~~CONFIDENTIAL~~

Modified Handling Authorized

# FM 6-25

DEPARTMENT OF THE ARMY FIELD MANUAL



# FIELD ARTILLERY MISSILE GROUP (REDSTONE) (U)





*HEADQUARTERS, DEPARTMENT OF THE ARMY*
*SEPTEMBER 1960*



~~CONFIDENTIAL~~

Modified Handling Authorized

*FM 6-25

FIELD MANUAL
No. 6-25

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 9 *September 1960*

# FIELD ARTILLERY MISSILE GROUP (REDSTONE) (U)


| | | Paragraphs | Page |
|---|---|---|---|
| CHAPTER 1. | GENERAL | | |
| Section I. | Introduction | 1–4 | 3 |
| II. | The Redstone missile system | 5–7 | 4 |
| III. | Missions | 8–12 | 8 |
| CHAPTER 2. | ORGANIZATION | | |
| Section I. | The field artillery missile group (Redstone) | 13 | 9 |
| II. | Headquarters and headquarters battery field artillery missile group, Redstone | 14 | 9 |
| III. | The field artillery missile battery, Redstone | 15, 16 | 10 |
| IV. | The engineer company, Redstone | 17, 18 | 11 |
| V. | The ordnance company, Redstone | 19, 20 | 12 |
| CHAPTER 3. | COMMAND | | |
| Section I. | Group commander and staff | 21, 22 | 13 |
| II. | Battery commanders, company commanders, and platoon leaders | 23, 24 | 15 |
| CHAPTER 4. | PRINCIPLES OF EMPLOYMENT | 25–36 | 17 |
| 5. | RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION | 37–41 | 30 |
| 6. | ORGANIZATION OF POSITION | 42–46 | 33 |
| 7. | SECURITY | 47–49 | 37 |
| 8. | COMMUNICATION | 50–52 | 40 |
| 9. | SURVEY | 53–56 | 43 |
| 10. | ADMINISTRATION AND LOGISTICS | | |
| Section I. | General | 57–59 | 46 |
| II. | Engineer company | 60–62 | 47 |
| III. | Ordnance company | 63, 64 | 49 |
| IV. | Ammunition handling procedures | 65–67 | 50 |
| V. | Propellant handling procedures | 68–76 | 52 |
| VI. | Maintenance and supply | 77, 78 | 58 |


*This manual supersedes FM 6-25, 27 February 1958.

4 COPY

| | | Paragraphs | Page |
|---|---|---|---|
| CHAPTER 11. | GUNNERY | | |
| Section I. | Introduction | 79–81 | 61 |
| II. | The gunnery problem | 82–85 | 63 |
| III. | Group fire direction | 86–92 | 70 |
| IV. | Determination of firing data | 93–101 | 76 |
| CHAPTER 12. | TRAINING | | |
| Section I. | General | 102–105 | 111 |
| II. | Redstone trainer | 106, 107 | 112 |
| APPENDIX I. | REFERENCES | | 113 |
| II. | CONDUCT OF SERVICE PRACTICE | | 124 |
| INDEX | | | 130 |

# CHAPTER 1
# GENERAL

## Section I. INTRODUCTION

### 1. (U) Purpose and Scope

*a.* This manual is a guide for the group commander, unit commanders within the group, and corps and army artillery commanders in the employment of the Redstone missile system. It covers organization; command; principles of employment; reconnaissance, selection, and occupation of position; organization of position; security; communication; survey; administration and logistics; gunnery; and training.

*b.* The material presented herein is applicable without modification to both nuclear and nonnuclear warfare.

*c.* Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to Commandant, US Army Artillery and Missile School, Fort Sill, Okla.

### 2. (U) Application

This manual applies to units organized under—

*a.* TOE 6–630D, Field Artillery Missile Group, Redstone.

*b.* TOE 6–631D, Headquarters and Headquarters Battery, Field Artillery Missile Group, Redstone.

*c.* TOE 6–634D, Field Artillery Missile Battery, Redstone.

*d.* TOE 5–214D, Engineer Company, Redstone.

*e.* TOE 9–217D, Ordnance Company, Redstone.

### 3. (U) Use

The organization and employment presented in this manual are based on the premise that the field artillery missile group, Redstone, is primarily a means of nuclear fire support. Field manuals 6–20, 6–140, 100–5, and 101–5 should be used in conjunction with this manual, since many of the principles and techniques for employment of other types of field artillery units also apply to the Redstone organization.

## 4. (U) References

Appendix I contains a list of publications pertaining to the field artillery missile group, Redstone, and its organic units. Pending publication of appropriate technical manuals, Notes on Development Type Materiel will be used as references for technical procedures.

# Section II. THE REDSTONE MISSILE SYSTEM

## 5. (U) Classification

Field artillery missiles are classified as short-range, medium-range, or long-range weapons (AR 525–30). The Redstone is an Army long-range, ballistic, guided missile.

## 6. (CM) Description

*a. Redstone Guided Missile.* The Redstone missile is 21.12 meters in length and 1.8 meters in diameter. It consists of three main parts—the warhead unit, aft unit, and thrust unit (fig. 1). The warhead and aft units are joined together to form the missile body, that part of the missile which goes all the way to the target. The thrust unit, which contains the propulsion system, separates from the missile body after engine cutoff and falls approximately ten miles short of the target. The missile weighs 62,000 pounds when fully prepared for firing.

*b. Propulsion System.* The Redstone missile is powered by a controlled thrust, bipropellant rocket engine that develops a constant thrust of approximately 78,000 pounds for a maximum of 121 seconds. Engine burning time is dependent on the range desired. The propellants used are an alcohol-water solution for fuel and liquid oxygen (LOX) as the oxidizer. Hydrogen peroxide ($H_2O_2$) is used to generate the steam required for operating the turbopump assembly that delivers the propellants to the rocket engine.

*c. Guidance and Control System.* The Redstone missile is directed in flight by a self-contained inertial guidance system. Three air bearing gyroscopes are used to position a stabilized platform so that it will maintain a fixed reference in space regardless of the position of the missile. Mounted on the stabilized platform are three potentiometers to enable attitude errors of yaw, pitch, and roll to be measured. A programming device insures that the missile has the correct pitch attitude throughout its trajectory. Also mounted on the stabilized platform are two accelerometers that send range and lateral velocity information to the range and lateral computers. Velocity and displacement errors from a predetermined flight path are thus determined. All error signals are sent into a control computer that will generate the commands to be sent to the control surfaces. Aside from certain prerecorded data pertaining to the correct flight path, no further information is utilized by the guidance and control system.

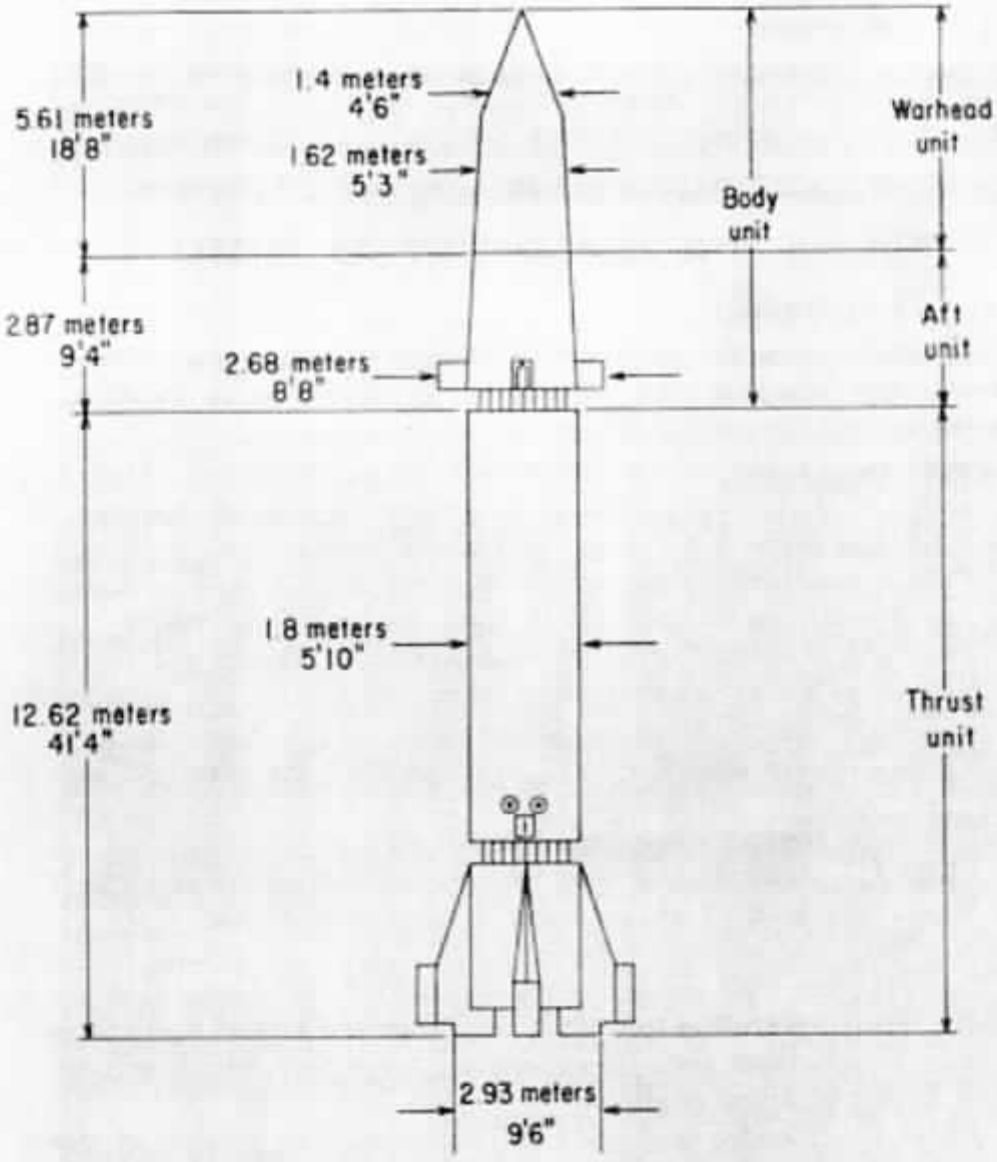



*Figure 1.* (U) *Redstone missile nomenclature and dimensions.*

*d. Ground Handling Equipment.* Standard army vehicles and equipment are used to the maximum extent possible in the Redstone system. Where possible, the specially designed equipment required for the system is mounted on a standard vehicle chassis or trailer to simplify the maintenance. The system is 100-percent mobile, and is air transportable.

*e. Fire Capabilities.* The Redstone missile is capable of carrying a nuclear warhead section to a maximum range of 324 kilometers. Minimum range is 93 kilometers. The design circular probable error is 300 meters. The group is capable of a maximum rate of fire of 4 missiles in a 24-hour period with adequate warning, providing that the firings are done from the same positions and that resupply

is adequate. The sustained rate of fire is 1 missile per 48-hour period.

*f. Vulnerability.* The Redstone missile system is considered invulnerable to any presently known electronic countermeasures.

## 7. (CM) Redstone Operational Flight Sequence

(fig. 2)

*a. Phase I, Firing to Propulsion Cutoff.* The missile is fired vertically from a portable launcher. The thrust develops gradually, and the missile initially rises slowly. During this time maneuvering control of the missile is accomplished by carbon jet vanes which deflect the stream of hot gases expelled from the rocket engine. As the missile gains speed, the air rudders also become effective. During this phase of flight the guidance system is capable of detecting, measuring, and correcting attitude and lateral path errors. A section of the range guidance computer (cutoff computer) is used to determine the proper time and position in space for propulsion cutoff.

*b. Phase II, Propulsion Cutoff to Separation.* Propulsion cutoff is initiated by the guidance system when the missile has attained sufficient displacement from its firing point, and is traveling at a velocity so that its trajectory will coincide with the standard trajectory at reentry. Separation of the body from the thrust unit occurs 10 to 30 seconds after propulsion cutoff.

*c. Phase III, Separation to Reentry.* Separation occurs at an altitude where the lack of atmospheric density renders the body air vanes ineffective as control surfaces. At this point, jet nozzles working in conjunction with the air vanes are utilized for missile attitude control. From separation to reentry the range and lateral computers accumulate deviations from the standard trajectory which will be applied during terminal guidance.

*d. Phase IV, Reentry to Impact.* Reentry is that portion of the trajectory where the body of the missile comes back into the earth's atmosphere. Upon reentry a deceleration switch initiates the following guidance and control changes.

(1) The control computer accepts signals from the lateral and range computer. The guidance gain is small at first, then it gradually increases until the control servo loop is operating at full gain.

(2) The attitude error signals are attenuated so that primary consideration is given to guidance errors. After all guidance corrections have been made, and if no further disturbances occur, the missile will dive into the target at the point designated by the standard trajectory.

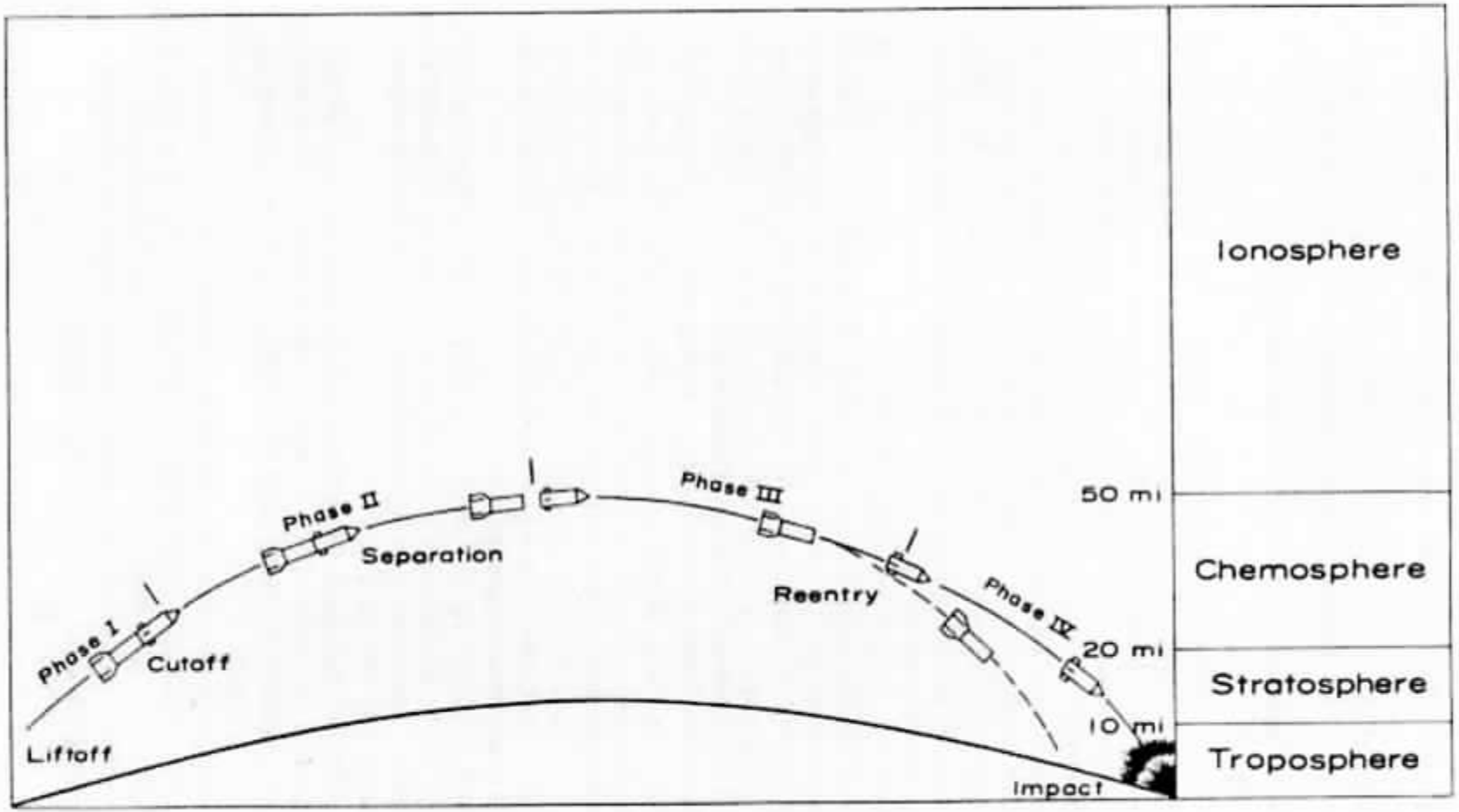



*Figure 2.* (U) *Missile flight phases.*

## Section III. MISSIONS

### 8. (U) Field Artillery Missile Group, Redstone

The mission of the field artillery missile group, Redstone, is to provide nuclear field artillery missile fires in general support of ground forces. Displacement will be either ordered or approved by the next higher commander.

### 9. (U) Headquarters and Headquarters Battery, Field Artillery Missile Group, Redstone

The mission of the headquarters and headquarters battery is to direct and coordinate operations of the group, provide facilities with which the group commander controls the group, and maintain personnel records for all elements of the group. For the artillery units organic to the group, it provides survey and fire direction, maintains appropriate supply records, and performs second echelon motor maintenance.

### 10. (U) Field Artillery Missile Battery, Redstone

The mission of the missile battery, Redstone, is to provide the firing component of the field artillery missile group, Redstone.

### 11. (U) Engineer Company, Redstone

The mission of the engineer company, Redstone, is to provide liquid oxygen and liquid nitrogen, and to provide engineer field maintenance and repair parts support for the mechanical engineer equipment of the group.

### 12. (U) Ordnance Company, Redstone

The mission of the ordnance company, Redstone, is to provide missiles, warheads, fuel, hydrogen peroxide, parts, tools, and maintenance for all ordnance and signal items for the group. It also provides field maintenance for ordnance and signal items to the limits of its capabilities and evacuation service for ordnance items beyond its maintenance capabilities.

# CHAPTER 2

# ORGANIZATION

## Section I. THE FIELD ARTILLERY MISSILE GROUP, REDSTONE

### 13. (U) General

The field artillery missile group, Redstone, is organized as a tactical and administrative unit and is self-sustaining. It is composed of a headquarters and headquarters battery; two field artillery missile batteries, Redstone; an engineer company, Redstone; and an ordnance company, Redstone (fig. 3).

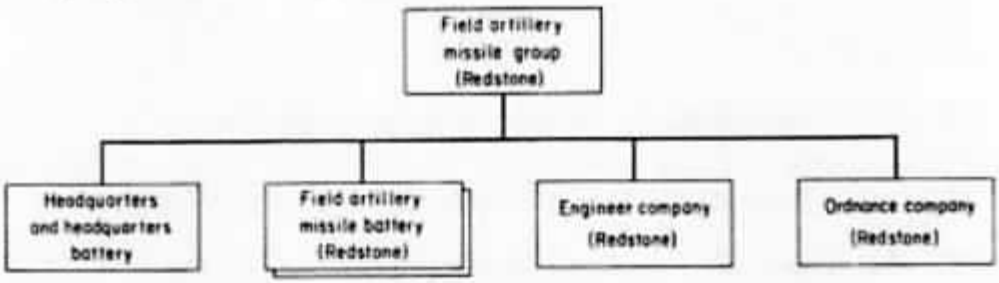



*Figure 3.* (U) *Field artillery missile group, Redstone.*

## Section II. HEADQUARTERS AND HEADQUARTERS BATTERY, FIELD ARTILLERY MISSILE GROUP, REDSTONE

### 14. (U) Functions

*a. Group Headquarters.* The group headquarters operates as a tactical and administrative headquarters. The group commander and his staff control and supervise all tactical and administrative operations of the group. The group commander's staff is composed of the executive officer, S1, S2, S3, S4, a communication officer, two assistant S3's, a liaison officer, a reconnaissance and survey officer, motor officer, surgeon, and chaplain.

*b. Headquarters Battery* (fig. 4). The headquarters battery performs the following functions:

(1) Furnishes enlisted personnel to operate the various staff sections and otherwise supports the group headquarters in all its functions.

(2) Draws and issues all classes of common supplies to the artillery elements of the group.

(3) Furnishes limited administrative logistical support and second echelon signal and motor maintenance support to the missile firing batteries.

(4) Furnishes personnel administration for the group.
(5) Provides unit level medical service to include medical care and evacuation, establishing an aid station, and furnishing aidmen to group units.
(6) Performs fire direction and survey functions for the missile firing batteries.
(7) When augmented with the security detachment, provides security personnel for safeguarding of nuclear warheads.

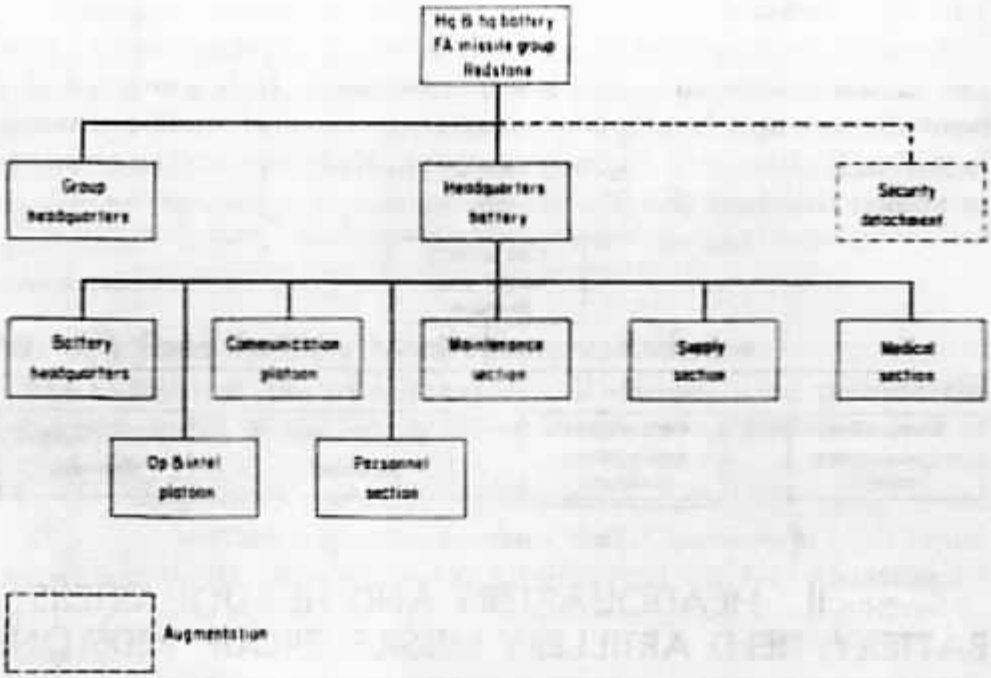



*Figure 4.* (U) *Headquarters and headquarters battery, field artillery missile group, Redstone.*

## Section III. THE FIELD ARTILLERY MISSILE BATTERY, REDSTONE

### 15. (U) General

The missile firing battery provides the firing component of the field artillery missile group, Redstone. It is composed of a battery headquarters, communications section, and a missile firing battery. The missile firing battery consists of a firing battery headquarters, a missile firing section, and a missile servicing section (fig. 5).

### 16. (U) Functions

The two firing batteries have a limited administrative capability but are dependent upon headquarters and headquarters battery for administrative and logistical support and second echelon maintenance. The firing batteries are responsible for drawing, storing, and transporting their prescribed load of nuclear rounds, including thrust units,

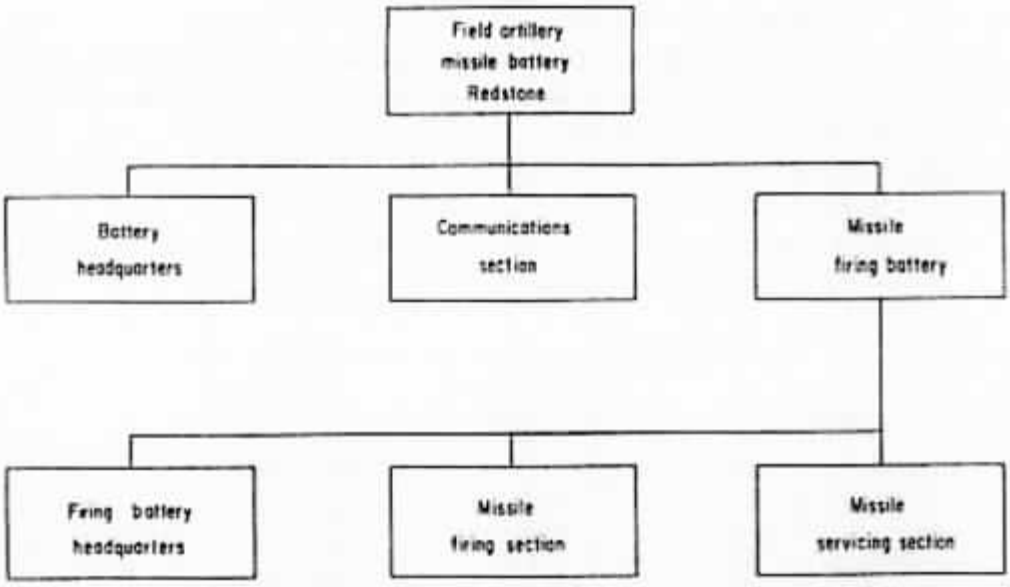



*Figure 5.* (U) *Field artillery missile battery, Redstone.*

aft units, warhead units, and propellants. They are responsible for the assembly, test, propellant loading, and firing of the missile. They are also responsible for organizational maintenance on all missiles, test equipment, and associated handling equipment. Each firing battery operates one launcher.

## Section IV. THE ENGINEER COMPANY, REDSTONE

### 17. (U) General

The engineer company furnishes liquid oxygen (LOX) and liquid nitrogen ($LN_2$) directly to the firing batteries of the Redstone group. It is composed of a company headquarters, a maintenance platoon, and two liquid oxygen/nitrogen generating platoons (fig. 6).

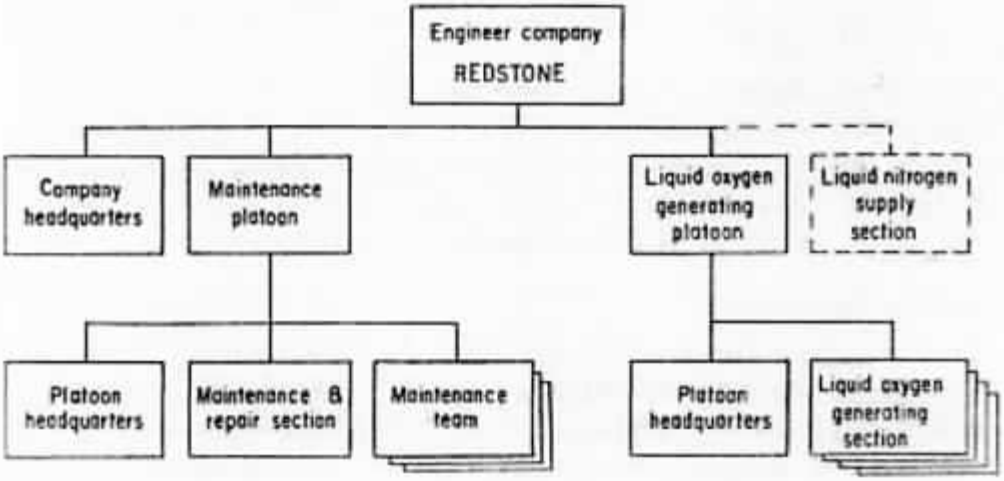



*Figure 6.* (U) *The engineer company, Redstone.*

### 18. (U) Functions

The personnel of the engineer company headquarters maintain close liaison with group headquarters, and the company commander acts as a technical adviser to the group commander. In addition to furnishing liquid oxygen and liquid nitrogen directly to the firing batteries, the company provides engineer field maintenance and repair parts support for engineer mechanical equipment of the group to include engineer equipment organic to the company.

## Section V. THE ORDNANCE COMPANY, REDSTONE

### 19. (U) General

The ordnance company provides missiles, alcohol and water mixture fuel, and hydrogen peroxide directly to the firing batteries of the Redstone group. The company is composed of a company headquarters, an operations section, a missile maintenance platoon, supply platoon, and an automotive maintenance platoon (fig. 7).

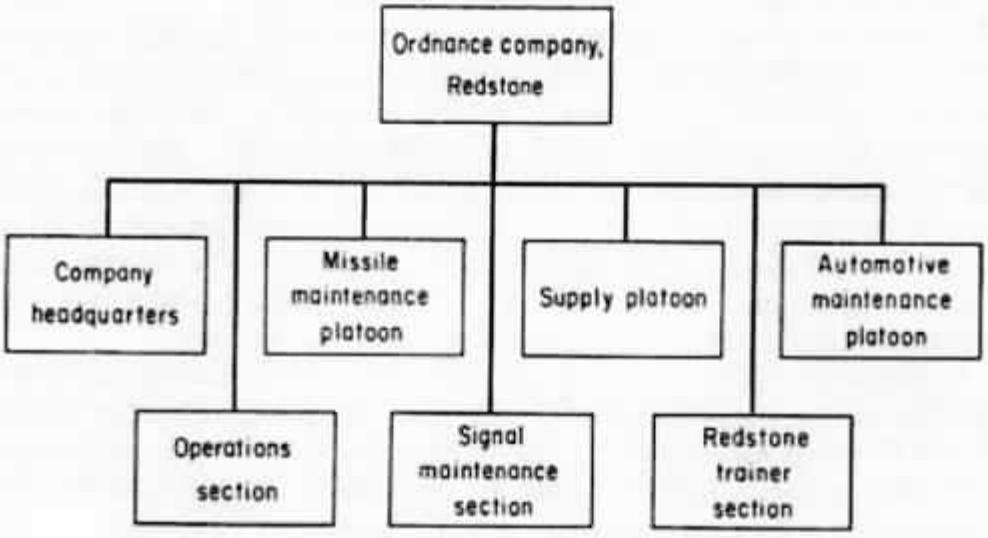



*Figure 7. (U) The ordnance company, Redstone.*

### 20. (U) Functions

The ordnance company headquarters maintains close liaison with the group headquarters. The company commander acts as an ordnance technical adviser to the group commander. In addition to furnishing all the missile components, the alcohol-water mixture, and the hydrogen peroxide directly to the firing batteries, the ordnance company provides other ordnance and signal support for the group. This support includes supply and maintenance of common ordnance and signal items as well as direct support for specialized items of missile equipment. The ordnance company performs pre-issue inspections of missiles before issue to the firing batteries and performs periodic requalification of missile guidance and control equipment.

# CHAPTER 3
# COMMAND

## Section I. GROUP COMMANDER AND STAFF

### 21. (U) General

The group commander commands the group and, with the assistance of his staff, controls and supervises all tactical and administrative activities of the group.

### 22. (U) Responsibilities

*a. Group Commander.* The duties and responsibilities of the commander of a field artillery missile group, Redstone, are essentially the same as those of commanders of other field artillery groups. This group differs from a normal artillery organization in that it includes engineer and ordnance technical support units. The group commander must be familiar with the capabilities and limitations of all units within the group in order to advise the next higher commander on the employment of the group and to recommend suitable position areas for the group. He must also be prepared to assist the next higher commander in the selection of appropriate targets for the Redstone missile and to recommend suitable position areas.

*b. Executive Officer.* The group executive officer assists the commander in the performance of his duties. He coordinates the activities of the staff and supervises all administrative functions performed with the group. Specific duties in operations are directed by the commander with such authority as the commander delegates.

*c. S1.* The S1 establishes and operates the office of record for the group. He supervises the publication and distribution of orders and authenticates administrative orders. His duties and responsibilities are similar to those of the S1 in any other artillery organization. Additional duties may be directed by the group commander or executive officer.

*d. S2.* The group S2 is the intelligence officer for the group. His duties and responsibilities are similar to those of the intelligence officer in any other artillery organization, except that this group has no target acquisition function.

*e. S3.* The group S3 is the operations and training officer and also the gunnery officer for the group. His functions include most of those normally performed by a group or division artillery S3. He monitors the transmission of fire missions from higher headquarters.

On receipt of a fire mission, the group S3 coordinates the activities of the firing batteries, the engineer company, and ordnance company in the accomplishment of the mission. During the actual preparation for firing and after completion of each mission, the group S3 receives reports from the firing battery commanders and prepares operational reports for submission to higher headquarters. The group S3 is responsible for the training of the fire direction computers. He supervises the computation of the data for fire missions and coordinates transmission of firing data to the firing batteries.

*f. S4.* The group S4 coordinates and supervises the supply activities of the group. His duties and responsibilities are similar in nature to those of a battalion S4 insofar as they pertain to the artillery elements of the group. The group S4 consolidates and forwards supply and maintenance reports as directed by the group commander.

*g. Assistant S3.* The assistant S3's perform specific duties and have responsibilities as directed by the S3.

*h. Communication Officer.* The group communication officer supervises the installation and operation of all communications within the group. He monitors transmission within the group for security violations and supervises communication training and maintenance in all elements of the group. He advises the group commander in all matters pertaining to communication and maintains contact with signal or communication officers of the next higher headquarters. In coordination with the headquarters battery commander, he advises the group commander on location of the command post.

*i. Liaison Officer.* The group liaison officer is the commander's representative in maintaining close contact with higher (or other) headquarters as directed. He keeps the higher artillery headquarters informed of the locations of all elements of the group and keeps the group informed of the current situation, plans, and impending displacements of the higher artillery headquarters. He must be familiar with detailed capabilities and limitations of all elements of the group in order to assist the higher artillery commander in planning appropriate employment of the group. Detailed duties and responsibilities of the group liaison officer are similar to those of other artillery liaison officers.

*j. Motor Officer.* The group motor officer is an assistant to the S4. He supervises the motor transport operations and maintenance within the group.

*k. Reconnaissance and Survey Officer.* The group reconnaissance and survey officer plans and supervises the survey required within the group. In performance of his primary duties, he is closely associated with the group commander, S3, field artillery target acquisition battalion, and engineer topographic battalion of the field army.

*l. Surgeon.* The surgeon advises the group commander and staff on matters pertaining to medical services of the group. He is responsible for the procurement, storage, and distribution of medical equipment and supplies. He exercises technical supervision over medical activities throughout the group. Detailed duties and responsibilities are contained in FM 101–5.

*m. Chaplain.* The duties and responsibilities of the chaplain are as directed by the Chief of Chaplains, U.S. Army. Specific duties within the group may be directed by the group commander.

## Section II. BATTERY COMMANDERS, COMPANY COMMANDERS, AND PLATOON LEADERS

### 23. (U) General

The duties of small-unit commanders as outlined in existing publications are generally applicable in the field artillery missile group, Redstone.

### 24. (U) Responsibilities

*a. Headquarters Battery Commander.* The battery commander of the headquarters battery is also the headquarters commandant of the group. He supervises the training and tactical operations of the headquarters battery. Although all personnel in the battery are under his command, most of them work under direct operational control of the various group staff officers. For this reason, he must coordinate closely with them on all matters pertaining to awards, discipline, and morale affecting his men. The battery commander has an assistant communication officer to assist him in his duties.

*b. Firing Battery Commander.* Each firing battery commander supervises the training and tactical operations of his battery. He is responsible for the maintenance of his prescribed nuclear load (PNL) and all associated fire control, test, and ground handling equipment. The firing battery commander also supervises the battery in preparing for and executing fire missions. He has an executive officer and a warrant officer to assist him in his duties.

*c. Engineer Company Commander.* The engineer company commander has all the responsibilities of a separate company commander. He commands the engineer company and also serves as engineer staff officer to the group commander. As staff engineer, he furnishes engineering advice and assists in the preparation of group plans, policies, and orders. He maintains close liaison with other units, such as the supporting engineer field maintenance company. As unit commander, he is responsible for planning and supervising the employment of his company in support of group operations. He has

a maintenance platoon leader, and two liquid oxygen generating platoon leaders to assist him in his duties. Primary responsibilities include—

(1) Establishing liaison with the missile battery commanders for coordinating the operations of his company in support of the firing batteries.
(2) Establishing liaison with the units of the group concerning maintenance of engineer mechanical equipment and supply of repair parts.
(3) Reconnoitering and selecting positions for occupation by elements of his company.
(4) Formulating plans for the production, storage, and delivery of liquid oxygen (LOX) and liquid nitrogen ($LN_2$).
(5) Establishing and supervising the local security of the engineer company.
(6) Planning and supervising unit supply, maintenance, administration, and training.
(7) Providing field maintenance of engineer mechanical equipment to the extent of the company's capabilities.

*d. Ordnance Company Commander.* The ordnance company commander has all the responsibilities of a separate company commander. He also acts as a special staff officer or technical adviser to the group commander for ordnance matters. The ordnance company commander maintains close liaison with the two firing batteries to insure immediate supply of alcohol, hydrogen peroxide ($H_2O_2$), missiles, warheads, and associated spare parts when required. He must organize and dispose his company to provide ordnance support for the firing unit. He also has the responsibility of maintaining that portion of the group prescribed nuclear load not carried by the firing batteries. To assist him in his duties, he has an executive officer, an operations officer, a supply platoon leader, an automotive maintenance platoon leader, and a special weapons electronic officer.

*e. Platoon Leaders.* The various platoon leaders throughout the group organization have all the command functions normally found at platoon level. In addition, most have important technical or supply functions for which they are directly responsible. It is imperative that officers assigned as platoon leaders be technically qualified in their respective fields.

# CHAPTER 4

# PRINCIPLES OF EMPLOYMENT

## 25. (U) Assignment

*a.* A field artillery missile group, Redstone, is assigned to field armies, and may be assigned to an independent corps.

*b.* The basis of allocation is one group per field army or independent corps.

## 26. (U) Organization for Combat

*a.* The objectives, considerations, and fundamentals in organizing field artillery for combat are discussed in FM 6–20.

*b.* A field artillery missile group, Redstone, assigned to a field army is given the mission of general support of the field army.

*c.* A field artillery missile group, Redstone, assigned to a United States Army Missile Command (Heavy) is assigned an appropriate tactical mission by the missile command.

*d.* Zone of fire of the group is the zone of action of the supported force.

## 27. (CM) Capabilities and Limitations of Employment

*a. General.* For information concerning the capabilities and limitations of field artillery missile units, see FM 6–20.

*b. Capabilities.*

(1) The maximum range of 324 kilometers permits effective fire support within its range capabilities throughout the area of responsibility of the army.

(2) Redstone groups are 100 percent mobile in organic vehicles, and transportable in current types of USAF aircraft. They are capable of road speeds comparable to heavy cannon artillery.

(3) The group is capable of firing up to four missiles on prearranged targets in a 24-hour period provided the higher headquarters gives the group adequate warning. A well trained unit which does not encounter any missile or support equipment malfunctions could fire a missile in six and one-half hours after arrival in its firing position, where survey has been completed and the position has been prepared prior to occupation. In order to maintain continuous fire support during displacement, it may displace by battery.

561463 O - 60 - 2

The group has the capability of displacing in about one hour on completion of a fire mission or may remain in position to accomplish an indefinite number of fire missions. The group commander may utilize any method of deployment consistent with the tactical situation, enemy ground and air capabilities, terrain, and weather. Four possible methods of deployment are discussed in paragraph 30.

*c. Limitations.*

(1) The Redstone minimum range of 93 kilometers will therefore dictate the physical location in employment of the group.

(2) The group has no target acquisition means.

(3) Although personnel of the group are trained to defend themselves against hostile ground attack, the unit's primary mission cannot be accomplished when this defense becomes necessary. Adequate personnel and equipment for ground and air defense must be provided by higher headquarters when the need is indicated.

(4) Long reaction time.

(5) It takes a unit over four hours to displace from a condition of having a fueled missile on the launcher.

## 28. (U) Targets

*a.* The Redstone is a field army artillery weapon for adding depth to the fires of corps artillery. It is used against ground targets of interest to the army commander, when authorized by the commander or his designated representative.

*b.* Some primary targets for the Redstone are—

(1) Troop concentrations (general reserve).

(2) Command installations (corps and higher).

(3) Missile firing sites.

(4) Airfields.

(5) Communication centers.

(6) Logistic installations.

(7) Critical terrain defiles.

## 29. (U) Position Area Requirements and Considerations

The force artillery commander selects primary, alternate, and supplementary position areas for the Redstone group under his control. A Redstone group commander must be prepared to advise and assist in the selection of these positions. The group will normally make a deliberate occupation of position. When the group occupies a position area with a common perimeter, it requires an area approximately 13 to 16 kilometers in diameter. The position area should have good access roads and firm ground or bearing surface. A desirable position area will provide good natural cover and concealment. It is desirable that survey control be available so that the required survey may be completed in a reasonable length of time.

*a.* The fundamentals of positioning field artillery, as presented in FM 6–20, apply to the Redstone group.

*b.* If other long-range missile units are present in adjacent army areas, liaison should be maintained in selection of position areas. Position areas are selected to provide either maximum overlap in critical enemy territory or minimum overlap and maximum coverage across the adjacent army sectors of responsibility, whichever best fits the tactical mission.

*c.* Redstone position areas will constitute a prime target and will be the subject of diligent search by enemy intelligence and target acquisition agencies. Therefore, it is necessary that passive and active measures be taken to avoid identification of the position by hostile civilians through clandestine measures, electronic and photographic means, and infrared techniques. Frequent displacements provide a measure of security against enemy countermeasures. However, displacement may expose a unit to detection by hostile elements, cause personnel fatigue, inflict wear and tear on sensitive equipment, and lower a unit's rate of fire. The advantage of displacement versus remaining in place should be considered carefully in selecting a method of deployment for the Redstone group.

## 30. (U) Methods of Deployment

*a. General.* There are four general methods of deployment of field artillery units (fig. 8). Each of the four methods has advantages and disadvantages. There are also many variations, modifications, and combinations of these methods which the artillery commander can use to meet the requirements of a particular situation. The value of a method depends on the force missions, the enemy and friendly situation, and enemy capabilities.

(1) *Method 1* (1, fig. 8). The group occupies a position area. The position area will always include firing positions. Firing batteries and headquarters and service elements are in a common perimeter. Firing batteries are positioned and every feasible action is taken to insure that the time required to prepare for and fire a mission is kept at a minimum. Displacement of the firing batteries or other elements of the group is made as required by the tactical situation rather than on the completion of fire missions. The group commander also selects alternate and supplementary positions to which the group or elements thereof can displace.

(a) The principal advantages of this method are as follows:

*1.* It simplifies command, administration, messing, survey, communications, and local security problems.

*2.* The time required to resupply missiles to firing batteries is reduced to a minimum.

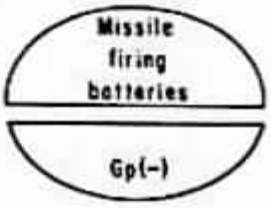
**Method 1**

Group position area: Headquarters and headquarters battery, missile firing batteries, ordnance company, and engineer company in a common perimeter.


①

**Method 2**

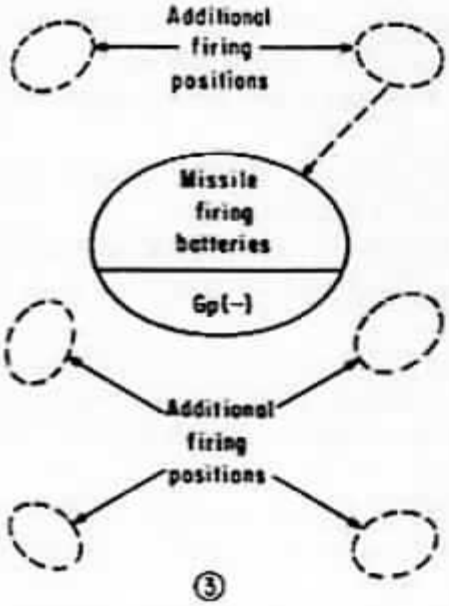
Group position area: Headquarters and headquarters battery, ordnance company, and engineer company in a seperate perimeter from the missile firing batteries.




②

**Method 3**

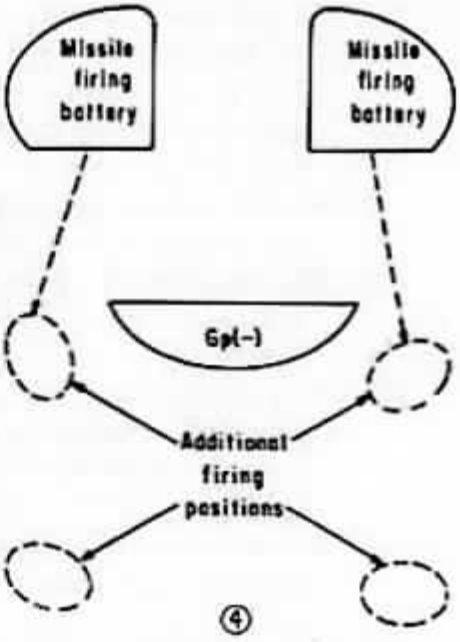
Group position area: Headquarters and headquarters battery, missile firing batteries, ordnance and engineer company in a common perimeter. Fire missions are normally accomplished from firing positions outside the perimeter; such positions are occupied only long enough to complete fire missions.




③

**Method 4**

Group position area: Headquarters and headquarters battery, ordnance company, and engineer company in one perimeter. Missile firing batteries in separate perimeters. A missile firing battery occupies another firing position on completion of a fire mission.




④

Note 1. Methods 3 and 4: Space near firing positions must be provided for other elements essential to firing a mission.

Note 2. Alternate positions are not shown on these diagrams.

*Figure 8. (U) Methods of deployment.*

3. Reaction time, rate of fire, and reliability in meeting firing schedules are affected favorably.
4. Ordnance support is facilitated.

(*b*) The principal disadvantages of this method are as follows:

1. The large concentration of personnel, vehicles, and weapons in one area facilitates detection by the enemy.
2. A single nuclear weapon employed against the group position area could destroy much of the group capability.
3. Displacement of the entire group may be necessary if the position is compromised.
4. Repeated firing of weapons from the same positions may disclose the location of the group.

(2) *Method 2* (2, fig. 8). The group occupies a position area. The position area will always include firing positions. Firing batteries and headquarters and service elements are in separate perimeters. Firing batteries are positioned and every feasible action is taken to insure that the time required to prepare for and fire a mission is kept at a minimum. Displacement of the firing batteries or other elements of the group is made as required by the tactical situation rather than on the completion of fire missions. The group commander also selects alternate and supplementary positions to which the group or elements thereof can displace.

(*a*) The principal advantages of this method are as follows:

1. The location of firing batteries and headquarters and service elements in separate perimeters makes it more difficult for the enemy to destroy the group potential with a single nuclear weapon.
2. Enemy action against one element of the group will not require displacement of the entire group.
3. The location of group elements in more than one area makes it more difficult for the enemy to locate the group as a whole.

(*b*) The principal disadvantages of this method are as follows:

1. Command, administration, survey, communications, and local security problems are more complex than in method 1.
2. The time and effort involved in missile resupply to firing batteries and repair of components is greater than in method 1.
3. Repeated firing of weapons from the same positions may disclose their location to the enemy.

(3) *Method 3* (3, fig. 8). The group occupies a position area. The position area will always include firing positions. Firing batteries and headquarters and service elements are in a common perimeter. Firing positions in addition to

those within the common perimeter are selected as necessary to provide desired fire capabilities. One of these additional firing positions is normally used (i.e., time permitting) when a mission is being fired. These positions are occupied by the firing batteries only long enough to complete the fire mission. The firing batteries then return to the group position area. Missions may be fired from positions within the group position area when it is infeasible to accomplish the mission from another location. Firing batteries are positioned and every feasible action is taken to insure that minimum time is required to prepare for and fire a mission from the group position area. Displacements, other than the movement of the firing batteries as mentioned above, are made as required by the tactical situation rather than on the completion of fire missions. The group commander also selects alternate and supplementary positions to which the group or elements thereof can displace.

(*a*) The principal advantages of this method are as follows:

*1.* Elements of the group are separated for relatively short periods of time, thus simplifying command, administration, messing, and local security problems.

*2.* Enemy detection of the firing positions that are normally used in firing does not disclose the location of the remainder of the group.

*3.* Displacement of firing batteries after firing reduces the possibility of their being materially damaged by counteraction against the position from which the mission was fired.

(*b*) The principal disadvantages of this method are as follows:

*1.* The firing battery must perform the complete firing operation after receipt of the fire mission.

*2.* A single nuclear weapon delivered on the group position area might destroy the effectiveness of the group.

*3.* Survey and communication problems are considerably greater than in methods 1 and 2.

*4.* Firing batteries may be detected during displacement.

*5.* Lack of suitable position areas, time, and routes may preclude the use of this method.

*6.* The requirement for providing sustained fire may preclude the use of this method.

(4) *Method 4* (4, fig 8). The group occupies a position area. The position area will always include firing positions. Firing batteries and headquarters and service elements are in separate perimeters. A firing battery is located in each firing position. Unoccupied additional firing positions are selected as necessary to provide desired fire capabilities.

The principal difference between this method and method 2 is that the firing batteries move to one of these additional firing positions as soon as a fire mission is completed. Firing batteries are positioned and every feasible action is taken to insure that the time required to prepare for and fire a mission is kept at a minimum. Displacements, other than the movement of firing batteries as mentioned above, are made as required by the tactical situation rather than on the completion of fire missions. The group commander also selects alternate and supplementary positions to which the group or elements thereof can displace.

(*a*) The principal advantages of this method are as follows:

1. Dispersion of group elements provides the group with a high degree of protection (passive defense) against nuclear attack at all times.
2. Detection and attack by enemy fire support means would probably require displacement of only part of the group.
3. The location of group elements in several areas makes it more difficult for the enemy to locate the group as a whole.

(*b*) The principal disadvantages of this method are as follows:

1. Command, administration, messing, and local security problems are more complicated than in the other methods.
2. Survey and communication problems are greater than in methods 1 and 2.
3. Achievement of the maximum rate of fire of the group is hindered.
4. Firing batteries may be detected during displacements.
5. Lack of suitable position areas, time, and routes may preclude the use of this method.
6. The requirement for providing sustained fire may preclude the use of this method.
7. Considerable time and effort are involved in missile resupply to firing batteries and repair of components.

*b. Headquarters and Service Elements.* With any of the methods in *a* above, headquarters and headquarters battery, the ordnance company, and the engineer company may be located together or separately from each other, depending on the decision of the group commander or on instructions from the next higher artillery headquarters.

*c. Displacements.* The authority to order intragroup (within group) displacements of the type peculiar to methods 3 and 4 *normally* rests with the group commander. Authority to order displacements to alternate and supplementary positions is set forth in the inherent responsibilities of tactical missions in FM 6–20.

*d. Avoiding Delays.* The description of each method points out that firing sections are positioned and every feasible action is taken to insure that the time required to prepare for and fire a mission is kept at a minimum. This is a reiteration of the need for speed and responsiveness in providing Redstone fires. Each missile cannot always be located exactly at the spot from which it will fire, but delays which can be avoided must be avoided. Procedures must be adopted which lessen or eliminate delays and insure that the Redstone group in position is ready to fire in the minimum time consistent with the characteristics of the missile.

*e. Firing Positions.* The *additional* firing positions mentioned in methods 3 and 4 are for use in carrying out the assigned mission rather than for occupation when the primary position becomes untenable. Therefore, they are referred to as additional positions rather than alternate positions. The commander selects alternate and supplementary positions as indicated in the description of each method. Use of the word "additional" in the discussion of positions does not define a new class of positions. For the tactical classification of field artillery position areas, see FM 6–20 and FM 6–140.

## 31. (U) Maneuver of the Redstone Group

*a.* For a detailed discussion of the maneuver of field artillery units, see FM 6–20.

*b.* The Redstone group is capable of marches by methods common to all field artillery—as a unit, by march unit and serial, by infiltration, or by multiple routes. For security reasons, the group should move during hours of darkness or other periods of limited visibility when feasible.

*c.* The Redstone group commander advises the next higher artillery commander concerning the technical requirements of Redstone equipment as they affect the maneuver and effective employment of the unit.

*d.* The ordnance company is organized and equipped as a single support unit and should not be divided. This affects its capability to support both batteries when they are widely separated. In the event displacement by battery is ordered, contact teams can be furnished each battery and the base shop may remain as one function.

*e.* The engineer company may be divided into two support units, if necessary, insofar as its capability to supply liquid oxygen (LOX) and liquid nitrogen ($LN_2$) is concerned.

## 32. (U) Intelligence

*a.* The Redstone group receives target intelligence and other intelligence from the next higher artillery headquarters. The group commander obtains detailed information concerning the terrain in his position area by aggressive reconnaissance.

*b.* The group employs deception measures in accordance with instructions from higher artillery headquarters.

*c.* For further information on counterintelligence activities, see FM 6–20.

## 33. (U) Fire Planning and Fire Support Coordination

*a.* A higher artillery headquarters normally plans and coordinates the fires of the Redstone group. The fire planning and fire support coordination functions of the group are advisory in nature.

*b.* When a higher artillery headquarters or fire support coordination agency is planning and coordinating the fires of the group, the liaison officer of the group acts as an adviser on the capabilities and limitations of the Redstone system.

*c.* Fires of the group are planned, coordinated, and integrated with other fires and with maneuver in accordance with existing principles for the employment of fire support as set forth in FM 6–20.

*d.* Responsibility for surveillance of fires of the group and for assessment of target damage is specified by the artillery headquarters assigning the fire mission.

*e.* The force artillery commander is responsible for the detailed analysis of potential nuclear targets to determine their suitability for attack by the Redstone group. For target analysis procedures, see FM 6–20 and FM 101–31.

## 34. (U) State of Readiness

*a.* The attainment of the maximum feasible state of readiness within a field artillery unit is a responsibility of the unit commander unless he is specifically directed otherwise by the appropriate higher commander. This is fundamental to effective tactical employment of field artillery units. Maximum feasible readiness is attained through the accomplishment of every action which can be taken consistent with the type of unit, the adopted method of deployment, the situation, and the characteristics of unit weapons and ammunition. Actions which can be taken by a Redstone commander prior to receipt of a fire mission in order to attain a high state of readiness and reduce response time are discussed in paragraph 35*c*.

*b.* The Redstone group commander is responsible for keeping the appropriate higher commander informed of the state of readiness of the group. The group commander requires a simple, clear, and rapid procedure which will enable him to make frequent and orderly reports of progress or delay in preparations. Such a procedure, to be fully effective, should also provide the appropriate higher commander with a suitable means of controlling the degree of preparation within a unit if such action is necessary or desirable. For simplicity, the procedure should be standard for all field artillery units capable of firing nuclear ammunition and should provide fire support coordination or control agencies with accurate readiness information in usable form.

*c.* The following standard procedure is used in meeting the requirement set forth in *b* above.

| *State of readiness* | *Group (Battalion) (Battery) (Platoon) (Section) (Weapon) Can fire (On Target ) In:* |
|---|---|
| A | Less than 5 minutes |
| B | 5 minutes |
| C | 10 minutes |
| D | 15 minutes |
| E | 30 minutes |
| F | 1 hour |
| G | 2 hours |
| H | 3 hours |
| I | 4 hours |
| J | 6 hours |
| K | 8 hours |
| L | 10 hours |
| M | 12 hours |
| N | 14 hours |

*d.* The times in *c* above fit the varying conditions encountered in nuclear-capable field artillery units, including the Redstone group. The procedure may be extended beyond the times shown if the appropriate commander considers such action necessary. However, times greater than those shown above may have little application to tactical situations.

*e.* The frequency of reports by a Redstone group commander and the communication means and procedure to be used should be established in standing operating procedures.

## 35. (CM) Time Factors

*a.* The time required for a Redstone group to execute most fire missions can be reduced to a minimum by prearrangement of fires as set forth in FM 6–20. The time required will vary, depending on the state of readiness of the group (par. 34).

*b.* The time required for a Redstone group to fire on a target of opportunity can be reduced appreciably by the timely transmission of a warning order by the higher artillery headquarters. Additional elements should be transmitted as soon as possible. Warning orders and fire missions are encoded and transmitted by the most reliable and expeditious means available.

*c.* There are certain actions which the Redstone group commander can take prior to receipt of a fire mission in order to attain a high state of readiness and reduce response times. Such actions include thorough position area reconnaissance, preparation of selected positions to include survey, occupation and organization of the position from which the mission will be fired (when using deployment methods 1, 2, and 4) are used (par. 30); organizational maintenance of unit equipment and ammunition, equipment tests, limited checkout of missiles, and tests on warheads, as appropriate.

*d.* In taking action as indicated in *c* above, the group commander considers the requirements of the supported force for fire support, the possibility of receiving timely warning orders, the degree of prearrangement of fires, the method of deployment, time factors involved (*e* below), planning factors, and the characteristics of Redstone organization and equipment.

*e.* The following time factors are furnished as a guide to commanders in the employment of the Redstone group. The cited situations ((1) through (7) below) are those that should be expected to be encountered in the field. The sustained rate of fire under field conditions will depend on missile resupply capabilities to the firing batteries, methods of deployment, equipment capabilities, weather conditions, degree of personnel fatigue, the overall situation, and other considerations. The time given below is the minimum achievable and cannot be expected to be attained in the majority of operations. The unit commander or liaison officer should be consulted for additional information.

(1) *Situation I.* Unit is in prepared position with occupation completed; fire missions are *prearranged* as to *time* and *place;* ammunition is available at the unit. Time at which firing can occur is as follows:

| | *Day* | *Night* |
|---|---|---|
| First round each battery. (Provided the unit is given the fire mission(s) 6 to 8 hours prior to the scheduled time not including any travel time.) | At scheduled time | At scheduled time |
| Second round each battery (same position). (Allows 3 hours for launcher to cool and replace or repair any damaged equipment.) | T plus 8 hours | T plus 9 hours and 15 minutes. |

(2) *Situation II.* Unit is in prepared position with occupation completed; fire missions are *prearranged* for *on call* request; ammunition is available at the unit. Time at which firing can occur is as follows:

| | *Day* | *Night* |
|---|---|---|
| First round each battery. (Provided the missile is fired within 3 hours after the missile is prepared for firing. 6 to 8 hours must be allowed to prepare the missile for firing.) | Call time | Call time |
| Second round each battery (same position). (Allows 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

(3) *Situation III.* Unit is in prepared position with occupation completed; fire missions are on *target of opportunity;* ammunition in a maximum state of readiness. Time from receipt of

first mission until firing is as follows: (Two missions received simultaneously.)

| | Day | Night |
|---|---|---|
| First round each battery | 2 hours and 15 minutes. | 2 hours and 30 minutes. |
| Second round each battery. (Allows 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

(4) *Situation IV.* Unit occupies prepared position from march column and executes fire *missions prearranged* as to time and place. Ammunition is available at unit. Time from receipt of first mission until firing is as follows: (This does not include travel time.)

| | Day | Night |
|---|---|---|
| First round each battery | 6 hours and 30 minutes. | 7 hours and 45 minutes. |
| Second round each battery. (Allows 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

(5) *Situation V.* Unit occupies prepared position from march column and fires missions on targets of opportunity. Ammunition available is at unit. Time from receipt of first mission until firing is as follows (this does not include travel time):

| | Day | Night |
|---|---|---|
| First round each battery | 6 hours and 30 minutes. | 7 hours and 45 minutes. |
| Second round each battery. (Allow 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

(6) *Situation VI.* Unit is in prepared position with occupation completed. Unit march orders, moves, occupies new prepared position and executes fire missions prearranged as to time and place. Ammunition is available at unit. From start of march order to firing, allow (this does not include travel time):

| | Day | Night |
|---|---|---|
| First round each battery | 8 to 10 hours | 9 to 11 hours. |
| Second round each battery. (Allows 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

(7) *Situation VII.* Unit is in prepared position with occupation completed. Unit march orders, moves, occupies new prepared position and executes fire missions on targets of opportunity. Ammunition is available at unit. From start of

march order to firing, allow (this does not include travel time):

| | Day | Night |
|---|---|---|
| First round each battery | 8 to 10 hours | 9 to 11 hours |
| Second round each battery. (Allows 3 hours for launcher to cool and repair or replace any damaged equipment.) | 8 hours | 9 hours and 15 minutes. |

## 36. (CM) Planning Factors

*a.* The following planning factors are furnished as a guide for Redstone unit commanders:

| *Operations performed* | *Day* | *Night* |
|---|---|---|
| Occupation of position and emplacement of launcher and erecting equipment | 45 | 60 |
| Missile preparation and assembly | 65 | 85 |
| Electrical and pneumatic connections | 45 | 60 |
| Horizontal checkout | 60 | 60 |
| Preparation for and erection of missile | 45 | 55 |
| Vertical checkout, propellant loading, and final laying | 100 | 100 |
| Final preparation | 30 | 45 |
| Total | 6 hours and 30 minutes | 7 hours and 45 minutes |

*b.* Because of the boil-off characteristics of liquid oxygen (LOX), propellant loading should not be accomplished more than approximately 3 hours prior to firing time. If the propellants are to remain in the missile for a longer time, consideration should be given to LOX resupply. Also alcohol and hydrogen peroxide temperature must be monitored to insure that they are within the proper limits. Recirculation and heating of the alcohol may be necessary during long delays.

*c.* The operational times shown in *a* above are optimum times based on a well-trained and coordinated unit and are compiled under the following assumptions:

(1) Completed survey.
(2) Low level of illumination at night.
(3) No major equipment malfunctions.
(4) Excess time not required for missile assembly.
(5) LOX, alcohol, $H_2O_2$ and $LN_2$ are present and available in sufficient quantities.
(6) All equipment present and operational.
(7) All personnel present and available.
(8) No extreme weather.

# CHAPTER 5

# RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION

## 37. (U) General

*a.* In the Redstone group, reconnaissance is the search for positions for subordinate elements, routes into these positions, and wire routes. The reconnaissance and selection of position areas is time consuming.

*b.* The normal method of securing information on routes and position areas is a map reconnaissance verified by a ground reconnaissance. If air reconnaissance is desirable, Army aircraft are obtained through higher headquarters since the group has no organic aviation section.

*c.* Because positions are a high priority target for enemy attack, all possible measures are taken to avoid disclosing the position during all phases of reconnaissance, selection, preparation, and occupation of position. To assist in maintaining secrecy, the group will normally occupy positions during darkness, inclement weather, and other periods of limited visibility.

## 38. (U) Definitions

*a. Position Area.* A position area is defined as that area or areas where the unit command post, truck park (if one is established), firing position(s), and administrative and logistical installations are located.

*b. Firing Position.* A firing position is defined as an area inside or separate from a position area, in which those elements of the unit essential for firing a missile are located or are to be located.

## 39. (U) Unit Position Areas

*a.* The group commander will select and designate position areas for units of the group. The unit commanders will then reconnoiter their respective areas and select specific sites for their installations. The group commander should consider the needs peculiar to each unit before assigning areas. Consideration will be given to separation of the firing batteries by sufficient distances, where practicable, to preclude loss of both by a single nuclear weapon. Natural cover and concealment are desirable and good communication routes into and out of the area are necessary. Care must be exercised in the selection of a position in a wooded area, since extensive damage could result from tree blowdown in the event of a nuclear attack. Each unit commander must be prepared to assist and advise the group commander in the selection of unit position areas.

*b.* The group headquarters and headquarters battery should be centrally located in a position from which the commander and his staff can best control the group. An area 300 to 500 meters in diameter is adequate for the group headquarters installations.

*c.* Depending on the plan of deployment, the firing positions may or may not be selected within the group perimeter. If firing positions are selected outside the group perimeter, they should be located so they can be reached in a maximum of 2 hours under blackout conditions. A firing position should be selected that will require a minimum of preparation. Although the position should be relatively flat, grades and slopes are permissible providing the launcher can be leveled, and the equipment can be moved into position and operated properly. Consideration should be given to the total silhouette of the erected missile in selecting a firing position. Emplacement of the launcher on a high prominence should be avoided. Additional consideration in selecting a firing position should also be given to the amount of vegetation or brush in the firing position. Heavily vegetated areas should be avoided as there is a danger of fire when the missile is fired.

*d.* The engineer company area must be very carefully selected because of the weight and size of the equipment and vehicles. Access routes must be good, all-weather roads with gentle grades, gradual curves, and good foundations. Terrain for generating sites for the liquid oxygen and liquid nitrogen equipment must be firm, level, well-drained ground with all-weather vehicle access and provide good ventilation. High elevations are to be avoided because of an accompanying loss in liquid oxygen-nitrogen production. Depending on the plan of deployment, the company may or may not be emplaced within a single perimeter. If a single perimeter is used, proper dispersion should be made of all elements of the company. The use of wooded and municipal areas will facilitate camouflage.

*e.* The ordnance company area should be accessible to an all-weather main route and should have an internal road net which can accommodate any of the group vehicles. In addition to a good road net, an area with natural cover and concealment is desirable. Ground within the area should be firm, level, and well drained. An all-weather access route to the area should be available. The area assigned should be sufficient for adequate dispersal of the company according to the tactical situation.

## 40. (U) Route Reconnaissance

*a. General.* Because of characteristics of certain vehicles in the group, route reconnaissance must be detailed. Limiting characteristics of these vehicles are the length, width, height, weight, and turning radius. Particular attention should be given to the condition and widths of roads, sharpness of turns, strengths of bridges and

culverts, bridge and tunnel clearances, and entrances to position areas. Population centers and critical road junctions should be by-passed. If it is determined from the reconnaissance that routes available are unsatisfactory, engineer support must be requested. Plans must anticipate and allow for time required to accomplish necessary engineer work.

*b. Limiting Characteristics of Vehicles.* When selecting a route, consideration should be given to the following limiting characteristics of vehicles in the Redstone group.

(1) Minimum turning radius—36 feet.
(2) Maximum overhead clearance—11 feet.
(3) Ground clearance—11½ inches.
(4) Up and down slopes—30° maximum.
(5) Side slopes—20° maximum.

## 41. (U) Displacements

*a.* See paragraph 30c for information pertaining to displacements.

*b.* The group commander is responsible for reconnaissance and a continuous study of the situation in order to make recommendations on displacements to the next higher artillery headquarters. He should advise the next higher artillery headquarters on positions, routes, and method and time of displacement.

*c.* A firing element of a Redstone group can move out of position in about 30 minutes under emergency conditions. Its normal time is approximately 1 hour.

Go to Page 33