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Marine Corps Aviation: Amphibious Warfare, 1940



U.S. Marine Corps

DEPARTMENT OF THE NAVY
Headquarters United States Marine Corps
Washington, DC 20380-0001

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FOREWORD

1. PURPOSE

Fleet Marine Force Reference Publication (FMFRP) 12-31, *Marine Corps Aviation: Amphibious Warfare, 1940*, is published to ensure the retention and dissemination of useful information which is not intended to become doctrine or to be published in Fleet Marine Force manuals. FMFRPs in the 12 series are a special category: reprints of historical works which are not available elsewhere.

2. SCOPE

This reference publication was written in 1940 at Headquarters, U.S. Marine Corps. It was approved for use as a text within the Marine Corps schools. The purpose of the volume was to provide a tentative doctrine for the employment of aviation units in amphibious operations to be used primarily as a reference for staff and students of the Marine Corps. The text deals specifically with the employment of aviation in the support of landing operations and in the defense of advanced bases. The publication is an excellent source of what the status of airpower in amphibious operations was in 1940. This is an excellent resource publication.

3. CERTIFICATION

Reviewed and approved this date.

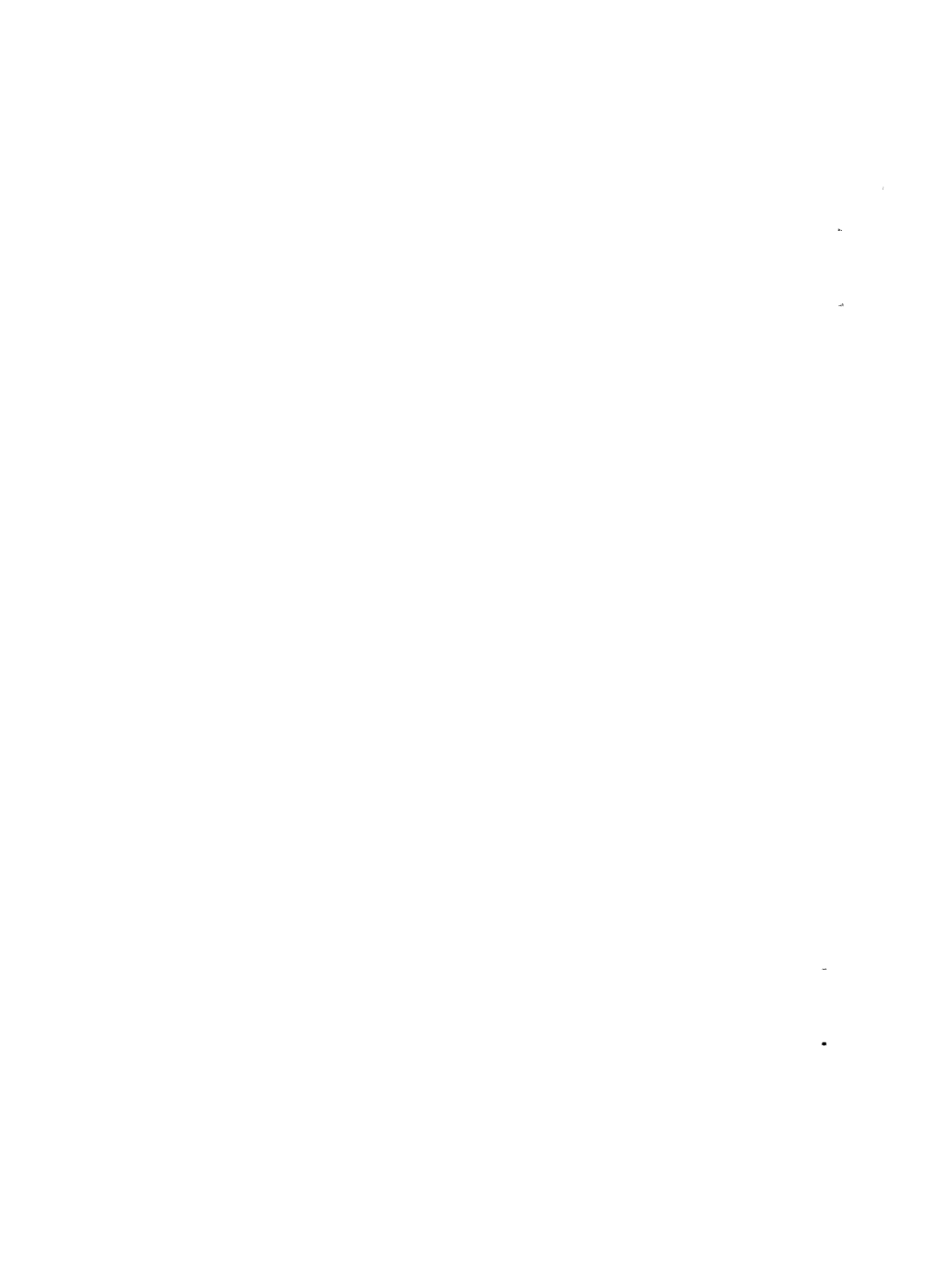
BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS



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INTRODUCTION

The purpose of this text is to provide a tentative doctrine for the employment of aviation units in amphibious operations, to be used primarily as a reference for staff and students of the Marine Corps Schools.

This text deals specifically with the employment of aviation in the support of landing operations and the defense of advanced bases.

MARINE CORPS AVIATION

AMPHIBIOUS WARFARE

TABLE OF CONTENTS

PART ONE

AVIATION IN LANDING OPERATIONS

	Page
Chapter I. General Considerations	3-15
Section 1. Introduction.....	3
2. Composition and Strength of the Air Force.....	4
3. Movement to the Theater of Operations.....	8
4. Air Bases.....	10
5. Responsibility for Air Support.....	13
6. Air Reconnaissance vs. Surprise.....	15
Chapter II. Preliminary Air Operations	16-22
Section 1. General.....	16
2. Reconnaissance.....	17
3. Reduction of Hostile Defenses.....	21
Chapter III. Air Support During Debarkation	23-28
Section 1. General Fighter Support.....	23
2. Air Attack of Surface Objectives.....	25
3. Tactical Reconnaissance.....	28
Chapter IV. Air Support During Ship-to-Shore Movement	29-38
Section 1. Fighter Support.....	29
2. Air Reconnaissance.....	31
3. Battle Missions.....	33
4. Special Combat Missions.....	35
Chapter V. Air Support During the Advance Inland	39-40

PART TWO

AVIATION IN DEFENSE OF ADVANCED BASES

Chapter VI. General Considerations	43-53
Section 1. Introduction.....	43
2. Composition and Organization of the Air Force.....	45
3. Responsibility for Air Defense.....	49
4. Airdrome Requirements.....	50
5. Communications.....	53
Chapter VII. Air Operations During the Reconnaissance Phase	54-59
Section 1. Strategical Reconnaissance.....	54
2. Tactical Reconnaissance.....	57
3. Fighter Support.....	58
4. Disposition of the Air Striking Force.....	59
Chapter VIII. Air Operations During Alert Phase	60-68
Section 1. Reconnaissance Missions.....	60
2. Offensive Combat Missions.....	63
3. Fighter Dispositions.....	66

VIII

	Page
Chapter IX. Air Operations During Final Defense Phase.....	69-75
Section 1. General.....	69
2. Reconnaissance Missions.....	70
3. Fighter Support.....	72
4. Air Attack of Surface Objectives.....	74

APPENDICES

Appendix A. Types of Aviation Orders.....	79-93
Purpose and Scope.....	79
General Forms.....	79
Sample Orders.....	86
Appendix B. Characteristics of Aerial Bombs.....	94-112
Purpose of Appendix.....	94
Classes of Bombs.....	94
Demolition Bombs.....	94
Armor Piercing Bombs.....	96
Fragmentation Bombs.....	96
Chemical Bombs.....	97
Practice Bombs.....	98
Parachute Type Bombs.....	98
Need of Different Size Demolition Bombs.....	99
Tactical Principles in Selection of Bombs.....	99
Effectiveness of Demolition Bombs Against Specified Objectives (table 1).....	99
Bomb Craters (tables 2 and 3).....	104
Depth of Water Penetration (table 4).....	106
Blast Effect on Reinforced Concrete (table 5).....	106
Data Relative to Effectiveness of Demolition Bombs in Operations Against Personnel (tables 6 and 7).....	107
Summary (table 8).....	109
Conclusion.....	111

**MARINE CORPS AVIATION
AMPHIBIOUS WARFARE**



PART ONE
**AVIATION IN LANDING
OPERATIONS**



PART ONE

AVIATION IN LANDING OPERATIONS

Chapter I—GENERAL CONSIDERATIONS

- Section
1. Introduction.
 2. Composition and Strength of the Air Force.
 3. Movement to the Theater of Operations
 4. Air Bases.
 5. Responsibility for Air Support.
 6. Air Reconnaissance vs. Surprise.

SECTION 1

1. Introduction.—Air operations in support of troop landings follow generally the principles previously outlined in the tactics and technique of the separate classes of aviation. Such differences as exist are concerned mainly with the details of operating from carriers or temporary advanced air bases, and with the special type of air support required in the actual seizure of a beachhead. The principles of air warfare are not changed; they are merely adapted to meet special situations. Obviously, greater difficulty of coordination will exist by reason of the limitations imposed by carrier operations, or by the necessity of operating from distant land bases. In either case the air units can employ only part of their inherent endurance for tactical purposes, the remainder being necessarily expended in the launching, rendezvous, concentration, and individual landings of carrier airplanes, and in covering the overwater distances to and from objectives in the case of distant shore-based units. To overcome these handicaps the attacking air force must have an initial numerical superiority great enough to permit partial concentrations to be effective against the defender's entire air strength. The problem of transporting air units to the scene of operations in such a manner as to permit their effective use upon arrival may well be a major task, particularly if the distances involved are beyond flying range of the aircraft, and no carriers are available. The problems of transportation and provision of adequate air bases will usually transcend any operational difficulties contemplated—given proper bases, aviation will be able to furnish support for the landing. Once ashore with airdromes established within the beachhead, air operations become comparatively simplified, reverting to the normal practices of land warfare.

SECTION 2

COMPOSITION AND STRENGTH OF THE AIR FORCE

	Paragraph
General-----	2
Fighting Units-----	3
Attack Aviation-----	4
Reconnaissance Units-----	5
Bombers-----	6
Utility Aviation-----	7
Summary of Strength-----	8

2. General.—An air force charged with the responsibility of supporting a landing should comprise largely those classes of aviation which are best adapted to gaining, maintaining, and exploiting air superiority. It must be particularly strong in combat aviation, with a preponderance of fighting and attack units, in order to neutralize the hostile air menace and effectively reduce the enemy's beach defenses.

3. Fighter Units.—A strong force of fighter units should be the first consideration, even though such provision is at the expense of other types. Air superiority over the transport area is an absolute essential before troops can be debarked; the ship-to-shore movement in small boats requires adequate air support if the troops are to reach their objectives. Such a concentration of highly vulnerable targets as necessarily attends a landing operation will invariably invite a violent reaction from enemy aviation, and unless adequate friendly fighter units are available **in the air** to intercept such attacks the landing schedule will be badly disrupted and serious casualties incurred. Fighting aviation is the only effective defense against this hostile air menace. Troop anti-aircraft discipline will avail little against boat strafing airplanes; nor will such anti-aircraft artillery and machine-gun fire as can normally be brought to bear from the transport group serve to deflect a determined dive-bombing attack. To ensure a successful debarkation and landing, enemy air units must have been previously destroyed, or fighter support over the transport and beach areas must effectively deny these areas to enemy airplanes. In either event fighting aviation must be employed en masse; to so employ it implies that it must be available. Therefore, the provision of adequate fighter strength should be given first priority. A group of four squadrons is considered the minimum necessary for a major landing operation; more will be often necessary when operating from carriers or distant land bases.

4. Attack Aviation.—Attack aviation is second only in importance to fighters. For offensive operations against hostile air bases, anti-aircraft installations, troop concentrations, and particularly against beach defenses, attack aviation is an extremely formidable and effec-

tive weapon. In addition to those targets normally assigned this class of aviation, the technique of landing operations requires that attack units be employed to strafe the beach defenses ahead of the advancing boat waves during the period between the lifting of naval gunfire and the actual landing of the troops. A series of strafing attacks will be necessary to properly fill in this time gap in the supporting fires schedule, each attack requiring at least one division of airplanes per landing beach. The required number of attack squadrons to be held in reserve for beach strafing tasks should be determined on this basis. Considering the air force and counter air force missions which may be previously or currently flown by the attack group, and the consequent losses expected prior to D day operations, the initial strength in attack units should be at least twice that required for beach strafing missions. While other types of combat aviation might be used in an emergency for beach strafing, such airplanes have only approximately one third of the combat efficiency against attack objectives as do the regular attack units, and would require three times the force with consequent additional losses from ground fire. Obviously such substitution should never be planned when the composition of the air force is being determined. A group of three or four attack squadrons is considered an appropriate force for major landing operations.

5. Reconnaissance Units.—(a) Reconnaissance aviation should be provided in sufficient strength for the normal reconnaissance and battle missions incident to the landing and subsequent operations ashore. Consideration should be given to the possibility of employing naval patrol units and carrier based scouts for much of the initial distant reconnaissance, and to the utilization of battleship and cruiser observation airplanes for spotting naval gunfire. If such naval units are available, the number of Marine reconnaissance squadrons might possibly be reduced in favor of additional combat aviation. In any event, it is considered advisable that all tactical reconnaissance and battle missions in direct support of the landing be performed by Marine reconnaissance squadrons, and this should be the minimum basis for determining the initial strength and number of units to be included in the air force. It should be borne in mind that a small reconnaissance unit free to operate can secure a great deal of information, while a much larger force, inadequately protected by combat aviation, may be unable to accomplish its mission in the face of hostile air opposition. Reconnaissance units should be carefully balanced with combat aviation, and not included in the air force merely because they are available.

(b) Past experience has shown that one observation squadron can provide the necessary tactical reconnaissance and battle missions for

a force the size of an army division, provided adequate general fighter support is available, and no combat missions will be required of the observation squadron. The number of reconnaissance and battle missions required by the Fleet Marine Force, or a major subdivision thereof, while engaged in a landing operation may be greatly in excess of those required of an observation squadron operating over a division front on land. If the Force lands on a single beach, or two small contiguous beaches, one squadron may be sufficient; on the other hand a simultaneous landing on a broad front will require more than one squadron for continuous operations during D day. Two squadrons should suffice for this type of landing where higher units provide for distant reconnaissance and air force missions. If no higher echelon exists, an additional squadron must be provided. If the Marine reconnaissance units must operate from distant bases, the number of airplanes should be correspondingly increased. In order to provide for reasonable contingencies, three reconnaissance squadrons of eighteen airplanes each are considered necessary for Fleet Marine Force operations.

6. Bombers.—The provision of Marine dive-bombing units will depend upon the availability of naval patrol bombers and carrier dive-bomber squadrons. If naval bombing units are available for the preliminary operations, Marine dive bombers need be provided only as a supplement for attack aviation during the actual landing operations for use against such precision targets as attack aviation cannot effectively engage. The two dive-bombing squadrons at present included in Fleet Marine Force aviation are considered sufficient for these supplementary tasks. If, however, no naval squadrons are available, additional Marine squadrons will be required for the important task of reducing hostile defenses prior to the landing. Under such conditions a bombing group of four squadrons would probably be necessary for a major overseas operation.

7. Utility Aviation.—Utility transports of the landplane type will be of little use until one or more beachhead airdromes have been established. Amphibian types should be provided for air force requirements. Utility aviation is classed as an auxiliary, and its inclusion in the landing force proper should not be at the expense of more important classes. Such units not actually required for the landing should be loaded for later discharge at the beach after airdrome facilities become available.

8. Summary of Strength.—(a) The exact proportion of each class of aviation included in the air force for landing operations will vary with conditions and expected hostile resistance. Types of bases available, whether advanced shore bases, carrier bases, or both, will greatly influence the composition of the force to be embarked.

Aside from tactical considerations, however, it is likely that availability of units will always be the determining factor. Substitution of types, while tactically unsound, may be necessary in order to provide the proper numerical strength.

(b) **The numerical superiority of the attacking air force over the defenders must be at least three to one, preferably five to one.** To attempt a landing with less strength invites defeat of the attacking air force in detail, with subsequent failure of the entire operation. Local control of the air over the landing area and general air superiority over the theater of operations are essential to success. The air force must be entirely competent in composition, equipment, size, and efficiency to provide this measure of support.

SECTION 3

MOVEMENT TO THE THEATER OF OPERATIONS

	Paragraph
By Air-----	9
Embarked on Carriers-----	10
Aboard Transports-----	11
Commercial Shipment-----	12

9. By Air.—Aircraft should be flown to the theater of operations whenever distance and the situation will permit. Air units so transported from their home bases arrive in the minimum of elapsed time with less hazard of damage en route, and are ready for immediate action, if necessary, upon arrival. This method presupposes available bases within the theater of operations, and may require numerous refueling bases along the route. If sufficient territorial or friendly foreign land bases are not available for the necessary refueling stops, it might be practicable to station carriers at intervals along the over-water route. The use of carriers for this purpose does not necessarily require that airplanes of the regular carrier group be disembarked, as they can usually be stowed below deck, rearranged on deck, or placed in the air during the period required for reservicing the Marine squadrons.

10. Embarked on Carriers.—Should the distance to the theater of operations preclude the transportation of air units by flight, or if there be no suitable landing fields available upon arrival, it may be necessary to transport the landing force aircraft aboard carriers. This method has many advantages, both from the tactical and logistical viewpoints. Supplies and equipment can be carried aboard for sustained operations, making the air force independent of shore bases for the initial operations. In this manner the ground units may be fully supported during the seizure of the beachhead and in subsequent operations ashore pending the preparation of suitable land bases.

11. Aboard Transports.—Should neither of the preceding methods be practicable, and the tactical situation permit, aircraft may be partially dismantled, wings and control surfaces lightly crated, fuselages wrapped with waterproof material and lashed down as deck loads on transports or cargo vessels. Other aviation material may be carried as cargo in the holds. The preparation of aviation material for such shipment requires several days time and must be carefully supervised by aviation technical personnel. The time and effort required for debarkation will depend upon the availability of docks and lighters at the unloading point. Under the most favorable conditions, the time required for debarkation, assembly, and test of airplanes should not greatly exceed forty-eight hours. A limited num-

ber of airplanes may be made available within twelve hours if a landing field or suitable hard beach is available nearby. Under favorable conditions transports or other naval vessels might serve temporarily as tenders for the operation of seaplanes or amphibians carried aboard. The transportation of air units partially disassembled has obvious military shortcomings, and is generally feasible only where supporting carrier-based aviation will be available for preliminary air operations.

12. Commercial Shipment.—Airplanes destined for overseas shipment, when unaccompanied by aviation personnel, should be crated and stowed aboard ship in the usual commercial manner. Commercial shipment is the least desirable method when airplanes are to be placed in operation immediately upon arrival, since unfavorable conditions at the port of debarkation may entail much delay in unloading and assembly. Under the best conditions several days would be required to place the air units in operating condition. Obviously this method of shipment should be restricted to replacement spares, or to the stocking of an advanced air base for contemplated future operations. It can be used only when the port of debarkation is reasonably secure from enemy action.

SECTION 4

AIR BASES

	Paragraph
General-----	13
Carrier Bases-----	14
Tender Bases-----	15
Advanced Air Bases Ashore-----	16

13. General.—Air bases for landing operations may be divided into two general classes: floating bases, which include carriers, tenders, and other vessels capable of operating land or sea planes; and advanced air bases ashore. Carriers may be temporarily assigned from the Battle Force to support landings, or one or more carrier divisions may be an integral part of the Naval Attack Force directly charged with making the landing. In the latter case one or more of the carriers would normally carry Marine squadrons. Tenders are currently used only for the servicing of naval patrol bombers, although squadrons of float seaplanes could be so operated from sheltered waters. Land bases include permanent home or territorial installations within range of the theater of operations, advanced air base facilities established on outlying islands or other terrain prior to the main operation, and temporary airdromes and advanced landing fields established within the beachhead after landing has been effected. A major landing operation would probably involve the progressive use of all these basing facilities, both afloat and ashore.

14. Carrier Bases.—(a) Since a major landing operation will probably require maximum employment of all the aviation that can be made available, the employment of carrier based aviation will often be mandatory. Aviation units so based are very flexible, having both strategical and tactical mobility. They can be brought to close striking distance of their objectives before launching, thus conserving their endurance for tactical operations. The use of carrier based aviation favors tactical surprise, as the defender may fail to locate the carriers before the attack is launched, whereas the construction of an advanced base ashore would most likely be detected by the enemy and the attacker's intentions deduced accordingly. In some instances carriers may be the only practicable method of bringing aircraft within striking distance of island objectives: in other situations it may be advisable to employ them as refueling depots for shore based units operating over long distances. In almost any conceivable situation involving overseas operations, airplane carriers may be considered as desirable or necessary adjuncts for the operation of supporting aircraft.

(b) Unfortunately, there are numerous limitations imposed on carrier operations. In the first place, the exigencies of Fleet operations

may not permit the diversion of carriers for the support of landing operations of secondary importance. In the second place, carriers are extremely vulnerable to attack from hostile surface craft and shore-based aviation. Naval commanders are properly reluctant to risk these vessels away from Fleet protection, especially when within easy bombing range of hostile shore-based air units. Should a carrier, or carrier division, assigned to support a landing be effectively attacked prior to or during the actual landing, it is very probable that a considerable percentage of the attacker's aircraft would be immediately destroyed, or at least neutralized, thus changing the balance of air power materially. Unless auxiliary shore bases are within operating radius, major casualties to one or more of the attacker's carriers might well cause abandonment of the landing. It can be readily seen that dependence upon carrier-based aviation alone for the support of landing operations is generally unsound practice, and that whenever possible supporting shore bases should be established and used by the major part of the attacking air force.

15. Tender Bases.—For operations from sheltered waters, certain types of Marine aircraft can be equipped with floats and operated as seaplanes. Reconnaissance and horizontal bombing units so equipped might be employed in certain situations to supplement land- or carrier-based aviation. Aircraft tenders, or other suitable vessels, could be employed as floating bases in the operation of such units; and it is conceivable that the possibility of employing tender-based air units may have to be considered in the plans for a landing operation. Float seaplanes, however, are generally inferior in performance to landplanes of the same type, and tender-based units require more time for reservicing between flights. Weighed against these disadvantages is the comparative ease of providing suitable landing facilities for seaplanes. Generally speaking, tender-based seaplane units are to be considered only as a supplement to the land-based air force, to be employed in those localities where landing fields cannot be provided.

16. Advanced Air Bases Ashore.—(a) When time permits, and suitable terrain is available within operating radius, air-base facilities should be set up ashore prior to the initiation of actual operations against a defended objective. The establishment of such a base has the following important advantages:

1. Makes possible the initial employment of all aviation with the expedition, including aircraft which have been shipped knocked down in cargo vessels.

2. Facilitates a detailed and intensive reconnaissance of the enemy defenses, and favors a thorough and well-planned series of offensive air operations designed to reduce these defenses, without incurring the risks incident to carrier operations.

3. Enables the Marine air units to utilize their maximum strength for the support of the landing attack, relieving to the same extent naval carrier-based units for normal Fleet missions.

4. Affords opportunity for concealment and dispersion of aircraft on the ground.

(b) Supporting air bases should preferably be located within one hour's flight of the objective, in order to permit airplanes of limited endurance, such as fighters, to operate for a reasonable time in the combat area. For the final stages of the landing it is very desirable to have a base of some sort not more than fifty miles distant. If this be impracticable, carriers should be made available for reservicing and rearming in order that continuous air support may be provided.

(c) The physical characteristics of land bases for landing force air units are similar in most respects to those required for normal land warfare. The air base proper may, and normally does, include a number of separate airdromes, or landing fields, so dispersed as to permit proper concealment of aircraft at rest. Hangars and other large structures are not contemplated for such air bases; supply and maintenance facilities, and the personnel, will usually be housed in temporary structures or under canvas. The actual landing fields or runways, however, must be of substantial construction to meet the requirements of constant operation.

(d) The tactical requirements of a supporting air base demand that all-weather day and night operation of aircraft be possible. Defensive considerations require that main airdromes be so located as to take advantage of antiaircraft installations guarding other base facilities, and that auxiliary and alternate airdromes be provided for dispersion and emergency operation of all air units. An island base, for example, might have auxiliary and alternate airdromes located on adjacent islands. No fixed rule can be given as to the number of landing fields which should be provided, as questions of available terrain and time available for their preparation will usually govern. Where possible, however, it is desirable to have a main airdrome for each group, and an auxiliary airdrome for each squadron of the group. Alternate airdromes, in addition to this recommended minimum, should be provided if at all possible.

(e) Temporary airdromes and advanced landing fields should be established within the beachhead area as soon as sufficient depth of terrain has been gained to obviate the possibility of aircraft and installations being subject to hostile artillery fire. Facilities should be progressively increased to permit of eventually basing the entire air force nearer the objective for the support of the advance inland.

SECTION 5

RESPONSIBILITY FOR AIR SUPPORT

	Paragraph
Control and Command.....	17
Organization of Naval Attack Force Aviation.....	18
Marine Units Support Landing.....	19

17. Control and Command.—The responsibility for all air operations incident to the seizure of a beachhead, including preliminary operations for the reduction of hostile defenses, rests with the Commander, Naval Attack Force. All naval aviation available, as well as those air units of the Fleet Marine Force which can be placed in full operating status, will normally be utilized for the initial air operations. The activities of these two forces will be coordinated under the senior air commander, Naval or Marine Corps, who will make dispositions and assign missions in accordance with the directive of the Commander, Naval Attack Force. The Commander, Fleet Marine Force, will usually exercise no direct control over the air units of his command until a substantial beachhead has been gained, or until such time as they may be released to him by the Naval Attack Force Commander.

18. Organization of Naval Attack Aviation.—(a) The organization of the supporting air force will be in accordance with current naval doctrine. When carrier divisions are included, task organizations will be listed by carrier groups, in which instance the Fleet Marine Force groups, if shore based, or on separate carriers, will be given appropriate task assignments. If Marine squadrons are separately embarked on carriers as part of the carrier group, they will ordinarily be included in the task assignment of that group. The air commander may elect, however, to group squadrons by classes, regardless of normal group organization; placing all the fighting aviation, for instance, under a single commander, and all the reconnaissance aviation in one task group, etc. Such a procedure simplifies the issuance of orders and is tactically sound. Where there is a choice of methods, tactical grouping by classes is considered preferable.

(b) Task assignments should consider the special training and equipment of the units listed. Naval squadrons may be expected to best perform those duties involving over-water scouting, the attack of hostile naval vessels, and the defense of the naval operating area against hostile aircraft. Marine squadrons will usually be detailed for observation missions over land, for attack aviation operations, for bombing defensive shore installations, and for the defense of the ship-to-shore movement against hostile aviation. This suggested division of tasks, while advisable, does not indicate the unsuitability

of either Naval or Marine squadrons for other assignments. Either is generally capable of performing all the missions appropriate to the class, whether operating over land or sea areas, except that Naval scouting squadrons are not trained for land reconnaissance and battle missions.

(c) Situations may conceivably occur in which Fleet Marine Force aircraft may be unable to participate in the initial air operations due to lack of bases, and thus require that all preliminary air missions be performed by naval-carrier-based aviation. The use of Fleet air units for these tasks should be considered, however, as a temporary emergency diversion from normal missions with the Fleet, and relief should be effected as rapidly as Marine units can be put into operation.

19. Marine Units Support Landing.—While Naval air units must usually be called upon to execute many of the combat air missions conducted during the preliminary phase of the landing operations, tactical reconnaissance and the air support of the actual landing is the normal function of Fleet Marine Force aviation. Every effort must be made to make Marine units available for these services. If suitable land bases cannot be provided, carriers should be assigned, even though this entails temporary removal of the regular carrier squadrons. The special equipment and training of Marine air units for landing operations is of no avail if their employment must wait for the seizure of a beachhead and subsequent preparation of airdromes ashore. Any plan which does not provide for full use of available Marine squadrons during landing operations is tactically unsound.

SECTION 6

AIR RECONNAISSANCE VERSUS SURPRISE

20. General.—The question of air reconnaissance versus possible surprise attacks was formerly given serious consideration in the discussion of landing operations. Many believed, with good reason, that preliminary air reconnaissance would sacrifice strategical surprise. It is now generally conceded that strategical surprise against an alert enemy will be practically impossible of accomplishment in any event. Air and surface scouting has reached such a stage of efficiency that only by a remote chance could a large expedition hope to approach within striking distance of a defended objective without being discovered. This being true, it follows that full advantage should always be taken of the possibilities of air reconnaissance. Comprehensive and timely information of the hostile defenses, available landing beaches, and the probable plans of the defender are of vital importance to the attacking force. Without such information proper tactical plans cannot be made; without air reconnaissance the information cannot be readily secured. The question of air reconnaissance versus strategical surprise is no longer to be considered; the urgent necessity of securing accurate and timely military information outweighs the nebulous possibility of achieving a surprise attack.

Chapter II—PRELIMINARY AIR OPERATIONS

- Section 1. General
2. Reconnaissance.
3. Reduction of Hostile Defenses.

SECTION 1

21. General.—Air operations conducted prior to the execution of a landing may be divided into two distinct phases: reconnaissance activities; and reduction of hostile defenses. Reconnaissance is normally the first mission attempted, although the hostile situation may require that reconnaissance be executed in force, in which case offensive action by combat aviation will be initiated simultaneously with the reconnaissance phase.

SECTION 2

RECONNAISSANCE

	Paragraph
Introduction	22
Strategical (Distant) Reconnaissance	23
Reconnaissance in Force.....	24
Tactical (Close) Reconnaissance	25
Elements of Information.....	26
Methods	27
Orders for Air Reconnaissance.....	28
Dissemination of Information.....	29

22. Introduction.—Preliminary air reconnaissance of the proposed theater of operations is begun at the earliest possible date. At first, while the attacking force is yet a considerable distance from its objective, this mission is classed as **strategical** reconnaissance. As the distance between the opposing forces decreases, the air mission develops into **tactical** reconnaissance. In any overseas movement which has for its ultimate mission the seizure of an advanced base, the necessity for obtaining detailed military information increases as the distance to the tentatively selected landing area is decreased. One flight cannot be expected to acquire all the needed information. The situation will usually require repeated flights to permit the flow of information to progress in logical sequence from the collection of general topographic and hydrographic data to the procurement of detailed military intelligence. The broad outlines of the information picture are first drawn by strategical reconnaissance; tactical reconnaissance sketches in the details. The difference between strategical and tactical reconnaissance is not so much a difference of method, but of time and space, and the amount of detail sought.

23. Strategical (Distant) Reconnaissance.—(a) Initial attempts at air reconnaissance will usually be made by long-range patrol seaplanes, operating singly or in small formations. The great radius of operation and endurance of these craft make them the ideal agent for overwater and coastal scouting; and their facilities for accurate navigation and long-range radio communication permit them to operate for limited periods independently of surface units, if necessary. Their chief disadvantage is vulnerability to air attack and anti-aircraft fire, due to their comparatively slow speed, large size, and limited service ceiling. Patrol seaplanes on distant reconnaissance missions attempt to avoid detection and consequent interception by taking advantage of weather conditions or approaching darkness. The information which they will be able to secure will vary with the opposition encountered, but will be generally limited to photographic observation and mapping activities over coastal or island regions.

(b) For inland reconnaissance, particularly where more detailed information is sought, and where air opposition is expected, the smaller, swifter, scout landplanes should be dispatched. The increased security against hostile attack enjoyed by the scout is, however, at the expense of reduced operating radius. The scout landplane on distant reconnaissance missions also uses every subterfuge to avoid detection, consistent with the performance of the assigned mission.

(c) Generally speaking, all distant reconnaissance missions are initially attempted by single aircraft or pairs, which have a better chance to avoid hostile air units than would larger formations. Several airplanes may well be dispatched at intervals on the same mission; at least one of them may then be expected to return with the required information.

24. Reconnaissance in Force.—When it is apparent that single airplanes are unable to complete reconnaissance missions in the face of strong hostile air resistance or heavy antiaircraft fire, resort must be had to a “reconnaissance in force.” A reconnaissance unit of sufficient size (usually a squadron) is escorted by a suitable force of fighters, and accompanied by a striking group of bombers, attack airplanes, or both. The striking group attacks the hostile airdromes and antiaircraft installations, while the escorting fighters engage the defending aircraft and prevent interference with the reconnaissance unit. During the resultant melee it is expected that the reconnaissance will be successfully completed. In a maneuver of this sort the reconnaissance squadron is the base unit; all others coordinate their actions with its movements. While the striking group endeavors to create as much havoc as possible with the ground installations, and the escorting fighters try to shoot down the maximum number of enemy airplanes, the commanders of these units must not permit themselves to be diverted from their primary mission of the moment—the support of the reconnaissance squadron.

25. Tactical (Close) Reconnaissance.—Once the landing force is committed to action against a particular area, tactical reconnaissance of the selected landing beaches, their seaward approaches, and contiguous land areas is begun. Concentration of aerial activity over any particular sector is to be avoided; the reconnaissance should be conducted over a broad front and so disguised in the general air operations as to prevent the enemy from deducing the tactical intentions of the attacker. It is entirely possible, with modern photographic equipment, to secure detailed information of a locality without flying directly over it at low altitude. Therefore, tactical surprise is not necessarily sacrificed by the activities of tactical reconnaissance airplanes.

(b) Generally speaking, tactical reconnaissance begins during the later stages of the preliminary phase, usually from D-4 to D-1 days, and is continuous thereafter throughout the landing operation and the subsequent advance inland. A further discussion of the subject will be found under the headings devoted to subsequent phases of the landing operation.

26. Elements of Information.—By whatever means preliminary air reconnaissance is accomplished, certain elements of enemy information must be secured. These elements will be listed according to desired priority in the appropriate intelligence annex and disseminated to all air units. Number and priority of elements listed will of course vary with each situation, but will include some or all of the following:

1. Hydrography and topography of beaches.
2. Defensive installations.
3. Troop dispositions.
4. Heavy artillery positions.
5. Location of airdromes and air units.
6. Road net and communication facilities.
7. Naval defense forces.

27. Methods.—Air reconnaissance may be photographic, visual, or, as is customary, a combination of the two. Photographic observation is to be preferred, as it furnishes an accurate, detailed, and permanent record of the enemy situation that may be studied at leisure. It has the defect, however, of showing conditions only as they exist at the moment of exposure. Under unfavorable weather conditions, photographic reconnaissance is not always practicable, and must necessarily be supplemented by visual observation. Visual observation, on the other hand, is generally restricted to lower altitudes, due to visibility conditions. The chief advantage of visual reconnaissance is the facility with which a rapidly moving situation can be observed and constantly reported by radio.

28. Orders for Air Reconnaissance.—Orders for air reconnaissance should be clear, brief, and specific; limited to a statement of the mission, the area to be covered, time involved, and any special information desired. The details of conducting the reconnaissance come within the province of the air commander and should be left to his discretion. The order, usually in the form of an annex, should include:

1. Mission, expressed in terms of information sought.
2. Relative importance of elements listed.
3. Area to be covered.
4. Time by which information must be available.
5. Contemplated action of main command during the reconnaissance (for distant missions).

29. Dissemination of Information.—The value of information secured by air reconnaissance depends largely upon the speed with which such information is delivered to the commander, and upon the method of evaluation and dissemination practiced by the staff. Information extracted from the reports of air observers is usually plotted on the F-2 Situation Map, or on the F-3 Operations Map, as appropriate, and issued to the command in the form of a periodic résumé of air information. Items of immediate importance to subordinate commanders are relayed without delay to the units concerned, by the means most expedient at the moment. Particular care must be taken to prevent periodic treatment of such items as deserve priority distribution.

SECTION 3

REDUCTION OF HOSTILE DEFENSES

	Paragraph
General.....	30
Fighter Escorts.....	31
Hostile Air Force.....	32
Other Objectives for Air Attack.....	33

30. General.—Information gained from air reconnaissance and other sources during the preliminary period will probably reveal suitable objectives for bombing and attack aviation units, the destruction of which would greatly facilitate the actual landing and seizure of a beachhead. Consideration should be given to a systematic plan for the reduction of these objectives by air attack, either during “reconnaissance in force” operations, or as purely offensive maneuvers conducted subsequent to reconnaissance flights. Repeated attacks will probably be necessary, and should be continuous up to the time of actual landing. Objectives should be assigned the various units in accordance with their capabilities.

31. Fighter Escorts.—Air attacks against hostile ground installations may be expected to bring about a violent reaction from the defending fighters. This will often be the first opportunity the attacker will have to reduce this force, so it is considered imperative that a strong fighter escort accompany the air-striking group, whenever fighter operating range permits, and thus be in position to engage the defenders with superior forces.

32. Hostile Air Force.—The hostile air force, wherever found, will be the first priority objective for all preliminary air offensives. This force represents the greatest potential threat to the attacker, and its neutralization must be accomplished at whatever cost. The initial air superiority of the attacker must be exploited to the limit during this phase. Particular care must be taken to seek out and destroy air units on concealed airdromes: air-base facilities of a permanent nature must be made untenable; and aircraft in flight must be intercepted and constantly harassed by a superior fighter force. In short, intensive counter-air-force operations must precede the arrival of the Naval Attack Force in the transport areas; otherwise, even a remnant of the hostile air force may be able to seriously impede the landing.

33. Other Objectives for Air Attacks.—(a) After the hostile air force has been neutralized, consideration can be given to the elimination of the next most important threats to the success of the landing. These are listed below in the usual order of priority:

1. Heavy gun emplacements.
2. Fortifications of a permanent nature.
3. Critical points in lines of communications inland.

4. Troop concentrations in rear areas.
5. Logistical establishments.

(b) Submarines and floating mines will be targets of opportunity, or secondary objectives, for all missions. Heavy gun emplacements, if located, will be primary objectives for dive-bombing units until neutralized. The attack of beach defenses during the preliminary period will be unusual, as such practice would forfeit tactical surprise on that beach, and would accomplish little unless the defenses were fully manned. Rear-area targets should be given attention by the attack units during this phase, reserving beach strafing until necessary to cover actual boat landings. Antiaircraft installations which menace the operation of reconnaissance airplanes should be neutralized during this period. To summarize: air operations designed to reduce hostile defenses should concentrate successively on the most important targets, beginning with the hostile air force and air base installations, and ending with the attack of rear area objectives which are an indirect threat to the landing. Once started, no respite should be given the defender until the attacking force is ashore.

Chapter III—AIR SUPPORT DURING DEBARKATION

- Section 1. General Fighter Support.
 2. Air Attack of Surface Objectives.
 3. Tactical Reconnaissance.

SECTION 1

GENERAL FIGHTER SUPPORT

	Paragraph
Introduction.....	34
Methods.....	35
Assignment of Units.....	36

34. Introduction.—From the air viewpoint, the most critical period of a landing operation occurs during the debarkation of troops from transports into small boats. The transports are practically dead in the water, grouped in a more or less congested area; fleets of small boats are clustered alongside; the decks and passageways are congested with troops and equipment. At this time the entire command is passing through a very restricted defile, and endeavoring to operate strictly on a timed landing schedule. No particular imagination is required to foresee the havoc that might result from an air attack during this phase. Even a small air unit getting through to the objective could do irreparable damage, and create so much confusion as to materially disrupt the landing. A well timed attack by a large force might well be disastrous. While the antiaircraft batteries on the transports and accompanying ships may be expected to inflict serious losses on hostile aviation, they cannot be depended upon to stop determined attacks. Those attacks must be stopped before they are within striking distance. The principal weapon with which this can be accomplished is a strong force of fighting aviation.

35. Methods.—(a) While every effort must be made to neutralize hostile air units prior to the debarkation phase, it is considered unlikely that this can ever be completely accomplished. The enemy will endeavor to conceal certain units, reserving them for attacks on the transports and small boats. The attacking air force must make ample provision to meet this threat by furnishing continuous general fighter support over the transport area during daylight hours. The method of providing this protection will be by air patrol with units relieved on station at appropriate intervals. If air bases are located more than fifty miles distant from the transport area, a considerable force will be required to maintain even one squadron on station. Where refueling and rearming facilities can be made available within this distance, a group of four fighting squadrons could maintain half its strength on station during the debarkation and movement to shore. For an average size transport group, two fighting squad-

rons in the air overhead is considered the minimum force necessary to insure reasonable protection. If more are available they should be used.

(b) The fighter force assigned the general support mission over the transport area should not be expected or permitted to attack surface targets. Bombs should not be carried, unless it be the new antiaircraft missiles designed for the attack of bombing formations. This fighter force has for its sole purpose the interception of hostile air attacks on the transport group: it must not permit itself to be diverted or enticed away from station.

(c) Fighter protection of the transport group is effective only during daylight hours. It cannot prevent the enemy from executing night attacks by the aid of flares, which he would certainly attempt if opportunity offered. In this connection it might be well to mention that, whereas night air bombing with illumination is less effective than daylight attacks, antiaircraft fire is also much less accurate during darkness. These facts should be carefully considered in deciding the hour to begin debarkation.

36. Assignment of Units.—General support over the transport area, which includes the vessels of the fire support groups, can be effectively provided by either Naval or Marine fighting squadrons. If carriers are being used, the primary mission of the Naval fighting units will be special support of the carrier group, and Marine units should be available to protect the transport area. If all fighting units are grouped in one task organization, the commander thereof will assign these concurrent missions as he deems expedient. It is relatively unimportant which squadrons are assigned: it is vitally important that sufficient force be available to provide reasonable protection.

SECTION 2

AIR ATTACK OF SURFACE OBJECTIVES

	Paragraph
General.....	37
Hostile Airdromes.....	38
Defiladed Heavy Guns.....	39
Submarines.....	40

37. General.—The air attack of surface objectives should continue during debarkation in order to divert the enemy's attention from the transport areas. Particular attention should be paid to the hostile air force, especially to the destruction of hitherto undiscovered aircraft and airdrome facilities. Defiladed heavy gun batteries which can range the transport group are an immediate threat and should be neutralized upon discovery. Hostile submarines must be guarded against during the debarkation phase. Other important targets for air attack will also most probably exist at this time. In fact, there will always be a great many more possible objectives than there are air units available to strike them; only those objectives which constitute an immediate and serious threat to the actual landing and supply of troops can normally be considered. These objectives should be listed by the Force commander in the priority desired, and such list made the basis of air force task assignments. Each air unit may then be assigned a primary mission with one or more secondary missions, all within the same general area. Targets of a fleeting nature, although in themselves of primary importance, may be assigned as secondary objectives, or listed as contingent objectives of the first priority. For example, hostile air units discovered on the ground in the act of taking off or landing may be listed as first priority targets for all appropriate combat air units regardless of the original missions assigned.

38. Hostile Airdromes.—(a) If the defender has been able to hold out a hidden reserve of air striking units during the preliminary air operations, such reserve will undoubtedly be put into action upon the arrival of a naval attack force off shore. The attacking air force must be prepared to deal with such units without delay, preferably before they can get into the air. While all combat air units will attack hostile aviation on the ground whenever discovered, it may be advisable in addition to assign a task group of appropriate size the primary mission of remaining in the air over the most likely localities for concealed enemy airdromes, to insure against hostile aircraft being able to take off.

(b) Attack squadrons are best adapted to this task; fighters armed with light bombs are the next best choice. However, these two classes may not be available. The attack units may be in reserve for the necessary beach strafing missions; all the fighter units may be re-

quired for general support over the transport and carrier group areas. In this instance dive bombing squadrons may be assigned as weapons of opportunity for the attack of hostile aircraft on the ground, employing suitable type bombs and machine gun fire. If so armed and employed, however, these units cannot at the same time be assigned secondary objectives, such as heavy gun batteries, which require large demolition bombs for their destruction.

(c) The size of this striking group will depend upon available intelligence as to the probable hostile strength in concealed air units; the availability of friendly combat aviation for assignment; and the existence of other objectives for air attacks as listed in the priority table. In any event, as long as the enemy has an effective remnant of an air force in existence, that remnant should never be neglected by the striking components of the attacker's force.

(d) In missions of this type, reconnaissance aviation should be detailed to support the assigned striking group in the location of proper targets. The combat units should cruise at a considerable altitude to avoid antiaircraft fire, and cannot therefore engage in effective search-attack methods without undue hazard. Individual reconnaissance airplanes are better equipped for surveillance of suspected localities.

39. Defiladed Heavy Guns.—If the hostile defenses include large-caliber guns, they will probably be so well concealed as to evade aerial observation prior to the time they actually open fire. They will usually be defiladed from ship's gunfire, and thus vulnerable only to bombing aviation. Such guns may be expected to open an accurate fire upon the transports and supporting vessels as soon as these vessels come within effective range. In order to avoid the resultant serious damage to matériel and attendant casualties from this fire, the guns must be neutralized quickly after they have been definitely located by observation aviation. To accomplish this task it is necessary to have dive-bombing units in the air, loaded with the proper bombs, in the vicinity of those localities which an intelligence study has indicated as the most probable locations for heavy guns. Effective attacks can thus be launched immediately after the discovery of the objectives; the inherent accuracy of dive bombers and the destructive power of heavy demolition bombs should combine to neutralize the hostile gun batteries without the necessity of repeated assaults. It may be expected that such gun positions will be heavily defended by antiaircraft machine-gun fire, which may inflict casualties on bombing aircraft as they are recovering from dives at low altitudes. This hazard must be accepted, however, as time will not usually permit the organization of a coordinated effort utilizing attack units for neutralization of the antiaircraft defenses. Dive-

bombing units assigned the primary mission of attacking heavy gun batteries when and if located may be assigned secondary objectives appropriate to the bomb load carried.

40. Submarines.—During the debarkation period a constant anti-submarine patrol is maintained, normally by naval scout bombers. If these are unavailable, the mission may be performed by Marine scouts. All unidentified submarines encountered in the danger zone described about the transport areas will be attacked without warning on the assumption that they are hostile craft.

SECTION 3

TACTICAL RECONNAISSANCE

General.....	Paragraph 41
Methods.....	42

41. General.—Intensive tactical reconnaissance, initiated on D-4 to D-1 day, is continuous throughout the debarkation phase when visibility permits. Particular attention is paid to beach defenses, airdromes, artillery positions, and the location and movement of enemy reserves. Suitable objectives for air attack must be located and reported to the air force, and the ground units kept posted as to recent changes in the defensive situation ashore.

42. Methods.—(a) Methods of conducting this reconnaissance are normal. Single airplanes, operating under the incidental protection of general fighter support, endeavor to reach positions over the shore line from which visual and photographic observations can be made. Visual observation will predominate during this phase, although provision should be made for photographing overnight changes in the beach defenses. Equipment should be available in some of the airplanes for development of films in the air, and for drop deliveries of finished prints to transports or boat group commanders.

(b) Reconnaissance areas assigned observation teams should be small enough to permit of the most thorough inspection of the landing beaches and contiguous terrain. In fact, the missions assigned at this time combine tactical reconnaissance of the immediate rear areas with the intensive reconnaissance of the actual battle zone normally performed by the infantry airplane. Infantry missions, as such, are scheduled to begin during the ship-to-shore movement. The debarkation phase is a period of transition from general reconnaissance to intensive reconnaissance; no particular attempt is made at this time to differentiate between the two missions in the assignment of aircraft.

Chapter IV—AIR SUPPORT DURING SHIP-TO-SHORE MOVEMENT

- Section 1. Fighter Support.
2. Air Reconnaissance.
 3. Battle Missions.
 4. Special Combat Missions.

SECTION 1

FIGHTER SUPPORT

	Paragraph
General Support-----	43
Special Support-----	44

43. General Support.—General support over the transport area continues during the ship-to-shore movement. After the initial debarkation the transports must remain in the area to unload reserves, equipment, and supplies. Their protection against air attacks is thus imperative, although once the troops have gotten away in the small boats the transports are no longer first priority targets for hostile aviation. It is generally advisable to assign one fighter task group the mission of general support over the transport and beach areas, with instructions to pay particular attention to the boat groups and to friendly air operations in the vicinity of the beaches. If the preliminary air operations have been successful, this arrangement will normally provide adequate protection. The entire area between the transports and the beach is small from an air viewpoint, and one fighting group of three or four squadrons should have no particular difficulty in covering it effectively.

44. Special Support.—If, however, the hostile air strength has not been effectively neutralized, it may be necessary to provide a special fighter force for the close-in protection of the small boats and landing troops. Such a force would also provide incidental support to friendly aircraft, particularly beach-strafting units, operating over the landing beaches; but would be restricted to the immediate area of the boat groups. Hostile combat aviation must be kept away from the boats and landing beaches at all costs, even if it requires the presence of the entire fighter force on special support. Troops in small boats or on congested beaches at the moment of landing are particularly vulnerable to air attack; the enemy may be expected to make serious attempts to reach such lucrative targets, employing small units in a series of continuous low-altitude surprise assaults. Such attacks, approaching over favorable routes from inland, will be difficult to detect and intercept, and will require the physical intervention of fighters between the hostile attack units and their objectives. This means that an echelon of fighters must operate at comparatively low altitudes over the landing troops, prepared to effect a

head-on interception against hostile aircraft approaching from any direction. Whether this echelon is specifically detailed by the air commander, or whether the fighting group commander responsible for the general support of the area detaches a squadron for this particular mission during the actual landing phase, will depend upon the estimated hostile air effort to be expected and the fighter force available. In any event, the troops must be given adequate air protection while landing. Any error in estimating the force necessary to accomplish this should be toward an excess.

SECTION 2

AIR RECONNAISSANCE

	Paragraph
General	45
Distant Reconnaissance	46
Close Reconnaissance	47

45. General.—Air reconnaissance is continuous throughout the ship-to-shore movement, and should cover both front and rear areas to whatever distance is deemed necessary. The assignment of missions during this phase will conform in general to normal practices for land warfare. Areas are assigned for distant reconnaissance, close reconnaissance, and for the special close-in reconnaissance, usually performed by the infantry airplanes.

46. Distant Reconnaissance.—Air reconnaissance of the land and sea areas beyond the immediate zone of hostilities may or may not be performed during the ship-to-shore movement. For the attack of a small isolated island base there would, of course, be no zone of the interior and no necessity for distant land reconnaissance, as all the area would be covered by the tactical reconnaissance airplanes. On the other hand, the seizure of a beachhead on a large island or on the mainland would require that distant reconnaissance missions be flown. If conducted, the purpose of this reconnaissance is to gain information and maintain contact with distant hostile forces which might be able to influence the campaign within a reasonable time. Distant reconnaissance may also be an air force mission for the discovery of objectives for an air attack. While missions of this sort will be flown when necessary during any phase of a landing operation, they do not directly affect the execution of the ship-to-shore movement, except possibly to divert a limited number of airplanes from other more pressing tasks. The subject is mentioned here as a reminder that aviation is primarily a long range arm, and that although engaged for the moment in close support of the landing forces, other missions considerably removed from the immediate battle zone may require attention concurrently.

47. Close Reconnaissance.—(a) During the ship-to-shore movement all observation airplanes engaged in reconnoitering the battle zone and immediate rear areas should concentrate on the discovery and prompt report of last minute changes in the hostile defenses. This is but a continuation of the work begun during debarkation, and further listing of proper objectives is unnecessary. Air-surface communication is very important at this time. Boat group commanders should be in radio communication with the observation teams assigned to that sector, in order that information regarding changed conditions on landing beaches may be promptly received and

acted upon. If radio fails, a summary of pertinent information with accompanying sketches or marked maps should be dropped to the proper boat group commander. Report of such contact is made later to the command post (on one of the transports) by radio or dropped message. The point to be made here is the necessity for speed in getting the information to the commander who must act upon it.

(b) The observation teams assigned tactical reconnaissance missions may continue during the ship-to-shore movement in performance of many of the duties commonly assigned to the infantry airplanes. Although battle missions are now scheduled, the airplanes ordinarily assigned for the infantry mission may be engaged in guiding the boat columns to the proper beaches. Until the troops actually land, the zone of tactical reconnaissance includes the beach defenses, or enemy front lines, normally covered by the infantry airplane.

SECTION 3

BATTLE MISSIONS

	Paragraph
The Guide Airplane.....	48
The Artillery Airplane.....	49
The Command Airplane.....	50

48. The Guide Airplane.—(a) Special infantry airplanes may be required during the ship-to-shore movement for the purpose of guiding boat waves through smoke or poor visibility to the proper landing beaches. One airplane will be required for each beach, and it would be well to have a relief airplane in the air ready to take over in the event of a casualty.

(b) The guide airplane may fly continuously in an elliptical course just in rear of the boat unit being guided. When it becomes evident that the boat unit's course must be changed in order to land on the designated beach, the airplane should fly close to the guide boat and signal the necessary change by dipping the right or left wing, each dip indicating a change in direction of five degrees to right or left. A more positive, although more hazardous, method is for the guide airplane to fly a shuttle course perpendicular to the designated beach, passing directly over the guide boat each time, thus showing the boat officers the proper course to follow. Radio communication may supplement this procedure; in fact it is highly desirable that unrestricted two-way communication be established between the guide airplane and the boat group commanders.

(c) When the troops have landed, or if no guide is required by reason of good visibility, the guide airplane reverts to its normal status of infantry airplane for that organization, and continues to provide intensive reconnaissance of the battle zone immediately in rear of the beach line. The reconnaissance airplanes which have been operating in these sectors may then shift their attention to matters in the immediate rear areas.

49. The Artillery Airplane.—Normally, battleships and cruisers of the fire-support groups will provide their own spotting airplanes for observation of naval gun fire during the ship-to-shore movement. Other vessels participating in the action may require that Marine aircraft be detailed for this duty. Methods of spotting naval gun fire on shore target areas do not differ materially from normal practice for heavy land artillery. Gridded maps are furnished the artillery observers, who report the fall of shots by radio. Obviously, this method of fire control requires at least one airplane for each firing ship.

50. The Command Airplane.—One or more tactical amphibians should be made available to the landing force commander for com-

mand missions during the ship-to-shore movement. These aircraft will land alongside the transport or other vessel carrying the command group, as soon as conditions permit after the transport area has been reached. Methods of conducting command missions are normal, merely substituting water areas for advanced landing fields. The command airplanes are subject to the direct orders of the commander to whom assigned for whatever missions may be expedient.

SECTION 4

SPECIAL COMBAT MISSIONS

	Paragraph
Smoke Screens-----	51
Beach Strafing-----	52
Bombing Rear-Area Objectives-----	53

51. Smoke Screens.—(a) Smoke laid and maintained by airplanes may be employed to advantage under certain conditions for concealing the approach of the small boats and thus reducing the fire effectiveness of the beach defenses. If used, it should be put down not later than the time at which the leading waves arrive within effective range of automatic weapons, and maintained in sufficient volume to blind the beach defenses and observation posts until the leading waves have disembarked and organized for attack. Smoke is laid in various ways:

1. By dropping a line of smoke bombs parallel to the beach and in front of the first boat wave. Airplanes may accomplish this from medium altitudes.

2. By spraying from smoke tanks at low altitudes, repeating as necessary to maintain a screen in front of the boats.

3. By spraying from smoke tanks at slightly higher altitudes, thus forming a smoke blanket over the small boats to provide anti-aircraft concealment.

4. By bombing or spraying the observation posts and beach defenses, leaving the approaching boats in the clear. This will usually be the most efficacious method, as it does not interfere with proper navigation of the boats.

(b) Smoke missions may be executed with all types of airplanes which are equipped to carry the smoke tanks, or the smoke bombs. This is primarily an attack mission, however, and attack airplanes should be used when available. Low-flying smokers, unless very fast and highly maneuverable, provide good targets for every defensive machine gun on the beach, which is of course a sound argument for the employment of the fast attack airplane. The use of smoke bombs to form the initial curtain avoids much of this exposure to anti-aircraft fire, and will usually be advisable.

(c) Smoke laid by airplanes during the approach to the beach may also find other uses of a tactical nature, such as to:

1. Conceal the main effort.
2. Camouflage a chemical attack.
3. Screen the flanks of leading units, while entering a bay or cove.
4. Blind searchlights and anti-aircraft batteries.
5. Cover a simulated landing or demonstration.

(*d*) Smoke, properly employed, is an effective tactical aid. It is, however, a source of potential danger to the careless or unskilled user, as wind and weather changes may require drastic alteration of operation plans which are dependent upon smoke for their effectiveness. If the use of smoke is contemplated in a given situation, definite plans must be made in order that the aviation units concerned may meet the matériel requirements and have the smoke airplanes ready in the air at the designated time and place. Whether or not smoke will be used must be decided by the Naval Attack Force commander.

(*e*) The pilots of the smoke airplanes should be given considerable discretion as to the exact time and place to put down the smoke screen. They are in much better position to judge the effect of wind, and the progress of the boat groups, than is the Force commander or any of his staff on the command vessel. Therefore, orders for laying smoke should specify time and space with reference to the movement of the forces to be screened. Only specially trained pilots are employed to lay smoke; they should be tactically competent to judge the proper time and place to start operations.

52. Beach Strafing.—(*a*) During the ship-to-shore movement there occurs a very critical period, beginning when the boats are about eight hundred to a thousand yards offshore and continuing until the troops have gained a foothold on the beach. The naval gun fire must lift to targets inland; the troops themselves cannot fire accurately from boats. Consequently, the beach defenders may be able to bring a very effective small arms fire to bear on the boat waves without fear of effective immediate retaliation. Naval bombardment of beach defenses, however effective, cannot be expected to neutralize or destroy all the machine guns which may be sited at or near the water's edge. Even a small number of such guns properly directed might be able to work havoc with the landing troops.

(*b*) Up to the present time, only one effective supporting measure has been devised—an intensive strafing of the beach defenses by attack aviation. During the four or five minutes which the boats require to reach the beach after naval gun fire lifts, successive echelons of attack aviation sweep low over the beaches parallel to the shore line, releasing parachute fragmentation bombs in trail and spraying the entire area with machine gun bullets. No attempt is made to strike individual targets; the entire beach area is smothered by fire. Echelons follow each other at about thirty second intervals, the last echelons working further inland as the boats approach the beaches and into the danger radius of the bombs. The number of airplanes in each echelon may vary from three to nine, depending

upon the width of the strip to be covered. Each section of three airplanes covers an effective width of about two hundred and twenty-five yards; the length of the area covered with one bomb loading is about fourteen hundred yards. The required force can be determined for any given situation by use of these figures.

(c) The exact time to begin aerial beach strafing should not be prescribed in advance, but should always be left to the discretion of the group or squadron commander charged with the mission. He will be in position to observe the progress of the boats, the movements of the firing vessels, and can usually anticipate the cessation or lifting of naval gunfire so that the leading echelon of attack airplanes can be in position to open fire on the beach defenses immediately. In order to accomplish this, the attack unit will rendezvous off one flank of the landing beach outside of effective antiaircraft range but within sight contact of the boat groups. Echelons will break away from the circling formation in succession at the prescribed interval, sweep once over the objective, and effect a rendezvous with the parent unit while en route to the base for rearming.

(d) Beach strafing, to be effective, must be done by attack airplanes specially equipped for the task. Losses from small-arms fire and antiaircraft machine-gun batteries must be expected even when speeds in excess of two hundred miles per hour at altitudes of less than one hundred feet are flown. If this task is attempted by slower airplanes, not equipped with parachute bombs and consequently restricted to bombing altitudes in excess of eight hundred feet, failure may result due to excessive casualties from ground fire and hostile fighters; and to the inability of these substitute types to properly cover attack objectives. Three squadrons of scouting airplanes, dive bombers, or fighters are required to approximate the results obtained in beach strafing by one attack squadron. Such a diversion of these types from normal missions will seldom be possible or advisable and should be considered only as a last resort. The provision of regular attack squadrons for beach strafing purposes may well be considered mandatory.

53. Bombing Attacks Against Rear Area Objectives.—(a) During the ship-to-shore movement the dive bombing squadrons continue to stay in the air, prepared to attack targets of opportunity in the immediate rear areas. Hostile field artillery and antiaircraft gun positions, concentrations of reserves, critical points on lines of communications, trains and troop columns, are proper objectives for dive bombers while the troops are getting ashore. In other words, during this short period, the bombing units render close support to the ground forces, supplementing the naval gunfire as is expedient. The

normal distant missions of bombing aviation will be secondary until the landing force artillery is ashore and ready to take over close support missions.

(b) However, should previous efforts have failed to neutralize the hostile air force, and enemy airdromes are known to exist within short operating radius, counter-air-force missions may continue to have precedence for the bombing units. Diversion of bombing aviation to missions of close support is always contingent upon the hostile air situation.

Chapter V—AIR SUPPORT DURING THE ADVANCE INLAND

	Paragraph
General	54
Fighter Support	55
Air Reconnaissance	56
Air Force Missions	57
Airdrome Requirements	58
Air-Ground Communications	59

54. General.—(a) The first stages of the advance inland may be considered as a transition from amphibious operations to normal land warfare. The combat troops are ashore and have penetrated far enough inland to permit the landing of artillery and supplies from the transports. Naval gunfire support is still available; the fire support groups and transports remain in the vicinity. Air support, then, is concerned not only with the troops ashore, but with the supporting naval vessels off the beach. Air units are still operating from carriers or distant land bases. Air missions in general remain much the same as they have been during debarkation and the ship-to-shore movement.

(b) As the attackers progress inland, gaining a beachhead of sufficient depth to permit the establishment of advanced airdromes ashore, the air force begins shifting its bases from carriers or distant airdromes to more convenient locations within the beachhead. The naval contingent of the air force may be released to the Fleet at this stage; all further air operations being usually within the capabilities of Fleet Marine Force aviation. The further conduct of air operations is in accordance with normal doctrine prescribed for land warfare.

55. Fighter Support.—Until the transports are unloaded, and as long as supporting naval vessels remain offshore, a certain measure of fighter support is necessary over the transport and landing beach areas. The water routes between transports and beaches are defiles on the attacker's lines of communication and supply; sporadic air raids from hostile aviation could cause a great deal of damage. The enemy air force, if not rendered impotent by continuous counter air force operations, might be expected, however, to concentrate on the attacking forces ashore which constitute the most immediate threat to the shore defenses. Therefore, fighter support over the transport area at this time is of less importance than it was during debarkation. In most instances the necessary air protection can be provided by one squadron in general support over the transport and beach areas. A second fighting unit may be required to furnish special support over the combat zone ashore. The size of the force to be kept in the air will depend entirely on the hostile air opposition to be reasonably expected.

56. Air Reconnaissance.—As previously brought out, air reconnaissance is continuous during a landing operation. The reconnaissance and battle missions assigned during the advance inland do not change appreciably from those previously flown, except that more attention should now be given to distant reconnaissance of hostile interior areas, and to probable routes of advance into enemy territory.

57. Air Force Missions.—When the troops are well established ashore, the air force as a whole may turn its attention from missions of close support to normal air force offensive missions deep into enemy territory. The point to be stressed here is the reversion to normal missions at the earliest practicable time. During the struggle to get ashore, the striking components of the air force are properly employed as mobile artillery in the close-combat support of the ground units; to so continue their employment during the advance inland is generally inadvisable, except in the absence of field artillery.

58. Airdrome Requirements.-Temporary airdromes and advanced landing fields should be established ashore as soon as the landing force has gained physical possession of the necessary terrain. Tentative sites will have been selected during previous air reconnaissance. The preparation of suitable fields should be accomplished without delay, in order that reservicing and communication facilities may be available to supporting aircraft. These temporary airdromes may be expanded later into advanced air bases, as required. Advanced landing fields will be progressively established as the troops advance, so that reconnaissance squadrons performing battle missions may have landing facilities in the near vicinity of the supported unit's command post. The more elaborate air base facilities are not established so close to the combat zone for obvious reasons.

59. Air Ground Communications.—In order that the landing force commander may be promptly advised of the situation ashore, all infantry units should be especially enjoined to cooperate with the infantry airplanes in reporting their front-line locations exactly by means of panels, wherever so requested by air observation teams. This information, in the form of sketches or marked maps, should be dropped on the command transport and to the senior officer ashore at frequent intervals.

MARINE CORPS AVIATION
AMPHIBIOUS WARFARE

PART TWO

AVIATION IN DEFENSE OF
ADVANCED BASES



PART TWO

AVIATION IN DEFENSE OF ADVANCED BASES

Chapter VI—GENERAL CONSIDERATIONS

Section 1. Introduction.

2. Composition of the Air Force.
3. Responsibility for Air Defense.
4. Airdrome Requirements.
5. Communications.

SECTION 1

60. Introduction.—(a) The air defense of an advanced base may be divided into three phases, corresponding in general to those phases prescribed for general base defense, viz: The **reconnaissance** phase; the **alert** phase, and the **final defense** phase. The reconnaissance phase begins when a direct threat against the advanced base becomes possible, and continues until a hostile force approaches within striking distance of the base defenses. Striking distance, from the air force viewpoint, may be considered as the effective operating radius of hostile aircraft from floating or advanced land bases. The alert phase begins when the hostile force arrives within this striking distance, and continues until the enemy has occupied transport areas preparatory to a general attack. It will be noted that the alert phase, as applied to air defense, begins **prior** to the arrival of the hostile troop convoy within overnight steaming distance of the base, and may thus antedate the general alert phase by several days.

(b) Air operations during the **reconnaissance** phase will include strategical scouting of distant sea and land areas, and tactical scouting of the areas immediately contiguous to the base. Aside from the intensive scouting operations to be performed, the reconnaissance phase may be considered a period of comparative respite for the air force. The time available may well be utilized for the perfection of passive defensive measures, and for the organization and further training of the separate task groups.

(c) During the **alert** phase scouting operations are intensified in those areas occupied by enemy forces, and if necessary may be slackened in other areas. Striking units begin counter air force operations, changing to the attack of hostile convoys as the enemy force approaches the base. Fighter squadrons initiate continuous general support over the base activities. The mission of the air force during

this phase is to maintain continuous surveillance of the enemy, to inflict the maximum damage on his forces before they can reach their transport areas, and to prevent enemy air forces from executing effective attacks on vital base installations. The base defense air force will make its maximum effort during the time that a discovered hostile force is making its approach, and while the ship-to-shore movement is in progress. Thus the action begun in the **alert** phase continues without abatement into the **final defense** phase.

(d) Part Two describes in detail the tactics and technique applicable to the air defense of an advanced base, following generally the outline given above. It is intended as a guide for the formulation of tactical doctrine, and should not be construed as a rigid manual. Flexibility and originality in the application of tactical principles to specific problems are to be encouraged.

SECTION 2

COMPOSITION AND ORGANIZATION OF THE AIR FORCE

	Paragraph
General.....	61
Reconnaissance Units.....	62
Striking Units.....	63
Fighting Units.....	64
Auxiliary Units.....	65
Task Organization of the Air Force.....	66

61. General.—For the defense of an advanced base all four classes of tactical aviation are essential. The proportions of each class will depend upon the geography of the base with reference to accessibility to enemy attack; its proximity to other friendly bases; and the maximum probable effort of hostile air and surface attacks which must be withstood. An effort should be made to provide a balanced air force insofar as the availability of units will permit. Substitution of types is always undesirable, but may become necessary in order to secure adequate numerical strength. The most modern types of naval aircraft will always be with the carrier divisions of the Fleet, and it may well be that the air forces assigned to the defense of bases may not be ideally equipped. Considerable versatility of tactical employment may therefore be a necessary evil, and units may frequently have to be employed on missions for which they are imperfectly suited. In planning the air defense of a base suitable types should be provided for the various missions insofar as they are available; substitution should be accepted only as a last resort. In any event there must be enough aircraft to provide a reasonable defense, which means that if less efficient types are provided, additional units will be necessary.

62. Reconnaissance Units.—(a) **Patrol Seaplanes.**—As any advanced naval base must of necessity be located near large water areas, the importance of patrol seaplane squadrons for distant reconnaissance is obvious. This class of aviation, when operating from tender bases, is independent of shore basing facilities, and has the necessary operating range and communication facilities for strategical scouting over areas several hundred miles removed from the advanced base. The ability of these craft to remain in the air for long flights, and to operate from advanced floating bases, is an invaluable asset when faced with the necessity of reconnoitering all sea and coastal areas within a radius of some seven or eight hundred miles, any part of which areas may contain enemy air or surface forces. Without patrol squadrons these areas cannot be adequately reconnoitered; the provision of such squadrons as a component of the base air force is thus essential. Inasmuch as no patrol squadrons are provided in the

Marine Corps aeronautical organization, they must be assigned from the Fleet for this duty. A minimum of two squadrons should be available for the average advanced base.

(b) **Scouting Units.**—The primary function of scouting units in base defense operations is to provide close reconnaissance of the area immediately surrounding the base, to a radius equal to the overnight steaming distance of major naval vessels. This is generally taken to be approximately one hundred and eighty miles, or something over one hour's flight time for the latest type scout landplane. One pair of scouting airplanes can cover a sector of twenty degrees to this distance on one flight of about three hours. Two squadrons are therefore required to cover the entire area of the scouting circle for one search. If the base is so situated that only part of the scouting circle need be covered, the minimum scouting force may be reduced accordingly.

63. Striking Units.—(a) **Types.**—Under this classification is included all the types designed for the attack of surface objectives: attack aviation, bombing aviation, and possibly torpedo units.

(b) **Attack Units.**—Attack aviation is particularly suitable and desirable for inclusion in the base air force. For the attack of aircraft on carrier decks, transports, troops in small boats, etc., no other class of aviation can approach its efficiency. It has sufficient radius of action (400-500 miles) to enable it to accompany bombers, or act independently, against hostile naval objectives while the enemy is yet outside the operating radius of his carrier-based aircraft. Its formidable fire power would have a most devastating effect on troops debarking from transports, crowded in small boats, or while gaining a precarious foothold ashore. A group of four attack squadrons should be sufficient for the defense of an advanced base; half that number might perhaps prove barely adequate.

(c) **Bombing Aviation.**—In computing the number of bombing units to be included in the air force, due consideration should be given to the capabilities of the patrol squadrons when used as bombers. Modern patrol seaplanes are very effective long-range, heavy bombers. At the conclusion of the reconnaissance phase the patrol units would be available for bombing missions, and thus form the nucleus of an air striking force. In addition, however, dive bombing units are necessary in base defense operations. The horizontal patrol bombers, being more vulnerable to fighter attack and the fire of antiaircraft batteries, are best utilized for night attacks of naval objectives. For day attacks, especially against precision targets, the dive bombers are superior within their range. They are also more useful during the final defense phase for the attack of

transports, supporting vessels, small boats, etc. A minimum of two dive bombing squadrons should be provided for the base air force.

(d) **Torpedo Aviation.**—As a supplement to bombing aviation, torpedo squadrons, if available, could be utilized during the alert and final defense phases for the attack of transports and supporting vessels. As this class properly belongs to the striking force of Fleet aviation, the inclusion of torpedo units in a base air force may be considered exceptional.

64. Fighting Units.—The adequate air defense of an advanced base will suggest that approximately fifty percent of the base air force consist of fighting units. Lack of a reporting net around an island base, for instance, will require that protection for base facilities be provided by the air patrol system, a method very wasteful of fighter strength. In order to maintain one squadron in the air continuously during daylight hours, three squadrons must be assigned to the mission. One squadron in the air cannot be considered adequate protection for a major naval base: two squadrons are scarcely sufficient force for the task. Six squadrons of fighters may then be considered the minimum necessary to provide continuous general support over the base facilities. Two additional squadrons might well be considered necessary for special support in connection with striking force missions. Thus a minimum of two four-squadron groups of fighting aviation might be considered necessary to properly balance a base air force. No such force is available in Naval aviation at the present time, nor would it ever likely be available for the defense of an advanced base. The defender must usually accept something less than adequate protection and endeavor by clever tactical employment to compensate for lack of strength. On this premise then, one group of fighting aviation may be compelled to do the work of two. In such a case, reasonable protection should be afforded the most vital areas of the base: for this, nothing less than three squadrons can be considered adequate.

65. Auxiliary Units.—In addition to the tactical squadrons, a base air force will require certain auxiliaries such as utility squadrons, service and headquarters units, and possibly attached ground units comprising engineer, motor transport, and communication troops. The construction, maintenance, and supply of dispersed airdromes, the establishment of road and wire communication facilities, and the provision of antiaircraft defense and ground security, will require the services of a well organized ground force, quite beyond the capabilities of aviation personnel. In this connection it should be remembered that the primary duties of aviation personnel are concerned with keeping tactical units in the air; in wartime all their energies

will be expended to this end. Provision and maintenance of air base facilities come within the province of appropriate ground units. Whether or not these units are attached to the air force is relatively unimportant, so long as they are made available for the tasks at hand.

66. Task Organization of the Air Force.—Whatever the peace time administrative organization may be, it is deemed advisable to organize the base air force into homogeneous tactical groups in order to facilitate operations and simplify the issuance of orders. Each group will have a main airdrome with such alternate and auxiliary airdromes as may be available for assignment. Each group will be assigned a commander and suitable staff; and will have attached to it a headquarters and service squadron. Such an air force as described might be given a task organization as follows:

TASK ORGANIZATION.

Reconnaissance Group, Colonel B.

VMS-1

VMS-2

VP-7 (Navy)

VP-9 (Navy)

Fighting Group, Colonel C.

VMF-11

VMF-12

VMF-21

VMF-22

Striking Group, Colonel D.

VMA-1

VMA-2

VMB-1

VMB-2

SECTION 3

RESPONSIBILITY FOR AIR DEFENSE

	Paragraph
Central Control.....	67
Authority of Air Commander.....	68

67. Central Control.—In order that the most effective use may be made of the air force assigned for the defense of an advanced base, its command must be centralized and control vested in that headquarters which is responsible for the general conduct of the defense. The defensive forces of a base may consist of naval surface vessels, Marine units ashore, and possibly Army troops. All of these units may have originally had air units attached. If so, such air units will become a part of the base air force under the direct command of the senior air commander. Tactical control of the base air force is a function of the base commander, who will normally be a flag officer of the Navy. Commanders of subordinate surface units will have no aviation attached, but will be supported as deemed necessary. Only through such centralized control of all available aviation may the relative importance of the various missions be determined and economical assignments made.

68. Authority of the Air Commander.—The plans for air support must be sufficiently flexible to allow the air commander considerable independence of action in their actual execution. His authority in this respect should be limited only by general instructions, which should include definite missions arranged in order of priority. The launching of air attacks under rigid and fixed plans is unsound. Targets are often fleeting, vulnerable one moment and strongly protected the next, changing with such rapidity that momentous decisions must frequently be made on the spot if full advantage is to be taken of the opportunities offered. Often the air commander alone may be in close touch with such a rapidly moving situation; his authority to act promptly should not be restricted. To a lesser extent, it may be necessary to delegate a limited freedom of action to the commanders of aviation task groups, or even on occasion to squadron commanders.

SECTION 4

AIRDROME REQUIREMENTS

	Paragraph
Main Airdromes.....	69
Auxiliary Airdromes.....	70
Dummy Airdromes.....	71
Advanced Landing Fields.....	72
Importance of Dispersion and Concealment.....	73

69. Main Airdromes.—(a) The main airdromes assigned to each major task group should be so located with respect to base activities as to take advantage of maximum antiaircraft protection. This is particularly true with respect to the air force headquarters airdrome, which will normally contain the major overhaul and supply facilities. Auxiliary antiaircraft machine gun protection will be necessary for all main and auxiliary airdromes; if insufficient machine-gun batteries are available, it may be necessary to improvise emergency crews from aviation personnel to man such machine guns as may be rigged for antiaircraft fire.

(b) All main airdromes must have adequate communication facilities: rail or improved motor road connections; radio and telephone nets; and command post installations for air force and task group administration. The responsibility for providing these installations rests with the base engineer and signal communication troops. Air force personnel will man the command posts and communications stations.

(c) The provision of substantial hangars and shops will seldom be practicable, due to lack of time and material, or because of the inadvisability of concentrating aircraft and personnel in such confined spaces. For the main overhaul and supply base certain buildings will of course be necessary, but they should be dispersed about the airdrome as much as possible and camouflaged. The airplanes may be parked at irregular intervals around the perimeter of the landing fields under shelter of trees, or in revetments with camouflaged overhead cover. Bomb and gas proof shelters should be provided for the airdrome personnel as a refuge from hostile air attacks.

70. Auxiliary Airdromes.—(a) As many auxiliary and alternate airdromes should be established as terrain and time will permit. Such airdromes must be so located as to reduce the probability of their early discovery by hostile aviation. They should be a considerable distance away from the main airdromes—as much as fifty miles in some cases—and should be dispersed and artfully camouflaged. No large buildings will be constructed on auxiliary airdromes, but underground shelters are desirable for gasoline and bombs. Ample supplies of these items should be stored on the airdromes prior to the

beginning of the alert phase, in order that designated units may shift their bases of operation without delay. Radio and telephone connections must be available to facilitate command and tactical control. Limited messing and quartering facilities are desirable for the crews of aircraft which may be operating from these fields.

(b) Normally but one squadron is assigned to an auxiliary airdrome. Each group will be assigned auxiliary airdromes within the same general area in order to facilitate tactical operations. Alternate airdromes, when available, are also assigned to each squadron, or to the group for further assignment as needed. Fighter airdromes are so located as to cover the most likely air routes of approach to the advanced base, and to facilitate the rapid assembly of units over the areas to be protected. Bomber airdromes must be located on a good road or navigable waterway to facilitate the handling of heavy material. The airdromes of bombing and attack units should be located well inland where possible, for purposes of concealment and dispersion. Auxiliary airdromes for scouting airplanes may be nearer the beach to facilitate coordination with the patrol squadrons of the reconnaissance group. Auxiliary seaplane bases are established in sheltered waters about the base for the dispersion of patrol seaplanes and utility amphibians.

71. Dummy Airdromes.—One of the most effective means of concealing the location of aircraft on the ground and confusing the enemy air forces as to their location, is to construct a number of dummy airdromes, partially concealed and camouflaged. Hostile observation airplanes will invariably spot these, and subsequent air attacks may be expected. A little ingenuity in the use of dummy or unserviceable airplanes will add to the realistic appearance of a fake airdrome and cause an over eager enemy to be completely deceived, and his attention diverted from the real airdromes. Portable hangars may be erected, and ground crews directed to taxi old airplanes around the field at intervals, or if the landing surface permits, planes may be flown in and out of the field at intervals.

72. Advanced Landing Fields.—Where possible, advanced landing fields will be established near the command posts of brigades, and smaller units which may be defending separate sectors. Advanced landing fields or seaplane facilities may also be established on adjacent islands or other distant terrain in order to extend the radius of action of air units, particularly reconnaissance aircraft. These advanced landing fields will normally be provided only with skeleton ground crews and limited fuel supplies.

73. Importance of Dispersion and Concealment.—(a) The geographical location for an advanced base will not generally provide unlimited terrain for the construction of landing fields; nor will such

location always permit of ideal dispersion for airdromes. Nevertheless, every effort must be made to disperse the defending air units and conceal them while on the ground.

(b) Generally speaking, dispersion is effected by distributing air units on auxiliary airdromes, and by further providing these units with alternate airdromes to which they can shift operations at intervals. Airplanes are individually dispersed on the airdromes so that concentrated targets are never presented to hostile aviation. Concealment is effected by the use of natural cover, supplemented by camouflage. Camouflage consists of painting individual aircraft to reduce overhead visibility, and the construction of overhead cover for revetments containing aircraft. Camouflage also includes the employment of dummy airdromes and dummy aircraft to draw hostile fire, and the construction of dummy obstacles on actual runways and landing areas to hide their identity from hostile air observation. The proper application of camouflage technique should be supervised by trained engineers.

(c) The restricted areas normally available for the passive defense measures outlined above tend to neutralize any halfway attempts at dispersion and concealment, because the enemy is able to concentrate his efforts over the most likely locations for airdromes. Drastic measures should be taken to make dispersion and concealment effective; camouflage discipline must be strictly observed. The hostile air force may be expected to be greatly superior in strength to that of the defenders, and its first objective will be the location and destruction of the defender's aircraft. The survival of the base air force until the final defense phase will depend almost entirely upon the effectiveness of passive defense measures during the preliminary hostile air operations.

SECTION 5

COMMUNICATIONS

Air-ground and Interplane Communication-----	Paragraph 74
Ground Communication-----	75

74. Air-ground and Interplane Communication.—The standard airplane radio equipment and procedure, supplemented by the usual methods of visual communication, will suffice for base defense air operations. All airplanes are now equipped with radio and the crews are well trained in its use. Radio control of air operations is normal procedure, and requires no particular discussion here.

75. Ground Communication.—(a) The dispersion of air units on widely scattered airdromes introduces a serious problem in ground communication. It will be necessary to establish an adequate wire net (telephone, telegraph, teletype) between air force headquarters and the various airdromes. The controlling factor in establishing ground communication facilities between air force units is the vital necessity for speed in the dissemination of information and orders. With the current high speeds of aircraft, a matter of a few seconds may well mean the difference between interception of a hostile air raid or failure to establish contact. Radio communication should not, therefore, be depended upon entirely, even though available. To facilitate the issuance of orders and the rapid assembly of units in the air, the air force and task group commanders must be able to effect instantaneous contact with subordinate commanders without the necessity of coding or decoding messages. The teletype is the most effective instrument for air force ground communications, as formal orders can be issued simultaneously to all air units concerned, with little or no danger of hostile interception or interference. Responsibility for the installation and maintenance of wire lines to air force headquarters, and between the various airdromes, rests with the Force signal communications officer. Air force communication personnel man switchboards and instruments, and are responsible for installation and maintenance of local airdrome circuits.

(b) Local airdrome telephone circuits should be provided as necessary to facilitate operations and administration. The various airdrome activities will be dispersed about the perimeter of the landing fields a considerable distance apart. Messenger communication between airdrome headquarters, squadron offices, ordnance, engineering, and operating crews would be impracticable. There is no point in providing rapid service to the airdrome switchboard from outside, unless provision is also made for the equally rapid internal dissemination of such information and orders.

Chapter VII—AIR OPERATIONS DURING THE RECONNAISSANCE PHASE

- Section 1. Strategic Reconnaissance.
 2. Tactical Reconnaissance.
 3. Fighter Support.
 4. Disposition of the Air Striking Force.

SECTION 1

STRATEGICAL RECONNAISSANCE

	Paragraph
General	76
The Patrol Plan.....	77
The Scouting Plan.....	78

76. General.—(a) Distant (strategical) air reconnaissance from an advanced base is designed to prevent the surprise approach of an enemy force within striking distance. This implies security against air surprise as well as surface surprise, and consequently entails the systematic search of all areas within which an enemy air or naval base might exist. For an isolated island base this requirement would necessitate the search of the entire area of the circle described about the defended base to a distance of several hundred miles. Such a task will be beyond the capabilities of the reconnaissance force normally available; it may be possible to search only those distant areas in which the presence of enemy forces is most probable. Usually a careful intelligence study will eliminate much of the area which might be occupied by enemy bases and will determine the most likely routes of approach for hostile forces, thus conserving air reconnaissance strength for intensive operations over particular danger zones. Surface scouting forces will be used wherever possible to supplement air reconnaissance, and the activities of these agencies coordinated to prevent duplication of effort.

(b) The base commander will allot areas for air and surface reconnaissance, indicating if necessary the distance to which aircraft will search, the frequency of the missions, and the particular information sought. This information will usually be contained in the intelligence annex, to which may be appended a patrol plan and a scouting plan. The air commander will normally be called upon to submit such plans for approval, or to aid in their preparation. The details of execution are always left to the air commander.

77. The Patrol Plan.—(a) The search of distant sea and coastal areas is normally assigned to patrol squadrons. If this class is not available, long range landplane scouts must be utilized for distant reconnaissance. The patrol plan is a graphic diagram imposed on appropriate charts, which indicates the sectors assigned to each

patrol squadron. These sectors may be geometrical in pattern for sea areas, or they may conform to coastal outlines of the mainland or chains of islands. The radii of the sectors should not greatly exceed seven hundred miles—two days steaming time for troop convoys, and approximately equal to the maximum operating radii of hostile land based bombers. The inner limit of the patrol sectors corresponds to the outer limit of the scouting circle, which is described with a radius of approximately one hundred and eighty miles from the base. In assigning sectors to patrol units, due consideration should be given to the physical limitations of the equipment and personnel. Although the aircraft can remain in the air for periods greater than twenty-four hours, daily missions should not greatly exceed eight hours, if long continued operations are contemplated. The technique of searching a sector is determined by the squadron commander in accordance with established naval doctrine. Usually the sector is subdivided by the squadron commander and such subsectors assigned to individual airplanes or sections as conditions warrant.

(b) Patrol seaplanes engaged on distant reconnaissance missions will not ordinarily carry bombs as their weight greatly reduces the radius of action. Single patrol seaplanes, or small formations, are very vulnerable to fighter attack and antiaircraft gun fire. To risk such attacks during daylight may result in loss of the aircraft and consequent failure of the reconnaissance mission. However, occasions may arise where a form of search-attack is advisable, such, for instance, as the search for a hostile aircraft carrier. Even so, single aircraft would not be employed for such a task; less than a division against one defended objective would have small chance of success. Generally speaking, then, it is preferable to separate the reconnaissance and bombing functions of patrol aviation.

78. The Scouting Plan.—To supplement the activities of patrol aviation, or long-range scouts, and to relieve them of the responsibility for strategical reconnaissance of areas within the range of shore-based aircraft, a scouting plan is drawn up and issued to the scouting units for execution. Usually, this plan includes all the sea area within one hundred and eighty miles radius of the base, or the overnight steaming radius of a hostile fifteen-knot convoy. An appropriate sector is assigned each squadron, which in turn subdivides the sector for assignment to individual airplanes or sections of two airplanes. Each such subsector covers an arc of twenty degrees for average conditions of visibility. Thus each squadron can cover three hundred and sixty degrees by single airplanes, or one hundred and eighty degrees if airplanes are dispatched in pairs. During the reconnaissance phase these sectors are searched daily, the

aircraft leaving the outer limits at dusk. The scouting plan, during the period of strategical reconnaissance, is but an additional measure of security; the patrol units are expected to discover the enemy long before he enters the scouting zone. Scouting missions may, therefore, be somewhat less frequent and less intensive than they will be during the alert phase.

SECTION 2

79. Tactical Reconnaissance.—Strictly speaking, tactical reconnaissance does not begin until the initiation of the alert phase. There may be occasions, however, where small enemy forces are known to be on islands or other terrain within short scouting range of the base: and it is considered advisable to maintain them under surveillance, even though they do not in themselves constitute an immediate threat. The base commander, or the shore defense commander, may request that air reconnaissance be made of certain contiguous land or coastal areas for the purpose of securing information as to their hydrography and geographical features, necessary in the proper planning of a defense. Such missions, within comparatively short distances, may be considered as tactical reconnaissance, even though they occur before contact has been established with a major hostile force. In this instance the classification of strategical or tactical reconnaissance depends upon the distances involved. Missions of tactical (close) reconnaissance are normally assigned to scouting or observation aviation.

SECTION 3

FIGHTER SUPPORT

	Paragraph
Introduction.....	80
General Support.....	81
Special Support.....	82

80. Introduction.—The reconnaissance phase should be utilized for the perfection of a fighter defense for the base. Establishment of airdrome facilities, organization of task groups, and training of units to operate en masse will occupy the available time. For purposes of training, daily air patrols should be flown over the base installations, even though no immediate danger of air attack exists. Activities should be carefully coordinated with the anti-aircraft defenses and zones of responsibility for each arm decided upon. In short, the period of respite afforded prior to the approach of a hostile force should be an intensive training phase for fighter units.

81. General Support.—General support missions will be flown during the reconnaissance phase for training purposes, and as a measure of added security. A surprise air attack is always possible, regardless of the efficiency of strategical reconnaissance. Air patrols of reasonable strength should therefore be on station (in the air) at the most probable times for enemy air attack—dawn and dusk. One squadron may perhaps be sufficient for this task, but as a matter of security, all squadrons should habitually be in an appropriate condition of readiness during these hours. Attacks are not expected during the reconnaissance phase; but to be surprised is inexcusable.

82. Special Support.—(a) Reconnaissance units are not habitually provided with fighter escort during this phase. The fighters have insufficient range to accompany patrol seaplanes even were they needed, and there would be no point in employing fighters with fast scouts. A reconnaissance in force is an offensive maneuver; it will normally not be included in the initial plans for defense of an advanced base.

(b) Should the striking force be used for the attack of a distant land base during the conduct of strategical reconnaissance, special support by fighting squadrons might possibly be required. However, such attacks against hostile bases which do not offer an immediate threat to the security of our own base may be considered a remote contingency. The attack of distant hostile bases which do threaten our security will usually occur during the alert phase, after such bases have been reconnoitered by our patrol units. Generally speaking, there will be no call for special fighter support during the reconnaissance phase.

SECTION 4

DISPOSITION OF THE AIR STRIKING FORCE

	Paragraph
General	83
Employment	84

83. General.—Offensive operations by the striking components of a base defense air force will be limited during the reconnaissance phase to the attack of objectives of a vitally important nature, the existence of which constitutes a serious threat to the integrity of the base. Normally, only the enemy air force installations, particularly his floating bases, will be considered as appropriate objectives for long range bombing missions. The attack of a hostile troop convoy will not usually be undertaken prior to the initiation of the general alert phase.

84. Employment.—(a) The reconnaissance phase may be utilized as an intensive training period for the air striking forces. Daily flight operations may be conducted for the perfection of technique and the improvement of air marksmanship. Completion of air-drome facilities and concealment measures will, however, have priority over actual air operations. Camouflage tests and drills are appropriate tasks for striking force units during the period of waiting. The guiding principle of employment should be conservation of air effort without loss of personnel efficiency, bearing in mind the probable limitation of fuel and other operating supplies.

(b) Offensive operations undertaken during the reconnaissance phase will usually involve only the long range patrol bomber, and long range horizontal land bomber types.

Chapter VIII—AIR OPERATIONS DURING ALERT PHASE

- Section 1. Reconnaissance Missions.
 2. Offensive Combat Missions.
 3. Fighter Dispositions.

SECTION 1

RECONNAISSANCE MISSIONS

	Paragraph
General.....	85
Tracking Hostile Convoy.....	86
Maintaining Search.....	87
Tactical Reconnaissance.....	88
Air Force Missions.....	89
Secondary Combat Missions.....	90

85. General.—When air reconnaissance has discovered the approach of an enemy force within striking distance of an advanced base, the alert phase may be said to begin. Reconnaissance is intensified; air striking forces are alerted for offensive missions; fighting units initiate continuous daylight air patrols over the vital areas of the base. All base activities are placed on a “contact imminent” schedule, and defensive works are manned. Precautions against hostile air raids take precedence over all other activities, as the enemy will undoubtedly precede his landing attack by preliminary air operations.

86. Tracking Hostile Convoy.—(a) Contact once having been established with a hostile convoy, every effort will be made to maintain surveillance. Aircraft discovering hostile naval units will endeavor to remain out of visibility range of the ships, report immediately by radio the size, composition, speed, and course of the hostile force, then continue tracking until relieved. Similar doctrine applies to the discovery of a land air base, except that greater difficulty will be experienced in maintaining surveillance without detection. In any event the report must be made and acknowledged before further action is taken. It may be prudent for the aircraft to draw away from the immediate vicinity of the enemy until this is accomplished.

(b) Upon receipt of a contact report at air force headquarters, the enemy position, track, and speed are plotted without delay, and the base commander duly notified. Relieving aircraft are immediately dispatched to the scene and continuous radio contact maintained with the trackers. Usually two aircraft, one on each flank of the hostile force, will be sufficient for the purpose. More than that will probably result in detection and destruction by hostile fighters. Contact is maintained throughout the hours of darkness, if conditions permit. If lost during the night a sufficient reconnaissance force must be dispatched to insure gaining a second contact without delay. Patrol

units will be utilized for tracking until the hostile force comes within the operating radius of scouting airplanes, after which most of the patrol seaplanes will normally be diverted to bombing missions, leaving all further tactical reconnaissance to the scouting squadrons.

87. Maintaining Search.—The discovery of one enemy convoy does not justify the abandonment of strategical scouting in other areas. There may be more than one hostile force approaching. The patrol plan remains effective until it is apparent that all enemy units have been discovered, or the imminent approach of an attacking force requires the utilization of all patrol squadrons for bombing missions.

88. Tactical Reconnaissance.—(a) As soon as a hostile convoy is reported, the scouting units begin covering their assigned sectors twice daily, and continue this schedule until the hostile force has actually entered the scouting circle. At this time the scouting force may partially abandon those sectors not likely to contain enemy forces, and concentrate on maintaining an intensive reconnaissance of the located enemy forces. Units not required for the initial missions should be held in concealed reserve for employment during the final defense phase.

(b) It is imperative that tactical reconnaissance airplanes report exactly the number and classes of transports, supply ships, and supporting combat vessels comprising the hostile force. They should particularly endeavor to locate and maintain contact with the enemy carriers, which might normally be expected to operate at some distance from the main body. A sharp lookout must also be kept for the approach of detached forces, raiding parties, and submarines. Airplanes on antisubmarine patrol will carry bombs; other reconnaissance planes may be so armed at this time if considered advisable.

(c) The entry of the hostile convoy into transport areas should be reported without delay, in order that air attacks may be launched at the proper times. This will usually entail night reconnaissance and the liberal use of observation flares. However, there is no longer any occasion for attempting secret observation of the enemy once he is committed to action. Night contact should not be particularly difficult to maintain during favorable weather when the hostile convoy is within a hundred miles of the base.

89. Air Force Missions.—Scouting units will be employed in connection with independent air force missions to locate proper objectives, maintain them under surveillance, guide striking forces to their targets by radio or beacon flares, and provide illumination for night attacks. Scouting airplanes may also accompany such forces to photograph results of bombing attacks. Better results will be obtained if one scouting unit is assigned solely for air force reconnaissance, other units being assigned as necessary to support surface forces.

90. Secondary Combat Missions.—Although modern scout bombers are effective striking weapons, their employment as part of the striking force during the alert phase should be limited to search-attack missions while on antisubmarine patrol. The number of strictly reconnaissance missions to be performed will probably occupy the full time of at least two scouting squadrons. As long as bombing and attack units are in operation, the assignment of attack missions to scouts will seldom be justified. Reconnaissance must always have priority.

SECTION 2

OFFENSIVE COMBAT MISSIONS

	Paragraph
General	91
Employment of Bombers.....	92
Employment of Attack Aviation.....	93

91. General.—(a) The early offensive employment of the air striking force may depend upon its strength with relation to the minimum requirements for base defense. If a sufficient margin of strength exists, the air striking force should endeavor by all means to get in the first blows on an approaching enemy, particularly if that enemy is depending on carrier-based aviation to support his landing attack. The base air force will usually have superior radius of action, as compared with carrier-based aircraft, and thus may have the opportunity to neutralize the hostile air force before it comes within effective range of the base. Other lucrative targets will be the transports and supply ships during their approach to the transport areas. As this approach will normally be made during darkness, continuous night attacks can be made without fear of the hostile fighters. The enemy will have made his final plans and dispositions for the landing; any material casualties which may be inflicted upon him at this time will cause serious confusion and delay.

(b) Priority of objectives for the striking force during the **alert** phase is as follows:

- Aircraft Carriers.
- Land Air Bases.
- Transports.
- Supply Vessels.
- Combatant Vessels.

Initially, the striking force should concentrate on the enemy air bases, whether floating or on shore. During the final approach to the transport area attention should be shifted to the transports and other unarmored vessels. Armored combatant ships are secondary objectives as long as more vulnerable targets exist. The importance of concerted air attacks is worthy of double emphasis; the air striking force should never be unduly dispersed on an excessive number of missions, but objectives should be taken one at a time in the order of their importance. Secondary objectives are always assigned, in the event that primary targets cannot be located or reached.

(c) If the defending air force is numerically weak, the base commander may feel obliged to forego any offensive air operations during the alert phase. Such striking forces as are available are then held in concealed reserve, and not placed into operation until the beginning

of the final defense phase. Such a course has the advantage of surprise against an enemy who may have been lulled into a false sense of security by his failure to discover any air striking units. Surprise attacks launched against transports during debarkation would seriously impede and delay the progress of the landing, if not entirely disrupt the operation and force withdrawal. The disadvantage of such a course lies in the possibility that the enemy air force may locate and destroy the defending air units on their airdromes, thus depriving the base defense of a most valuable weapon before it is brought into use. The question of whether or not to employ an inferior air striking force prior to the final defense phase cannot be answered dogmatically; the base commander must estimate the situation and decide for himself in each instance.

(d) Even though the air force is to be used offensively during the alert period, it is always incumbent upon the air commander to consider holding out certain units in reserve, to assure the availability of a striking force during the final defense phase. These units are dispersed and concealed and should not be operated prior to the arrival of the hostile convoy in the transport area. The effectiveness of their attacks will depend largely upon the surprise factor involved. The number of units to hold in reserve will vary with each situation; perhaps the minimum requirement would be two attack squadrons, or their equivalent in other types.

92. Employment of Bombers.—(a) **Patrol Bombers.**—(1) The patrol bomber, or the Army type of long-range horizontal bomber, will usually be the initial weapon to be used against an attacking force. These aircraft are effective up to a bombing radius of eight or nine hundred miles. Distant air bases, or aircraft carriers with an approaching convoy, will be the initial objectives assigned this class. Other naval objectives should be considered of a secondary nature for long-range missions, as the hazards incident to such operations are justifiable only when opportunity exists to deal the enemy a telling blow. The vulnerability of aircraft carriers is, however, sufficient incentive for even the most conservative air commander. When such hostile objectives are reported within range, patrol bombers should be dispatched against them. The technique of such operations is covered elsewhere; it will suffice to state here that six patrol bombers is considered the minimum effective force to dispatch against one aircraft carrier, and that attacks will normally be launched under cover of twilight or darkness. The daylight attack of a carrier, surrounded by a cordon of vessels armed with antiaircraft batteries, and protected by its own fighter force, is hardly within the capabilities of a small unit of patrol bombers, unsupported by other types.

(2) If any patrol-bomber units remain in action after the initial offensive operations, they may be used against the transports during

the final night approach of the hostile convoy to its debarkation areas. A succession of individual attacks, arranged by time periods, is preferable for this operation. It is not expected that hostile carriers will be in the near vicinity of the convoy at this time, nor that they may be readily located during darkness. Therefore, the entire bombing group will normally concentrate on the main convoy.

(b) **Dive Bombers.**—(1) The dive bombing units, within the limits of their operating radius, may be employed in conjunction with patrol bombers for coordinated attacks against appropriate objectives. In fact, the two types should be employed in the same task group as soon as the hostile convoy comes within range of the dive-bombing units. Hostile carriers remain the primary objective, and may be attacked during daylight with a combined force of patrol units and dive-bombers, supported if practicable by attack aviation. Superior accuracy of bombing against moving targets and relative immunity to anti-aircraft fire are valuable characteristics of the dive-bombers, and should be utilized to the limit in the assignment of objectives to squadrons. The patrol-bomber is limited to rather large and comparatively slow-maneuvering targets; the dive-bomber can effectively attack the fastest cruisers. Thus, if a hostile aircraft carrier is in company with a supporting force of combatant ships, the dive-bombers might be utilized to attack these vessels as a diversion while the heavy bombers attack the carrier.

(2) During the close approach of the hostile convoy, dive bombers should be used against transports. They are reasonably effective for night attacks against illuminated targets, when employed individually or in small formations; each airplane or formation being assigned a time period for its attack to permit individual aiming of bombs and to avoid possibility of collision in the darkness. In the attack of a large convoy at night a series of continuous individual airplane attacks should have a most harassing effect.

93. Employment of Attack Aviation.—(a) Attack aviation may be employed in connection with bombing units, or separately, in missions against hostile seacraft. It is normally employed to support bombing aviation, although it can under favorable circumstances be effectively employed alone against aircraft on carrier decks or airdromes, and against troops on transports.

(b) Due to the necessity of holding out an adequate striking reserve for the final defense phase, and because of the peculiar effectiveness of attack aviation against debarking troops and small boats, it is believed generally advisable not to employ a small attack group during the alert phase. Such attack squadrons as are available might well constitute the nucleus of the final reserve, and remain inoperative and well concealed until the beginning of the final defense phase.

SECTION 3

FIGHTER DISPOSITIONS

	Paragraph
Introduction	94
General Support	95
Special Support	96

94. Introduction.—(a) Fighting aviation will be called upon for its maximum effort during the alert phase. Enemy air attacks may be expected with increasing intensity during this period, as the hostile air force will undoubtedly seek to materially reduce the defenses prior to the arrival of the transports off-shore. If such attacks are to be intercepted, fighter units must maintain constant vigilance, particularly during those daily periods which are most favorable for the launching of air attacks. If the base is located on a small island, or the use of adjacent terrain for warning net installations is restricted, the interception of hostile air attacks becomes a formidable task. The average fighter strength assigned the defense of a base will probably be inadequate to entirely prevent determined attacks by a superior force; the best that can be hoped for under expected conditions of base defense is to be able to seriously interfere with the accuracy of the hostile bombing and to inflict such casualties on the enemy air force as to discourage further efforts against the vital areas of the base.

(b) In extreme cases, where the available fighter force is hopelessly outnumbered by the escorting enemy fighters, the base commander may direct that preliminary air raids be entirely unopposed in the air, reserving the small defending fighter force for operations during the final defense phase. Such a drastic course of action is not, however, generally recommended. It leaves the base installations partially at the mercy of hostile aviation, depending upon the effectiveness of the anti-aircraft defenses; and does not guarantee the presence of the defending fighters during the final defense phase, due to the probability that they will be discovered and destroyed on their airdromes.

95. General Support.—(a) The primary mission of defensive fighter aviation is the provision of general air support for the base installations. The technique used to provide such support will depend upon the location of the base, but will in most cases be restricted to the air-patrol method. If continuous daylight patrol is to be maintained, but one-third of the available fighter strength will be effective; if activities are restricted in part to early morning and late afternoon patrols, one-half of the available strength can be placed in the air. Much will depend upon known enemy methods of conducting air attacks.

(b) Every effort should be made to provide as many aircraft reporting stations as possible, utilizing vessels of the local naval defense

force, detached posts on adjacent islands, antiaircraft warning installations, etc. Obviously, if conditions permit, a complete aircraft warning net that would permit the employment of ground-alert tactics would be most desirable. Even a partially complete warning system covering certain approaches will be of great assistance to the fighting group commander. The air-patrol method of defending an area is excessively wasteful of fighter strength, and will seldom insure complete protection against air attacks. Any provision that can be made to permit the partial employment of air-alert or ground-alert methods will greatly increase the efficiency of the defending fighter force.

(c) The area assigned the fighting group to protect should be restricted to the vital base and air force installations. It will be impossible to provide protection, except incidentally, to outlying stations or defensive positions: the dispersion of fighter units over a large area would completely defeat their primary function. Points more than ten miles apart cannot be adequately defended by a single fighting group operating on the air patrol system. Therefore, the defended area should be restricted to that diameter, if possible.

(d) Definite division of responsibility between the fighter units and the antiaircraft defense force must be determined by the base commander and published to all concerned. The normal area to be assigned the antiaircraft batteries is that part of the base area lying within the circle of battery positions, the fighter force being usually assigned all the area outside of this circle. In other words, when the enemy bombers arrive over the gun batteries, the defending fighters should withdraw and permit the guns to engage the enemy. The fighters may then reengage the enemy during his withdrawal, if such action appears advisable. It is generally impracticable for both defending agencies to be engaged simultaneously.

96. Special Support.—(a) Protective escort missions for the air striking units may be considered as secondary tasks for the base fighter force. Generally speaking, such employment of defending fighters will be rare. The requirements of base defense with a limited fighter force will seldom permit the dispatch of fighter units on distant missions. If more than an adequate force is available for base defense, however, fighter units may be assigned air force missions of escorting bomber and attack units to and from their objectives. Such employment is obviously desirable, even though seldom practicable, and would greatly increase the efficiency of the striking force. The temptation to send fighters along on important offensive missions will always exist, and the air force commander will often be faced with a dilemma in this respect. Decision must be based on the existing situation, which usually will indicate that the fighters should remain over the base installations.

(b) Special support for detached ground forces, or separate activities outside the base area proper, may be required during the conduct of a base defense. In the defense of a large island, or coastal area, the fighter units detailed for general support over the vital base installations may be unable because of distance to provide protection for activities which may be temporarily tactically important. Numerous requests for protection from commanders of such activities may be expected. Some of them may require immediate attention; all of them should be carefully considered. Usually the amount of special fighter support available will be so limited as to preclude its provision to activities other than distant airdrome areas, or the more important sensitive spots on the lines of communication. General fighter support over the base area will have to suffice in most instances.

Chapter IX—AIR OPERATIONS DURING FINAL DEFENSE PHASE**Section 1. General.**

2. Reconnaissance Missions.
3. Fighter Support.
4. Air Attack of Surface Objectives.

SECTION 1

97. General.—When the enemy succeeds in establishing himself in his transport areas, his air supremacy may be conceded. Hostile preliminary operations will in all probability have reduced the defending air force to comparative impotency; such units as remain in existence will have been seriously decimated, and their operations hindered by superior forces of hostile fighters, unless they have been entirely inoperative and so cleverly concealed during the alert phase as to evade discovery. The conduct of defensive air operations during the final defense phase will, therefore, be fraught with great difficulty, requiring improvisation of material, stealth of operation, and clever tactical planning. Such air strength as is left the defender must be conserved for expenditure during those crucial periods when the attacking force is most vulnerable. Reconnaissance will normally be limited to tactical and battle missions; all air missions not of a combat nature must be reduced to the minimum. In short, air operations during the final defense phase are devoted entirely to close support of the base defenses. All aircraft not otherwise employed which are capable of offensive operations against surface objectives will be so used, regardless of type. The maximum air effort must be expended to prevent hostile troops from securing a foothold on the beach.

SECTION 2

RECONNAISSANCE MISSIONS

	Paragraph
Distant Reconnaissance-----	98
Tactical Reconnaissance-----	99
Battle Missions-----	100

98. Distant Reconnaissance.—Once the enemy forces have closed in on the base, the necessity for distant air reconnaissance in most cases ceases to exist. Every available reconnaissance airplane will be required for close-support missions. The dispatch of such aircraft on distant missions of any sort at this time will be seldom justified.

99. Tactical Reconnaissance.—(a) During debarkation and the ship-to-shore movement of the enemy, tactical reconnaissance is concerned mainly with determining the hostile main and secondary efforts, and the early detection of feints or demonstrations. The number and type of vessels in each transport area, the number and location of supporting combat vessels, and the location of lucrative targets for air attacks should be reported by radio as soon as visibility permits accurate air observation. The progress of debarkation and the movements of small-boat waves toward the beaches are matters of vital concern to the shore defense commander; continuous and rapid air-ground communication is necessary if he is to be kept properly informed of the situation. No attempt is made at this time to separate the functions of tactical reconnaissance and infantry contact. The airplanes assigned to tactical reconnaissance missions report all enemy activities until a landing has actually been effected. The number of airplanes necessary to keep in the air will depend upon many factors, but the rule should be to duplicate missions wherever possible. The casualty rate of reconnaissance aircraft is apt to be extremely high during this phase.

(b) After the enemy has gained an initial foothold ashore, tactical reconnaissance becomes more properly concerned with the ship-to-shore movement of reserves and supplies, and the possible approach of reinforcements. The sea areas between transports and beaches now contain the hostile lines of communication and correspond to the immediate rear areas in land warfare. The observation of front-line troops is a function of the infantry airplane; therefore, when front lines have been established in shore combat, normal assignments of reconnaissance aircraft will prevail.

100. Battle Missions.—(a) **The Infantry Mission.**—Infantry missions should take the air just before the leading hostile boat waves reach the beaches, and will be continuous thereafter during the action ashore. The assignment of infantry airplanes will normally be one to each brigade or sector commander, as deemed advisable.

(b) **Command Missions.**—Command airplanes will be made available to the principal defense headquarters at the beginning of the final defense phase and will remain so assigned during the existence of the Shore Defense Force. Utility amphibians and other nontactical types should be utilized for these missions when possible.

(c) **Artillery Airplanes.**—Suitable spotting airplanes will be made available to the base defense artillery commander prior to the arrival of the hostile transports within range, such assignment to remain in effect so long as the airplanes are needed. Air spot will normally be limited to heavy and medium batteries, and the number of spotting airplanes requested should be held to the minimum required for the accurate delivery of long-range fires.

SECTION 3

FIGHTER SUPPORT

	Paragraph
General Support-----	101
Special Support-----	102
Fighters Against Surface Objectives-----	103

101. General Support.—It is highly desirable that general fighter support be maintained over the vital base installations during the final defense phase, insofar as the remaining fighter strength will permit. Hostile air superiority may be so pronounced at this time, however, as to render ineffective any attempt to provide general air defense of any considerable area. The tactical situation on the ground may be such as to require the concentration of all available fighter strength over critical areas occupied by units of the shore defense forces. The higher commander under which the air force is serving may be called upon to decide which activities are to be given priority in the matter of fighter support; seldom will there be enough fighter units available at this time to protect the entire base area. If general support is to be attempted, the fighting group commander should be given considerable latitude in order that maximum protection may be given to those activities most vulnerable to air attack.

102. Special Support.—(a) Special fighter support of the air striking force in the surprise attacks of transports and small boats will greatly increase the effectiveness of such attacks, and should be provided. If the hostile fighters defending the transport areas can be deflected and prevented from interfering with attack and bombing units during the very short period of time necessary for the striking units to complete the assault, the results to be obtained will justify the sacrifice of part of the escorting fighting force in combat against superior numbers. It should be remembered that from the standpoint of air defense the period of hostile debarkation is the crucial moment in the landing attack; every possible effort should be made at this time to strike the enemy an effective blow in order to disrupt his landing. Even a single fighter squadron on escort mission may quite possibly provide enough interference to permit the striking force to reach its objectives.

(b) Special fighter support will also be advisable over the beach defenses during the time the hostile landing boats are approaching close to the beaches. It is at this time that the enemy air force will most probably attempt to strafe the beach defenses with attack and light bombing aircraft. Such attacks must be intercepted and broken up before they can reach their objectives. As the normal conduct of strafing attacks is by successive echelons sweeping along the beach,

so must the defending fighters be prepared to attack by echelons, engaging each hostile attacking unit in turn.

(c) In planning special support for the various activities on a time-schedule basis, consideration must be given to the limited full-throttle endurance of fighting planes and to their very short available combat time. The fuel endurance at full throttle may not greatly exceed one hour, and the combat time—or the endurance of the ammunition supply—will not exceed ten minutes. Fighters with empty ammunition boxes are obviously of no defensive value. Times of take-off for the various support missions must, therefore, be scheduled in coordination with the most probable times of anticipated combat action.

103. Fighters Against Surface Objectives.—While the hostile air force is present in strength and active, the use of organized fighter units for the attack of surface objectives will never be justified. Fighters loaded with bombs lose much of their characteristic performance as fighting planes, and must jettison the bomb load before engaging in air combat. The few units available for base defense will normally be so heavily engaged in air combat with superior enemy forces as to preclude all consideration of diverting them to ground attack. The practice of so using fighters in peacetime maneuvers leads to erroneous conclusions as to their availability for such missions during a war. The only possible justification for such usage is as a last resort when remnants of various units are consolidated into provisional attack groups. If the number of fighters is so reduced that they can no longer provide effective air support, they may then be pooled with the odd attack, bombing, and scout airplanes remaining in service, loaded with bombs, and the entire provisional group expended in a final effort to check the hostile advance.

SECTION 4

AIR ATTACK OF SURFACE OBJECTIVES

	Paragraph
General	104
Attack of Transports.....	105
Attack of Small Boats.....	106
Close Support of Beach Defense Units.....	107
Close Support of Withdrawals and Counterattacks.....	108

104. General.—In the treatment of this section, all attack and bombing units, with such other types as may be temporarily diverted to strafing missions, will be referred to as the air striking force. It is assumed that the reader is familiar with the technique of operation and proper objectives for the different classes of aviation. The discussion will be limited, therefore, to the general tactical employment of the air striking force as a whole. The assignment of units to individual missions will be in accordance with previously described doctrines, and is a function of the air commander.

105. Attack of Transports.—At the very beginning of the final defense phase, when the hostile troops start debarking, the air striking force has its best opportunity to strike a decisive blow. The technique of the assault will vary with visibility conditions, depending upon whether debarkation begins before daylight, but the results sought are the same. The air striking force must endeavor to simultaneously inflict as many matériel and personnel casualties on as many different transports as is possible. In this manner the maximum confusion and disruption of schedules can be caused to the enemy. If the attacks can be made effective enough and repeated at short intervals it is entirely possible, through air action alone, to force a withdrawal from the transport area and at least a temporary abandonment of the landing. The maximum strength of the air striking force, supported by fighter escort, should by all means be made available for this initial effort. At no other time during the action will the enemy be so vulnerable to air attacks.

106. Attack of Small Boats.—If the enemy succeeds in effecting an orderly debarkation, hostile troops in small boats continue to offer lucrative targets for air attack, although not so concentrated as while debarking. Attack and light bombing units should make continuous strafing attacks during the approach to the beach, endeavoring to sink as many boats and create as much confusion as possible. In making such attacks each attacking airplane of a unit picks out individual boats for targets; the air units maintain such formation as is compatible with this form of attack, in order to afford mutual protection against hostile fighters. Proper weapons for the attack of small boats are machine guns, small bombs, and chemical spray.

Command boats, if identified, are first priority targets, inasmuch as the principal air force mission at this time is to confuse and delay the approaching enemy by disrupting his tactical organization. The tactical principles involved in such attacks are similar to those used in land warfare, merely substituting boat waves for approaching columns, and individual boats for small bodies of troops passing through defiles.

107. Close Support of Beach Defense Units.—When the hostile boat waves reach the beach, there occurs a short period of congestion and confusion among the landing troops, affording strafing air units an excellent opportunity to inflict severe casualties. Attack squadrons are most effective for this task, attacking in a column of successive airplanes along the water line, paying particular attention to the boats and troops in the water. Care must be taken not to unduly endanger friendly beach defense troops. After hostile troops have gained cover ashore they are no longer lucrative targets for attack aviation and should be left to front-line ground forces.

108. Close Support of Withdrawals and Counterattacks.—(a) When the defenders are forced to fall back from beach defenses to inland positions, the character of combat changes to normal land warfare. The employment of the air striking force for close support of the ground forces is then subject to the principle previously outlined, to wit: Aviation is properly employed only against those targets beyond the range or capabilities of surface weapons. An exception to this rule may be taken in the case of an imminent rout; in such a case the remaining available air force may be thrown into the breach against the forward elements of the advancing enemy. Likewise, in the support of an important counterattack, aviation may be profitably employed to strafe enemy strong points along the front lines. Generally speaking, however, the air striking force should be employed only against rear area objectives.

(b) In the conduct of a base defense, the availability of an effective air striking force to assist ground units after the enemy has completed a successful landing may be considered a doubtful possibility. It is practically certain that before this stage of the final defense is reached, the defending air force will have ceased to exist as an organization. The few airplanes left to the defense at this time will have to be used in the manner which appears most expedient to the officer charged with the base defense, regardless of their original purpose.

**MARINE CORPS AVIATION
AMPHIBIOUS WARFARE**

APPENDICES

APPENDIX A

TYPES OF AVIATION ORDERS

	Paragraph
Purpose and scope-----	1
General Forms-----	2
Sample Orders-----	3

1. Purpose and Scope.—(a) This appendix is intended as a guide for the formulation of aviation orders. It presupposes a working knowledge of the general technique of order writing. Skeleton forms are given for the various types of orders, corresponding generally in arrangement to the forms prescribed for surface units. As an additional guide, there are included sample orders as they would actually be written.

(b) Any of the type orders outlined may be issued in the form of an **Aviation Annex** to the Operation Order (Plan) of a higher echelon of command, merely by the substitution of proper headings and endings. The body of the aviation order need not be changed when issued as an annex, although for the sake of brevity the body of the annex might well include only pertinent extracts of paragraphs 2 and 3 of the aviation order. Aviation annexes are generally issued with operation orders of a unit the size of the Fleet Marine Force, or a Naval Attack Force, having at least a group of aviation attached. A brigade or similar unit, with an attached observation squadron, does not usually issue an aviation annex, but includes all instructions to aviation in the proper subparagraph of the brigade operation order.

2. General Forms.—(a) **Form for an Air Force Order.**—

Title
PLACE OF ISSUE
Date and Hour.

File Notations

SECRET (CONFIDENTIAL) (RESTRICTED).

Operation Order (Plan)

No. -----

Maps:

Charts:

TASK ORGANIZATION.

- (a) **Task Group Title,** Rank and Name of Commander.
(Composition of Task Group.)

- (b) (Enumerate other Task Groups after appropriate letter (b), (c) etc.)

(NOTE.—Task organization may be omitted when units employed are regularly assigned to the organization and are employed under regular commanders, provided that the order does not lose in clarity or conciseness by such omission.)

1. Information.

(a) Enemy.—

(1) **Surface.**—A statement in general terms of the location, strength, and situation of the enemy surface forces that affect the plan. When the order or plan provides for operations against surface components of the enemy, such as hostile reserves, troops in movement, fleets, carriers, transports, lines of communication, and supply establishments, show the known characteristics of the objective. Refer to Objective Folders, F-2 Reports, and Operation Map or Overlay as applicable.

(2) **Air.**—List strength, composition, and location of hostile air elements, and antiaircraft defenses. Give details of hostile aircraft reporting service, and type of hostile resistance to be expected (activities of enemy fighter units, etc.), referring when pertinent to F-2 Report and Operation Map or Overlay.

(b) Own Forces.—

(1) **Surface.**—Mission, plan, and tasks of adjacent friendly forces of the same echelon, and general measures prescribed by immediate superior for cooperation and security. Indicate cooperation expected of antiaircraft units. Refer to Operation Map or Overlay.

(2) **Air.**—Give general scheme of employment of supporting air units (Fleet carrier divisions, shore based units, Army units), and air units which are being supported. List general operations of other friendly air units in area. Describe location of any new airdromes or landing fields not previously plotted. Give necessary details concerning friendly aircraft reporting service. Refer to Operation Map or Overlay.

2. **Decision of Commander.**—State briefly and clearly the general task of the whole force for meeting the situation covered by the Operation Order (Plan), the general methods to be employed in execution, and, if desired, the purpose of the operation. To convey clearly the will of the commander, such of the following details of maneuver as are applicable to the operation of the air force as a whole should be given:

Route Out.

{ Applicable only when air force operates }

Route Back.

{ in one formation. }

Time of assuming condition of readiness (1, 2, 3), or time of take off. (If air force operates from **one** airdrome.)

Rendezvous: Include time, place, formation, and altitude. When applicable include same data for higher participating units. (Only used when air force operates in **one** formation.)

Time of Attack. (When no rendezvous has been prescribed, and when the air force is to make a coordinated attack.

Initial Point.

{ When air force is to attack as }
{ **one** unit. }

Direction of Attack.

Method of Attack. Scheme of maneuver. (By group column, echelon of squadrons, etc.). Give details of coordination when required.

Maneuvers after Attack.—Rally by groups, or by squadrons, etc. Instructions for subsequent attacks, reservicing, rearming, etc.

Rendezvous after attack (Rally).—Applicable only when air force is to rendezvous in **one** formation. May be omitted if properly covered under "Maneuvers after Attack," see above.

3. (a) **Title of Task Group (a)**, followed by a statement of the principal task, minor tasks, and detailed instructions for the Task Group listed. Include directions as to cooperation and security; collection and dissemination of information obtained, reference to Intelligence Annex (for reconnaissance units); unit to be supported; armament and fuel to be carried, where applicable.

(b) **Title of Task Group (b)**, followed by a subparagraph of similar substance and arrangement as in (a) above.

(c) List in appropriate numbered subparagraphs instructions applicable to two or more Task Groups, or to the entire command, which are necessary for coordination but do not properly belong in another subparagraph. Include particularly measures for cooperation, security, and the collection and dissemination of information, which do not properly belong in above subparagraphs. List special ground defensive measures, such as camouflage, dispersion, and concealment of aircraft, etc. Specify special reports to be rendered, and measures to be taken in preparation for next mission or task.

4. Refer to Administrative Order (Plan) by number when issued (or to Logistic Annex). When neither of these is issued give necessary instructions concerning logistic arrangements for the operation. Include supply of fuel, ammunition, bombs, etc.; instructions concerning trains, traffic, personnel, and evacuation of injured personnel and damaged matériel.

5. Provisions necessary to the exercise of command, such as signal communications, annexes (plan of communications); zone time to be used; location of air commander on ground or in air; designation of deputy commander; location of task group commanders (if abnormal). Specifically, this paragraph should contain lettered subparagraphs which list all command posts of major surface and air units (on the ground), and the location of the air command post of the air force and major units thereof.

Signature.

Rank.

Title of Command.

(Signed by commander or principal staff officer.)

Annexes:

A. (Name)

B. do.

Distribution:

(Authentication by air force operations officer.)

(b) **Form for a Wing Order.**—

Orders for a composite wing, such as Aircraft, Fleet Marine Force, will be written usually as an air force order. Paragraph 2 (a) is therefore applicable in all respects to the Wing Order.

(c) The Air Force or Wing order may be issued as an annex to the operation order of a higher echelon of command. Substitute heading and ending as follows:

**ANNEX ---- TO OPERATION ORDER NO. ----
FLEET MARINE FORCE (NAF)
AVIATION**

File Notations.	Title.	{ Same as parent order.
(Of parent office.)	Place.	
	Date and Hour.	
* * *	* * *	

Signature.

(Force commander or C. of S.)

Appendices (to annex, if any).

Distribution	{	Same as for	}
Authentication		parent order.	

(c) Form for a Composite Group Order.—

File

CONFIDENTIAL.

Title.

Operation Order

PLACE OF ISSUE.

No. -----

Date and Hour.

Maps:

Charts:

TASK ORGANIZATION.**(a) Task Group Title**, Rank, and Name of Commander.

(Composition of Task Group. Task group usually designated by name indicating mission.)

(b) Enumerate other task groups as above.

1. **Information.** Same form as air force, except more concise.
2. Same form as air force order. General task of whole group. Details of scheme of maneuver applicable to entire unit.
3. Same form as air force order. Detailed tasks and instructions.
4. Reference to appropriate logistical data. Special instructions regarding supply, evacuation, traffic, personnel.
5. Refer to signal communication annex if issued. List command posts of supported ground units, higher and supporting or supported air units; ground and air command post of group commander.

Signature.

Title of Command.

Rank.

Annexes:

A. (Name).

B. do.

Distribution:

(Authentication.)

NOTE.—The Composite Marine Group as at present organized constitutes a miniature air force. Consequently, orders for such a unit must necessarily follow the air force form, and are more difficult to draft properly than is an order for a homogeneous tactical group which normally operates in the air as a single formation. See Par. 2 (d) which follows.

(d) Form for a Tactical (Homogeneous) Group Order.—

File Notation.

CONFIDENTIAL (if applicable).

Title.

Operation Order

PLACE OF ISSUE.

No. -----

Date and Hour.

Maps:

Charts:

TASK ORGANIZATION (may be omitted normally).

1. **Information.**—Give a brief summary of pertinent enemy and friendly information, surface and air, referring to F-2 report where applicable. Refer particularly to anti-aircraft cooperation and the Aircraft Reporting Service.
2. **Decision of the commander.** State the group mission in general terms. Include such of the following details of the scheme of maneuver which may be common to all squadrons of the group participating in the operation:

Route Out:**Route Back:**

Time of: Stations, taxi-out, or take-off (when all squadrons are on the same airdrome.)

Group Assembly: Include place, time, altitude, and formation. When applicable, list immediately following the assembly of all higher participating units. (Wing or Air Force.)

Group Initial Point: When appropriate precede group initial point by the initial point of higher participating units. If necessary follow by squadron initial points.

Axis of Attack: (For bombing or attack group.)

Method of Attack:**Maneuver after Attack:**

Rally: Include place and formation. The group rally is followed by the rally of higher participating units when appropriate.

Landing Instructions: (If necessary.)

3. (a), (b), (c), Instructions to the squadrons of the group. A separate lettered subparagraph is assigned to each squadron wherein is contained the squadron mission; appropriate parts of the scheme of maneuver (when not shown in paragraph 2; assignment of targets: ammunition, bomb, and chemical loadings when these are not identical for all squadrons.
 - (x) Contains instructions applicable to two or more squadrons which do not properly belong in the above subparagraphs, including when pertinent:
 - (1) Instructions concerning ammunition, bomb, and chemical loadings when these are identical for all squadrons.
 - (2) Special measures for ground defense.
 - (3) Instructions regarding rendition of special or nonroutine reports.
 - (4) Instructions regarding the operation of airdrome runways.
 - (5) Instructions covering preparation for the next mission.

Special instructions to combat crews. Armament details. Radio frequencies.

By order of (Squad. Commander).

Rank,
Signature,
Squadron Flight Officer.

(2) When necessary to assure cooperation with supporting or supported air or surface units, or when prescribed by higher authority, the squadron should issue a formal operation order similar in form to the group order.

3. Sample Orders.—

(a) An Air Force Order.—

File No. Air Force. (Blank) Attack Force.
SECRET. HONOLULU. T. H.
Operation Order 1 June -----

No.----- 1.

Maps: Hawaii, Oahu, etc., 1:20,000. * * *

Charts: Hawaiian Islands. * * *

TASK ORGANIZATION.

- (a) Cardiv One, Rear Admiral A.
CV-2. CV-3.
VF-2. VF-3.
VS-2. VS-3.
VB-2. VB-3.
VT-2. VT-3.
- (b) Cardiv Two, Rear Admiral B.
CV-4. CV-5.
VF-4. VF-51.
VS-41. VF-52.
VS-42. VS-5.
VB-4. VB-5.
- (c) Fleet Marine Force Wing, Brigadier General X.

First Marine Aircraft Group.

Second Marine Aircraft Group.

1. (a) (1) **Surface.**—Departmental intelligence analysis indicates the strength of the enemy garrison on HAWAII to be about 10,000 troops, including 1 16" gun and 20 6" naval guns, which force is estimated to consist of:

* * *
* * *

See F-2 Report and Situation Map. Annex -----.

- (2) **Air.**—Enemy aviation on HAWAII is believed to consist of * * * located on airdromes at * * *.

(b) (1) **Surface**.—The main Blue Fleet will operate in the vicinity of MIDWAY and will not be available to support the landing on HAWAII. The entire (Blank) Attack Force will operate against HAWAII, beginning on D-2 day.

(2) **Air**.—Carrier Divisions with the Fleet will prevent hostile air forces outside the Hawaiian area from interfering with the bombing operation. The ----- Wing, U. S. Army will provide for the air defense of the PEARL HARBOR base. For location of antiaircraft defenses and aircraft reporting stations see Annexes * * *.

2. This Force, with the Fleet Marine Force Wing attached, will support the (Blank) Attack Force in the seizure and occupation of HAWAII; will provide air reconnaissance of the island of HAWAII and environs; conduct preliminary offensive operations for the reduction of hostile air forces and fixed defenses; and provide for the close support of the Fleet Marine Force during the actual landing. Preliminary air operations will commence for all task groups on 5 June ----- D day will be announced by dispatch.

3. (a) **Cardiv One**, operating initially from the area west of KAUAI, will reconnoiter the islands of the HAWAIIAN GROUP west of Long. 159°, paying particular attention to the location and destruction of hostile air and submarine bases in this area. Cardiv One will be further responsible for the location of hostile naval forces within the sea area, * * *, and will intercept any movement of hostile aircraft toward OAHU and HAWAII. Beginning on D-2 day * * *.
* * *.

(b) **Cardiv Two**, operating initially from an area north of MAUI, will reconnoiter the islands of the HAWAIIAN GROUP east of OAHU, paying particular attention to the location and destruction of hostile air bases on MAUI and HAWAII; and to the location of hostile submarines and other naval craft in this area. * * * Beginning on D-2 day * * * will provide general support for the Transport Group.

(c) **Fleet Marine Force Wing**, operating initially from Fleet Air Base, PEARL HARBOR, and from WHEELER FIELD, will reconnoiter HAWAII, beginning * * *, with particular reference to locating and attacking major fortifications, heavy gun emplacements, troop concentrations, and supply establishments. Beginning on D-3 day,

shift air units to prepared air base on KAHOOLAWE, and provide close reconnaissance and combat missions for the landing operations * * *.

(x) (1) All carriers and land bases will be prepared to reserve and re-arm units of other task groups on thirty minutes' notice * * *.

(2) * * *

4. (a) See Administrative Order No. -----

(b) * * *.

5. (a) See Communication Plan, Annex -----

(b) Command Posts.

(1) Comairfor, NAF.

Cardiv One, CV-2.

Cardiv Two, CV-4.

FMF Wing, Fleet Air Base.

PEARL HARBOR.

(2) (Blank) Attack Force, USS OKLAHOMA.

Fleet Marine Force, USS OKLAHOMA.

"C"

Vice Admiral, U. S. Navy,
Comairfor, (Blank) Attack Force.

Annexes:

* * *

Distribution:

"A"

Official:

"X"

Lieutenant Commander, USN.

Flag Secretary.

(b) A Wing Order.—

File No.----- Aircraft Wing, Fleet Marine Force.

SECRET. Fleet Air Base, PEARL HARBOR, T. H.

Operation Order 4 June -----

No. 1.

Maps: Hawaii, Oahu, etc. 1:200,000 * * *.

Charts: Hawaiian Islands * * *.

TASK ORGANIZATION.

(a) Reconnaissance Group, Colonel "Air One."

VMS-1.

VMS-2.

VMS-3.

- (b) Striking Group, Colonel "Air Two."
 VMB-1.
 VMB-2.
 VMA-1.
 VMA-2.
- (c) Fighting Group, Lieutenant Colonel "A."
 VMF-11.
 VMF-12.
 VMF-21.
 VMF-22.
- (d) Utility Group, Lieutenant Colonel "B."
 VMJ-1.
 VMJ-2.

1. (a) (1) Surface.—* * *

See F-2 Report and Situation Map.

See Objective Folders, * * *.

(2) Air.—Enemy fighter opposition encountered over OPOLU PT. and KEAHOLE PT. indicate * * * two defensive squadrons based on HAWAII. Air photographs indicate existence of bombing or attack units on airdromes at * * *. Hostile observation planes sighted over DIAMOND HEAD on 4 June * * *.

(b) (1) Surface.—The Fleet Marine Force, operating as a part of the (Blank) Attack Force, will execute landings on HAWAII on D and D-1 days. (See R-3 Operations Map and FMF Operation Order No. 1.)

(2) Air.—Cardivs One and Two will provide additional air support for the landings. (See Air Force, (Blank) Attack Force, Operation Order No. 1.)

2. This wing will support the Fleet Marine Force in the landings on HAWAII by executing air reconnaissance and combat support to cover the actual landings.

Condition Three of readiness will be assumed at 0001, 5 June. D day will be announced by dispatch.

* * * * *

3. (a) Reconnaissance Group, operating initially from WHEELER FIELD, will execute distant reconnaissance missions over HAWAII, beginning at 0500, 5 June. Pay particular attention to the location of heavy gun batteries, fortifications, troop concentrations * * * and to the loca-

NOTE.—Under Task Organization, subparagraph (d), Utility Group. This group will be included in Task Organization, only if used tactically.

tions of suitable landing beaches between OPOLU PT. and KEAHOLE PT. Be prepared to support Striking Group on call. Provide for shift of base to KAHOOLAWÉ on signal for further operations in direct support of the landing * * * Comply with pertinent provisions of Annex -----, Intelligence.

(b) Striking Group, operating initially from present airdromes on OAHU, and supported as may be necessary by the Fighting and Reconnaissance Groups, will execute offensive missions against those objectives listed in Objective Folders "A" and "B" (appended), and such other suitable objectives as may be subsequently reported by the Reconnaissance Group. Initial preliminary offensive missions will begin at 0500, 6 June, and continue until objectives are neutralized. Be prepared to shift base to KAHOOLAWÉ on signal for further operations in direct support of the landings.

* * * * *

(c) Fighting Group, operating initially from the Fleet Air Base, PEARL HARBOR, will be prepared during the preliminary air operations to provide special support for the Reconnaissance and Striking Groups on call. Provide for shifting base to KAHOOLAWÉ on signal for further operations in direct support of the transport groups and landing forces.

* * * * *

(d) Utility Group will be prepared to execute normal messenger, transport and ambulance missions on call. Support the Reconnaissance Group during the landings by provision of command amphibians in the transport area * * *.

(x) (1) Antiaircraft defense of the KAHOOLAWÉ air base will be conducted in accordance with Annex ----, Artillery. Group commanders will arrange necessary details of coordination with the AA commander.

(2) * * *.

(3) * * *.

4. See Administrative Plan No. ---- (if applicable).

* * * * *

A ten day level of supplies will be maintained at the KAHOOLAWÉ air base from 1200, 5 June.

* * * * *

5. (a) See Annex ----, Communications.

* * * * *

(b) Command Posts.

(1) Air Force, (Blank) Attack Force, CV-3.

FMF Wing, WHEELER FIELD.

Reconnaissance Group, WHEELER FIELD.

Striking Group, LUKE FIELD.

Fighting Group, Air Base, PEARL HARBOR.

(2) (Blank) Attack Force, OKLAHOMA.

Fleet Marine Force, PEARL HARBOR.

By Command of Brigadier General "X."

"Y."

Colonel USMC,

Executive Officer.

Annexes:

* * *

* * *

Distribution:

"A."

Official:

"Z."

Lieutenant-Colonel USMC,

Operations Officer.

(c) **A Group Order.**

File No.-----

Striking Group, FMF Wing,
LUKE FIELD, OAHU, T. H.

SECRET.

5 June ----, 1200.

Operation Order

No. 1.

Maps: Hawaii, 1:20,000, * * *.

Charts: Hawaiian Islands * * *.

TASK ORGANIZATION (May be omitted for Group).

1. (a) (1) **Surface.**—Enemy forces have been located on
HAWAII at * * *.

Heavy gun emplacements and fortifications exist at * * *.

Supply establishments have been photographed at * * *.

See F-2 Report and Situation Map, and objective folders "A"
and "B." For details of enemy antiaircraft defenses and Air-
craft Reporting Net see special Situation Map (appended).

(2) **Air.**—At least two squadrons of hostile fighters of the
low-wing monoplane type are defending the installa-
tions on HAWAII. For details of tactics employed see F-2
Report.

* * * * *

(b) (1) **Surface.**—The Fleet Marine Force, supported by the combat vessels of the (Blank) Attack Force, will execute landings at * * * on HAWAII, beginning * * *.

(2) **Air.**—The Air Force, (Blank) Attack Force, will provide general air support for the (Blank) Attack Force and vessels of the transport group during the approach to HAWAII. Aircraft Wing, Fleet Marine Force, will reconnoiter HAWAII, initiate offensive missions against the hostile defenses, and provide close air support for the landings. See F-3 Operations Map * * *.

2. This Group, supported by VMF-11 and VMF-12, will initiate offensive air operations against the defenses of HAWAII on 6 June ---- by attacking the objectives specified in Objective Folder "A" and "B."

Route Out: DIAMOND HEAD—LAAU PT.—CAPE KAEA—KEAHOLE PT.—Objectives.

Route Back: Direct.

Time of Take off: 0300, 6 June.

Group Assembly: DIAMOND HEAD, 0320, 2000 feet, right echelon of squadrons, VMA-1, VMA-2, VMB-1, VMB-2.

Group Initial Point: KEAHOLE PT.

Axis of Attack: Objective "A" 90° Mag.

Objective "B" 30° Mag.

Maneuver after Attack: Bombers withdraw individually at low altitude direct to Rally Point. Attack squadrons execute 180° turn and proceed to Rally Point.

Rally: KEAHOLE PT., 2,000 ft., group javelin formation (See sketch attached).

Landing Instructions: Land in order of take off * * *.

3. (a) **VMB-1**, supported by VMA-1, will attack objective "A" with 100 lb. demolition bombs, repeating attacks as necessary to expend bomb load and accomplish neutralization. Secondary objective: * * *

(b) **VMB-2**, supported by VMA-2, will attack objective "B" with 500 lb. bombs. Secondary objective: Supply Base at * * *.

(c) **VMA-1** will support VMB-1 in the attack of objective "A" by neutralization of hostile AA defense at * * *.

(d) **VMA-2** will support VMB-2 in the attack of objective "B" by neutralization of hostile AA defenses at * * *.

(x) (1) Emergency refueling at KAHOOLAWA at direction of Group Commander only.

(2) Bomb loadings for Attack Squadrons:

30 lb. fragmentation bombs. A. P. machine gun ammunition. One section in each squadron will carry smoke tanks in lieu of bombs.

(3) All units fuel to capacity.

4. See Administrative Plan No. ---- (if issued).

5. (a) See Annex ----. Communications.

Radio frequencies: 3105 K. C.

* * *

(b) (1) Group Commander in 1-MB-1.

Deputy Commander, Major "VMA-1."

(2) Group CP. LUKE FIELD.

Fighting Group, Fleet Air Base, PEARL HARBOR.

By order of Colonel "G."

"F"

Lieutenant Colonel, USMC.

Executive Officer.

Annexes:

* * *

* * *

Distribution:

"B."

Official:

"M."

Major USMC,
Operations Officer.

APPENDIX B

CHARACTERISTICS OF AERIAL BOMBS

	Paragraph
Purpose of Appendix.....	1
Classes of Bombs.....	2
Demolition Bombs.....	3
Armor-Piercing Bombs.....	4
Fragmentation Bombs.....	5
Chemical Bombs.....	6
Practice Bombs.....	7
Parachute Type Bombs.....	8
Need of Different Size Demolition Bombs.....	9
Tactical Principles in Selection of Bombs.....	10
Effectiveness of Demolition Bombs Against Specified Objectives (table 1).....	11
Bomb Craters (tables 2 and 3).....	12
Depth of Water Penetration (table 4).....	13
Blast effect on Reinforced Concrete (table 5).....	14
Data Relative to Effectiveness of Demolition Bombs in Operations Against Personnel (tables 6 and 7).....	15
Summary (table 8).....	16
Conclusion.....	17

1. Purpose of Appendix.—The purpose of this appendix is to describe briefly the bombs employed by bombing and attack aviation, and to provide a general working knowledge of their capabilities. Since no proper assignment of tasks can be made without such knowledge, it is essential that commanders be thoroughly familiar with the power, effect, possibilities, and limitations of these agents of destruction available to aviation.

2. Classes of Bombs.—Bombs may be classified as follows:

Explosive:

 Demolition.

 Armor-piercing.

 Fragmentation.

Chemical:

 Incendiary.

 Smoke.

 Gas.

Inert:

 Practice.

3. Demolition Bombs.—(a) The demolition bomb is designed for the destruction of material objectives. The destructive effect of this bomb is produced by the detonation of its high explosive content, and varies with the quantity of explosive contained. The majority of service demolition bombs are of the “thin-walled” type, which sacrifices strength of casing (and consequent penetrating power) for increased explosive capacity.

(b) **Sizes.**—Demolition bombs in use by the Army and Navy, respectively, differ somewhat in size, weight, and explosive content. During peace-time operations, Marine aviation normally employs bombs furnished by the Navy; under the stress of national emergency, Marine units may be supplied with bombs from Army stock. For this reason a brief description of the bombs of both services is given. The following is a tabulation of the most common sizes with reference to actual weight and explosive content:

Size (pound)	Service	Actual weight	Explosive charge (TNT)
		(Pounds)	(Pounds)
100.....	Army.....	112	65
100.....	Navy (MKI-3).....	116	65
100.....	Navy (MK IV).....	119. 5	54. 5
300.....	Army.....	295	162
500.....	Navy (MKIII-1).....	475. 5	340
500.....	Navy (MK IX).....	491	323
600.....	Army.....	600	322
1,000.....	Navy (MK III).....	973	509
1,000.....	Navy (MK V).....	976	771
1,000.....	Navy (MK IX).....	988	731
1,100.....	Army.....	1, 140	605
2,000.....	Army.....	2, 000	1, 130

(c) **Body Characteristics.**—Depending upon the shape of body, demolition bombs are known as “streamline” or “cylindrical.” Although the “streamline” form creates less air resistance during descent, the ballistic characteristics of the two are, for practical purposes, the same. Modern development tends toward the “cylindrical” type because of reduced cost in manufacture and greater strength of casing.

(d) **Strength of Bomb Cases.**—Against certain targets instantaneous detonation on the surface is required. Against others, detonation must be delayed until after the bomb has penetrated the surface of the target. Ordinarily, the bomb fuze determines the exact moment of this detonation; and, whether instantaneous or delayed, it is imperative that the bomb case be intact at the time, in order that the maximum effect of the explosion may be obtained. For this reason, the strength of the average demolition bomb case is such that it will not only withstand the shock of impact, but will penetrate an “unprotected” surface to the maximum diameter of the bomb without breaking.

(*c*) **Fuzes.**—The bomb fuze is a mechanical device to initiate detonation. Demolition bombs of the 300-pound class, and above, have both nose and tail fuzes. Smaller bombs have only the nose fuze. Fuzes are classified as to whether they are instantaneous or delayed in their action. An instantaneous fuze is designed to give immediate explosion upon impact; while the delay fuze is designed to permit penetration of the target before exploding the bomb. Both types are equipped with arming devices which allow “safe” dropping from altitudes under 4,000 feet.

4. Armor Piercing Bombs.—This is a special type of bomb designed to pierce targets protected by armor plate. The bomb must be dropped from high altitudes to attain the velocity necessary for penetration; and, to insure penetration without breaking, the walls of the bomb must be of unusual strength, and consequent thickness. This necessitates, for a given size bomb, a reduction in explosive content; and results in a much less effective detonation than that of the average “thin-walled” type bomb of the same size. The 1,000-pound Navy bomb, Mk III (see table, par. 3a), is the nearest approximation of the armor piercing bomb. Further development appears suspended, as it is believed the thin-walled demolition bomb is capable of destroying any target.

5. Fragmentation Bombs.—(*a*) **Description.**—The fragmentation bomb weighs approximately 30 pounds, and has an explosive content of 4.66 pounds of TNT. The bomb body consists of a cylindrical steel tube over which is fitted a number of steel rings. The tube carries the explosive, while the rings form the material for fragments. On detonation the rings break into about 1,400 pieces. The bomb is fitted with only one fuze, which is instantaneous and carried in the nose.

(*b*) **Explosive Effects.**—The following are notes compiled from Army tests with regard to the explosive effects of 30-pound fragmentation bombs:

1. Blast effect: at one foot compares favorably with 100-pound demolition bomb at three to four feet. Blast effect by direct hit is very effective on tanks, trucks, etc.

2. Percentage of hits when dropped with parachute, permitting bomb to strike vertically (based on low panel tests). Targets placed at varying distances from point of impact, as shown:

Feet:	Percent
33 -----	100
66 -----	86
99 -----	43
132 -----	25
165 -----	18

3. Maximum danger radius from fragments: 500 yards.

(c) **Targets.**—The following are considered as proper targets for fragmentation bombs: Airplanes, small open boats, searchlights, trucks, artillery tractors, personnel, animals, and other targets easily destroyed by fragments.

6. **Chemical Bombs.**—(a) **Definition.**—The chemical bomb is the instrument to be employed when it is necessary to apply chemical agents to an objective from high altitudes. Although chemical bombs weighing from 28 to 32 pounds (depending on filling) are available to attack aviation for low altitude bombing, it is anticipated that chemical spray will usually take precedence over bombs for this type of work. Hence the discussion contained in this paragraph will be limited solely to those bombs contemplated for use by bombing aviation.

(b) **Description.**—In appearance the chemical bomb closely resembles the demolition bomb, since it is essential that both have the same ballistic characteristics. Unlike the demolition bomb, however, it needs only a means of expelling its contents upon impact; and the bomb case need be no stronger than necessary to contain the chemical agent until that time.

(c) **Tin-Can Bombs.**—There has recently been developed a new method of distributing chemicals from aircraft. One-gallon tin containers filled with the desired chemical are placed on bomb racks or carried inside the airplanes. When carried inside the airplane, they are fed through a chute to insure even distribution. They should be dropped from low altitudes in order to insure accuracy and avoid undue dissipation of the chemicals. On impact these containers break, and each contaminates an area of about 10 yards in radius.

(d) **Incendiary Bombs.**—Inasmuch as it has been found that demolition bombs have a marked incendiary effect, in addition to their power of explosion, further development of a bomb for solely incendiary purposes has been suspended.

(e) **Smoke bombs.**—(1) **White phosphorus.**—Closely akin to an incendiary bomb is the white phosphorus bomb, since particles from the latter, when falling upon easily combustible material, will quickly cause fires. But white phosphorus has other, and more important, functions. It creates casualties when particles strike men and animals. It is also one of the most effective screening agents; and for this reason is classed as a smoke bomb. From an aviation viewpoint, white phosphorus bombs find their primary use in the creation of obscuring smoke clouds for protection of aircraft against antiaircraft fire. They may thus be employed against antiaircraft

batteries with a two-fold purpose in mind, i. e., to blind the batteries, and to cause casualties to the personnel manning them.

(2) **Water Impact Smoke Bomb.**—This is a floating bomb designed by the Navy for producing a smoke screen at or near the surface of the water. It weighs approximately 50 pounds, and contains approximately 28 pounds of smoke mixture. It consists, in brief, of an aluminum nose casting which carries a pyrotechnic smoke charge, a hollow wood float which provides buoyancy, four fins, and a valve cap. The nose of the bomb carries a water impact fuze. Impact with the water operates the firing mechanism in the nose; which, acting through a primer, a time fuze, and a quick match, initiates the action of the smoke mixture. The bomb emits a dense white smoke for about three minutes.

(f) **Gas Bombs.**—(1) General.—Gas bombs are developed in conjunction with the Chemical Warfare Service. Such bombs may be filled with any type of chemical agent. Among the most common fillings are tear gas and mustard.

(2) Mustard.—Mustard bombs are used to create casualties among men and animals, and are used against such targets as: airdromes: installation or areas which have been damaged by destructive bombardment and which must be repaired; communication centers: supply centers; AA battery positions; railroad yards: defiles; bridge approaches; points where troops are assembled for motor, rail, or water transportation; decks of small or commercial vessels, and aircraft carriers. It will be noted from the above list, that many of the targets are equally appropriate for attack units.

(3) Tear Gas Bombs.—Tear gas bombs are used for harrasing effect where high concentrations are desired over limited areas.

7. **Practice Bombs.**—This type of bomb is used to give bombing personnel the requisite training in bombing, and in handling and loading bombs on airplanes.

8. **Parachute Type Bombs.**—The most recent development in the fragmentation and smaller chemical bombs, for use by attack aviation, is the parachute type bomb. Instead of the fin assembly of the ordinary bomb, this type has a parachute fitted to it. As the bomb is released from the airplane, the parachute opens and arms the bomb. This action of the parachute also serves to retard the bomb in its descent. Because of this latter feature, this type of bomb has made it possible for airplanes to bomb at greatly reduced altitudes without fear of being struck by fragments from their own bombs. Whereas the minimum safe altitude for dropping bombs without the parachute is 800 feet, the minimum safe altitude with the parachute is 65 feet. This low altitude of release insures greater accuracy in bombing, and likewise reduces exposure to hostile anti-

aircraft fire and pursuit aviation. Parachute bombs can be carried suspended vertically on internal bomb racks and horizontally on external bomb racks.

9. Need of Different Size Demolition Bombs.—Since the power of a demolition bomb varies with its explosive content, it is possible to design bombs for specific type missions. Obviously, a bomb which will destroy a strong massive objective will also destroy a light fragile objective. However, that bomb is so heavy that no great number could be carried on one flight. It would therefore be a waste of power and of effort to employ a bomb heavier than necessary to destroy the objective. It is also desirable to keep the number of sizes of bombs to a reasonable minimum consistent with economy of power and effort. The resulting compromise is represented by the various sizes of demolition bombs previously described.

10. Tactical Principles in Selection of Bombs.—(a) Never use a bomb heavier than that necessary to accomplish the desired results. It is better to carry many bombs of the proper size, and thus obtain a high probability of hitting and destroying the objective, than to carry a heavier bomb than necessary with the resulting reduction in the probability of hitting the target and applying more power than necessary to destroy it.

(b) Always use a bomb of sufficient size to accomplish the destruction desired. If a 600-pound bomb is required, two 300-pound bombs will not accomplish the same destruction.

11. Effectiveness of Demolition Bombs Against Specified Objectives.—(a) **General.**—The data tabulated in this paragraph are based on practical tests conducted in this and in foreign countries, and on deductions by the Ordnance Department, United States Army. These data, while conservative, have not been entirely supported by results of practical tests. Nevertheless, they indicate reasonable expectations of the results which may be secured from bombing operations, and may be employed with a reasonable degree of reliance for tactical purposes.

(b) **Navy Bombs.**—Owing to the lack of specific data on the capabilities of Navy bombs (listed in par. 3b), these bombs are not considered in the discussion which follows. However, in order to arrive at some workable figures for their employment, it is believed that a process of deduction may be resorted to. Thus, where a Navy bomb has a TNT content corresponding to that of an Army bomb, it may reasonably be expected to have the same explosive effect and, consequently, the same destructive capabilities. (See par. 3a.) For practical purposes, then, it can be assumed that the 100-pound Navy bomb has the same destructive powers as the 100-pound Army bomb; the 500-pound Navy bomb, the same as the 600-pound Army bomb;

and the 1,000-pound Navy bomb, the same as the 1,100-pound Army bomb. The Navy has no standard bombs to compare with the 300-pound and 2,000-pound bombs of the Army.

(c) **Tables of Effectiveness Against Specified Objectives.**— Probable objectives for demolition bombs have been selected for use in the following tables, and data with regard to the proper size bombs to be employed in attacking them has been tabulated. It will be noted that where the 100-pound bomb is appropriate for any particular target, it has been included. Whenever bombing airplanes are equipped with a type of rack that makes it possible to carry a greater weight of 100-pound bombs than of 300-pound bombs, approximating the bomb load capacity of the particular airplane, it is desired that the former be employed in attacks on rail communications (rolling stock and tracks), ordinary brick or temporary wartime structures, ammunition dumps, and airplanes. Although not specifically noted in the table below, it is believed that the above principle should also apply to an attack on light naval craft such as submarines and destroyers.

Table I.—EFFECTIVENESS OF DEMOLITION BOMBS AGAINST SPECIFIED OBJECTIVES

Objective	Bomb	Fuze	Point to be attacked	Danger (radius)	Probable results from detonation of bombs within danger radius
(a) Bridge, concrete reinforced and supported wholly by piers.	1,100	Delay	Piers and approach spans of bridge.	15 feet.	Displacement of piers and span, causing collapse of one or more spans.
(b) Bridge, concrete, reinforced of massive construction supported by piers and suspended by cables.	2,000	Delay	Piers, cable anchorages and tower supports at end of bridge.	15 feet	Displacement of piers and destruction of anchorages should cause collapse of the main span. Several hits may be required.
(c) Bridge, steel railway light construction.	600	Delay	Piers and approach spans	15 feet.	Hit alongside pier should determine foundation causing collapse of pier and span.
(d) Railway engines and cars	100, 300	Instantaneous.	On or alongside target	10 feet.	Direct hits should cause damage beyond repair. Near hits should disable target so that immediate repairs cannot be made.
(e) Railway tracks.	100, 300	Instantaneous.	If a single track, the track itself. If rail center, distribution over entire area desired.	7 ft—100 pounds. 9 ft—300 pounds.	100-pound bomb should cut rails and tear up 20 feet of roadway. 300-pound bomb should cut rails and tear up 30 feet of roadway.
(f) Railways—underground (Subways).	600	Delay	On ground above.	15 feet to either side.	Should penetrate, and detonation should cave in roof or cause collapse of walls.

Table 1.—EFFECTIVENESS OF DEMOLITION BOMBS AGAINST SPECIFIED OBJECTIVES—Continued

Objective	Bomb	Fuze	Point to be attacked	Danger (radius)	Probable results from detonation of bombs within danger radius
(g) Buildings—of steel, brick, and concrete construction; latest type of factories, warehouses, rail terminals—in fact, all types of construction except skyscrapers.	100 300	Delay	Building itself	Building itself	Should penetrate floors before detonating—should destroy walls and floors and cause serious fires.
(h) Seacraft:					
Modern submarine					
Transport					
Aircraft carrier	300 or Navy	Delay	Vessel itself	20 feet	Should sink or seriously damage vessel.
Destroyer	500.				
Supply vessel	600 or Navy	Delay	Vessel itself or in water at side of vessel.	25 feet	Should sink or seriously damage vessel.
Light cruiser	500.	Delay	Vessel itself or in water at side of vessel.	35-45 feet	Should sink or seriously damage vessel.
Battle Cruiser	2,000	Delay			
Battleship	2,000 or Navy 1,000	Instantaneous.	Distributed over area occupied by dump.	Direct hits on piles of ammunition.	Blast should detonate piles of ammunition.
(i) Ammunition dumps	100 300				

Table 1.—EFFECTIVENESS OF DEMOLITION BOMBS AGAINST SPECIFIED OBJECTIVES—Continued

Objective	Bomb	Fuze	Point to be attacked	Danger (radius)	Probable results from detonation of bombs within danger radius
(j) Airplanes	{ 100 300 }	{ Instantaneous Delay }	Distributed over area occupied by airplanes.	{ 75 to 100 feet 100 to 125 feet }	{ Blast should severely damage wings, crushing ribs. Fragments should cause additional damage. Should crack dam or cause hole in its side causing collapse in structure. Cause collapse of dock for 75-100 feet.
(k) High masonry dams and spillways.	2,000	Delay	Close to dam on water side.	15 feet	
(l) Concrete docks	600	Delay	Dock itself or close along-side.	25 feet	

1 When the bomb rack arrangement is such that more 100-pound bombs can be carried than 300-pound bombs up to or approximating the airplane's weight carrying capacity in bombs, it is preferable to use 100-pound bombs.

12. Bomb Craters.—A general knowledge of the size craters to be expected upon the impact of the various demolition bombs with instantaneous and delay fuzing is necessary to properly evaluate incidental results of attacks and to intelligently employ the correct size bomb against new targets as they may appear.

(*a*) **Craters in Sandy Loam.**—The following table shows craters that have been obtained on soil of sandy loam character, by bombing from five and eight thousand feet. With different altitudes and types of soil the crater dimensions will vary. The table is of use in evaluating the incidental results of attacks on rail centers and airdromes. In the attack of a rail center, the craters formed by the demolition bombs would, in many instances, require filling to provide a foundation for railway tracks, thus augmenting the delay incident to repair. Craters formed by bombs detonating upon an airdrome would have to be filled and tamped to insure a firm surface for take-off and landing. This would be particularly necessary if the airdrome was used by heavily loaded bombing or transport airplanes.

Table 2.—CRATER DIMENSIONS—SANDY LOAM

Bomb (pound)	Depth of crater	Diameter at surface	Earth displaced
With instantaneous fuze:	<i>Feet</i>	<i>Feet</i>	<i>Cu. yds.</i>
100.....	2	9	4
300.....	3	13	10
600.....	5	17	17
1,100.....	6	20	28
2,000.....	7	22	47
With delay fuze:			
100.....	5	20	30
300.....	7	27	70
600.....	10	37	170
1,100.....	13	45	320
2,000.....	17	50	600

(*b*) **Craters in Solid Rock.**—The following table shows craters that have been obtained in solid rock, which was described by geologists as “Granite-porphry.” While there is no positive information available relative to the hardness or ability to resist penetration of this rock compared with reenforced concrete, this table may provide a guide in the selection of the proper bomb to attack massive, heavily armored installations that may be constructed in the future.

Table 3.—CRATER DIMENSIONS—SOLID ROCK

Bomb	Fuze	Altitude	Kind of Impact	Functioning	Depth	Diameter
1,100	Delay	4,000	10° Forward Slope	High Order, Delay	3	19
1,100	Delay	4,000	Across 20° Slope	High Order, Delay	5 $\frac{3}{4}$	24
2,000	Delay	4,000	15° Forward Slope	High Order, Delay	5 $\frac{1}{2}$	33
2,000	None	15,000	Across 20° Slope	High Order, Short Delay	6 $\frac{3}{4}$	31

13. Depth of Water Penetration.—The following table outlines those distances below the surface of the water at which several types of demolition bombs equipped with delay fuzes will detonate when released from various altitudes. In determining the probable results to be expected in attacks against a particular ship, dam, or reservoir, for example, the table will indicate that part of the target which will receive the greatest blast effect. From the construction of the target at that particular point, the destructive results may be estimated.

Table 4.—DEPTH OF WATER PENETRATION With 0.10 sec. delay fuze

Altitude of release (feet)	300 pounds	600 pounds	1,100 pounds	2,000 pounds
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
2,000.....	24	26	28	30
4,000.....	33	35	37	39
6,000.....	37	39	42	45
8,000.....	39	43	46	50
10,000.....	41	46	50	54
12,000.....	43	48	53	57

14. Blast Effect on Reinforced Concrete.—The table shown in this paragraph contains data pertinent to the selection of appropriate bombs for operations against dams, piers, moles, docks, and other massive objectives. Each of the bombs listed can blast through a reinforced concrete wall of the thickness noted opposite if the bomb detonates close alongside the wall. The diameter of the hole blasted is approximately twice the thickness of the wall. The blast effect of a bomb detonating below the water and alongside a target such as a dam or reservoir, is augmented by hydraulic pressure. If the thickness of the target at that distance below the surface of the water where detonation occurs is no greater than approximately twice that which can be penetrated by the blast effect of the bomb, the forces of blast effect and hydraulic pressure should be such as to cause similar damage to that resulting from complete penetration, that is, collapse of the structure above the place at which detonation occurs. This table, in conjunction with table 3, may be used, for example, in estimating the probable results of the attack of a dam. If a 2,000-pound bomb with a 0.10-second delay fuze is dropped from an altitude of 12,000 feet, it will detonate 57 feet below the surface of the water. The construction of the particular type of dam will indicate its thickness at this distance below the

water level. If the thickness of the particular dam at this point is approximately 25 feet, the bomb detonating alongside the wall on the water side should blast out a portion of the dam with the probability of resulting collapse of the structure above that point.

Table 5.—BLAST EFFECT ON REINFORCED CONCRETE WALL

Type of bomb (pound)	Thickness of wall	Diameter of hole blasted
	(Feet)	(Feet)
600.....	8. 6	17. 2
1,100.....	10. 4	20. 8
2,000.....	12. 3	24. 6

15. Data Relative to Effectiveness of Demolition Bombs in Operations Against Personnel.—

Table 6.—HORIZONTAL DANGER RADIUS BOMB FRAGMENTS

Bomb (pound) :	Maximum danger radius of fragments from point of detonation
100	Yards 1, 000
300	
600	
1, 000	
2, 000	

(a) **Relative Ineffectiveness of Fragments.**—The above table indicates the distance at which a fragment from a detonated bomb casing will disable a man. The above distances are approximate and indicate the radius in which a bomb casing fragment is traveling with sufficient energy (60-foot-pounds) to cause casualties to personnel. It is not intended to convey the impression that 100 percent casualties will be obtained within the danger radius. The percentage of personnel that will be hit at ranges of 500, 1,000 and 2,000 yards is very small. The Ordnance Department, in conducting the Low Panel Test with kneeling silhouettes to determine the percentage of panels perforated at varying distances from point of detonation of the 30-pound fragmentation bomb, arrived at the following figures:

	Percent
10 meters.....	100
20 meters.....	86
30 meters.....	43
40 meters.....	25
50 meters.....	18

These figures may be interpreted to mean that within 10 meters from the point of detonation 100 percent casualties may be expected; within 50 meters, 18 percent casualties are expected. The assumption that the percentage of casualties varies inversely with distance is roughly correct. The statement that fragments of demolition bombs may be dangerous at a point as distant as 2,000 yards is included in this text to serve as a guide in peacetime safety requirements. The probability of obtaining casualties on personnel at such a distance is infinitely small.

When it is appreciated that the fragments from demolition bombs are much fewer than those of fragmentation bombs, weight for weight, the percentage of casualties is considerably less with the use of demolition bombs even at shorter radii.

Therefore, this discussion will serve to emphasize the point that demolition bombs should not be employed in the attack of troops or of animals. The fragmentation bomb is best suited to such missions. The superior fragmentation of such bombs will greatly outweigh any advantages which may, theoretically, result from the increased blast effect of demolition bombs in the vicinity of the point of detonation.

Table 7.—BLAST EFFECT ON PERSONNEL

Bomb (pounds) :	Approximate maximum distance that blast is effective on personnel
	<i>Feet</i>
100.....	40
300.....	55
600.....	75
1,100.....	90
2,000.....	100

(b) **Relative Ineffectiveness of Blast Effect.**—Experiments have indicated that the blast effect resulting from the detonation of TNT is at any given point approximately directly proportional to the amount of the explosive detonated. However, it is further indicated that the **blast effect for any given amount of TNT is inversely proportional to the square or cube of the distance from the point of detonation.** The radius of effectiveness resulting from blast is very limited. This may be appreciated by reference to Table 1 wherein it is noted that the danger radius in which bombs must detonate to achieve destructive results on matériel objectives is quite small. The above table, reviewed in conjunction with Table 6, will emphasize further the fallacy of employing demolition bombs against personnel or animals.

16. Summary.—(a) Use of Demolition Bombs.—Demolition bombs should be employed solely against matériel objectives. While casualties to personnel and animals may result from the destruction of matériel objectives, this is purely incidental. Demolition bombs should not be employed against bivouacs or troops concentrations with the primary object of destroying personnel, nor should they be employed against light matériel objectives which are susceptible to destruction by fragmentation bombs. Fragmentation bombs distributed over an occupied airdrome should result in greater damage to the airplanes thereon than that achieved by demolition bombs. Demolition bombs may be employed properly against airdromes of permanent construction upon which may be found brick, steel, and concrete hangars, workshops, warehouses, and living quarters. A mission against such an objective would involve destruction of the permanent construction.

(b) Buildings.—Demolition bombs are particularly efficacious against the average factory or warehouse. The 100-lb demolition bomb has been proven effective for the destruction of such targets. The most effective destruction is secured by a direct hit, although a hit adjacent to a building may produce very material damage. The blast effect of a bomb which detonates after penetrating a building may be expected to cause extensive destruction to machinery, equipment, supplies, and the structure of the building itself. The delay fuze is desired for two reasons: when a bomb strikes a roof, the damage is far greater if it penetrates well into the building before detonating; when a bomb misses a building by a small amount, the mining effect obtained by delay fuzes may undermine the structure and cause the collapse of certain members.

(c) Lines of Communication.—Rail lines of communications are appropriate targets for demolition bombs. The maximum amount of damage is secured if a train is hit, as the wreck of a train, together with the destruction of rails and the formation of a crater, will increase the delay incident to clearing the right of way and repairing the damage. A bridge is the most effective point of attack of any particular line of communication as its reconstruction may require weeks. Reconstruction in the face of continuing attacks may be impossible. Therefore, demolition bombs used against rail terminals when quantities of rolling stock are present and against bridges will most effectively destroy lines of communications. To indicate the results which may be anticipated in the attack of rail lines, a brief résumé of tests conducted by the British in 1918 are outlined. Bombs of 25-lb, 50-lb, 112-lb, and 230-lb sizes were dropped on railroad tracks. Extracted from the reports are the following typical results:

Table 8.—EFFECT ON RAILROAD TRACKAGE

Bomb (lb.)	Amount of explosive	Point of hit	Altitude of release	Crater dimensions	Notes
25	<i>Pounds</i> 12.5	3 feet from center of track.	<i>Feet</i> 2,000	10 feet x 6 feet x 10 feet.	Nearest rail cut. Other rail bent. 8 timbers destroyed.
50	21	Center of track.	2,000	14 feet x 7 feet x 11 feet.	Radius ring thrown 6 feet. Outer rail bent. Inner rail thrown 70 yards.
112	28	Center of track.	2,000	9 feet x 6 feet x 9 feet.	One rail cut, the other bent. 9 timbers destroyed.
230	100	Center of track.	2,000	22 feet x 9 feet x 80 feet.	One rail broken at fish plate and whole rail thrown 40 yards. Other rail broken in three places. 13 timbers destroyed.

The conclusions drawn by the British Air Ministry were that in event of a direct hit being registered on the permanent way with a 112-pound bomb, the damage so caused can usually be made good by a party of ten men in from one to one and one-half hours. The maximum damage caused by a direct hit with a 230-pound bomb would take two to three hours to repair with ten men available. The figures are the result of actual operations and based on the assumption that the materials for repair are at hand. The above figures do not include the filling of the craters but just sufficient repair work to make passage of a train possible. The British Air Ministry is further of the opinion that in the attack of railways the resultant delay is due chiefly to the loss of time incident to bringing up materials and men to effect the necessary repairs and that it is not unreasonable to suppose that at least six hours would be lost in bringing up the materials and men necessary to carry out the repairs in the event of a direct hit by a 230-pound bomb. In the above figures, no account is taken of the disorganization of traffic and congestion of trains produced by the delay. It should be noted that in comparing the results achieved with wartime bombs with the probable results which might be secured by the present type of bombs, the effects of the 230-pound bomb rather than the 112-pound bomb more nearly approaches the American 100-pound bomb. The amount of explosive

contained in the American 100-pound demolition bomb is 65 pounds as against only 28 pounds of explosive in this particular British 112-pound bomb.

(*d*) **Underground Objectives.**—Underground railways, subways, sewers, water and gas mains, underground electric telephone, and power lines can be damaged seriously by delayed action demolition bombs which hit in the streets above them. Study of the construction of subways for vehicular or rail traffic indicates that no difficulty will be encountered in causing considerable destruction to a subway should a direct hit be secured. Subway roofs are ordinarily about two feet thick. There is usually but about five feet of soil above the subway roof. It appears that the 600-pound demolition bomb equipped with a delay fuze will penetrate to the subway even if one of the roof beams is hit, with detonation occurring very close to the roof. The resulting detonation should collapse the supports within a 10-foot radius of the 600-pound bomb, thus caving in the roof for a considerable area. A 600-pound bomb landing alongside or within ten feet of the retaining walls will cause collapse of a great portion of the wall. 600-pound bombs landing along the tunnel exits should cut out support and retaining walls, resulting in a cave-in sufficient to stop traffic until repaired. Underground water and gas mains within ten feet from the surface of the ground should be destroyed with little difficulty by using 600-pound bombs. Hits within fifteen feet of the mains are required. In the event that mains are within five feet from the surface, 300-pound bombs should achieve the damage required.

(*e*) **Naval Vessels.**—Past tests carried out in this country and in England have proven conclusively that all types of naval vessels can be either sunk by demolition bombs, or so seriously damaged as to render them ineffective. Any vessel without a protective deck can be easily destroyed by demolition bombs, either by direct hits or by hits in the water close to the vessel's side. Large-type demolition bombs striking naval vessels which have heavily protected decks will completely demolish the superstructure of such vessels. If hits are obtained close to gun turrets, these turrets will be rendered ineffective. It is difficult to believe that any type of battleship now afloat could long continue its place in the battle line if subjected to several hits by large capacity bombs, even though the protective deck itself were not penetrated.

17. Conclusion.—From this brief study of the capabilities of aerial bombs, it is apparent that in order to obtain best results from air bombardment there must be a careful selection of weapons for the objective. The aerial bomb is inherently a weapon of great destructive power when properly applied; it is comparatively ineffective

when poorly placed, or when the capacity of the bomb is ill suited to the task at hand. The proper application of the bomb to the objective is a matter of air marksmanship and of concern only to the aviator; the selection of proper sizes and types of bombs to accomplish the degree of destruction sought is a matter of interest to all officers who may exercise tactical control over attached or assigned aviation units.



