Problems of the Landing Attack

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THE RECENT WAR TENDED TO CAST THE AMPHIBIOUS OPERATION INTO A FAIRLY RIGID MOLD. THERE IS a danger, therefore, that in developing the landing attack of the future we will become so circumscribed by the elaborate set of rules and details of execution prescribed in the past that our improvements will be step by step in nature and small in significance. It is necessary to stand off and survey the entire field and discover the major steps forward which can be taken. This article proposes to take the preliminary steps of such a survey; namely the delineation of the major problems of amphibious warfare which must be solved. If these major problems are clearly stated, then major and entirely novel means of solution may be developed.

As a forward step, it is necessary to disclaim origination by the author alone of all the ideas to be discussed. They are in reality a synthesis of the thoughts of many forward thinking officers, obtained in bull sessions over most of the post war period. This article is designed simply to bring them together in one place, correlate them, and present them in a form which it is hoped will be informative and interesting, particularly to younger officers who are not in a position to find out what constructive thinking is being done on the future of amphibious warfare.

This much can be said regarding a workable method for the solution of the problems which we will discuss: Once the problems are stated and approved by higher authority they could be called military planning goals. Each goal would then be evaluated in terms of research and development, and in terms of tactics and techniques. The fields of research and development could then be surveyed and existing lines of progress which might lead to solutions would be exploited. New lines of attack which could fill gaps and voids in the program would be initiated. As research and development progress, they might in turn result in new planning goals and almost certainly would show a need for new tactics and techniques. Thus research, development, and tactics would all be interrelated and would themselves be dependent upon a statement of military goals by the operating forces. Let us proceed with the first step in this suggested chain — a proposed listing of the problems.

The ship to shore movement requires much more adequate protection than it now receives. Proximity fuzes, the possibility of new methods of contamination, and the development and refinement of the armored attack threaten this movement

The Ship to Shore Movement

WE HAVE USED the above title to achieve brevity; we really desire to discuss not only the ship to shore movement itself but the events on each end of that movement: means of reaching the objective area, the procurement of intelligence relating to the landing points for the troops, and to some extent the disembarkation of troops from ship to shore conveyances and their deployment for action.

The heart of the problem is the ship to shore conveyance. For years the boat was used. The advent of the amphibious vehicle was hailed as revolutionary, which somewhat overstated the case. There is a tendency today to restrict ourselves merely to improving the vehicles we now have. This is suitable for an interim measure, but a consideration of the entire problem shows that there are three media which might be employed to reach the shore; air, water surface, and underwater. All three must be considered. The principal factors to which these means of ship to shore movement must be related are as follows:

1. *The principal of mass.* An amphibious operation involves, in almost every case, a vast expenditure of time, effort, and naval means and is of great strategic import. It therefore requires that the attacker have a clear margin of overall superiority. It is thus particularly important that the landing attack concentrate its means against the weak point of the enemy.

2. *The principal of surprise.* The movement and concentration of the large forces involved in a major amphibious operation are difficult to conceal. Detection by the enemy may result in counteraction to make his weak point strong, reduce our required overall superiority, and thus deny us the advantage of the employment of mass. To escape detection we must rely upon concealment, speed and mobility.

3. *The principal of security.* The strategic and psychological importance of a major amphibious operation may well place it in the category of a strategic target and subject it to attack by new, strategic weapons. The physical congestion characteristic of the sea areas used by the attack force in past operations would then be suicidal. Yet this very congestion provides, at present, the concentration of forces which enables us to take advantage of the principal of mass.

4. *The principal of coordination.* Since the ship to shore movement constitutes the approach march and initial deployment for battle of the troops involved, it is evident that it must be precisely coordinated and controlled and that the troops must arrive at their landing points in the required tactical formations for the assault and capture of their objectives.

At this point the conveyance problem might be stated thus: there is a requirement for a ship to shore conveyance for the landing force which possesses as many as possible of the following characteristics:

1. High speed and maneuverability.
2. Capacity to transport a small tactical unit such as the squad or platoon.
3. Ability to be precisely controlled and coordinated and to move in formations which accommodate larger tactical formations such as battalions and regiments.
4. Easy debarkation of troops.
5. Easily concealed from hostile reconnaissance.
6. Readily transportable by larger transport means.
7. Sufficient range to permit concentration near the desired landing points from widely dispersed transports relatively far out at sea.

The above may be refined somewhat by a consideration of the following logical points. First, concealment is relative. There is no value in concealment of the ship to shore conveyance, by use of submersible craft for example, if the transports and other requisite elements of the attack force cannot be concealed also. Therefore, we must rely upon speed and mobility in this day of long range detecting devices, rather than upon absolute concealment, except for minor raids and incursions. Second, the past has taught the world of the power of the amphibious assault and in the future we shall find fewer and fewer beaches which might be called enemy weak points. We should therefore take a far reaching and daring step: we must avoid beach landings if possible. Third, the distances and intervals necessary for the required dispersion in the future will be of considerable magnitude, of an order which almost precludes the use of waterborne craft. Such craft may be useful as an interim measure, for landing reserve and supply elements of the landing force or for use in conjunction with transports of such speed as to provide for strategic mobility of a high order. Our major conveyance problem can now be stated in this fashion: we require an air conveyance which can carry and debark at least one squad, can move in formation at high speed and land in formation at low speed in varying and difficult terrain, can be transported to the area in larger transports, has an operating radius capable of spanning medium distances, and can be precisely controlled and coordinated. The conveyance should lend itself to mass production, and should be easy to maintain and simple to fly.

In relation to the ship to shore movement the next problem concerns control of that movement. Considering the fact that in a major amphibious operation of the future hundreds of ships and craft must be coordinated and maneuvered simultaneously and in conjunction with the employment of thousands of aircraft, yet all elements must be widely dispersed and out of sight of each other, it is seen that control is a vital function and an important and continuing problem. This

problem is increased a hundredfold under conditions of decreased visibility for then even the individual components of each element cannot see each other. Yet, for purposes of concealment and surprise, we should exploit such conditions and be able to use them as a tool in our hands rather than have to regard them as a hazard or barrier to our operations. Control is essentially a problem of rapid and reliable communications based upon accurate and timely information regarding the ship to shore movement. Taking the latter element first, we may simplify by saying that the high command needs a graphic picture of the entire movement and of each element thereof, and that this picture must instantaneously portray all changes. This graphic picture can provide the information upon which decisions may be based. Decisions once made must be promulgated and disseminated to all pertinent elements of the movement so that necessary action can be taken immediately. Thus the chain of events is information, decision, transmittal of orders, and execution. There is a further requirement for lower echelons. They must know of the actions and movements of higher, lower and adjacent units. They must also be able to communicate laterally as well as vertically within the chain of command in order to amplify the graphic picture, and receive and transmit orders. It is evident that the two functions should be performed in close physical proximity; that is, the means for receiving information of graphic, or pictorial nature, should be adjacent to the means for receiving and transmitting communications of a literal (written or spoken) nature.

OUR PROBLEM begins to resolve itself into a requirement for a compact, high speed combat information center, or operations and command room. The nomenclature is not important; the functions are. This CIC must provide to the commander and his staff, of whatever echelon is involved, a complete and continually accurate graphical picture of the actions and movements of each subordinate element of his command in the ship to shore movement and a similar picture of adjacent units in the case of other commanders than the highest one. Since the ship to shore movement may be made by air, this picture may have to be three dimensional in order to be pictorially accurate and understandable. As a second function the CIC must furnish a means of instantaneous communication of ideas, in the literal sense, to all affected elements. This includes orders from commanders to subordinates, and information from subordinates to commanders and adjacent units. The system should be a type of "battle circuit" without delays incident to switching and relaying, and should be fitted with selective devices so that the sender may select his addresses, singly or in combination. Messages should be received in a form permitting rapid assimilation; for example, a teletype tape or screen. The number of circuits must be kept to the minimum and the equipment must be suitable for use by small elements as well as large. In the widely dispersed formations of the future even individual craft must indicate their positions graphically and be able to receive instructions of a literal nature.

THE SHIP TO SHORE movement requires much more adequate protection than it now receives. Proximity fuses, the possibility of new methods of contamination, and the development and refinement of the armored attack all threaten the safety of the ship to shore movement conducted in the congested, slow moving, unsheltered craft of today. This particular paragraph will discuss the protection of the movement against enemy ordnance, particularly tanks, leaving other factors for later pages. If we can destroy the tank, we can also destroy emplacements of a stationary type and destroy personnel, by using the appropriate type of ammunition. We therefore concentrate upon the tank because it combines the protection of the pillbox with mobility, fire power, and shock power. At present we rely upon the exterior supporting fires of naval aircraft and gunfire to protect the ship to shore movement, both by preliminary bombardment prior to D-Day, by preparatory bombardment just before H-hour, and by close supporting fires during the movement to the shore. Tanks, however, may remain in safe concealed positions and survive the preliminary and preparatory bombardments. The close supporting fires delivered during the ship to shore movement must keep well ahead of the troops, lest the latter be hit by shorts from our own guns and aircraft. Thus there is an extremely important gap in the supporting fires which is critical at the landing point for several minutes prior to the actual "touchdown" and debarkation and deployment of troops. During this interval the troops are helpless to protect themselves, and conversely, hostile tanks may be quickly moved into positions from which they are free of our fires and can "work over" the ship to shore movement. It is evident that as the exterior supporting fires lift, weapons which are organic to the troops and which are accompanying them during the ship to shore movement must be employed to fill the gap. These weapons must have certain characteristics if they are to function properly. First, the weapon must be able to destroy hostile tanks. Second the weapon must be able to participate as an integral part of the ship to shore movement. This requires that it have the same speed, maneuverability and landing characteristics as the conveyances which carry the troops, since it should be able to operate as the first wave of the ship to shore movement and establish a cordon of fire within which the subsequent waves may safely land, disembark and deploy. Since our emphasis is upon air vehicles, it

follows that we require an air antitank gun and that it must be able to fire while in flight and that its flight characteristics must be the same as the troop carrying air vehicles, to include low speed. It is readily seen that these requirements eliminate the conventional attack aircraft for this particular function.

THE TRANSPORT of the future should bear little resemblance to that which we use today. Debarkation by clambering over nets is archaic and outmoded as well as time consuming. For our major amphibious efforts we require a transport which can embark a battalion landing team and can also carry the conveyances needed to move that landing team. When air vehicles come into being the transport must be able to launch them in mass; not necessarily the entire complement at once but substantial elements of it. Successive launchings of individuals vehicles would be unsatisfactory. As long as waterborne vehicles are used, the transport should provide means for loading and launching such craft from within the vessel.

In certain cases, where the economics and logistics of the situation permit, or it is demanded by other considerations, a transport which utilizes the air as a medium is required in order to attain the great strategic mobility possible by that means. This opens up an entire new transport field wherein the requirements would be those of long range, high speed, ability to land on the water and discharge troops in their ship to shore conveyances, and a carrying capacity as large as possible within design limitations.

Intelligence, in relation to the ship to shore movement, is necessary in order to reveal the hazards which must be overcome to insure success. It embraces not only the determination of hostile dispositions and defensive works and measures in the landing areas but also the hydrographic, meteorological, and aerological conditions which obtain at the time of the landing as well as the accessibility and trafficability of the chosen landing points.

At the present time imperfect means exist of determining these factors by remote control—that is, other than by sending men in physically to check the facts—but the problem is recognized and its future depends upon developments in various scientific fields. To complete the problem of the ship to shore movement, however, we may say that there is a requirement for quickly and accurately determining, or forecasting, by remotely controlled devices, the following: location of all natural and man made hazards to landing as they pertain to the selected type vehicle to be used in the ship to shore movement (with particular emphasis upon contamination and defensive mining); measurement of the water depth and the contour of the bottom off beaches to be used; height and character of the surf and associated currents; state of the weather and visibility during the landing period and thereafter.

Attaining and Maintaining Fire Superiority

THIS PROBLEM is common to all warfare but is of peculiar and special importance in the amphibious attack because during the ship to shore movement the troops themselves are unable to fire for their own protection and must rely upon external means to gain the required fire superiority at the selected landing points, and because for a number of hours after landing and deployment they must continue to rely upon relatively light weapons which they have been able to carry with them in their conveyances. Even after heavy equipment has been brought ashore by those subsequent increments of the attack which follow the initial assault, the attainment and maintenance of fire superiority is a continuing problem rendered more acute than in normal land warfare by the difficulties of amphibious logistics.

Under present conditions, sources of enemy fire are located only in a general and imperfect way and are silenced only by a large expenditure of ammunition. A large number of rounds is used to compensate for the vagueness of detection and location and for the inherent inaccuracies of the weapons systems in use.

The ideal situation would exist if, the moment the enemy fired one shot, the source of that round were instantly and accurately determined, this information were then instantaneously introduced into a fire control system, and one round, which would unerringly find its mark and destroy the hostile target, were then fired by the weapon most suited for the task. Further, during the above sequence of events, our own troops should have maximum protection against the effect of the enemy's one shot.

This problem may be subdivided for more detailed consideration into the problems of: target detection and location: fire control; coordination of fires; weapons systems; and armor. It should be noted that all land armies have requirements in the above fields; our discussion will be limited to those requirements which stem from the amphibious role of the Marine Corps.

Target detection and location are the heart of the problem. The enemy will conceal his weapons with all the artfulness of which he is capable so that location by visual or photographic means will be difficult. Conditions of reduced visibility will have the same effect. Remembering that we are particularly interested in fire superiority during and just after the ship to shore movement we state the requirements for a target detection and location system as follows: (1) The system should be capable of being waterborne and/or airborne; (2) It must detect and locate the target by recording and evaluating the phenomena resulting from both the discharge of the hostile weapon and the trajectory of its projectile, or either of these by itself; (3) It should include multi-

ple means of obtaining location, such as electronic, accoustic, infrared, photographic and any other; (4) it must be able to utilize a number of recording stations simultaneously, airborne, waterborne, and ground; (5) the location of the target must be instantly placed in relation to a reference point which is common to the target, the detection system, and the weapons which will take the target under fire; (6) and finally, this location must be instantly transmitted to the fire control system of the friendly counterbattery weapons, via the fire support coordination center which will designate the weapons which are to be used against the particular target, in terms which the fire control system can readily translate into firing data for the guns.

Coordination of fires is an important link in the counterbattery process. We will not discuss that coordination function which relates to the planning of coordinated fire support since it depends upon the professional excellence, coordination, and judgment of operating personnel as well as on an ever changing tactical situation. We will discuss that function which pertains to the designation of weapons for fire upon targets of opportunity. This decision depends upon the location and character of the target, the availability of the different counterbattery means, and their capabilities and limitations in respect to range, masking by terrain, accuracy, destructive power, and time required to put into action against the target. These are all technical, numerical, or definite physical values. *There is no reason why a decision based upon these factors should be delayed by the necessity for human action.* In conjunction with target locator systems, we see that there is a requirement for a machine which we may call the counterbattery designator. It should receive inputs representing the factors listed above. Its output should be first, the designation of the weapon which is selected to deliver the fires, and second, the selective transmission to the fire control system of that weapon of the location and character of the target in terms which will permit mechanical translation into values for range, azimuth, and fuze setting, and selection of type of ammunition. A further requirement is that the machine be able to accept not only the target location and character inputs generated mechanically by the target locator system but also such inputs generated physically by an operator who receives requests for fires from front line troops or other sources which have located a target but are unable to take it under direct fire with the weapons organic to them or assigned to their direct support.

The mission of any fire control system is to insure that the weapon it controls is properly laid at the moment of discharge so that a hit on the target is obtained. Fire control is thus limited by the inherent accuracy of the piece on the one hand and by the exactness of the location of the target on the other. Within these limits, and for certain weapons, fire control systems are already highly developed. Our requirement here may thus be stated as follows: Fire control systems must keep pace with increased weapon accuracy and must be able to instantly receive, translate, and transmit to the guns the information they receive from the target locator. The systems as thus developed must be extended for the control of all weapons used in the amphibious operation —not just the larger caliber naval guns, but also the small close-in support craft, conventional support aircraft, airborne guns which are part of the ship to shore movement, and any other weapons systems which may be devised.

In reviewing the problem of weapons we should confine ourselves to those of application to amphibious warfare, and we should state our requirements in terms of entirely new weapons or novel applications of existing ones, not just refinement of present guns. These weapons must be integrated with the new target locators, counterbattery designators, and fire control methods previously discussed. A good example is the requirement for an air antitank gun discussed previously in connection with the ship to shore movement. We are at all times in need of what might be called the universal requirements for weapons which apply to all military forces; namely, increased accuracy, penetrating power and destructive effect, rate of fire, and simplicity of the weapon and its related equipment. For amphibious operations, however, we have requirements which go beyond these. In conjunction with the above, we also require that the weapons be light in weight, small in caliber; all without sacrifice of penetrating power. Thus our general amphibious requirement is for hard hitting weapons of medium range which can be employed from air vehicles with slow speed flight characteristics; from small, shallow-draft, close-in support craft; and from amphibious gun carriages. This calls for new weapons, based upon new principles; the present practice of attempting to mate a conventional ground weapon with a carriage which was designed for some other purpose is a shotgun wedding. New weapons and new carriages, both designed for amphibious operations, are the basic requirement for the future in this field.

Fire superiority is achieved when one contender has a net balance of *effective* fire over the other. This is best attained by one force delivering a greater volume of rapid, accurate fire than the other. However, it can be assisted if the effectiveness of the enemy's fire is reduced or nullified by passive action in conjunction with our own counterfire. This introduces the subject of armor. We need armor, of the proper types, to protect troop conveyances, major weapons, assault troops, logistic installations, and personnel required to work continuously. Since the trend in the future is to high speed and mobility, it is evident that the heavy armor plate

of the present will not be satisfactory. Our primary problem, thus, is to find light weight armor. Such armor might then be fashioned to meet the following requirements: (1) Protect antitank weapons from tank fire. (2) Protect troop conveyances of whatever type used against small arms, antiaircraft fire, and VT fuse or airburst TOT's. (3) Protect the vital and most vulnerable portions of the body of all assault troops and essential logistic personnel against fragments. (4) Provide a shield for the principal crew served weapons which will give them protection against air bursts, and small arms. (5) Provide a light portable shelter for shore party and other working personnel in exposed positions.

The Security of the Beachhead

BECAUSE of the strategic implications of successful amphibious attack, the enemy may be expected to react with great violence and speed. The landing force, hampered by the weight carrying limitations of its conveyances in the initial stages of the ship to shore movement, is for a number of hours after landing deficient in heavy weapons and mobile equipment. This tends to make the landing force vulnerable to armored attack in particular and sensitive to counterattack of any kind, particularly on the flanks. Thus security of the landing force against counterattack, particularly during the first phase of the operation, is vital.

Because of the strategic implications of successful amphibious attack, the enemy may be expected to react with great violence and speed. The landing force is for a number of hours after landing deficient of heavy weapons and mobile equipment. The security of the landing force is vital

The security of the beachhead is intimately related to certain of the problems previously discussed; particularly the protection of the ship to shore movement and the attainment and maintenance of fire superiority. Since many of these requirements apply directly they will merely be referred to in this discussion.

Once again the major problem may be subdivided. *Security of the beachhead is dependent upon early detection of hostile forces, a warning system, active defensive measures, passive defensive measures, and the coordination of all into an integrated plan for defeat of the counterattack and resumption of the offensive.*

The movement of enemy forces during daylight under the eyes of reconnaissance aircraft is difficult. Therefore, while improvement in daylight detection by the better models of television, aerial photography and other devices should be exploited, it is the detection of the enemy at night or during other conditions of reduced visibility with which we must concern ourselves primarily. Here we see that our problem is closely related to that of detection of hostile targets, taken up under the subject of fire superiority. In this case, however, we must add some requirements since our target will be mobile and of a different nature; i.e., it will normally be moving and it will not be firing at the time we wish to locate it. The fact that we do not have the phenomena of weapon discharges and trajectories complicates the problem, on the other hand it may be simplified because a moving target may permit so called passive detection (no transmission needed, only a receiver) and because normally any moving target is easier to detect than one hidden and immobile. Our added requirements in this case are these: we need a target locator which can be used from the air or ground to detect, locate, and track moving targets such as vehicles and tanks. This locator must be able to translate and transmit this information, not only to the counterfire weapons control systems, but also to a warning system which can alert the entire command.

The moment enemy forces are detected all members of the landing force, and the principal elements of the Attack Force, must be alerted so that active and passive defensive measures may be put into effect. This requires that information from the target locator and all other reconnaissance agencies be collected, collated, and then transmitted to all elements of the command, preferably in the form of a sound signal of prescribed meaning. Such a system has been developed to a rather high state for defense against aircraft; but against ground attack the system is slow and uncertain. This is due in part to the fact that accurate and definite reports on enemy troop movements are difficult to obtain and are usually very difficult to filter from the many vague, inaccurate, and confusing reports that reach the central intelligence agency. Further delay is entailed in transmitting the information since in many cases it requires that orders accompany it, or that a higher commander reach some pertinent decision regarding the affair. This slow moving method may serve against a moving column of foot troops, but it is imperative that we entirely revise the system to cope with the armored or motorized attack. We must equal, at the very least, the present efficiency of the warning system used in air raids.

Presuming that our target locators can give us accurate information, transmitted automatically back to headquarters, we then have a requirement for an agency which can rapidly filter and evaluate such reports and flash the warning condition required. At the present time such evaluation requires the use of human judg-

ment almost exclusively; this must be obviated by a complete tactical doctrine of antimechanized defense, to include prearranged plans of counteraction. Very little human judgment, with its attendant delays, is required at present to receive a radar warning and track of enemy planes, vector defending aircraft against the raiders, and control the fire of antiaircraft weapons. More of this in later paragraphs; here let us say this agency for evaluating reports on enemy armored movements and alerting and directing counteraction must be as automatic as possible—certainly to a degree far beyond that of today. This agency will likewise be required to maintain a graphical picture of the continuing movement of the enemy and also the movements and positions of the defender as he executes the prearranged plans required. A further requirement is the transmittal of this complete picture to the counterattacking force accompanied by the transmission of literal instructions until such time as contact is made with the enemy and control of the action can be taken by the local commander. A final requirement is that the moment the report of attack by the enemy is verified, instantaneously a sound signal should be triggered by automatic means in all elements of the command. This signal must not be dependent upon any "passing of the word" by sentries or relay by phone, or even flash radio—it should be done automatically by one impulse from the central filtering agency which will activate all receivers throughout the command.

While it must always be clearly understood that the best defense lies in the aggressive conduct of active defensive measure, there is still a requirement for passive defensive measure which may assist the active defense or which may protect those individuals and installations which are not required to participate in the active defense. The requirement for protection here is the same as that detailed in the discussion of fire superiority. Measures which may assist the active defense are principally of an engineering nature and many of them are already developed to a considerable degree. The requirement here is for their complete integration into the active defense and for improvements in the tactics, technique and speed of their use. First we must perfect our methods and rapidity of using the mines, smoke, etc., that we have on hand for combatting tanks in a passive way; then it will be worthwhile to set forth ordnance specifications for new devices which may be employed within the procedural framework developed for existing devices. At present we have no overall system or even doctrine for the employment and coordination of a passive defense plan involving rapid laying of mines, use of smoke, use of obstacles and barricades; all integrated with the active system of fires and counter attack. Therefore our first requirement is to solve the above.

A similar need exists in the field of active antitank defense. We simply have not put enough thought on the subject so that we can come up instantly with the best plan for fighting tanks with all weapons at our command, to include artillery, naval gunfire, aircraft, antitank guns, and infantry-engineer-tank counterattacking forces. Our requirement, and a pressing one, is for an overall, effective antitank doctrine which will apply to any force of combined arms. Once the doctrine is conceived it must be tested and rehearsed in the field. When firm, we may then state requirements for new weapons and devices which can improve the efficiency, speed and effectiveness of our antitank system of defense. Of course, the standard requirements for weapons which are listed in the paragraphs on attaining fire superiority will hold in this field also.

Logistics

EVEN THOUGH many of our tactical problems are brought to a solution, the effort will be wasted unless progress in logistical support can keep pace. It will be of little value to devise new weapons and new "tactics of dispersion" if we cannot keep the gun crews supplied with ammunition, feed the troops, and move them with the speed required. Perhaps the major problems in the field of logistics are related to the saving of man hours of labor—by saving both the man and the hours. The length of time required to get supplies to the using troops across the barriers of water, beach and difficult terrain and the large numbers of men employed in supply echelons must both be decreased. The same is true, of course, in relation to the obverse face of the logistical picture—evacuation and salvage. In reaching a solution to the problem of logistics it is probable that emphasis should be on a far reaching development program, well coordinated and embracing hundreds of items, rather than a broad research program or a school conducted study, although each of the latter will have its place also. *A primary requirement is thus the formulation of an integrated Marine Corps development program embracing all those items and stating the requirements for each.* In stating the requirements upon which such a program might be based we will break the major problems into four more easily handled problems: Equipment and materiel; transport to the objective area; unloading and movement to the using troops; and salvage and evacuation.

1. *Equipment and materiel.* The overall problem in this field is the design of equipment and materiel *specifically for amphibious military requirements.* While it is undeniable that certain major savings accrue when standard commercial and industrial items are utilized, it has been found in global warfare that this may often be false economy. Very often there is no commercial need for specific items of equipment needed by the Amphibious forces, or else the industrial item is sufficiently

different from the optimum military specifications as to require significant compromises to be made in regard to efficiency from a Marine Corps standpoint. Major items of materiel and equipment, therefore, should be designed to meet our amphibious military specifications. This is a vast job in itself and represents the foremost problem in this field at present; the establishment of amphibious military specifications for the multitude of items used and the development of each to at least pilot model stage. The final design of each item must satisfy our rigorous standards for light weight, ruggedness, dependability, waterproofing, ease of maintenance and operation, simplicity of packaging, psychological acceptability where pertinent, adaptability to means of transport and to methods and machines for unloading and delivering, and delivery to the services in the numbers required. Note that in many instances these standards will differ for amphibious operations.

2. *Transport to the objective area.* This requirement may be simply stated as being the problem of adapting all items to transport over long distances by air or water. It will require development of mechanical means of loading and unloading as well as methods of tiedown and stowage.

3. *Unloading and movement to the using troops.* This problem is the one which involves the greatest use of manpower and the maximum amount of rehandling. The ideal would be if an item of equipment were unloaded mechanically into a conveyance which could transport it directly to the consumer, the using marine, wherever in the battle he might be. Timely delivery is also a requisite; the materiel must be delivered to the user when he needs it. This ideal is impossible of attainment because dumps must be interposed between the transport and the user, in order to have a reserve which will cushion the effect of enemy action tending to interrupt the supply chain, in order to store the surplus of items which can be landed in excess of immediate requirements, and to provide echelonment in depth and dispersal of supplies. Nevertheless, the field is wide open for improvement in the amount of rehandling, loading, and unloading which must be done and the number of men which are required to perform these functions. The primary requisite is that the beach, or other terrain between the transport and the selected dumps, be crossed by the supplies without handling. The only handling required should be that demanded by the tactical and logistical situation.

4. *Evacuation and Salvage.* The problem here is the reverse of the one stated in paragraph three above. Casualties, both personnel and materiel, must be evacuated with a minimum of rehandling and expenditure of manpower from the forward areas to the rear collecting points or hospitals. Medical science, of course, has continuing requirements for improved care of sick and wounded, which the author does not presume to state.

Security of the Attack Force

WHILE THIS REQUIREMENT is not the responsibility of the Landing Force, it is of immediate concern since the measures taken will effect the tactics and techniques used by the Marines. Many of the problems which were examined in relation to attaining fire superiority and to security of the beachhead are applicable to the larger overall problem of security of the attack force as a whole. In stating the problem, once again we may break down the overall requirement into two subsidiary ones; passive defensive measures and active defensive measures. Neither one may be examined fully because of security restrictions but the principal implications which affect the Landing Force may be indicated.

1. *Passive defensive measures.* These will undoubtedly affect the Landing Force to the greatest degree because the principal defensive measure in this category will be that of dispersion to greater and greater distances between all elements of the Attack Force and within each element. This requirement will thus aggravate the following problems of the Landing Force; control and timing of the ship to shore movement; dissemination of orders to widely scattered subordinate echelons; control, spotting, and delivery of supporting fires by naval gunfire vessels and aircraft; and protection of the Landing Force against the effects of newly developed weapons, particularly during the ship to shore movement, in conjunction with those measures used by the Attack Force as a whole. The problems we have outlined in preceding pages must be reviewed, therefore, in the light of these conditions.

2. *Active defensive measures.* The problem for the Landing Force here will be to see that those measures taken by the Attack Force give adequate protection to the Landing Force, particularly during its most vulnerable phases, and that measures which may be taken by the Landing Force, especially after establishment ashore, are fully coordinated with the active defense plan of the entire Attack Force.

Conclusion

ALL OF THE PRECEDING PARAGRAPHS aim for the same goal; to present a tentative statement of those requirements whose solutions are most urgent if we are to take big steps forward in our development of the art of amphibious warfare. It is important to note that before any solutions can be found to problems such as these, which a moment's thought reveals are important to our future progress, the problems must be stated in military form. Official and specific requirements must be set up in the *form of a Marine Corps program.* Only then can scientists, engineers, developers, and designers clearly set their sights and put forth productive work toward fulfilling the needs of the Marine Corps. USMC