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NIGHT OPERATIONS

1962

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MARINE CORPS EDUCATIONAL CENTER
MARINE CORPS SCHOOLS
QUANTICO, VIRGINIA

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MARINE CORPS EDUCATIONAL CENTER ORDER P3340.2B

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1. Purpose. To promulgate, in accordance with references (a) and (b), the publication MCS 3-4, "Night Operations," for use in instruction conducted by the Marine Corps Educational Center.

2. Cancellation. MCECO P3340.2A-TIP(EC) 4, "Night Operations of the Landing Force."

3. Scope. This manual outlines the principles and techniques employed by Marine Corps landing forces during the conduct of operations at night.

4. Action. Recipients will remove enclosure (1), the last page of this manual, and insert it in the Marine Corps directives file in numerical sequence.

P. H. ASHLEY
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SECTION 1

INTRODUCTION

1. Purpose. — This text sets forth the basic principles, tactics, and techniques employed by the operating forces of the Marine Corps in the conduct of night operations.

2. Scope. — This publication discusses the essential planning details and the principles of employment for units in night operations. Special attention is paid to night amphibious operations and the fundamental considerations of offensive and defensive night combat operations for both ground and air units. It also discusses the principles for the employment of the various supporting arms and supporting units in night operations. Included are the effect of darkness on operations under special conditions, and the equipment which is important to night operations.

3. Night Operations.

a. General. — Periods of reduced visibility are an inherent part of normal combat situations. In the past, most night operations have been of a defensive nature. Mass destruction weapons and the tactical doctrine of potential enemies have made apparent the need for offensive night operations. On the battlefield the success of a command may depend on its ability to fight both offensively and defensively at night.

b. Special factors. — Extreme climate and terrain besides an enemies capability for night combat require an increased capability for night operations. For example, in desert operations night provides the primary camouflage of the battlefield, or in the case of arctic operations there may be long periods of reduced visibility. In both cases, night operations become increasingly important.

c. Training.

(1) Training is a prerequisite for success in night combat. A variety of new equipment has been developed in recent years to assist units in night operations; however, effective counter-measures have been developed to counter this new equipment. The margin of victory in night combat still depends on the well trained individual.

(2) Training for night combat should commence at the very inception of basic training and be continued in established training programs. A regular training program carried out at night will ensure that the individual can perform his particular combat function at night.

(3) To gain and maintain proficiency in night combat techniques requires a continuing program for night training of at least 25% to 35% of the normal training schedule. One effective plan for conducting night training is to schedule training from 1200 till 2400 each day. This plan ensures a balanced training program including night training and is particularly effective for regimental, group, division, and wing level. It allows for administrative time as well as preparatory time for night operations similar to that required in a combat situation. The method of "turning the clock around" (1900 for 0700, 0400 for 1600) is more applicable for small units of battalion and squadron size that require intensive night training for short periods.

SECTION 2

THE SHIP-TO-SHORE MOVEMENT

4. General. — The execution of night landings does not require any departure from the basic doctrine set forth in LFM 01, "Amphibious Operations", nor does it involve any substantial variation in landing force technique. Certain essential considerations, however, require added emphasis. Conditions that are tolerable in daylight may be disastrous during night operations. There must be some overriding factor, such as the achievement of surprise, for the commander of a large force to decide to conduct a night amphibious operation in lieu of a day amphibious operation. The hazards are more readily acceptable for night amphibious landings of the RLT or smaller units.

5. Planning Considerations.

a. Rehearsals. — Because of the detailed coordination required in the execution of night landings, extensive training and rehearsals should be conducted for all participating elements.

b. Landing beaches and objectives. — Landing beaches and objectives must be easily identifiable from seaward. They may be narrower than for daylight landings since boat waves consist of a minimum number of craft, which ensure effective control. Initial objectives should be a short distance from the landing zones or beaches. Exit routes from landing zones and beaches should be readily accessible and approaches to initial objectives well defined and easy to negotiate.

c. Control. — Control, an important factor in night landings for both the naval and landing force, requires considerable planning time. In this regard, fire support plans should emphasize the destruction of the enemy's jamming and electronics countermeasures capability, so that our forces can make maximum use of radio, radar, and electronic reconnaissance means.

d. Deception. — A detailed study must be made to determine the various means of deception that can be employed to increase our chances of achieving surprise in a night landing.

6. Naval Considerations.

a. Since effectiveness of naval support for the landing is governed by the accuracy of ship and boat locations, every means, natural or manmade, must be employed to ensure faultless navigation. This may include the landing of beach parties prior to the main landing for the purpose of setting up guidance systems.

b. Minesweeping conducted during darkness will not be as effective in terms of channel or area clearance. The mine hazard must be recognized.

c. During hours of darkness effective direction of close air support and naval gunfire and damage assessment are more difficult. This may require additional ammunition to ensure adequate target coverage.

d. Since the beaching of landing ships is possible at night it provides an effective means of landing supporting elements in a night landing.

7. Conduct of a Night Surface Landing. —The following is a listing of considerations or functions that have added significance in the conduct of a night surface landing.

a. Personnel should be given to the minutest details regarding the ship-to-shore movement.

b. Thorough drills must be conducted in the embarkation into the landing craft.

c. Lucite wands, luminous tape, or luminous marking paint may be utilized for embarkation of personnel into landing craft.

d. The transfer of personnel between ships during darkness should be kept to a minimum.

e. Boats and amphibian vehicles should serve only its parent ship and those adjacent to it.

f. Transfer lines should not be used.

g. The dispatching and controling of waves can be accomplished by the use of voice radio, screened blinker light, infrared equipment, or loudspeaker. The method employed will depend on security requirements and the visibility. No matter what method is used adequate backup must be provided.

h. In a night surface landing, landing force reconnaissance units or underwater demolition teams may be employed to plant radar or radio beacons on or off the landing beaches. Lights or beacons should be of uniform height and intensity. Use of white lights should be avoided, where practicable, to avoid confusion with lights ashore. Plans must designate "safe havens" for these personnel during preparatory fires.

i. Guide ships or boats with radar equipment should lead the boat waves from the rendezvous areas to the line of departure. An LCPL MK4 guide boat should be assigned to each boat wave, however, if not available, wave boats should be equipped with a radar reflector or beacon to permit accurate tracking by control ships.

j. Approach control points should be established at intervals in the boat lanes.

k. The line of departure should be established as close to the beach as the hydrographic and tactical conditions permit.

l. If conditions permit, the course from the ship marking the approach lane to the line of departure should be the same as that from the line of departure to the beach.

m. Coxswains and amphibian vehicle operators must be equipped with a detailed approach schedule listing the courses to steer and the ships they will pass enroute to the line of departure. Reciprocal courses must be provided for return trips.

n. When possible beaches should be marked prior to the first wave. If this can't be accomplished marking lights are included in the first wave.

8. Conduct of a Night Helicopter Landing. — In order to attain success in the conduct of a night helicopter landing the following must be considered over and above the normal factors of a daylight landing.

a. Helicopters cannot fly formation at night unless the situation allows the use of running lights. Even then the size of the waves or formation are very limited. Under extreme night conditions, the stream technique (helicopter every 2 minutes) may have to be used.

b. Control and navigational problems will be reduced by the selection of landmarks which can be easily recognized at night, such as roads, rivers, rail beds, or hill masses.

c. Maximum use should be made of parachute or helicopter-landed pathfinders equipped with both visual homing and landing devices and any electronic equipment available to assist the helicopter waves.

d. Approach and retirement lanes should be well separated and should involve minimum directional changes. If a common route must be used, then altitude separation must be prescribed.

e. In the landing zones, dump sites, egress routes, and assembly areas should be identified with colored lights, fluorescent tape or markers.

f. Personnel should be given thorough indoctrination in debarking from the aircraft, ditching procedures, and the direction to the assembly area from the helicopter upon touchdown.

9. Intelligence and Reconnaissance.

a. The need for intelligence prior to and during the conduct of a night amphibious operations and for night operations ashore will require an increased reconnaissance effort on the part of both the naval and landing force. Electronic-reconnaissance, aerial reconnaissance, submarine reconnaissance, UDT, and landing force reconnaissance elements should be employed to the maximum.

b. Hydrographic reconnaissance must be detailed. The landing of troops at the precise times and places is especially important in a night landing since the place of landing often serves as a reference point for subsequent operation ashore.

c. The landing of reconnaissance units for detailed reconnaissance of landing zones and the adjacent area for a night helicopter landing should be made well in advance of L-Hour. Normally, pathfinder teams in a night landing will not have time to conduct extensive landing zone reconnaissance prior to L-Hour. "Safe Havens" should be designated during preparatory fires.

d. Recovery of reconnaissance personnel during night operations is difficult; however, they may be recovered by a number of techniques: submarine, high-speed naval craft, helicopter, and fixed-wing aircraft.

SECTION 3

OFFENSIVE OPERATIONS ASHORE

10. General. — The night attack gives the attacker a distinct psychological advantage over the defender. The problems of target acquisition by the enemy are magnified, enabling the attacker to avoid the heavy losses that might be incurred by assault in daylight. With visibility reduced, surprise is more easily obtained. When combined with day attacks, night attacks allow the attacker to exploit a daytime success, improve his dispositions for further operations, or prevent the enemy from strengthening his defense.

11. Purpose. — Night operations may be undertaken to: complete or exploit a success achieved during daylight; seize initial objectives important to the successful continuation of the attack at daylight; surprise the enemy by attacking during hours of darkness; maintain pressure against the enemy, preventing his reorganization of forces, restoration of communications, and effective preparation of defensive positions and defensive fires; avoid heavy casualties by moving across terrain which is ideally suited to the enemy defense; and to fix or attract enemy reserves.

12. Fundamentals. — Conditions encountered during night combat places increased importance on the following fundamentals:

a. Thorough training and positive leadership.

b. Detailed information of the terrain and enemy.

c. Sufficient time for planning and preparation.

d. Simple plans and detailed orders.

e. Suitable objectives.

f. Complete secrecy in preparation and surprise in execution.

13. Basic Considerations. — Regardless of the form of maneuver employed in night operations, units are normally assigned missions requiring seizure or control of clearly specified areas or terrain objectives and/or the destruction of enemy forces. During the planning phase for a night attack the following factors must be considered:

a. Enemy situation. — As in daylight operations the disposition of enemy forces and his method of operation will influence the plan of attack, the selection of H-Hour, and the selection of initial objectives.

b. Observation. — Plans may provide for illumination in critical areas where visual observation is considered essential.

c. Reconnaissance. — Reconnaissance is not the responsibility of special reconnaissance units alone. Route reconnaissance, reconnaissance of assembly areas, objectives, and of mine fields and other obstacles are but a few of the reconnaissance

tasks that concern the logistic and support elements as well as the tactical elements.

d. Obstacles. — Movements at night may be seriously impeded by obstacles, and relatively small forces defending an obstacle at night can often delay or halt movements of larger forces. Helicopters can be employed to avoid such obstacles.

e. Cover and concealment. — Cover may have to be sacrificed to ensure ease of movement. Concealment is more easily attained.

f. Key terrain. — Plans for night operations are directed toward early seizure or control of key terrain features. At the same time commanders must avoid positioning large forces on identifiable terrain features in order to deny lucrative targets to the enemy.

g. Avenues of approach. — In night operations it is important to select easily identifiable and navigable avenues of approach which facilitate silent and rapid movement of forces to objectives.

h. Weather. — Extreme weather conditions aggravate the psychological effect of operating at night. However, from the attackers viewpoint excellent opportunities for complete surprise arise during foul weather.

i. Planning time. — Night operations require more time than daylight operations for preparation and rehearsal of plans. The difficulty involved in controlling and coordinating movements in conjunction with supporting fires during darkness and the requirement for secrecy during preattack reconnaissance and preparations require that deliberate and specific attention be given to each detail of the attack.

j. Rehearsals. — Because of the complex communications necessary to overcome the difficult problem of control, and the necessity for the widest knowledge of all pertinent details of the plan it is particularly important that rehearsals be conducted for all night operations.

k. Leadership. — In the conduct of night operations positive and bold leadership by commanders at all levels is essential to achieve maximum effect from available combat power. Communication difficulties and the decentralized nature of operations place greater responsibility on small unit leaders for independent thought and action.

l. Control. — Although the problem of maintaining direction and control are increased during night operations, the commander can overcome these through training, careful planning, and positive leadership. It is primarily in this area that night attack plans and orders must be quite detailed. To facilitate control, plans for the night attack must be simple, tactical control measures clear, special measures taken to assist in maintaining direction, and identification means set forth.

(1) The following tactical control measures are applicable to night attacks:

(a) Release point. — A point on the ground at which a subordinate commander assumes control of his unit. These should be readily recognizable in the dark and may be marked by artificial means. This point is designated by the commander who initiates the release. As an example, the battalion commander would designate the company release point, the company commander the platoon release point, etc. The

point is a control feature and should not be used as an area for reorganization or for the conduct of other details. Release points can be either to the front of or in rear of the line of departure.

(b) Point of departure. — The commander may designate a point or points of departure along the line of departure in order to ensure control of the unit and to make sure that initial forward movement is made along the selected route.

(c) Probable line of deployment. — This is a previously selected line where final deployment is contemplated. It must be easily recognizable at night. It is usually within 150 meters of the objective. If the probable line of deployment is also an obstacle, the attacking units will move through the obstacle and deploy on the enemy side. In this case, note of this fact will be made in the commander's order. The unit strives to reach the probable line of deployment undetected, but the line must be close enough to the objective to permit maximum control during the assault.

(d) Limit of advance. — This is a line beyond and to the flanks of the objective which is predesignated to control the forward movement of the attacking unit. It is also designed to prevent the assaulting units from being endangered by their own supporting arms. Units do not move forward of this line until they have received authority to do so from higher command. If no easily recognizable terrain feature is available, the limit of advance is designated in terms of meters past the objective, but in any case it will be chosen so that the unit assaults completely through the objective. Since the limit of advance often does not provide the most readily defensible terrain, the attacking unit may shift its position on the objective during reorganization to take maximum advantage of the terrain available.

(e) Phase Lines. — Phase lines may be employed to control the forward movement of assault units when the terrain offers readily identifiable features.

(f) Check Points. — Check points are used in the same manner as phase lines. They aid in accurate location of the assault units and are employed by commanders as reference points for supporting fires. These points are usually referred to by random number to facilitate reporting in the clear by radio, and are employed most effectively when the attacking forces are advancing along identifiable routes in assigned zones of action.

(g) Special measures may be necessary to assist in maintaining direction. These must be provided for in attack plans. Examples include:

(1') Objectives must be easily identified and should include features that will assist in maintaining direction.

(2') Attack routes should follow recognizable ground forms.

(3') Guides and connecting files are normally employed.

(4') A method, direction, and rate of advance may be prescribed.

(5') Infrared devices may be employed to aid night vision, to transmit control signals, to locate and mark routes, etc.

(6') Carefully registered fires (WP, tracers, pyrotechnics, and flares fired beyond the objective) are particularly valuable aids in maintaining direction.

(7') Identification means should be utilized to facilitate recognition of leaders and to prevent troops from firing on each other.

14. Supporting Fires and Illumination. ——A night attack may be conducted either with or without supporting fires and illumination, but in either case a detailed plan is formulated for their use.

a. Supported attack.

(1) When a supported and illuminated attack is planned, all fires and illumination are planned as to time, type, location, and duration. All weapons are placed in position to fire and, whenever possible, are registered on their targets prior to the crossing of the line of departure by the attacking unit. Registration must be kept to a minimum. During a supported and illuminated attack, the methods of controlling supporting fires are identical to those used in a normal daylight operation. Where the use of illumination is restricted, stricter control measures must be instituted, particularly when these fires are to be shifted to the flanks and beyond the objective to isolate it during the attack and consolidation.

(2) All supporting fires and illumination are controlled by the attacking unit commander. When planned for use during the entire attack, the fires on the objective and to the flanks of the attacking unit are fired during the movement to the probable line of deployment and are shifted on order of the attacking unit commander. When the unit has completed its deployment, and again on signal of the attacking unit commander, these fires are shifted behind the objective to isolate it from enemy counterattack and also further to the flanks of the unit to protect it during consolidation.

b. Unsupported attack. — An unsupported and nonilluminated attack is designed to take advantage of the cover of darkness to make the attack a success. When the commander of the attacking unit feels that his attack has been positively discovered and the need for improved control and fire support outweighs the concealment of darkness, he calls for supporting fires and illumination, and continues his attack as in daylight. These supporting fires and illumination are planned identically to fires and illumination for a supported and illuminated attack, but are delivered on an "on call" basis. Even during an unsupported and nonilluminated attack, normal harassing and interdiction fires will be continued in order to keep the enemy fixed in position and to help cover noise made by the attacking unit.

15. Passages of Lines. — A night passage of lines should be planned and executed to cause the least possible interference and intermingling with front line units. This can be accomplished by mutual cooperation and coordination, control, secrecy, simplicity, and speed of execution. The benefits in conducting a night passage of lines, in the conduct of a night attack, is that the attacking force can get added support from the front line unit through: increased security provided; assistance in conducting tactical deception measures; and the availability of additional forces to support the attack by maneuver or to cover a withdrawal should such action become necessary.

16. Forms of Maneuver.

a. Frontal attacks and envelopments. — These are the most common form of maneuver employed in night attacks. As such, they almost invariably will be limited objective attacks. They are:

(1) Generally launched against the nearest enemy position.

(2) Effective against an enemy position defense or to eliminate an enemy salient in our defensive position.

(3) Employed instead of a daylight attack to avoid heavy losses by our forces. It may be executed by company through division size units.

(4) Generally commence early in the night so defensive positions can be prepared prior to daylight or early in the morning in order to continue the attack under daylight conditions, or to be better prepared to defend against an enemy counterattack.

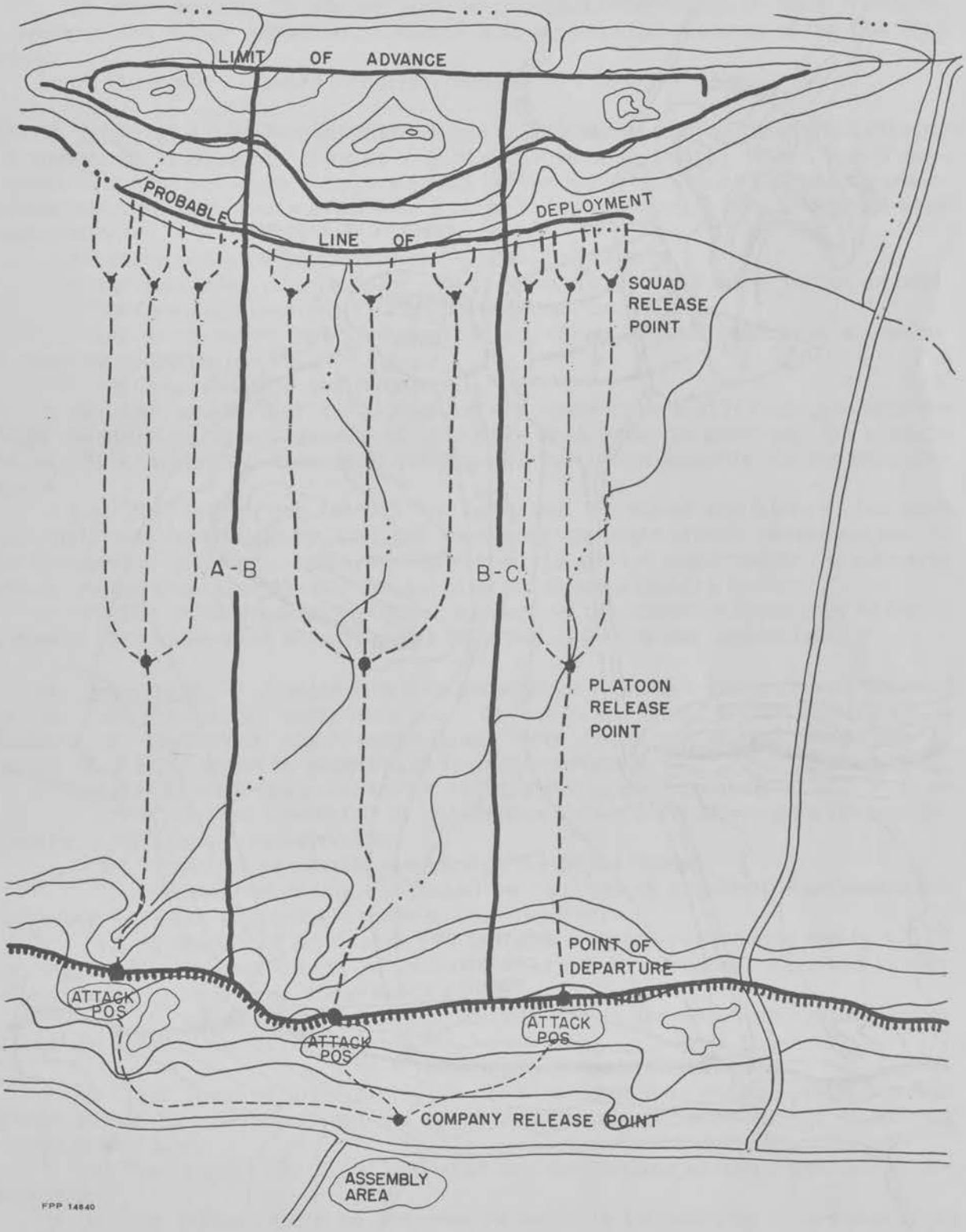


Figure 1. — Frontal night attack, battalion size.

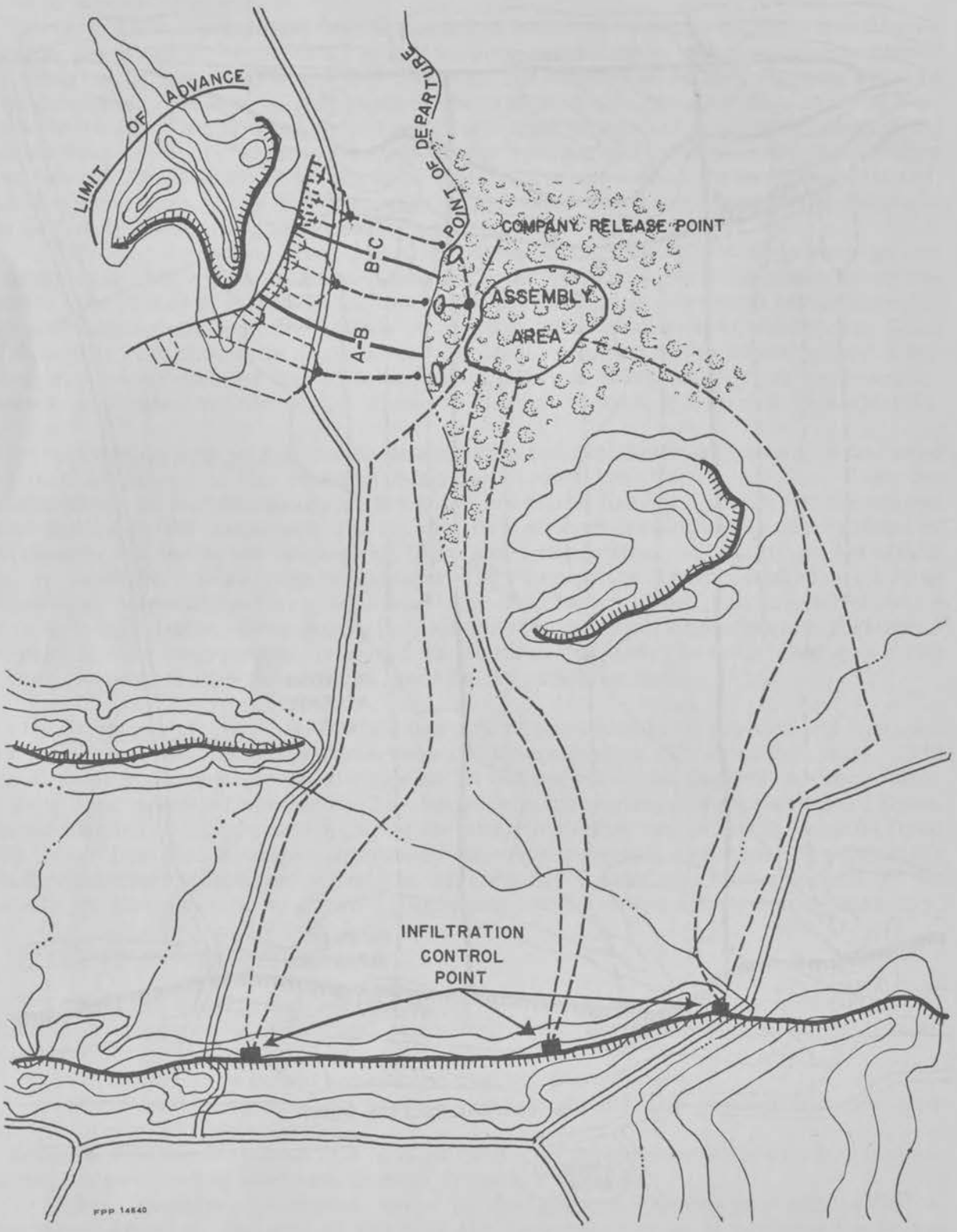


Figure 2. — Night surface infiltration, battalion size.

(5) The majority of support will be provided from behind friendly positions; therefore, the major logistical problems will arise in the resupply of the attacking force.

(6) Generally executed by surface forces.

b. Infiltration. — Frontal attacks and envelopments may be launched following movement by infiltration. Russian regimental size units during World War II conducted a number of night attacks against the Germans following infiltration. Guerrillas use this method to a great extent prior to launching night attacks against rear installations.

(1) Some of the characteristics of this maneuver are:

(a) Execution may employ either helicopter or surface forces or both.

(b) Generally involves smaller forces than the RLT.

(c) It is more effective against an enemy mobile defense or an enemy employing guerrilla tactics.

(d) Generally it is nonilluminated.

(2) The attack may take place on the same or on a different night than the night infiltration. Plans include an assembly area prior to going into the advance phase. This assembly area must provide for maximum security for the attacking force.

(3) The infiltration should be conducted by squad and platoon size units and will be controlled by the unit executing the night attack. Movement should be by stealth, therefore, tanks or other vehicles are not employed by the attacking force. Supporting arms usually are not attached to the attacking force.

(4) The difficulties of logistical support to the attacking force may be overcome by the employment of helicopters once the objective has been seized.

c. Penetration. — A night attack by penetration to seize an objective in the rear of the enemy's initial disposition may be conducted under certain conditions. A number of successful night penetrations were conducted during World War II.

(1) A night attack by penetration is characterized by:

(a) Bold leadership and troops well trained in night combat.

(b) It may be conducted in conjunction with a night attack on a limited objective, a feint or a demonstration.

(c) The attack is usually executed by a surface force.

(d) Greater emphasis is placed on security to provide for screening the attacking force and to mark the route to the objective.

(e) Execution of this form of night attack is generally conducted by a BLT or larger force. Employment of tanks and armored personnel carriers is very effective and provides additional shock action.

(f) An increase in logistical support due to the attachment of supporting arms and units to the attacking force.

(2) This form of night attack is effective against an enemy mobile defense. Plans should include going into the attack in the event of discovery and bypassing the assembly area.

(3) The attack can be illuminated or nonilluminated and supported or unsupported.

(4) The attack should be commenced early in the morning so the attack can continue during daylight.

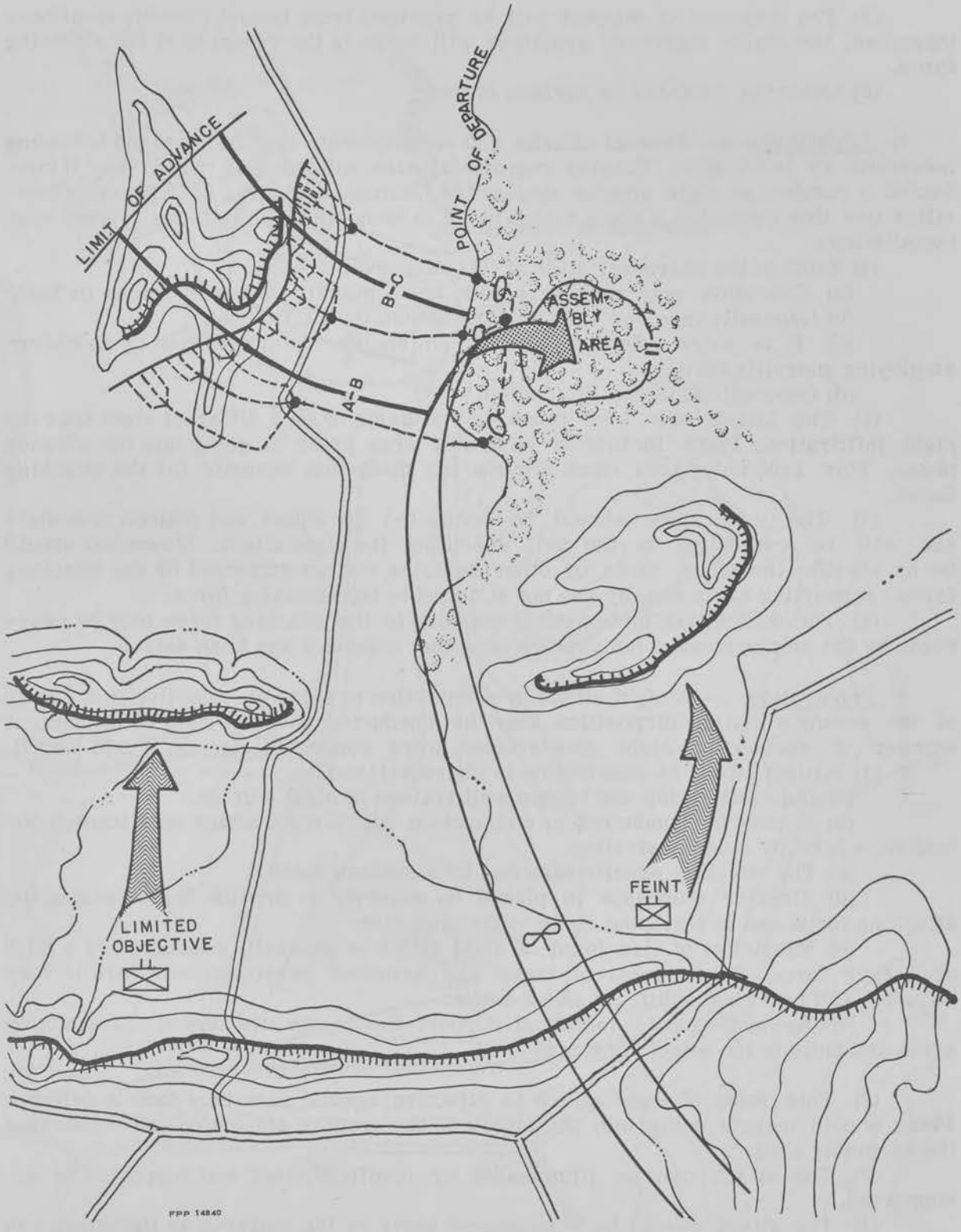


Figure 3. — Night helicopterborne penetration, regimental size.

d. Turning Movement. — This maneuver may be conducted by surface or helicopterborne forces. Characteristics of the movement, when conducted at night, will generally be the same as a daylight penetration except that the enemy's main defenses are bypassed instead of attacked. Such attacks, when conducted by helicopterborne forces must be in conjunction with surface forces to provide for juncture.

17. Pursuit. — Night pursuit can be made when there is a well defined axis of advance. Security units well forward and to the flanks provide protection for the pursuing force. Engineer elements, in conjunction with the security units, will assist in obstacle clearance. Although movement at night is not rapid, a night advance of a few miles into an enemy position will have a surprising effect on his ability to conduct effective countermeasures against friendly forces. The rate of advance at night of 1 to 2-1/2 miles per hour is considered rapid. Even so, a night attack commencing at 2100 at a rate of advance of 1 mile per hour will cover 9 miles by 0600 the next day.

18. Reconnaissance in Conjunction with Night Offensive Operations. — In night operations reconnaissance elements can provide for installation of infrared guiding devices along the routes of approach to the objective and for objective reconnaissance. Screening the attacking force and providing security along the flanks of the objective to warn of enemy counterattacks should be assigned to security elements and not to reconnaissance elements.

SECTION 4

DEFENSIVE OPERATIONS

19. General. — The principles of defense do not change because of darkness. Areas must be denied to the enemy; maximum casualties inflicted; and the attack disorganized to the extent necessary to permit a counterattack. Although amphibious operations are essentially offensive operations, sometimes elements of the landing force may be required temporarily to assume a defensive attitude.

20. Basic Considerations.

a. Use of terrain.

(1) Key terrain. — As in the daytime, control of key terrain is essential to the defense. Possession of dominating terrain is necessary to ensure observation, to control supporting fires, and to deny that terrain to the enemy.

(2) Cover and concealment. — Positions which do not offer suitable cover and concealment during daylight may be occupied at night, thereby deceiving the enemy as to the exact location of the defenses. Thus, forward slope positions untenable in daylight may be occupied under cover of darkness.

(3) Obstacles. — Manmade and natural obstacles materially assist in the conduct of night defense by disrupting and canalizing the attack formations of the enemy, however, the enemy may launch a night attack through obstacles which appear to be impassable.

(4) Observation and fields of fire. — Listening posts, battlefield surveillance radars, and infrared detection devices are employed to overcome limitations in visual observation at night. Automatic weapons may be emplaced forward of their daytime position to cover prepared or natural fields of fire and to deceive the enemy as to the location of the main defensive positions. Fields of fire are selected and cleared with particular attention being devoted the open areas between platoon and company positions.

(5) Avenues of approach. — At night, fence lines and hedgerows, as well as roads, trails, and streamlines may mark suitable avenues of approach. These features are also commonly used as control or guide points for an attacking force.

b. Security. — One purpose of night reconnaissance in the defense is security. The greater the degree of unit separation, the more difficult security will become. The disposition of covering forces at night requires special considerations. Not only is greater alertness essential, but patrolling must be more aggressive, and an increased number of security posts, including deep outposts and listening posts, must be established. Trip flares may be employed to provide additional early warning of the enemy's approach. Extensive use is made of available surveillance radars, infrared detection equipment, and improvised warning devices. The strength of the principle defense localities must not be jeopardized by providing for a disproportinate number of security posts and patrols.

c. Mutual support. — Mutual support is more important at night than in daytime because movement of forces to support a unit under attack may be particularly difficult. Greater reliance may have to be placed on prearranged supporting fires.

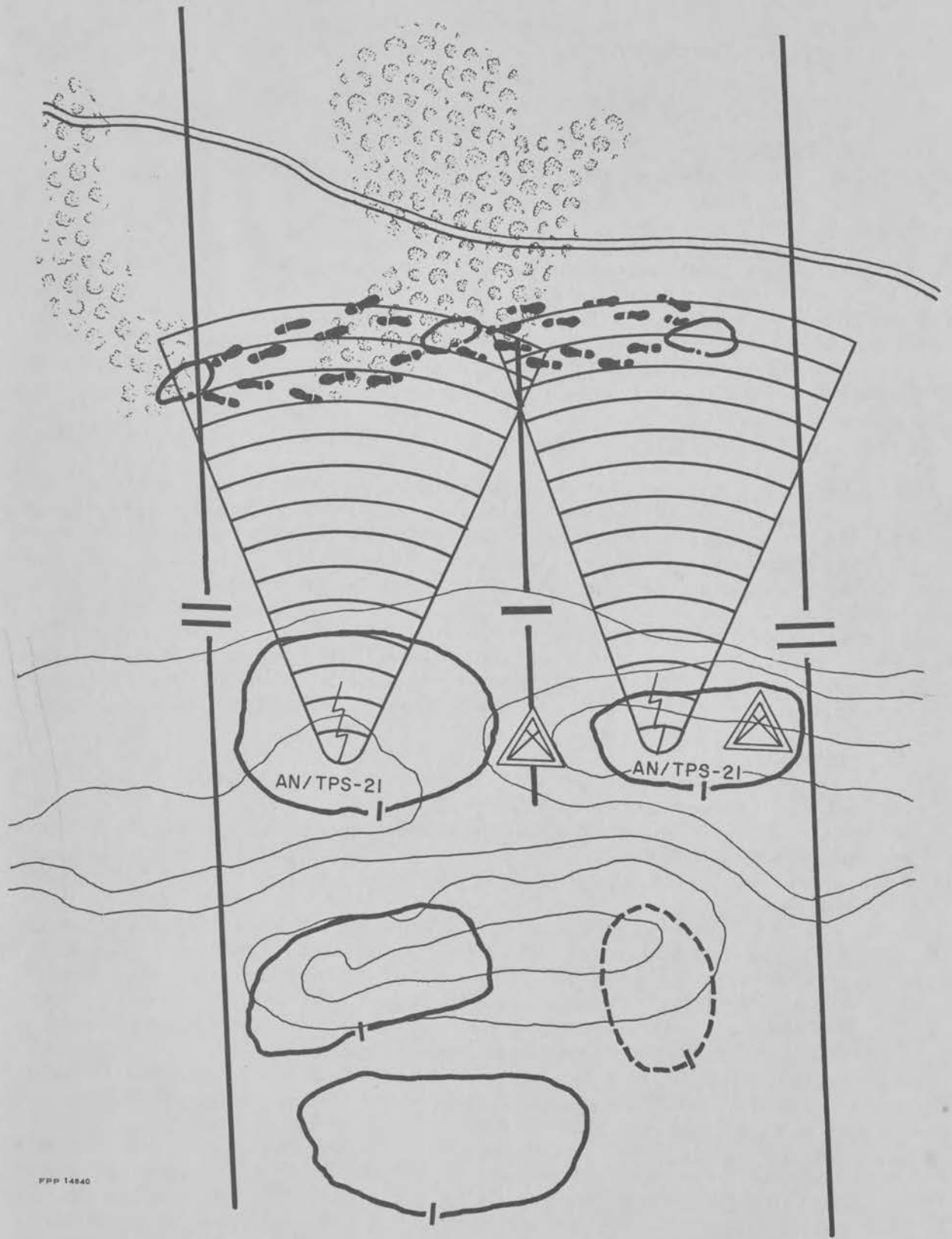


Figure 4. — Security at night.

d. Defense in depth. — Emphasis must be placed on organization of positions in depth to prevent the enemy from exploiting any success achieved during a night attack.

e. Flexibility. — Flexibility in a night defensive action requires effective communications, a high state of unit and individual training, discipline, and speed of reaction.

f. Maximum use of offensive action. — Detailed counterattack plans are prepared and rehearsed. If a position is penetrated, a counterattack at the earliest practical time may be ordered, or the attack may be delayed until daylight. Normally, a counterattack is launched as soon as possible after penetration is slowed or stopped, and when fire alone has failed to eject the enemy. The longer offensive action is delayed, the greater is the enemy's opportunity to reorganize and consolidate his newly gained position.

21. Special Considerations. —The following must be emphasized in a night defense.

a. Supporting arms. — To compensate for the limited ability of observers to adjust on targets at night, fires of supporting arms must be planned in detail and adjusted during daylight whenever possible. Fires are planned within the limits of target acquisition and observation and normally provide support in the following general phases: before the enemy deploys, counterpreparation, fires during the attack, and support of counterattacks. Close air support may be integrated into night defensive operations as in offensive operations. However, it must be considered that more precise fire support coordination and flight control measures will be required because of proximity of friendly troops, the more generally confined field of operations, and the reduction of visual target identification means.

b. Illumination.

(1) General. — The objective of illumination, used in support of a defense, is to provide friendly forces with the advantage of sufficient light to assist in the conduct of the defense while denying equal advantages to the enemy. Illumination plans must be formulated and integrated into the overall defensive plan. Centralized control must be exercised by the highest echelon effected by its use in order to ensure coordination.

(2) Searchlights. — The use of searchlights requires preselected positions, an adequate communication network, and provisions for alternate positions. Maximum illumination is obtained from searchlights when they are used in a direct illumination role. When operated from a defilade position, illumination by diffusion will provide light approximating a quarter moon, and illumination by reflection will provide light equivalent to that received from a full moon.

(3) Illuminating projectiles. — Plans should provide for scheduled and on-call illumination as necessary. Continuous illumination by this means generally is impractical for extensive periods of time.

(4) Air delivered flares. — Air delivery of flares normally is prearranged and coordinated. With a sufficient amount of diffused light or with radar equipped aircraft to provide adequate navigation, flares may be accurately placed at night. If effective navigation cannot be accomplished, then the assistance of an external agency such as Air Support Radar Teams will be required to position the aircraft.

(5) Hand delivered flares and improvised illumination. — These devices are a means for individuals to temporarily illuminate an area in their immediate vicinity.

c. Control. — Control, coordination, and movement of troops at night can be greatly facilitated through complete familiarity with the terrain in the defensive area coupled with continuous reconnaissance. In addition, a detailed orientation of all individuals as to the plans for defense and rehearsals of contemplated movements is essential. A system of identification must be promulgated to all units. Such a system should include passwords, identification markers, and a plan for pyrotechnic signals.

d. Command posts. — Particular attention should be paid to the organization and security of command posts for night defensive operations. (See MCS 3-20, "Command Post Organization and Echelonment").

22. Types of Defense.

a. The position defense.

(1) General. — The position defense at night permits maximum application of defensive principles. In addition to the basic and special considerations mentioned within this chapter, the following point should also be stressed in application to a night position defense.

(2) Change in troop dispositions. — Daytime troop dispositions should be changed after dusk whenever possible. At night a defensive position should present a completely different picture from that shown during daytime.

b. The mobile defense. — A division or corps employing a mobile defense at night must increase its reconnaissance and surveillance efforts to ensure that the intelligence coverage of the area into which the enemy attack is channeled is complete. The area should be reconnoitered in daylight and darkness by both ground and air elements. Detailed knowledge of the terrain is absolutely necessary to counter the enemy thrust.

23. Retrograde Movements. — The best time to withdraw from action is after a successful defense. Darkness facilitates disengagement and may conceal a withdrawal from enemy observation and reconnaissance for a relatively long period. Reconnaissance elements normally should not be employed as rear guards in a retrograde movement.

SECTION 5

OPERATIONS UNDER SPECIAL CONDITIONS

24. General. — Normally operations under special conditions warrant employment of special techniques plus detailed planning. They are in this respect similar to amphibious operations. Reviewing operations under special conditions it is apparent that night combat may provide the margin of victory. This is substantiated by the extensive night attacks conducted by the British in Africa during World War II. Proper application of the special techniques required for successful operations under special conditions in daylight or darkness rest on the training of units and individuals.

25. Jungle. — Darkness in the jungle produces a distinct psychological effect on personnel unfamiliar with this environment. The principles for night operations are applicable to the jungle, however, modifications will be required to fit a specific situation.

a. Generally, night operations in the jungle will consist of small and widely separated actions such as patrols, ambushes, infiltration, and attacks for limited objectives. Movement at night of large forces can be successfully accomplished, however, the movement is extremely slow due to the darkness and jungle terrain.

b. Darkness also compounds the difficulties of aerial target location in the jungle. Consequently, air operations in support of night jungle operations will consist of interdiction beyond the bomb line, and helicopter logistical support.

c. Jungle terrain, isolation of units, and limited fields of fire for small arms places a heavy reliance on supporting fires in night defensive situations. Reliance on sound sensing to adjust supporting fires at night is also a technique employed in the jungle during daylight. Jungle foliage decreases the effectiveness of illumination and even when adequate, there will be large areas of shadows.

d. The jungle at night affords almost complete concealment from ground and aerial observation, therefore, most logistical support must be accomplished during daylight hours.

26. Cold Weather. — The number of hours of darkness varies widely with latitude and season. During the long days of the summer months, orthodox night combat techniques apply unchanged. In winter, special factors must be considered; night movement and control are facilitated by an increase in visibility resulting from reflection from the snow, however, movement over ice and snow under conditions of reduced visibility may be hazardous. Throughout the spring breakup, vehicle traffic will be restricted to the hours of darkness because during daylight in this period, the ground thaws and becomes very unstable for vehicular traffic.

a. Cold weather operations are characterized by maneuver over relatively treeless terrain. Night operations can provide concealment and surprise for units regardless of size to maneuver in this type of terrain. Air is capable of providing

all types of support even though adverse conditions do exist. Pilots flying close support missions will have difficulty in distinguishing friend from foe in the snow covered terrain, but marking friendly positions should be relatively easy.

b. Supporting arms of all types can be employed effectively in both the offense and defense. Low temperatures are more of a deterrent than darkness to an alert defense in cold weather.

c. Primary consideration should be given to resupplying units at night to take advantage of the concealment offered by the darkness.

27. Mountain. — As in the jungle, mountain operations lack the unity characteristic of combat in rolling terrain. The principle of surprise is paramount in successful night operations in the mountains.

a. Excellent observation and restricted frontages necessitates employment of night attacks for limited objectives or by infiltration against enemy defenses. Generally, these will be the unsupported type of night attack. Darkness, unpredictable weather, air currents, and cloud-covered peaks will extensively reduce air support in alpine terrain.

b. Compartmentation and the difficulties of shifting supporting fires will require emphasis be placed on detailed night counterattack plans. Illumination is very effective in defensive situations.

c. In areas where the enemy has superior observation, reliance on logistical support at night is important, however, in alpine terrain, night movement as in the jungle, is extremely slow.

28. Desert. — Basic tactical doctrines, apply to desert operations; but they must be adopted to the peculiarities of desert terrain and climate. Darkness is less of a psychological factor than the heat and lack of water.

a. Maneuver over treeless terrain in desert operations is similar to that of cold weather operations; however, extreme heat replaces extreme cold. Night operations normally increase the possibility of surprise and decrease the number of casualties in offensive operations. Air support and supporting arms of all types can be extensively employed in night operations in the desert.

b. Activity increases after darkness in the desert. The defense must be alert during this period.

c. Plans should be made to accomplish most of the logistical support at night.

29. Built-up Areas.— The psychological impact of a large, dark, and silent city will handicap even the individual familiar with this environment.

a. Limited objective attacks and infiltration by small units at night may be employed to seize objectives impossible to take in daylight. Streets and large buildings may assist air support in the location of targets, however, close air support will be difficult. Supporting fires may improve the enemy defensive position. Fire caused

by supporting arms may provide illumination in deep valleys of a city which cannot be illuminated by flares.

b. As in the jungle, short fields of fire and isolation of units increases the requirement for supporting fires in the night defense of a built-up area. Night counterattack plans must be detailed to be effective in builtup areas.

c. Logistical support may best be accomplished during daylight hours by the extensive use of passageways through the buildings. During daylight, the streets should be avoided; however, by staying close to the buildings, some protection is afforded vehicles and personnel.

SECTION 6

AIR OPERATIONS

30. General. — Air support during darkness will vary little from those conducted during daylight except for the greater skill required in the execution of close air support missions. The all-weather air support delivery systems and procedures are not affected. The problems to be encountered will revolve around the identification of friendly forces, target identification and marking, and control of aircraft where attacks are made under night visual conditions.

31. Basic Considerations.

a. Pilots will be unable to locate friendly forces on the ground using the normal visual methods for daylight operations. During the rehearsal, pilots must become thoroughly familiar with the methods used to mark friendly positions at night. The use of smoke at night for target marking is effective only when used in conjunction with target illumination.

b. Night close air support operations may require additional tactical air control parties and air support radar teams since control problems under these conditions are magnified, and pilots need assistance in maintaining separation between aircraft and lining up on targets.

c. The integration of close air support missions with helicopter operations will require control of aircraft in the objective area to a greater degree than required during daylight operations when visual contact between aircraft can be maintained with relative ease. Therefore, a tactical air coordinator airborne (TAC(A)), well briefed on the ground situation and plan of attack, armed with marking rockets and flares, will frequently be the key controlling agency. Aircraft working without lights close to friendly forces present an identification problem to antiaircraft personnel as well as to other airborne aircraft.

32. Close Air Support.

a. General. — As in daylight, aircraft executing close air support missions at night may attack from any direction and from nearly any angle with bomb, rocket, and strafing runs. However, effectiveness of the mission will be subject to the degree of reduced visibility, the availability of control facilities, and the ability to locate and identify targets. Accuracy, under the above circumstances, follows the same general pattern as in daylight delivery with strafing being the most accurate and napalm, rocketry, and bombing following in that order. Generally, night bombing attacks will be restricted to glide bombing, low-level skip bombing, and horizonal bombing under the control of air support radar teams. New electronic equipment, battlefield illumination, and training will increase aviation capabilities in this field.

b. Methods of execution. — Although close air support delivery methods do not change when the support is rendered at night, there are several methods of delivery that are preferred. The most accurate and rapid method is control by the air support radar team. The second best method is to employ a forward air controller. The least desirable method is to use a tactical air coordinator airborne.

(1) Air support radar team control. — Air support radar teams provide the best method of controlling night offensive strikes to be immediate front of friendly ground forces because target illumination is not required and aircraft can make the run while "blacked out." When directed by the direct air support center, aircraft report to the air support radar team on the assigned frequency. The aircraft will be picked up on the surveillance radar usually from a prearranged orbit point, depending on the manner of control (automatic, semiautomatic, or voice), the air support radar team then vectors the aircraft into position for the run. Essential information as to the nature and size of the target and the type of ordnance required is determined in advance, and the pilot is generally prebriefed for the mission. If prebriefing is not possible, the pilot is instructed during the run-in to the target as to the ordnance and fuze setting to be used. The direction of the run and the safety requirements for troops are determined by the air support radar team, which is advised of the current situation on the ground by the direct air support center. There are three general methods of control: automatic, semiautomatic, and voice. Automatic is most accurate, with the aircraft flight path and weapon release being controlled by the air support radar team; however, this method requires preplanning and specially configured aircraft. In semiautomatic control the aircraft is equipped with a course correction instrument and the pilot flies a predetermined course, airspeed, and altitude, and the weapon release command is given by voice. If the aircraft is not equipped for either automatic or semiautomatic control, the drop can be accomplished by the use of voice control throughout the run. The pilot follows voice instructions pertaining to flight course and weapon release given to him by radio from the air support radar team. There is inaccuracy in the voice control method, resulting from delays in reaction time on the part of the controller and the pilot and from problems of communication. Errors are minimized when the air support radar team is experienced and the pilots have been trained with the controllers. The release altitude and the size of the weapon also affect accuracy of delivery.

(2) Forward air controllers. — When an air support radar team is not in position to control night close air support, limited support can be delivered by well qualified attack pilots and experienced forward air controllers. The target must be marked for the attack aircraft in such a manner that the flight leader can identify it and conduct his strike. There are several ways that this can be accomplished. If there is sufficient diffused light, the forward air controller can direct the flight leader on to the target. Alternately, the target may be illuminated by artificial means. As soon as the pilot has positive identification of the target, the run is controlled as in the daytime.

(3) Tactical air coordinators (airborne). — Night support strikes may also be controlled by a forward air controller working with a tactical air coordinator who is airborne in a high performance aircraft equipped with flares and smoke rockets or napalm for marking targets. Other aircraft, such as fixed-wing transports may also be equipped with flare dispensers to provide target illumination.

33. Helicopter Support. ——Helicopters can support the ground elements of the landing force engaged in night operations by transporting troops from ship-to-shore and between objectives inland. Night movement of troops by helicopter permits development of a plan of attack ashore which emphasizes secrecy and surprise. Generally larger landing zones are required for night operations than for day operations unless a reduced rate of build-up ashore is acceptable. These landing zones should be free of enemy surveillance and fire and should have electronic helicopter control and guidance facilities as well as visual landing aids to establish final approach and actual landing points. (See LFB-26.)

34. Fixed-wing Transport Support. — Aerial drops of supplies and equipment can be accomplished at night by fixed-wing transports. They can also drop reconnaissance parties to scout and prepare landing zones for helicopter operations, gain intelligence, or perform clandestine operations in the rear of the enemy.

35. Reconnaissance. — The visual and electronic reconnaissance capabilities of a composite reconnaissance squadron and other aircraft are valuable aids to night offensive operations. Added to information supplied by other agencies of the landing force, the information provided by night photography and electronic surveillance may enable the commander to gain an adequate picture of the enemy situation on which to base his decisions.

36. Miscellaneous Air Operations. — In addition to the tasks enumerated above, aviation units can perform such functions as wire laying, night spot for artillery and naval gunfire, messenger service, night emergency evacuation, liaison, and aerial refueling.

SECTION 7

COMMUNICATIONS

37. General.

a. To be effective, a communication system must operate on a 24 hour basis. Night conditions are more likely to effect ground communications than aircraft communications, however, night conditions do not greatly effect communications systems or equipment. Very high frequencies are less effected by night interference than high frequencies. The doctrine and employment of Marine Corps communications are set forth in FMFM-10.

b. While night operations do not effect the operations of communications, there may be an increased requirement for radios due to the need for additional control. Since security and surprise are inherent factors in a night operation and the situation develops more slowly than day attack situations, wire to forward units should be exploited.

c. The types of communications employed during night operations is dependent upon the requirement of surprise and the organization of the unit or units involved. If surprise is not a prerequisite of the night attack (i.e., an attack supported completely by illumination from start to finish and requiring little clandestine movement or an attack followed a nuclear drop), communications means are employed as they normally would be for a daylight operation.

d. Because of the increased difficulty of maintaining communication systems at night and the difficulty of control, alternate means of communications are essential to night defensive operations.

38. Communication means and night operations. — The following considerations relating to the employment of communications during night operations are promised upon the requirement of surprise. In this regard, the communication means supporting the operation must of necessity be employed in such a manner that they do not compromise the operation.

a. Radio. — Prior to contact, conditions of radio silence are imposed upon the unit making or supporting the night attack. These conditions might completely restrict the use of radio until contact is made, or an emergency occurs. In conditions involving radio silence, consideration should be given to having all units guard assigned frequencies in order to be ready for normal radio operation if required. Because of restrictions on use of noisy generating equipment by units in close contact with the enemy, battery operated equipment should be used whenever possible. The range capabilities of these radio sets should be more than ample to control units during the operation against limited objectives. If possible, most of the radio operators assigned to operate within specific nets should be able to send and receive CW signals on radio and code on signal lamp equipment.

b. Visual. — Visual communications may be used for control during the movement to contact when restrictions are placed upon radio transmissions. However, these communications are not used without precautions. An inherent limitation in

the use of visual signals is that to have any meaning they must be coded, and the codes must be simple and readily understandable. Wide dissemination must be made of the visual signals to prevent confusion, particularly when two or more units are involved in the night operation or when one unit moves through another in the dark. Infrared devices, unless utilized only against an enemy with no infrared capabilities, require restrictions similar to the employment of radio. When visual signals are in Morse code, a number of men within a unit should be able to transmit and receive code. Signal lamps, hooded flashlights, pyrotechnics, and infrared equipment are examples of visual devices which can be used to receive and send coded messages.

c. Wire. — It is possible, and often desirable to use wire during a night operation. Units of squad or even platoon size normally do not use wire for internal control, however, units of company size and battalion size may plan to use wire from command post locations along the route or routes to be taken to the objective. In some instances it might even be possible to lay wire lines along these routes in advance. Platoons or companies marching along these routes during the night operation merely tie into the prelaid wire lines and report to their higher headquarters. Extreme care must be exercised in laying wire lines prior to the operation since the operation may be compromised or communications tapped. Wire lines can be laid at night from command posts along the routes used in the approach by using dispensers MX 306 A/G on packboards. Routes must enable a wireman to move through the dark noiselessly.

d. Messengers. — Messengers, well trained in night movements and in navigation at night using either stars or compass, are most valuable as a secure and reliable communication means. Messengers must be trained to move noiselessly at night; they must be able to move from unit to unit in the dark without getting lost or without inciting friendly troops to fire upon them; and they must be men of stamina who maintain their wits when confronted with an unusual situation in the dark.

e. Sound. — Sound communications during movement to contact are restricted to whispers or to sound codes rendered by tapping against rifle butts, etc., and are more extensively used for control and identification within patrols. Whistles can be used to launch an attack.

f. Radio relay. — Because of the time required for setting up radio relay equipment, the requirement for use of lights in its erection, and its weight and size, it is difficult to displace radio relay equipment at night. If however, the headquarters are to remain intact, then radio relay communications continue to be operated between command posts (infantry battalion to infantry regiment, infantry regiment to infantry division) as in daylight operations. Should the success of the night operation require a command post displacement, normal echelonment procedures for communications are followed.

SECTION 8

FIRE SUPPORT

39. General. — The employment of artillery, naval gunfire, tanks, and antitank weapons in support of night operations follows the same basic principles as in daylight operations.

40. Artillery.

a. General. — Artillery is capable of providing effective supporting fires at night. To ensure effectiveness of this support, the observers should study the terrain under daylight conditions. If the situation is such that observers have not been able to study terrain under daylight conditions, target acquisition at night or under conditions of reduced visibility will be adversely affected. Registrations can be conducted and observed fires delivered, under illumination fired either by the adjusting battery or by other artillery units. The AN/MPQ-10, countermortar radar, or its replacement, can be used to conduct registrations and to adjust fire on targets of opportunity. Use of the countermortar radar to control artillery fires in this manner reduces the need for illumination.

b. Planning Considerations. — The following considerations should be emphasized when planning artillery support of night operations:

(1) Close liaison must be effected between the supported and supporting unit. The forward observers, especially, must know the infantry company commander and be familiar with the operating procedures and plan of attack of the supported company.

(2) Preparation of position areas, especially the marking of approach routes, gun position areas, and command post areas will be completed, insofar as possible, prior to occupation.

(3) Survey of position areas and target areas should be made during daylight so that effective fire support plans may be prepared.

(4) Artillery units can fire illumination for detection and location of targets and for the adjustment of fires; it should be remembered, however, that once illumination is used, the night vision of troops is adversely affected and it will be necessary to continue the use of illumination.

(5) In offensive operations, artillery units can assist infantry and armored units to maintain direction by firing flares over designated points; it can also fire white phosphorus shells to designate objectives.

(6) The decreased effectiveness of night artillery fires, due to the inability to accurately locate targets, may necessitate an increased requirement for greater amounts of ammunition. If extensive illuminative operations are planned, this requirement will be even greater.

c. Artillery in a night amphibious operation. — In most cases, it is more expeditious to use naval gunfire support and close air support during the early phases of a waterborne or helicopterborne assault than to land artillery units to provide close fire support. Artillery units can make a ship-to-shore movement under conditions of reduce visibility; however, longer periods of time are required to effect the movement, prepare the position area, and to be prepared to render effective fire support. Artillery reconnaissance units should be landed with the assault infantry

units to reconnoiter, select, and start preparation of artillery position areas. Forward observers and liaison teams will land with the infantry units and be prepared to control the fires of the artillery units as soon as they land.

41. Naval Gunfire.

a. General. — Naval gunfire is capable of supporting night operations. The principles and techniques for employment of gunfire support of night operations are the same as those employed under daylight conditions except that more careful coordination and detailed planning will be required to offset the limitations imposed by the reduction in visibility.

b. Planning considerations. — The following considerations should be emphasized when planning gunfire support of night operations.

(1) The effectiveness of naval gunfire depends upon the accuracy with which the position of the fire support ships can be fixed. When supporting night operations, the precision with which a ship's position can be fixed is dependent upon the accuracy of the charts provided and the availability of navigational aids such as suitable reference points or radar beacons. Adequate gunfire support for a night landing demands that adequate navigational aids be available. Plans should provide for the establishment of radar beacons ashore at the earliest possible time.

(2) Poor charts, a lack of navigational aids and the limited observation inherent in night operations may result in significant errors in the delivery of close supporting fires. Therefore, normal safety margins will have to be increased to ensure acceptable safety for the supported units.

(3) The capability to accomplish destruction type missions is greatly reduced because of the limitations imposed on observation. This limitation can be overcome only partially by the use of illumination.

(4) Plans must ensure that bombardment allowances of gunfire support ships will include sufficient amounts of illumination projectiles.

(5) Coordination of the landing beach preparation and close supporting fires with the ship-to-shore movement and initial assault during a night waterborne or helicopterborne landing requires special consideration. Waterborne landings under cover of darkness require special techniques to accurately locate the position of the leading assault wave in relation to the beach and make possible the timely lifting of fire support to ensure adequate safety of the supported units from their own fire support. Section 2 of this text discusses the techniques that may be used to accurately locate the position of the assault waves. Providing adequate safety for helicopter operations will probably require an increased use of restrictive fire plans and careful selection of fire support areas and fire support stations to provide the required safety with a minimum reduction in fire support.

42. Tanks.

a. General. — Tanks can be employed to support landing force operations at night. The proper use of special infrared night driving equipment greatly enhances such support, however, the inherent disadvantage of noise may preclude the employment in certain night operations. The advantages and feasibility of coordinated tank-infantry night operations may be determined through consideration of the following factors:

(1) Tanks may be able to operate at night over terrain covered by enemy antitank weapons because of the enemy's decreased capability to deliver aimed fire.

(2) The effectiveness of direct fire is reduced by darkness. However, employment of the tank mounted searchlight overcomes this to some degree.

(3) Maintenance of physical contact between individual tanks and infantry during movement is difficult. The infantry is responsible for maintaining contact between tanks and infantry.

b. Planning considerations. — The following considerations should be emphasized when planning the employment of tanks in support of night operations.

(1) Reconnaissance and terrain analysis. — The sensitivity of tanks to terrain, coupled with the reduction invisibility from within the tank, increases the necessity for detailed map and visual reconnaissance of the area of operations. Whenever possible, tank crews should be brought to OP's for daylight orientation of the terrain over which the attack is to be made in order to determine routes into forward assembly areas, attack positions, and to the objective. Tank reconnaissance personnel may be sent out with night patrols to obtain detailed information of the terrain and firing positions.

(2) Coordination. — Detailed coordination with infantry is required to provide a complete understanding of individual roles and to ensure cooperation between individuals of the tank and infantry squads. Planning should make provision for the close-in protection and guidance of tanks by infantry, preparation of fire support plans (including illumination), and the development and dissemination of prearranged signals between tanks and infantry for maneuver and fire control. A means of identification between adjacent and supporting units is essential.

(3) Control. — Plans should provide for all essential control measures including intermediate objectives, formations, direction of attack, and the necessary communications to support the plan of attack. The selection of limited objectives and a well defined direction of attack will assist in exercising control. The infrared tank vision devices can also assist in control.

(4) Reorganization. — Complete plans for reorganization of the tank-infantry elements upon seizure of the objective must be promulgated in advance of the attack.

(5) Employment of tank illumination. — Tank searchlights may be employed to illuminate targets and blind the enemy. Care must be taken to ensure that illumination is not premature and thereby disclose the position of the tanks with the attendant loss of surprise. Tanks equipped with searchlights either work in pairs or work with a tank not equipped with these lights. One tank illuminates the target while the other observes and fires. This is necessary due to the dazzle created by the beam which tends to blind the crew of the illuminating tank. Observation is best obtained from the flank of the illuminating tank.

43. Antitank Weapons. — The rifle, multiple, 106mm, self-propelled, M50 (Ontos) may be employed in night operations to perform both antitank missions and direct fire support missions. Planning considerations for the employment of the M50 are similar to those of the tank.

44. Nuclear Weapons Support.

a. The primary differences between day and night employment of nuclear weapons are:

(1) The effects of flash blindness will extend to a greater distance.

(2) Debris in the target area may restrict night movement.
(3) Visual delivery techniques normally cannot be employed.

b. These differences, if taken into account, can enhance the effectiveness of nuclear fire support. Darkness, coupled with the blinding effects of the nuclear explosion, gives the user a decided psychological advantage which will assist in exploitation. Friendly forces should be adequately warned and take protective measures to avoid flash blindness. When offensive exploitation is to follow the night employment of nuclear weapons, battlefield illumination is desirable. Air delivery requires radar control of the delivery aircraft, and ground delivery requires unobserved fire techniques. Because of the difficulty confronting a pilot in locating targets visually at night, ground delivery of nuclear weapons assumes greater importance in support of a night attack. When utilized, night air delivery of nuclear weapons normally will be accomplished under air support radar control.

SECTION 9

BATTLEFIELD ILLUMINATION

45. General. — The efficient employment of battlefield illumination provides an increased capability to operate during darkness by landing force elements operating ashore. Because the use of illumination during the assault ship-to-shore phase may reduce the possibility of surprise, and because illumination from seaward reflects over an expanse of water and silhouettes naval ships and craft for enemy shore or air bombardment, illumination will rarely be used during the ship-to-shore movement. For a more detailed description of battlefield illumination see LFB-18.

46. Types of Illumination. — Illuminators available include pyrotechnics, searchlights, and emergency means.

CHARACTERISTICS OF NAVAL ILLUMINATING SHELLS

ITEM	5 – inch 38 Cal	6 – inch 47 Cal
Classification	Standard	Standard
Candle Power	330,000	800,000
Burning Time (Seconds)	50	50
Rate of descent (Feet per second)	30	40
Fuze Time (Seconds)	45 (Maximum)	45 (Maximum)
Maximum usable range (Full charge) (meters)	14,100	18,200
Diameter of area illuminated (meters)	360 – 550	480 – 640

FPP 14840

Figure 5. — Characteristics of Naval illuminating shells. (5''/54 illumination ammunition is under development)

a. Pyrotechnics. — Pyrotechnics are munitions containing chemicals that produce a temporary brilliant light that can be used for illuminating an area at night. This group consists of illuminating grenades, trip flares, artillery and mortar shells, naval illuminating shells, and aircraft flares.

(1) Illuminating grenades. — Illuminating grenades may be hand thrown or launched from a rifle and are designed to burn on the ground. They are available to all ground forces. (See figure 7).

(2) Trip flares. — There are two types of trip flares currently in use. These are parachute trip flares and ground trip flares. (See figure 7.)

(3) Artillery and mortar shells. — All artillery and mortar units in the Fleet Marine Force except rocket and 8'' Howitzer units are capable of providing illumination by firing illumination munitions. (See figure 8).

(4) Naval illuminating shells. — Ships equipped with five and six inch guns can provide illumination. (See figure 4.)

(5) Aircraft illuminating flares. — Tactical fixed-wing aircraft within the Fleet Marine Force are capable of providing illumination. (See figure 5.)

(6) Characteristics of pyrotechnics used for illumination are shown in figures 5, 6, and 7.

b. Searchlights.

(1) The 30'' General Purpose Searchlight was developed by the U. S. Army to furnish direct or indirect illumination of wide sectors of a battlefield or other areas where surveillance is desired or work is to be accomplished during hours of darkness. Engineering and service tests have been completed on the searchlight and companion generator. The searchlight and generator should be type classified as Standard A in FY '63 by the U. S. Army. Characteristics of the 30'' General Purpose Searchlight are:

Candlepower . . . . . .435 million (peak beam).
Type Beam . . . . . .Variable focus 3-6 degrees.
Maximum usage range . . .10,000 yards.
Employment capability . . .Continuous operation for 12 hours with one out of action period of less than one minute.

(2) The tank battalion, FMF has eighteen 18-inch searchlights or six per gun company. When employed as direct illumination, the beam is aimed directly at the area to be illuminated and will detect large targets of truck and tank size against a low reflective background at 1500 yards when observed by the naked eye. Using the 6-power vision devices in the tank detection increases the range to 1600 yards. For further information see TIP(MZ)2. Characteristics of eighteen inch searchlight are:

Candlepower 2,500,000
Type Beam . . . . . .Focused 8° wide
Maximum usable range . . .1400 meters
Employment capability . . .Continuous operation for approximately 150 hours.

c. Emergency means. — Emergency means of illumination may be improvised in the field from available materials. Any combustible material, such as petroleum products and vegetation, may be ignited by incendiary grenades, white phosphorous shells, illuminating flares, or other incendiary munitions. Such fires provide only marginal illumination over a limited area and may be difficult to control.

CHARACTERISTICS OF AIRCRAFT ILLUMINATING FLARES

ITEM	FLARE, A/C MK. 6-Mod 6	FLARE, A/C PARACHUTE MK. 8-Mod 2	FLARE, A/C PARACHUTE M24
Weight (lbs)	30	20	23
Classification	Standard (NAVY)	Standard	Standard
Candle power	1,000,000	500,000	About 2,500,000
Burning time (minutes)	3.5	3	2
Rate of discent (feet per sec.)	7.5	8	10
Dia. of area illuminated (mtrs)	2,300	1,150	3,500-4,000
W/O observing instruments-illumination for aimed fire. Distance from observer to targets (mtrs)	2,300	5,500	
Optimum height for activation of flare (feet)*	1,900	1,600	2,500
Maximum usable range	Same as range of the aircraft limited by battlefield visibility conditions.		
Fuze time	300-12,000 feet of free fall	120 seconds delay	3, 5, 10, 15, 20, 25, and 30 seconds delay
Munition required for continuous illumination (per hr)	20	25	30
Projector	Bomb racks or MK. 1 Mod. 0 Container	Bomb racks	Bomb rack or Aero 5A-1 A/C Flame Launcher

* Based on burn-out of flare 100 feet above ground.

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Figure 6. — Characteristics of aircraft illuminating flares.

47. Techniques of Employing Illumination. — Illumination may be direct or indirect. (See figure 6.)

a. Direct illumination. — Direct illumination is light provided directly from a light source to the area to be illuminated. It can be provided by the searchlights or pyrotechnics.

(1) Advantages. — The advantages of direct illumination are that it:

(a) Provides sufficient light over a limited area to permit aimed fire of ground weapons and adjustment of direct and indirect fire and air missions.

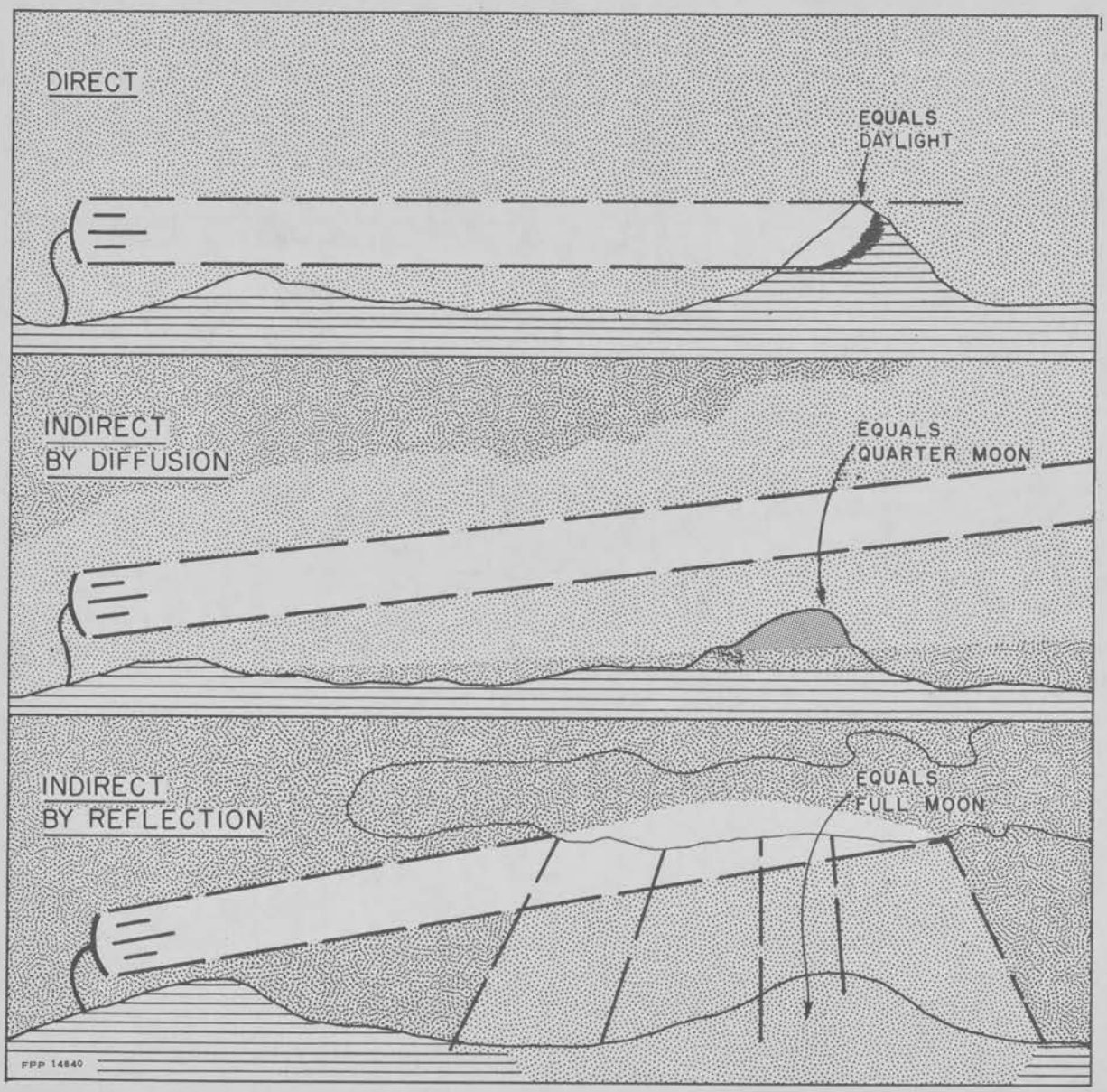


Figure 7. — Direct and indirect illumination.

(b) Permits rapid movement of troops and vehicles, minefield-laying operations, evacuation of casualties, and resupply.

(c) Provides a reference point for all elements.

(d) May be employed to harass and blind the enemy.

(2) Disadvantages. — The disadvantages of direct illumination are that it:

(a) Requires suitable terrain and careful sighting to obtain effective illumination.

(b) Is a light source which is vulnerable to enemy fire.

(c) Impairs night vision of friendly troops over a large area.

b. Indirect illumination. – Indirect illumination light can be provided by large searchlights. The light rays are reflected or diffused into an area from defilade.

CHARACTERISTICS OF ILLUMINATING GRENADES AND TRIP FLARES

ITEM	HAND ILLUMINATING GRENADE Mk 1	FLARE TRIP, PARACHUTE M48	FLARE, TRIP M49	GRENADE, RIFLE ILLUMINATING M27
Weight (lbs)	0.625	5	1.5	1.5
Classification	Standard	Standard (Navy)	Limited Standard	Standard
Candle Power	55,000	110,000	40,000	80,000
Burning Time (seconds)	25	20	55	55
Rate of Descent (feet per second)	Does not Apply	10	Does not Apply	Does not Apply
Dia. of area illuminating (meters)	200	250–450	150	240
W/o observing instruments—illumination for aimed fire. Dist. from weapon to target (meters)	100–250	100–450	100	100–350
W/binoculars, illumination for surveillance or adjusted fire Dist. from observer to illuminated area (meters)	1,100	2,300	900	1,800
Optimum height of activation flare (feet)	Does not Apply	300 *	Does not Apply	Does not Apply
Maximum range (meters) and type of projectors	Hand thrown–40 meters, Using rifle grenade launcher M7–200	None – difficult to fire other than vertical	Hand thrown approximately 30 meters (normally fixed)	200
Fuse time	7 seconds delay	3 seconds delay	Instantaneous	Instantaneous on impact

* Flare activates from 250–400 ft above ground. This altitude cannot be controlled.

Figure 8. — Characteristics of illuminating grenades and trip flares.

CHARACTERISTICS OF ARTILLERY AND MORTAR ILLUMINATING SHELLS

ITEMS	SHELL, ILLUMINATING 81MM, M301 'A2	SHELL, ILLUMINATING 4.2 inch M335	SHELL, ILLUMINATING 105-MM M314 A2	SHELL, ILLUMINATING 155-MM M118 A2
Weight Aprox (lbs)	11	28	46	102
Classification	Standard	Substitute Standard	Standard	Standard
Candle Power	500,000	500,000	450,000	1,000,000
Burning time (seconds)	75	70	60	70
Rate of descent (feet per second)	12	30	35	35
Dia. of area illuminated by one shell (meters)	1150	750	1000	2000
W/o observing instruments.- illumination for aimed fire. Distance from weapons to targets (meters)	1600	1250	1550	3200
W/observing instruments.- illumination for surveillance or adjusted fire from observer to illuminated area(meters)	5300	3550	5100	10,950
Recommended height of burst (meters)	392	564	752	690 *
Maximum Range of Projectile (meters)	2100	3650	9150	13,700
Fuze and fuze time	M84 0-25 seconds variable	MTSQ, M501 0-75 seconds	MTSQ M501 and M501 A1 0-75 seconds	MTSQ, M501 A1 0-75 seconds
Continuous illumination (rounds per minute)	2	2	2	2

* 155mm illumination is authorized for use with the 155mm gun when fired with NORMAL charge only.

Figure 9. — Characteristics of artillery and mortar illuminating shells.

This is referred to as artificial moonlight because it has characteristics somewhat similar to natural moonlight. The two methods of producing artificial moonlight are:

(1) Illumination by diffusion. — Illumination by diffusion is light provided in an area by directing a searchlight beam at a minimum elevation above the ground over the area to be illuminated. The area beneath and to the flanks of the beam are illuminated by light scattered by atmospheric particles. Maximum illumination obtained from diffused light approximates that of a quarter moon.

(2) Illumination by reflection. — Illumination by reflection is light provided in a specific area by directing a searchlight beam against low flying clouds at such an angle that light rays are reflected down upon the area. A limited amount of light is also received by diffusion. Maximum illumination obtained from reflection approximates that of a full moon.

(3) Advantages of indirect illumination are that it:

(a) Provides sufficient light for area surveillance with binoculars.

(b) Facilitates movement and control of troops and vehicles, minefield-laying operations, evacuation of casualties, resupply, night patrolling and raiding, and operation of supporting troops.

(c) Limits accurate location of light source.

(d) Hampers enemy air observation.

e. Night vision. — Artificial illumination destroys normal night vision. Therefore, once begun, illumination usually is required until the conclusion of the engagement. Failure to maintain the illumination level, can result in partial or total night blindness of sufficient degree and duration to permit the enemy to gain tactical advantage. (See LFB-6.)

SECTION 10

LOGISTIC SUPPORT

48. General. — Logistic support of an amphibious operation can be accomplished effectively at night. Frequently, much of the logistic support required for night operations is accomplished during daylight. Conversely, however, preparations for the logistic support of the following day's combat can be accomplished during hours of darkness. Such night preparations may be made necessary by enemy activity that precludes logistic support of combat units during daylight, or they may be desirable in order to maintain secrecy or to deceive the enemy.

49. Basic Considerations. — The efficiency of certain types of logistic support units decreases markedly during conditions of night operations. To compensate for this reduction in efficiency, plans must take the following into consideration:

a. Personnel. — Logistic support activities, especially shore party operations, conducted at night require additional personnel. Plans provide for utilization of personnel on a rotational basis in order to maintain logistic support at required levels of efficiency. Material handling equipment should be employed whenever possible to obviate the use of large working parties which are relatively inefficient and difficult to control at night.

b. Equipment. — Equipment can seldom be utilized around the clock for sustained periods of time. Periodic shutdowns, servicing, and maintenance are required. Under blackout conditions, continued operations pose safety problems, and extensive damage can result from operation of vehicles and equipment in the dark. The difficulties encountered when operating vehicles and equipment under blackout conditions should be carefully weighed against the tactical disadvantage of using lights. However, marked increase in efficiency under blackout conditions can be achieved by training.

c. Control. — The movement of vehicles and equipment must be closely controlled during night operations. Road patrols, MPs at beach exits, road junctions, and turnoffs and adequately illuminated sign posts are employed to aid in maintaining control. Drivers and equipment operators should be thoroughly briefed prior to being dispatched. Convoy travel is used when drivers are unfamiliar with the terrain or location of logistic support installations. Convoy commanders are carefully briefed as to routes and security measures. Extra traffic control points are established. Additional communications may be provided for control purposes if necessary.

d. Security. — The requirements for security of logistic activities and installations are increased when logistic support operations are conducted at night. Adequate local security and defense for vehicle movements and installations in the beach and logistic support areas are particularly important. For night logistic support operations the convoy system is normally used to increase security and control. Combat service support units are responsible for their own local security.

50. Employment of Specialized Techniques. — Adaptions and modifications of standard logistic support techniques may be required at night.

a. Supply. — The supply of combat units at night is hindered by the difficulties of location, identification, and handling of supplies. These problems of supply control may be solved by the utilization of specialized packaging, storage, and distribution techniques, as well as special measures for the control and security of supply operations.

(1) To provide for expeditious delivery of supplies at night by boat, LVT, truck, helicopter, or other means prescribed amounts of supplies in the categories most frequently required (rations, fuel, and ammunition) are positioned, palletized, or placed in containers in predetermined types and amounts to be dispatched to the combat unit on request. A similar technique is the use of standard loads for delivery by truck, LVT or helicopter. The utilization of floating or mobile dumps whereby designated landing craft or amphibian vehicles carry a load prescribed by the commander is an example of the technique of standard load in an amphibious operation. Packaged supplies or standard loads are readily identified by coded requests and can be expeditiously dispatched with minimum communications between consumer and supplier.

(2) To facilitate control of supplies within supply installations and distribution from supply points, dumps are laid out in similar patterns, based on the clock system; for example, under this system Class I (rations) would always be located at 6 o'clock, Class III (fuel) at 3 o'clock, Class V would be located at 9 o'clock; the dump control and dispatching point would be located at 12 o'clock. Use of such a system permits unfamiliar personnel to adapt themselves to a new area with the minimum of confusion. The identification of supplies and equipment during night operations requires special attention to marking supplies and equipment. Bold letters, luminous paint, and coded identification of supply by class and type are used.

(3) In the night operation of logistic support installation, luminous signs, tape, and other devices which are visible for a short distance are used by traffic control points and guides to ensure that incoming personnel, equipment, and supplies are conducted to the proper areas. Vehicles should be moved by serials to a preselected site where loading or unloading operations can be undertaken expeditiously and quietly. Daylight reconnaissance of resupply routes to be used at night is required by both control personnel and key vehicle operators. This reconnaissance should cover not only supply routes and approach lanes for helicopters, but also areas where supply activities (loading, unloading, and distribution to troop units) are likely to take place. As necessary, security personnel are embarked with surface vehicles and employed in helicopter landng zones.

b. Evacuation and hospitalization. — Operations at night increase the difficulties of collecting, sorting, and evacuating casualties. Night operations ashore require additional collecting personnel. Routes to evacuation stations must be clearly marked, and all personnel must be fully instructed on their location to assist in the evacuation effort. To aid in their handling, casulaties are identified by the serousness of their injury through tags of luminous color. In order to ensure orderly and expeditious evacuation at night, plans should provide for:

(1) Clearly defined and marked routes.

(2) Movement by convoy.

(3) Notification to units along routes of evacuation when casualty convoy can be expected to pass through their area.

(4) Notification to receiving medical unit or shore evacuation stations of number and estimated time of arrival of casualties.

(5) Adequate litter bearers and transportation.

(6) Helicopter transportation, which should be used whenever possible during night operations for evacuating emergency cases.

c. Transportation. — Movement of personnel, supplies, and equipment by air, water, or surface means usually require increased emphasis on control and additional visual and electronic control devices. When operating ashore, stocks of fuel, maintenance and recovery equipment, and personnel are positioned along the routes to be used by surface vehicles and in helicopter landing zones prior to the beginning of night transport operations. Terrain and adverse weather conditions may seriously impede helicopter night transport operations, thus placing an additional burden on water and surface means.

d. Service. — Plans must provide for areas where service and maintenance tasks requiring illumination can be performed. Salvage operations are continued at night. Normally, roads are less congested and salvage may be expedited. Close coordination with control agencies is especially important during night salvage operations. Other service functions, such as construction, repair of facilities, etc., are performed at night only to the extent necessary to ensure success of combat operations.

SECTION 11

EQUIPMENT

51. General. — The following paragraphs contain brief descriptions of the major items of surveillance, control guidance, and illumination equipment which have special significance to night operations and are available in the landing force. A brief description of developmental trends of new equipment is also made within this section. The current and anticipated development of equipment falls within the purview of the following:

a. Radar. — Radar is a radio detecting and ranging line of sight instrument consisting of a transmitter that sends out micro radio waves and a receiver that picks them up after they have been reflected by a mobile or immobile object. Mobile objects are distinguished from immobile objects through use of moving target indicating circuitry. It indicates the direction, distance and angle of the reflecting object. As such it is capable of seeing through darkness, fog, and sparse cloud cover and well beyond the range of the unaided human eye.

b. Infrared. — Infrared systems are classified as either active or passive. The detection element of an active system uses a source of infrared radiation to illuminate a target. The passive system, on the other hand, uses no source and depends on the infrared radiation emitted by the target for its operation.

52. Surveillance. — Surveillance means listed below are available to the landing force for obtaining information on the enemy and terrain during the conduct of night operations.

a. Ground surveillance radar (ground targets).

(1) Fleet Marine Force units are presently equipped with radar set AN/TPS-21, a moving target indicator, which is a principal means of battlefield surveillance at night. The AN/TPS-21 is a light-weight, team-pack radar set designed for detection, location, and tracking of moving personnel and vehicles. These moving targets are indicated by an aural presentation. Once the target is detected, the operator can determine its range with an accuracy of 25 yards, and its azimuth with an accuracy of 1/2°. The maximum range of this set is 20,000 yards. For movement, the set breaks down into five man-pack loads, each averaging about 50 pounds. (See FMFM-15, "Amphibious Reconnaissance".)

b. Airborne surveillance radar (ground targets). — Side-looking radars are being developed and, when available for operational use, will enable Marine and naval aircraft to detect moving ground targets. Present Navy and Marine electronic-reconnaissance aircraft can locate enemy electromagnetic-radiating targets. (See FMFM-15, "Amphibious Reconnaissance.")

c. Countermortar radar.

(1) The AN/MPQ-10A is a towed radar set designed to track low velocity, high angle artillery rounds and compute the location of the enemy mortar or artillery piece. This set is also used to conduct precision registration of friendly artillery units and may be used for limited ground surveillance in landing force operations. For weapons location and radar controlled gunnery, the radar set must be in defilade

to minimize ground clutter. For moving target detection, the radar must be moved to a site that provides line-of-sight transmission to the area or terrain over which surveillance is desired. The AN/MPQ-10A may also be used for fixing positions and vectoring friendly aircraft. The set consists of the tracker mount, which is mounted on a 40mm gun carriage, the radar set control, a recorder unit, and a trailer mounted diesel generator. This set will detect heavy artillery projectiles and missiles up to a range of 20,000 yards. There are three sets in each artillery regiment of the Marine division.

(2) AN/KPQ-1 is a portable counter-mortar radar set designed to replace the AN/MPQ-10A in the very near future. Its primary use is to determine the location of enemy mortar installations. As a secondary application, this equipment may be used to determine point of impact for friendly mortar fire.

d. Sniperscope. — The sniperscope is a device for seeing objects in the dark without illuminating them with visible light. Mounted on a carbine, it can be used to engage targets with aimed fire at ranges up to 125 yards. It can also be used in signaling at night and in detecting enemy infrared equipment. Sixty sniperscopes are provided each infantry regiment.

(1) Weaponsight, infrared, Varo, M9902. — The weaponsight, or VARO M9902, is a recent modification of the Sniperscope. It is a battery operated, basic infantry weapon mounted, telescopic, night-aiming device designed to permit accurate and visually secure night firing. The telescope with near infrared light source is mounted on the conventional military rifle. The reticle lamp and high voltage power supply are powered by a self-contained 1.1 volt dry battery, while the light source is powered by a nickel cadmium rechargeable battery, contained in a separate canvas knapsack and connected to the light source by a suitable cable. The overall dimensions of the carrying case containing a telescope and light source are approximately 18 inches long by 12 inches wide by 9 inches thick. The unit weighs approximately 25 pounds. The weapon sight assembled weighs 13.4 pounds, of which 5.8 pounds is carried on the weapon and 7.6 pounds on the user's belt.

(2) The primary purpose of the infrared weapon sight is to provide accurate and visually secure night firing for all basic infantry weapons, and as a secondary use, to aid in the night detection of enemy use of infrared light sources.

e. Metascope. — A metascope is a small device which receives infrared rays and converts them into visible light. It is used to detect a source of infrared light in an area and the direction from which the light is coming. There are three metascope devices available in the force reconnaissance company, four in the division reconnaissance battalion, and six in the service regiment of the Marine division. (See FMFM-15, "Amphibious Reconnaissance.")

f. Aerial photography. — Aerial photography is a prime source of information on terrain aspects needed for planning, as well as on enemy dispositions. In amphibious operations, Marine composite reconnaissance squadrons, as well as naval aircraft, provide aerial photographic support for night operations. Both Navy and Marine photographic aircraft can employ artificial illumination to photograph limited areas. Latest types of infrared aerial film can be used on the darkest of nights with good results. During the conduct of the attack, aerial photography may be employed to detect movement of enemy reserve forces. In a defensive situation, night photography likewise will be of great benefit in the detection of enemy followup forces.

g. Communication intercept. — The organization and capabilities of communication intercept units are covered in appropriate publications of a higher classification. In night operations, communication intercept units attached to, or supporting the landing force provide support as in any type of operations. However, efforts of such units are likely to be particularly profitable if directed towards gathering information on enemy reserve forces, whose movements are likely to be controlled primarily by radio communications.



Figure 10. — Weapon sight, infrared Varo, M9902.

h. Flash ranging. — Headquarters battery, force artillery has one flash ranging set which is capable of locating enemy artillery firing positions by means of flash ranging. This battery, is not active during peacetime, but will be activated in each FMF upon mobilization.

53. Control and Guidance. — Various means listed below are available for control and guidance of forces engaged in operations at night. Included are those items of equipment for air navigation control and guidance, homing, fire control, and movement

control. Many of the items of equipment listed in paragraph 9 may be employed to augment control and guidance equipment.

a. Tactical Air Navigation System (TACAN). — Is composed of two units; a truck mounted (M-45, 6x6) UHF radio transmitter (AN/MRC-16) and a transmitter and receiver (ARN-21). There are two AN/MRC-16's located with each Marine air traffic control unit. Normally, two Marine air traffic control units are assigned to each Marine wing service group. This permits continuous traffic control should one MATCU become inoperative due to mechanical malfunctions, etc. The ARN-21 is located within the aircraft.

b. Air support radar. — The Marine air support squadron has three air support teams equipped with the helicopter-transportable AN/TPQ-23. (See MCS 3-78).

c. Fire control radar.

(1) In the light AA missile battalion, each missile battery is equipped with acquisition and missile control radars that may be used to provide emergency control for night helicopter operations.

(2) Within the naval component of an amphibious task force there are various types of search and fire control radars which are capable of controlling naval gunfire.

d. Naval Gunfire Radar Beacons (AN/TPN-7). — There are four AN/TPN-7s and three radar beacon teams in the air and naval gunfire platoon, communications co., headquarters bn., Marine division, and four in ANGLICO, FMF. Their purpose is to give the fire control radar aboard ships a reference point from which the fire control problem can be solved for indirect and night firing. The beacon is triggered by the radar impulses from the ship's fire control radars. The exact position of this beacon must be known.

e. Helicopter homing beacons. — Radio homing and terminal guidance beacons are being developed. They may be air dropped or emplaced by parachute or helicopter-landed reconnaissance parties in the landing zone and along approach lanes to assist and guide the helicopter waves.

f. Naval ship-to-shore movement control devices. — Infrared devices are used by the Navy for boat control. Shipboard surface search radars are utilized for tracking and vectoring boat and vehicle waves to the beach. Phosphorescent illuminate, and infrared beach markers are used in guiding landing craft and vehicles to the proper landing beach.

g. Helicopter control. — In addition to the homing radio beacons the following means, when available, are useful for the control of helicopters between the loading zone and the landing zone:

(1) Radar. — The air search radars of the ships of the amphibious task force and those of the Marine air control squadrons may be used to track and vector the various helicopter flights. (See MCS 3-78.)

(2) Airborne Early Warning (AEW) aircraft. — To assist in controlling helicopters over land masses where ground radars are incapable of providing guidance, the AEW aircraft of the fleet can be used to control helicopters while airborne. An example of the AEW radar is the AN/APS-20. It operates in a 5'' band and

provides slant range and true azimuth of returns. A typical operation allows detection of single A/C (Reciprocating) to 65 nautical miles, a flight of 6A/C to 125 nautical miles, and ships of 2000 ton or higher to 200 nautical miles.

h. Ground control approach radar.

(1) Presently in use is the FPN-36 Quad Radar and AV/CPN-4 system. It has a range of 40 miles and can control precision approaches at five miles.

(2) Presently in production is the AN/TPN-8. It weighs about 1800 pounds complete with its power unit. It can be used for height finding, surveillance, approach control, and, if required, taxi control. It has operated satisfactorily with single place jet aircraft at 10,000 feet at ranges exceeding 40 miles. About 2-3 hours are required to erect and place this equipment in operation. For further information on ground control approach radar see MCS 3-78.

i. Tank control and guidance. — The tank when equipped with infrared night driving devices permit night operations over any terrain that is negotiable by tanks during daylight.

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