The strobe line can be used to acquire jamming targets.

(4) *Target range indicator.* The target range indicator (5, fig. 21) displays two traces that extend across the face of the indicator. Both traces represent



ORD G30675

1—Paired pip (nonradiating magnetron)
2—Panoramic sweep
3—Paired pip (radiating magnetron)
4—Pedestal
5—Range sweep

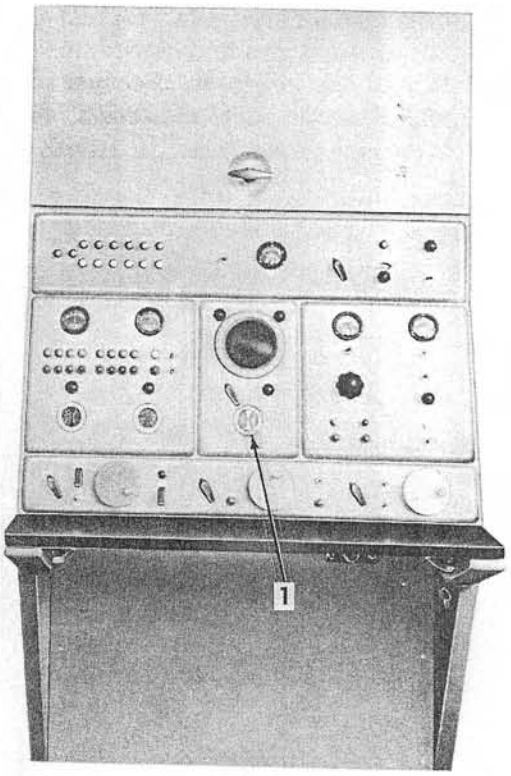
Figure 25 (C). Countermeasures control-indicator—basic presentation (U).

a maximum range of 40,000 yards or 200,000 yards. The return signal that produces the target pip (2, fig. 24) on the upper trace (1, fig. 24) is obtained from the target tracking radar system. The return signal that produces the target pip (4, fig. 24) on the lower trace (6, fig. 24) is obtained from the target ranging radar system. The range notches (3 and 5, fig. 24) on the upper and lower traces represent the range setting of a common range unit which may be controlled by the target range operator. When the radar systems are accurately tracking in range, the target pips are centered in the range notches.

(5) *Countermeasures control-indicator.* The countermeasures control-indicator (2, fig. 21) displays two traces across the face of the indicator. The upper trace is the panoramic sweep (2, fig. 25) and represents the tunable frequency spectrum of the target ranging radar system. Two pairs of pips (1 and 3, fig. 25) represent the two magnetrons of the target ranging radar system. The pips (3, fig. 25) representing the radiating magnetron are displayed on a pedestal (4, fig. 25). The position of the pedestal along the panoramic sweep represents the relative frequency of the radiating magnetron. The pairs of pips (1, fig. 25) not on a pedestal represents the relative frequency of a standby (nonradiating) magnetron. The lower trace is the range sweep (5, fig. 25), and is a duplication of the lower trace (6, fig. 24) on the target range indicator.

d. Radar Set Group. The radar set group (3, fig. 20) is located against the roadside wall of the trailer mounted tracking station. The radar set group consists of electrical and electronic equipment associated with the operation of the target tracking, target ranging, and missile tracking radar systems.

e. Missile Radar Control Console. The missile radar control console (2, fig. 20) is located against the roadside wall of the trailer mounted tracking station. The missile radar control console contains controls, a range indicator, and other equipment associated with the missile tracking radar system. The range indicator (1, fig. 26) displays a single trace similar to the upper trace (1, fig. 24) of the target range indicator. The missile is tracked in range on the range indicator in the same manner that the target is tracked in range on the upper trace of



ORD G30678

1. Range indicator

Figure 26 (C). Missile radar control console.

the target range indicator. The trace represents a range of either 52,000 or 200,000 yards, depending upon the type of missile (NIKE-AJAX or NIKE-HERCULES, respectively) selected for the engagement.

f. Target Ranging Radar Control. The target ranging radar control (1, fig. 20) is located against the roadside wall of the trailer mounted tracking station. The target ranging radar control contains controls, a test scope, an IF signal generator, power equipment, and other equipment associated with the target ranging radar system.

25 (U). LOPAR Antenna-Receiver-Transmitter Group

Note. The key numbers shown in parentheses in *a* through *f* below refer to figure 27.

a. General. The LOPAR antenna-receiver-transmitter group (fig. 27) consists of the antenna and the receiving and transmitting equipment for the low power acquisition radar (LOPAR) system. The group consists of the acquisition antenna (2), acquisition antenna pedestal (5), acquisition receiver-transmitter (3), the acquisition modulator (4), and an auxiliary antenna (1). The pedestal, receiver-transmitter, and modulator are cylindrical tubs stacked one on the other. The auxiliary antenna is mounted on the acquisition antenna. The entire group is supported by a tripod secured to the pedestal at the top and to leveling jacks at the bottom.

b. Acquisition Antenna. The acquisition antenna (2) is mounted on the acquisition antenna pedestal (5) and rotates continuously in azimuth during operation. The elevation scan of the antenna reflector is variable within the range from 0 to +391 mils. A protective Fiberglas radome encloses the antenna reflector. Selective identification feature/identification friend or foe (SIF/IFF) equipment is attached to a holding bar mounted on the lower portion of the antenna.

c. Acquisition Antenna Pedestal. The acquisition antenna pedestal (5) supports the acquisition antenna (2). The pedestal contains the antenna drive equipment and the equipment that electrically couples the antenna, the acquisition receiver-transmitter (3), and the acquisition modulator (4).

d. Acquisition Receiver-Transmitter. The acquisition receiver-transmitter (3) contains receiving and transmitting equipment associated with the LOPAR system. Built-in test equipment is incorporated in the acquisition receiver-transmitter to facilitate maintenance.

e. Acquisition Modulator. The acquisition modulator (4) contains the high voltage and pulse generating equipment for the transmitting system of the LOPAR system.

f. Auxiliary Antenna. The auxiliary antenna (1) is mounted on top of the main acquisition antenna and rotates in synchronism with it.

26 (U). Target Track, Target Range, and Missile Track Antenna-Receiver Transmitter Groups

a. Target Track Antenna-Receiver-Transmitter Group. The target track antenna-receiver-transmitter group (fig. 28) consists of the antenna and the receiving and transmitting equipment for the target tracking radar system. The track antenna reflector and the target track receiver-transmitter are gimbal mounted on the target track antenna support (3, fig. 28) and enclosed by the track antenna radome (1, fig. 28). The reflector and receiver-transmitter are rotated in elevation by elevation drive equipment located in the antenna support. Azimuth rotation is accomplished by means of azimuth drive equipment that rotates the entire antenna support. The azimuth drive equipment is housed within the target track antenna support base (2, fig. 28). With special purpose kits 1430–051–2916 and 1430–799–8679 incorporated, the ability to operate effectively during severe winds is increased by the addition of antenna pedestal fairings (1, fig. 28.1).

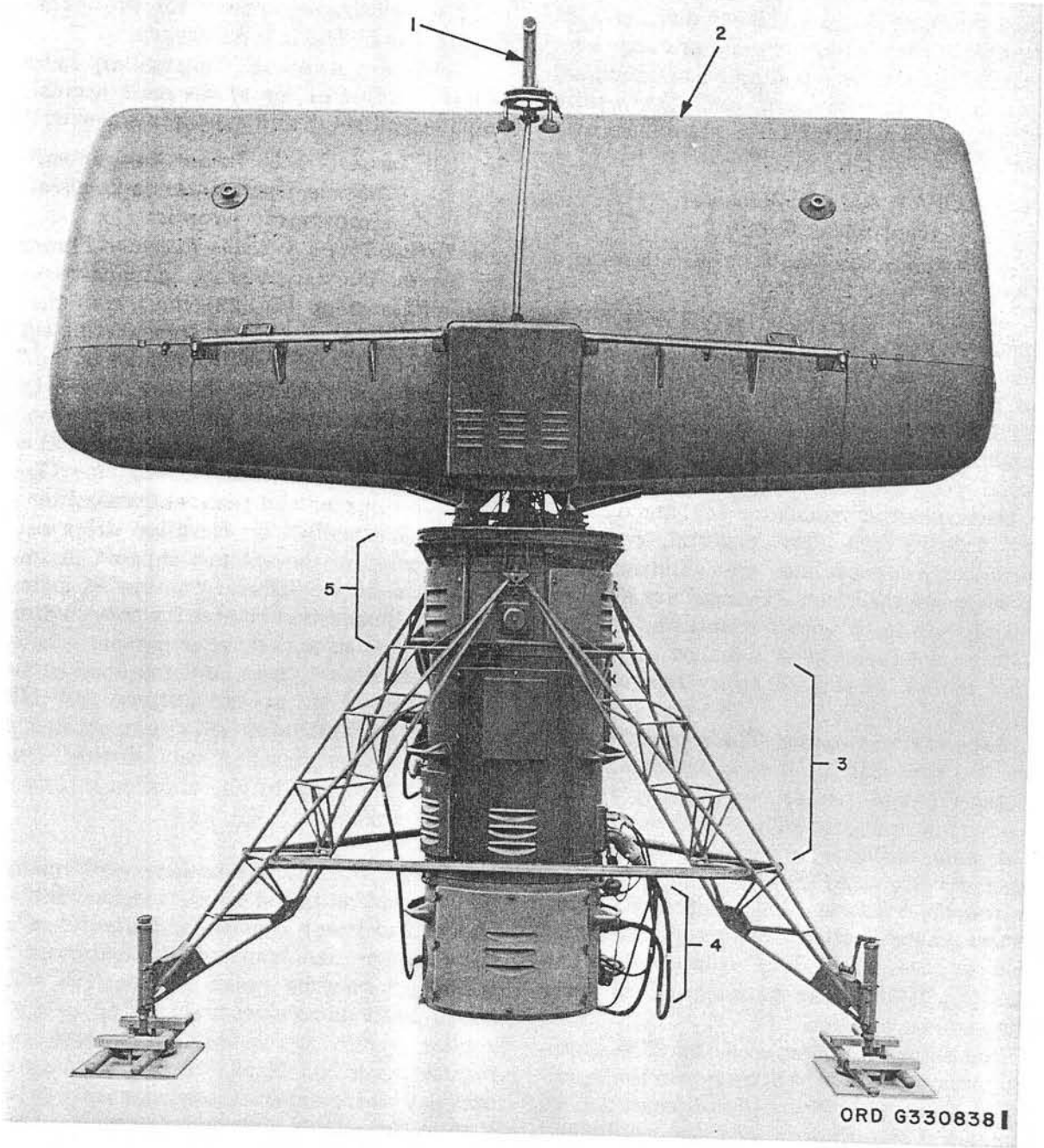
b. Target Range Antenna-Receiver-Transmitter Group. The target range antenna-receiver-transmitter group consists of the antenna and the receiving and transmitting equipment for the target ranging radar system. The target range antenna-receiver-transmitter group is similar to the target track antenna-receiver-transmitter group (fig. 28) described in *a* above except that the target range antenna-receiver-transmitter group contains two receiver-transmitters.

c. Missile Track Antenna-Receiver-Transmitter Group. The missile track antenna-receiver-transmitter group consists of the antenna and

the receiving and transmitting equipment for the missile tracking radar system. The missile track antenna-receiver-transmitter group is similar to the target track antenna-receiver-transmitter group (fig. 28) described in *a* above.

27 (U). Radar Test Set Group

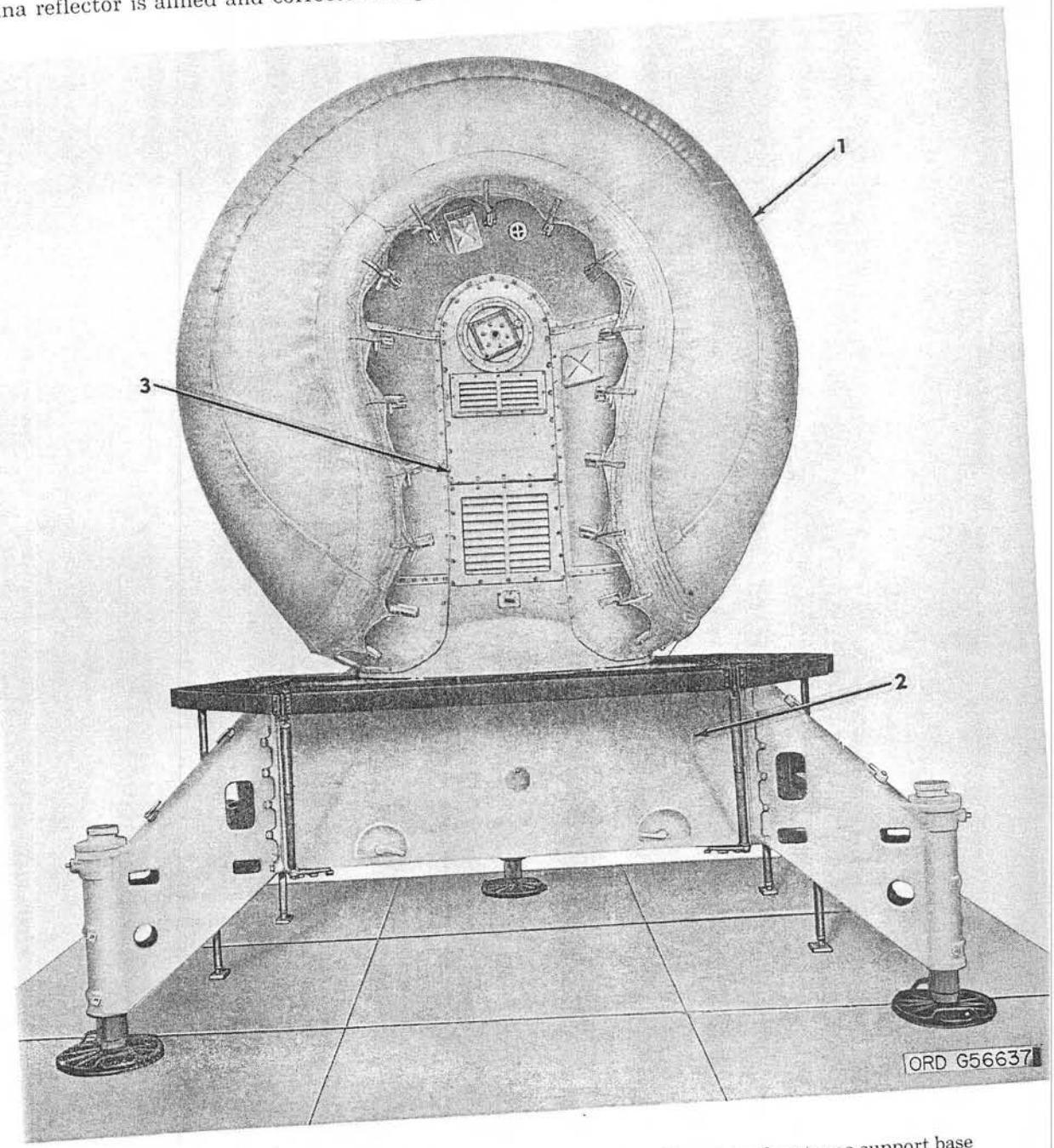
The radar test set group (fig. 29) consists of the radar test set (2, fig. 29), the RF detector (3, fig. 29), and the antenna assembly-mast group (1, fig. 29). The radar test set group is



1—Auxiliary antenna
2—Acquisition antenna
3—Acquisition receiver-transmitter
4—Acquisition modulator
5—Acquisition antenna pedestal

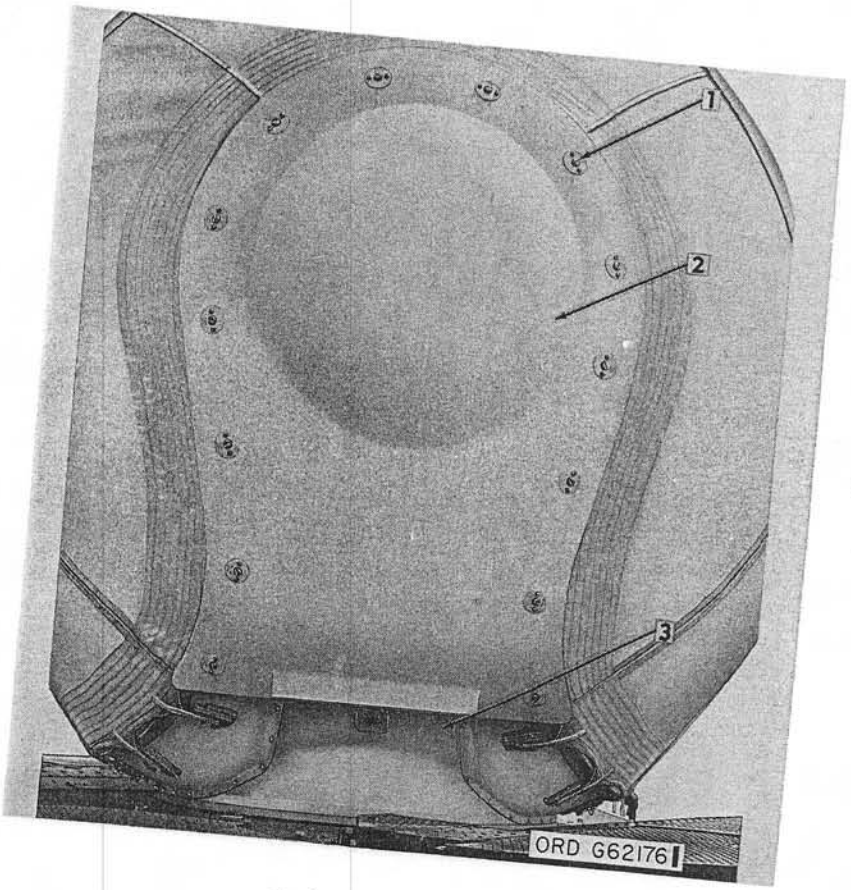
Figure 27 (U). LOPAR antenna-receiver-transmitter group (U).

used to aline and test the target tracking, target ranging, and missile tracking radar systems. The target track and missile track antenna reflectors are alined optically by sighting and alining the axis of the antenna reflector with a point on the graduated arms at the top of the antenna assembly-mast group (1, fig. 29). The target range antenna reflector is alined and corrected for parallax by radiating rf energy from the target range antenna-receiver-transmitter group to a feedhorn at the top of the antenna assembly-mast group. The rf energy received from the feedhorn is converted to a dc voltage by the RF detector (3, fig. 29) to produce an indication of the alinement of the antenna reflector. The radar test set (2, fig. 29) generates rf test signals that are radiated



1- Track antenna radome
2 -Target track antenna support base
3- Target track antenna support

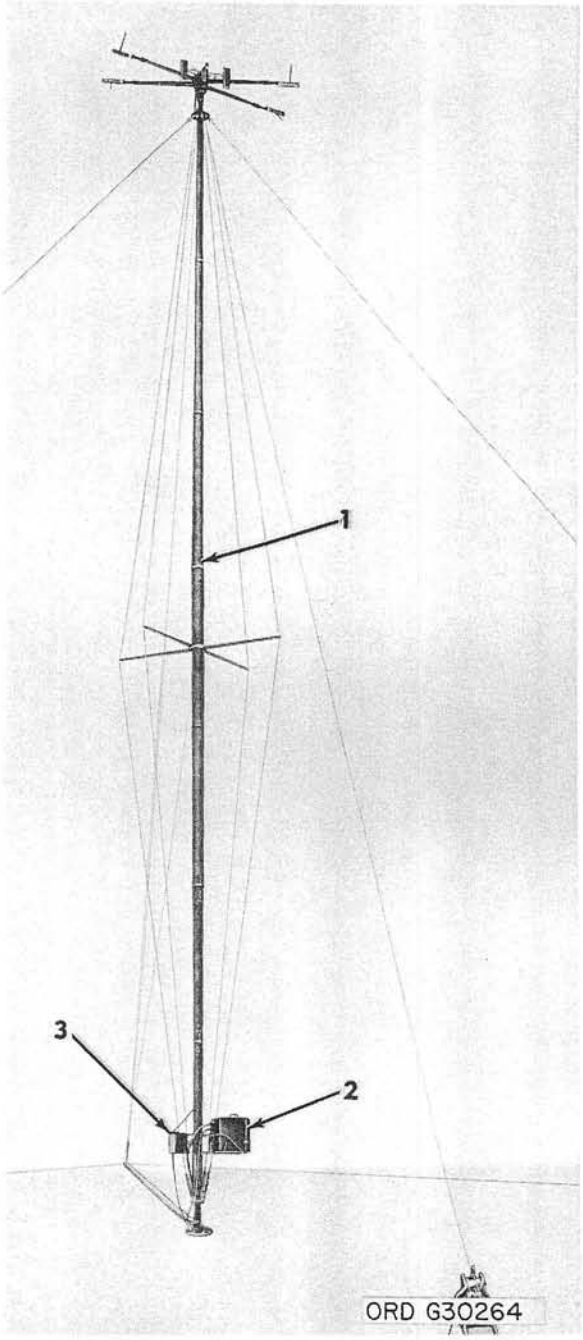
Figure 28 (U). Target track antenna-receiver-transmitter group (U).



1 - Latch (14)
2 - Antenna pedestal fairing
3 - Track antenna pedestal

Figure 28.1 (U). Target track or missile track antenna-receiver-transmitter group—overall view with special purpose kit 1430-051-2916 or target range antenna-receiver-transmitter group with special purpose kit 1430-799-8679 (U).

from the feedhorn at the top of the antenna assembly-mast group. These signals simulate missile transmitted signals or target return signals and are used in checks and adjustments of the missile and target tracking radar systems.



1—Antenna assembly mast group
2—Radar test set
3—RF detector

Figure 29 (U). Radar test set group (U).

27.1 (U). T1 Trainer

The T1 trainer (fig. 29.1) associated with the radar course directing central (RCDC), consists of trailer mounted equipment and interconnecting cables that provide simulated radar signals for training personnel in the operation of the RCDC.

28 (U). Operator Positions and Duties

The positions and duties of the operators in the trailer mounted director station and the trailer mounted tracking station are described in *a* and *b* below.

Note. The key numbers in parentheses in *a* below refer to figure 14.

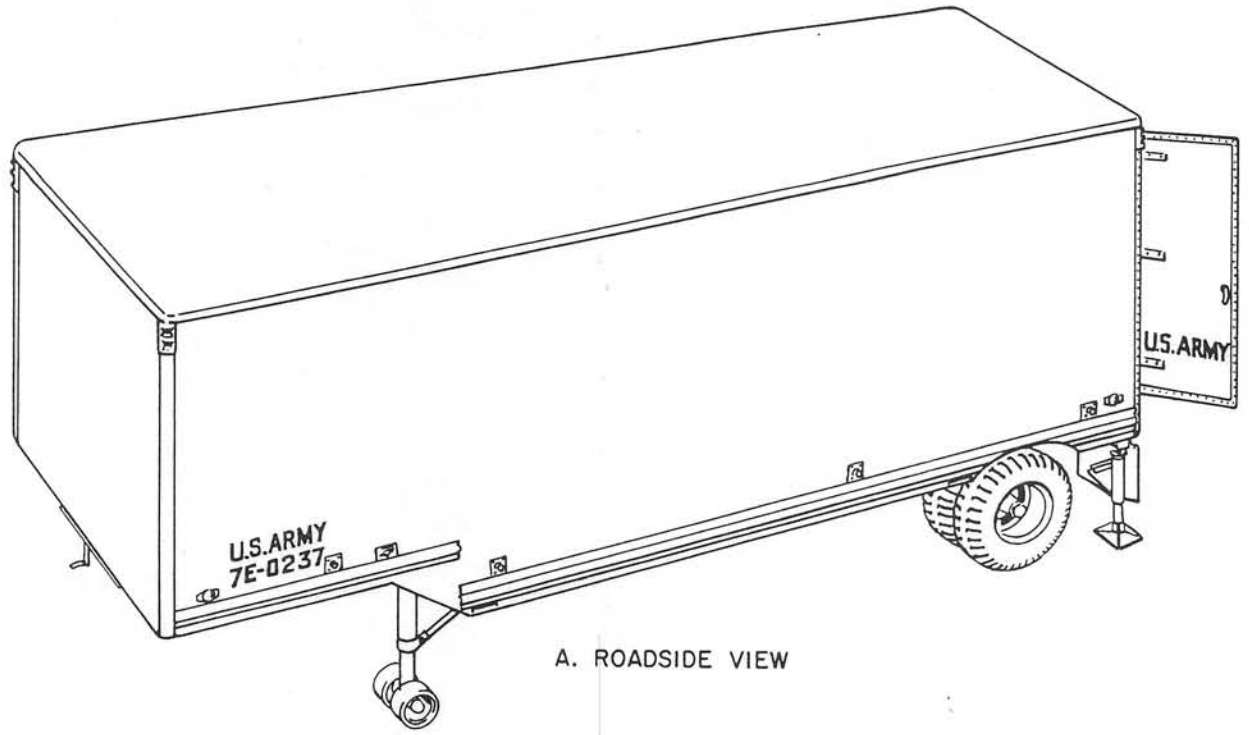
a. Trailer Mounted Director Station.

Note. The battery control officer is normally the battery commander. To cover the situation where the battery commander is absent or a duty officer is performing his duties, the designation "battery control officer" is used instead of "battery commander."

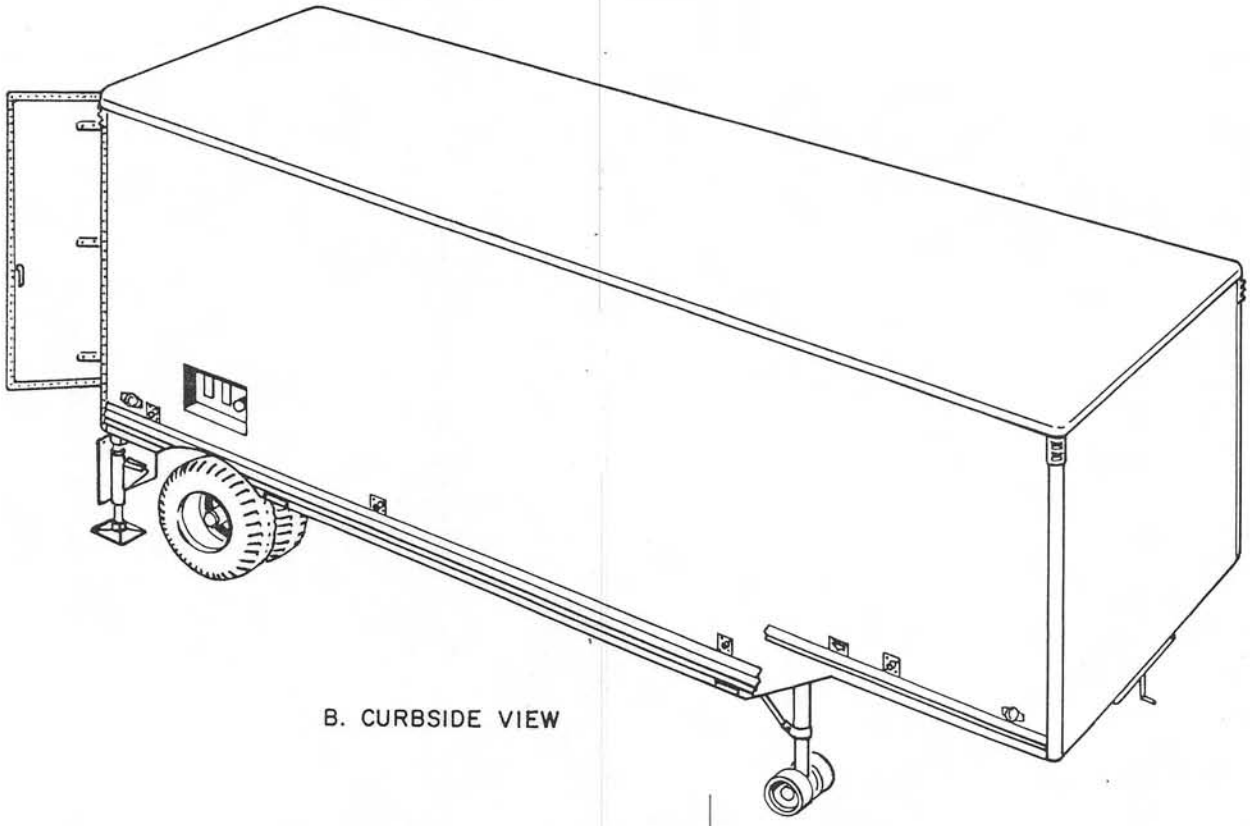
(1) *Battery control officer.* Under normal alert conditions of surveillance or when an attack is expected but not in progress, the battery control officer's position (12) is the right operating position in front of the battery control console (8). During an engagement, the computer operator takes over this position and the battery control officer takes over the center operating position (13) in front of the battery control console. In this position, the battery control officer can view and monitor the early warning information, local threat, equipment status, and conduct of the mission as displayed on the plotting boards and indicators. A detailed description of the tactical responsibilities of the battery control officer is contained in chapter 7.

(2) (Deleted).

(3) *Acquisition radar operator.* The acquisition radar operator's position (7) is the left operating position in front of the battery control console (8). The duties of the acquisition radar operator include operation of the acquisition radar, both LOPAR and HIPAR/



A. ROADSIDE VIEW



B. CURBSIDE VIEW

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Figure 29.1 (U). Radar signal simulator station AN/MPQ—T1 (T1 trainer) (U).

AAR, performance of target designation procedure, and operation of the SIF/IFF equipment in association with and under the direction of, the battery control officer.

(4) *Computer operator.* The computer operator stands in front of the computer group (1) and places the computer group in full operation prior to an engagement. During an engagement, the computer operator's position (12) is at the right end of the battery control console (8) in front of the altitude plotting board. This is the position occupied by the battery control officer prior to an engagement. The duties of the computer operator during an engagement consist of monitoring equipment status and operating tactical controls at the direction of the battery control officer.

(5) *Early warning plotting board operator.* The early warning plotting board operator stands in front of the early warning plotting board (5) and manually marks target early warning information on the plotting board. The plotting board operator receives this plotting information over the telephone from an Army Air Defense Command Post (AADCP).

(6) *Switchboard operator.* The switchboard operator's position (11) is in front of the recorder group (9). His duties consist of operating the telephone switchboard and the recording equipment.

a.1. NIKE–HERCULES ATBM Trailer Mounted Director Station.

(1) In the trailer mounted director station (fig. 19.2) for the NIKE–HERCULES ATBM System, the short range surveillance operator occupies the left chair at the battery control console, the battery control officer, the center chair, and the long range surveillance operator, the right chair.

(2) Equipment available to the short range surveillance operator is the short range PPI (8, fig. 19.3), the short range target designate control (9, fig. 19.3) and the LOPAR control-indicator (7, fig. 19.3).

(3) Equipment available to the long range surveillance operator is the long range PPI (4, fig. 19.3), the long range target designate control (3, fig. 19.3), and the HIPAR control-indicator (5, fig. 19.3).

(4) The battery control officer is seated in front of the fire control-indicator (6, fig. 19.3). He may monitor both PPI's from this position.

(5) The long range and short range surveillance operators have radar and designation controls available to them. The battery control officer has his battery and firing controls directly in front of him and has access to the surveillance operators' controls.

(6) The position and duties of the early warning plotting board operator and the switchboard operator are the same as in an Improved NIKE–HERCULES System.

Note. The key numbers shown in parentheses in *b* below refer to figure 20 except where otherwise indicated.

b. Trailer Mounted Tracking Station.

(1) *Azimuth operator.* The azimuth operator's position (5) is the center operating position in front of the target radar control console (7). The azimuth operator monitors the B scope indicator (4, fig. 21) and the azimuth indicator (3, fig. 21). The duties of the azimuth operator are to acquire and track the designated target in azimuth. The azimuth operator is responsible for signaling the battery control officer that the target is being tracked or is not being tracked.

(2) *Elevation operator.* The elevation operator's position (4) is the left operating position in front of the target radar control console (7). The elevation operator monitors the elevation indicator (1, fig. 21). The duties of

the elevation operator are to manually search for, acquire, and track the designated target in elevation.

(3) *Target range operator.* The target range operator's position (6) is the right operating position in front of the target radar control console (7). The target range operator monitors the B scope indicator (4, fig. 21) and the target range indicator (5, fig. 21). The duties of the target range operator are to manually track and gate the designated target in range.

(4) *Tracking supervisor.* The tracking supervisor's position (10) is centered behind the positions of the azimuth, elevation, and target range operators. The tracking supervisor monitors the B scope indicator (4, fig. 21), countermeasures control-indicator (2, fig. 21), and the elevation, azimuth, and target range indicators, (1, 3, and 5, fig. 21). The duties of the tracking supervisor are to coordinate and supervise the operation of the target tracking and target ranging radar systems, and when the countermeasures control-indicator indicates that interference is present, to utilize the techniques required to maintain effective operation.

(5) *Missile tracking operator.* The missile tracking operator's position (11) is in front of the missile radar control console (2). Under normal operating conditions, he is continuously advised of the equipment status when a target has been designated, acquired, and tracked. After a missile has been designated and acquired, he ascertains, by means of indicators on the console, that the missile tracking radar system is locked on the designated missile. After the missile is launched, he monitors the range indicator to see that the missile is being accurately tracked. Under emergency conditions, in addition to monitoring missile tracking before and after launch, the missile tracking operator can manually select the launching section and missile to be fired and designate "missile ready" and "missile fired" by means of controls on the console.

CHAPTER 4

GUIDED MISSILE LAUNCHING SET

Section I. FUNCTIONAL DESCRIPTION

29 (U). General

The guided missile launching set consists of the launchers, the controlling and indicating equipment, and the testing equipment required to prepare, monitor, test, and launch a NIKE-HERCULES or a NIKE-AJAX guided missile.

30 (U). Launching Control

Under normal conditions, the operations leading to the launching of a guided missile are initiated and controlled from the battery control area. Under emergency conditions, the required information can be transmitted by voice communications from the battery control area to the launching set. Then the operation of the guided missile launching set is controlled locally from the launching control console in the trailer mounted launching control station or from the Hercules launching section control-indicator in the launching section. The guided missile launching set is under the direction of the launching control officer who is in contact, by voice communications, with operating personnel in the battery control area and the launching sections.

31 (U). Safety Provisions

The control and firing circuits of the guided missile launching set are interlocked in a logical firing sequence. Interlocked circuits provide maximum safety to personnel and insure that prerequisite circuit functions in the firing sequence are completed before the subsequent circuit function is initiated.

32 (U). Indicators

Color-coded indicator lights at the launching control console, at the Hercules launching section control-indicator, and at the launcher control-indicator indicate the completion of all important circuit functions of the guided missile launching set. Illuminated green indicator lights indicate to the operator that the specific circuit function has been completed; illuminated amber or red indicator lights indicate that the specific circuit function has not been completed.

33 (U). Communications

The guided missile launching set is linked to the battery control area by a voice communications network. The guided missile launching set can also be linked to the battery control area by radio communications.

34 (U). Operating Power Sources

Both 60-cps and 400-cps electrical power is required for operation of the launching set. The 400-cps power is obtained by means of frequency converters that convert 60-cps power to 400-cps power. Under normal conditions, commercial 60-cps power is utilized; under emergency conditions, engine-driven generators supply the 60-cps power.

Section II. PHYSICAL ARRANGEMENTS

35 (U). General

The guided missile launching set is the equipment located in the launching area of a NIKE-HERCULES battery (fig. 8). The launching set described in this manual is emplaced as a fixed defense installation in the Continental United States (CONUS).

36 (U) Launching Area

a. A typical launching area is shown in figure 30. The launching set in a typical launching area is normally composed of three launching sections and a trailer mounted launching control station. The launching set may contain a combination of NIKE-AJAX and NIKE-HERCULES sections,

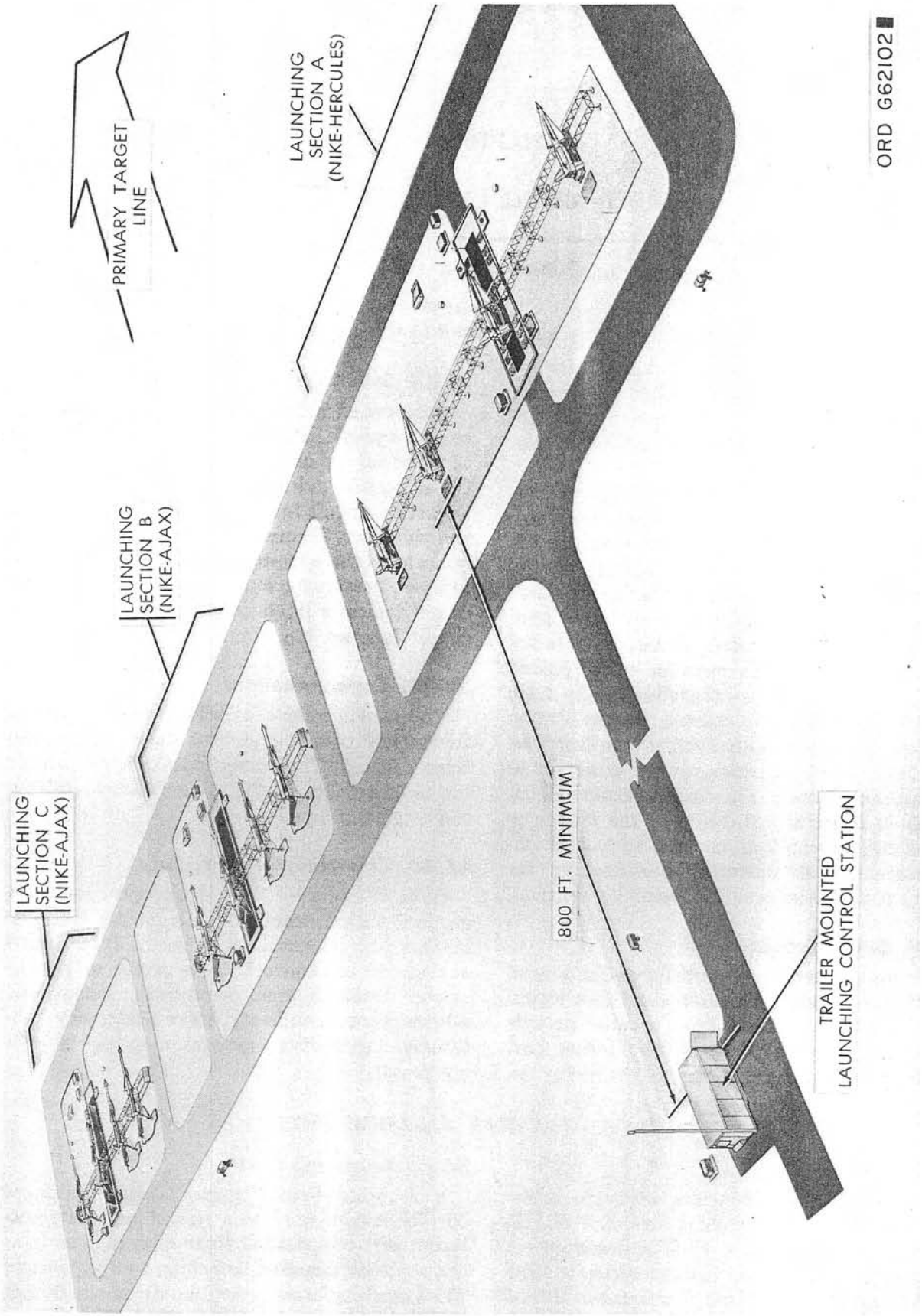


Figure 30 (U). Launching area — typical layout.

as shown in figure 30, or NIKE-HERCULES sections only.

b. The launching area requires a rectangular area of approximately 43 acres. When terrain and real estate availability permit, the launching area is oriented with the launchers facing in the direction of the primary target line as shown in figure 30, and with the shorter sides of the rectangular area parallel to the primary target line. This arrangement is desirable but is not mandatory. The launching sections are located approximately 60 feet apart. The trailer mounted launching control station is located to the rear of the launching sections at a minimum distance of 800 feet from the nearest launcher.

37 (U). NIKE-HERCULES Launching Sections

Four configurations of NIKE-HERCULES launching sections are used in fixed CONUS sites. The four configurations are designated CONUS B, CONUS C, CONUS C Modified, and CONUS D. The CONUS B, CONUS C, and CONUS C Modified sections are NIKE-AJAX sections that have been converted to accommodate NIKE-HERCULES equipment. The CONUS D section is designed specifically for NIKE-HERCULES equipment. More than one configuration may be employed within the same launching set.

a. CONUS B Launching Section. Four Hercules monorail launchers (fig. 31) are used in a CONUS B launching section. Elevator-mounted launcher No. 1 can be loaded in the underground storage chamber and then raised to the surface for firing. Satellite launchers No. 2, No. 3, and No. 4 are permanently emplaced on the surface. The four launchers are interconnected with loading racks. The loading racks permit moving missiles between launchers. A launcher control-indicator is emplaced on the surface near satellite launcher No. 4. The underground part of the launching section is constructed of reinforced concrete and consists of the underground storage chamber, section control room, and elevator well. The underground equipment includes loading racks for missile storage, three launcher control-indicators and the section control equipment. The section control equipment is composed of the Hercules launching section control-indicator and the Hercules section simulator group. Stairways, escape hatches, and blast-proof doors are also provided. The launching section can accommodate seven ready NIKE-HERCULES missiles or ten ready NIKE-AJAX missiles.

b. CONUS C Launching Section. A CONUS C Launching section is generally similar to the CONUS B section described in *a* above except for the following differences:

(1) Only three launchers are provided. An adapter rack is mounted on the elevator in place of elevator mounted launcher No. 1.
(2) Only two launcher control-indicators are required underground.
(3) The launching section can accommodate only six ready NIKE-HERCULES or NIKE-AJAX missiles.

c. CONUS C Modified Launching Section. A CONUS C Modified launching section is generally similar to the CONUS B section described in *a* above except for the following differences:

(1) An adapter rack is mounted on the elevator in place of elevator-mounted launcher No. 1.
(2) Four Hercules monorail launchers are permanently emplaced on the surface. The four launchers may be arranged with two to each side of the elevator, or with three on one side and one on the opposite side.
(3) Two launcher control-indicators are on the surface and two are underground.
(4) The launching section can accommodate only six ready NIKE-HERCULES or NIKE-AJAX missiles.

d. CONUS D Modified Launching Section. A CONUS D launching section is generally similar to the CONUS B section described in *a* above except that the underground storage chamber contains an additional storage room and a fan room. A 400-cps frequency converter is located in the fan room.

Section III. EQUIPMENT DESCRIPTION

38 (U). Hercules Monorail Launcher

Note. The key numbers shown in parentheses in *a* and *b* below refer to figure 32.

a. The Hercules monorail launcher functions as a firing platform for both NIKE-HERCULES and NIKE-AJAX missiles. The four Hercules monorail launchers (1, 7, 8, and 9) in a CONUS B launching section are identical except in emplacement. Launcher No. 1 (9) is elevator mounted; the satellite launchers (1, 7, and 8) are emplaced on concrete aprons (5) on the surface. Emplacement of launchers in CONUS C, CONUS C Modified, and CONUS D sections is similar except for the differences outlined in paragraph 37.

b. The Hercules monorail launcher is of box-type welded steel construction and is approximately 23 feet long and 8 feet wide with an overall height of 31-1/2 inches. The launcher erecting beam (2) supports the launching-handling rail (3) and the missile. The erecting beam is erected and lowered by means of a hydraulic system and is set for an erected angle of elevation of either 85 degrees, 87-1/2 degrees, or 90 degrees. The 87-1/2 degree angle is most commonly used.

39 (U). Launching-Handling Rail

a. The launching-handling rail (3, fig. 32) supports and guides the missile on the launcher during the fraction of a second required for the missile to become airborne, thereby assuring that the missile is launched at the correct angle. The rail also provides a means of moving the missile along the loading racks.

b. The launching-handling rail (fig. 33) is approximately 26-1/2 feet long and 14-1/2 inches in height with an overall width of 40 inches at the outriggers. Hydraulic wedgelocks on the launcher erecting beam lock the locking lugs of the rail in position and secure the rail to the beam. The two stop bolts at the rear of the rail are used to adjust the position of the missile and to prevent the missile from sliding off the erected rail. The rail release, at the forward end of the rail, supports the forward end of the missile. At launch, the forward motion of the missile releases the rail release. The electrical breakaway shears an umbilical cable assembly from the missile at launch, thereby breaking the electrical connections between the missile and the launcher. The positioning handle and the inching handwheel provide the means for releasing the rail and moving it along the loading racks. An electrical

1. Hercules monorail launcher (satellite launcher No. 3)
2. Launcher erecting beam
3. Launching-handling rail
4. Guided missile M6 (Nike-Hercules)
5. Concrete apron (3)
6. Launcher control-indicator
7. Hercules monorail launcher (satellite launcher No. 4)
8. Hercules monorail launcher (satellite launcher No. 2)
9. Hercules monorail launcher (elevator-mounted launcher No. 1)

Figure 32 (U). NIKE-HERCULES CONUS B *launching section—typical surface view—legend.*

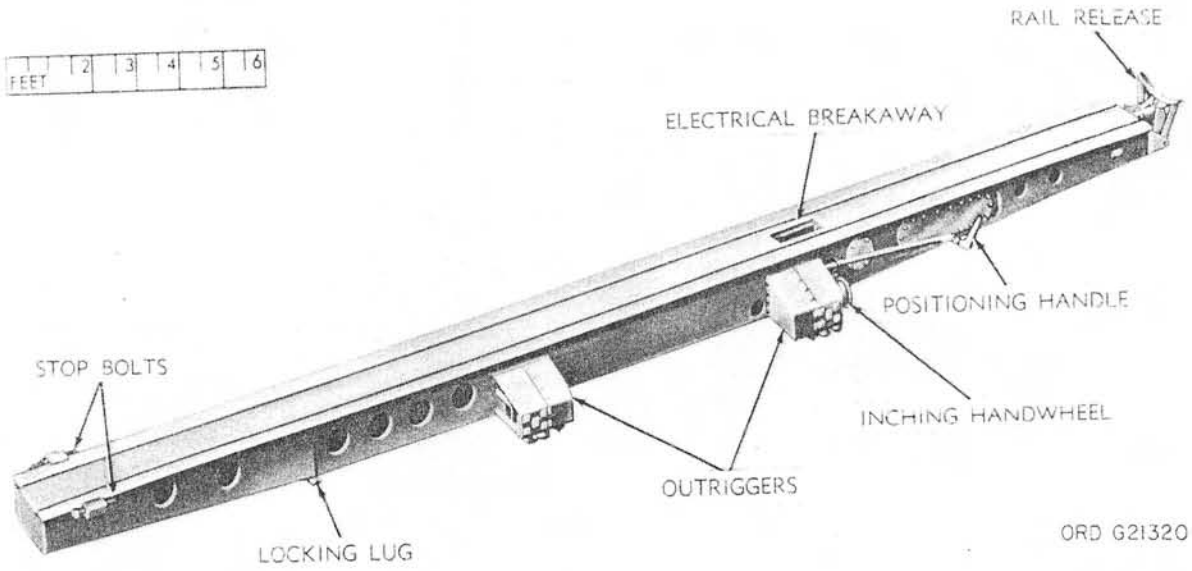


Figure 33 (U). Launching-handling rail.

system in the rail provides the connections for testing and firing the missile.

40 (U). Launcher Control-Indicator

The launcher control-indicator (fig. 34) provides controls and indicators for testing and monitoring of missiles on the launchers and on loading racks, and provides local control of the launchers. One launcher control-indicator (LCI) is associated with each of the four Hercules monorail launchers. Each LCI is connected by cables to the Hercules launching section control-indicator in the section control room and to a launcher. The three LCI's located underground are also connected by cables to missile test stations on the loading racks. The underground LCI's control launchers No. 1, No. 2, and No. 3, and nine test stations. The LCI located on the surface controls launcher No. 4 but has no associated test stations.

41 (U). Hercules Launching Section Selector

The Hercules launching section selector (fig. 35) is installed in the section control room. The selector consists of the Hercules launching section control-indicator (1, fig. 35) and the Hercules section simulator group (2, fig. 35).

a. Hercules Launching Section Control-Indicator. The Hercules launching section control-indicator (1, fig. 35) is connected by cables to each launcher control-indicator in the launching section and to the trailer mounted launching control station. A control panel on the control-indicator contains controls and indicators required to prepare the missile for firing. A manual orders panel on the control-indicator is provided for emergency use when cables are disrupted between the launching area and the

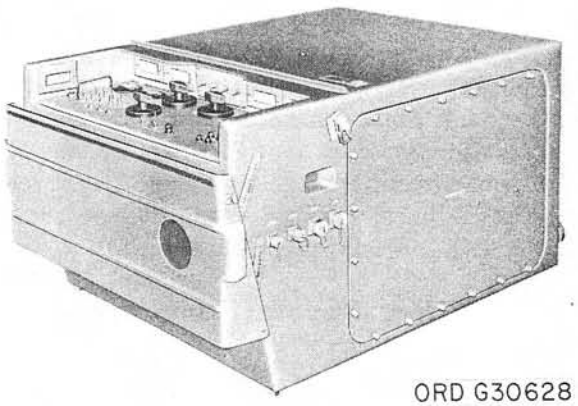
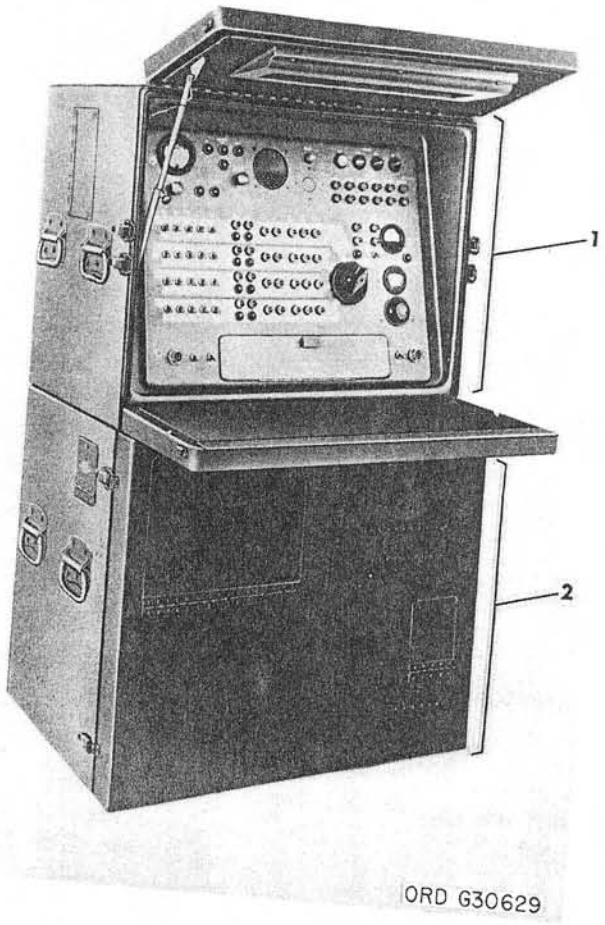


Figure 34 (U). Launcher control-indicator.



1. Hercules launching section control-indicator
2. Hercules section simulator group

Figure 35 (U). HERCULES launching section selector.

battery control area. The manual orders panel enables the operator at the launching section to complete the firing circuit.

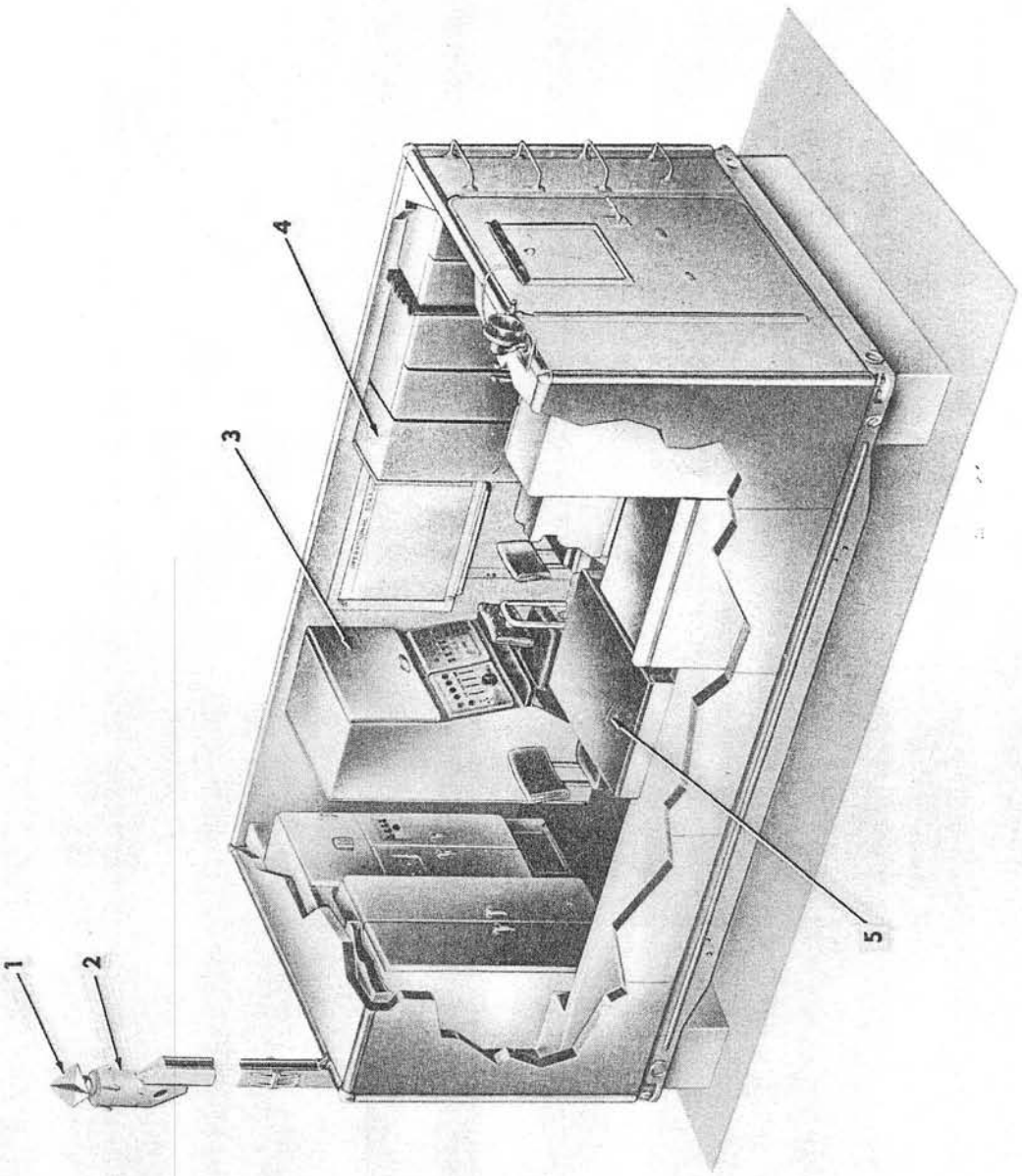
b. Hercules Section Simulator Group. The Hercules section simulator group (2, fig. 35) is connected by cables to the Hercules launching section control-indicator, to each launcher, and to the launching section power source. The simulator group contains the electronic components required for presetting the roll amount gyro in the missile prior to launch.

42 (U). Trailer Mounted Launching Control Station

Note. The key letters shown in parentheses in paragraph 42 refer to figure 36.

The trailer mounted launching control station (fig. 36) contains the launching control group which consists of the launching control console (3), the intercommunication cabinet station (4), the flight simulator group (2), the radar target simulator (1), and associated equipment required for tactical control of the launching area.

a. Launching Control Console. The launching control console (3) is located near the forward end of the trailer mounted launching control station. The launching control console (fig. 37) contains the controls and indicators required for tactical operation of the launching area and for coordination of operations between the battery control area and the launching area. The controls and indicators on the console provide the console operator with information regarding the equipment status, the



1. Radar target simulator
2. Flight simulator group
3. Launching control console
4. Intercommunication cabinet station
5. Launching control officer's desk

Figure 36 (U). Trailer mounted launching control station — cutaway view.

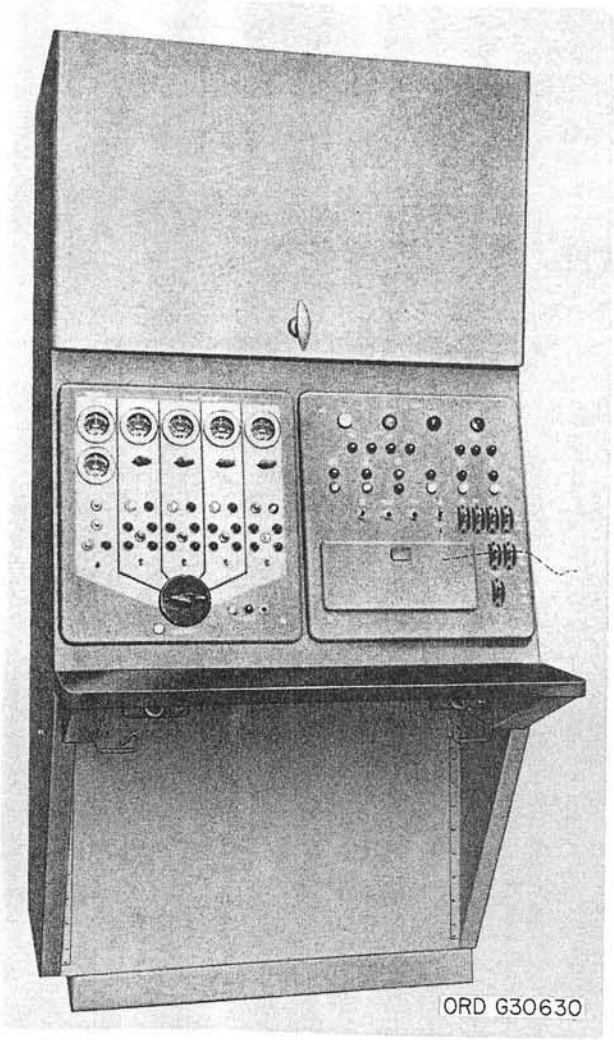


Figure 37 (U). Launching control console.

missile and mission designation, and the preparedness of each launching section. The console operator monitors the missile preparedness information from each section and selects the section to fire as directed by a launching control officer who is stationed at the launching control officer's desk (5) across from the console.

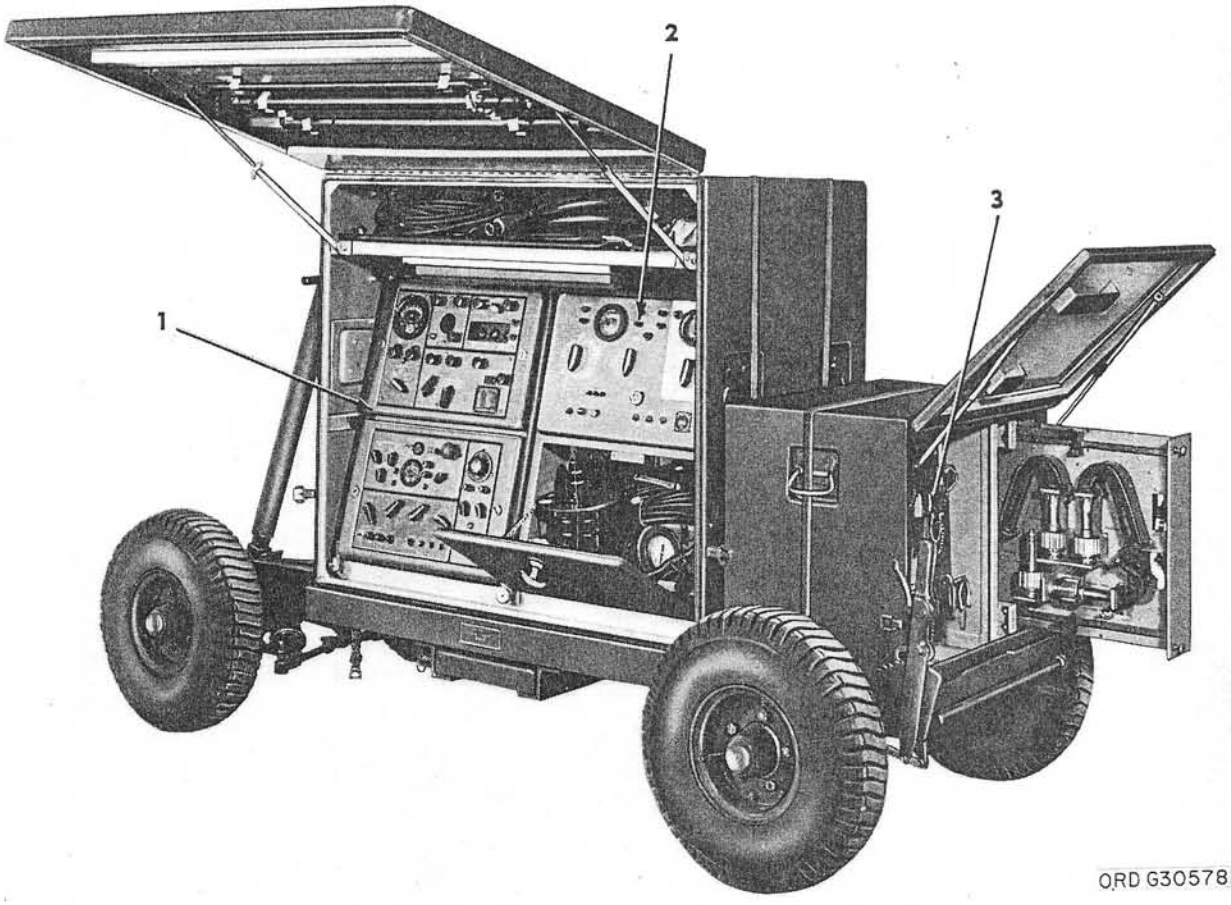
b. Intercommunication Cabinet Station. The intercommunication cabinet station (4) is located against the curbside wall of the trailer mounted launching control station. The intercommunication cabinet station contains a telephone switchboard and related equipment which provides two-way communication between all system telephone locations.

c. Flight Simulator Group. The flight simulator group (2), during operation, is hoisted to the top of a 30-foot mast attached to the front roadside corner of the trailer mounted launching control station. The simulator group simulates a missile for the missile tracking radar system prior to designation of a missile and between firing of missiles.

d. Radar Target Simulator. The radar target simulator (1) is mounted on top of the flight simulator group (2) and is used as a radar target for periodic checks of the target tracking radar system.

43 (U). Launching Area Hercules Missile Test Set

The launching area Hercules missile test set (fig. 38) includes the Hercules missile RF test set group (1, fig. 38), the Hercules electrical power and servo test set (2, fig. 38), and the test adapter (3, fig. 38). This equipment is used to perform operational checks on the missile guidance set of the NIKE-HERCULES missile and on the flight simulator group (2, fig. 36). The launching area Hercules missile test set is normally mounted on the missile test set truck, as shown in figure 38.



1. HERCULES missile RF test set group
2. HERCULES electrical power and servo test set
3. Test adapter

Figure 38 (U). Launching area HERCULES missile test set mounted on missile test set truck.

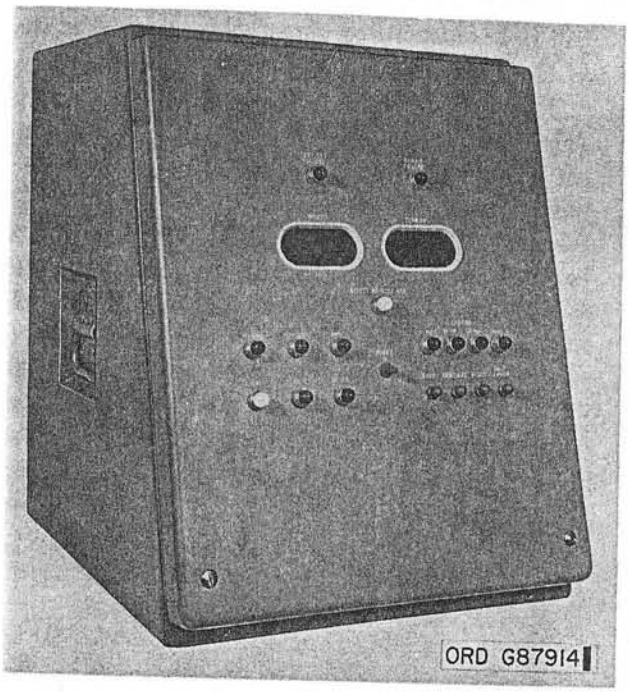


Figure 38.1 (U). Fault locating indicator (U).

43.1 (U). Fault Locating Indicator

The fault locating indicator (fig. 38.1) and its associated equipment are used to locate faulty modules in guidance set transponder-control groups (mushroom only). These transponder-control groups will have been checked previously by the NIKE-HERCULES missile RF test set group and the NIKE-HERCULES missile electrical test set group and found to be faulty.

CHAPTER 5

GUIDED MISSILE M6

Section I. PHYSICAL DESCRIPTION

44 (U). General

The NIKE-HERCULES missile, designated guided missile M6, consists of the missile body and the rocket motor cluster. Guided missile M6, mounted on a launching-handling rail, is shown erected on a Hercules monorail launcher in figure 39. The overall length of guided missile M6 is approximately 39 feet and the gross weight is approximately 10,550 pounds.

45 (U). Missile Body

a. General. The missile body (fig. 40) consists of a forward body section, a warhead body section, a rear body section, and four main fins. The missile body is approximately 27 feet long and the gross weight is approximately 5250 pounds. The maximum body diameter is 31.5 inches and the fin span is 90 inches.

b. Forward Body Section. The forward body section (fig. 40) contains the transponder-control group (1, fig. 41), the major component of the missile guidance set. Four forward fins (fig. 40) are positioned at 90-degree intervals around the circumference of the forward body section. The antenna horns (2, fig. 41) of the missile guidance set are mounted in the forward fins.

c. Warhead Body Section. The warhead body section (fig. 40) contains the warhead (3, figure 41) and associated equipment.

d. Rear Body Section. The rear body section (fig. 40) consists of the missile motor section, the equipment section, and the actuator section. The missile motor section contains the major portion of missile rocket motor M30 (4, fig. 41) and associated equipment. The equipment section contains the missile batteries and either an accessory power supply (5, fig. 41) or a hydraulic pumping unit. The actuator section contains the actuator assemblies and mechanical linkage that move the elevons. The blast tube (6, fig. 41) of missile rocket motor M30 extends through the equipment section and the actuator section to an opening in the rear of the actuator section.

e. Main Fins and Elevons. The four main fins (fig. 40) are positioned at 90-degree intervals around the circumference of the missile body. The main fins extend from the forward end of the warhead body section to the forward end of the actuator section. The four elevons are hinged to the trailing edges of the main fins and are connected to the mechanical linkage in the actuator section.

46 (U). Rocket Motor Cluster

The rocket motor cluster (fig. 40) consists of a cluster of four rocket motors M5E1, a rocket motor thrust ring, and four rocket motor cluster fins. When assembled to the missile body, the rocket motor cluster fits over the actuator section of the missile body. The overall length of the cluster is approximately 14 feet and the gross weight is approximately 5300 pounds. The maximum width (less fins) is 34 inches and the fin span is 138 inches.

Section II. FUNCTIONAL DESCRIPTION

47 (U). Aerodynamic Configuration

Guided missile M6 is an aerodynamic, supersonic missile with a symmetrical cruciform configuration. Because the center of gravity is located slightly forward of the center of pressure, the missile is inherently stable about the pitch and yaw axes. The symmetrical airfoil section of the main fins is such that an increase in the angle of attack produces a rearward movement of the center of pressure, further increasing stability and permitting operation over a wide range of velocities and missile attitudes. In addition, the symmetrical

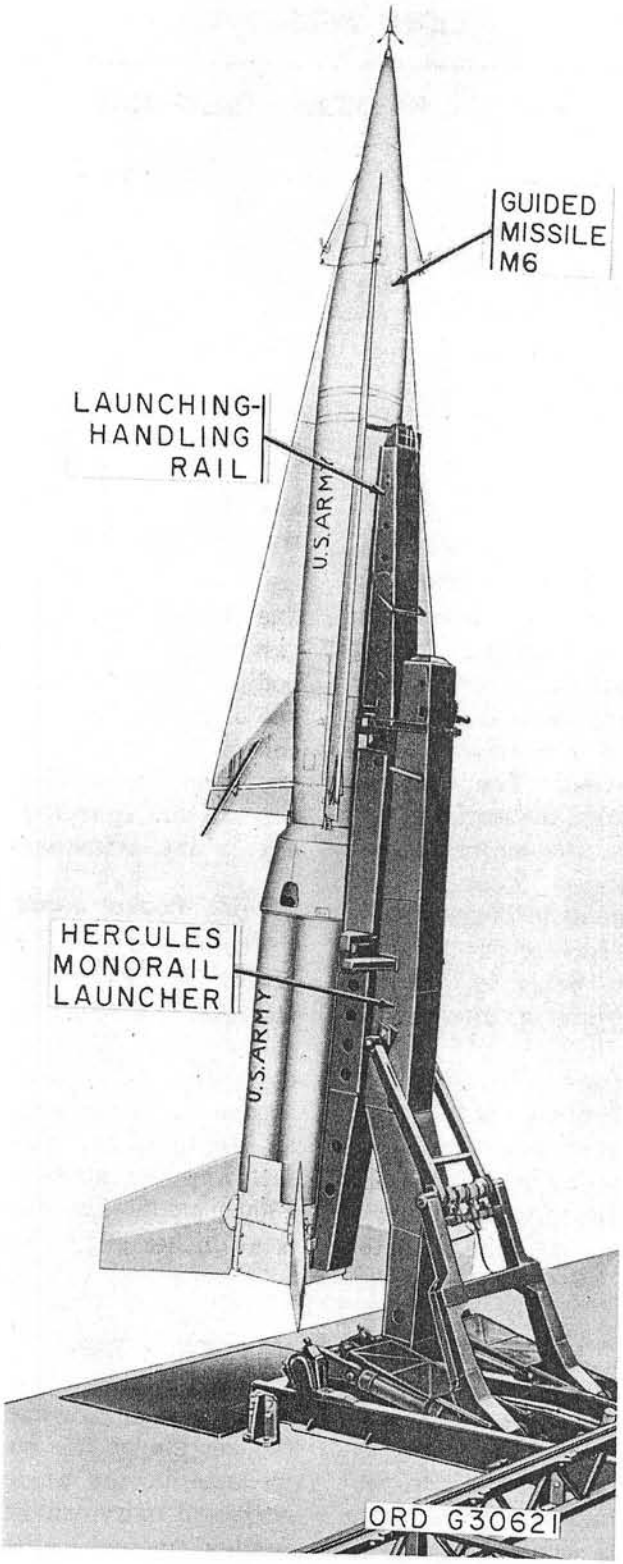


Figure 39 (U). Guided missile M6 on HERCULES monorail launcher.

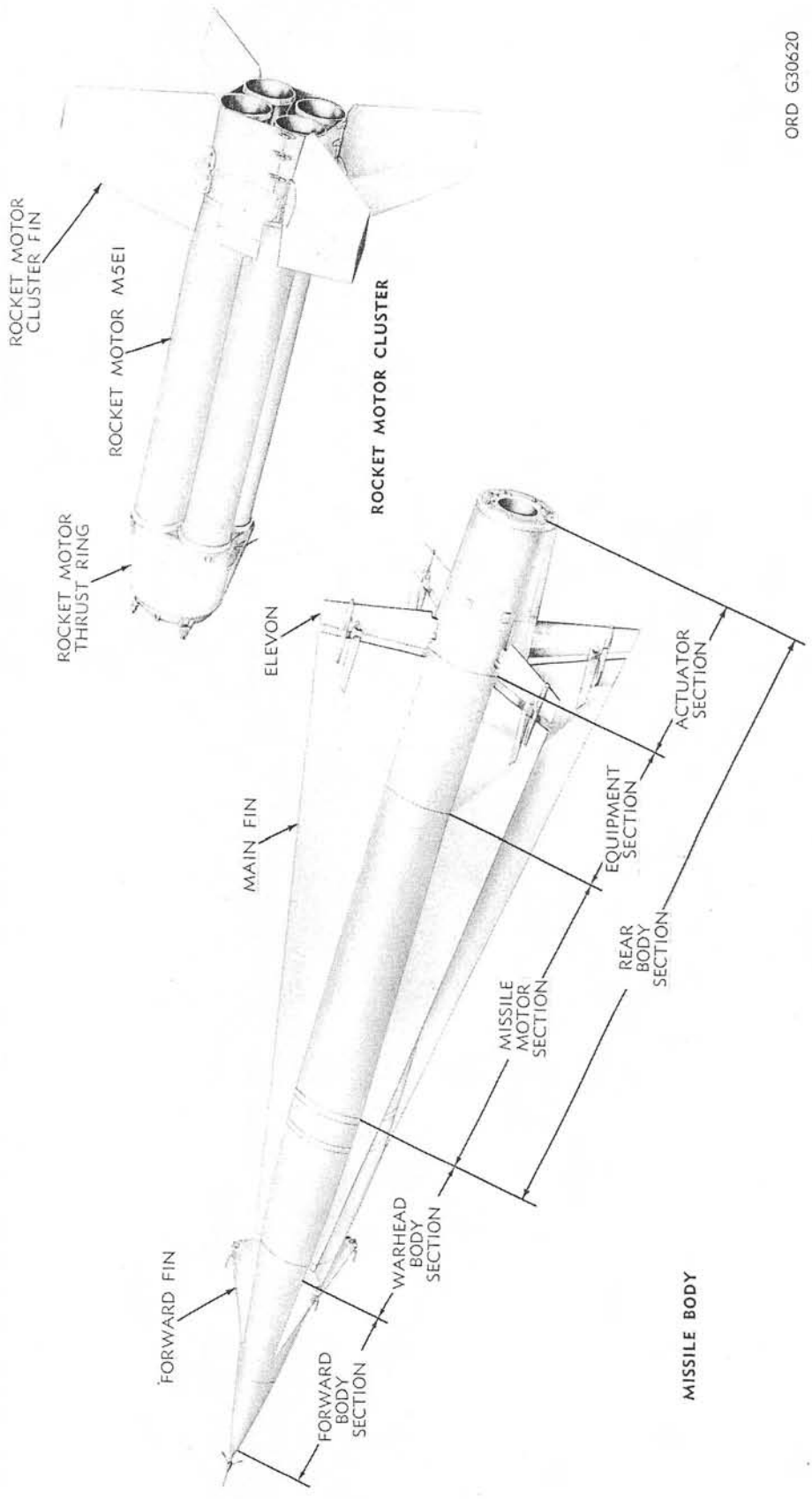
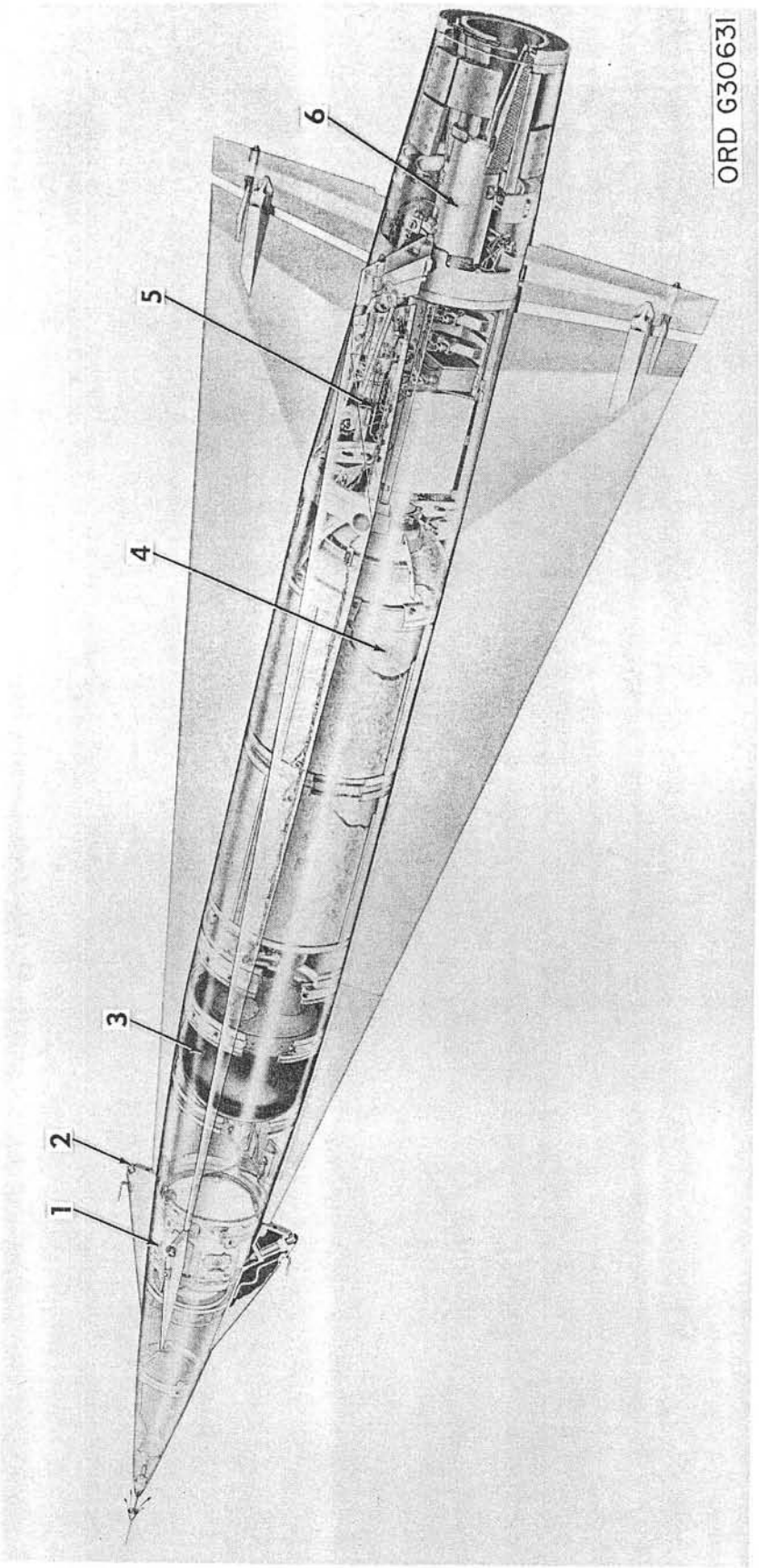


Figure 40 (U). Guided missile M6 — major components.



1. Transponder-control group
2. Antenna horn
3. Warhead
4. Missile rocket motor M30
5. Accessory power supply
6. Blast tube

Figure 41 (U). Missile body — cutaway view.

airfoil section permits quick response to guidance commands with minimum elevon deflection. The elevons are movable control surfaces on the trailing edges of the four main fins and permit control of the missile trajectory. Deflection of the elevons unbalances the lift forces produced by the main fins and causes the missile to rotate about the pitch, yaw, or roll axis, depending upon the combination of elevons deflected. The four rocket motor cluster fins, in conjunction with the main fins, stabilize the missile during the boost phase.

48 (CMHA). Missile Guidance System

a. General. The missile guidance system performs four main functions in controlling and detonating guided missile M6. First, it controls the missile trajectory in accordance with guidance commands (coded rf pulses) initiated by the computer system and transmitted to the missile by the missile tracking radar system. Second, it transmits an rf response pulse to the missile tracking radar system that enables the missile tracking radar system to track the missile. Third, it causes detonation of the missile warhead when a burst command is received. Fourth, it initiates fail-safe detonation of the warhead if ground guidance ceases or a malfunction occurs within the missile. The missile guidance system consists of four functional groups of circuits as shown in figure 42. They are the receiving and decoding circuits, steering control circuits, transmitting circuits, and command and fail-safe detonation control circuits.

b. Receiving and Decoding Circuits. Guidance commands in the form of coded rf pulse groups are transmitted by the missile tracking radar system, received at the missile by two receiving antennas, and applied to the receiving and decoding circuits. These circuits receive, amplify, and convert the coded rf pulse groups into video pulses. Video pulses produced by correctly coded rf pulse groups are decoded and applied to the steering control circuits as dc steering voltages. Video pulses produced by incorrectly coded rf pulse groups are rejected. This minimizes enemy interference and prevents the missile from responding to guidance commands intended for other missiles. The receiving and decoding circuits also produce a modulator trigger pulse each time a guidance command is received and decoded and apply this pulse to the transmitting circuits.

c. Transmitting Circuits. The transmitting circuits use the modulator trigger pulse to produce rf response pulses that are transmitted by the two transmitting antennas. When received by the missile tracking radar system, the response pulses complete the ground-air-ground link and thereby provide accurate missile tracking information. The transmitting circuits also produce hold-off pulses that are applied to the fail-safe detonation control circuits.

d. Steering Control Circuits. The steering control circuits consist of seven flight-control instruments and three steering amplifiers. These circuits receive the dc steering voltages from the receiving and decoding circuits and, in conjunction with feedback voltages developed by the flight control instruments, control operation of the elevon actuator assemblies to produce the appropriate elevon deflections. The flight control instruments enable the missile to respond smoothly to steering orders.

e. Command Detonation and Fail-Safe Control Circuits. The computer command circuits initiate detonation of the warhead by sending a burst command to the missile by way of the missile tracking radar system. Upon receipt of the burst command, the command detonation control circuits activate the warhead detonation devices. In a surface-to-surface mission, the burst command does not detonate the war-

head. Instead, the burst command arms the barometric fuze, which detonates the warhead at preset altitude above the target, and disables the fail-safe circuits. The fail-safe control circuits operate if ground guidance ceases or if a malfunction occurs within the missile. Should either condition prevail for approximately 2 seconds, causing interruption of

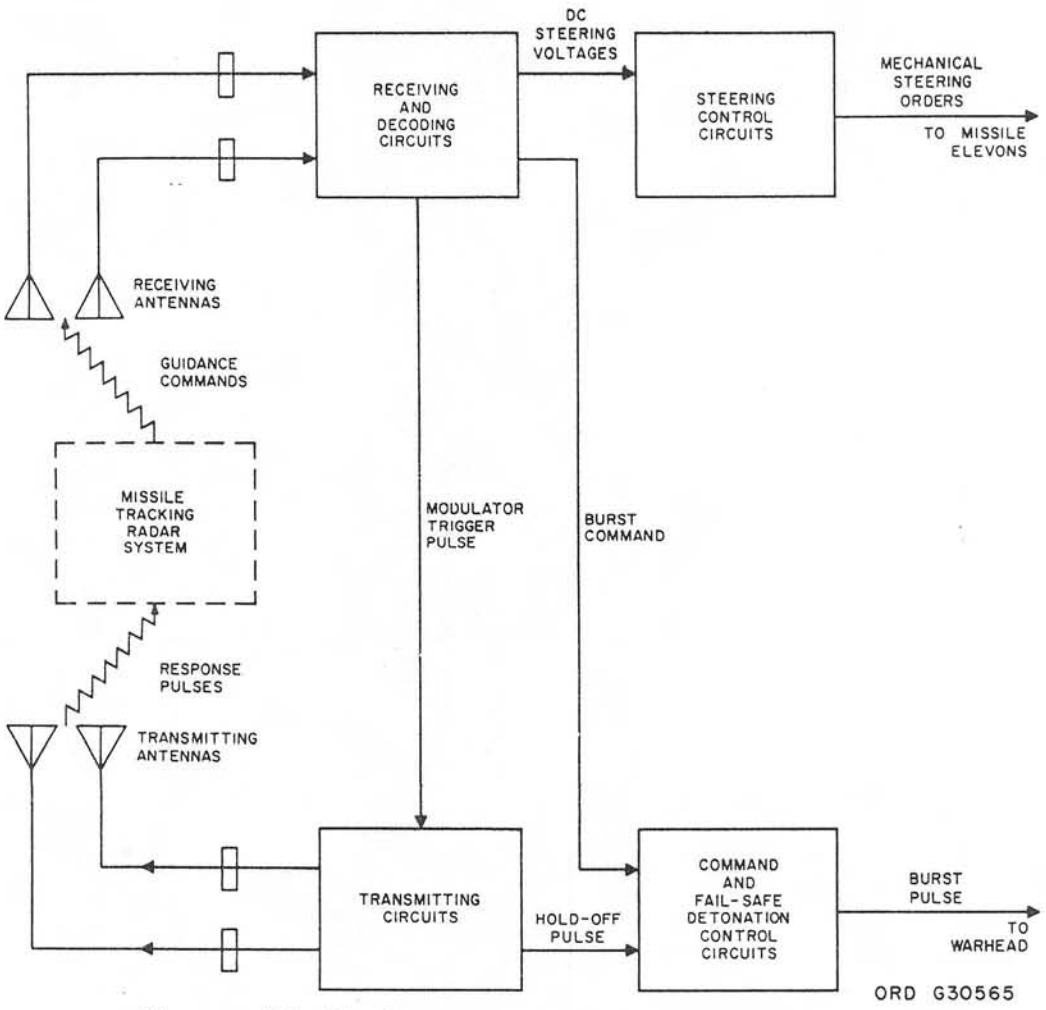


Figure 42 (U). Missile guidance system—functional block diagram.

the hold-off pulses from the transmitting circuits, the fail-safe circuits cause automatic destruction of the missile.

49 (U). Hydraulic System

The hydraulic system consists of three actuator assemblies, a mechanical linkage, and an accessory power supply or hydraulic pumping unit. The actuator assemblies are electrically controlled by the steering orders from the missile guidance set and, by means of the mechanical linkage, produce the appropriate deflections of the elevons to maneuver the missile.

Hydraulic power to the actuator assemblies is supplied by an accessory power supply (APS) in some models and by a hydraulic pumping unit (HPU) in other models. The APS uses an ethylene oxide decomposition reaction turbine to drive a hydraulic pump. The HPU uses a squib-activated battery to power a dc motor which drives a hydraulic pump.

50 (CMHA). Propulsion System

a. The propulsion system consists of the rocket motor cluster and missile rocket motor M30. The rocket motor cluster contains four rocket motors M5E1 (fig. 40) that are ignited simultaneously approximately ¼-second after the launch order to provide the initial (boost) thrust. Missile rocket motor M30 (4, fig. 41) is ignited after separation of the cluster to provide thrust during the controlled flight period. Both missile rocket motor M30 and rocket motor M5E1 are solid propellant motors.

b. At burnout of the rocket motor cluster, the greater aerodynamic drag of the cluster causes it to fall away (separate) from the missile body. Separation pulls a lanyard linking the cluster to the missile body. The lanyard activates thermal batteries that provide the current to ignite the initiators of missile rocket motor M30.

c. In a surface-to-air or surface-to-surface mission, the rocket motor initiators are ignited approximately 3/4-second after separation. In a surface-to-air low altitude mission, a motor start delay timer relay prevents the thermal battery current from igniting the rocket motor initiators until 9 seconds after liftoff. By means of the delayed motor start, missile velocity is reduced and a shorter turning radius and lower initial altitude are obtained.

d. Firing of the missile rocket motor initiators is prevented before the boost period by a safety and arming switch which applies a short circuit across the initiators and opens the circuit from the thermal batteries. During the boost period, the force of acceleration arms the switch, thereby removing the short circuit from the initiators and completing the circuit from the thermal batteries.

e. The rocket motor cluster produces 173,600 pounds of thrust and has a burn time of 3.4 seconds. Missile rocket motor M30 produces 13,500 pounds of thrust and has a burn time of 29 seconds.

51 (CMHA). Warhead System

a. The family of warheads to be used with guided missile M6 includes one fragmentation (warhead T45) and two nuclear types. Information on the nuclear warheads is not presented in this manual because of the security classification of this material.

b. Warhead T45 (fig. 43) consists of approximately 20,000 cubical, 140-grain, steel fragments arranged in single and double layers around a 625-pound explosive charge and a warhead booster. Detonation of the warhead is initiated by a burst pulse from the missile guidance set. The burst pulse ignites a small explosive charge in two safety and arming devices M30A1. These charges ignite two explosive harnesses M38. The explosive harnesses detonate the warhead booster which in turn detonates the warhead charge. The safety and arming devices M30A1 cannot be fired until they are armed by the force of acceleration during the boost period. The fragment distribution (blast pattern) of warhead T45 (fig. 44) is approximately spherical with a conical dead zone to the rear.

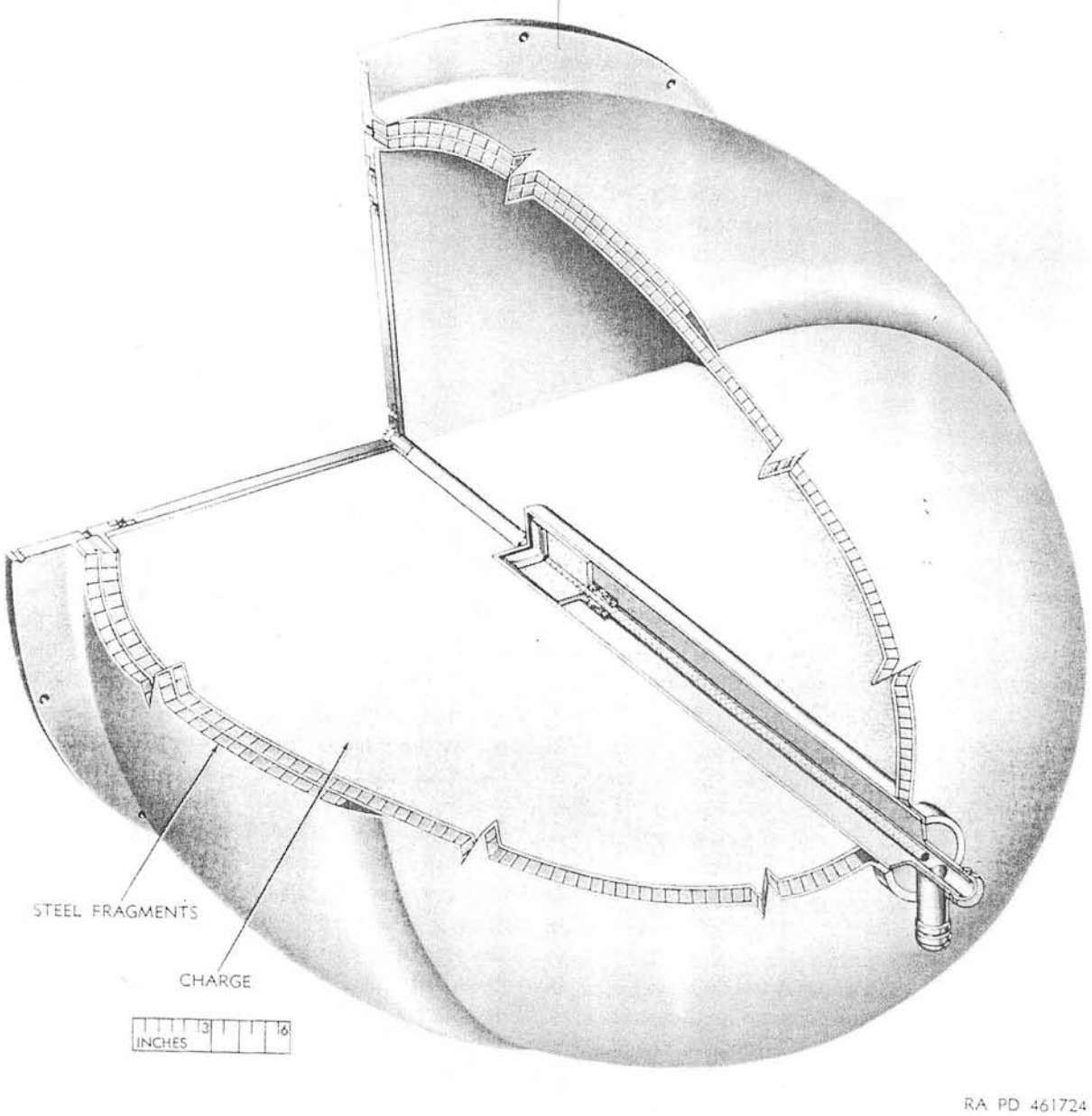


Figure 43 (CMHA). Warhead T45 — cutaway view.

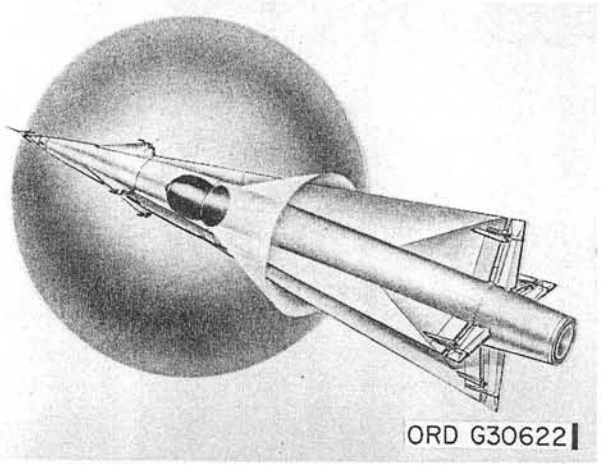


Figure 44 (CMHA). Warhead T45 — blast pattern.

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CHAPTER 6

ASSEMBLY AND SERVICE AREA EQUIPMENT

Section I. OVERALL FUNCTION

52 (U). Scope

This section explains the overall function of the assembly and service area and outlines the normal procedure in the handling of NIKE-HERCULES and NIKE-AJAX missiles, from uncrating of the missile components to delivery of the missiles to the launching area.

53 (U). Assembly Area

a. The major components of the NIKE-HERCULES missile (guided missile M6) are received in the assembly area (fig. 45) in shipping containers. The forward body section (fig. 40) and the rear body section are received in the same pressurized metal container. The warhead body section is received in a separate pressurized metal container. The main fins and elevons, the rocket motor cluster fins and accessories, the rocket motor cluster (less fins), and missile rocket motor M30 (4, fig. 41) are received in individual wooden containers. The rocket motor igniters M24A1, missile rocket motor initiators, missile batteries, and other small components are received in individual cartons or cans.

b. The rear body section (fig. 40) and the forward body section of guided missile M6 are uncrated, and the rear main fins and elevons are uncrated and installed on the rear body section. The forward body section is temporarily installed on the rear body section, the accessory power supply (5, fig. 41) or hydraulic pumping unit is serviced, and functional tests are performed on the missile electrical, guidance, and hydraulic systems. At completion of these tests, the accessory power supply or hydraulic pumping unit is again serviced and the missile is taken to the service area (fig. 45) for installation of missile rocket motor M30 (4, fig. 41) and the warhead body section (fig. 40). The warhead body section, rocket motor cluster, missile rocket motor M30, and associated components are taken to the service area and are not uncrated until they are ready to be assembled or joined to the missile.

c. The missile body of the NIKE-AJAX missile (guided missile M1) is received in the assembly area completely assembled except for installation of the warheads and fins. After uncrating, the fins are attached and functional tests are performed. The missile body is then transported to the service area for warhead installation and propellant fueling.

54 (U). Service Area

a. The warhead body section (fig. 40), rocket motor cluster, and missile rocket motor M30 (4, fig. 41) of guided missile M6 are uncrated in the service area (fig. 45). The rocket motor cluster is assembled on the rocket motor cluster truck (fig. 46) with the exception of the two lower rocket motor cluster fins which are stored in the lower part of the truck for assembly on the cluster after it is transported to the launching area. A continuity test of rocket motor igniters M24A1 is performed prior to installation. After this test, the rocket motor cluster is transported to the launching area either on the rocket motor cluster truck or on the missile body or rocket motor cluster transporter adapter (fig. 46) mounted on missile flat-bed trailer M261A1 (fig. 47). At the launching section, the rocket motor cluster is removed from the truck or adapter with a hoisting device and the cluster is secured to a launching-handling rail (fig. 33).

b. The forward body section (fig. 40) is removed from the rear body section to permit installation of missile rocket motor M30 (4, fig.

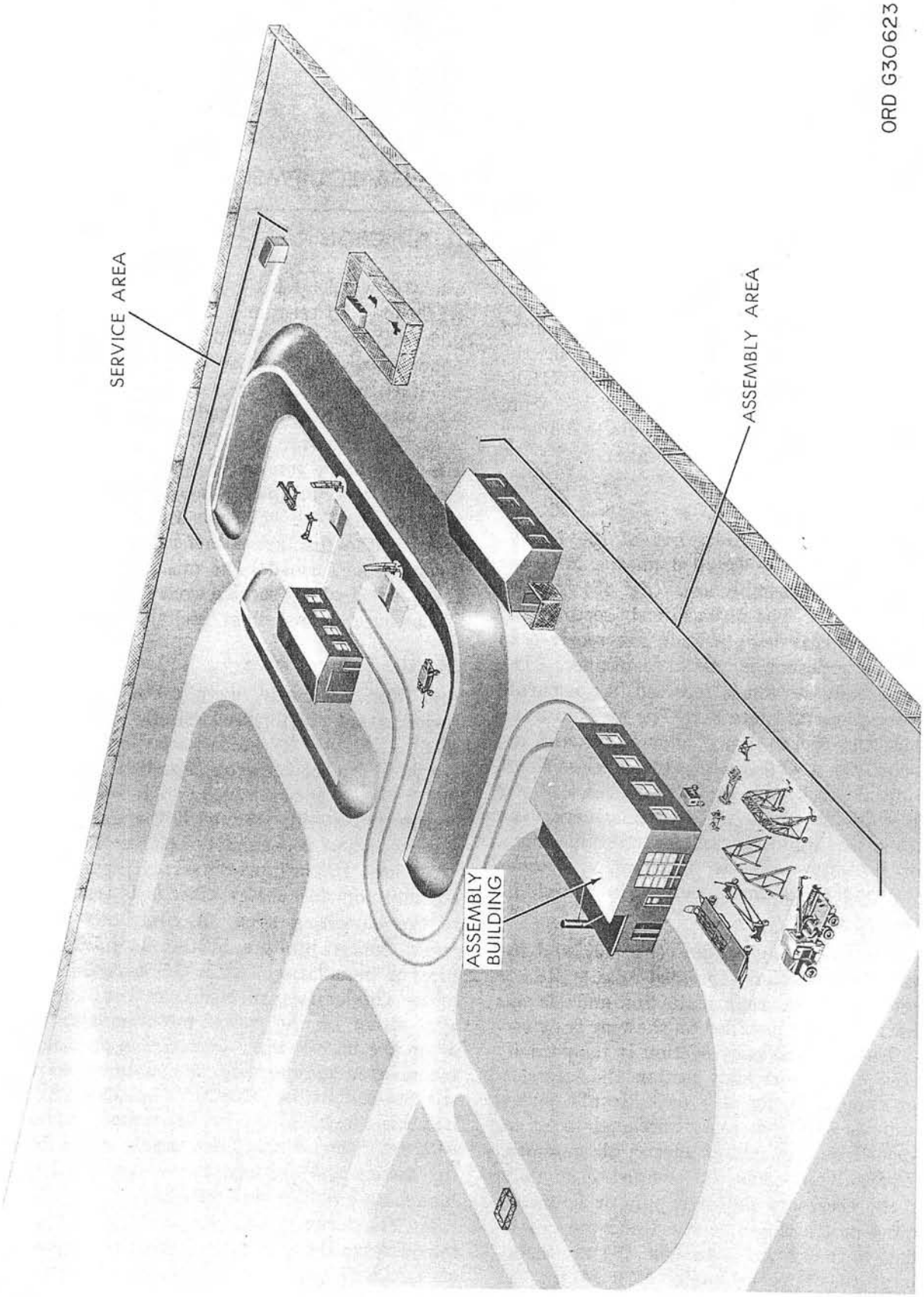


Figure 45 (U). Assembly and service area — typical layout.

41) and the warhead body section (fig. 40). After the motor and warhead body section are installed, the forward body section is installed, and the missile body is transported to the launching area either on the Hercules missile body truck (fig. 46) or on the missile body or rocket motor cluster transporter adapter mounted on missile flat bed trailer M261A1 (fig. 47). At the launching section, the missile body is removed from the missile truck or transporter adapter with the Hercules missile body hoist beam (fig. 50) attached to a hoisting device. The missile body is then joined to the rocket motor cluster and secured to the launching-handling rail. After the missile body is joined to the rocket motor cluster, the lower rocket motor cluster fins, rocket motor igniters M24A1, and the safety and arming devices M30A1 are installed.

c. The booster rocket motor for the NIKE-AJAX missile (guided missile M1) is attached to a launching-handling rail on missile flat bed trailer M261A1, and the missile body is joined to the rocket motor. A continuity check of the propulsion system is performed, the missile is fueled, the warheads are installed, and the missile is transported to the launching area where it is transferred from missile flat bed trailer M261A1 to the loading racks at the launching section. There the lower booster fins, safety and arming devices, and nose closure fitting are installed and starting mixture is added.

Section II. EQUIPMENT

55 (U). Scope

This section describes briefly the function of the handling and test equipment used primarily in the assembly and service area to uncrate, assemble, and test guided missile M6.

56 (U). Handling Equipment

a. Hercules Missile Body Truck. The Hercules missile body truck (fig. 46), in conjunction with the Hercules handling ring segments (fig. 50), is used to support the rear body section (fig. 40) after its removal from the shipping container and during assembly and testing. The truck can be used to transport the rear body section from the assembly area to the service area and to transport the missile body from the service area to the launching area.

b. Forward Body Section Truck. The forward body section truck (fig. 46) is used to hold the forward body section (fig. 40) during assembly of the missile.

c. Rocket Motor Cluster Truck. The rocket motor cluster truck (fig. 46) is used for assembly of the rocket motor cluster (fig. 40) and can be used to transport the cluster from the service area to the launching area. It can also be used to transport a launching-handling rail (fig. 33), a missile body or rocket motor cluster transporter adapter (fig. 46), or a missile body (fig. 40).

d. Missile Body or Rocket Motor Cluster Transporter Adapter. The missile body or rocket motor cluster transporter adapter (fig. 46) is used to support the missile body (fig. 40) or the rocket motor cluster while transporting either unit from the service area to the launching area.

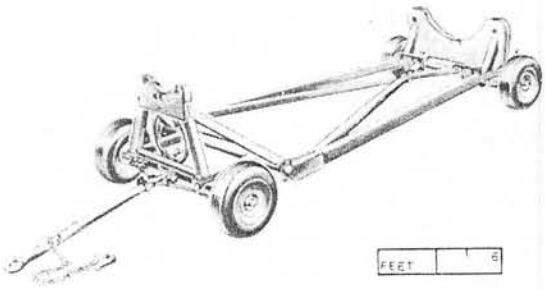
e. Missile Flat Bed Trailer M261A1. Missile flat bed trailer M261A1 (fig. 47) is used in conjunction with the missile body or rocket motor cluster transporter adapter (fig. 46) to transport a missile body (fig. 40) or rocket motor cluster from the service area to the launching area.

f. Trailer Mounted Power Driven Reciprocating Compressor. The trailer mounted power driven reciprocating compressor (fig. 47) is used to provide clean dry air for servicing the accessory power supply (5, fig. 41) or hydraulic pumping unit.

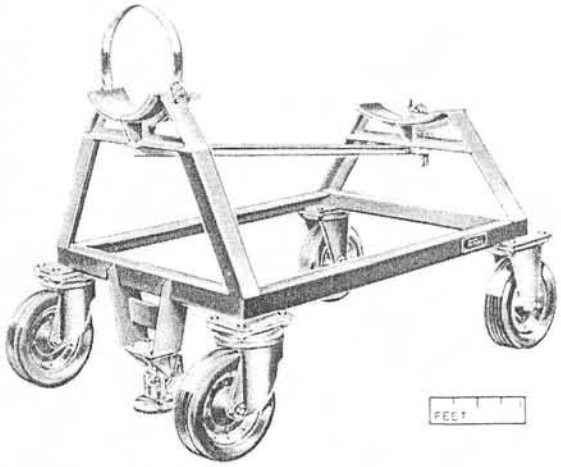
g. APS Filler and Service Equipment. The APS filler and service equipment (fig. 47) includes pressure tanks of ethylene oxide and nitrogen and the necessary valves and hoses for servicing the accessory power supply (5, fig. 41).

h. Handling Rack. The handling rack (fig. 47) is used to store a missile body (fig. 40) or a rocket motor cluster when either is mounted on a missile body or rocket motor cluster transporter adapter (fig. 46). The handling rack may also be used to store the transporter adapter when the adapter is not in use.

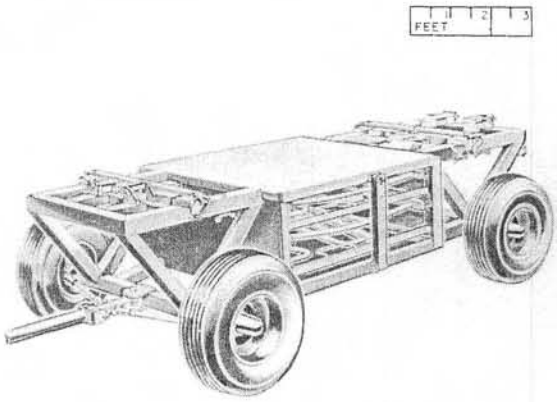
i. Battery Charging Rack MT-1498/G. Battery charging rack MT-1498/G (fig. 48) is used



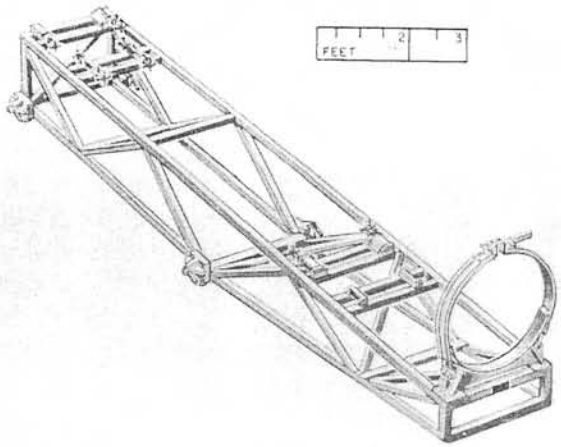
HERCULES MISSILE BODY TRUCK



FORWARD BODY SECTION TRUCK



ROCKET MOTOR CLUSTER TRUCK



MISSILE BODY OR ROCKET MOTOR CLUSTER TRANSPORTER ADAPTER

ORD G30624

Figure 46 (U). Handling equipment.

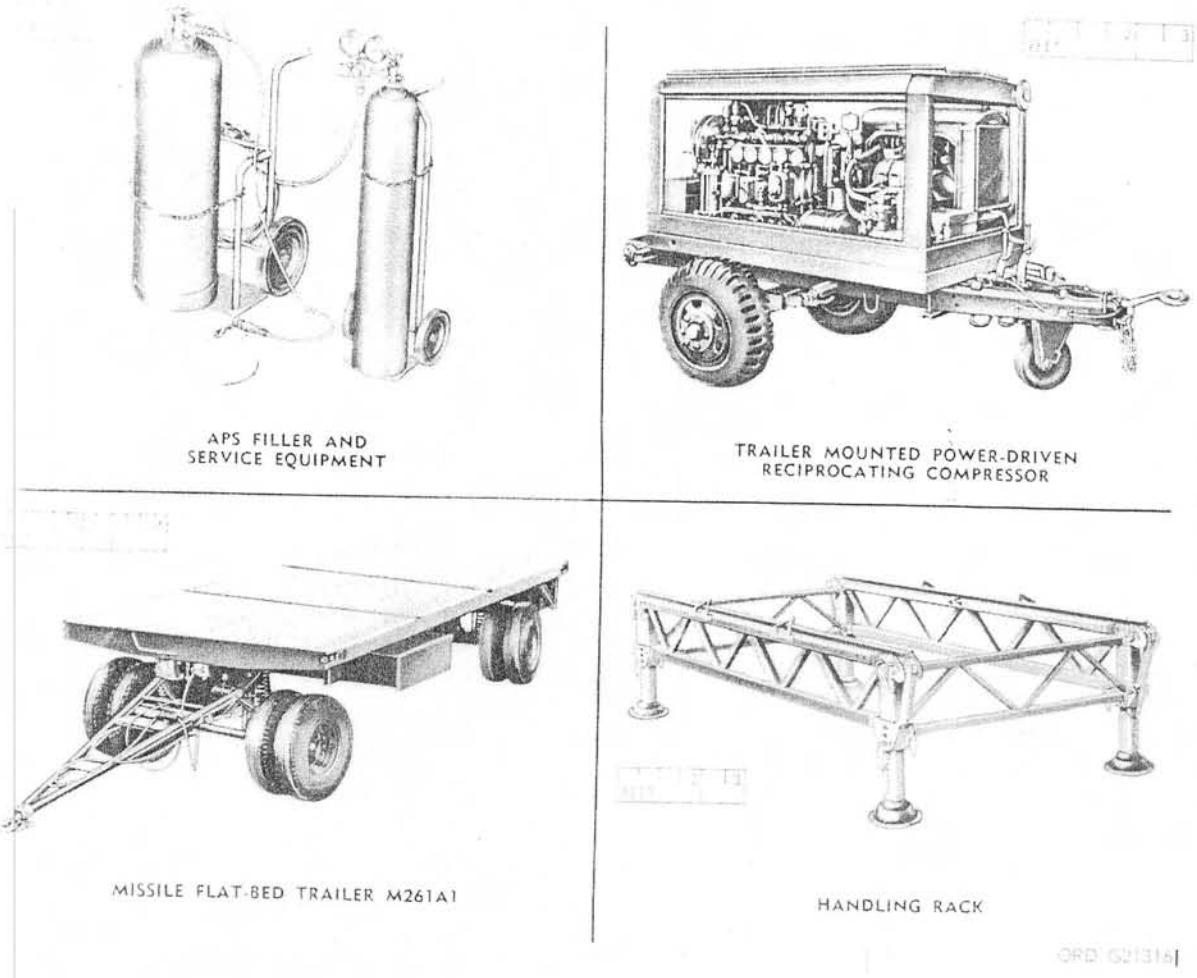


Figure 47 (U). Handling equipment.

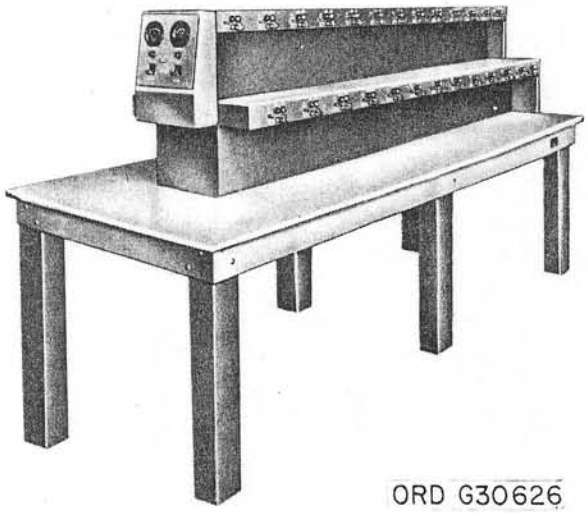


Figure 48 (U). Battery charging rack MT-1498/G.

to support and monitor missile batteries while they are being charged.

Note. Battery charging is required only on the chargeable storage batteries used in missiles prior to serial number 13684. Missiles 13684 and subsequent use squib batteries that do not require charging.

j. Portable Hoisting Unit. The portable hoisting unit (fig. 49) is used with the appropriate hoist beams to hoist and position missile components during assembly and joining operations.

k. Rocket Motor Cluster Hoist Beam. The rocket motor cluster hoist beam (fig. 50) is used to lift the rocket motor cluster (fig. 40) from the rocket motor cluster truck (fig. 46) to missile flat bed trailer M261A1 (fig. 47) or to a launching-handling rail (fig. 33).

l. Hercules Missile Body Hoist Beam. The Hercules missile body hoist beam (fig. 50) is used to lift the missile body (fig. 40) from the Hercules missile body truck (fig. 46) onto missile flat bed trailer M261A1 (fig. 47) or a launching-handling rail (fig. 33).

m. Rear Body Section Hoist Beam. The rear body section hoist beam (fig. 50) is used for transferring the rear body section (fig. 40) from the shipping container to the Hercules missile body truck (fig. 46).

n. Warhead Body Section Hoist Beam. The warhead body section hoist beam (fig. 50) is used to support and position the warhead body section (fig. 40) during installation of the warhead body section in the missile body.

o. Missile Rocket Motor Hoist Beam. The missile rocket motor hoist beam (fig. 50) is used to remove missile rocket motor M30 (4, fig. 41) from the shipping container and to support the motor while it is being installed in the missile body.

p. Ajax Rocket Motor Hoist Beam. The Ajax rocket motor hoist beam (fig. 50) is used to support rocket motor M5E1 (fig. 40) during assembly of the rocket motor cluster.

q. Hercules Handling Ring Segment. Four Hercules handling ring segments (fig. 50) are assembled to the rear body section (fig. 40) before the rear body section is placed on the Hercules missile body truck (fig. 46). The ring formed by the four segments rides on rollers at one end of the truck, permitting rotation of the rear body section for installation of the rear main fins and for other assembly and maintenance operations.

r. Power Supply Truck. The power supply truck (fig. 51) is used to provide electrical power for operating the hydraulic pumping unit during air and oil servicing and missile electrical checkout.

57 (U). Assembly Area Hercules Missile Test Set

The assembly area Hercules missile test set (fig. 52) includes the Hercules missile RF test set group (1, fig. 52), the Hercules missile electrical test set group (2, fig. 52), and the test adapter (3, fig. 52). The Hercules missile RF test set group generates rf signals that simulate guidance commands to test the response of the missile guidance set and hydraulic system. The rf signals are coupled to the missile antennas by means of the test adapter and waveguides. The Hercules missile RF test set group also provides various calibration and measurement circuits. The Hercules missile electrical test set group provides facilities for testing the servo systems and power supplies in the missile. The Hercules missile electrical test set group is used during servicing and hot run of the accessory power supply and, in conjunction with the Hercules missile RF test set group, during the missile electrical checkout.

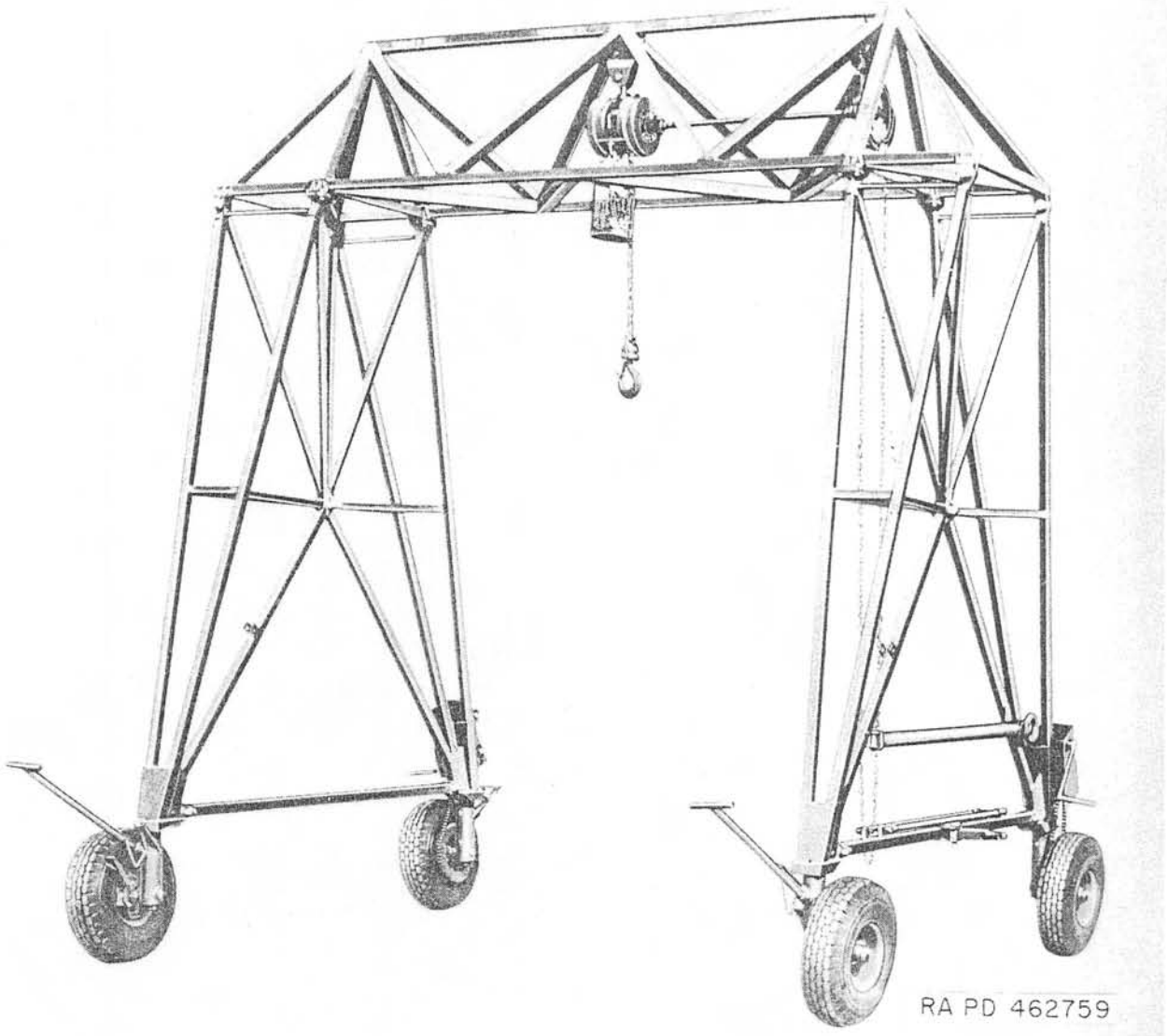
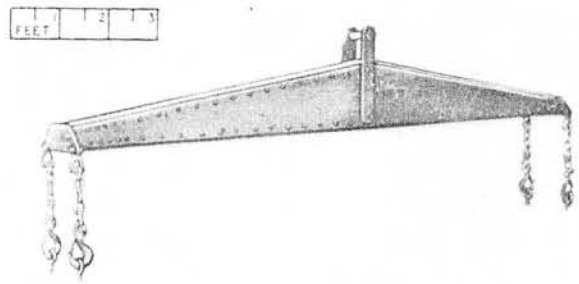
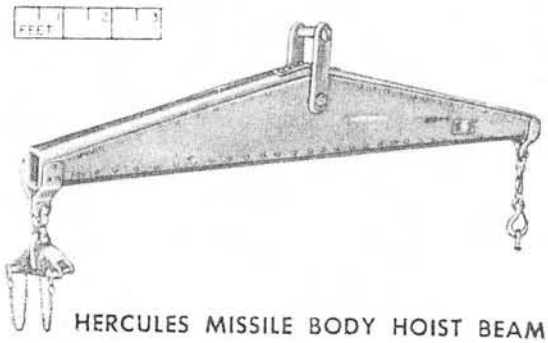


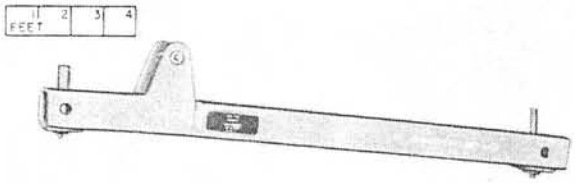
Figure 49 (U). Portable hoisting unit.



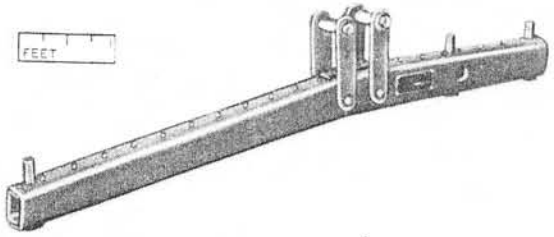
ROCKET MOTOR CLUSTER HOIST BEAM



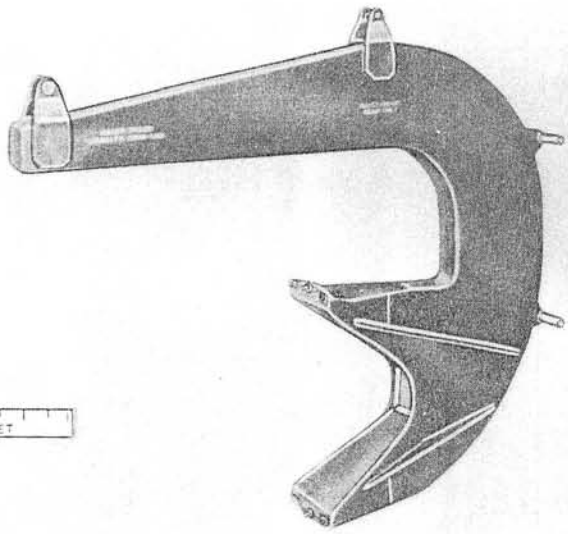
HERCULES MISSILE BODY HOIST BEAM



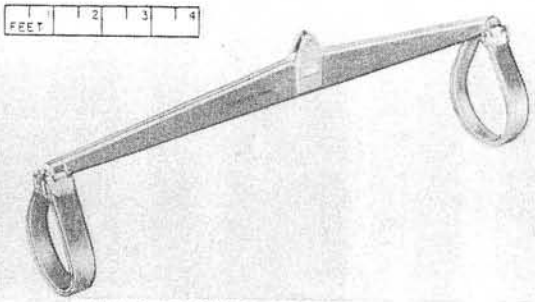
REAR BODY SECTION HOIST BEAM



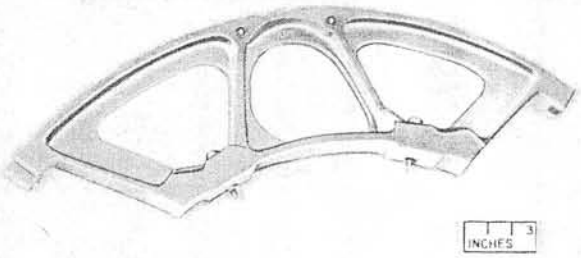
WARHEAD BODY SECTION HOIST BEAM



MISSILE ROCKET MOTOR HOIST BEAM



AJAX ROCKET MOTOR HOIST BEAM



HERCULES HANDLING RING SEGMENT

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Figure 50 (U). Hoist beams and handling ring segment.

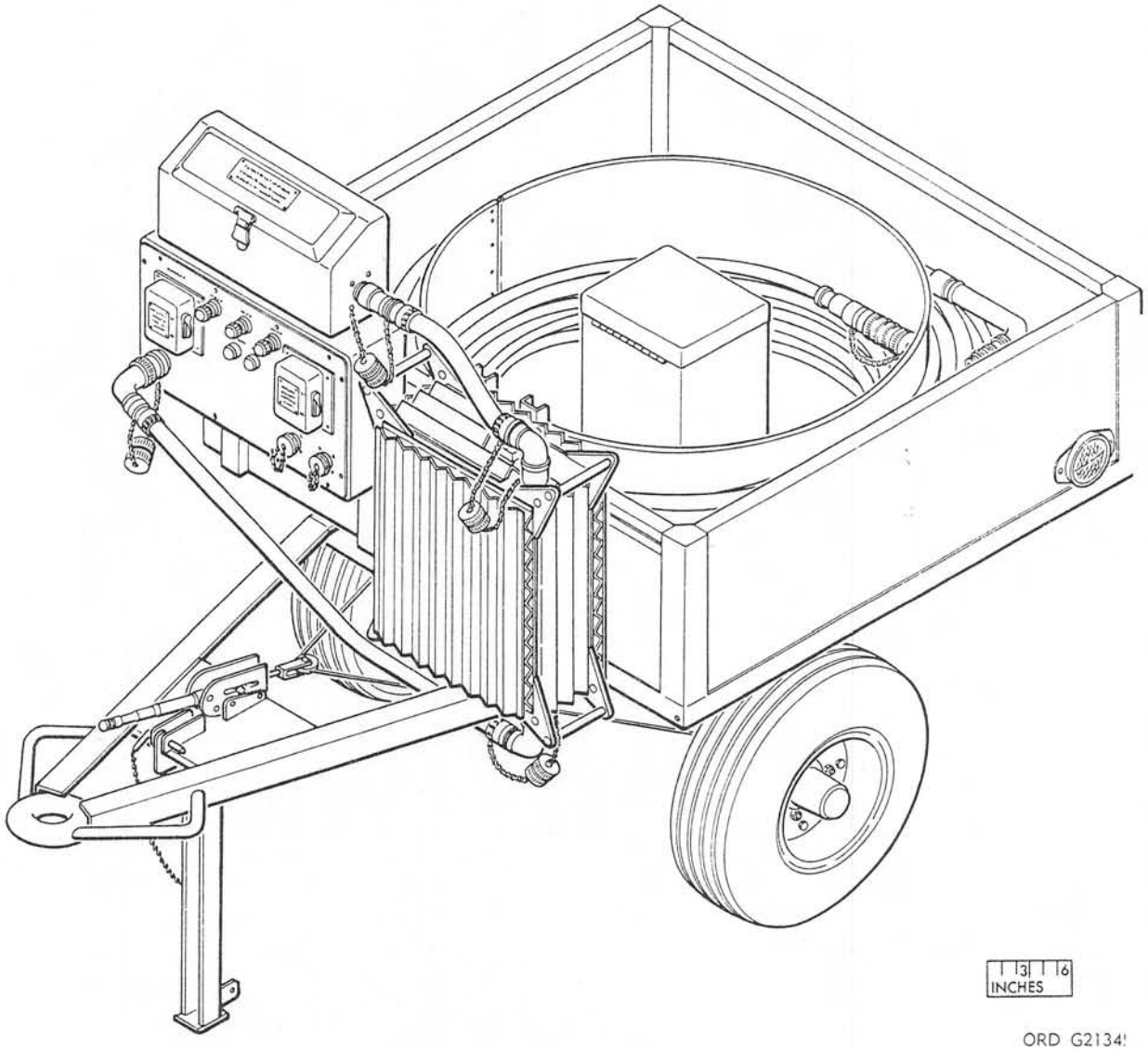
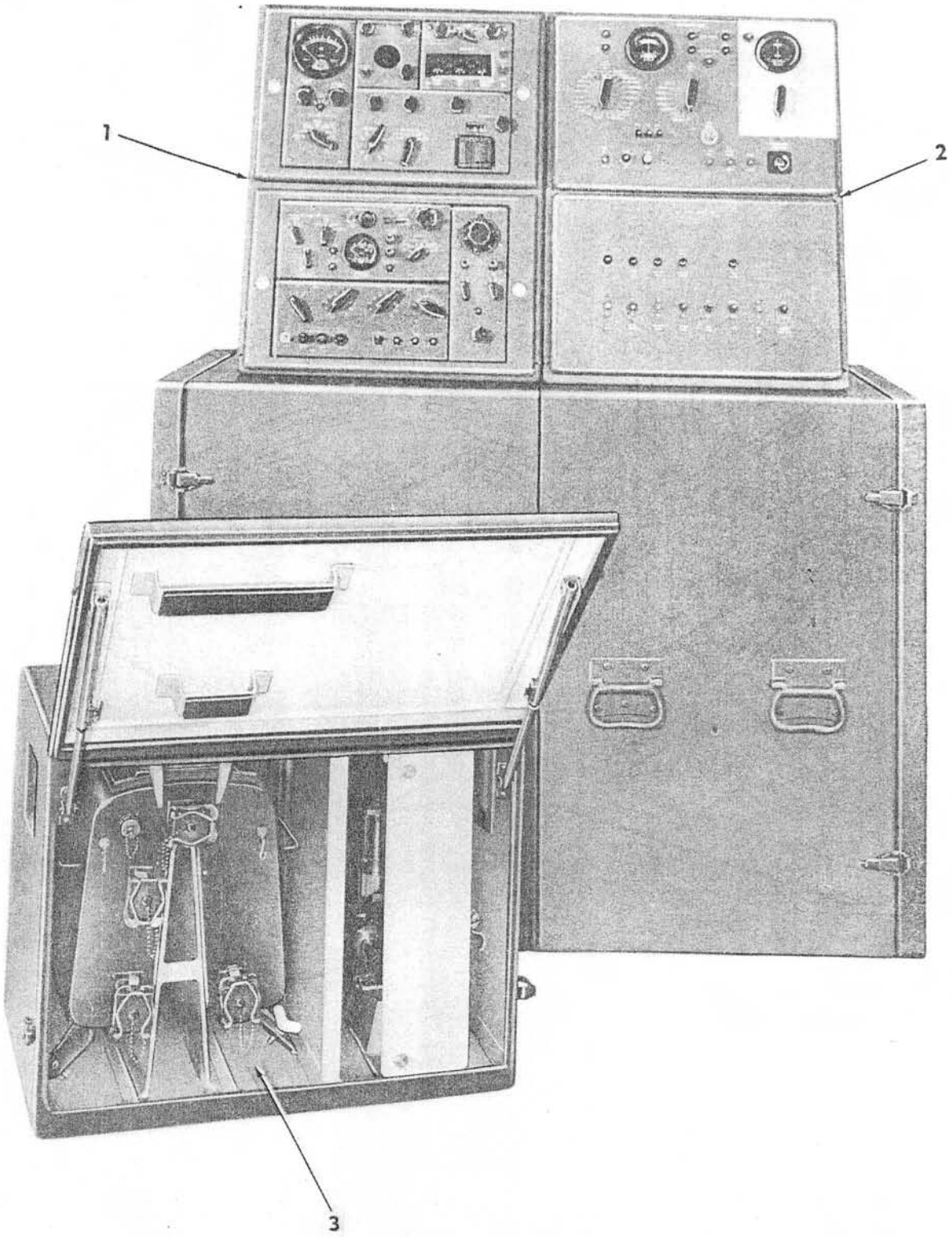


Figure 51 (U). Power supply truck.



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1. HERCULES missile RF test set group
2. HERCULES missile electrical test set group
3. Test adapter

Figure 52 (U). Assembly area HERCULES missile test set.

CHAPTER 7 (C)

TACTICAL CONTROL

Section I (C). PRINCIPLES OF TACTICAL CONTROL

58 (U). General

To provide the most efficient control and operation of the Improved NIKE–HERCULES System or the NIKE–HERCULES ATBM System during an engagement, full responsibility for tactical control is assigned to a battery control officer. Tactical control is facilitated by placing controls, indicators, and plotting boards required for direction of the system at the disposal of the battery control officer. These controls, indicators, and plotting boards are located in the trailer mounted director station. The battery control officer must assume the eight responsibilities described in paragraphs 59 through 66 below. When the system is operating in integration with the Army Air Defense Command Post (AADCP), the AADCP provides tactical control for the defense area and designates targets, missions, and missiles.

59 (U). Determination and Establishment of Equipment Status

During operation, the battery control officer must have the battery ready to fire as soon as the target is within range. In order to accomplish this efficiently, he must keep informed of the tactical situation and establish the required equipment status at the appropriate time. He determines the required equipment status from information provided by the acquisition radar displays and the plotting boards. He establishes the required equipment status by means of controls on the battery control console. Equipment status lights indicate to each operator the prevailing equipment status.

60 (U). Selection of Targets for Engagement

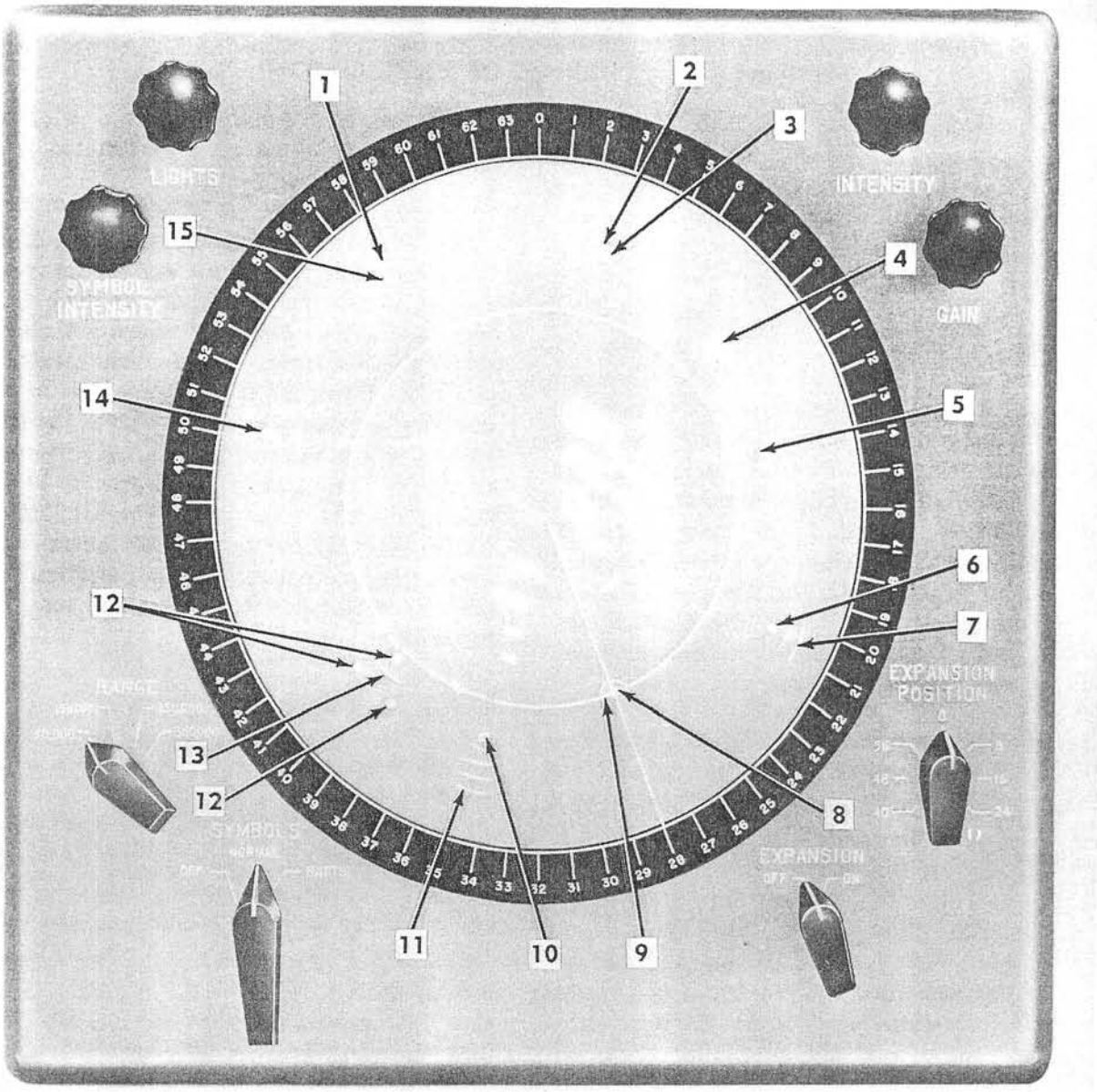
The battery control officer evaluates the threat to the defended area and assigns priority to the targets to be engaged. The battery control officer continuously surveys the tactical situation on the plan position indicator (PPI) or PPI's. When the battery operates under the direction of remote AADCP control, the battery control officer interprets the AADCP symbols on the PPI and assigns the target to be designated. In the event that several Improved NIKE–HERCULES Systems are emplaced with overlapping defense areas, the selection of targets is coordinated to realize the total firing capability.

61 (C). Identification of Targets

Note. The key numbers shown in parentheses in *a* and *b* below refer to figure 53 except where otherwise indicated.

Note. The AADCP and SIF/IFF symbols which appear on the PPI's in the NIKE–HERCULES ATBM System are identical to the symbols which appear on the PPI in the IMPROVED NIKE–HERCULES System. The PPI's however differ in appearance.

a. AADCP Identification. When the Improved NIKE–HERCULES System is operated in conjunction with the Missile Master System, identification of acquisition radar return signals is made automatically for the battery control officer by means of



ORD G62101

1- IFF mode symbol (SIF/IFF)
2- Friend symbol
3- Return signal
4- Battery engagement symbol
5- Battery ground position symbol
6- Return signal
7- PI mode symbol (SIF/IFF)
8- Return signal
9- Designated target symbol
10- Return signal
11- Emergency mode symbol (SIF/IFF)
12- Return signals
13- FLI mode symbols (SIF/IFF)
14- Return signal
15- Return signal

Figure 53 (C). PPI display—SIF/IFF and AADCP symbols (U).

AADCP symbols appearing over the return signal on the PPI. The battery control officer interprets the AADCP symbols, selects a target, and directs the acquisition radar operator to designate the target to the target tracking operators. An upper semicircle appearing over a return signal on the PPI is a friend symbol (2) and indicates that the return signal is from a friendly aircraft. A 330-degree arc is the battery ground position symbol (5). When a target is assigned to the battery for engagement, the battery ground position symbol moves over the return signal (8) of the designated target. The 330-degree arc is then the designated target symbol (9). When another battery is assigned a target, a defocused spot appears over the return signal of the target as the battery engagement symbol (4). Identification of targets is also provided by information supplied to the early warning plotting board operator by the Missile Master System.

b. SIF/IFF Identification. The battery control officer may instruct the acquisition radar operator to interrogate an unidentified aircraft, using the selective identification feature/identification friend or foe (SIF/IFF) equipment associated with the acquisition radar systems. The SIF/IFF interrogation is used only when other sources of identification are not available. The battery control officer has the responsibility of deciding whether the aircraft is friendly or hostile. If the correct response is received from the aircraft after SIF/IFF interrogation, a symbol appears on the PPI adjacent to the return signal of the interrogated aircraft, indicating that the aircraft is friendly. If the symbol does not appear on the PPI, the aircraft is considered hostile. If the battery control officer should subsequently determine a target to be friendly, he can manually cancel the engagement at any time before intercept. Because it is possible that a hostile aircraft carrying IFF equipment and employing passive countermeasures could transmit the proper response signals, the battery control officer must use every available means to identify the aircraft correctly. The four modes of SIF/IFF interrogation are described in (1) through (4) below.

(1) *IFF mode.* The identification friend or foe (IFF) mode is intended for general use and is used except when a definite need arises for using one of the other modes. When an unidentified aircraft is interrogated in the IFF mode and responds correctly, a single line appears on the PPI as the IFF mode symbol (1) adjacent to the return signal (15) of the interrogated aircraft.

(2) *PI mode.* The personal identification (PI) mode requires a more complex response from the interrogated aircraft and thereby increases the difficulty for an enemy aircraft to respond correctly. When an unidentified aircraft is interrogated in the PI mode and responds correctly, two parallel lines appear on the PPI as the PI mode symbol (7) adjacent to the return signal (6) of the interrogated aircraft.

(3) *FLI mode.* The flight leader identification (FLI) mode enables one aircraft in a group of aircraft to respond for the entire group. When a group of aircraft is interrogated in the FLI mode and the correct response is received, a single line appears on the PPI as the FLI mode symbol (13) adjacent to one of the return signals (12) of the interrogated group of aircraft.

(4) *Emergency mode.* The emergency mode is employed when the most positive identification is required. The emergency mode consists of the other three SIF/IFF modes used simultaneously. When an unidentified aircraft is interrogated in the emergency mode and responds correctly, four parallel lines appear on the PPI as the emergency mode symbol (11) adjacent to the return signal (10) of the interrogated aircraft.

62 (U). Designation of Target

a. In the Improved NIKE-HERCULES System, the target selected for engagement is verbally designated by the battery control officer to the acquisition radar operator. The acquisition radar operator, at the proper time, signals the three tracking radar operators to acquire and track the target. When the target is being tracked, the target tracked signal is sent to the battery control console.

b. In the NIKE-HERCULES ATBM System, after the target has been acquired, the target is designated to the target tracking radar at the proper time. When the target is acquired and is being tracked, the target tracked signal is sent to the fire control-indicator on the battery control console.

63 (U). Designation of Mission-Warhead Combination

a. In the Improved NIKE-HERCULES System,the battery control officer is responsible for designating missiles of the proper mission-warhead combination. There are two possible missions he can select: surface-to-air and surface-to-surface. There are four possible warheads he can select: A NIKE-AJAX high-explosive warhead, which is the only type used in NIKE-AJAX missiles; a NIKE-HERCULES high-explosive warhead; a small nuclear warhead; and a large nuclear warhead. The battery control officer designates the mission-warhead combination that is appropriate for the target to be engaged. The following combinations of missions and warheads can be designated:

Mission	*Warhead*
Surface-to-air	NIKE-AJAX high-explosive NIKE-HERCULES high-explosive NIKE-HERCULES small nuclear or NIKE-HERCULES large nuclear
Surface-to-surface	NIKE-HERCULES small nuclear or NIKE-HERCULES large nuclear

The destructive power of the nuclear warhead prohibits its use at low altitudes. Before a missile equipped with a nuclear warhead is fired in a surface-to-air mission, the battery control officer directs the computer operator to set into the computer system, minimum burst altitude values that allow the computer system to establish the minimum burst altitude that is safe for the terrain under the predicted intercept point.

b. In the NIKE-HERCULES ATBM System, there are three possible missions: surface-to-air antiaircraft, surface-to-air antimissile, and surface-to-surface. The following combinations of missions and warheads can be designated:

Mission	*Warhead*
Surface-to-air antiaircraft (A-A)	NIKE-AJAX high-explosive NIKE-HERCULES high-explosive NIKE-HERCULES small nuclear or NIKE-HERCULES large nuclear
Surface-to-air antimissile (A-M)	NIKE-HERCULES high explosive, small nuclear, and large nuclear
Surface-to-surface	NIKE-HERCULES small nuclear or large nuclear

64 (U). Firing of Missile

Probably the most important responsibility of the battery control officer is the firing of the missile. Tactical signal lights and the horizontal and altitude plotting boards provide the battery control officer with the information necessary to determine the proper time to fire. The tactical signal lights indicate that events to be performed prior to firing have been accomplished. The horizontal plotting board indicates the range and azimuth of the target and the

predicted intercept point. The altitude plotting board indicates approximately how much time remains for an intercept, and the altitude of the predicted intercept point. The battery control officer issues the fire signal to the launching area at the optimum time to fire.

65 (U). Monitoring of Fired Missile

After firing, the battery control officer monitors the position of the missile and target from displays on the horizontal and altitude plotting boards. By monitoring the missile and target positions, the battery control officer can determine whether or not the missile is on an intercept course. Missile and target altitude data from the altitude plotting board also provide the battery control officer with the data necessary for observing safety requirements. Due to the destructive power of a nuclear warhead, the course of a missile with a nuclear warhead must be continuously monitored on the altitude plotting board. The minimum burst altitude circuit in the computer system may not protect areas that have higher ground elevation than the area under the predicted intercept point. Transmission of the burst order is initiated manually by the battery control officer if safety requirements warrant.

66 (U). Reports of Completed Engagement

Upon completion of an engagement, the battery control officer assesses the results and advises the Army Air Defense Command Post (AADCP) of the degree of success attained.

Section II (C). SEQUENCE OF EVENTS

67 (U). General

Equipment status determines the actions of operating personnel and the degree of readiness of the Improved NIKE–HERCULES System or the NIKE–HERCULES ATBM System to fulfill its mission. Three degrees of equipment status are used: white, blue, and red. Each status is designated by white, blue, and red indicator lights, respectively. Three lights at the various operating locations throughout the system indicate the prevailing equipment status established by the battery control officer. Yellow equipment lights and associated circuits are provided in addition to the white, blue, and red status lights; however the yellow equipment status is not used. If the battery control officer changes the status, a gong sounds at the target radar control console to indicate that the prevailing equipment status has changed. Paragraphs 68 and 70 describe the sequence of events that occur in normal operation of an Improved NIKE–HERCULES System during each degree of equipment status for a surface-to-air mission and a surface-to-surface mission or of a NIKE–HERCULES ATBM System during each degree of status for a surface-to-air anti-aircraft (A–A), surface-to-air antimissile (A–M) or surface-to-surface missions. Paragraph 71 describes emergency operating procedures associated with the tactical control circuits.

68 (C). Surface-to-Air Mission

Note. The operation of the NIKE–HERCULES ATBM System during a surface-to-air antiaircraft or anti-missile mission is essentially the same as the operation of the Improved NIKE–HERCULES System during a surface-to-air mission.

a. White Equipment Status.

(1) White equipment status is a low-voltage condition for the Improved NIKE–HERCULES System. This status permits partial operation or warmup of the equipment. Such a status is advantageous because it permits the system to be constantly ready for an immediate advance to a higher tactical status and eliminates the necessity of keeping the equipment fully operational at all times, thereby greatly reducing equipment wear.

(2) Activity of the operators in the battery control area during white equipment status is largely confined to recording information received by telephone or other means associated with early warning facilities. This information is manually plotted on the early warning plotting board. When early warning facilities are not available to permit a warning of 30 minutes or more, the

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acquisition radar system is energized from the standby condition to operate condition. The early warning information is then obtained from the display on the PPI or PPI's.

(3) During white equipment status, performance checks are made on the missiles in the launching area to determine that the missiles are operational.

b. Blue Equipment Status. Blue equipment status is the "preparing to fire" status and is initiated by the battery control officer. At this time identification of the target is unknown. When blue equipment status is initiated, the events in (1) through (15) below occur.

(1) All white equipment status lights are extinguished and all blue equipment status lights are illuminated throughout the system.

(2) A gong sounds at the target radar control console to indicate the change in equipment status. The target tracking operators energize the target tracking radar system to the operate condition.

(3) A siren is energized by the battery control officer to signal all personnel in the battery control area to man their positions.

(4) A siren, located on the trailer mounted launching control station, is automatically energized to signal all personnel in the launching area to man their positions. At each launching section an alarm buzzer sounds to alert each launching section operator.

(5) Two communication conference circuits are established. One circuit connects all operating locations concerned primarily with command functions. The other circuit connects all operating locations concerned primarily with technical operations.

(6) If the acquisition radar systems and associated SIF/IFF equipment have not been previously energized to the operate condition, they are energized from standby to operate as quickly as possible so that targets in the area can be detected and interrogated.

(7) In the launching area, the launching section personnel place the generators in operation and prepare one missile at each launcher.

(8) The flight simulator group on the trailer mounted launching control station is energized and then acquired by the missile tracking radar system. The missile tracking radar system transmits test guidance and burst commands to the flight simulator group to check operation of the missile tracking radar system. Commands received by the flight simulator group are indicated on the launching control console and the launching control console operator relays the indications back to the missile tracking radar operator by telephone.

(9) The launching control officer orders all launching sections "on deck" to further prepare for launching in anticipation of a missile request.

(10) The acquisition radar operator now interrogates the aircraft that is approaching and, if it is found to be hostile, the battery control officer orders it designated as the target to the target tracking operators.

(11) The target tracking operators perform the necessary operations to acquire and track the target.

(12) The battery control officer sends a missile and mission request to the launching area. The proper missile is designated by the launching control officer.

(13) The designated missile is energized to be ready for launching.

(14) Indicator lights at the missile radar control console indicate the selected launching section and the designated missile within the section.

(15) The missile tracking radar system locks on the designated missile at the selected launching section.

c. Red Equipment Status. Red equipment status is the "firing" status and is initiated by the battery control officer. When red equipment status is initiated, the events in (1) through (15) below occur.

(1) All blue equipment status lights are extinguished and all red equipment

status lights are illuminated throughout the system.

(2) A gong sounds at the target radar control console to indicate the change in equipment status.

(3) Deleted.

(4) Gyro azimuth circuits from the computer system to the designated missile are energized so that a roll amount gyro in the missile can be oriented on the predicted intercept point determined by the computer system. The designated missile is now ready for firing.

(5) The multichannel data recorder in the recorder group begins to record tactical data.

(6) Four seconds after the target tracked signal is received, the computer system solves the intercept problem and issues a ready to fire signal.

(7) The computer operator conditions the plotting pens to automatically plot a plan view of the engagement. The altitude plotting board plots the altitude of the predicted intercept point against time of flight. The horizontal plotting board plots the azimuth and ground range coordinates of the target and the azimuth and ground range coordinates of the predicted intercept point.

(8) The battery is now ready to fire. The battery control officer determines the appropriate time to fire, then actuates the fire switch at the battery control console. A fire signal is sent to the target radar control console, the missile radar control console, the launching control console, and the designated launching section. Simultaneously, firing buzzers sound for 2 seconds at the launching control console and at the Hercules launching section control-indicator in the designated launching section.

(9) Two seconds after the fire command is received at the launching control console, the launch order is automatically generated, and one-fourth second later, the missile rocket motor cluster is ignited.

(10) The missile now leaves the launcher. Approximately 1 second later, the computer system senses "missile away" and a missile launch signal is transmitted to the battery control console, the target radar control console, and the missile radar control console.

(11) Fire circuits at the launching area are now deenergized and the battery control officer selects the type of missile for the next firing. In preparation for the next mission, the launching control console operator selects another section which has a ready missile designated.

(12) Immediately after the missile is launched, plotting of the azimuth and ground range of the predicted intercept point is discontinued at the horizontal plotting board and a plot of the present missile position begins. Simultaneously, at the altitude plotting board, the plot of altitude of the predicted intercept point is discontinued and a plot of the target altitude against time to intercept begins. In addition, a plot of the missile altitude against time to intercept begins.

(13) Approximately five seconds after the missile is launched, the computer system evaluates target and missile position data and sends steering orders by way of the missile tracking radar system to the missile to guide it to the target intercept point.

(14) At a predetermined time before zero time to intercept, the computer system sends the burst order to the missile.

(15) After completion of the mission, the missile track radar antenna automatically slews to the next designated missile. The equipment status either remains in the red condition to fire again immediately or is returned to the blue condition.

69 (Deleted).

70 (U). Surface-to-Surface Mission

The surface-to-surface mode of operation is used against fixed ground targets. The sequence of events during white equipment status is the same as for the normal surface-to-air mission (par. 68). Blue and red equipment statuses are established by the battery control officer in the same sequence as for the normal surface-to-air mission. The events occurring during each status that are different from those occurring during a normal surface-to-air mission are described in *a* and *b* below.

a. Blue Equipment Status.

(1) The battery control officer selects the surface-to-surface mission which automatically identifies the target as hostile and designates the appropriate nuclear warhead.

(2) Since a NIKE–AJAX missile is never used in a surface-to-surface mission, the launching control officer orders only a NIKE–HERCULES launching section to prepare a missile.

(3) Launching section personnel condition the missile command burst circuits so that the normal burst order is used by the missile as an arming signal and burst occurs at the desired altitude.

(4) Elevation, azimuth, and range coordinates are manually set into the target tracking radar system.

(5) The guidance cutoff switch at the missile track antenna-receiver-transmitter group is adjusted so that the burst order which causes guidance cutoff occurs at the correct time.

(6) Values derived from firing tables pertaining to the displaced aiming point altitude, and to the time of initiating the final dive are set into the computer system.

b. Red Equipment Status.

(1) The battery control officer makes a last minute check of the coordinates of the target, as corrected from the firing table, set into the target tracking radar system.

(2) The battery control officer checks the target position and displaced aiming point on the horizontal and altitude plotting boards. If the points check, the battery is ready to fire.

(3) After the missile is launched, missile guidance is maintained in the same manner as for the normal surface-to-air mission until the burst order is transmitted by the operation of the guidance cutoff switch of the missile tracking radar system. The burst order removes ground guidance, disarms the fail-safe mechanism, arms the barometric fuze, and rolls the missile 180 degrees.

(4) The missile follows a vertical trajectory to the preset burst altitude where the missile bursts.

71 (U). Emergency Operating Procedures

a. General. When normal transmission of tactical control signals between areas or within an area is disrupted, the battery control officer still directs the overall operation of the Improved NIKE–HERCULES battery. If cables are damaged, he verbally transmits commands through the command hot loop supplemented by the technical hot loop of the voice communications system. If telephone lines are damaged, the voice communications system is switched to radio. Both hot loops are automatically established when equipment status is designated as blue or red.

b. Local Setting of Equipment Status. The battery control officer notifies an operator at the target radar control console, who is connected to the command hot loop, of the status change. He also orders the launching control officer to locally establish the equipment status. The launching control officer notifies each launching section operator to manually set the

status for his section. The status is then passed along to each individual launcher.

c. Local Designation During Blue Equipment Status. When notified to change to blue equipment status, the launching control officer orders the operators of the selected launching sections to place their sections "on deck". The battery control officer notifies the launching control officer to designate locally the missile and mission request.

d. Local Designation During Red Equipment Status.

(1) When notified of change to red equipment status, the launching control officer notifies the operator at the pertinent launching section that his section is selected for launching. Then the launching control officer notifies the missile tracking radar operator which section is selected and which launcher designated. The missile track operator manually acquires the missile. The launching section operator locally energizes the missile designate circuits. The missile tracking radar operator is notified to energize missile ready circuits.

(2) Gyro azimuth data is verbally given by the computer operator to the launching section operator every 10 seconds while the missile is still on the launcher. The launching section operator, through controls at his position, sets in this gyro azimuth data until the missile is fired.

(3) The fire command initiated by the battery control officer is normally transmitted through cables from the battery control console to the trailer mounted launching control station and then to the section launching the designated missile. During an emergency, the battery control officer closes his fire switch and verbally issues the fire command to the launching area. The launching control officer closes his manual fire switch which automatically fires the designated missile. If cables in the launching area are damaged, the launching section operator, on orders from the launching control officer, closes his fire switch, launching the designated missile.

(4) Normally the launch order is automatically transmitted through the launching control console to the missile 2 seconds after the fire command. In an emergency, the launching control officer can transmit the launch order manually. At the designated launching section, the operator can also issue the manual launch order at the command of the launching control officer.

(5) At 1.3 seconds after the missile liftoff, the computer system responds to the upward acceleration of the missile and transmits a missile launched signal to the battery control console, to the target radar control console, and to the missile radar control console. The missile launched signal is indicated at these consoles regardless of the condition of the interarea cables.

Section III. COMMUNICATION

72 (U). General

Communication between various locations in the Improved NIKE-HERCULES System is accomplished by means of a voice communication system. This system provides communication facilities under both normal and emergency conditions. The system consists of a telephone system, an intercom system, and an emergency communication system.

73 (U). Functional Description of the Telephone System

a. The telephone system provides service among all stations in the battery control and launching areas. If desired, the telephone system can provide telephone communication with areas outside the Improved NIKE-HERCULES System.

b. The telephone system consists of two switchboard networks. One network connects telephone stations in the battery control area and the other network connects telephone stations in the launching area. Each network includes a manually controlled telephone switchboard with facilities for 29 telephone lines. The switchboard for the battery control area is in the trailer mounted director station. The switchboard for the launching area is in the trailer mounted launching control station.

c. For normal operation during white equipment status, all telephone stations in both areas are connected into one overall switchboard-controlled administrative system. Also, the three cable trunk lines and the three alternate field wire pair trunk lines between the areas are available for routing calls between the battery control area switchboard network and the launching area switchboard network.

d. During blue or red equipment status, the overall administrative system is divided into three tactical systems. Two of these are conference hot loops known as the command hot loop and the technical hot loop. The other is the administrative circuits not on the hot loops. Two of the three cable trunk lines are used for the hot loops. The other cable trunk line is retained for the administrative circuits.

(1) The command hot loop consists of telephone stations primarily concerned with the command functions associated with firing the missile. These telephone stations are disconnected from their respective telephone switchboards to form a system of simultaneous communication.

(2) The technical hot loop consists of telephone stations primarily concerned with the technical operations associated with firing the missile. These telephone stations are disconnected from their respective telephone switchboards to form a system of simultaneous communication.

(2.1) Certain telephone stations can be switched into either hot loop. The trailer mounted director station, the trailer mounted tracking station, the trailer mounted launching control station, and the launching sections each contain one section of this type.

(3) The administrative circuits consist of all the telephone stations that remain under switchboard control during blue or red equipment status. These are the telephone stations not connected in either hot loop.

74 (U). Functional Description of the Intercom System

a. The intercom system provides independent voice communication between each Hercules launching section control-indicator and the four associated launchers. This enables the operator at the control-indicator to speak to all launcher personnel within the section simultaneously, and the speech of any launcher personnel may be heard by the operator at the control-indicator.

b. The intercom equipment for each launching section consists of a master station in the Hercules launching section control-indicator and substations at each launcher.

75 (U). Functional Description of the Emergency Communication System

a. The emergency communication system provides emergency communications during blue or red equipment status in case of damage to the three cable trunk lines of the telephone system or to the lines between the telephone switchboard in the trailer mounted launching control station and the launching sections.

b. The emergency communication system consists of the three alternate field wire pair trunk lines associated with the telephone system, four radio sets, and two emergency field wire pairs for each launching section. These are described in (1) through (3) below.

(1) *Alternate field wire pair trunk lines.* Three alternate field wire pair trunk lines, located some distance away from the cable trunk lines of the telephone system, connect the telephone switchboard in the battery control area to the telephone switchboard in the launching area. In case of damage to the cable trunk lines of the telephone system, the alternate field wire pair trunk lines provide trunk line connections for the command hot loop, the technical hot loop, and the administrative circuits.

(2) *Radio Sets.* During blue or red equipment status, two independent radio channels provide communication between the battery control area and the launching area when both the cable trunk lines of the telephone system and the alternate field wire pair trunk lines become inoperative. Each channel has a radio set in the battery control area and the launching area. The radio command hot loop channel provides a communication link for all telephone stations on the command hot loop and terminates at each telephone switchboard. The radio technical hot loop channel provides a communication link for all telephone stations on the technical hot loop and terminates at each telephone switchboard. Under these conditions the administrative telephones in the battery control area cannot communicate with the administrative telephones in the launching area.

(3) *Emergency field wire pairs.* During blue or red equipment status, two emergency field wire pairs for each launching section provide communication between the launching sections and the radio sets in the launching area when normal telephone lines between the launching sections and the telephone switchboard in the launching area become inoperative.

CHAPTER 8

MAINTENANCE SUPPORT

Section I. GENERAL

76 (U). Scope

a. This chapter presents the maintenance theory for the Improved NIKE-HERCULES Air Defense Guided Missile System. Maintenance is any action taken to keep materiel in serviceable condition or restore it to serviceability when unserviceable. Maintenance includes parts supply servicing, repair, modification, inspection, modernization, product improvement, overhaul, rebuild, test, reclamation, condition determination, and classifying as to serviceability. Maintenance support is the maintenance and parts supply of an item of equipment. Maintenance allocation is the process of selecting the scope of maintenance authorized to each echelon.

b. Varied characteristics and functions of the many electronic, hydraulic, pneumatic, and mechanical components of the Improved NIKE-HERCULES Air Defense Guided Missile System add to the complexities of this equipment. Such widely diversified equipment is supported by a combination of technical services. It is the responsibility of the heads of the developing technical services to insure the compatability of maintenance and support within the weapons system.

c. Organizational, field, and depot maintenance scope and instructions are given in the appropriate technical manual for specific equipment. The appropriate technical manual for a specific piece of equipment at a given level of echelon maintenance may be determined by referring to the index of manuals. These manuals may be supplemented by technical bulletins, modification work orders, and other official publications. Maintenance allocation is based on and assigned in accordance with the primary mission, character, and mobility of the command involved, economical distribution of funds, skills, technical supervisors, tools, shop equipment, repair parts, and materials.

77 (U). Categories of Maintenance

The three broad categories of maintenance operations are organizational, field, and depot maintenance. For the purpose of providing further flexibility and accuracy in defining maintenance operations, the three broad categories of maintenance have been subdivided into five echelons, which are numbered, consecutively, first through fifth.

Section II. ORDNANCE SUPPORT

78 (U). Organizational Maintenance (First and Second Echelons)

Organizational maintenance is that maintenance authorized for and performed by a using organization on the equipment for which it is responsible. Organizational maintenance consists of proper operation, preventative maintenance, inspection, cleaning, servicing, lubricating, testing, and adjusting as prescribed and authorized in the applicable publications. It also includes replacement of chassis and certain parts.

a. First Echelon. First echelon maintenance is that degree of maintenance performed by the user or operator of the equipment in providing the proper care, use, operation, cleaning, preservation, lubrication, and such adjustment, minor repair, testing and parts replacement as may be authorized by pertinent technical publications and tool and parts lists.

b. Second Echelon. Second echelon maintenance is that degree of maintenance performed by specially trained personnel provided for that purpose in the using organization. Appropriate publications authorize the second echelon of maintenance additional tools and the necessary parts, supplies, test equipment, and skilled personnel to perform maintenance beyond the capabilities and facilities of the first echelon.

c. Organizational Maintenance.

(1) *Missile.*

(*a*) *Electronic guidance section.* Organizational maintenance does not include component repair and extends only to replacement of the complete guidance set or those plug-in type parts and/or subassemblies provided as organizational repair parts.

(*b*) *Mechanical items.* Organizational maintenance extends only to replacement of parts not requiring the use of special tools or skills beyond those associated with normal missile assembly, servicing, and checkout.

(2) *Ground equipment.* Organizational maintenance is limited to those repairs and replacements which can be accomplished by tools, test equipment, and repair parts authorized for users.

(3) *Extent of repair.* The degree or extent of repairs, replacements, and maintenance is limited to that specified and authorized by the appropriate technical publication. Unserviceable organizational repair parts are replaced by direct exchange except for those having no reclaimable value (expendable-nonrecoverable).

79 (U). Field Maintenance (Third and Fourth Echelons)

Field maintenance is that maintenance authorized and performed by designated maintenance activities in direct support of using organization(s). This category is normally limited to maintenance consisting of replacement of unserviceable parts and repair or replacement of subassemblies or assemblies.

a. Third Echelon. Third echelon maintenance is that degree of maintenance authorized by appropriate technical publications to be performed by specially trained units in direct support of using organizations. Third echelon maintenance is authorized a larger assortment of parts, subassemblies and assemblies, and more precise tools and test equipment than is provided to using organizations. Third echelon organizations repair subassemblies and assemblies, and repair the overflow from the lower echelons within limits imposed by specified authorization of tools, parts, and test equipment. They also support the lower echelons by providing technical assistance and mobile repair crews and repair parts, when necessary.

(1) Guided missile firing units are serviced by a direct support maintenance unit. Direct support is that Ordnance service (maintenance and supply) rendered using units on class II and IV materiel. Any Ordance unit or organization charged with providing maintentenance and supplying assistance to a using unit is classed as a direct support unit. All user needs including maintenance service, supply service inspection, instruction in the proper care and handling, and assistance in operation where required, are normal direct support functions.

(2) A direct support organization has the capability of supplying parts and performing third echelon maintenance for all Ordnance materiel assigned to an artillery missile batallion(s) or unit(s). It is equipped and trained to detect and isolate malfunctions and to perform repairs of assemblies and subassemblies in the combat zone immediately adjacent to the units supported.

(3) Ordnance direct support units have and maintain a mobility equivalent to that of the tactical units supported. Unit transportation is provided to insure movement in one echelon with equipment mounted in such a manner that displacement with a minimum of 4 hours warning is possible.

(4) Execution of the direct support mis-

sion through the medium of contact teams is followed to the extent practicable. Direct-support teams are organized and equipped with a supply of fast-moving repair parts, organization replacement items, and support maintenance tools to carry emergency repair service to the battery emplacement. Repair capability is of the emergency nature of isolation of failure to chassis-type assemblies and the replacement of unserviceable chassis with serviceable ones. Component repair, except of a minor nature, is performed at the direct-support shop.

(5) Direct-support guided missile units have the capability of conducting complete technical inspection of all supported guided-missile materiel prior to its issue to the using units.

(6) Unserviceable materiel, not immediately repairable either from want of time, tools, skills, or volume, is evacuated by the direct support unit to the general support maintenance unit. A maintenance float, based upon known average deadline percentage, is provided for the replacement of evacuated materiel.

(7) Enforcement of organizational maintenance is a command responsibility at all levels. To the direct support unit is delegated the responsibility of performing periodic technical inspections of ordnance materiel to insure its adequate care and preservation by the user. It is also incumbent upon the direct support unit commander, in accordance with the assigned maintenance mission to advise, assist, and instruct using personnel in proper maintenance, and supply discipline and procedures.

(8) Direct-support missions are assigned on an area basis. Within the capabilities of the direct support unit, guided missile units within a specified area are normally supported by the direct support unit designated by the commander having support maintenance responsibility. Support units are not associated command-wise with any particular tactical unit, and support missions may change as tactical units are displaced in combat operations.

b. General Support

(1) General support maintenance is that degree of maintenance authorized by appropriate technical publications to be performed by units organized as semimobile or permanent shops to serve lower-level maintenance. The principal function of general-support maintenance is to repair subassemblies and assemblies for return to stock.

(2) General support embraces all assistance within the combat zone or communication zone required to back up the direct support unit. General-support maintenance units are provided to receive the overflow of unserviceable materiel from a number of direct support units. General support units do not normally have direct contact with using units and provide supply support only for organic shop operations. The general support unit's mission is to evacuate unserviceable materiel in volume from the direct support unit for repair and return it to stock with a minimum of delay and expensive evacuation and to permit the rapid displacement of the direct support unit. General maintenance in the zone of the interior, if not provided by tables of organization and equipment, is performed at post-ordnance level.

80 (U). Depot Maintenance

a. Depot maintenance is that maintenance required for the repair of materiel which requires a major overhaul or the complete rebuild of parts, subassemblies, assemblies and/or the end item, as required. Such maintenance is intended to augment stocks of serviceable equipment or to support lower levels of maintenance by the use of more extensive shop equipment and personnel of higher technical skill than are available in organizational or support maintenance activities.

b. The fifth level of maintenance is that degree of maintenance authorized for rebuilding major items, assemblies, parts, accessories,

tools, and test equipment. It normally supports supply on a rebuild and return-to-stock basis.

81 (U). Missile Maintenance Support

Maintenance support for the missile is considered in two categories: explosive with allied hardware and nonexplosive (electro-mechanical). The complete missile body with explosives and propellants in one or more packages is considered an ammunition item (class V) and is handled through ammunition supply channels. The maintenance of guided-missile general supplies includes all designated non-explosive components of the missile and all ordnance materiel of the ground guidance, launching, and handling equipment. As previously explained, the most forward ordnance element for the support of these general supplies is the direct support unit.

82 (U). Technical Assistance for Levels of Maintenance

The various types of technical assistance available to the echelons of maintenance are described in *a* through *d* below.

a. Manufacturer's Representatives. Manufacturer's representatives are technical specialists who provide services as working advisers and instructors on the operation and maintenance equipment manufactured by their companies.

b. Contract Field Technicians. Contract field technicians are technical specialists of manufacturing, engineering, or consulting organizations obtained by the Government on a contract basis. They perform maintenance and provide services as working advisers and instructors on the operation and maintenance of special categories of equipment.

c. Regional Maintenance Representatives. Military and/or civil service employees make periodic visits from specialized depots, and specialized sections of general depots to all military users of equipment for the purpose of assisting in improving organizational and supply maintenance, reporting the unsatisfactory performance of materiel and materiel-design deficiencies, assisting in inspecting equipment for economic repairability on request, assisting in evaluating unserviceable equipment, and providing informal on-the-job training.

d. Maintenance Specialists. Maintenance specialists are U. S. Army military and Department of the Army civilian personnel provided under the provisions of AR750-22. They are technically qualified to assist unit and activity commanders in determining deficiencies in the maintenance capabilities of their organizations; to make recommendations for the improvement of the maintenance service, repair-parts support, tools, and test-equipment supply, and the availability of publications to the appropriate commanders; and to render assistance, upon request of the commanders, in the planning and conducting of organizational schools to qualify personnel in the operation and maintenance of equipment.

1. Electronic shop 1
   - *a.* Servo test set AN/MPM-48A (Console No. 3)
   - *b.* Servo test set AN/MPM-47 (Console No. 2)
   - *c.* Computer test set AN/MPM-45 (Console No. 1)
   - *d.* Power supply set AN/MSQ-31
   - *e.* Storage cabinet
   - *f.* Personnel heater
   - *g.* Utility cabinet
2. Electronic shop 2
   - *a.* Radar test set AN/MPM-37A
   - *b.* Electrical power test set AN/MPM-42 (Console No. 5)
   - *c.* Radar test set AN/MPM-43 (Console No. 4)
   - *d.* Power supply group OA-1065/MPM-34
   - *e.* Storage cabinet
   - *f.* Personnel heater
   - *g.* Storage cabinet
3. Electronic shop 3
   - *a.* Console A
   - *b.* Console B
4. HIPAR emergency contact unit
5. Guidance section test set group
6. Air leak check equipment
7. Transponder control test set group
8. Air control cabinet
9. AF and power components test set group
10. RF and pulse components test set group
11. Oscilloscope and spectrum analyzer electrical cabinet
12. Launcher electrical function test set
13. Single channel valve tester
14. Assembly site electrical equipment tester
15. Launcher hydraulic power package tester
16. Hydraulic test assembly console
17. APS tester
18. Variable resistor test set

Figure 54 (U). Field maintenance test equipment—legend.

Section III. FIELD MAINTENANCE TEST EQUIPMENT

83 (U). General

Type 4 field maintenance test equipment (fig. 54) consists of the electronic and mechanical assemblies required to provide third and fourth echelon support maintenance to the using organization. The test equipment is grouped within the categories listed in *a* through *c* below.

a. Missile body and Hercules monorail launcher test equipment (5 through 11, fig. 54).

b. Missile guidance set and flight simulator group test equipment (12 through 18, fig. 54).

c. Radar course directing central test equipment (1 through 4, fig. 54).

84 (U). Characteristics

The field maintenance test equipment is capable of isolating malfunctions down to component level and is sufficiently accurate for adjustment, alinement, and calibration purposes. When required, the test equipment simulates the actual operating conditions of the equipment being tested, thereby improving the reliability of the test being performed.

85 (U). Purpose

The purpose of the field maintenance test equipment is to keep down maintenance time of the overall system to a minimum. To accomplish this purpose, the test equipment should be used to determine marginal performance so repair can be made before component failure results.

86 (U). Description

Note. The key numbers shown in parentheses in *a* through *c* below refer to figure 54.

a. Missile Body and Hercules Monorail Launcher Test Equipment. The missile body and Hercules monorail launcher test equipment consists of seven assemblies used to maintain the NIKE-AJAX and NIKE-HERCULES missile bodies and the Hercules monorail launcher. The test equipment is described in (1) through (7) below.

(1) *Variable resistor test set.* The variable resistor test set (18), in conjunction with accessory equipment, tests linear variable resistors used in the fin control circuits of NIKE-AJAX/HERCULES missiles.

(2) *Launcher electrical function test set.* The launcher electrical function test set (12) is used to determine the functional condition of external cabling circuits of the NIKE-HERCULES launching-handling rail and the NIKE-AJAX launcher-loader system.

(3) *Assembly site electrical equipment tester.* The assembly site electrical equipment tester (14) is used to check for malfunctions in the NIKE-AJAX/HERCULES electrical test sets.

(4) *Launcher hydraulic power package tester.* The launcher hydraulic power package tester (15) consists of an electrical and hydraulic system used to perform various tests on NIKE-AJAX/HERCULES hydraulic pumping units and power packages.

(5) *Hydraulic test assembly console.* The hydraulic test assembly console (16) supplies hydraulic fluid at regulated pressures for testing components of the NIKE-AJAX/HERCULES missile and launcher.

(6) *APS tester.* The APS tester (17) is used to test the efficiency of the accessory power supply (APS) to insure that the hydraulic output meets the established minimum requirements.

(7) *Single channel valve tester.* The single channel valve tester (13) is used with accessory test equipment to perform static and dynamic tests of actuator assemblies and control sections of NIKE-AJAX/HERCULES missiles.

b. Missile Guidance Set and Flight Simulator Group Test Equipment. The missile guidance set and flight simulator group test equipment consists of seven assemblies used to maintain the NIKE-AJAX and NIKE-HERCULES missile guidance sets and the flight simulator group. The test equipment is described in (1) through (7) below.

(1) *Guidance section test set group.* The guidance section test set group (5) is used to perform tests on the guidance set of the NIKE-AJAX missile.

(2) *Air control cabinet.* The air control cabinet (8) is used to supply regulated air pressure to other test equipment.

(3) *Transponder control test set group.* The transponder control test set group (7) is used to perform tests on the transponder-control group of the NIKE-HERCULES missile.

(4) *RF and pulse components test set group.* The RF and pulse components test set group (10) is used to perform tests on RF and pulse components of the guidance sets of NIKE-AJAX/HERCULES missiles.

(5) *AF and power components test set group.* The AF and power components test set group (9) is used to perform tests on AF and power components of the guidance sets of NIKE-AJAX/HERCULES missiles.

(6) *Air leak check equipment.* The air leak check equipment (6) is used to test air supply tank assemblies, actuating cylinder assemblies, and hydraulic accumulator assemblies of the NIKE-AJAX missile and the accessory power supply accumulator of the NIKE-HERCULES missile.

(7) *Oscilloscope and spectrum analyzer electrical cabinet.* The oscilloscope and spectrum analyzer electrical cabinet (11) is used to supplement the RF and pulse components test set group (10) and the AF and power components test set group (9) in performing tests on the guidance sets.

c. Radar Course Directing Central Test Equipment. Equipment for testing components of the radar course directing central is contained in the three trailers and one van. The three trailers are designated electronic shop 1 (1), electronic shop 2 (2), and electronic shop 3 (3). The van is designated HIPAR emergency contact unit (4). The major test equipment contained in the electronic shops is described in (1) through (3) below. The HIPAR emergency contact unit is described in (4) below.

(1) *Electronic shop 1.*

(*a*) *Computer test set AN/MPM-45 (Console No. 1).* Computer test set AN/MPM-45 (Console No. 1) (1c) is used to test relays, zero set and computing amplifiers, and other dc components.

(*b*) *Servo test set AN/MPM-47 (Console No. 2).* Servo test set AN/MPM-47 (Console No. 2) (1b) is used to test indicator units and range and video components.

(*c*) *Servo test set AN/MPM-48A (Console No. 3).* Servo test set AN/MPM-48A (Console No. 3) (1a) is used to test servo and communication components.

(2) *Electronic shop 2.*

(*a*) *Radar test set AN/MPM-43 (Console No. 4).* Radar test set AN/MPM-43 (Console No. 4) (2c) is used to test IF, audio, and pulse components.

(*b*) *Electrical power test set AN/MPM-42 (Console No. 5).* Electrical power test set AN/MPM-42 (Console No. 5) (2b) is used to test power supplies and components.

(*c*) *Radar test set AN/MPM-37A.* Radar test set AN/MPM-37A (2a) supplements electrical power test set AN/MPM-42 in testing radar modulators, radar transmitters, and other rf assemblies.

(3) *Electronic shop 3.* Electronic shop 3 (3) contains two test consoles (3a and 3b) for performing electronic maintenance that is beyond the capabilities of electronic shops 1 and 2.

(4) *HIPAR emergency contact unit.* The HIPAR emergency contact unit (4) contains equipment for use in maintenance of the HIPAR system.

APPENDIX I (U)

LIST OF MANUALS

1. List of Technical Manuals Covering Improved NIKE–HERCULES Air Defense and Anti-Tactical Ballistic Missile Systems

a. Overall System Manuals.

TM 9–1400–250–10/2	Operator's Manual: Overall System Description (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9–1400–250–15/2	Operator's Manual: Destruction of NIKE Guided Missile Systems Materiel to Prevent Enemy Use (NIKE-AJAX, NIKE-HERCULES, and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9–1400–250–12	Preventive Maintenance Services (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9–1400–250–35	Direct Support, General Support, and Depot Maintenance: Cables, General Maintenance Procedures and Information (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9–1400–251–12	Operator's and Organizational Maintenance: Voice Communication System (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems and NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9–1400–257–50	Depot Maintenance: Slip Ring Assembly and Electric Contact Ring Assemblies (NIKE-HERCULES Air Defense Guided Missile System)
TM 9–2330–212–15	Operation, Organizational, and Field Maintenance: Trailers

b. Manuals Covering Entire Radar Course Directing Central.

TM 9–1430–250–10/3	Operator's Manual: Electronic Counter-Counter Measures: Radar Course Directing Central (NIKE-AJAX, NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9–1430–250–20/7	Organizational Maintenance: Theory: Radar Course Directing Central: Tactical Control and Power Distribution System (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9–1430–250–20/12	Organizational Maintenance: Theory: Radar Course Directing Central: Tactical Control and Power Distribution (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9–1430–251–10	Assembly and Emplacement: Radar Course Directing Central (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9–1430–251–10/2	Operator's Manual: Siting Requirements for Radar Course Directing Central (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9–1430–253–12/2	Operator and Organizational Maintenance: Radar Course Directing Central (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9–1430–253–12/4	Operator's Manual: Radar Course Directing Central (Improved HERCULES Air Defense Guided Missile System)
TM 9–1430–253–20/2	Organizational Maintenance: Location and Access Procedures, Special Tools and Equipment, Preventive Maintenance and Corrective Maintenance: Radar Course Directing Central (Less HIPAR) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9–1430–254–35/2	Field and Depot Maintenance: Wiring Diagram and Wiring Tables: Radar Course Directing Central (Improved NIKE-HERCULES Air Defense Guided Missile Systems and NIKE-HERCULES Anti-tactical Ballistic Missile (ATBM) Systems)
TM 9–1430–267–12	Operation and Organizational Maintenance: Guided Missile System Radar Signal Simulator Station AN/MPQ–36 (15D2) (NIKE-AJAX Air Defense Guided Missile System)
TM 9–1430–267–20	Organizational Maintenance: Schematics: Guided Missile System Radar-Signal Simulator Station AN/MPQ–36 (15D2)
TM 9–1430–267–35/1	Field and Depot Maintenance: Description and Theory: Guided Missile System Radar-Signal Simulator Station AN/MPQ–36 (15D2)
TM 9–1430–267–35/2	Field and Depot Maintenance: Guided Missile System Radar Signal Simulator Station AN/MPQ–36 (15D2)

TM 9-1430-268-12/1	Operator and Organizational Maintenance: Guided Missile System Radar-Signal Simulator Station AN/MPQ-T1 (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-268-12/2	Operator and Organizational Maintenance: Functional Schematic Diagrams: Guided Missile System Radar-Signal Simulator Station AN/MPQ-T1 (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-268-12/3	Operator and Organizational Maintenance: Unit Schematic Diagrams: Guided Missile System Radar-Signal Simulator Station AN/MPQ-T1 (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-268-12/4	Operator and Organizational Maintenance: Theory: Guided Missile System Radar-Signal Simulator Station AN/MPQ-T1 (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-268-35	Direct and General Support and Depot Maintenance: Guided Missile System Radar-Signal Simulator Station (AN/MPQ-T1) (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)

c. Manuals Covering Acquisition Radar System.

TM 9-1430-250-12/5	Operator and Organizational Maintenance: Check Procedures: Electronic Frequency Selection: Anti-tactical Ballistic Missile, High Power Acquisition Radar (Systems 502 through 537) (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-250-12/6	Operator and Organizational Maintenance: Check Procedures: Electronic Frequency Selection: High Power Acquisition Radar (Systems 502 through 537) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-250-20/5	Organizational Maintenance: Theory: Radar Course Directing Central: (Less HIPAR) Low Power Acquisition Radar System (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-250-20/10	Organizational Maintenance: Theory: Electronic Frequency Selection/Anti-tactical Ballistic Missile High Power Acquisition Radar System (NIKE-HERCULES Anti-tactical Ballistic Missile (ATBM) Systems)
TM 9-1430-250-20/11	Organizational Maintenance: Theory: Low Power Acquisition Radar System (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile Systems)
TM 9-1430-250-20/12	Organizational Maintenance: Theory: Radar Course Directing Central: Tactical Control and Power Distribution (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-250-20/13	Organizational Maintenance: Theory: Electronic Frequency Selection: High Power Acquisition Radar Systems 502 Through 537 (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-250-35	Field and Depot Maintenance: Theory: Acquisition Radar System (Less HIPAR) (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-251-10/4	Operator's Manual: Assembly and Emplacement: HIPAR (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-251-12/2	Operator and Organizational Maintenance: Check Procedures: Low Power Acquisition Radar and Computer (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-253-12/1	Operator and Organizational Maintenance: EFS/ATBM, HIPAR (NIKE-HERCULES Anti-tactical Ballistic Missile Systems)
TM 9-1430-253-12/2	Operator and Organizational Maintenance: Radar Course Directing Central: ATBM (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-253-12/3	Operator and Organizational Maintenance: High Power Acquisition Radar (Systems 502 through 537) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-253-12/4	Operator and Organizational Maintenance: Radar Course Directing Central (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-20/2	Organizational Maintenance: Functional Schematic Diagrams: Low Power Acquisition Radar and Tactical Control System (Less HIPAR) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-20/5	Organizational Maintenance: Functional Schematic Diagrams: Electronic Frequency Selection/Anti-tactical Ballistic Missile High Power Acquisition Radar System (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-254-20/6	Organizational Maintenance: Functional Schematic Diagrams: Low Power Acquisition Radar and Tactical Control Circuits (ATBM) (NIKE-HERCULES Anti-tactical Ballistic Missile System)

TM 9-1430-254-20/7	Organizational Maintenance: Functional Schematic Diagrams: High Power Acquisition Radar System (Systems 502 through 537) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-34	Field Maintenance: Acquisition Antenna-Receiver-Transmitter Group (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-254-34/8	Direct Support and General Support Maintenance: Emergency Contact Unit System Application High Power Acquisition Radar (Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-254-34/9	Direct Support and General Support Maintenance: Electronic Frequency Selection/ Anti-tactical Ballistic Missile System, High Power Acquisition Radar EFS Receiver Group, Moving Target Indicator Group (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-254-34/10	Direct Support and General Support Maintenance: Electronic Frequency Selection/ Anti-tactical Ballistic Missile: High Power Acquisition Radar, Power Control-Oscillator Group; Power Control-Indicator High-Voltage Pulse Generator; Induction Voltage Regulator Step-up Power Transformer (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-254-34/11	Direct Support and General Support Maintenance: Electronic Frequency Selection, Anti-tactical Ballistic Missile High Power Acquisition Radar; Klystron Amplifier, EFS and ATBM Antennas; EFS and ATBM Antenna Couplers; Refrigerant Condenser, Liquid Cooler 9994083 Pumping Unit, Liquid Cooler 9999047 (NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-254-34/12	Field Maintenance: High Power Acquisition Radar: EFS Receiver, Moving Target Indicator Group, HIPAR Control-Monitor (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-34/13	Field Maintenance: High Power Acquisition Radar (Systems 502 through 537) Control-Oscillator Group; Waveguide Pressurizer; Power Distribution Unit; Liquid Cooler; Induction Voltage Regulator (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-34/14	Direct Support and General Support Maintenance: Klystron Amplifier Transmitter Control-Indicator, High Voltage Power Supply, High Voltage Pulse Generator, Antenna Coupler and HIPAR Antenna Electronic Frequency Selection High Power Acquisition Radar (Systems 502 through 537) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-254-35/2	Field and Depot Maintenance: Wiring Diagrams and Wiring Tables; Radar Course Directing Central (Improved NIKE-HERCULES Air Defense Guided Missile Systems and NIKE-HERCULES Anti-tactical Ballistic Missile Systems)
TM 9-1430-255-12/1	Operators and Organizational Maintenance: Check Procedures: Low Power Acquisition Radar System (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-257-20	Organizational Maintenance: Unit Schematics Acquisition Radar System (Less HIPAR) (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-257-20/3	Organizational Maintenance: Unit Schematic Diagrams: High Power Acquisition Radar Systems (502 through 537) (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-257-20/4	Organizational Maintenance: Unit Schematic Diagrams: Electronic Frequency Selection/Anti-tactical Ballistic Missile High Power Acquisition Radar System (NIKE-HERCULES Anti-tactical Ballistic Missile Systems)

d. Manuals Covering Tracking Radar Systems.

TM 9-1430-250-20/6	Organizational Maintenance: Theory: Target Tracking, Target Ranging, and Missile Tracking Radar Systems and Radar Test Set Group (Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-252-34/2	Field Maintenance: Tracking Station Group (Improved NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-252-35	Field and Depot Maintenance: Theory: Target Tracking, Target Ranging, and Missile Tracking Radar Systems, Radar Test Set TS-847A/MSW-1, Radar Test Set Group and Antenna, and Mast Group OA-1600/T (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)

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TM 9-1430-253-34	Field Maintenance: Target Tracking, Target Ranging, and Missile Tracking Antenna-Receiver-Transmitter Groups and Radar Test Set Group (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-256-12/1	Check Procedures: Target Tracking, Target Ranging, and Missile Tracking Radar Systems and Radar Test Set Group (Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-256-20/3	Organizational Maintenance: Functional Schematic Diagrams: Missile Tracking, Target Tracking, and Target Ranging Radar Systems and Radar Test Set Group (Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES Anti-tactical Ballistic Missile System)
TM 9-1430-259-20	Organizational Maintenance: Unit Schematics: Target Tracking, Target Ranging, and Missile Tracking Radar Systems, Radar Test Set (TS-847A/MSW-1) and Radar Test Set Group (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems and NIKE-HERCULES Anti-tactical Ballistic Missile System)

e. Manuals Covering Computer System.

TM 9-1430-250-20/3	Organizational Maintenance: Theory: Radar Course Directing Central, Computer System and Recording Devices (NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-251-12/1	Check Procedures: Computer System and Data Recorder (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-251-34	Field Maintenance: Director-Computer Group OA-1479/MSA-19 (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)
TM 9-1430-251-35	Field and Depot Maintenance: Theory: Computer System and Data Recorder (NIKE-HERCULES Air Defense Guided Missile System)
TM 9-1430-255-20	Organizational Maintenance: Functional Schematic Diagrams: Computer System and Data Recorder (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems and NIKE-HERCULES Anti-tactical Ballistic Missile (ATBM) Systems)
TM 9-1430-258-20	Organizational Maintenance: Unit Schematic Diagram: Computer System and Data Recorder (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile System and NIKE-HERCULES Anti-tactical Ballistic Missile System)

f. Manuals Covering Launching Area.

TM 9-1440-250-10	Operator's Manual: Guided Missile Launching Set
TM 9-1440-250-12/1	Operation and Organizational Maintenance: Daily and Weekly Check Procedures: Guided Missile Launching Set
TM 9-1440-250-12/2	Operation and Organizational Maintenance: Monthly Check Procedures: Guided Missile Launching Set
TM 9-1440-250-12/3	Operation and Organizational Maintenance: Daily, Weekly, and Monthly Check Procedures: Guided Missile Launching Set With NIKE-AJAX Missiles
TM 9-1440-250-20/1	Organizational Maintenance: Guided Missile Launching Set
TM 9-1440-250-20/2	Organizational Maintenance: Schematics: Guided Missile Launching Set
TM 9-1440-250-34	Field Maintenance: Launching Control Group OA-2202/MSW-4 (NIKE-HERCULES Air Defense Guided Missile System) and Launching Control Group OA-868/MSE-2 (NIKE-AJAX Air Defense Guided Missile System)
TM 9-1440-250-35	Field and Depot Maintenance: Wiring Diagrams: Guided Missile Launching Set
TM 9-1440-251-10	Assembly and Emplacement: Guided Missile Launching Set
TM 9-1440-251-34	Field Maintenance: Control-Indicator C-2620/TSW and Simulator Group OA-2010/MSW-4 (NIKE-HERCULES Air Defense Guided Missile System) and Control-Indicator C-1488/MSE-2 and Simulator Group OA-758/MSE-2 (NIKE-AJAX Air Defense Guided Missile System)
TM 9-1440-252-34	Field Maintenance of the HERCULES Monorail Launcher, Launching-Handling Rail, Side Truss, Loading Rack Support, Launcher Transport Modification Kit and Launcher Basic Accessory Kit.
TM 9-1440-253-35	Field and Depot Maintenance: Launcher Control Indicator C-2699/TSW

g. Manuals Covering Guided Missile.

TM 9–1410–206–35	Direct Support, General Support and Depot Maintenance: Air Defense Guided Missile: Ammunition Items (HERCULES)
TM 9–1410–250–12	Operation and Organizational Maintenance: Air Defense Guided Missile (HERCULES)
TM 9–1410–250–34	Field Maintenance: Guided Missile M6 (Less Missile Guidance Set)

h. Manuals Covering Missile Guidance Set and Flight Simulator.

TM 9–1410–250–35	Field and Depot Maintenance: Missile Guidance Set and Guided Missile Flight Simulator: Description and Theory
TM 9–1410–251–34	Field Maintenance: Missile Guidance Set AN/DPW–10 and AN/DPW–11 Tested at Guidance Set Group Test Equipment
TM 9–1410–251–35	Field and Depot Maintenance: Theory and General Maintenance: Missile Guidance Sets AN/DPW–10 and AN/DPW–11 and Flight Simulator AN/MPM–28, AN/MPM–28A and AN/MPM–28B
TM 9–1410–251–50	Depot Maintenance: Units of Missile Guidance Set and Guided Missile Flight Simulator Tested at Final Position of Depot Maintenance Test Equipment
TM 9–1410–252–50	Depot Maintenance: Units of Missile Guidance Set and Guided Missile Flight Simulator Tested at Fail-Safe Position of Depot Maintenance Test Equipment
TM 9–1410–252–34	Field Maintenance: Flight Simulator and RF and Pulse Components of Missile Guidance Set Tested at Guidance Set Group Test Equipment
TM 9–1410–253–34	Field Maintenance: AF and Power Components of Missile Guidance Set Tested at Guidance Set Group Test Equipment
TM 9–1410–253–50	Depot Maintenance: Units of Missile Guidance Set and Guided Missile Flight Simulator Tested at Radio Set Position of Depot Maintenance Test Equipment
TM 9–1410–254–50	Depot Maintenance: Units of Missile Guidance Set and Guided Missile Flight Simulator Tested at Signal Data Converter Position of Depot Maintenance Test Equipment
TM 9–1410–255–50	Depot Maintenance: Units of Missile Guidance Set and Guided Missile Flight Simulator Tested at Driver Detector Position of Depot Maintenance Test Equipment
TM 9–1410–261–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Amplifier-Decoder Position of Depot Maintenance Test Equipment
TM 9–1410–262–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Modulator Position of Depot Maintenance Test Equipment
TM 9–1410–263–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Control Servo Position of Depot Maintenance Test Equipment
TM 9–1410–264–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Power Supply Position of Depot Maintenance Test Equipment
TM 9–1410–265–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Amplifier Position of Depot
TM 9–1410–266–50	Depot Maintenance: Units of Missile Guidance Set and Flight Simulator Tested at Input Network Position of Depot Maintenance Test Equipment

2. List of Technical Manuals Covering Improved NIKE-HERCULES Air Defense Guided Missile System Support Equipment

a. Manuals Covering Support Equipment for Guided Missile Body and Launcher.

TM 9–4935–250–35	Field and Depot Maintenance: Operator's Instructions: Launcher Hydraulic Power Package Tester 8529385
TM 9–4935–251–35	Field and Depot Maintenance: Operator's Instructions: APS Test Stand 9027068
TM 9–4935–255–35	Field and Depot Maintenance: Operator's Instructions: Launcher Electrical Function Tester 8523704
TM 9–4935–256–35	Field and Depot Maintenance: Operator's Instructions: Assembly Site Electrical Equipment Test Set 8523705
TM 9–4935–257–34	Field Maintenance: Operator's Instructions: Single Channel Valve Test Assembly 8523703
TM 9–9502–11	Operator's Instructions: Field and Depot Maintenance: Hydraulic Component Missile Test Stand 8523711
TM 9–9502–14	Operator's Instructions: Field and Depot Maintenance: Variable Resistor Tester (8020300 and 8523701)

b. Manuals Covering Support Equipment for Missile Guidance Set and Flight Simulator.

TM 9-4935-252-34/1	Field Maintenance: Operator's Instructions: Missile Guidance Set Test Equipment
TM 9-4935-252-34/2	Field Maintenance: Missile Guidance Set Test Equipment
TM 9-4935-252-35	Field and Depot Maintenance: Schematics and Wiring Diagrams: Missile Guidance Set Test Equipment

c. Manuals Covering Support Equipment for Radar Course Directing Central.

TM 9-4940-250-34	Field Maintenance: Operation and Field Maintenance: Trailer-Mounted Electronic Shop
TM 9-4940-250-35	Field and Depot Maintenance: Schematics and Wiring: Trailer-Mounted Electronics Shop 1
TM 9-4940-251-34	Field Maintenance: Operation and Field Maintenance: Trailer-Mounted Electronic Shop 2
TM 9-4940-251-35	Field and Depot Maintenance: Schematics and Wiring: Trailer-Mounted Electronic Shop 2
TM 9-4940-252-34	Direct Support and General Support Maintenance: Operation and Maintenance: Trailer-Mounted Electronic Shop 3
TM 9-4940-252-34/4	Direct Support and General Support Maintenance: Self-Test Check Procedures: Trailer-Mounted Electronic Shop 3
TM 9-4940-252-35	Direct Support, General Support, and Depot Maintenance: Schematics and Wiring: Trailer-Mounted Electronic Shop 3

d. Manuals Covering Units Under Test At Support Equipment.

TM 9-1400-250-35/1/1 TM 9-1400-250-35/1/2 TM 9-1400-250-35/1/3 TM 9-1400-250-35/1/4	Direct Support, General Support, and Depot Maintenance: Units of NIKE-AJAX, NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems Tested at Position 1 of Trailer-Mounted Electronic Shop 1
TM 9-1400-250-35/2/1 TM 9-1400-250-35/2/2 TM 9-1400-250-35/2/3 TM 9-1400-250-35/2/4	Direct Support, General Support, and Depot Maintenance: Units of NIKE-AJAX, NIKE-HERCULES, and Improved NIKE-HERCULES Air Defense Guided Missile Systems Tested at Position 2 of Trailer-Mounted Electronic Shop 1.
TM 9-1400-250-35/3/1 TM 9-1400-250-35/3/2	Direct Support, General Support, and Depot Maintenance: Units of NIKE-AJAX, NIKE-HERCULES, and Improved NIKE-HERCULES Air Defense Guided Missile Systems Tested at Position 3 of Trailer-Mounted Electronic Shop 1
TM 9-1400-250-35/4/1 TM 9-1400-250-35/4/2 TM 9-1400-250-35/4/3 TM 9-1400-250-35/4/4	Direct Support, General Support, and Depot Maintenance: Units of NIKE-AJAX, NIKE-HERCULES, and Improved NIKE-HERCULES Air Defense Guided Missile Systems Tested at Position 4 of Trailer-Mounted Electronic Shop 2
TM 9-1400-250-35/5/1 TM 9-1400-250-35/5/2 TM 9-1400-250-35/5/3 TM 9-1400-250-35/5/4	Direct Support, General Support, and Depot Maintenance: Units of NIKE-AJAX, NIKE-HERCULES, and Improved NIKE-HERCULES Air Defense Guided Missile Systems Tested at Position 5 of Trailer-Mounted Electronic Shop 2
TM 9-1430-260-34/1 TM 9-1430-260-34/2 TM 9-1430-260-34/3 TM 9-1430-260-34/4	Direct Support and General Support Maintenance: Units of NIKE-AJAX, NIKE-HERCULES and Improved NIKE-HERCULES Tested at Position 6 of Trailer-Mounted Electronic Shop 3
TM 9-1430-261-34/1 TM 9-1430-261-34/2 TM 9-1430-261-34/3 TM 9-1430-261-34/4 TM 9-1430-261-34/5 TM 9-1430-261-34/6	Direct Support, and General Support Maintenance: Units of NIKE-AJAX, NIKE-HERCULES and Improved NIKE-HERCULES Tested at Position 7 of Trailer-Mounted Electronic Shop 3
TM 9-1430-268-35/2 TM 9-1430-268-35/3	Direct Support, General Support and Depot Maintenance: Units of Radar-Signal-Simulator Station AN/MPQ-T1 Tested at Trailer-Mounted Electronic Shop 3 (Position 6)
TM 9-1430-268-35/4 TM 9-1430-268-35/5	Direct Support, General Support, and Depot Maintenance: Units of Radar-Signal-Simulator Station AN/MTQ-T1 Tested at Trailer-Mounted Electronic Shop 3 (Position 7)

3 (U). Repair Parts List and Supply Manuals Covering NIKE-HERCULES Air Defense Guided Missile System.

a. Radar Course Directing Central.

Y4-2-4	Computer Assembly CP-217/MSA-7 (8000451) (for RCDC AN/MSW-1)
TM 9-1430-250-12P/2/1	Organizational Maintenance Repair Parts and Special Tool Lists for RCDC Antenna Receiver-Transmitter Group, Acquisition, OA-1601/T, OA-1596/T, OA-4343/TP, and OA-4428/TP A-Frame, Vehicle Mounting
TM 9-1430-250-12P/2/2	Illustrations
TM 9-1430-250-12P/3/1	Organizational Maintenance Repair Parts and Special Tool Lists for RCDC Antenna Receiver-Transmitter Group, Missile Tracking, Trailer Mounted OA-1340/MPA Antenna-Receiver-Transmitter Group Target Tracking Trailer Mounted OA-1487/MPA
TM 9-1430-250-12P/3/2	Illustrations
TM 9-1430-250-12P/4/1	Organizational Maintenance Repair Parts and Special Tool Lists for RCDC Director Station, GM, Trailer Mounted AN/MSA-19, AN/MSA-23, AN/MSA-23A, AN/MSA-23B, AN/MSA-25, AN/MSA-25A, AN/MSA-26 and AN/MSA-26A
TM 9-1430-250-12P/4/2	Illustrations
TM 9-1430-250-12P/5/1	Organizational Maintenance Repair Parts and Special Tool Lists for RCDC Tracking Station, GM, Trailer Mounted AN/MPA-5, AN/MPA-6, AN/MPA-6A, and AN/MPA-7.
TM 9-1430-250-12P/5/2	Illustrations
TM 9-1430-250-15P/1/1	Organizational Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC Antenna-Mast Group, Collimation OA-1600/T, Modification Kit, Battery Control
TM 9-1430-250-15P/1/2	Illustrations
TM 9-1430-250-15P/20/1	Organizational Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool List for RCDC Test Set, Radar TS-847A/MSW-1
TM 9-1430-250-15P/20/2	Illustrations
TM 9-1430-250-35P/2/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC Antenna-Receiver-Transmitter Group, Acquisition OA-1601/T, OA-1596/T, OA-4443/TP and A-Frame, Vehicle Mounting
TM 9-1430-250-35P/2/2	Illustrations
TM 9-1430-250-35P/3/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC Antenna-Receiver-Transmitter Group, Missile Tracking Trailer Mounted OA-1340/MPA (Antenna-Receiver-Transmitter Group, Missile Tracking OA-1485/MPA), Antenna-Receiver-Transmitter Group, Target Tracking, Trailer Mounted OA-1487/MPA (Antenna-Receiver-Transmitter Group Target Tracking OA-1488/MPA)
TM 9-1430-250-35P/3/2	Illustrations
TM 9-1430-250-35P/4/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC Director Station, GM, Trailer Mounted AN/MSA-19, AN/MSA-23, AN/MSA-23A, AN/MSA-23B, AN/MSA-25, AN/MSA-25A, AN/MSA-26, AN/MSA-26A (Director-Computer Group, GM OA-1479/MSA-19, OA-3284/MSA-23, OA-3284A/MSA-23, OA-3284B/MSA-23, OA-3330/MSA-25, OA-3330A/MSA-25, OA-3331/MSA-26 and OA-3331A/MSA-26)

TM 9-1430-250-35P/6/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Antenna-Mast Group, Collimation OA-1600A/T and Modification Kit, GM Battery Control Area
TM 9-1430-250-35P/6/2	Illustrations
TM 9-1430-250-35P/7/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Antenna-Receiver-Transmitter Group, Target Tracking, Trailer Mounted OA-1487A/MPA (Antenna-Receiver-Transmitter Group, Target Tracking OA-1488A/MPA)
TM 9-1430-250-35P/7/2	Illustrations
TM 9-1430-250-35P/9/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Director Station, GM, Trailer Mounted AN/MSQ-52, AN/MSA-19C, AN/MSQ-61, AN/MSQ-67, AN/MSQ-62, AN/MSQ-61A (Director-Computer Group, GM OA-3932/MSQ-52, OA-1479C/MSA-19, OA-7162/MSQ-61, OA-7295/MSQ-67, OA-7163/MSQ-62, and OA-7162A/MSQ-61)
TM 9-1430-250-35P/9/2	Illustrations
TM 9-1430-250-35P/10/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC Tracking Station, GM Trailer Mounted AN/MPA-5A and AN/MPA-5B (Tracking Station Group, GM OA-1595A/MPA-5 OA-1595B/MPA-5)
TM 9-1430-250-35P/10/2	Illustrations
TM 9-1430-250-35P/12	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Detector, Radio Frequency RF-122/T
TM 9-1430-250-35P/13/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Test Set, Radar AN/TSM-47
TM 9-1430-250-35P/13/2	Illustrations
TM 9-1430-253-12P/1/1	Organizational Maintenance Repair Parts and Special Tool List for RCDC: Antenna-Receiver-Transmitter Group, Acquisition (EFS)
TM 9-1430-253-12P/1/2	Illustrations
TM 9-1430-253-12P/2/1	Organizational Maintenance Repair Parts and Special Tool List for RCDC: Director Station, GM, Trailer Mounted AN/MSA-19D and AN/MSQ-52A
TM 9-1430-253-12P/2/2	Illustrations
TM 9-1430-253-35P/1/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Antenna-Receiver-Transmitter Group, Acquisition (EFS) and (EFS/ATBM)
TM 9-1430-253-35P/1/2	Illustrations
TM 9-1430-253-35P/2/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for RCDC: Director Station, Trailer Mounted, AN/MSA-19D and AN/MSQ-52A (Director-Computer Group, GM OA-1479D/MSA-19 and OA-3932A/MSA-52)
TM 9-1430-253-35P/2/2	Illustrations
TM 9-1430-268-15P/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Simulator Station, Radar Signal, GM System, Trailer Mounted AN/MPQ- T1
TM 9-1430-268-15P/2	Illustrations

b. Assembly and Service Area

Y9	Rack, Battery MT-1498/G (8013386) (For Assembly and Service Group M15)
TM 9-1410-250-35P/1/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM, Air Defense, MIM-14A and MIM-14B (Body, GM) (Winterization Kit, Gas Turbine Generator Set) (Container, Shipping and Storage, Transponder M466)
TM 9-1410-250-35P/1/2	Illustrations

TM 9-1410-250-35P/4/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Power Conversion Unit, GM, Shop Equipment, Trailer Mounted (9021422)
TM 9-1410-250-35P/4/2	Illustrations
TM 9-1450-250-12P/2/1	Organizational Maintenance Repair Parts and Special Tool List for Ground Handling Equipment, Adapter, Adjustable, Trailer to GM Component, M36, Rings, Handling GM Truck, GM Body Section XM-473, Truck, GM Rocket Motor, M442, Truck, GM Nose Section, XM439
TM 9-1450-250-12P/2/2	Illustrations
TM 9-1450-250-12P/3	Organizational Maintenance Repair Parts and Special Tool Lists for Ground Handling Equipment Truck, GM Test Set, M451 and M451A1 and Truck, Fault Locating Indicator
TM 9-1450-250-12P/4/1	Organizational Maintenance Repair Parts and Special Tool Lists for Ground Handling Equipment, Beam, Hoisting, GM, M8 ans XM13, XM14, XM12, XM11, M7E1 and M7E2 and Hoisting Unit, Portable, GM, XM26E1, Modification Kit, GM Assembly Area (9978679), Sling Multiple Leg, M20
TM 9-1450-250-12P/4/2	Illustrations
TM 9-1450-250-35P/2/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Ground Handling Equipment, Adapter, Adjustable Trailer to GM Component M36 Ring, Handling, GM Truck, GM Body Section, XM473 Truck, GM Rocket Motor M442 Truck, GM Nose Section XM439
TM 9-1450-250-35P/2/2	Illustrations
TM 9-1450-250-35P/3/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Ground Handling Equipment, Truck, GM Test Set, M451 and M451A1 Truck, Fault Locating Indicator
TM 9-1450-250-35P/3/2	Illustrations
TM 9-1450-250-35P/4/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Ground Handling, Equipment: Beam Hoisting, GM, M8 and M13, M14, M12, M11, M7A1, and M7A2; Hoisting Unit, Portable, GM, M26A1; Modification Kit, GM Assembly Area (9978679); Sling, Multiple Leg, M20, Beam Hoisting, GM (8003042)
TM 9-1450-250-35P/4/2	Illustrations
TM 9-1450-250-35P/8	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Ground Handling Equipment, Fixture Assembly, Actuator Centering (8523-723), Fixture, Position Control, Fin (8523720) Fixture, Nose Section (8521673)
TM 9-1450-250-35P/10	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Tool Lists for Truck, GM, Body Section Aft (8523726)
TM 9-1450-250-35P/13/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Stand, Hydraulic System Components, M1 (8523711)
TM 9-1450-250-35P/13/2	Illustrations
TM 9-1450-250-35P/16	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Unit, Missile Hydraulic System

c. Launching Area

TM 9-1440-250-12P/1/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set: Launcher, Monorail, GM M36E1
TM 9-1440-250-12P/1/2	Illustrations
TM 9-1440-250-12P/2/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set, Launching Control Group GM, Trailer Mounted AN/MSW-4
TM 9-1440-250-12P/2/2	Illustrations

TM 9-1440-250-12P/3/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set Simulator Group OA-2010/MSW-4 and OA-2060/MSW-4
TM 9-1440-250-12P/3/2	Illustrations
TM 9-1440-250-12P/4/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set Simulator Group OA-2010/MSW-4 and OA-2060/MSW-4
TM 9-1440-250-12P/4/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set Simulator Group OA-2010/MSW-4 and OA-2060/MSW-4
TM 9-1440-250-12P/4/2	Illustrations
TM 9-1440-250-12P/6/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM Launching Set, Launching Handling, GM M3A1 and XM3
TM 9-1440-250-12P/6/2	Illustrations
TM 9-1440-250-35P/1/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Launching Set Launcher, Monorail, GM M36
TM 9-1440-250-35P/1/2	Illustrations
TM 9-1440-250-35P/2/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Launching Set, Launching Control Group, GM Trailer Mounted AN/MSW-4 (Launching Control Group, GM OA-2282/MSW-4)
TM 9-1440-250-35P/2/2	Illustrations
TM 9-1440-250-35P/3/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Launching Set Control-Indicator C-2620/TSW, C-2620A/TSW and C-2620B/TSW
TM 9-1440-250-35P/3/2	Illustrations
TM 9-1440-250-35P/4/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Launching Set Simulator Group, OA-2010/MSW-4 and OA-2060/MSW-4
TM 9-1440-250-35P/4/2	Illustrations
TM 9-1440-250-35P/5/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Pumping Unit, Hydraulic, XM30, Test Stand, Hydraulic System Components M14
TM 9-1440-250-35P/5/2	Illustrations
TM 9-1440-250-35P/6/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Launching Set Rail, Launching-Handling, GM, M3A1 and XM3
TM 9-1440-250-35P/6/2	Illustrations

d. Missile

Y2-1	
Y2-2	GM, Antiaircraft, M1 (8001739, 8164737, 8014376, 8163923, 8163924 and 8164760 Missile Guidance Set (8006598, 8006663, 8023044, 8172596 and 8172604) (For the Antiaircraft GM M1)
TM 9-1410-206-35P/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Ammunition Components (GM, Air Defense MIM-14A and MIM-14B) and (Rocket Motor Cluster, Trainer, XM29)
TM 9-1410-206-35P/2	Illustrations
TM 9-1410-250-12P/1/1	Organizational Maintenance Repair Parts and Special Tool Lists for GM, Air Defense MIM-14A and MIM-14B
TM 9-1410-250-12P/1/2	Illustrations
TM 9-1410-250-20P/7	Organizational Maintenance Repair Parts and Special Tool Lists for GM Air Defense Body Section GM Training XM84 (10119274) (Rocket Motor Cluster, Trainer, XM29)

TM 9-1410-250-35P/1/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Air Defense MIM-14A and MIM-14B (Body, GM) (Winterization Kit, Gas Turbine Generator Set) (Container Shipping and Storage Transponder M466)
TM 9-1410-250-35P/1/2	Illustrations
TM 9-1410-250-35P/7	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for GM Air Defense (Body Section GM Training, XM84 (10119274)

4 (U). Repair Parts List and Supply Manuals Covering IMPROVED NIKE-HERCULES Air Defense Guided Missile System Support Test Equipment.

a. Radar Course Directing Central

SM 9-4-4935-N14/1	Stock List of Components of Sets Kits, and Outfits for Test Equipment, Electronic Shop, Field Maintenance, Truck Mounted (9143034)
TM 9-1430-250-35P/21/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Electronic Shop, Trailer Mounted, M304 and M304A1, (Electronic Shop Group M16) Shop Equipment, GM Remote Control Systems
TM 9-1430-250-35P/21/2	Illustrations
TM 9-4940-250-15P/1/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Equipment, Electronic Shop Field Maintenance, Trailer Mounted AN/MPM-46A (8514296) (Shop 1) and Modification Kit Electronic Equipment
TM 9-4940-250-15P/1/2	Illustrations
TM 9-4940-250-15P/2/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Equipment, Electronic Shop, Field Maintenance Trailer Mounted AN/MPM-46B (9983984) (Shop 1) and Modification Kit, Electronic Equipment (5956000)
TM 9-4940-250-15P/2/2	Illustrations
TM 9-4940-251-15P/1/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Equipment, Electronic Shop, Field Maintenance, Trailer Mounted, AN/MPM-44 (8514310) (Shop 2) and Modification Kit, Electronic Equipment (5956001)
TM 9-4940-251-15P/1/2	Illustrations
TM 9-4940-251-15P/2/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Equipment Electronic Shop, Field Maintenance, Trailer Mounted AN/MPM-44A (9983981) Modification Kit, Electronic Equipment (5956001)
TM 9-4940-251-15P/2/2	Illustrations
TM 9-4940-252-15P/1/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool List for Test Equipment Electronic Shop, Field Maintenance, Trailer Mounted AN/MPM-52A (9996505) (Shop 3) and Test Accessories for AN/MPQ-T1 Simulator (10167770)
TM 9-4940-252-15P/1/2	Illustrations
TM 9-4940-253-15P/1	Organizational, Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool List for Test Equipment, Electronic Shop, Field Maintenance Truck Mounted
TM 9-4940-253-15P/2	Illustrations

b. Assembly and Service Area

SC 4935-92-CL-003	Sets, Kits and Outfits Components List Shop Sets, Special Field Maintenance Nike Hercules Guided Missile Materiel: Set 4935-697-3669, Set 4935-697-3646
TM 9-4935-253-12P/1/1	Organizational Maintenance Repair Parts and Special Tool Lists for Electrical Test Equipment, Test Set, GM (9025326)
TM 9-4935-253-12P/1/2	Illustrations
TM 9-4935-253-20P/3/1	Organizational Maintenance Repair Parts and Special Tool Lists for Electrical, Test Equipment, Test Set, GM AN/DSM-46B
TM 9-4935-253-20P/3/2	Illustrations
TM 9-4935-253-35P/1/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Electrical Test Equipment Test Set, GM (9022326) (Test Set Group, GM OA-2341/D (9025327) or OA-2431A/D (9978738)
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TM 9-4935-252-35P/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Equipment, Guidance Set (8159420)
TM 9-4935-252-35P/2	Illustrations
TM 9-4935-253-12P/2/1	Organizational Maintenance Repair Parts and Special Tool Lists for Electrical Test Equipment, Test Set, Guidance Missile AN/DSM-23A
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TM 9-4935-253-12P/4/2	Illustrations

TM 9-4935-253-35P/2/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Electrical Test Equipment Test Set, GM AN/DSM-33A (9025325) or AN/DSM-33B (9978733) (Case Assembly Portable (8523556) and Test Set, Electrical Power and Servo TS-1326/DSM (9025328) or TS 1326A/DSM (9978737)
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TM 9-4935-255-35P/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Set, Electrical Circuit, GM Launcher AN/TSM-21 (8523704)
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J738-2	Equipment, Air Leak Check (8020350 and 8523710) (For Type IV Equipment for GM.
J738-6	Cabinet, Air Control (8020349 and 8163240) (For Type IV Equipment)
J738-9	Stand, Air Test, Power Plant Component (8020347 and 8523709) and Stand Air Test, Hydraulic Component (8020348 and 8523822) (For Type IV Equipment)
J738-12	Stand, Flow Test, Power Plant Regulator Valve (8020346) (For Type IV Equipment for GM.
J738-17	Tester, Missile Electrical Harness (8020302) (For Type IV Equipment)
SC 4935-92-CL-002	Sets, Kits and Outfits Components List: Shop Sets: Special Field Maintenance, Nike-Ajax/Hercules GM Materiel; Set A 4935-606-5231, Set B 4935-605-7757, Set C 4935-606-5232, Set D 4935-605-7756, Set E 4935-606-5233, Set F 4935-605-7755
SC 4935-92-CL-011	Sets, Kit and Outfits, Components List Shop Sets, Special Field Maintenance Nike-Hercules Guided Missile Materiel, Set 4935-724-3428, Set 4935-724-3429, Set 4935-724-3429, Set 4935-724-3430
SM 9-4-4935-NO1	Stock Lists of Components of Sets, Kits, and Outfits, Shop Sets, Special Organi-Maintenance Nike-Ajax/Hercules GM Materiel Set A 4935-523-9528, Set B 4935-893-9528, Set B 4935-893-1412, Set C 4935-624-1847
SM 9-4-4935-N12	Stock List of Components of Sets, Kits and Outfits Shop Equipment GM, Base Maintenance (Class V) Corporal (4935-893-0049) Hawk (Class V) Corporal (4935-893-0048) Hawk (4935-474-2697) Lacrosse (4935-448-6284) Nike-Ajax/Hercules (4935-472-9821) Hercules/Improved Hercules (4935-593-8655)
TM 9-1450-250-35P/6/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Valve, Angle (9152042), Valve, Angle (9152043), Fixture Assembly, Auxiliary Power Supply Mounting (8523723), Fixture Assembly, Actuator Centering (8523720), Fixture Assembly, Actuator Centering (8523720), Fixture, Nose Section (8521673), Rack, Holding, Fin Assembly (8523729), Truck, Guided Missile Body Section, M490 (8523726), Fixture Assembly, Hydraulic Valve, Dynamic Test (8523-722), Test Set, Resistor AN/PSM-12 (8523706), and Tester, Guidance Section Air Leakage (8166423)

TM 9-4935-250-35P/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Test Stand, Hydraulic Pumping Unit, M2 (8529385)
TM 9-4935-250-35P/2	Illustrations
TM 9-4935-250-35P/4/1	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tool Lists for Simulator GM, Pre-Launch Signal (9021312)
TM 9-4935-250-35P/4/2	Illustrations

APPENDIX II (U)

REFERENCES

1. Publication Indexes

The following indexes should be consulted frequently for the latest changes or revisions of references given in this appendix and for new publications relating to the materiel covered in this manual.

Index of Administrative Publications	DA Pam 310-1
Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings	DA Pam 108-1
Index of Blank Forms	DA Pam 310-2
Index of Graphic Training Aids and Devices	DA Pam 310-5
Index of Supply Manuals, Ordnance Corps	DA Pam 310-29
Index of Doctrinal, Training, and Organizational Publications (Field Manuals, Reserve Officers Training Corps Manuals, Training Circulars, Army Subject Schedules, Army Training Tests, Firing Tables and Trajectory Charts, Tables of Organization and Equipment, Type Tables of Distribution and Tables of Allowances	DA Pam 310-3
Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 4, 6, 7, 8 and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders	DA Pam 310-4

2. Supply Manuals

The following supply manual pertains to this materiel.

Ammunition, Explosives, Bulk Propellants, and Explosive Devices	SM 9-5-1375

3. Forms

The following forms pertain to this materiel.

Equipment, Inspection and Maintenance Worksheet	DA Form 2404
Equipment Maintenance Records, Organizational	DA Form 2408-3
Maintenance Request	DA Form 2407
Materiel Inspection and Receiving Report	DD Form 250
Rejection Memorandum	DA Form 829
Report of Damaged or Improper Shipment	DD Form 6
Request for Issue or Turn-In	DA Form 1546

4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment.

a. Camouflage.

Camouflage, Basic Principals	FM 5-20

b. Decontamination.

Decontamination	TM 3-220
Defense Against CBR Attack	FM 21-40

c. Destruction to Prevent Enemy Use.

Demolition Materials	TM 9-1946
Explosives and Demolitions	FM 5-25
Operators Manual: Destruction of NIKE Guided Missile Systems Materiel to Prevent Enemy Use (NIKE-AJAX, NIKE-HERCULES Air Defense Guided Missile Systems)	TM 9-1400-250-10/3

d. General.

Accident Reporting and Records	AR 385-40
Army Safety Program	AR 385-10
Authorized Abbreviations and Brevity Codes	AR 320-50
Corrosion Control and Treatment	TB 9-337
Dictionary of United States Army Terms	AR 320-5
First Aid for Soldiers	FM 21-11
Military Symbols	FM 21-30
Military Terms	FM 21-5
Northern Operations	FM 31-71
Ordnance Direct Support Service	FM 9-3
Ordnance General and Depot Support Service	FM 9-4
Ordnance Major Items and Major Combinations, and Pertinent Publications	SB 9-1
Organization, Policies, and Responsibilities for Maintenance Operations	AR 750-5
Organizational Maintenance NIKE-HERCULES Launching and Handling Equipment (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)	LO 9-1400-250-20
Organizational Maintenance NIKE-HERCULES Radar Course-Directing Central (NIKE-HERCULES and Improved NIKE-HERCULES Air Defense Guided Missile Systems)	LO 9-1430-250-20
Report of Malfunctions and Accidents Involving Ammunition and Explosives During Training and Combat	AR 700-1300-8
Techniques of Military Instruction	FM 21-6

e. Technical Manuals.

Army Equipment Record Procedures	TM 38-750
Operation and Maintenance of Army Materiel in Extremely Cold Weather 0° to −65°	TM 9-207
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel; and Related Materials Including Chemicals	TM 9-247
Painting Instructions for Field Use	TM 9-213
Preservation, Packaging, and Packing of Military Supplies and Equipment	TM 38-230
Preventive Maintenance Services (NIKE-AJAX, NIKE-HERCULES, Improved NIKE-HERCULES Air Defense Guided Missile Systems)	TM 9-1400-250-12
Use and Care of Hand Tools and Measuring Tools	TM 9-243

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USAR: None

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

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