

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 compatibility

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.

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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 check-out.

(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 Ordnance unit or organization charged with providing maintenance 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 battalion(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-

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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.