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Marine Corps Aviation: General, 1940

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FOREWORD

1. PURPOSE

Fleet Marine Force Reference Publication (FMFRP) 12-26, *Marine Corps Aviation: General, 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 published in 1940 by the U. S. Marine Corps as part of a series of texts on branches within the Marine Corps. This volume presents the organization and characteristics of Marine aviation and then assimilates those factors into the mission of reconnaissance aviation, combat aviation, and utility aviation. A short section is given to the Marines' relationship to the Army Air Corps. This publication is an excellent source when researching World War II and applying lessons learned then to contemporary situations.

3. CERTIFICATION

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

M. P. SULLIVAN
Major General, U.S. Marine Corps
Deputy Commander for Warfighting
Marine Corps Combat Development Command
Quantico, Virginia

DISTRIBUTION:

MARINE CORPS AVIATION

GENERAL

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INTRODUCTION

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

It is designed to cover the mission, organization, characteristics, and tactical employment of Marine Corps aviation units. Much of the subject matter has been taken from previously published material. Acknowledgment is hereby made to the authors of various Army, Navy, and Marine Corps publications, whose works have been freely quoted in the pages of this text.

Part one is devoted to a general discussion of basic characteristics, organization, and nomenclature of military aviation. The tactics and technique of the various classes of aviation are discussed in part two.

GLOSSARY OF TERMS

The following aviation terms and definitions are those commonly used throughout the text, and in aviation lectures and problems presented by the Marine Corps Schools.

1. Air base.—A command comprising all the installations and facilities necessary for the regular operation, maintenance, repair, and supply of a specific air force. It may be a shore base, or a floating base (carrier or tender).

2. Airdrome.—A military landing field from which an air unit may operate, and on which are located necessary maintenance, repair, and servicing facilities. There are base airdromes and advanced airdromes depending on their location with respect to the front lines.

3. Airport.—A commercial landing field, or seaplane area, with facilities for the shelter, supply, and repair of aircraft.

4. Auxiliary Airdrome.—A military landing field where limited personnel and supplies are available.

5. Advanced Landing Field.—A landing field near the command posts of front line units, from which reconnaissance aircraft may conduct limited operations in close support of engaged units. It may or may not afford servicing facilities.

6. Alternate Airdrome.—An additional auxiliary airdrome assigned to a unit for purposes of dispersion and concealment.

7. Air Attack.—An assault by combat aircraft against surface objectives.

8. Attack Airplane.—An aircraft designed especially for ground strafing attacks against personnel, airdromes and other light matériel.

9. Air Combat.—An engagement between aircraft in the air.

10. Arrive.—A term used to indicate the time when an airplane or a formation in the air has arrived over a designated location.

11. Assembly Point.—An Air Corps term used to indicate that point over which the various elements of a command first assemble in the air in the formation prescribed. (See Rendezvous.)

12. Aviation.—A general term commonly used in referring to aeronautical matériel and personnel.

13. Battle Missions.—The three missions performed by reconnaissance aircraft in connection with front line units just prior to or during combat: the infantry mission, the artillery mission, and the command mission.

14. Combat Aviation.—A term used only in general reference to attack, bombing, and fighting aviation.

15. Clear.—The time when the airplane, or the last airplane of a formation, is actually in flight and has cleared the take-off area.

16. Ceiling.—The limiting altitude attainable by an airplane. The term refers both to limitations imposed by the design of the aircraft, and to the prevailing cloud level.

17. Dog fight.—A term descriptive of a melee in which fighting planes of opposing forces lose their cohesion as units and engage in a series of individual combats.

18. Duel.—An individual combat between two airplanes in the air.

19. Fighting airplane.—A fast, highly maneuverable aircraft designed primarily for air combat.

20. Formation.—Two or more airplanes in coordinated flight.

21. Initial Point.—That point over which the various elements of an air command take up the disposition required for the attack of an objective.

22. Land.—The exact time when an airplane, or the last airplane of a formation, is on the ground and has vacated the landing runway.

23. Landing Field.—An area of such size and nature as to permit of aircraft landing and taking off in safety.

24. Readiness.—A term indicating that flying personnel and aircraft are ready to take off on most probable missions.

25. Radius of Action.—The distance an airplane can fly away from its base in a straight line and return without refueling. It is theoretically half of the range—actually less due to wind and navigational factors.

26. Range.—The distance an airplane can fly in a straight line, at most economical speed, without refueling.

27. Rendezvous.—A term in general use by Naval aviation to indicate assembly point of the elements of an air command, either after initial take-off or after deployed air maneuvers.

28. Reconnaissance Aviation.—A general term referring to patrol, scouting, and observation aviation.

29. Stations.—A term used to indicate that flying personnel are in their airplanes, engines are turning over, and the unit is ready to taxi out for the take-off.

30. Time of Take-off.—That instant at which an airplane, or the leading airplane of a formation, begins its run on the ground, preparatory to flying.

31. Tactical Aviation.—A general term referring to the combat and reconnaissance classes of aviation.

32. Utility Aviation.—A general term referring to transport and other nontactical types of aviation.

MARINE CORPS AVIATION
GENERAL

PART ONE

ORGANIZATION AND GENERAL CHARACTERISTICS

CHAPTER I

ORGANIZATION AND ADMINISTRATION

SECTION 1

1. Mission of Marine Corps Aviation.—The primary mission assigned to Marine Corps Aviation is to support the Fleet Marine Force in landing operations, and to support other troop activities in the field. Secondarily, Marine Corps Aviation serves as replacement squadrons for Naval carrier based aircraft.

SECTION 2

ORGANIZATION OF UNITS

2. General.—a. The organization of Marine Corps aviation is based on the principal of grouping a definite number of aircraft of one class, with the necessary personnel for tactical operation and maintenance, into basic units (squadrons). These basic units are then combined into larger administrative and tactical organizations (groups and wings).

3. The Section.—The section is the smallest aviation unit. It is composed of two or three airplanes and their assigned personnel, and operates normally as the basic element of the division. While scouting squadrons habitually operate by sections of two airplanes, or even singly, it is unusual for sections of combat squadrons to operate independently. The section corresponds to the infantry platoon, and is normally led and commanded by a captain or a first lieutenant.

4. The Division.—The division, comprising two or three sections of three (two) airplanes each, is the basic tactical unit of the squadron. It is primarily a tactical and training unit, having no administrative or supply functions unless operating on separate detached duty. The number of airplanes in the division of a combat squadron (fighting, scouting, bombing) is based upon the number of that class which can be most effectively maneuvered and operated tactically under the direct personal control of the division leader. This principle does not necessarily apply to scouting and observation squadrons, inasmuch as the normal missions performed by these units are such as to seldom require tactical operations by divisions. For purposes of uniformity in administration and training, however, the scouting division usually has the same organization as the combat division. The aviation division corresponds tactically to the infantry company. It is led and commanded by a major or a captain.

5. The Squadron.—The squadron, consisting of two or three divisions, is the basic administrative and maintenance unit. The tacti-

cal squadron corresponds in function to the infantry battalion, being capable of independent operations, but normally acting as part of a larger unit. The headquarters and service squadrons have functions analogous to those of a regimental headquarters and service company, respectively. Tactical squadrons perform training, tactical, and maintenance functions, leaving the major supply and repair functions to the headquarters and service units of the group. Marine Corps tactical squadrons have an authorized operating strength of eighteen airplanes, but for reasons of economy or tactical expediency may operate but 12 airplanes. Each tactical squadron is authorized reserve airplanes equal to 50 percent of the operating strength, in order to permit continuous operation at full complement. Reserve operating crews are normally available for but a part of these reserve airplanes, and it is seldom possible for a squadron to operate more than its assigned strength at one time, even though authority for such operation were obtained. The squadron commander, who in flight normally leads the first division, is a lieutenant-colonel.

6. The Group.—a. The present Marine Corps aviation group is composed of 1 fighting squadron, 1 dive-bombing squadron, 1 scouting squadron, a utility squadron, and a headquarters and service squadron. Within the near future the scouting squadron will be equipped with scout-bomber airplanes, while an observation squadron of 12 observation airplanes and 3 special photographic airplanes will be added to each group. The Marine Corps composite group, as described, is the principal tactical, administrative, supply, and repair unit. The group corresponds to an infantry regiment in size and importance, and is commanded by a colonel.

b. A temporary tactical combination of two or more squadrons is also designated as a group, although in this instance no separate group commander and staff is provided, the senior squadron commander acting also as group commander. A temporary task group is usually composed of squadrons of the same class, or of dissimilar squadrons assigned to one mission.

c. A group, as organized by the Army Air Corps, consists of four tactical squadrons of the same class, with a group headquarters and headquarters squadron organically assigned.

7. The Wing.—The wing is composed of two or more groups. It may be a permanent administrative and tactical organization as found in the Army Air Corps; or a temporary tactical combination of groups for the accomplishment of a specific task. The wing corresponds in importance to the infantry brigade, and is an appropriate command for a rear admiral or brigadier general.

8. Air Force.—All the aviation assigned or attached to a major command.

SECTION 3

DESIGNATION AND ASSIGNMENT OF UNITS

9. Designation of Units.—a. Naval and Marine Corps aviation units are designated by a combination of numerals and letters, as follows:

The letter V signifies heavier than air.

A designates an attack unit (tentative).
B designates a bombing unit.
F designates a fighting unit.
O designates an observation unit.
P designates a patrol unit.
S designates a scouting unit.
T designates a torpedo unit.
J designates a utility unit.
N designates a training unit.
M designates miscellaneous aircraft.

b. The number of the squadron is given in connection with the identifying letter combination, thus: VS–2 for Scouting Squadron Two. Marine squadrons insert the letter "M," thus: VMS–2 for Marine Scouting Squadron Two; VMF–1 for Marine Fighting Squadron One; etc. All the squadrons assigned to one carrier, when of different classes, are given the same number, thus: The CV–2 (U. S. S. *Lexington*) has VF–2, VS–2, VB–2, etc. Should there be two fighting squadrons assigned to the CV–2, they would be numbered VF–21 and VF–22, respectively. The squadrons of the two Marine Groups, First Marine Aircraft Group and Second Marine Aircraft Group, are numbered in like manner to correspond with the group number, thus: VMF–1, of First Marine Aircraft Group; VMS–2 of Second Marine Aircraft Group; etc.

c. (1) Individual airplanes are given distinctive markings to permit ready identification in the air. All airplanes belonging to one carrier or group, for instance have tails of a certain color. All squadron leaders' airplanes have the engine cowling painted red, with a red stripe painted around the fuselage. Division and section leader's airplanes have solid colors on the nose cowlings, with a wide

stripe of the same color painted around the fuselage, while the wing position airplanes have either the lower or upper half of the nose cowling painted to correspond with the section leader's airplane. In addition, all airplanes of a squadron are numbered consecutively, number one being the squadron commander's airplane. This identifying number, together with the squadron number and letter symbol, is painted on the sides of the fuselage in large letters, as follows:

2—MS—1 indicates the squadron commander's airplane of Marine Scouting Squadron Two, Second Marine Aircraft Group.

(2) Details of Naval aircraft markings are prescribed from time to time by the Navy Department, and reference should be made to the latest instructions on the subject if exact information is desired.

10. Assignment of Units.—All Marine air units, with the exception of base air detachments, are assigned to the Fleet Marine Force. Base air detachments are assigned to the various established Marine air bases as a component part of such bases. Aircraft of the Fleet Marine Force, generally known as "Aircraft, Fleet Marine Force," is at present organized into one wing consisting of the First Marine Aircraft Group at Quantico, the Second Marine Aircraft Group at San Diego, and VMS–3, a separate scouting squadron, at St. Thomas, V. I. Headquarters of the wing is at San Diego.

11. Command of Units.—According to Navy Regulations, the command of an aircraft tactical unit is vested in the senior naval aviator regularly assigned to that unit. A nonflying officer is ineligible to command an aviation unit. Officers of the Navy are not ordered to command Marine Corps air units, and vice versa, except that when Marine Corps and Naval air units are operating together as a task force, the senior naval aviator, Navy or Marine Corps, present with the formation exercises tactical command. (See NR Art. 150 (11), (12), (13), (14), (15).)

12. Liaison.—Marine aircraft will not ordinarily be attached to units smaller than a brigade. Where Marine aircraft are *attached* to a brigade or larger unit, the commanding officer of such aircraft will act in the capacity of special staff officer to the commander of the unit to which attached. The duties incident to this assignment will be in addition to his regular duties as commander of aircraft. Where aircraft are *supporting* the operations of a brigade or larger unit, but not attached, an air liaison officer will be detailed to the staff of such unit for the purpose of coordinating air operations with those of the supported unit.

SECTION 4

ADMINISTRATION AND TRAINING

13. Administration.—a. Marine Corps aviation is a branch of Naval aviation, and for all supply and technical matters is subject to regulations prescribed by the Bureau of Aeronautics. Marine Corps Headquarters, through the office of the Director of Marine Corps Aviation, administers personnel matters and prescribes general policies. Tactical control is a function of the Commander, Fleet Marine Force; Commander, Aircraft, Battle Force, United States Fleet; or the commander of a foreign shore base to which aviation is attached.

b. For local administrative purposes, the squadron is the basic unit. Disciplinary powers are vested in the group commander, except that a squadron operating independently has the same command functions as a separate Marine battalion.

c. Equipment and supplies, other than aeronautical items, are procured and accounted for in accordance with Marine Corps regulations. Aeronautical matériel is handled in accordance with instructions issued by the Bureau of Supplies and Accounts.

14. Individual Training.—a. **Officer pilots.**—Pilots are selected from junior line officers, warrant officers, and aviation cadets who are qualified for flying duty. They are trained at the Navy Flight School, Naval Air Station, Pensacola, Florida; and when graduated therefrom are designated as naval aviators. Newly qualified pilots joining Marine aviation units are usually given an advanced course of flight training before being assigned to tactical squadrons. To properly train a Marine Corps pilot requires about 2 years of intensive work, inclusive of the year spent at Pensacola. Junior officer pilots in addition to flying duties, are given such ground assignments of a technical or administrative nature as may be desirable. Each group and each squadron details flying officers for duty as executive officer, flight officer, engineer officer, gunnery officer, communication officer, intelligence officer, photographic officer, etc. In addition to such technical assignments, the duties of personnel officer, matériel officer, mess officer, and police officer are normally, within the squadron, performed by pilots.

b. **Enlisted pilots.**—A limited number of aviation enlisted men are selected annually for flight training and given the regular course at Pensacola. Upon graduation they are designated as naval aviation pilots, promoted to noncommissioned rank (subject to vacancies), and assigned to squadrons as required. When in command of an airplane they have the same duties and responsibilities as do the officer pilots. Naval aviation pilots are most frequently utilized as co-pilots, radio operators, observers and aerial gunners; although the more experienced are assigned to utility squadrons as transport pilots.

c. **Observers.**—No regular corps of commissioned observers is provided for scouting squadrons in the current peacetime organization. Junior artillery officers are attached from time to time for air spotting practice, but can not with this training alone be considered as fully qualified air observers. Pending the authorization, detail, and training of regular observers, the pilots and enlisted gunners of scouting airplanes perform the observer's duties.

d. **Nonflying officers.**—Nonflying officers and warrant officers of suitable qualifications are currently assigned such group administrative duties as supply, mess, police, motor transport, etc., in order to release pilots for tactical operations.

e. **Mechanics.**—Enlisted mechanics fall naturally into two groups: Those whose duties are maintenance and service of airplanes on the operating line, with additional flight duties as gunners and observers; and those specialists whose duties are confined to the general overhaul shops, and who are not regular flight crew members. A small percentage of enlisted mechanics are trained in Army and Navy technical schools. The majority are trained in Marine Corps units by the apprentice system.

f. **Aerologists,** radio technicians, photographers, armorers, and parachute riggers are specially trained in Army or Navy technical schools. Annual complements for these schools are maintained in order to provide a steady flow of skilled personnel for these activities.

15. Unit Training.—a. **Basic.**—All Marine aviation personnel are given the basic infantry training, engage in annual small arms target practice, and participate in regular drills, ceremonies, and inspections.

b. **Individual flight training.**—Individual flight training is continuous throughout the year, including cross country navigation, instrument flying with radio aids, night flying, strange field landings, and basic formation flying. New pilots are given intensive training to bring them up to standard, while the experienced pilots maintain their proficiency by frequent flights under various conditions.

c. **Tactical.**—Tactical training is conducted by squadrons, conforming as closely as possible to the annual schedule prescribed by the United States Fleet for Naval squadrons. This includes training

in formation flying, gunnery and bombing, simulated combat maneuvers, and in the performance of cooperative missions with ground units of the Fleet Marine Force. The training schedule culminates in the annual maneuvers of the Fleet Marine Force. Marine Corps squadrons are also trained to operate from aircraft carriers as a part of the Fleet Air Arm. Selected units participate regularly in naval maneuvers with the Carrier Divisions, United States Fleet.

CHAPTER II

CHARACTFRISTICS OF AVIATION

SECTION 1

GENERAL

16. Introduction.—This chapter is intended as a brief review of the general characteristics of aviation which have a bearing on its tactical employment. The discussion includes the physical characteristics of the airplane inherent in its design; the variable characteristics of airplane operation; and the personal or psychological factor as it affects the tactical operation of air units. While the airplane and its operation are today considered commonplace, and a superficial knowledge of aviation is possessed by every school boy, there yet remain certain basic characteristics of military aviation which may not be so commonly known. A thorough understanding of these characteristics, and their influence on the military capabilities and limitations of aviation, is considered as a necessary preface to the study of general air tactics.

SECTION 2

AIRPLANE CHARACTERISTICS

17. General.—From a military point of view the following general characteristics of the airplane, and its operation, are of primary importance:

a. Three dimensional movement.
b. Facility as a means of observation.
c. Speed.
d. Ceiling.

18. Three Dimensional Movement.—The ability of the airplane to provide communication and transportation between widely separated places without regard to surface obstacles is perhaps its most important military characteristic. This makes all territory which is within the range of aircraft subject to air attack or air observation.

19. As a Means of Observation.—The airplane can carry an observer to varying altitudes over any terrain. It therefore provides a most advantageous means for overcoming many obstacles to terrestrial observation; and provides a practical means for rapidly and comprehensively reconnoitering large areas of terrain which might otherwise be inaccessible in the time available.

20. Speed.—The most striking characteristic of the airplane is its speed and ability to travel over a direct line between two points. Tactically, speed and rate of climb have the same significance. Rate of climb is velocity in the vertical direction; speed, in the horizontal direction. The possession of superior speed and rate of climb obviously gives a combatant complete freedom of action. He can force his opponent to fight or he can avoid action in accordance with his mission and plan. Therefore, the military fighting airplane should have the highest speed (using the word in a tri-dimensional sense) consistent with the performance of the duties for which it is primarily designed.

21. Ceiling.—a. **Absolute ceiling.**—The absolute ceiling of an airplane is the limiting altitude which the airplane can attain. At this altitude, no excess power remains available for climb and the rate of climb becomes zero.

b. **Service ceiling.**—The altitude at which the rate of climb is 100 feet per minute is arbitrarily defined as the service ceiling.

22. Effects of Weather.—a. **General.**—Unfavorable weather conditions are the greatest deterrent to continuous military air operations.

b. **Winds.**—Winds short of gale force will not seriously interfere with general air operations. They must be considered, of course, as to their effect on air navigation, and the increased hazard to aircraft while on the ground. On the other hand, strong winds may be a decided aid in operating from small fields.

c. **Clouds and fog.**—(1) Prior to the last few years clouds and fog were considered the greatest menace to flying. Today, through the perfection of instruments, a pilot may traverse fog or cloud covered areas in comparative safety. From a military standpoint, however, fog is a very definite deterrent to the successful accomplishment of a mission where the ground objective to be observed or attacked is obscured by fog, because the normal objective is a comparatively small area which must be seen or definitely located by landmarks in order to be attacked.

(2) Experiments are being conducted which indicate that, by the use of intersecting beacons, airplanes can be sent direct to the objective under most unfavorable weather conditions.

(3) Experiments have also been conducted, with excellent success, which indicate the practicability of landing airplanes on a fog covered airdrome.

d. **Visibility as to weather.**—Visibility, as expressed in connection with weather, is a term which indicates the radius of vision in the air which the existing state of weather will afford to the operating personnel of the airplane.

23. Airdromes—General characteristics.—The operation of airplanes requires an airdrome consisting of a landing strip or runways for taking-off and landing airplanes, and areas where the airplanes can be serviced and maintained in proper mechanical condition. The landing field or runways must be level, smooth, of firm surface, and without obstructions within, or high obstructions near, the boundaries. The landing field should be of such shape, or the runways should be so located, that the airplanes can always take off and land headed into the wind.

SECTION 3

THE PERSONAL EQUATION

24. Absence of Mass Psychology and Shock Action.—a. In ground warfare, the ultimate fighting unit is the enlisted man. Officers lead and control their units. Leadership and the understanding of mass psychology often turn apparent defeat into victory. In air combat, the pilot or observer is the ultimate fighting unit. Men on the ground maintain and service the airplanes only. Due to the lack of close personal contact, the element of mass psychology can be of little assistance to the leader of a combat formation of aircraft. Therefore, the measure of the successful performance of any mission rests largely upon the degree of thoroughness of the disciplinary and tactical training of the pilots and observers, as well as upon their individual initiative, nerve, flying ability, and general resourcefulness.

b. In land warfare, shock action by physical contact still holds an important place in determining the issue of battle. In air warfare, this is not true, since to ram a hostile airplane means the destruction of both friend and foe. The same determination which is needed to bring down an enemy by ramming would, with equal certainty, bring him down by machine-gun fire. In the air, therefore, physical shock may normally be dismissed from consideration as an important form of action. Success depends upon maneuver and fire action.

25. Endurance of Personnel.—When military necessity demands it, men are urged to the verge of exhaustion. If this occurs, the man becomes of little value until a long period of rest has elapsed. Where air operations are to extend over weeks and even months, the energy of men must be conserved. If operations are to continue over a long period of time, it is well not to demand of any individual the execution of more than two missions in a single day. Particular care must be taken in the case of the pilot operating at high altitudes where the availability of a sufficient amount of oxygen is of vital importance. With an insufficient amount of oxygen, a pilot will soon become devitalized to such an extent that his fitness for flying will be affected. For flying at high altitudes, both oxygen and a special apparatus must be provided for the flying personnel in order to overcome the effect of the rarity of the air.

MARINE CORPS AVIATION
GENERAL

PART TWO

TACTICS AND TECHNIQUE

CHAPTER III

RECONNAISSANCE AVIATION

SECTION 1

GENERAL

26. Definition.—Reconnaissance aviation is the term used in the Marine Corps to denote that general class of aviation whose design, equipment, and training prepares it primarily for the service of information. Specifically, the term includes those units referred to as *reconnaissance* and *ground force observation aviation* in the Army, and those units referred to as *patrol*, *observation*, and *scouting* aviation in the Navy.

27. Mission.—a. The mission of reconnaissance aviation is to secure and furnish information of a strategical or tactical nature, and to spot for naval and shore-based artillery. It engages in air combat only for protection against hostile fighters, and does not normally attack ground objectives while engaged in reconnaissance flights.

b. Naval and Marine Corps reconnaissance aviation is also equipped and trained to a limited extent for the secondary mission of attacking surface objectives.

28. Classification of Reconnaissance.—a. Air reconnaissance may be classified as distant (strategical) or close (tactical), according to mission; visual or photographic, as to method. A distant reconnaissance mission, for instance, may require visual observation, photographic observation, or a combination of both.

SECTION 2

THE RECONNAISSANCE AIRPLANE

29. Types.—a. Naval reconnaissance aviation uses three general types of airplanes: the long-range patrol seaplane, the cruiser and carrier scout, and the battleship observation airplane. The Marine Corps now employs the scouting-type airplane for reconnaissance missions. In the near future it will also have the observation type airplane. Detailed characteristics of the various models of these types are published annually by the Bureau of Aeronautics as restricted matter.

b. **The patrol seaplane.**—This is a multi-engine, multi-place, flying boat of great range and endurance in the air. It carries cabin and messing facilities for its crew, and is thus able to provide relief and rest periods for the operating personnel without cessation of flight. The patrol seaplane is designed and its crew trained primarily for long-range strategical reconnaissance of sea and coastal areas. It is also capable of carrying a heavy bomb load, and is equipped with a very accurate bomb sight designed for high altitude horizontal bombing. It carries several defensive machine guns for protection against hostile fighters. Complete radio and navigational equipment permit this type of aircraft to operate at will over the open sea, independent of surface vessels. Servicing is accomplished at shore bases, or from tenders in protected waters.

c. **The scouting airplane.**—The present type of naval scouting airplane is a carrier landplane of two-place, single-engine design. It is of medium size, has moderate speed and range, and fair maneuverability. A special type of catapult seaplane is used for scouting from cruisers. Both these types carry offensive and defensive machine guns, and have bomb racks for carrying light and medium bombs. Radio and navigational equipment permit operation over limited sea areas. The scouting airplane is employed by the Navy for tactical scouting and by the Marine Corps for all those missions commonly assigned to Army observation units. Spotting naval gunfire is a secondary task.

d. **The observation airplane.**—(1) **Navy.**—As employed by the Navy, this is a convertible catapult seaplane carried on board battleships for the primary purpose of spotting naval gunfire. Secondary missions include tactical scouting and antisubmarine patrol. This type is similar in appearance and equipment to the scouting airplane, but has less speed, range, and bomb carrying capacity.

(2) **Army.**—The Army observation airplane is similar in characteristics to the Naval scouting and observation types, but carries more specialized equipment for land reconnaissance missions. It is not designed for carrier operation, nor for extended flights over water, but otherwise is well adapted to Marine Corps missions. The latest type of observation airplane adopted by the Air Corps is a three place, midwing monoplane, carrying pilot, observer, and gunner. Only defensive armament is provided on Army observation airplanes, as their use for ground attack missions is not contemplated.

e. **Special.**—The autogyro type of airplane has been tested by the Marine Corps and by the Army Air Corps with varying success. Its chief advantage lies in its ability to land in very small fields, and to remain over a given area with very little forward speed. The chief disadvantages are its vulnerability to the fire of ground weapons and fighting airplanes, which it shares to some extent with the captive observation balloon. Like the balloon, it gives the observer practically a stationary platform, and is particularly desirable for artillery spotting. It appears probable that this type of aircraft may eventually replace the observation balloon in the Army Air Service.

30. Armament.—a. **Machine guns.**—Normally, reconnaissance airplanes are armed for defensive purposes only. One forward fixed machine gun is provided in single engine types for protection from frontal attacks. The pilot operates this gun from the front cockpit. An additional machine gun is provided for protection from the rear hemisphere. This gun is mounted in the rear cockpit on a flexible mount, and is operated by the observer. The latest model Marine Corps scout airplane mounts several fixed guns, since it is also designed for attack missions. Patrol seaplanes do not mount fixed guns, but employ several flexible guns so arranged as to cover all approaches.

b. **Bomb racks.**—Naval types of reconnaissance airplanes are provided with standard bomb racks, to permit their use on occasion as combat aviation. The present model of Marine Corps scouting airplane will carry a considerable number of fragmentation bombs, or a lesser number of heavier bombs, and will be readily convertible to attack or dive bombing missions. Naval scouting airplanes will

carry up to five hundred pounds weight of bombs, while the patrol seaplanes in current use will carry a weight of two thousand pounds. This bomb load necessitates a corresponding reduction in fuel carried, and thus reduces the range available.

c. **Chemical tanks.**—Naval and Marine Corps scouting airplanes may carry two seventeen-gallon chemical or smoke tanks in lieu of bombs, with the same corresponding range restriction. These are spray tanks, operated by the pilot or observer. Each tank covers a strip approximately one-half mile in length by 200 yards in width. The Marine Corps scouting airplanes may carry a fifty-gallon tank in lieu of the two smaller ones.

31. Equipment.—a. **Radio.**—All Naval and Marine Corps scouting airplanes are equipped with two-way radio apparatus which may be used for telephonic or telegraphic communication under average conditions up to a maximum distance of approximately one hundred and fifty miles. The patrol seaplanes carry more powerful sets, and are able to maintain radio communication throughout their flight range.

b. **Photographic equipment.**—While all scouting and observation airplanes can be used for oblique aerial photography with hand-held cameras, only certain specially constructed airplanes can mount the vertical or mapping camera. Available cameras and trained personnel are sufficient to equip only two or three airplanes in each Marine scouting squadron for complete photographic reconnaissance missions. For night photography, flares and flashlight bombs are carried by the reconnaissance airplane.

c. **Other equipment.**—The reconnaissance airplane carries a Very pistol, message pick-up gear, and message drop bags for use in communication with ground units. For night flying, landing lights and flares are provided.

32. Operating Personnel.—a. **General.**—The personnel of airplane reconnaissance units are divided into flight crews (pilot and observer-gunner) which operate the airplanes in the air, and ground crews which are responsible for service, maintenance, and administration details.

b. **The pilot,** in Marine Corps scouting units, flies the airplane and performs during peacetime the more important of the visual observation missions. In addition to being a competent airman, the scouting pilot should have a sound basic knowledge of the tactics of surface units. It is considered essential that he be a commissioned officer of considerable experience and sound training.

c. **The observer,** in peacetime Marine Corps scouting units, is usually an enlisted man qualified in aerial gunnery and radio opera-

tion. He may also be a qualified pilot, and it is desirable that he have this rating in order to permit the commissioned pilot more leisure for tactical observation. In photographic airplanes, the observer is an enlisted photographer. In artillery liaison airplanes he is usually a junior artillery officer, temporarily detailed for this duty. Commissioned observers should be provided for wartime scouting and observation squadrons.

SECTION 3

PHYSICAL CHARACTERISTICS AND TRAINING

33. Personnel Factors.—a. The airplane can only provide a fast-moving observation post overlooking a given area. Whether proper military advantage can be taken of this facility depends upon the human equation—the observer. Regardless of whether observing be done by an officer designated and trained for this duty alone, by a commander or staff officer from a ground unit, or by the pilot of the aircraft itself, certain prerequisite training and experience are essential.

b. The commissioned observer, when provided, is responsible for securing the information desired, and for submitting an accurate report of the information secured. In order that he may recognize ground units and understand their operations when he observes them on the ground, the observer should have a working knowledge of the organization and tactics of ground units. He must also be familiar with basic fleet dispositions, and with the type and markings of naval vessels. Above all, the observer must know where to look for the essential information, and have the faculty and ability to observe and to report accurately what actually comes within the range of his vision. In addition to the foregoing qualifications, an observer should be skilled in aerial gunnery, as the safety of his airplane will often depend upon his accurate machine gun fire. He must be a competent radio operator, in order that vital information may be relayed to the ground units. He should be well versed in aerial photography and adept with the camera. It is desirable, also, that he be a pilot with sufficient skill to assume actual control of the airplane in an emergency. A properly trained observer will be able to do all these things, and at the same time make a thorough and accurate reconnaissance of his assigned area; whereas, an untrained, inexperienced man in the rear seat of a reconnaissance airplane would see little or nothing and would secure no information of value.

c. A competent aerial observer is the product of training and experience; his place cannot be filled by an enlisted mechanic, nor by a nonflying officer temporarily assigned to that duty. While our more experienced pilots are competent observers, it is difficult for one man to act as both pilot and observer; and impracticable to assign two experienced officer pilots to one airplane. An obvious need exists in Marine Corps Aviation for the provision and peace-time training of a nucleus of regular commissioned observers.

d. It is not the primary duty of an air observer to report his conclusions. He reports: what he sees, what it is doing when he sees it, where it is located, and the hour at which he sees it. What was observed should include the composition of the object and its size. What it is doing should include its activities and movements, if any. In other words, the observer reports **what, where,** and **when.** Information furnished by air observers, frequently in fragmentary form and at various hours, is coordinated and evaluated, and the conclusions are drawn primarily by the appropriate members of the staff and the commander of the ground unit concerned.

e. Fatigue causes the pilot and the observer of a reconnaissance airplane to lose their efficiency rapidly after two hours in the air. Therefore, two hours is considered as the duration of a normal mission. Obviously, this rule cannot apply to distant reconnaissance missions, nor is it invariable for other missions. Frequently it may be necessary to keep an airplane in the air to the limit of its fuel capacity.

34. Reconnaissance by Airplane.—a. **Visual reconnaissance.**—That which an observer can observe and report depends upon the visibility, the cover or camouflage existing on the ground, the antiaircraft discipline of the ground troops, and the skill of the aerial observer in noting the objects and details on the ground which come into the range of his vision.

(1) **During hours of daylight.**—At the following (and lower) altitudes, an observer flying in the vicinity can, during average daylight conditions, distinguish objects and details of similar or greater visibility as follows:

10,000 feet—railroad trains; motor and troop columns and objects of like size, on roads.
2,500 feet—small troop concentrations outside of trenches.
1,500 feet—men in trenches and in shell holes.
500 feet—the uniforms of troops.

(2) **During hours of darkness.**—(a) The effectiveness of daylight air observation has generally forced large movements of troops and material to be made at night in order to escape detection and

prevent attack by combat units of hostile aviation. This in turn makes night observation of major importance. However, the securing of accurate and comprehensive information at night is much more difficult than in the daytime. Accurate information results from the ability to see and recognize objects and terrain features. On a very dark night this ability is practically nonexistent, and only large bodies of water are distinguishable. On bright moonlight nights large objects stand out clearly to an observer flying at low altitudes, and even small bodies of troops and single vehicles can be noted on roads. On nights of medium darkness, the general characteristics of the terrain (whether open or wooded), rivers, roads, railroads, etc., are distinguishable, and movements of large bodies of troops and trains on white roads can be noted. However, in practically all cases at night the observer must resort to the use of flares to secure accurate detail. Night photography promises to be of considerable value in spotting enemy activities at night, although at the present time only small areas can be photographed, as the flash bombs are not powerful enough to light up a large area.

(b) Notwithstanding the difficulties of night observation or reconnaissance, an experienced observer can usually bring back valuable information. His success depends upon his knowledge of the aspect of things at night, what to look for and where to look for it. It will be difficult to carry on extensive ground activity at night without indications of it showing in some form.

(c) Large columns of troops on white roads are visible even on fairly dark nights. Smaller columns with the men marching in single file on each side of the road mingle with the shadows and trees and are practically invisible on an average night. Columns of vehicles such as trucks, artillery, and mechanized forces are easier to locate, as they must generally use main roads and cannot conceal themselves on the sides of the road. Lights of any kind attract the observer's attention and may cause him to drop flares for a closer investigation.

(d) Bivouacs are often discovered by lights, smoke, or fires. Activity of vehicles within, or entering and leaving an area, invite the closer investigation of the observer.

(e) Railroad trains can be easily located, even on the darkest nights, by lights, reflections from the firebox, sparks, etc. Under certain conditions of light, reflections from the rails can be seen, and a moving blot on this reflection indicates a train.

(f) Artillery and antiaircraft artillery in position are hard to locate except when firing.

(g) In general, if a force has been located prior to darkness, its movements after dark can usually be discovered. Searching a large

area, however, to determine the presence or absence of forces presents a difficult problem. The movement of large forces (a regiment or larger) covers so much road space that it will probably be found by an intensive air search. Small units have much better chances of escaping discovery.

(h) Flares are habitually used by night observation airplanes to light up the area to be observed. Two types of flares are used for this purpose:

First, there is what is called the observation flare. It is a small parachute flare of about 50,000 candlepower, illuminates an area of about one quarter of a mile in diameter for a period of 30 seconds, and weighs about 1 pound.

Second, there is the landing or "airways" flare. It weighs about 16 pounds, burns for 3 minutes with 250,000 candlepower, and illuminates an area of approximately 1 square mile.

b. **Photographic reconnaissance.**—Photographic reconnaissance is employed to supplement visual aerial reconnaissance. The photograph furnishes a permanent and accurate record, the details of which may be studied at leisure by photographic interpretation experts using magnifying glasses and other similar aids. By means of flares, aerial photographs may be taken at night. Much valuable information, which otherwise could not be secured, can be obtained by means of the aerial photograph. The aerial photograph is especially valuable in disclosing camouflage, in revealing the extent and nature of the enemy's fortifications and other works, and in mapping. As compared to visual reconnaissance, there is more delay in securing information by means of photographic reconnaissance. Normally, after the exposure is made, the film must be brought to the ground and developed; and the print must be made, dried, and delivered to the interpreting personnel. About 1 hour is required to complete the photograph after the exposure has been made and before the photographic print can be used. A special apparatus has been recently developed, by means of which the aerial photograph can be developed and completed in the airplane within 10 or 15 minutes after exposure. This method obviously enhances considerably the value of securing information by photographic reconnaissance.

35. Air-Ground Training and Cooperation.—The training together of air reconnaissance units and the ground units which they serve is a matter of greatest importance, and one which has been too frequently neglected. The personnel of both units should be personally acquainted, and should have a mutual understanding of each other's problems. The ground units should have at least some experience in antiaircraft discipline and training, and in the prompt recognition of airplane types and markings. The air units should

become familiar with the organization and operations of the ground forces. The observers must have actual experience in viewing ground units when disposed in various formations. Cooperation and training to perfect communication between ground and air units is especially important. Proficiency in the use of air-ground visual signal codes and in radio communication is mandatory if aviation is to be of appreciable value in the execution of reconnaissance missions for front-line units. This cooperation is easier to achieve if the same air and ground units are habitually paired for training.

36. Air Force Training.—a. Air reconnaissance units must also be trained in purely aviation activities, including cooperation with combat aviation in independent air operations. Training periods must be provided for:

(1) **Aerial navigation.**—Individual reconnaissance airplanes must be navigated accurately, both day and night, in all kinds of weather, over great distances. Navigational training includes the use of all available navigation facilities, such as radio range beacons, radio direction finders, airplane instrument flying, and dead reckoning aids. Patrol squadrons are also trained in celestial navigation.

(2) **Communications.**—Radio communication between airplanes, from ground to airplanes, and from airplanes to ground, is an essential part of modern air tactics. All Marine Corps pilots are required to maintain a certain proficiency as radio operators, and must pass an annual test in radio transmission and reception of telegraphic code messages. This is emphasized in the case of reconnaissance units, considerable time being devoted annually to the subject.

(3) **Gunnery and bombing.**—Pilots of reconnaissance units are trained in aerial gunnery, with fixed and free guns; and in the accurate dropping of bombs by sight or diving methods, depending upon the type of airplane with which the unit is equipped. Observers and mechanics are trained in aerial free gunnery. Annual periods of instruction, practice, and record firing are allotted all squadrons in order to maintain individual and unit proficiency.

(4) **Formation and group tactics.**—Each Marine scouting squadron is required to be proficient in squadron and group formation flying. Frequent carrier operations and aerial concentrations require close, precise maneuvering of large air units, and necessitate constant practice for individual pilots and basic element leaders. Participation in tactical problems is continuous throughout the training year, assuring the proper cooperation between reconnaissance and combat units.

SECTION 4

METHODS OF EMPLOYMENT

37. General.—The reconnaissance units of Marine Corps aviation have a triple function. They are trained to operate from aircraft carriers as naval scouts; to support amphibious operations of the Fleet Marine Force; and to perform the normal functions of Army observation aviation in support of land operations. All these separate functions may be necessary during the various phases of a major Fleet Marine Force operation.

38. Naval Operations.—a. Marine scouting squadrons are subject to duty aboard naval carriers, either as replacements for naval squadrons in Fleet operations, or in connection with the preliminary phases of a landing operation. In either case, they operate in accordance with prescribed carrier doctrine.

b. Carrier scouts are employed generally to perform tactical scouting for the battle line, in order to establish and maintain contact with the hostile fleet or elements thereof. This duty entails operations over sea areas up to the limit of safe flight radius, and presupposes a high degree of navigational skill. It also requires an accurate and extensive knowledge of naval vessels, especially the ability to recognize silhouettes at a considerable distance. A scouting pilot must also be well versed in basic naval tactics and be familiar with the standard formations employed by surface vessels. Naval scouts are frequently used for strictly air force missions, involving the location, surveillance, and illumination of surface targets for air attack by the striking components of Fleet aviation. Detailed instructions

for the employment of carrier-based scouts are not, however, within the scope of this text; and only the briefest outline can be given here for purposes of general information.

c. Scouting of distant coastal land areas is a normal function of Naval patrol squadrons, but may also be performed by carrier-based Naval and Marine scouts. In connection with projected landing operations, it is highly desirable that strategical and tactical reconnaissance of the landing areas be accomplished by Marine units especially trained for such operations.

39. Amphibious Operations.—The operation of reconnaissance units in amphibious warfare is fully covered in other texts.

40. Land Operations.—a. When Marine aviation reconnaissance units operate ashore in support of land forces in a major campaign, the methods of employment correspond to those prescribed for the air service units of the United States Army. The basic tactical doctrines, the designation of missions, and the procedure for gathering and disseminating information are identical. The organization and assignment of units differs to some extent. Therefore, in the discussion of land warfare, the matter contained herein is largely quoted from selected texts of the Army schools. The term "observation aviation" is considered more descriptive of the missions performed, and is thus retained in lieu of "scouting aviation." The current designation of Marine Corps reconnaissance units as "scouting squadrons" does not alter their normal functions as observation aviation when supporting forces ashore.

41. Missions for Observation Aviation.—a. Missions for observation squadrons supporting a Marine brigade or larger unit may be classified as those pertaining wholly to the service of information, or **reconnaissance** missions; and those which are executed in connection with front-line units just prior to and during combat, or **battle** missions.

b. The reconnaissance mission includes distant (strategical), and close (tactical) reconnaissance. Orders to observation units should specify which is to be accomplished.

c. The term *battle missions* designates inclusively the infantry mission, the command mission, and the artillery mission. It has no reference to the air attack of ground troops, nor to air combat between airplanes. Battle missions are a special type of close reconnaissance, conducted to secure information of the enemy and friendly front-line troops during battle. In other words, it is the intensive reconnaissance carried out over the immediate combat area, the purpose of which is to amplify and supplement information gained by ground troops, furnish air observation for the artillery, and afford a liaison agency between the commander and his front-line troops.

42. The Reconnaissance Mission.—a. **General.**—The reconnaissance mission is executed to observe and to secure general information of an area, road, route, or particular locality. It may be accomplished by visual observation, or by photography, as specified in orders to the observation units. It may be executed during daylight or darkness. Based largely on the location of the area to be observed with reference to the front lines, and the intensity of the observation to be conducted, reconnaissance by means of the observation airplane is classed as **distant** and **close** reconnaissance.

43. Distant Reconnaissance.—Distant, or strategical, reconnaissance is that which is accomplished at a comparatively great distance beyond the front lines. As soon as war is declared and before the main forces are in contact, reconnaissance aviation is sent deep into hostile territory in order to procure information upon which to base strategical and major tactical plans. The determination of the location of hostile concentration areas; the strength, general composition, routes, and direction of movement of major hostile columns; defensive organization, rail and road traffic; and the location of supply establishments, air bases, and factories are proper objectives of distant land reconnaissance. Distant reconnaissance over sea and coastal areas has for its object the location of hostile naval units; naval and air bases; defensive organizations ashore; troop concentrations ashore or afloat; and the location and movements of enemy merchant craft.

44. Close Reconnaissance.—Close, or tactical, reconnaissance is that which is accomplished at a comparatively short distance from the front line when detailed information of a tactical nature is desired. It is continuous before, during, and after battle. Proper objectives of close reconnaissance include the movement of enemy forces to or from the battle area, disposition of heavy artillery and reserve units, and the early discovery of indications of major tactical maneuvers, such as envelopments, counter attacks, or withdrawal from action. Close reconnaissance, during battle, is concerned mainly with what is happening in the enemy's immediate rear areas, and the information sought is that which would influence the commander's tactical dispositions. Observation of the actual battle area is not a primary function of close reconnaissance.

45. Reconnaissance Areas.—a. The territory to be reconnoitered is divided into air areas, and these areas are assigned to definite air units as a means of coordinating the reconnaissance activities of Force aviation with those of the observation squadrons which may be directly supporting the brigades. In general, Force aviation retains responsibility for distant reconnaissance beyond the immediate sphere of influence of the front line brigades, leaving to brigade

observation squadrons the close reconnaissance and battle missions. The boundary between distant and close reconnaissance areas should be not more than one day's march of infantry in front of the brigade lines, and a like distance to the flanks if the brigade is operating independently. In stabilized situations, this boundary may be drawn in to within five miles of the front lines. Orders to air units should clearly designate the type of reconnaissance desired (distant or close), defining area boundaries by prominent topographical features.

b. The attachment of air reconnaissance units to the Marine brigade is contemplated only when the brigade is operating on independent or semi-independent missions. Otherwise all reconnaissance units should operate under Force control, being assigned to support subordinate brigades as required. In any event, however, definite assignment of reconnaissance areas should be made to separate air units, as follows:

(1) "VMS-1 will execute distant reconnaissance beyond the line: FREDERICKSBURG — REMINGTON — MANASSAS — OCCOQUAN, to include the SHENANDOAH VALLEY."

(2) "VMS-2 will provide close reconnaissance over the area occupied by the First Brigade, to the line: FREDERICKSBURG—REMINGTON — MANASSAS — OCCOQUAN, paying particular attention to * * * * * *."

In this instance the observation unit assigned close reconnaissance missions would also perform battle missions for the First Brigade.

c. The assignment of an air area to a command does not prohibit the air service of that command from reconnoitering outside of that area when it is desired to secure information of immediate importance to that command.

46. The Infantry Mission.—a. The infantry mission is executed to secure information of the location and activity of the enemy front lines and reserves, his works, and the terrain he occupies on the field of battle. The infantry mission is also executed to secure information of and to maintain communication with friendly front-line troops when this cannot be readily accomplished by other means. It is usually executed only by the observation unit assigned to conduct close reconnaissance missions. Each brigade will as a rule be assigned one or more infantry airplanes. When the situation is particularly difficult, the infantry mission may be divided into two separate missions termed the **contact** mission and the **liaison** mission.

b. (1) The contact mission is executed primarily to secure information of the **enemy.**

(2) The liaison mission is executed to secure information of **friendly troops.**

c. (1) It is of special importance that infantry troops of all grades and ranks have full knowledge of the object, method of operations, possibilities, and limitations of the infantry mission and air service activities of a similar character. Only by close cooperation between the ground troops concerned and the observers in the air can satisfactory results be attained.

(2) Before starting on the infantry mission, the pilot and observer make a thorough study of the map and all information available as to the location, identity, and general situation of the friendly and hostile troops to be observed. All agencies should make a particular effort to see that all possible information is made available to this observation team. After taking off, the observer checks his radio with the set on the airdrome and with the Brigade command post to insure that the set in the air and both sets on the ground are functioning satisfactorily. The airplane is then flown toward the front. The locations of regimental and other command posts are identified en route.

(3) When near the front lines, the airplane will be flown at an altitude of a few hundred feet in order that troops under cover on the ground may be seen. In case the infantry plane observer cannot locate friendly troops on the ground he will fire a rocket or a light signal calling on the infantry to outline the front line by displaying panels or lighting flares. Such calls by the observer should be made only when he is unable by any other means to locate own front lines. As soon as the observer secures information as to the location of the front lines, this information is transmitted to the brigade command post by radio or dropped message. When necessary, such information is transmitted also to the regimental command posts and other activities by dropped messages.

(4) The priority given to the securing of information of the enemy, information of friendly front lines, or other information, will be governed by the situation and will depend upon the instructions given the observation team. Information of the hostile front lines is determined by flying in and out of the hostile front lines at such a low altitude that the uniforms of individuals or small bodies of hostile advance elements may be identified. Securing information which will assist in determining the location, strength, and activity of the hostile reserves of divisions and lower units is an important responsibility of the infantry or contact team. All information of hostile troops and activities is reported to the brigade command post. When there is any doubt that information important to the forward ground troops will reach these troops promptly from the brigade command post, the infantry team also reports such information to these troops direct.

(5) The infantry team notes and reports to brigade headquarters all rockets and other signals from both friendly and hostile infantry.

If necessary, signals from friendly infantry are relayed to the artillery. All areas in which either friendly or hostile shells are falling are noted and reported. Features of terrain, such as natural and artificial obstacles on frontal or flanking avenues of approach; trenches; machine-gun pits; wire entanglements; buildings; roadways; hills and ridges; hostile artillery placed well forward; tanks, whether attacking, moving into combat area, parked, or ready for counterattack; troop movements and reserves; all are objects of information which the infantry team should observe and report.

(6) The infantry mission has many possibilities, but it also has many limitations. The flying of the infantry missions involves unusual risks and is most trying on the observation team. The infantry airplane is subjected to attack by fighter aviation; it is in danger from machine-gun and rifle fire not only from the enemy but also from untrained or inexperienced friendly troops. For protection, the pilot should never fly a straight course for any appreciable length of time. He should constantly turn, twist, and skid at high speed. Flying in such a manner makes observation more difficult and it may not be possible to locate objectives without flying over the sector several times.

47. The Artillery Mission.—The artillery mission is executed to assist the artillery by furnishing information as to the nature and location of artillery targets and by furnishing aerial observation for the adjustment of fire. The artillery mission is executed by attached brigade squadrons, and by Force air units. When required, a definite number of observation airplanes with their operating teams are designated for artillery missions. These airplanes and teams are then subject only to the call and tactical orders of the artillery commander. The artillery team operates with designated battalions of artillery which have been ordered by the artillery commander to maintain communication with and to fire on call from the artillery air observer.

48. The Command Mission.—a. The command mission is executed by order of the commander to secure particular information, or to perform some special service desired at that time. When the situation is in doubt, especially during an attack, it may be necessary for brigade headquarters to dispatch special air observation teams to obtain particularly urgent information of the location of friendly or hostile troops. A mission of this kind may be ordered to verify information received from other sources, or to check conflicting reports which have come from different air observation teams or from the air and ground information services. At times the command airplane will be used to transmit messages or orders from Force

or brigade headquarters to subordinate units. As a rule, one or two airplanes will be maintained on the alert at the squadron airdrome or at a landing field near the Force or brigade command post, prepared to execute missions of this character on call.

b. The observation personnel selected for this type of work must be experienced, thoroughly familiar with the sector, and know every detail of the situation up to the time that they are ordered on their mission. As a general rule, command missions should be undertaken only by the regularly assigned crew of the command airplane. The substitution of a staff officer for the regular observer, unless such staff officer is especially trained in air observation, is not recommended. Personal reconnaissance flights by a troop commander should be escorted by other aircraft.

49. The Special Photographic Mission.—a. In addition to the incidental photographic data secured by observation teams in the performance of reconnaissance and battle missions, it will frequently be necessary to provide special photographic airplanes for aerial mapping and mosaic work, and for the detailed photography of specified areas and objectives. Missions of this type are normally executed by single aircraft, but if fighter opposition is expected, and no friendly fighter support is available, a section of three airplanes may be employed. The leading airplane is primarily charged with taking the photographs; the other two take positions from which they can best protect the camera airplane from air attack.

b. When an observation team is directed to "photograph an area," it is understood that overlapping vertical photographs are to be furnished. Obliques will not be taken unless specifically requested. The overlap should be about fifty percent to facilitate stereoscopic study of the entire area, and to avoid using the distorted outer edges of the prints. The pictures must be clear and sharp, scaling about six inches to the mile. In order to get this large scale without requiring the photographic airplane to fly within effective antiaircraft range, cameras of long focal length (20 to 24 inches) are necessary. At 20,000 feet the 24-inch lens gives a scale of 1:10,000, or 6 inches to the mile, covering an area about 1 by 1½ miles. The 12-inch lens, which is current equipment, takes the same size photograph from 10,000 feet. Oblique photographs are commonly taken from much lower altitudes, and from their nature cannot be made to any definite scale.

c. The areas to be photographed depend mainly upon the adequacy of available maps. Assuming that accurate maps are available, photographic observation should be limited to those areas occupied by enemy forces with which contact is imminent or probable. Gen-

erally speaking, periodic photographs should be made of enemy defensive positions, bivouac areas, rear area installations, lines of communication, and airdrome areas. As an example of the capabilities of aerial photography, the normal defensive zone of a division may be taken as a unit of measurement. Such a zone will measure from 5 to 10 miles wide by 5 miles deep, averaging about 36 square miles in area. A modern photographic airplane, flying at 180 miles per hour, can expose enough film in a single flight of about 20 minutes to cover this area with overlapping vertical photographs. Each print should have a net usable area of about one-half square mile; therefore 72 separate photographs will be required. Development and printing may be completed within 1 hour from the time the camera reaches the laboratory. Thus it is possible to have the finished prints in the hands of the agency which requested them within 2 or 3 hours elapsed time. A finished mosaic of the same area might well require 2 or 3 days. Single photographs of "pin point" objectives, either vertical or oblique, can be taken and developed by special apparatus carried in the airplane for immediate delivery to troop commanders. This has been done within the space of 15 minutes.

d. **Mosaics** are aerial maps of limited areas, constructed by carefully matching the centers of overlapping vertical photographs. To be accurate enough for fire control and other precise military purposes, they must be adjusted to given control points on the ground, previously located by accurate surveying methods. If not so controlled during assembly they are of value chiefly as a pictorial representation of the terrain, and as a supplement to topographical maps. Considerable time is required for their preparation, thus limiting their usefulness to stabilized situations. In a moving situation, a set of overlapping vertical photographs, which can be secured without delay and studied individually, is always preferable to the mosaic for securing essential elements of information. Therefore, mosaics should not be requested by the Force commander, except for mapping purposes.

e. **Strip maps** are overlapping vertical photographs of a road, beach line, river, or other narrow area, matched and mounted on strips of convenient length. They may be constructed to any desired scale within the capabilities of the equipment, and require very little time for completion and delivery, in comparison with an area controlled mosaic. Strip maps are accurate enough for most military purposes; they require but a single pass of the airplane over the ground, and are available to the requesting agency within 3 or 4 hours. When the area to be photographically mapped is less than a mile in width, the strip map should be specified in lieu of the mosaic.

f. Tabular summary of photographic capabilities.—

Type of photography	Size of area	Tactical use required	Time required to deliver finished prints
Overlapping verticals.	Unlimited	F-2 and F-3 study	1 hour to photograph 90 square miles (180 m. p. h.) 1 hour to develop and print.
Mosaics	Up to 100 square miles for single mosaic.	Surveying and map making.	2 to 3 days for average size mosaic.
Strip maps	Unlimited	Road, river, beach maps	180 miles in 1 hour (or speed of airplane); 2 to 3 hours to develop, print, and mount.
Vertical "pinpoints." Obliques	Depends on altitude and camera; average 1 square mile.	F-2 and F-3 study of objectives.	Approximately 1 hour with standard equipment; 15 minutes with special airplane developer.

SECTION 5

SECONDARY COMBAT MISSIONS

50. General.—The tactical use of reconnaissance airplanes for the purpose of attacking ground troops has been abandoned by the Army Air Corps. Naval Aviation, however, continues to prescribe dual functions of reconnaissance and combat for their patrol and scouting squadrons, due to the exigencies of naval warfare and the prevalence of "targets of opportunity." Because of the limited number of combat aircraft available to Marine Corps aviation and the varied requirements of Marine air operations, Marine reconnaissance airplanes, especially of the scout-bomber-attack types, may likewise be employed on secondary combat missions. Generally, the employment of reconnaissance aircraft for dual purposes of reconnaissance and attack is not looked upon with favor when they are supporting large scale land operations. Reconnaissance airplanes, operating singly or in small units as they will in this type of operation, will have little offensive power against the large numbers of troops encountered. Furthermore, the importance of their primary mission will seldom justify the risk involved in ground attack. Again, the limited amount of reconnaissance aviation available to a commander in large scale land operations will rarely permit the diversion of any part to the mission of ground attack, unless the need for aerial reconnaissance has been greatly reduced, or no longer exists. Such a condition, however, is not at all likely. Diversion of reconnaissance aircraft to ground attack missions, therefore, may be justified only as a last resort when it is necessary to employ all means available to stave off an imminent defeat. Reconnaissance aircraft, when employed on combat missions, will conform to the tactics laid down for corresponding combat classes insofar as their design and equipment permit.

51. Attack Missions.—This type of mission involves the strafing attack of ground personnel, artillery batteries, light matériel, boats, and aircraft on the ground. Light bombs, machine guns, and chemicals are employed from low flying aircraft generally in surprise attacks. When reconnaisance units are employed in this fashion they become attack aviation and the methods prescribed in chapter IV,

section 2, will govern insofar as the design and the armament of the reconnaissance airplane will permit. The new Marine scouting airplane is considered an efficient weapon for attack purposes.

52. Bombing Missions.—a. The naval patrol seaplane is an effective longe range horizontal bomber, provided with a gyroscopic bomb sight of latest design, ample defensive armament, and racks for the heaviest demolition bombs. The naval scout-bomber is designed for dive bombing, carrying a 500 pound or lesser demolition bomb. These two reconnaissance types are decidedly useful as combat aviation, and naval tactics contemplate their regular employment as such. The provisions of chapter IV, section 4, are applicable to these types. Replacement airplanes now being procured for Marine scouting units have the same general bombing characteristics as the naval scout-bomber.

SECTION 6

AIR—GROUND COMMUNICATIONS

53. General.—An important function of airplane observation is the transmission to the ground troops of the information secured, and the reception of instructions and information from the ground by the observer in the air. There are four methods of accomplishing this. The airplane may land near the command post of the supported unit for a personal conference between the observer and the ground commander, or his representative; messages may be sent and received by radio; the observer may communicate with the ground units by visual signals, employing prearranged codes; or communication may be effected by drop and pick-up method.

54. The Advanced Landing Field.—The observation unit supporting a brigade or Force normally operates from a squadron airdrome located from 10 to 50 miles behind the front lines. Wire communication between the airdrome and the ground unit command post may be difficult or impossible to maintain during a moving situation, while at the same time it is highly desirable that the air observers be in close personal contact with the staff of the supported unit. To permit this necessary oral communication, the brigade, or Force, establishes an advanced landing field near its command post. This field need be nothing more elaborate than a safe landing and take-off area for an observation airplane, although limited service and concealment facilities are desirable. The airplanes designated to perform close reconnaissance and battle missions can land at this field before and after completion of their missions, and thus receive and deliver more complete instructions and information than would be possible by other means of communication. The command and artillery airplanes stand by on the advanced landing field while awaiting call.

55. Transmission of Information while in the Air.—a. **Preparation of messages.**—While in the air all information gained is recorded by the observer on the form provided for making his report, or on a map.

b. **Radio.**—The airplane is equipped with a radio set, and messages sent by radio are received by the ground sets which are tuned to operate with that airplane. One radio set for communicating with the reconnaissance airplane is located at the command post and one at the airdrome from which the observation airplane is operating. An artillery battalion designated to operate with airplane observation is equipped with a radio set tuned to receive messages from the observation airplane working with that particular battalion.

c. **Drop and pick-up message.**—If information cannot be transmitted promptly by means of radio to the unit to which it should be furnished, a copy of the message is dropped to such ground unit. The message is placed in a special bag provided with a streamer to make it more visible. The airplane flies low near the command post or other place where the information is to be received, and the bag is dropped on a plot of ground where it can be seen and found. This form of communication is known as **dropped message.** When it is anticipated that dropped messages are to be received, a **dropping ground** is designated and a detail provided to watch for, recover, and deliver dropped messages. A ground-to-airplane panel station usually affords a suitable dropping ground. **Airplane pick-up stations** are prepared places where airplanes can pick up messages from the ground without landing. A cleared plot of ground unobstructed by trees, wires, buildings, or hills, and of sufficient size to permit an airplane to fly within 10 or 20 feet of the ground is required. A light cord to which a message is attached is supported some 6 feet or higher above the ground by two poles set up about 15 feet apart. The airplane flies over low, trailing a line and a fish-shaped weight which engages this string. The line is then drawn in and the message obtained by the observer.

d. **Ground panels to the airplane.**—(1) **From command posts.**—When, for any reason, the observation team cannot receive radio communication from the ground, ground units establish a ground-air panel station. This is an open plot of ground sufficiently clear of trees and shrubs to permit the observer to see the panels. Panels are displayed according to a prescribed code to indicate that one-way radio messages from the airplane to the ground have been received and to give instructions to the observation team in the air.

(2) **From the front lines.**—When called upon to do so by an airplane observation team, front-line troops indicate the position of the line by displaying panels, smoke, or other means of identification.

e. **Pyrotechnics and signals.**—Pyrotechnics of various kinds, such as rockets, flares, and smoke signals are also used to effect air-ground communication. A Very pistol is used to discharge flares from the

airplane for the purpose of communicating with ground troops. Engine and wing signals are also employed for this purpose.

56. Formal Report of Team.—Immediately after a mission has been completed and a landing made, a full and complete report of the operation, including a copy of all messages sent and received, is submitted in writing by the observer (or pilot) to the squadron operations officer. The pilot cooperates in preparing this report, but the responsibility for preparing and submitting the report rests primarily with the observer, provided he is an officer. A special form for noting this data in the air and for use in making the report is provided. The squadron operations officer is responsible that the report or the information contained therein is transmitted to the proper agency—that is, to F-2, F-3, or the Force artillery commander, in accordance with existing regulations and instructions. This report should state exactly **what** was or was not observed, the exact **hour** observation was made, **where** it was made, and what was the **action,** or **condition** of the objective observed.

57. Codes, Methods, and Means Prescribed by Signal Communications Officer.—The signal communications officer of the ground unit with which observation aviation is operating prescribes the various codes, wave lengths, types of flares, and other means of communication which are to be used for air-ground communication. A standard code card is issued to all concerned, being withdrawn and changed at intervals. The wave lengths are prescribed in communication annexes to Force or brigade operations orders.

SECTION 7

ORDERS FOR RECONNAISSANCE AVIATION

58. General.—The form and technique used for aviation orders follows that prescribed for other units. The principles to be observed are the same; the technical details may vary somewhat. The orders to air reconnaissance units are included in three documents, namely: the intelligence annex to the Force or brigade order; the aviation subparagraph of the Force or brigade order; and in the aviation order (aviation annex) and flight schedule issued direct to the air units concerned.

59. The Intelligence Annex.—Ordinarily before the Force operation order is written, F-2 prepares his schedule of reconnaissance to be made by the various agencies, specifying under each agency the tasks it is to perform, and the nature of the information desired. Aviation is directed in this schedule to obtain certain information of specified areas, and to report at periodic intervals. This directive is embodied in the intelligence annex to the Force order. If aerial photographs are desired, the areas to be photographed, the type of finished photographs, and the date, time, and place of desired delivery is specified. In other words the intelligence annex should state in detail what it expects air reconnaissance units to accomplish, and when the information is to be furnished. A list of missions is given in the desired order of priority; but the method of accomplishment is left to the air commander. The aviation annex or aviation subparagraph of the Force or brigade operation order does not repeat these missions, but merely directs the responsible air unit to comply with the pertinent provisions of the intelligence annex.

60. The Aviation Subparagraph.—a. In the case of a Force order, this paragraph will state only in general terms the missions assigned to Aircraft, Fleet Marine Force, referring to the aviation annex for details, thus:

3. * * * * * * *

(d) Aircraft, Fleet Marine Force, will support the landing * * * * * * * by performing reconnaissance and combat missions * * * * * * paying particular attention to fighter support over the transport area, and * * * * *.

Comply with pertinent provisions of Annex A, Intelligence. For further details see Annex B, Aviation.

b. A brigade order, on the other hand, is usually concerned only with an attached observation squadron, for which no aviation annex would be necessary. The aviation subparagraph of a brigade order should contain more detail, thus:

3. * * * * * * *

(d) VMS–1, operating from squadron airdrome at FREDERICKSBURG, and from advanced landing field at QUANTICO, will:

(1) Conduct intensive reconnaissance, from 0510, 1 Sept. of the area * * * * * * * * * * paying particular attention to * * * * * * * *

(2) Maintain one infantry airplane over Brigade front from 0630.

(3) Be prepared to cooperate with 1st Bn, 10th Marines (artillery) on call.

(4) Maintain one command plane on advanced landing field from 0530.

(5) Comply with pertinent provisions of Annex A, Intelligence (if one is written for the brigade order, otherwise, include all air reconnaissance instructions in this subparagraph).

c. The aviation subparagraph of the Force or brigade order does not trespass on the province of the air commander by specifying certain units or certain airplanes for any mission. It does not prescribe the method by which a mission is to be performed, nor too closely confine the air unit to a rigid time schedule. When close coordination with a ground unit is essential, specify what is wanted, giving the time as relative to the movement of the ground units, thus:

> VMS–1 will smoke beach "A" when leading wave is 500 yards offshore, and **not**
> VMS–1 will smoke beach "A" at 0549.

The provisions of this paragraph are equally applicable to aviation group orders with respect to missions assigned to reconnaisance squadrons.

61. The Aviation Annex.—The aviation annex to the Force operations order is nothing more or less than the aviation Wing or Group order assigning missions to the various subordinate units thereof. The general missions assigned to Aircraft, Fleet Marine Force, or to a separate group, are broken down and allotted to the appropriate subordinate aviation units, specifying such details of time and space as may be necessary. Reconnaisance areas are assigned by group headquarters to the various scouting squadrons; or squadrons may be attached to the different brigades as directed by the Force commander. As a rule, each scouting squadron will be disposed of in a separate sub-paragraph of the aviation annex, as follows:

3. (a) VMS–1 is attached to 1st Brigade from 1200, 31 Aug.
(b) VMS–2 will execute distant reconnaissance beyond the line: * * * * * * *, paying particular attention to * * * * * * *.

(c) VMS-3 will execute close reconnaissance and battle missions in support of 2d Brigade * * * * * * *.

(d) VMF-1 will * * * * * * * *

(e) VMB-1 will * * * * * * * *

(x) (1) For further details of reconnaissance see Annex A, (Intelligence) to Force Operations Order No._____

(2) Airdromes assigned as follows: * * * * * * * *.

(3) *.

62. The Squadron Order and Flight Schedule.—a. The observation or scouting squadron does not normally issue a formal written operations order in advance. Upon receipt of the aviation annex, or the aviation subparagraph of the brigade order, the squadron commander consults the pertinent parts of the intelligence annex and makes a list of the missions which his unit is required to perform. The squadron flight officer then assigns these missions to individual observation teams, or to section leaders as may be appropriate, specifying time of take-off, nature of mission in detail, and time of landing. These details are posted on the operations map, and published in the flight schedule, which is usually written on the operations blackboard in standard form. Other pertinent data of interest to pilots and observers is also posted on this board, and a conference of all pilots and observers should precede the first take-off. A formal order or a copy of the flight schedule is usually prepared later for the squadron records. At least one hour is required for the preparation and issue of a flight schedule, and more time is desirable for thorough indoctrination of flight personnel.

CHAPTER IV

COMBAT AVIATION

SECTION 1

GENERAL

63. Function.—Combat aviation is designed, equipped, and trained for offensive employment as a striking force against hostile air and surface targets. It is purely an offensive weapon, regardless of whether the commander employing it is operating his surface forces offensively or defensively. Combat aviation has no passive defensive value. The defensive armament with which certain classes of combat aircraft are equipped is intended only for protection against enemy aircraft while in flight.

64. Control and Command.—a. While reconnaissance units may be attached to subordinate commanders for purposes of closer cooperation, combat aviation is always employed as a supporting unit under the direct tactical control of the Force commander. The tactical principles involved in the use of an arm of such range and versatility preclude the parceling out of small units to subordinate commands. Combat aviation may directly support the activities of a brigade, and may act in close cooperation with even smaller units, but it does so under Force control. The attachment of combat aviation to a subordinate unit of the Fleet Marine Force is justified only when such unit is acting independently, beyond supporting distance of Force controlled air units.

b. In accordance with this principle of centralized control, the Fleet Marine Force normally relinquishes control of its air units when operating as part of a larger naval force. The commander of a naval attack force which includes Marine units will ordinarily exercise direct control over all the air combat units, Naval and Marine, which are under his command, operating such units as a task force under the senior air commander.

65. Orders to Combat Aviation.—a. The orders to combat aviation are written by the air commander, usually as an annex to the Force operations order. The aviation subparagraph of the Force order merely states general missions and refers to the aviation annex, thus:

3. * * * * * * *

(d) Aircraft, Fleet Marine Force, will support the landing * * * * * * * by executing reconnaissance * * * * * * * * * and combat missions, paying particular attention to neutralization of hostile combat aviation during the ship-to-shore movement, and to strafing of beach defenses just prior to landing of small boats * * * * * * * * * * * * * * * for further details see Annex B, Aviation.

b. The aviation annex is written by the air commander after consultation with the Force staff. It contains all the details of coordination with surface forces, and allots missions to the various combat and reconnaissance units. The form of the annex follows that prescribed for surface units, differing only in minor technical details. Task organizations should be arranged to suit the tasks and may or may not conform to the administrative organization.

SECTION 2

ATTACK AVIATION

66. Definition.—a. Attack aviation is that branch of the air force which is primarily organized, equipped, and trained to destroy personnel and light matériel objectives. It is suitable for employment against troops on the march, in camp or bivouac, in light shelter, or in boats or small ships. It is likewise well adapted to interdict highways, and to destroy light bridges, motor vehicles, railroad rolling stock, supply establishments, antiaircraft installations, and aircraft on the ground.

b. The term "attack aviation" has been discontinued in the Army Air Corps. The functions hitherto performed by attack aviation are now accomplished by a newly designated class of aviation known as Light Bombardment Aviation, which, in addition to the attack of light matériel objectives and personnel, also comprehends the attack of medium matériel objectives. The tactics and technique employed by Light Bombardment Aviation may be those of Bombing Aviation or those of Attack Aviation as hereinafter discussed, depending upon the requirement of the situation and the equipment available. Attack Aviation, as used in this text, refers to those types of Light Bombardment Aviation, or similar types in the Marine Corps, designed for operation at low altitudes. The tactics discussed are those applicable to the operations of these types.

67. Characteristics.—a. **Airplane.**—The current model attack airplane being furnished for the Marine Corps is a two seater, single-engine monoplane. Performance characteristics and armament details correspond in general to those of the Army attack airplane (A–17), described in the following subparagraph.

b. **Weapons.**—The characteristics of the weapons employed by attack aviation are:

(1) **Machine guns.**—(a) **Fixed guns.**—The four fixed machine guns are free firing, being mounted in the wings just outside of the

disc of propellor rotation. They may be fired singly, by pairs, or all simultaneously. Six hundred rounds of ammunition per gun are carried in belts.

(b) **Flexible gun.**—One .30-caliber machine gun is flexibly mounted in the rear cockpit for protection of the airplane from air attacks. Six hundred rounds of ammunition for this gun are carried in metal magazines holding one hundred rounds each.

(2) **Bombs.**—At present, three types of bombs are standard for use by attack aviation: demolition, fragmentation, and chemical. Bombs may be dropped singly (selective), in train (at a time interval), or all simultaneously (salvo). Release may be effected manually or electrically. When bombs are dropped in train their release is so timed that the individual effective radii of about 75 yards will overlap.

(3) **Chemicals.**—The attack airplane carries two wing tanks for spraying liquid chemicals. One of these tanks, containing 17 to 20 gallons, will cover with fine spray an area approximately 800 yards by 200 yards. The attack airplane can also carry one 50-gallon chemical tank, which will cover an area approximately one mile by 200 yards. The release mechanism is controlled by the pilot who can operate any or all tanks at will. Chemicals and bombs can be carried on the same flight.

68. Missions.—Specific missions of attack aviation include the following tasks:

a. **Air force missions.**—(1) The destruction of aircraft at rest and aviation base facilities vulnerable to attack weapons.

(2) The destruction or neutralization of antiaircraft defenses, while supporting bombing aviation.

(3) The attack of vulnerable seacraft in coast defense.

(4) The destruction, or the interruption of movement, of personnel and matériel through the attack of factories, logistical establishments, lines of communication, and troop concentrations.

b. **Close support of ground forces.**—(1) **Prior to the battle of ground forces.**—The destruction or interruption of movements of personnel or matériel by attacking lines of communication, supply establishments, concentrations and movements of personnel or matériel.

(2) **During the battle of ground forces.**—The destruction or interruption of movements of personnel and matériel by attacking troops concentrating for the attack, reserves, supply establishments, and communication systems. In the absence of artillery, attack aviation may be used to lay down preparation fires on front-line positions.

(3) **At the conclusion of the battle of the ground forces.**—The interruption of the enemy's retreat by attacking the retreating columns; or conversely, the interruption and delay of any pursuing force.

c. The above arrangement of specific missions cannot be said to be a classification of objectives in the order of their importance, since each operation must depend upon a careful estimate of the air situation as well as the ground situation. There can never be sufficient attack aviation to warrant its indiscriminate use simply because it is capable of accomplishing various missions. The limited amount makes it essential that it be used only on first priority objectives and that such priority be determined by the situation as a whole rather than the suitability of the target. For example, as long as opposing air forces exist in sufficient strength to deny freedom of action to our own aviation, it is usually inadvisable to employ attack aviation for any role except counter air force operations.

69. Principles of Employment.—a. Attack aviation is a weapon of long range and great striking power against concentrated troops and light surface objectives. It can effectively operate against the ground defense protecting air force objectives, either alone, in conjunction with, or in support of bombing aviation. Its depth of penetration is limited only by its radius of action. When aviation is acting in close support of the ground forces, its striking power should be used against those targets which cannot be reached by the weapons of the ground arms, or on targets for which ground weapons are not suitable or available. In almost all ground situations there are vital targets beyond the range of the weapons of ground arms which can be powerfully dealt with by attack aviation. Therefore, the use of attack aviation to supplement the fire power of ground arms is generally discouraged as it may result in the neglect of the more distant, and perhaps more vital, objectives. As a general rule, attack aviation should be used in lieu of artillery only when the time limit precludes the assembly of sufficient artillery units to provide the necessary preparation, and when such absence of artillery may involve failure of the campaign as a whole.

b. Attack aviation should be employed only when suitable objectives have been definitely located by other means, and information as to the nature and composition of the target is sufficiently complete for the attack unit to properly arm and plan the operation prior to take-off.

c. A comparatively small force of attack aviation can, by sporadic attacks on widely separated objectives cause the enemy to continually work under a handicap due to restrictions imposed on mass move-

ments, additional security measures required, and the general delay and confusion incident to constant threat of air attack. This decrease in efficiency, particularly true of airdrome installations and troops on the move or in bivouac, may well be an important factor in the conduct of the campaign. The threat of destruction from the air may be a greater deterrent to surface operations than the actual results of strafing attacks would seem to warrant.

70. General Method of Operation.—a. **Daylight operations.**—During daylight, attack aviation employs its units to make coordinated assaults against designated portions of the objective. Normally, the squadron or the entire group is employed as a unit. Subdivisions of the squadron, or even individual airplanes, may break away from the parent formation for the purpose of assaulting the separate parts of the objective, or successive small objectives requiring the application of only a limited amount of fire power. These units rejoin the formation immediately upon completion of their attacks.

b. **Night operations.**—At night, attack airplanes are used singly or in small formations not exceeding the size of a division. When periodic harassment is desired, and a coordinated or mass assault is unnecessary, it is preferable to dispatch single aircraft at intervals. When the objective is of such nature or size as to require a surprise massed assault, the section or division is employed.

c. **Low-altitude flight.**—Attack aviation habitually operates from minimum altitude in order to secure a greater measure of surprise against the objective. It is extremely difficult for ground troops to locate invisible aircraft, or to estimate by sound alone the direction of the impending attack. Attack units approaching just over the trees or concealing folds in the ground will usually be able to open fire before their approach is detected, thereby neutralizing to some extent the effects of retaliatory antiaircraft and small-arms fire. Low flying is also the best defense against hostile fighters, as aircraft close to the ground are difficult to detect from above, and must be attacked from the upper hemisphere which is well covered by the defensive machine guns of the attack formation.

71. Plan of Operation.—a. **Information.**—In addition to other agencies, reconnaissance aviation is charged with gaining necessary information of the objective to be attacked. Information so furnished forms in a large measure the basis for the plan of operation. In case of a mobile objective, reconnaissance aviation furnishes radio information of all movements during the time the attack unit is en route thereto. If the assault is to be made at night, reconnaissance aviation may also cooperate with the attacking unit by illuminating the objective.

b. **Plan of action.**—The plan of action and scheme of maneuver covering the attack of any assigned objective vary with the situation and conditions existing at the moment. It is for this reason that dogmatic methods of attack can not be devised which will apply to the various types of objectives attack aviation may be called upon to attack. The plan of action and scheme of maneuver should be carefully worked out prior to the take-off. If the situation changes prior to the arrival of the attack unit at the objective, a new scheme of maneuver for the unit at the objective may be necessary. In such a case, new instructions are given by radio or visual signals.

c. **Communications.**—All attack airplanes are equipped with two-way radio, both voice and key, for interplane communication and for communication with the ground. For a unit the size of a squadron or larger it is now customary to have at least one airplane equipped with an additional radio set for communication at greater distances and over a wider band of frequencies.

72. The Assault.—a. **General.**—The term "assault" means specifically the actual attack as delivered, including the operations incidental to covering the approach. The principal decisions involved in planning the assault are: first, the combination of weapons to be employed; second, the strength of the assaulting force; and, third, the tactics and technique of the assault proper. All these decisions are influenced primarily by the mission of the unit or the results to be accomplished, and all are interdependent. The assault proper is executed by aircraft passing but once over the target, the aircraft immediately withdrawing to the rallying point. Rarely will attack aircraft circle and repeat the assault.

b. **Weapons to be employed.**—The weapons selected for an assault depend on the nature and extent of the objective, and whether neutralization or complete destruction is the result sought.

c. **Strength of the assaulting force.**—The strength of the assaulting force in any given operation depends upon the nature and size of the objective. Sufficient force must be assigned to accomplish the desired results. In attack operations the group is the normal tactical unit. The squadron is the smallest unit capable of independent daylight operations. With respect to assaults against selected elements of an objective, the section or individual airplane is the basic assault unit.

d. **Time of assault.**—The time the objective is to be assaulted may or may not be stated as a precise hour. In case attack aviation is employed with bombing aviation in a combined mission, the time of assault must be definitely stated. In the assault of troop movements, the time of assault should be such that it will assist the

attack unit in accomplishing the mission assigned by gaining surprise and placing the troop movements at a disadvantage.

e. **Direction of approach.**—The direction of the wind, position of the sun, and nature of the terrain are considered factors of primary importance in determining the most advantageous direction of approach to the objective by the assaulting units. A surprise assault should be sought whenever possible. Other considerations being equal, the assault should be made from the direction which offers the most disadvantages to the defending forces. The preferred direction of approach is generally along rivers, valleys, streams, ravines, and similar well-defined terrain features, because such avenues of approach afford the greatest amount of concealment from ground observation, and materially assist in accurate navigation.

f. **Maneuver at objective.**—Small targets or very small areas are assaulted most effectively by single airplanes, attacking in succession from the parent formation. Such targets, for example, may consist of small boats, railroad tracks, or highway bridges a considerable distance from organized defended areas. The presence of effective antiaircraft gun and machine-gun fire may force the assaulting aircraft to use chemicals and smoke. Moreover, the assault of an objective defended by antiaircraft units becomes a complex mission, consisting of the neutralization of the latter, as well as the destruction of the targets which they defend.

g. **Antiaircraft artillery defenses.**—(1) Since antiaircraft artillery gun units are small, widely scattered, and easily moved, they present difficult objectives to find, except when firing. Antiaircraft artillery gun units probably will not disclose their positions by firing until the area they are defending is actually threatened by bombing aviation. Their **destruction** by the weapons of attack aviation is therefore unlikely.

(2) The **neutralization** of antiaircraft artillery defenses can, however, be completely or partially achieved by covering them with chemicals or smoke cloud. Neutralization of antiaircraft defenses by chemicals or smoke requires the accurate laying of the chemicals or smoke clouds by low-flying airplanes on lines carefully calculated from wind data. These data are predicted before taking off and may be tested en route.

(3) In supporting bombing aviation, the scheme of maneuver must be based on the direction of attack of the bombing unit. This is due to several factors. Antiaircraft artillery defense is essentially an area defense. A consideration of these defenses will lead to the selection of the most favorable route of approach by the bombing aircraft. Since the horizontal travel of bombs dropped at higher altitudes enables the

bombing aircraft to drop their bombs from a point hundreds of yards short of the target, they can turn and withdraw over the same route without coming within effective range of all the antiaircraft artillery normally defending the opposite side of the same area. Therefore, it is necessary for attack aviation to neutralize only those antiaircraft defenses which most effectively cover the route of approach used by the bombing unit.

(4) In overcoming antiaircraft defenses, both neutralization and destruction are attempted.

h. **Hostile aircraft.**—(1) Aircraft on carriers, if exposed on the deck, can be destroyed by a combination of fragmentation and phosphorus bombs. The latter may cause fires if gasoline begins to leak from punctured airplane tanks, and also serve to blind observation, thus insuring withdrawal as well as cover for successive assaulting units.

(2) The destruction of aircraft on airdromes presents a more difficult problem, due to their dispersion and the cover provided by trees or artificial protective measures. A combination of fragmentation bombs and phosphorus bombs, dropped in trail by formations of sufficient size to insure covering the parking area offers the best possibility for attaining the desired results. In case of a square-shaped airdrome, where airplanes parked on all four sides require that the entire perimeter be assaulted, the two parallel sides offering the most favorable approach or permitting the quickest execution should be assaulted first, followed by a simultaneous assault on the remaining sides. All assaults must be carefully coordinated.

(3) The neutralization of airdromes or aircraft located on airdromes may be accomplished by mustard bombs or spray which will contaminate the equipment and landing field.

i. **Seacraft.**—(1) **Attack operating alone.**—In the attack of seacraft, assault units are assigned to each vessel to be attacked. This assignment of units to definite objectives can be made only when complete information is available. Plans of attack made prior to the take-off will, however, be subject to changes made en route, or after arrival in the vicinity of the objective. These changes in plans would be announced to the elements of the command by means of radio.

(2) **Combined action.**—In any action against a hostile fleet or overseas exepedition, the mission of attack aviation should invariably be that of supporting bombing aviation by neutralizing the antiaircraft defenses of those vessels whose fire can effectively cover the route of approach of the bombing aircraft. This involves a definite assignment of attack units for the assault of each vessel at-

tacked. The strength of the assault unit and the munitions to be employed will vary according to the size and type of vessel to be attacked and the purpose of the assault.

(3) **Small boats.**—Small boats carrying landing parties are best assaulted by the individual airplane, using machine guns, mustard spray, and fragmentation bombs.

j. **Area targets.**—Large areas are assaulted by formations in echelon, dropping bombs in trail and spraying chemicals. This class of targets includes beach defense areas, cantonments, bivouacs, entraining areas, large transportation parks, large railroad yards, and factory areas. In covering large areas, general destruction and demoralization, rather than accurate fire, is the aim sought.

k. **Linear targets.**—(1) Linear targets, such as marching columns of infantry, cavalry, artillery, motor trucks, railroad tracks, and trains are best assaulted by single airplanes in column. Sections are used where the width of target requires greater dispersion of munitions than can be laid down by a single airplane.

(2) The most suitable linear objective for attack aviation is a column of troops on the march. Such attacks will cause delay and demoralization of the troops even when the physical effect of the attack is not great. Troops subjected to heavy machine gun fire and the effect of fragmentation bombs will not continue their march at an undiminished rate. Depending upon the intensity of the attack, they will be compelled either to halt and return the fire, to take cover off the road, or to effect a partial deployment. Therefore, attack aviation is particularly adapted to delaying the movements of large bodies of ground troops when the formation of columns is necessary. In many situations, time and space factors enter in a decisive manner and the ability to delay the movement of hostile columns may mean victory. Delay of hostile columns, will, therefore, constitute one of the important tasks to be assigned attack aviation.

(3) Deployed troops form a poor objective. However, troops on railway trains, in unarmored boats, and in truck convoys, are proper objectives for attack aviation.

SECTION 3

FIGHTING AVIATION

73. Definition.—Fighting aviation is that branch of the air force which is organized, equipped, and trained primarily for air combat. It is employed to support bombing, attack, and observation aviation, to intercept enemy bombing and attack aviation, and to deny operations to hostile observation aviation.

74. Characteristics.—The present fighting airplane is a fast, highly maneuverable, single-engine, single-seater type. It is armed with 2 fixed machine guns—1 caliber .50 and 1 caliber .30—and carries 200 rounds of caliber .50 and 600 rounds of caliber .30 machine gun ammunition. The airplanes are equipped with bomb racks capable of carrying two 100-pound demolition bombs.

75. Mission.—The mission of fighting aviation is to deny freedom of action to hostile air forces, and, within its range of action, to cover the operations of friendly air or ground forces.

76. Employment.—a. **General.**—(1) Since the World War the trend for the tactical employment of fighting aviation has been towards the massing of larger units in the air. Sections of two or three airplanes may be considered as the smallest operating unit, except in special cases involving the use of single airplanes; such as the attack of balloons, operations in heavy weather, and at night.

(2) Radio communication is exercising a marked influence on the control of elements of a formation and upon the tactical employment of large units. By means of two-way radio communications with the leaders of subordinate echelons, the commander has constantly in hand a force that heretofore could operate only in accordance with prearranged plans, or upon signals difficult to transmit and interpret properly.

(3) The basic principles of air combat are surprise, maneuver, and bold offensive action; these are applicable to all units of whatever size. The relative effectiveness of large formations is, however, greatly increased by their massed fire power, ability to utilize planned schemes of maneuver, and by their sustained offensive power.

(4) The formations used in fighting action are designed to afford ready control of subordinate units by the leader, to enhance the probability of adequate security against surprise, and to insure success in attack; bearing in mind the questions of visibility and security from antiaircraft fire. Units to include the group are echeloned in depth and altitude, while beyond the group the echelonment is usually laterally and in depth. For example, if two or more groups were operating together on the same mission in the same area, they would usually operate at the same general altitude, coordinating their routes and movements over the area in such a way that the more important part of the area would at all times have some fighter protection.

b. **Principles of employment.**—(1) **General.**—Fighting aviation is generally considered as a defensive weapon, designed for the interception and attack of hostile aircraft which may threaten a defended objective. In action, however, fighting aviation always operates offensively; the characteristics and armament of the fighting airplane preclude the use of purely defensive tactics as practiced by bombing or attack units. There are two general principles governing the tactical employment of fighting units, differing only in the relative extent of the assigned area of operations. When fighting aviation operates under the principle of **general** support, the area assigned is comparatively large and permits the fighting unit commander considerable freedom of maneuver and choice of targets. When assigned for the **special** support of a local area, another formation of aircraft, or a group of naval vessels, fighting aviation is restricted in its action to the immediate vicinity of the defended objective, and to the attack of enemy aircraft actually threatening that objective. Therefore, fighting aviation operating in **general** support is to some extent operating offensively, while those units in **special** support are limited to a strictly defensive mission. In the first instance, fighting aviation defends a general area by bold offensive action throughout that area, seeking out hostile aircraft wherever they may be within the limits assigned. In the second instance, fighting aviation defends a special localized area by its ability to place a screen of fighting airplanes between hostile aircraft and that one particular area. The technique employed in the actual attack of hostile aircraft is the same in either case. Fighting units in general support retain the initiative and are better able to exploit their offensive powers; this method should always be specified when practicable.

(2) **General support missions.**—Fighting units operating in general support should be given sufficient freedom of action to permit them to intercept hostile aircraft anywhere within a radius of 25 to 50 miles from the defended area. They will actually patrol only the air areas immediately over the zone of operations occupied by the

parent surface force. Interceptions outside the limits of this zone will depend upon the existence of an aircraft warning net, fighting units standing by on ground or air alert being dispatched as required. Units on air patrol will usually operate at high altitudes, echeloned laterally and in depth. The lateral interval between squadrons (or divisions) should permit equidistant spacing around the perimeter of the defended zone, maintaining sight contact where possible. Small hostile formations or single airplanes are immediately attacked by the fighting unit discovering them; large formations require that the attack be delayed enough to mass at least one fighting squadron for the initial assault. However, if the hostile aircraft appear to be in position to launch an effective assault, they will be attacked immediately by the first fighting unit on the scence, regardless of relative strength.

(3) **Special support missions.**—Special fighter support may be ordered for a localized ground area of great importance; for a movement of troops or naval vessels; or as an escort for other formations of aircraft. Such missions can only be performed by the air patrol method. The technique involved does not differ from that normally employed by air patrols on general support, except that sight contact must never be lost with the supported unit. The elements of the fighting unit so engaged are disposed in such fashion as to ensure that no enemy aircraft can penetrate to the defended objective without being subjected to effective air attack. The fighting unit does not follow up any retiring enemy formation, nor does it anticipate an action by going out to meet hostile aircraft; its function is to act as a screen for the supported area or unit, and cannot, therefore, permit itself to be diverted.

(4) **General and special support areas.**—The land or sea areas assigned fighting units for general and special support missions may be separated by considerable distance, or the area of special support may lie within the general support area. In the latter case the protection provided by the fighting unit assigned to special support supplements the protection afforded by general support units.

c. **Tactical formations.**—(1) Fighting aviation operates during daylight in formation in order to afford volume of fire, continuity of attack, and mutual protection against hostile aviation.

(2) At night, fighting aviation operates by individual airplanes, or small formations.

d. **Tactical echelons.**—(1) **Designations.**—Fighting aviation normally operates in three echelons: namely, assault, support, and reserve. The assault echelon operates at the lower altitude. The support and the reserve formations, in order, are echeloned in altitude to the right or left, and in depth.

(2) **Altitude and distance.**—The altitude and the distances of echelonment at which these formations operate depend mainly on the weather, enemy operations, and the characteristics of the type of airplane employed. The assault echelon habitually operates at such an altitude that the ground can be clearly seen. The support formation is echeloned between the assault and the reserve formations. The reserve is operated at the maximum ceiling available, up to the service ceiling of the airplane.

e. **Flight tactics.**—(1) **Position.**—Fighting aviation operates to secure such a position with reference to hostile aircraft that the hostile machine guns can not be brought to bear on the attacking airplane, and that the machine guns of the attacking airplane can be brought to bear on the hostile aircraft within effective range.

(2) **Altitude.**—A relative position of higher altitude is the most favorable for the operating of fighting aviation when on patrol. For this reason fighting aviation, or at least a portion of it, normally operates at the highest altitude practicable.

f. **Methods of interception.**—Fighting aviation has three general methods of intercepting hostile aircraft:

(1) **Ground alert.**—When an adequate ground warning net exists, fighting units may remain alerted on the ground, prepared to take off upon the receipt of radio information as to the route, altitude, course, and speed of an approaching hostile formation. This is the most economical method of providing fighter defense of an area, but it presupposes a sufficient depth to the warning net to permit the fighters to take off, gain altitude, make the interception and have at least 5 minutes of combat time before hostile bombers can reach their objectives. Modern bombers must, therefore, be reported about 100 miles away from the defended area. The fighting units are directed from the airdrome plotting station, which receives the reports from the warning net operators, plots the course of the hostile formation, and relays continuous radio information to the fighting unit commander in the air. Obviously, a high degree of communication efficiency is required if successful interceptions are to be made.

(2) **Air alert.**—The fighting unit operating on air alert keeps a portion of its strength in the air over the defended area, prepared to make a head-on interception of any hostile force reported by the ground warning net. The saving in time over the ground alert method permits timely interceptions to be made even when the outer limit of the warning net is no more than 50 miles beyond the boundary of the defended area. The air alert method permits not more than one-third of the effective fighter strength to be brought to bear against any one target, as it is impossible to continuously maintain

more than that percentage of units in the air. It requires the same degree of communication efficiency as the ground alert system.

(3) **Air patrol.**—This is the least efficient method of interception, but is the one often forced on the defender of an island base or an airplane carrier through lack of warning net facilities. Part of the fighting units patrol the air over or beyond the defended area and hope to intercept the enemy through sight contact. A large fighter force is necessary to assure interception by this method, but even if interception be made the enemy is already so close to his objective, and the defending fighting units so dispersed, that it is unlikely that a determined attack can be stopped. The defenders may have to be content with inflicting such damage as they can on the enemy's **empty** bombers as they turn homeward.

77. Ground Attack Missions.—The employment of fighting units as attack aviation is current practice among most of the air powers. Fighters were so used during the World War, and are being so used today. The United States Army Air Corps does not normally employ its fighters for ground attack missions, holding that such usage is tactically improper when attack aviation is provided. Naval aviation, on the other hand, advocates the use of fighters as light dive bombers, and as attack aviation for strafing the antiaircraft defenses of naval vessels in connection with heavy bombing attacks. In view of the fact that Naval aviation has no attack class, such usage can be considered justified. The Marine Corps is equipped with Naval fighting airplanes, and in the past has followed the Naval doctrine of using them for ground attack missions. With the provision, however, of special attack squadrons, the necessity for diverting fighters to such missions becomes less pressing. It is considered unlikely that, in major warfare, the air situation will often permit this employment. Attack missions for fighters should be considered, then, as secondary tasks of a strictly emergency nature. When fighting units must be employed against ground targets the tactics and technique of attack aviation apply insofar as the design of the fighting airplane and its armament will permit. In this connection it must be remembered that the engines of modern fighting airplanes are supercharged for high altitude performance, and that they cannot be operated with full power at levels under 6,000 feet.

SECTION 4

BOMBING AVIATION

78. Definition.—a. Bombing aviation is that component of the air force the primary function of which is to destroy matériel objectives on land or water by means of projectiles dropped from aircraft.

b. It is capable of applying its destructive power effectively to a wide variety of objectives, such as naval vessels, bridges, dams, railroads, buildings, and other substantial structures. The increasing radius of action of this class of aviation exerts a constant and material influence upon the concept of its employment and to a considerable extent upon the employment of all other classes of aviation. This increasing radius of action likewise produces a considerable effect upon the organization and training of bombing aviation and, to some extent, upon the tactics employed. The radius of action of bombing aviation permits it to strike at great distances from its operating base and to find security and service deep in friendly territory.

79. Characteristics of the Bombing Airplane.—a. Bombing airplanes are of two distinct types: the long-range horizontal bomber, and the medium-range dive bomber. Their characteristics are markedly different as to design, but similar as to employment.

(1) The horizontal bomber may be a large multi-engine airplane or flying boat of the "Flying Fortress" or "Flying Dreadnaught" type; a twin-engine type of smaller dimensions; or a single-engine airplane of high performance and load carrying ability. Formerly the horizontal bomber was characterized by slow speed and poor maneuverability, but modern designs of streamlined monoplane construction have made the heavy bomber a craft of very high speed and greatly improved maneuverability. The horizontal bomber is equipped with a gyroscopic bomb sight which permits accurate bombing from level flight at high altitudes. The small factor of safety inherent in the design of this type of aircraft does not permit of

radical diving. The naval representatives of this type include the patrol bomber (a flying boat) and the torpedo bomber (a single-engine landplane). The Army has the multi-engine "Flying Fortress" type and small twin-engine models. The Marine Corps has no horizontal bombers at present.

(2) The dive bomber employed by Naval and Marine Corps aviation is a medium-sized, single-engine monoplane of fairly high speed, rugged construction, and excellent maneuverability. It does not carry the gyroscopic bomb sight but launches its bombs with a high degree of accuracy by approaching the target in a dive bordering on the vertical. The dive bomber is usually more accurate than the horizontal bomber, is less vulnerable to antiaircraft fire, but does not have the speed, range, or bomb carrying capacity of the larger, multi-engine type.

(3) The necessary characteristics of the bombing airplane can be summed up as follows: It must be capable of carrying bombs of sufficient size to destroy the strongest objective likely to be attacked. It must have sufficient radius of action to reach objectives far behind the enemy's front lines, in fact into his zone of the interior, or at least as far as the rear of his communication zone. Study and experience indicate that the 1,000- and 2,000-pound bombs are as large as will be needed to destroy the strongest objective. As to radius of action, it would appear that our current designs are at present adequate. Available speed is now in excess of two hundred miles per hour.

b. **Armament.**—The offensive and principal armament of the bombing airplane is the bomb; its defensive armament consists of machine guns.

(1) **Offensive armament.**—(a) The demolition bomb is designed for the destruction of matériel objectives. The principal destructive effort is produced by the detonation or blast effect of the high explosive content. The greater amount of explosive in a bomb the greater is its destructive effect. A secondary effect of considerable importance results from flying fragments of the bomb case. As the explosive effect causes more destruction of matériel objectives than is caused by the flying fragments of the bomb case, service bombs are produced with the so-called thin-wall type cases so as to give more space for explosives. The bomb cases are strong enough, however, to withstand impact upon and, in some types of bombs, to penetrate the surface of the objectives.

(b) While the use of chemical bombs is not contemplated under our present national policy, it is nevertheless essential that their use be considered as a retaliatory measure against an enemy using them. There are many possible uses of chemical bombs, particularly

in conjunction with the demolition bomb. As an illustration, consider the attack on a vital hostile rail center with demolition and mustard-filled bombs. The mustard gas would prevent repair and reconstruction of the damage done the rail centers by the demolition bombs during the persistence of the gas, unless the area was decontaminated (which is nearly an impossible task) or the repair personnel wore gas marks and protective clothing. In any event, repair would be hampered and delayed.

(2) **Defensive armament.**—The defensive armament of bombing aviation consists of .30 and .50 caliber machine guns. Bombing aviation, when flown in formation of a size commensurate with the air opposition expected, can defend itself against an attack which employs machine guns and comes within effective range of its defensive armament. This defense, however, is not effective against aerial bombing attacks, or attacks made by airplanes armed with large caliber (long range) machine guns or cannon, since such attacks will be delivered from such a distance or altitude that the defensive machine guns will be ineffective. Therefore, bombing aviation frequently needs the protection of another type of aviation which can interpose itself between the bombing and the hostile attacking aviation. This mission is performed by fighting aviation, and is known as protective escort, or special support.

80. Principles of Employment.—a. The fundamental principle governing the use of bombing aviation is that of destruction. The goal towards which bombing aviation must work is the degree of destruction necessary to fulfill the mission. This will usually require concentrated and continuous operations against a minimum number of primary objectives. To disperse bombing attacks over a great number of objectives is inconsistent with this fundamental principle.

b. **Other factors governing employment.**—(1) Bombing aviation causes a more severe reaction from hostile aviation and antiaircraft weapons than any other component of an air force.

(2) In operations where the bombing objective is of paramount importance, the plans for the employment of fighting, attack, and observation aviation will be such as to further the mission assigned to the bombing units.

(3) The power of bombing aviation should not be dissipated upon any objective that can properly be neutralized by other available agencies.

(4) Bombing aviation is not normally a weapon of opportunity. Definite objectives are assigned for each operation undertaken.

81. Classification of Objectives.—a. **According to size.**—Bombing objectives may be classified as **pin point,** requiring precision bombing, or **area,** requiring a given density of pattern. Where destruction

is necessary, pin point objectives should be attacked during daylight hours. Area objectives are susceptible of being attacked by day or night. Some examples of pin point objectives are bridges, munition dumps, repair shops, naval vessels, and fixed gun emplacements. Examples of area objectives are railroad yards, industrial centers, concentration areas, and naval bases.

b. **According to capabilities of force available.**—In selecting objectives the principle of destruction—the employment of sufficient force to accomplish the mission—must be borne in mind. The employment of sufficient force to accomplish the mission requires consideration of:

(1) Size of force available.
(2) Suitable bomb pattern.
(3) Size of bombs required (nature of objective).
(4) Whether one or more attacks must be made (continuity of action).

82. **Selection of Objectives.**—a. The decision as to what objectives bombing aviation should attack and the desired priority of such attacks should be made by the commander of the unit to which bombing aviation may be assigned, attached, or directed to support.

b. It should be remembered that bombing aviation should not be employed against objectives for which other means of destruction are available, nor against objectives whose destruction will not be of vital importance. Usually there will be more objectives to be destroyed than can be accomplished by the bombing aviation available.

c. **Information of the objective.**—In order to attack an objective effectively, the following information concerning it should be available:

(1) The location.
(2) The size (area).
(3) The nature (composition).
(3) Best routes of approach.
(5) Location of hostile antiaircraft artillery and occupied fighter airdromes.
(6) Degree of destruction desired.
(7) Detailed photographic data of individual bombing objectives.

83. **Operations.**—a. **Force used.**—The maximum number of airplanes that can take off at one time, and the rate of operating from a given airdrome is limited by the size, shape, and physical condition of the airdrome, the number of runways available, the degree

of training of the personnel, and the possibilities of hostile attack against the airdrome.

b. **Tactical formations.**—(1) **General.**—During daylight, bombing aviation flies in formation for two reasons: to afford protection against hostile fighting aviation, and as a means of insuring the placing of a suitable bomb pattern on the objective. During hours of darkness bombing aviation operates normally by single airplanes or small formations.

(2) **Defensive formations.**—The single bombing airplane has several dead angles into which its guns can not fire. In order to obtain the maximum of self protection from enemy fighting aviation, bombing airplanes must be flown in a formation so arranged that the greatest concentration of machine-gun fire from the formation itself can be brought to bear against all avenues of hostile fighter approach. Practically every formation insures this result to some extent, but formations vary widely in their defensive powers. Suitable defensive formations are those which provide at least two gunners to meet the attack of any one airplane.

(3) **Offensive.**—Nearly all types of defensive formations are also suitable for offense, as the desired shape of the bomb pattern and its density can be varied by echelonment of the formation.

(4) Weather conditions permitting, bombing formations are habitually flown at high altitudes to avoid effective antiaircraft artillery fire.

84. Conduct of the Attack.—a. **Daylight attacks.**—When the objective has been decided upon, the attack proceeds in accordance with a prepared plan. The unit follows the selected route, holding to its course regardless of hostile attacks. In distant raids, meterological conditions are given consideration, the direction and velocity of the wind exercising a greater effect than in other airplane operations. The altitude from which the objective should be bombed depends largely on the activity of hostile aviation and antiaircraft guns. With the present sights, reasonably accurate bombing can be done against visible objectives from even the highest attainable altitudes. Where pin-point targets are strongly defended by antiaircraft guns, dive bombing units should be used in order to obtain the required accuracy without excessive losses.

CHAPTER V

UTILITY AVIATION

85. Definition.—Utility aviation is that branch of Naval aviation which is organized, equipped, and trained to furnish air transportation for personnel and supplies, provide rescue and salvage service for other branches of the air force, and such other nontactical missions as may be required. It may also be used on occasion to supplement the activities of reconnaissance aviation.

86. Characteristics.—a. Utility airplanes are of three general types; the multi-engine land plane transport, similar or identical with commercial transport airplanes; the amphibian transport of like size and power; and the single-engine tactical amphibian, suitable for emergency ambulance and rescue work, and for the rapid transportation of special personnel and supplies. The utility squadron may also contain a limited number of tactical and training airplanes, necessary for command and administrative purposes, but in general should be considered as containing only nontactical types.

b. Transport airplanes normally carry no armament, offensive or defensive, but can be equipped in an emergency as bomb or chemical carriers. The tactical amphibian carries a defensive machine gun, and may be equipped with offensive machine guns and bomb racks if desired.

87. Organization.—Marine Corps utility squadrons are organized into three divisions of four airplanes each: the transport division; the amphibian division; and the tactical division, containing the command airplanes used by the group commander and his staff. The organization of a utility squadron is, however, very flexible as to numbers and types of airplanes provided, and may be made applicable to any situation.

88. Employment.—a. Utility missions are so varied that very little can be prescribed in the way of doctrine. The airplanes may be employed singly, in pairs, or by divisions. Their greatest usefulness will be in the transportation of personnel and aviation supplies between bases or airdromes, the evacuation of wounded to base hos-

pitals, the emergency transportation of ground troops and their equipment, and the supply of remote garrisons or detachments. Other missions of a service nature will include towing targets for aerial and antiaircraft gunnery practices, salvage and rescue of wrecked airplanes and stranded crews, messenger and mail service, and special command missions. In short, the utility squadrons exist to relieve reconnaissance and combat squadrons of all nontactical flights.

b. The amphibian division of the utility squadron may be required to perform photographic reconnaissance missions, or command and battle missions, particularly in major landing operations. When performing such missions the provisions of Chapter III, "Reconnaissance Aviation," are applicable.

c. Air transportation of ground troops and supplies should be controlled by the Force staff, and coordinated with other flights by the air-operations officer. There will seldom be sufficient tranport aircraft to meet all the demands, so rigid control and assignment of priority is necessary. The air force logistical requirements should usually be given priority in the assignment of air tranport missions. The recommended procedure is to have regular transport schedules between the various bases and headquarters, avoiding as much as possible the special or "emergency" flights.

d. The practicability of landing troops, particularly infantry, along coasts by large seaplanes, and the feasibility of parachute troops being employed from any large type of airplane, indicates a further utilization of transport aircraft in the future. The technique of any large-scale aerial landing operations of this nature, however, has not been fully developed. It is sufficient to say that the present transport equipment is entirely inadequate for such employment except on a very minor scale.

CHAPTER VI

THE AIR FORCE

89. General.—a. An air force comprises all those classes of reconnaissance, combat, and utility aviation which may be grouped together under a single command. Such a force is sometimes referred to as combined aviation. In general, the tactical principles involved in the employment of the air force have been covered in the discussion of the tactics and technique of the various classes. Air force operations merely weld the components into a balanced and powerful weapon, assigning to each class those missions for which it is especially designed, but so coordinating their activities with each other and with the supported ground units as to provide mutual protection and support. In combined air operations the predominant role is assigned that class whose normal function fits the mission at hand. All other classes of aviation participating in the operation act as supporting units. The basic element may thus be reconnaissance aviation, where the procurement of military information justifies the employment of the air force, or a major part of it, for a "reconnaissance in force"; or bombing aviation may be assigned the predominant role in an offensive operation directed against distant hostile objectives. In any event, air force operation orders will designate the base unit, with which all other units will coordinate their activities.

b. Air-force missions may be of strategical or independent nature, conducted without reference to the positions or movements of opposing ground forces; or they may be executed in direct tactical support of ground units during the combat phase. In a normal campaign, supporting aviation initiates the action by strategical reconnaissance, and by preliminary offensive operations against the hostile air force and major ground installations. As the opposing ground forces come into contact, the role of supporting aviation becomes more tactical in nature; and in the final stages of the combat phase, aviation may be employed for direct combat support of front line troops.

90. Independent Operations.—a. **General.**—Air force operations during the strategical phase of a campaign are of two general

classes: distant reconnaissance missions; and air attacks directed against distant objectives. The two missions may be often combined, the operation then being known as a reconnaissance in force; or if the predominant role be offensive, the operation may be described simply as a preliminary reduction of hostile strength.

b. **Reconnaissance in force.**—A reconnaissance in force implies a massed flight of combined units, the function of the combat classes being to screen and protect the reconnaissance squadrons while the desired information is being obtained. Bombing and attack squadrons will attack enemy vital objectives, with the object of diverting the hostile fighters and antiaircraft fire from the reconnaissance units. Fighting squadrons will provide close support for the reconnaissance units, to prevent their being molested by enemy fighters. In other words, the entire air force is operating on a reconnaissance mission, air combat and air attack of ground objectives being considered of secondary importance and incidental to the procurement of military information.

c. **Reduction of hostile strength.**—In preliminary offensive operations directed against distant objectives, bombing or attack aviation will be assigned the predominant role. If the mission is the destruction of heavy matériel objectives, or the attack of major naval units, the base element will be bombing aviation. If the mission is to be the destruction of hostile aircraft on airdromes or carriers, then attack aviation may be the base unit. In any event, the attack will be preceded by air reconnaissance of the objective, and it may be supported by fighting aviation. It is, therefore, an air force operation. In a combined operation involving bombing aviation as the base unit, the following sequence of events is typical and illustrates the relationship existing between the various classes: Reconnaissance aviation locates, reports, and maintains surveillance of the targets; attack aviation precedes the bombers to neutralize the antiaircraft defenses; fighting units accompany the bombers and engage the defending hostile fighters; thus giving to the bombers that freedom of action necessary for the accomplishment of their mission. Such coordinated effort must be based on thorough planning, accurate timing, and careful execution of details.

91. Tactical Support of Ground Troops.—a. **General.**—During the combat phase there is less occasion for the combined employment of aviation in massed flights. The separate classes will be engaged mainly in carrying out their own specific missions in direct support of the ground units. The function of the air commander is mainly to coordinate missions with respect to time and space so that the maximum mutual support and protection may be achieved. In general, bombing, attack, and reconnaissance units will be expected to

operate without fighter escort, the available fighter strength usually being required for the adequate general support of the area of operations. Bombing and attack units may be combined into task forces for the assault of selected objectives, or they may operate independently of each other. Reconnaissance units will normally be given priority in the assignment of special fighter support, when it becomes evident that general fighter support is inadequate.

b. **Normal employment.**—The proper tactical employment of combat aviation is based on the premise that it should be used only against those objectives which are beyond the range or capabilities of ground weapons, or for which there are no ground weapons available. It is employed against front-line troops only as a last resort, when a grave emergency exists for which there is no other reserve. Combat aviation is properly used against those sensitive points in the enemy's immediate rear areas, the destruction or neutralization of which will impede the movement of his reserves, or disrupt his lines of communications. Trains, bivouac areas, rail centers, troop columns or concentrations, hostile airdromes, and major bridges on rail or truck lines are examples of lucrative targets for combat aviation. Ground troops should not expect to see combat aviation continually over the front lines, but should be taught to realize that the formations they see or hear passing to or from the hostile rear areas are rendering far more effective support than could be provided by these same units in the comparatively ineffectual, if more spectacular, strafing of front line trenches. Combat aviation should not be considered a convenient substitute for field artillery and machine guns, but rather as a special long-range weapon which enables the commander to extend his combat zone into the enemy's rear areas.

c. **Aviation in the counterattack.**—When a ground force is on the verge of overwhelming defeat, but still in possession of an aviation reserve, all available air units may be thrown into the breach against the most advanced hostile elements in a desperate effort to relieve the pressure and permit reorganization or reenforcement of the ground units. Such employment of aviation is in the nature of a counterattack, and is subject to the same guiding principle: The maximum force should be employed at the time and place where it will accomplish most. The aviation reserve should be committed entirely, or not at all.

d. **Aviation in pursuit.**—Conversely, when the enemy has been defeated, aviation may properly be employed to assist in the pursuit. Reconnaissance aviation maintains contact with the retreating columns; combat aviation endeavors to stop them by attacking their heads while passing through defiles, or at road intersections, thus permitting the pursuing ground units to complete their destruction.

The employment of combat aviation against retreating columns not only inflicts material physical damage, but completes the demoralization of the defeated troops, often turning an orderly withdrawal into an utter rout. If the retreating enemy has any aviation left he may be expected to react strongly in the air. Friendly fighters must be ever on the alert to furnish maximum protection to the air striking forces, and to the pursuing ground units. The temptation to divert fighters to ground attack missions must be especially guarded against at this time.

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