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

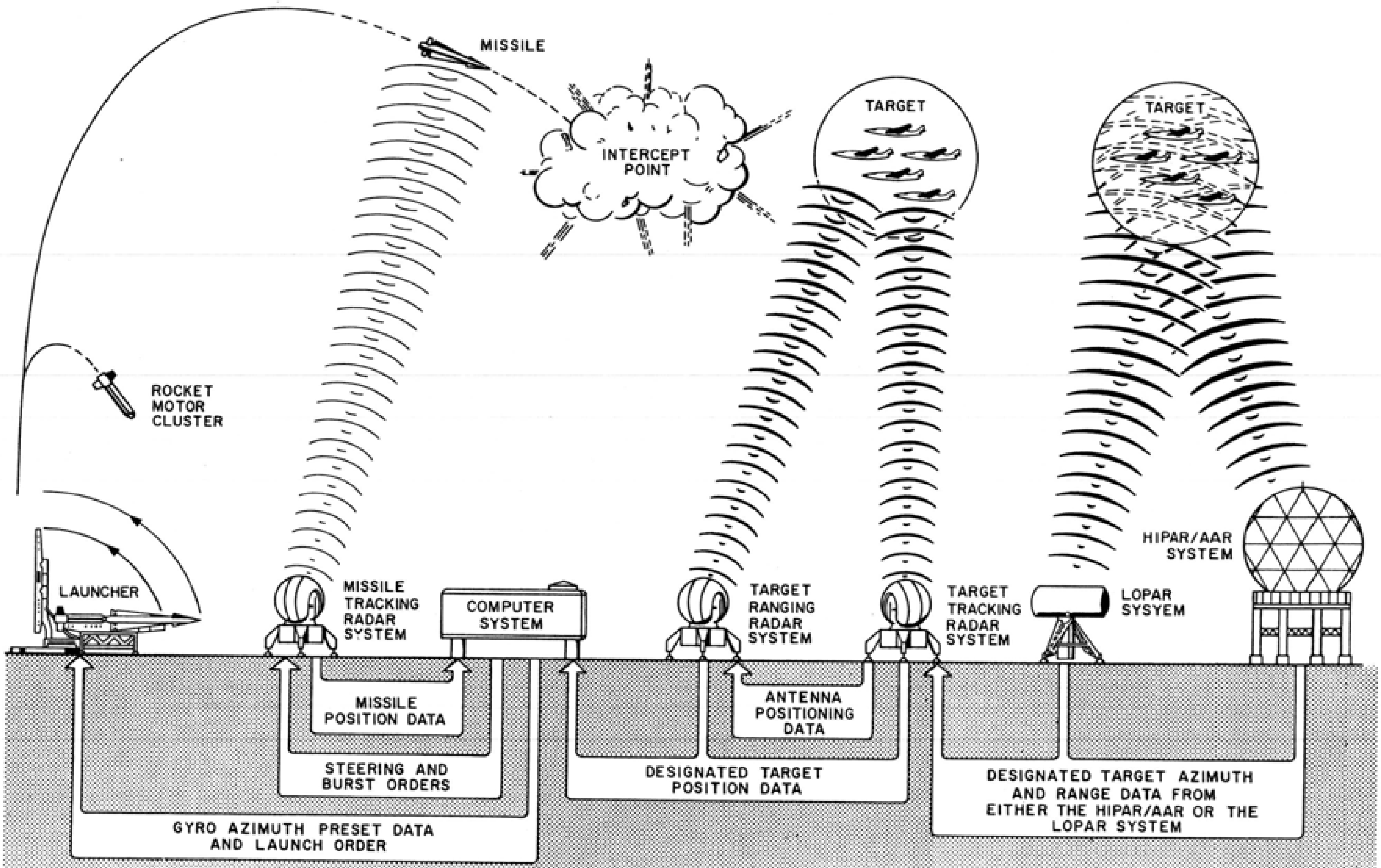

Figure 5 (U). Surface-to-air-mission—functional diagram (U).

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 th missile during trajectory; and issue steerin and burst orders to the missile. The batter control officer determines the type of missio missile, and warhead to be used. The batter control officer also supervises selection of t target to be engaged and issues orders to rea the missile for launching and to fire the missi

b. Launching Area. The launching area c tains the guided missile launching set wh consists of NIKE–HERCULES and NIK AJAX launchers and launching control eq ment, or of only NIKE–HERCULES equipm Personnel in this area maintain a suppl ready missiles.

c. Assembly and Service Area. The as bly and service area is a support area provides equipment and facilities for as bling, testing, fueling, and storing missile

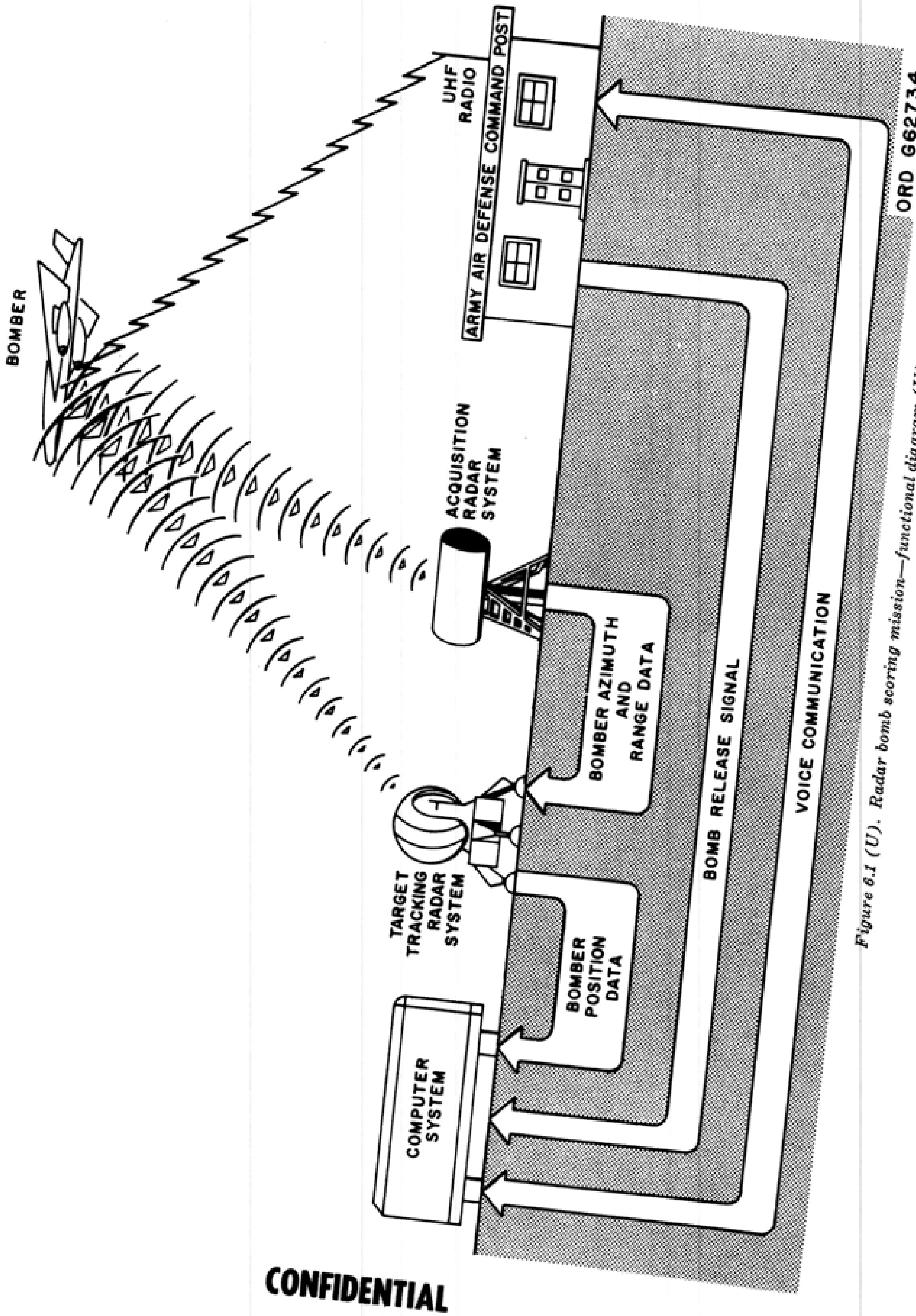

Figure 6.1 (U). Radar bomb scoring mission—functional diagram (U).

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.

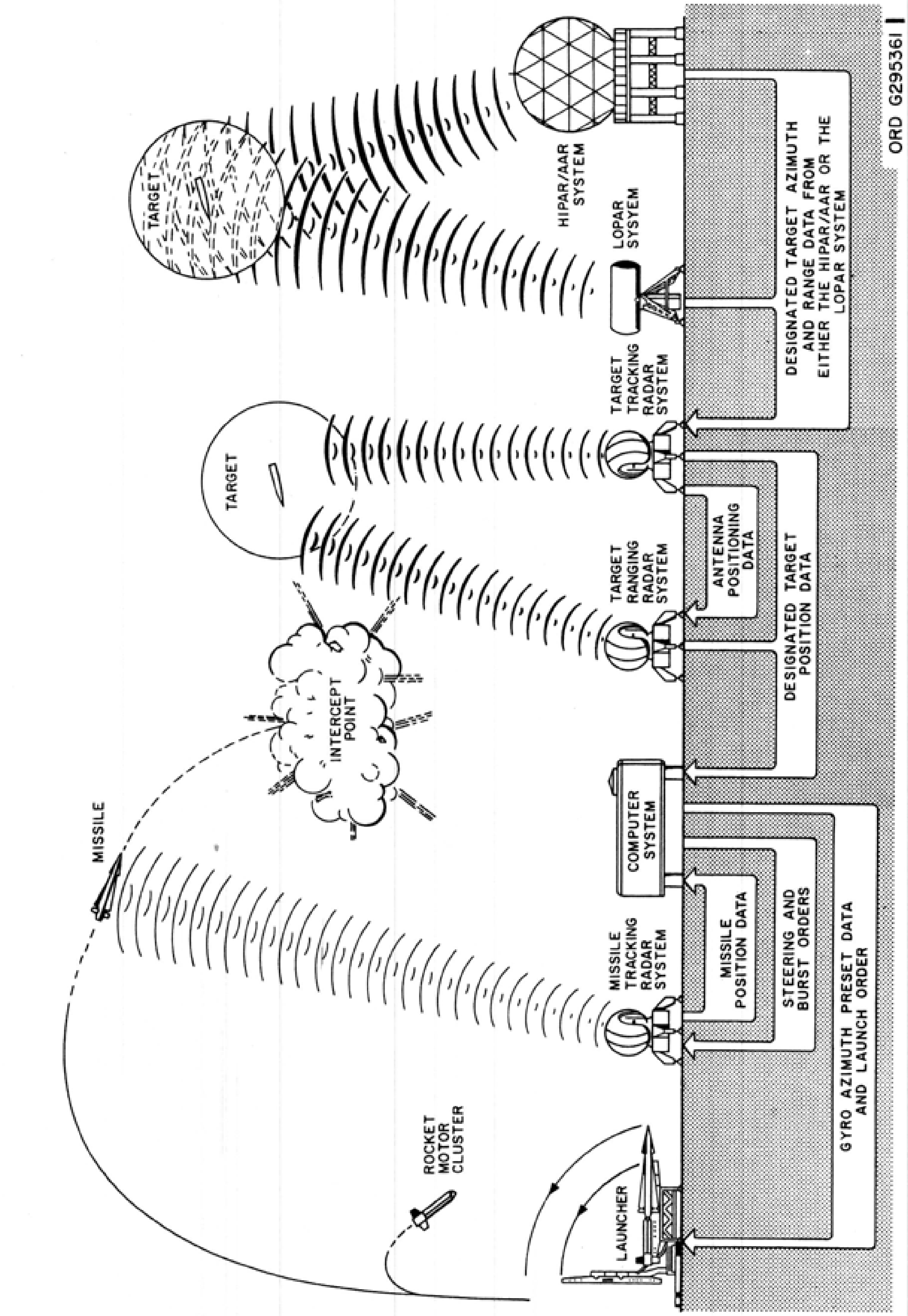

Figure 6.2 (U). Surface-to-air anti-missile mission—functional diagram (U).

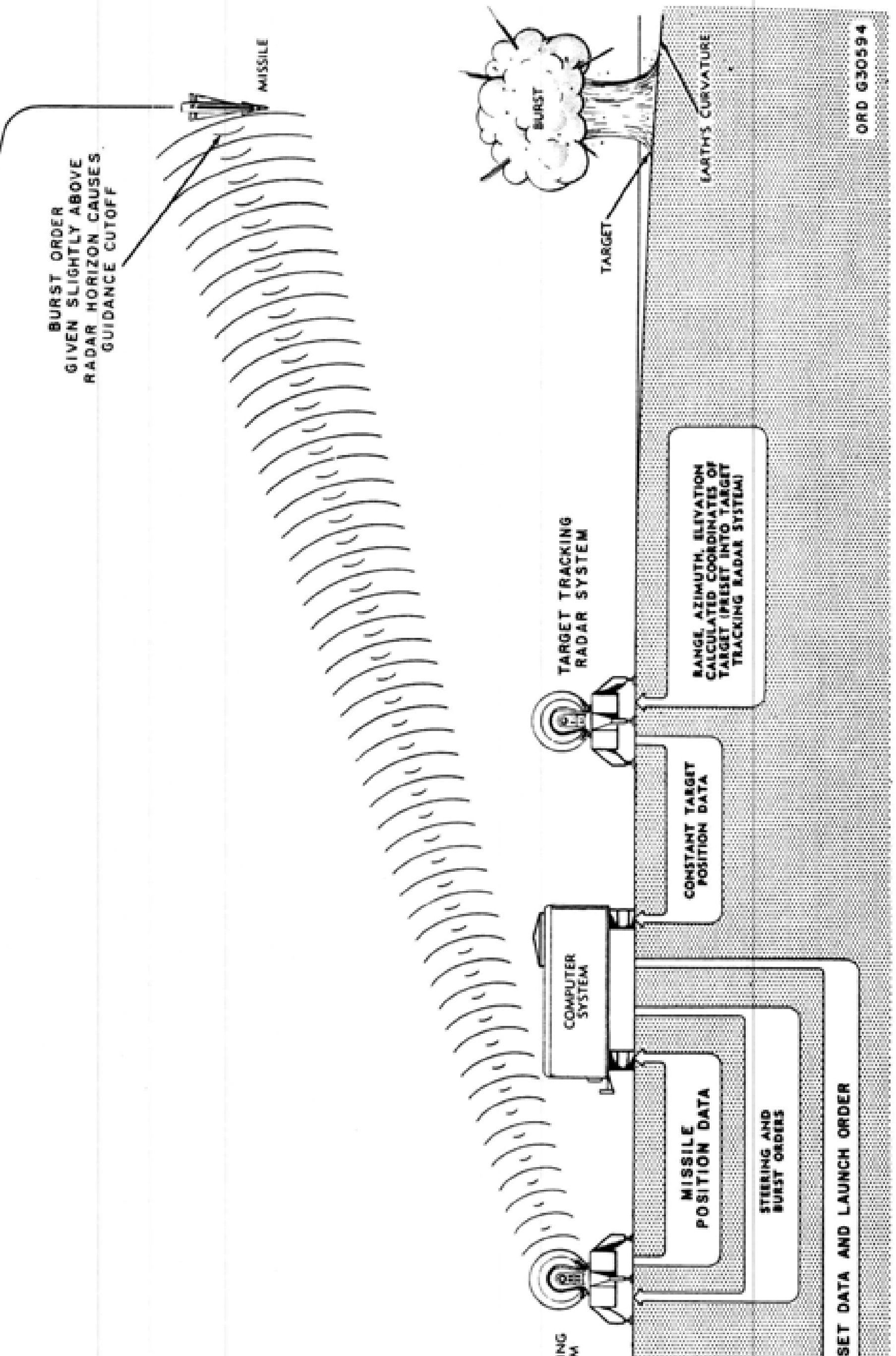

Figure 7 (U). Surface-to-surface mission—functional diagram (U).

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).

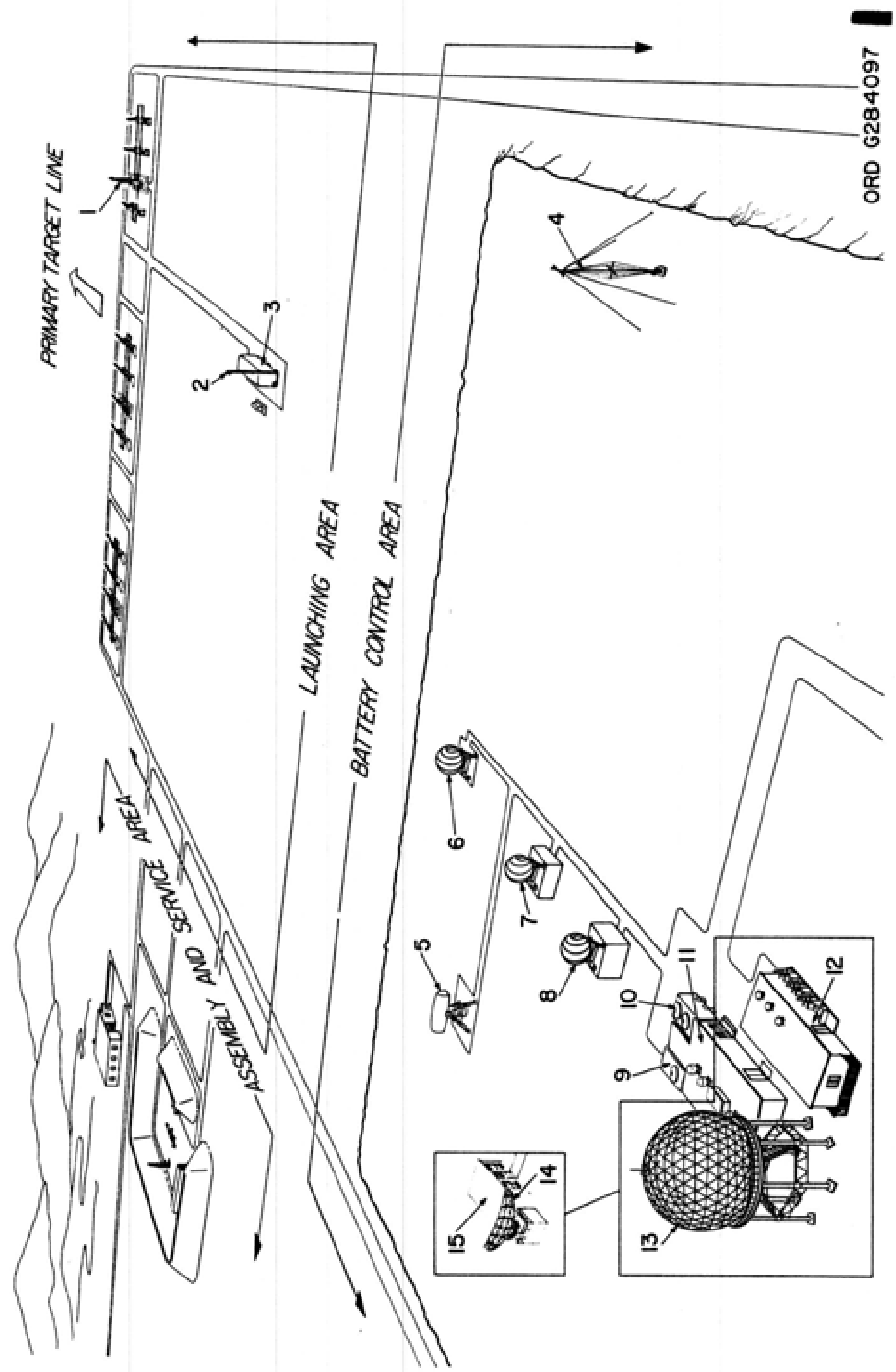

Figure 8 (U). Battery layout—typical consolidated site (U).