

1846-17

ELEMENTS OF AIR TACTICS

by

Commander A.H. Douglas, U. S. N.

Delivered before the Classes of

the U. S. Naval War College

on 23 October, 1933

Note: This pamphlet was used as the basis for the subsequent paper called AIRPLANE CHARACTERISTICS, used in Tactics Jackets, Classes of 1935, and thereafter.

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Department of Operations  
Naval War College  
Newport, R.I.  
October, 1933

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ELEMENTS OF AIR TACTICS 23

by 2

Commander A.H. Douglas, U.S.N. 30

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Red pencil mark through it

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ELEMENTS OF AIR TACTICS -23

1. Naval airplanes are divided into ten classes in accordance with the mission to be performed.

~~Slide No.~~ /

Classes and designations.

They are:

<u>Class</u>	<u>Designation</u>
Bombing - - - - -	VB
Fighting - - - - -	VF
Ambulance - - - - -	VH
General Utility - - - - -	VJ
Training - - - - -	VN
Observation - - - - -	VO
Patrol - - - - -	VP
Transport - - - - -	VR
Scouting - - - - -	VS
Torpedo - - - - -	VT

In this lecture and here at the War College we are concerned only with a few of these classes, namely, bombing, fighting, observation, patrol, scouting and torpedo; consequently these types only will be discussed.

2. The standard aircraft tactical organization is the section of three planes. The three plane section is readily adaptable to the tactics of fighting, torpedo, bombing and scouting planes. It permits concentration, maneuverability, and volume of fire. The aircraft division may consist of two or three sections depending upon the size of the squadron and the task assigned it. The squadron consists of two or more divisions depending upon the number of planes assigned the squadron. In our naval service the strength of squadrons varies from as low as 6 to as high as 18 planes.

3. Before going further a few definitions will be given in order to be familiar with their employment.

(a) Aircraft Wing. A tactical command consisting of two or more squadrons of the same class whose normal missions are the same.

(b) Aircraft Squadron. The standard administrative and tactical unit in all aviation operations. [It is composed usually of six, twelve or eighteen operating planes, together with the necessary personnel and spare planes for their operation, maintenance, minor overhaul, and minor repair.]

(c) Aircraft Division. A tactical sub-division of an aircraft squadron, composed usually of either two or three sections.

(d) Aircraft Section. The standard tactical sub-division of an aircraft squadron composed of three planes.

(e) A Flight. All aircraft which are operating together for the accomplishment of a single mission.

(f) A Group. Normally a subdivision of a flight consisting of a number of planes of the same class operating together.

4. Before going into the tactical employment of aircraft I beg your indulgence for a few moments in order that this discussion may proceed on a basis of mutual understanding with regard to just what should be expected of aircraft, their limitations, capabilities, etc., in contrast to what some rabid enthusiasts advocate and claim.

I refer particularly to one enthusiast who wrote quote "aircraft possess the most powerful weapons ever devised by man --- as battleships are relatively difficult to destroy, imagine how much easier it is to sink all other vessels and merchant craft --- In case of an insular power which is entirely

~~dependent on its sea lanes of commerce for existence, an air siege would starve it into submission in a short time" unquote.~~

4. It is manifestly improper to assume that aircraft at the present time furnish a panacea for all of the many evils that may be showered on us by an enemy.

5. The report of a Special Board appointed by the Secretary of the Navy in 1925 has this to say about aviation quote

(a) To win a war a combatant must gain a final decision.

(b) To gain a final decision, a combatant must sustain an offensive, then occupy and control first sea areas, then land areas.

(c) Aircraft acting alone cannot repeat cannot occupy and control either sea areas or land areas. unquote.

6. The mission of naval aircraft (I mean carrier and ship based aircraft) [as stated in our basic war plan,] during any war, is operation from mobile floating bases and surface ships.

(1) As an arm of the fleet.

(2) For overseas scouting.

(3) Attacks on enemy submarines, aircraft or surface war vessels.

7. Tactics is the art of using armed forces in battle to defeat enemy armed forces, military tactics in the case of land battle, naval tactics in the case of naval battles and air tactics in the case of battles in the air.

8. The principles of war have been studied and applied by all the great leaders of history.

9. One cannot study the campaigns of great leaders such as Napoleon, Lee, Jackson, von Moltke and Nelson without becoming aware of the application of the various principles of war.

Napoleon said "the principals of war are those which have guided the great leaders whose achievements have been handed down to us by history".

The principles of war have been classified as follows:

- (a) The Principle of the Objective.
- (b) The Principle of the Offensive.
- (c) The Principle of Superiority.
- (d) The Principle of Cooperation.
- (e) The Principle of Simplicity.
- (f) The Principle of Economy of Force.
- (g) The Principle of Surprise.
- (h) The Principle of Movement.
- (i) The Principle of Security.

These principles apply to the operation of aircraft in much the same way they apply to other naval units.

The fundamental tactical principle is superiority at the decisive point of contact.

11. ~~The principles of war are unchanging. Their application varies with the situation, the fundamentals of which are time, distance, weather and relative strength, including factors such as numbers, morale, communication and armament.~~

10 12. In every situation there are one or more paramount principles which, selected and properly applied, lead to success. If they are neglected or improperly applied, failure ensues, no matter how well the remaining principles may be observed and applied.

11 13. All methods of application of the principles of war must be bold and aggressive and marked with a resolute determination to impose our will upon the enemy.

12 14. Tactics change with changes in material and the conditions of war. The tactics that were successful in the World

War are by no means necessarily the tactics that will be successful in future wars. But the Principles of War remain unchanged.

13<sup>15</sup>. Let us see some of the applications of the Principles of War as applied by aviation in the World War, more to demonstrate the principle rather than to expound the tactics employed.

~~Show slide of Guynemer.~~

~~Slides no 2 and 3~~

14<sup>16</sup>. On 19 July 1915, Corporal Guynemer flying a plane armed with one flexible machine gun overhauled a German plane at 12,000 feet. Guynemer dove and placed his plane some fifty yards behind, under and to the left of the enemy, his observer opening fire. The German pilot was killed and the plane went down in flames. This was the first victory of Georges Guynemer, victor of fifty three combats in two years. The victory was won by the proper application of the principles of surprise, offensive, and of superiority at the decisive point, namely, the blind angle of the German gunner.

15<sup>17</sup>. On 23 September 1916, Guynemer sighted a group of five Fokkers flying three in line above and two below engaged in attacking another Frenchman. Guynemer dove at the trio. At 11:20 one fell in flames as Guynemer pulled up and attacked again causing the second to dive away thirty seconds later to a forced landing with observer killed and pilot wounded. At 11:23 the third pilot, the only one who ever saw his assailant, was falling in flames. These air battles were won by the same indomitable spirit of the offensive which carried Guynemer through his fifty three victories coupled with the completely successful use of surprise.

~~Show slide No. 4~~

~~Lieut. René Fonck.~~



16-18. On 30 September 1917, Captain Weissman, who had killed Guynemer on 11 September, 1917, met Lieut. René Fonck at 24,000 feet, Weissman was flying a biplane Rumpler and Fonck a single seater Spad. The remainder of Fonck's patrol was some 3,000 feet below. Fonck went into a climbing turn and maneuvered for a position from which he could attack with his single fixed gun without encountering the superior fire of the Rumpler's fixed and free guns. Soon the position was attained and Fonck did a sudden reversement followed by a zoom up under the tail of the German which enabled him to secure victory with a short burst of six rounds.

Thus victory was won by utilizing the superior maneuvering ability of the Spad to apply the principle of movement, and the achievement of superiority at the point of contact in spite of the superior gunpower of the German.

~~Show slide No. 5~~

~~Von Richthofen.~~

17 19. With the inauguration of formation fighting by Captain Boelke and von Richthofen, a tactical principal new to air fighting was introduced, the time honored principal of cooperation in order to achieve superiority at the point of contact.

Richthofen's squadron flying and fighting in formation downed 194 allied airplanes in six months and forced the allies to adopt formation tactics.

18 20. It was proven many times during the World War that the principle of the offensive was most important in air warfare, that the best defense against aircraft is to attack the enemy air force from the air, destroy his planes, his hangars and his supply bases.

19 21. In July 1918, the allied air forces in certain sectors were operating their aircraft in a system of defensive patrols which, since they were continuous, were of limited strength.

The Germans soon commenced operating at irregular intervals in greater strength and the allied losses were terrific. Again we see the application of the ancient tactical principle of superiority of force at the point of contact.

The major weapon of a battleship is the heavy guns and as a result we find the tactics of a battleship to be those that will best develop its gunfire. The principal armament of a fighting plane is also the gun so we find that fighting plane tactics are also absolutely dependent upon gunnery.

20 23. The desire to develop a concentration of gunfire at equal ranges causes the battle formation of battleships to be a line of bearing of units normal to the bearing of the enemy battle line. The same consideration, the desire to develop a concentration of fire on a common objective, causes the battle approach formation of fighting planes to be a line of units normal to the enemy direction. The desire to lay down an efficient torpedo salvo causes destroyers to attack on certain bearings and in close concentration. The same desire will cause torpedo planes to attack in a similar way since the principles of torpedo fire are the same regardless of the nature of the torpedo craft.

21 24. The moment that we realize that the underlying principles of war as proven in the past govern air warfare as well as war on land and sea, a great deal of the obscurity surrounding air tactics and air strategy disappears.

22 25. In the records of the fighting at Jutland can be found lessons of the greatest value to scouting squadrons. What would Jellicoe not have given if he had had an efficient scouting squadron or squadrons at his disposal, and what might the outcome have been if each O.T.C. had had continuous and exact information? There is a lesson for torpedo squadrons

in the successes and failures of the German and British torpedo craft in the same battle.

23-26. Stonewall Jackson's maxim "Always mystify, mislead and surprise the enemy" is just as valuable advise for the student of flying plane tactics as for the infantryman.

AIRCRAFT SCOUTING -17

Scouting operations are defined as those conducted for the purpose of obtaining information of the enemy. There are <sup>five</sup> ~~four~~ types of scouting operations:

- (a) Search: [operations to locate an enemy force known or believed to be at sea.]
- (b) Contact Scouting: [scouting operations after contact with the enemy has been made. Contact scouting is of two types:]
  - (1) Strategical Scouting.
  - (2) Tactical Scouting.
- (c) Observation: [Operations within a fixed area, or on a fixed line, with a view to ascertaining the presence of the enemy within, or his absence from that area, or his passage over a fixed line.]
- (d) Patrol: [similar to observation, but more frequently used when the line is moving and is only fixed in relation to a moving origin.]
- (e) Reconnoitering: [operations to determine the details of information concerning localities or forces.]

Missions and Employment of Scouting Squadrons. 45

~~Slide No. 6 and 6A~~

[~~Scouting plane being catapulted.~~

Scouting squadrons permanently or temporarily assigned to Aircraft Battle Force, are assigned the following major missions:

- (a) Offensive action against enemy aircraft and enemy <sup>surface</sup> ~~gunfire~~ vessels in contact with the Battle Force.
- (b) Strategic Scouting.
- (c) Tactical Scouting.
- (d) Service of Security (Screening).

The aircraft of the Scouting Force are assigned the following major missions:

- (a) Search.
- (b) Strategic Scouting.
- (c) Tactical Scouting.
- (d) Offensive action against enemy aircraft and surface vessels in contact with the Scouting Force. (mainly enemy offensive screens).

The performance characteristics of aircraft limit their employment in carrying out the scouting missions assigned. The following indicate in general the types of aircraft which can be utilized and the conditions of operation.

Search from ahead:

- (a) In and out method and two line method.

- (1) VS types on cruisers may be utilized to increase the front or decrease the distance steamed by fastest vessel.
- (2) VS types on carriers. Same as above.
- (3) VP type but they are not ordinarily employed on this type of search.
- (4) ZR type may be utilized effectively.

- (b) Station Patrol:

- (1) VS types on cruisers not ordinarily employed on account of limited number of planes available on each vessel.
- (2) VS types on carriers can be employed very effectively.
- (3) VP type can be employed very effectively. A primary function of this type.
- (4) ZR type can be employed effectively.

Search from the flank - all methods.

- (a) VS types on cruisers. Not ordinarily effective due to short endurance. May be used to examine areas in which enemy may be, if using speed slower than assumed speed or an hour of departure later than assumed.
- (b) VS types on carriers. Same as above. Not effective. Carriers would not normally be employed on this type of search.
- (c) VP type - can be employed but not effectively due to necessity for return to tender.
- (d) ZR type - extremely effective. This is a primary function of this type; it is probably the most effective naval type for this purpose under favorable conditions.

Search from the rear.

(a) Trailing method.

- (1) VS types on cruisers - may be utilized to increase the front or to increase the advance, by examining the area ahead in the afternoon and thus permitting higher sustained speed of the scout vessel during the night.

Strategic Scouting.

- (1) VS types on cruisers. Can be employed with great effect. This is a major function of cruiser based planes.
- (2) VS types on carriers. Can be employed with great effect.
- (3) VP type. Can be employed but under limitation of geographical and time coordination.
- (4) ZR type. Can be effectively employed, but is highly vulnerable.

Tactical Scouting.

- (1) VS type on cruisers. Can be employed with great effect. This is a major function of cruiser based planes.

- (2) VS types on carriers. Can be employed with great effect. This is a major function of carrier based VS planes.
- (3) VP type. Can be employed but under limitations of geographical and time coordination.
- (4) ZR type. Cannot be effectively employed. Highly vulnerable.

Observation and Reconnoitering.

- (1) VS type on cruisers. Can be effectively employed. This is a function of cruiser based aircraft under special circumstances.
- (2) VS types on carriers. Same as above.
- (3) VP type. Too slow and vulnerable.
- (4) ZR type. Too slow and vulnerable.

In carrying out scouting operations in accordance with any of the various methods, aircraft, as limited by their characteristics are guided by the same principles that govern scouting operations of ships. In planning operations, due account must be taken of the possibility of forced landings and the surface and aerial search must be so conducted that the search does not become fatally ineffective due to this cause.

It should be constantly borne in mind that in any scouting operation the most valuable service which cruiser and/or carrier aircraft can perform and the one for which they are better suited than surface vessel, is contact scouting, piercing the enemy screen and investigating what lies behind it. Chances of damage to the limited number of planes available should be avoided in order that they may be available for investigation of enemy screened forces that may be encountered.

Scouting operations may be assigned as a mission to any squadron regardless of the type of aircraft of which it is composed. Normally the major burden of scouting falls on these classes of squadrons:

- (1) Scouting squadrons (VS)
  - (a) Carrier based (on wheels).
  - (b) Cruiser based (on floats).
- (2) Patrol squadrons (VP)
  - (a) Tender based.
- (3) Dirigibles (ZR)
  - (a) Tender or shore based.

The following classes of squadrons may be called upon to carry out scouting missions or combine scouting with their primary mission.

- (1) Fighting Squadrons (VF)
  - (a) Tactical scouting. Fighting planes equipped with radio will frequently find themselves in a position to communicate vital information and should always consider the transmission of such information as part of their mission.
  - (b) Observation and Reconnoitering. Due to the high performance of fighting planes, special situations may arise where these missions may be assigned.
- (2) Torpedo and Bombing Squadrons (VT)

This type is poorly equipped for and is with difficulty adopted to scouting operations. The nature of the general situation will dictate their employment on scouting missions. Consideration of flight deck operations practically forbid the use of carrier VT for scouting.



The mission of the scouting plane squadron is scouting, but they may be called upon to perform the following secondary missions:

- (a) Screening.
- (b) Relief gunnery observation.
- (c) Dive bombing.
- (d) Protection work as two seater fighters.
- (e) Liaison work.
- (f) Light smoking.
- (g) Reconnaissance over land and liaison with ground troops.
- (h) Photography.

Scouts<sup>P</sup> - Procedure on contact with enemy. <sup>38</sup>

Transmit information as early as possible <sup>confining</sup> confirming reports to facts not opinions. Do not withhold information to clear up uncertainties; report what is certain and do it promptly. Avoid detection by using clouds, sun and wind. Do not make radio reports of own position unless ordered to do so or in emergency. Avoid unnecessary radio transmission and make only reports necessary to accomplish the mission, making reports as brief as possible.

Be certain that the force reported is enemy before reporting. Give definite information of the enemy's numbers, composition, position, course and speed. As various enemy forces become visible, their relative positions become information of the highest importance.

The ideal of scouting is to present to the force commander a complete and accurate picture of the enemy force and movements.

When enemy aircraft carriers are encountered information of the approximate number of planes on deck is of the highest importance.

All engagements with important forces of the enemy should be reported particularly attacks on aircraft carriers.

Upon making contact with enemy forces other than the force for which the search is being conducted, aircraft will be guided by circumstances in determining whether or not contact report is to be sent out at once. If the force sighted is an important one or is in a position calling for prompt action against it by our forces, the report should be sent out at once.

Concentration after contact.

In concentrating, scouting units should remain well separated but near enough to the enemy to observe his movements over a wide area and from many angles.

Under no circumstances shall scouts concentrate unless ordered to do so, or it becomes absolutely certain that all units of the force searched for have been located. The possibility of a first contact being a false one or with a false screen is to be remembered.

Commence contact scouting by all units as soon as it is certain that the force contacted is the objective of the search.

Procedure on Encountering Enemy Aircraft while Scouting 55

If enemy aircraft are encountered prior to the completion of the scouting mission, scouting aircraft should endeavor to avoid action with them.

If enemy aircraft are encountered when our scouting aircraft are returning from a scouting mission, such scouting aircraft should seek engagement with them only if the situation provides very favorable chance of <sup>securing</sup> screening a tactical success or of interfering with important enemy movements. If portions of the scouting force, while scouting, encounter superior enemy air forces, adjacent scouting units will not ordinarily diverge from

their scouting mission to reinforce or assist. If the units thus threatened by the enemy in superior strength are unable to avoid action, or to continue on in the general direction prescribed, they shall endeavor to draw enemy air activity to themselves and thus permit adjacent units to proceed without opposition. If one or more of the units of the scouting formation is forced from its position by enemy action or other cause, adjacent units shall, as far as practicable, adjust their interval so as to close the gaps thus created.

Attack on Enemy Surface Vessels 37

Show Slide No. ~~7~~ 7A

Scouting plane equipped with bombs.

Scouting aircraft carrying bombs shall ordinarily not permit themselves to be deflected from their scouting mission *for* of the purpose of employing such weapons against the enemy. When an opportunity is presented to do serious damage to the enemy by this means, it may be accepted, provided that the probable value of damage thus done will be greater than the possible value of the information which might otherwise be gained. However, the use of such weapons, should, as a rule be withheld until the missions of the scouting flight have been accomplished.

Scouting units which encounter enemy aircraft carriers with airplanes on deck are authorized to attack provided the assigned mission of the entire scouting group of which the unit is a part is not jeopardized thereby. In any case the scout shall report the contact before the attack, giving the number of planes on deck and shall report the completion of the attack.

Scouts shall not hesitate to attack enemy submarines discovered in a position from which attack upon heavy units of our fleet may shortly develop.

Scouting by Aircraft against Aircraft. 37

Scouting by aircraft against aircraft presents many difficulties. Experience has shown that large formations can sometimes

pass fairly close to a scouting plane and remain unobserved.

The following radii of horizontal visibility are assumed by the aircraft in the fleet:

Six or less small planes - - - - - 5 miles.

Three or less large planes - - - - - 5 miles.

Seven to twelve small planes - - - - - 7 miles.

Seven to twelve large planes - - - - - 10 miles.

These radii of visibility will be reduced by <sup>great</sup> ~~reat~~ differences in altitude. As a general rule, an altitude for the enemy planes should be assumed and an attempt made to scout from below.

It is very difficult to observe planes passing at a lower altitude. Vertical visibility except under unusually good conditions cannot be depended upon to exceed 3000 feet.

Anti-Submarine Patrol.

Scouts are frequently detailed as anti-submarine patrol about heavy units of the fleet. In addition to bombing and reporting submarines located, they should also zoom repeatedly upon submarines in threatening positions when in sight of the vessels protected, as this very effectively calls attention to the danger. Aircraft float lights, if available are also effective markers.

In the clear waters adjacent to the Southern California coast and in the Panama and West Indian areas, submarines can frequently be seen on clear days, even when submerged, from altitudes as high as 8000 feet. In darker waters, such as off the coasts of England and France, altitudes of 1000 to 1500 feet were found to be best.

The different methods of search will not be taken up ~~in this lecture~~ as they are fully covered in "The Service of Information and Security" and in "Aircraft Tactical Instructions", Vol. I.

Fighting Squadrons

Show slide No. ~~8~~ 84

Modern carrier fighting plane.

The general battle mission of fleet fighting squadrons is to gain and maintain control of the air in the battle area in order to assist the battle line in defeating the enemy. Their secondary mission is attack on enemy surface forces for the same purpose. The accomplishment of the foregoing missions involves detailed operations as follows:

- (a) Attack on enemy spotting planes.
- (b) Attack on enemy torpedo and bombing planes.
- (c) Attack on enemy fighters.
- (d) Attack on enemy light surface craft.
- (e) Attack on enemy major surface units in support of heavy bombers.

In minor operations at sea, fighting units operate with various special missions which involve operations of the foregoing classes plus:

- (a) Defensive combat patrols in the vicinity of the fleet or unit to which attached.
- (b) Dive bombing and machine gun attacks on enemy submarines or light forces.
- (c) Bombing and machine gun attacks on enemy carriers.

In the absence of other instructions the mission of the Fighting Squadrons is the destruction of enemy aircraft whether encountered in the air or on board carriers or other vessels. In main actions upon the completion of definitely assigned tasks, Fighting Squadrons shall, until forced to refuel or unless specifically directed otherwise, operate to destroy such enemy aircraft as are encountered in the battle area.

In the absence of other instructions Fighting Squadrons shall consider their primary objectives to be the enemy spotting planes and enemy planes threatening our spotters whenever the range between the battle lines is such as to make aerial spotting essential (approximately in excess of 20,000 yards).

Provision should be made if possible for attacks on enemy observation planes, either by a task flight of fighting planes for that purpose or by the fighting planes defending our battleline. It is of particular importance to prevent the enemy employing aircraft for gunnery observation purposes in the opening stages of the engagement.

Provision should be made for the defense of our battleline against attacks by enemy aircraft. Normally fighting planes from carriers will be assigned to this duty. These planes should, as a rule, be launched in sufficient time to have them above our battleline before gun fire is opened or earlier if enemy aircraft are operating with a view of attacking our battleline. They should take stations so that attacking enemy planes can be engaged before their attack is in dangerous proximity to our battleline.

Fighting planes can destroy enemy aircraft in the air or on their upper flight decks. Other types of aircraft can normally destroy enemy aircraft only when the enemy planes are on board their carriers. Fighting planes must break up the enemy air attacks and must pursue the enemy aircraft back to their carriers, attacking them both in the air and after they land. When the enemy carriers are designated as the objective of a task group, the carrier should be attacked whether planes are on deck or not. When enemy aircraft are designated as the objective of attack they shall be attacked wherever located - in the air or on deck.

When VF aircraft are assigned a mission of supporting the attack of VT, they should destroy any enemy aircraft encountered

in sufficient force and proper position to jeopardize the success of the VT attack. If no such enemy forces are encountered they should support the VT attack by bombing and machine gunning the defending anti-aircraft batteries.

Tactics of Fighters (VF) <sup>-24</sup>

In combat between fighters the initial advantage rests with those planes which have the superior altitude or which have achieved surprise.

✓✓✓ The methods of achieving surprise are the concealment of the approach in mists, haze, clouds or smoke, the approach out of the sun's rays, the high speed approach from ahead, the approach concealed in the blind angles of the enemy and the approach while the enemy is devoting his attention elsewhere.

Fighting planes should avoid flying close to cloud formations which may provide a means of concealment for hostile planes and should always avoid flying immediately under broken clouds.

Principles of Formation Fighting

The following are principles of formation fighting tactics:

- (a) Retain tactical control; avoid melees.
- (b) When practicable, avoid action until the altitude advantage has been gained.
- (c) Regain all altitude possible after each dive.
- (d) Even if the attackers are inferior in numbers they may attack successfully from superior altitude, provided they attack resolutely and intelligently.
- (e) The immediate objective of attacks should be the highest enemy groups.
- (f) Attacks should be made by sections diving in succession.

Battle tactics of Fighting Squadrons must be simple and rapid and must subordinate all other considerations to the fundamental object of tactics - superior force at the point of contact.

Attack of Fighter formation on another Fighter formation.<sup>5-6</sup>

The approach to the attack of one large fighting unit on another must be positive and rapid. To engage in complicated maneuvers during the approach will disclose the plan of action to the enemy and facilitate his counter stroke.

Tactical control must be maintained throughout the action. The approach will usually be made in open attack formation with sections in echelon. In attacking an enemy fighting squadron approach from the flank is considered better than from directly above.

Each section should attack in succession, the immediate objective being the highest enemy section. The attack should not be shifted to the next lower section until the highest is destroyed. Under no circumstances should a section follow down any of the enemy below the level of the enemy division.



If the attacking squadron is superior in numbers to the enemy, the last section should withhold its attack to see if the enemy formation has been broken up. If any enemy planes or groups are not destroyed, this last section should destroy them before they have a chance to counter attack. The highest intact enemy groups should be destroyed first.

Single seater fighters against two place fighters. 47

The problems of a <sup>single</sup> seater formation attacking a flight of enemy two place fighters are somewhat more difficult than those presented by attacking a formation of heavier and less maneuverable airplanes. The attack from ahead and slightly above or below the target level is dangerous because of the ability of the two place fighter or similar type to lift or depress its nose to meet the attack of end on fire. The rapidity of approach favors the defense in this case, since it makes the interval between arriving within effective range and the point where the attack must be broken off almost instantaneous, while the defense can utilize either the fixed or free gun during the entire time that the enemy is within effective range.

In attacking an enemy two place formation the most effective method will be to concentrate on the leader and the wing planes nearest the direction from which the attack is launched. If the enemy flight consists of two units it will be advisable to concentrate the attack on the higher of the two units while merely enough attention is devoted to the lower unit to keep it occupied. Thus a division of 9 planes could assign two sections to the destruction of the upper enemy unit and one section to contain the lower unit.

Fighting Planes attacking a Bombing Squadron. 44

Show slide No. 9

Heavy Bombing Squadron flying formation for light bombing.

The method to be employed will depend almost entirely on the existing tactical situation. If the bombing formation menaces important surface units the fighting squadron attack must be pressed home with comparatively little regard for the safety of the fighters, using the methods of approach which best develop the fire power of the fighters. These methods are normally those which meet the fire of one or more defensive gunners, to offset which the fighters have the advantage of surprise, the offensive and of a longer range and heavier guns. Methods which rely on attacking from ahead, while keeping the fighters comparatively immune, render the attack slow, ineffective, and wasteful of ammunition.

In attacking a formation the same principles as are used in attacking a single plane still hold good. If the attacking formation is superior in strength to the enemy, each section should take a sector and attack in that sector until the enemy is put out of action. The section assigned to attack the enemy center usually that of the divisional leader, approaches and opens fire at long range in order to draw the fire of the enemy gunners. In the meanwhile the other sections will attack in their respective sectors according to the instructions of the leader governing flights of the types in progress. Sections assigned to attack from the flanks dive rapidly at their respective wings of the target formation and rake it with enfilading fire. Sections assigned to attack from below dive under the enemy formation and climb up <sup>at</sup> ~~the~~ full power in the dead angles and deliver their fire at short range.

If the enemy is superior in strength the attack is concentrated on the rear and the highest parts of the enemy formation in order to defeat it in detail.

Formations should be attacked from angles such that enemy planes are blinded by each other, thus allowing the entire division to concentrate on a few of the enemy.

After the first dive toward the enemy formation in which he indicates the objective, the leader should climb and act as top guard, circling or turning overhead and watching not only the progress of the fight but also searching the sky for approaching planes.

After fighting planes have made the initial attack on an enemy formation they should dive in succession following their section leader. As soon as one plane is part way on its dive, another starts directly at the objective, the object being to have successive planes arrive and deliver their fire from different angles as rapidly as possible, after delivering its burst of fire each plane climbs rapidly back into position clear of enemy fire.

Fighting Plane Protection of VO or VT Formations or of ships.

Experience has demonstrated that the protective force should be divided into:

- (a) A high patrol.
- (b) A low patrol.

The high patrol should maintain tactical concentration.

Two methods of low patrol have been successfully used:

- (a) The low patrol divided into two divisions at different altitudes.
- (b) The low patrol divided into sections at approximately the same altitude.

The essentials of protection are that:

- (a) The patrols must maintain sight contact with the force protected, and, if practicable with each other.
- (b) They must support each other in case the enemy attacks any unit in superior force.
- (c) They must maintain a constant watch in all directions by circling around and outside of the force protected.

(d) Minor enemy attacks must not decoy forces from their proper positions and thus leave gaps in the protection.

The high patrol should be stationed as far above the force protected as practicable. It must, however, maintain contact with the force protected. If there are broken clouds above the force protected the high patrol should be above them, maintaining contact, if necessary, by a liaison plane. The high patrol should be about 10,000 feet or more, if its performance permits, above observation or torpedo planes. If clouds permit, the high patrol should operate at service ceiling when protecting surface craft from attacks by enemy fighters. If only enemy heavy bombers or torpedo attacks are to be expected, the high patrol can properly operate at lower altitudes, approximately 12,000 feet for bombers to 8,000 feet for torpedo planes. /

The duty of the high patrol is to support decisively the lower units. It must not permit itself to be lured down prematurely by minor enemy attacks.

The low patrol may be organized with individual sections or into two divisions.

If the section organization is used, the sections are disposed equally about the force protected and fly a circle outside of and above it, all sections circling in the same direction at approximately the same altitude. If the divisions organization is used, the two divisions fly at different altitudes one circling in one direction and the other in the opposite direction.

If the cloud ceiling permits, the low patrol should fly at 4,000 to 6,000 feet above observation or VT planes. In no case should the low patrol fly above clouds while the force protected is below them.

The duty of the low patrol is to engage any enemy attack coming in.

The units of the patrol must support each other, but they must not be lured away by minor attacks thereby leaving gaps in the circuit through which the enemy could attack unmolested.

The great advantage of the section organization of the low patrol is the thoroughness with which it maintains search; its disadvantage is the danger of defeat in detail by strong forces of enemy fighters if the patrol circuit is so large the units cannot support each other quickly.

The great advantage of the division organization is that it maintains a better concentration of the protective fighters. The search maintained is not as thorough as that of the section organization, but this defect is minimized by the two divisions circling in opposite directions.

Tests have demonstrated that in clear air and against a cloudless sky a division of fighters can be seen directly overhead at 13,000 feet altitude. It was, however, extremely difficult to see them and, had they not previously been sighted and followed in they probably would not have been observed. A cloud background usually increases the distance of visibility.

#### Fighters attack upon Protected Formations - 41

The leader of the attacking fighters must exercise good judgment as to the urgency of attacking the force protected.

If VT planes are close to their objective, the attack should be made upon them immediately without first destroying the protective escort.

If time is not so pressing, the protecting escort should, in general, be destroyed before attacking the force protected. If the protective escort is much scattered, it is probably best to endeavor to destroy it in detail, attacking the higher units first. If the escort is well concentrated, it is usually necessary to apply the principles of attack upon a concentrated fighting squadron.

Maneuvers have clearly demonstrated that fighters attacking torpedo planes or observation planes which are under fighter protection, may almost certainly count on delivering one effective dive, without opposition, on the force protected, but that thereafter, protecting planes coming down are in position to destroy the attacking fighters.

~~7~~ Numbers of VF's necessary to destroy unprotected VT's or VO's.

No arbitrary figures can be given to cover this point but in general, <sup>in the fleet</sup> fighters should be despatched in the following ratio:

- (a) 3 VF's to destroy 1 VT or 1 VO.
- (b) 6 VF's to destroy 3 VT's or 3 VO's.
- (c) Above 3 VT's, a number of VF's can destroy, or frustrate the mission, of an equal number of VT's. This is due to the fact that the greater the number of VT's in a formation the less their maneuverability.

Fighters protecting surface craft from VT attack must attack repeatedly and with the utmost vigor, even if heavily outnumbered, to disorganize the VT attack before it reaches its objective.

Fighters protecting surface craft from dive bombing attack must make every effort to disorganize the attack before it starts its dive. Once the dive has started it is extremely unlikely that it can be frustrated. However, the dive bombers are at a distant disadvantage as they recover from their dive.

FIGHTING UNITS ON DEFENSIVE ROLES 33  
Wing Fighting Tactics

<sup>7</sup> The fighting <sup>tactics</sup> of a wing of two or more squadrons are dependent almost entirely upon coordination of the assaults of <sup>individual</sup> individual squadrons by doctrine and by radio orders from the wing commander.

The governing principle in the disposition of the wing should be mutual support between squadrons while retaining freedom of movement.

The basic method of attack on a single enemy squadron is the wave attack by squadrons in succession each attacking squadron climbing and reforming after one assault. In case a number of targets is presented the distribution of attacking units is governed by the judgment, initiative and previous indoctrination of the squadron leaders.

There is a comparatively limited number of fighting aircraft with our fleet therefore it will be imperative to keep the assignment of fighting units to defensive roles, such as protection of observation, bombing or torpedo flights to a minimum.

A tactical organization which assigns any appreciable percentage of fleet fighting aircraft to the definite task of protecting spotting, torpedo or bombing planes before air supremacy is gained directly violates the principle of the offensive and the principle of superiority at the point of contact.

Observation and attack units are by no means unprotected when a massed fighting plane offensive is being vigorously directed against the enemy fighting strength. On the contrary they are receiving protection of the highest order. The surest way to insure defeat in the air is to disperse fighting strength in purely defensive roles. In air fighting the offensive wins and a vigorous offense is the best defense.

#### Dive Bombing Tactics

Show slide No. 10a

Dive bomber with bomb installed.

The following remarks deal primarily with light dive bombers of the VF type but they also apply to all dive bombers except where light dive bombers are specifically mentioned.

Dive bombing consists of diving the plane directly at the target, sighting by means of the conventional fixed gun sight, and releasing the bomb when on the target. [Theoretically the most accurate results require calm air and on absolutely vertical dive, in which case the bomb can be released at any altitude and a hit will result on a stationary target. When bombing in a wind or on moving targets correction to the point of aim must be made to compensate for the drift of the bomb due to the wind, drift of plane due to wind, course of target if in motion, and the lag of the bomb which lag varies with the angle of dive, altitude of release and the speed of the plane. The most important of these factors is the angle of dive.]

It is vital to safety that the plane be pulled out of the dive the instant the bomb is released. [In practice it has been found particularly difficult to use an absolutely vertical dive because slight skidding or slipping cannot be readily recognized. In addition, there is a very real danger of the bomb striking the propeller in a vertical dive. [Therefore, the best results have been obtained by using a dive of about 75 degrees in order to reduce the tendency to skid, which will surely cause a miss. Even with wing bomb racks, cases have occurred of bombs striking the propeller, probably because the plane was turning slightly toward the bomb.] Experience has demonstrated that it is usually most accurate to bomb down wind or from ahead of a moving target. Usually the speed of a moving target is sufficient to cause a relative wind from ahead. The greatest advantage of this direction of attack is that the drift caused by the wind (true wind on a stationary target or relative wind on a moving one) tends to counteract the lag of the bomb and thus increases accuracy.

In dive bombing attack formations the following general rules should be borne in mind:

- (a) Approach the target in loose formation (from the sun if practicable) at an altitude of at least 10,000 feet.



A loose formation is harder to see and is a poorer target than a close one. The higher the formation, the less likely it is to be seen by a ship. In the approach, maneuver as little as possible as the sun glint from a dipped wing has often revealed an approaching attack that otherwise would not have been seen.

- (b) Resort to clouds wherever practicable to aid in the element of surprise.
- (c) Push home the attack as quickly as possible.
- (d) Do not let the attack string out. Keep hitting the enemy continuously.
- (e) Dive from different directions as nearly simultaneously as practicable.
- (f) Avoid permitting an enfilade fire, but risk of enfilade is permissible in attacks from the sun.
- (g) It is more difficult for a ship to fire at a target directly overhead than at a target at a lesser angle of elevation.
- (h) After delivery of an attack, retreat, zigzagging at full speed at low altitude in the probably blind angle of fire.
- (i) If a number of objectives are to be attacked at the same time, the bombers should be divided into a number of groups equal to the number of targets and these groups should attack simultaneously in order to obtain the maximum advantage of the element of surprise.

On a clear day against a bright blue sky a division of dive bombers (light of VF type) was seen at 13,000 feet altitude and a squadron of heavy bombers at 15,000 feet altitude.

When surface units are not forewarned light bombers above 12,000 feet are seldom sighted against a bright sky.

A cloud background makes planes visible at greater distances.

Lacking surprise, dive bombers should maneuver in the early stages of the attack to confuse the anti-aircraft fire. A spiral dive, followed by the straight dive of the final attack is highly effective. Upon the completion of the final dive, planes should retire at low altitudes at maximum speed in irregular flight as this offers a more difficult target for anti-aircraft fire than does zooming. Tests have demonstrated that the loss of speed and greater time in range due to zooming helps the anti-aircraft gunner amazingly, provided he is not occupied with meeting another attack.

Light dive bombing groups, that is the VF type, assigned the mission of supporting heavy bombers or torpedo attacks shall:

- (a) If the attack is seriously threatened by enemy fighters, discharge their bombs and engage the enemy fighters in order to protect the VT.
- (b) If the VT attack is not seriously threatened by enemy fighters, bomb in advance of the VT.

vvvv The dive bombers should endeavor to attack about three minutes before the VT whose attack they are supporting.

~~Show Slide No. Hand 11A~~

~~[Carrier with planes on deck (picture from air).~~

In case an enemy carrier is encountered with planes on deck, a successful dive bombing attack by even a small number of planes, may greatly influence future operations. For this reason, groups of dive bombers, including scouting units on scouting missions, which may encounter enemy carriers with planes on deck are authorized to attack provided this does not vitally jeopardize the success of the assigned mission or of important operations.

The commanders of large groups of dive bombers, <sup>whose</sup> ~~shewe~~ <sup>who</sup> assigned mission is not an enemy aircraft carrier but ~~the~~ <sup>who</sup> encounter enemy carriers with planes on deck should, in general,

attack if the number of planes on deck is large.

In case fighting type bombers i.e. VF are assigned the task of bombing an enemy carrier but find that carrier in the act of launching planes, the decision as to whether to attack the planes in the air or on deck will depend upon the relative size of the opposing forces, the size of bombs carried by the bombers and the effectiveness of anti-aircraft fire.

For instance, a large attacking force, armed with small bombs and finding the enemy with almost all planes launched should certainly attack the planes in the air.

On the other hand a small force similarly armed but finding the carrier with most of its planes on deck should almost always bomb the deck.

Dive bombers of other than the fighting or VF type can hardly expect to destroy planes in the air and therefore should attack the decks of the enemy carrier under the circumstances just outlined.

~~Show slides no 12 and 12A (AKAGI)~~  
In attacking enemy carriers, it must be borne in mind, not only that foreign navies normally stow their aircraft in hangars, but also that some foreign carriers are equipped with double flight decks, the upper deck being for landing and the lower for taking off. Attacks upon carriers should therefore be made with bombs of sufficient weight to penetrate the upper flight decks.

~~Show slide No. \_\_\_\_\_~~

~~Akagi (pp 319, Jane's 1932)~~

In main action when all bombs have been expended upon the assigned objectives, dive bombers of the fighting type shall, unless specifically ordered to the contrary, remain in the air to destroy enemy aircraft. Dive bombers of other types shall unless, specifically ordered otherwise, or unless on scouting missions, return to their carriers to reload.

Dive bombers which return to carriers with unexpended bombs shall not drop them until very shortly before landing.

While standing by to land, they shall endeavor to locate and attack submarines or light forces threatening the carriers.

Heavy Bombing Attack (*Sight bombing*) -36

Show slide No. 13 and 13A

Heavy Bomber.

Heavy bombing planes are primarily used to attack important enemy vessels, their objectives usually being battleships ~~and~~ or aircraft carriers.

The number of planes in each attack unit will depend upon the objective:

(a) Use of nine-plane division

Used against shore activities, vessels concentrated at base or anchorage where maximum volume of "fire" is desired. The effectiveness of anti-aircraft gun fire would be a determining factor in the employment of such large formations.

(b) Use of six-plane division

Against heavy surface craft where good concentration of "fire" coupled with defense against enemy aircraft is regarded, and where anti-aircraft gun fire is not considered as dangerous as the possible attack by aircraft.

(c) Use of three-plane division

Against surface craft where dispersion of "fire" is essential or where effective anti-aircraft gunfire is more to be feared than attack by enemy aircraft.

During the passage to the objective an altitude of two to three thousand feet above that at which it is intended to bomb should be reached. If the objective is well defended by anti-aircraft guns, the bombing altitude should be at least 10,000 feet if the ceiling permits.

If there is a thick cloud ceiling which the bombers can reach during passage, it is advisable to fly just below it as this provides protection from attacks from above.

If there are small holes in the ceiling, accompanying protective fighters can be expected to fly above the clouds to give added protection. If there are dispersed clouds at low altitudes, or if the objective is known to be in clear air, the bombers should climb above the clouds to reduce the chances of being sighted by surface vessels.

The following are conditions which are helpful during daylight in making effective bombing approaches and attacks:

- (a) Target not protected by aircraft.
- (b) Target under effective fire from surface vessels.
- (c) Bombers supported by light bombers (VF).
- (d) Attack from the sun.
- (e) Attack from ahead or astern.
- (f) Low broken clouds not exceeding six on a scale of zero to ten.
- (g) Attack at dusk or dawn from the dark semi-circle.

[The advantages of (a) and (b) are obvious.] The support of a well time light bombing attack (delivered about the time the heavy bombers reach effective anti-aircraft range, or in other words about five minutes before the time of bomb drop), is excellent.

An attack from the sun at altitudes above 8,000 feet is almost invisible.

An attack from ahead or astern generally renders it difficult to bring the whole anti-aircraft battery to bear on the approaching bombers and also introduces difficulties, due to the roll of the ship, in ~~area~~ regard to excessive train of the guns at high angles of elevation.

Attacking high speed vessels from astern has the serious disadvantage of greatly reducing the closing rate, hence the attack from ahead is generally preferable.

A vessel free to maneuver, such as an aircraft carrier, may, however, turn away from the approaching attack and thus force an approach from astern. With such an objective, the approach from the sun seems preferable.

During the approach the divisions should not be closer to one another than 1000 yards and should avoid affording the anti-aircraft batteries opportunity for enfilade fire.

Clouds are of less value to the bombers than it is generally believed. They hide him from his objective, but they also hide his objective from him. Experience indicates that low broken clouds of seven or more on a scale of ten, practically prohibit bombing from above them. If the objective is surrounded by broken cumulus clouds, the bomber should avoid an approach which will silhouette him against them for any time, for they constitute an excellent background, from the enemy's point of view.

No effective means of covering a bombing approach by smoke screens has yet been devised.

Division leaders should be allowed full initiative during the approach but in choosing their bombing objective they should be guided by squadron doctrine which is as follows:

- (a) When the assigned objective is the enemy Main Body and Detached Wing the most powerful units shall be attacked, preference being given, other things being equal, to those in the van.
- (b) Enemy Main Body in multiple column.
  - (1) If heavy air resistance is encountered, <sup>deploy</sup>~~deploy~~ into three attack divisions and attack the van ships of three columns.

(c) Enemy Main Body in column, not under fire:

(1) If heavy air resistance is encountered, deploy into three attack divisions and attack the three leading ships from ahead and either bow, the first attack division taking the leading ship, the second the second ship, etc.

(d) Enemy Main Body engaged in main action:

(1) If heavy air resistance is encountered, deploy into three attack divisions and attack the three leading ships from the <sup>disengaged</sup> unengaged side.

Bombing groups are frequently called upon to coordinate their attacks with the attack of destroyers, torpedo planes and light bombers. The heaviest destroyer attack is normally launched from the bows of the objective. In fair visibility there is little difficulty in coordinating the bombing attack with that of the destroyers, but much time may be lost in the enemy's vicinity while waiting for the destroyer attack to develop. For this reason, strict synchronization with surface forces is not demanded. The safest procedure is to drive home the attack promptly and retire with still greater promptness.

#### Night Bombing

Night bombing is now a part of the gunnery exercises required of VT - VP planes, ~~The Mark XI bomb sight has been used with considerable success,~~ targets being illuminated by parachute flares. Bombs are usually painted white to help the following planes drop with the leader. Experience has shown that the six plane bombing formation is the most suitable for this type of bombing. Darkened vessels are extremely hard to locate at night, but at the same time anti-aircraft batteries have difficulty in picking up the planes.

There is still much to be learned about night bombing which has not progressed sufficiently to give any very definite information about it.

Torpedo Plane Attacks -21

~~Show slide No. 14~~

~~Torpedo plane with torpedo attached.~~

Our torpedo planes are two purpose planes, that is they can carry a torpedo or ~~1~~-1000 lb. bomb. *or 3 -500 lb bombs.*

Torpedo planes are used to attack and destroy major units with torpedoes, their primary objective being the battle line, their secondary objective the enemy's fast wing.

When the launching of VT planes is contemplated the officer who is in command of operations must decide at least one hour before launching as to whether the armament will be bombs or torpedoes. VT planes can be loaded with either equipment within one hour.

In all battle plans in which aircraft are assigned the task "attack enemy battle line and fast wing", their attack will normally be concentrated on the enemy's most powerful units.

Simultaneous attacks by bombing <sup>and</sup> {torpedo} squadrons are preferable but time must not be lost to accomplish this. If simultaneous attacks are not practicable, they should be in as close succession as possible.

The effectiveness of the torpedo against capital ships and the importance of reducing the speed of the enemy battle line will usually lead to attacks with torpedo planes rather than with heavy bombs.

The limited supply of torpedoes available will usually make it inadvisable to launch torpedo squadrons until the enemy is definitely located within striking distance.

Torpedo planes are extremely vulnerable to gunfire just before launching torpedoes. An isolated torpedo plane attack upon the enemy Main Body in daylight with good visibility cannot be expected to succeed. To be successful, a torpedo plane attack



practically requires the assistance of any one of, or a combination of, such factors as:

- (a) Low visibility, such as haze or darkness.
- (b) <sup>Battle line</sup> Main Body gun fire.
- (c) Destroyer attack.
- (d) Smoke screens.
- (e) Powerful aircraft support by bombers. *and/or dive bombers*

The standard cruising organization for torpedo planes is the nine-plane division which must maintain tactical concentration or visual contact until deployment and should <sup>whenever</sup> ~~wherever~~ practicable have fighter escort.

The best altitude for approach depends upon many factors. If there are comparatively low <sup>unbroken</sup> ~~unbroken~~ clouds, protection from fighter attack can usually be obtained by flying just beneath them but unless the surface visibility is poor, this usually results in being sighted at long range. If there is a sheet of clouds, but the objective is known to be in the clear, it is frequently advisable to approach just above the clouds, thereby avoiding being sighted by surface screens. In approaching fleets in circular dispositions, the outer screens frequently report the approaching attack in time for carriers to launch fighters for defense. Very frequently a layer of haze exists at the surface and to a comparatively low altitude with excellent visibility above. From high altitudes it is possible to see surface objects with great distinctness, while the surface visibility is very low. Under such conditions it is advisable for torpedo planes to approach at comparatively high altitudes until the objective is located, ~~then~~ when they should deploy outside of anti-aircraft range and dive into the haze. It must be remembered that low visibility is not an unmixed advantage for torpedo planes, for, while it hides them from the objective, it also hides an unlocated objective from them. Against definitely located objectives an approach in hazy weather at extremely low altitude is frequently

successful, particularly if there is a hazy coast for a background. In making low altitude approaches the gunfire of screens must, however, be borne in mind and screening vessels should be avoided as much as practicable. If the approach is not made at extremely low altitude, it should be made, in clear weather, at such altitude as will distinctly minimize the effectiveness of the anti-aircraft fire of the vessels disposed as screens about the objective. Pilots are trained to dive from high altitudes to the torpedo launching altitude after the screen has been passed. It is suicidal to fly over screens at low altitudes in clear weather.

The following methods of attack have been used:

- (a) Concentrated attack: this is an attack on one flank only of an enemy formation. It is usually employed against enemy battle line when in action and the attack must be made from the disengaged side.
- (b) Wave attack: this attack is made in waves with several sections each on one flank only of the enemy formation. Usually employed against a column of insufficient length to use a concentrated attack or when the tactical situation demands a heavy concentration against a certain portion of the enemy formation. This attack is also most effective when used against ships in action, not free to maneuver.
- (c) Divided attack: this attack is made by attacking with divided force with about half attacking each bow of the enemy formation. This type of attack is the most effective because of the cross fire obtained against enemy formations not engaged and therefore probably free to maneuver.

The following general principles should be borne in mind in making attacks with torpedo planes:

- (a) In an attack against capital ships during a main

engagement, the torpedo plane attack should be coordinated with that of the light forces, if practicable, but the attack should not be coordinated if it would thereby involve delay and jeopardize the air attack.

(b) In a coordinated attack during main engagement, a most effective cross fire of torpedoes may be obtained if torpedo planes launch their attack on the side opposite to that from which light forces are attacking. (They will usually attack on the engaged side, therefore the torpedo plane attack will usually be launched against the disengaged side).

(c) If stubborn resistance be encountered and anti-aircraft gunfire is heavy, the attack should not be jeopardized by maneuvering for position to attack on the disengaged side.

(d) In attacking ships free to maneuver and when **not** operating in conjunction with surface craft, it is usually desirable to produce a cross fire of torpedoes by divided attack. In making an anvil attack in coordination with surface craft, the divided attack is also desirable, since lack of time or other emergency may make coordination with surface attack impossible.

(e) In the selection of targets, ships in the van and flagship should be given preference. However, since any maneuver of the targets will, in general, cause the torpedoes to pass ahead of the point of aim, it may often be advantageous <sup>eous</sup> ~~eous~~ not to select the leading ship as one of the points of aim, but rather to leave that to the natural dispersion of the torpedoes.

(f) Full advantage should be taken of existing weather conditions.

- (g) Smoke screens should be used to cover the approach of planes provided they will not embarrass the action of the O.T.C. Smoke screens should never be used after the main engagement is joined without definite orders from the O.T.C. The initial smoke screen should be laid ahead of the target line or sharp on either bow.
- (h) After the main engagement is joined the employment of a wave attack with at least nine torpedo planes in each wave will prolong the period of confusion of the enemy battle line.
- (i) Avoid enfilade fire by having attack groups well separated and in a formation approximating line.
- (j) In divided attack, all groups must strike as nearly simultaneously as practicable. If this is not done the object of ~~divided~~ dividing the attack will be defeated.

Aircraft Smoke Screens

Show Slide No. 15 and 15A

Heavy smoker equipped for laying smoke.

Heavy smokers are of the VT type.

Aerial smoke screens are produced by means of the ejection of titanium tetrachloride (also known as F.M.). When ejected into the atmosphere this material vaporizes and forms a thick, white opaque screen or curtain, (F.M. weighs about 14 lbs per gallon).

In heavy smokers the F.M. is ejected from the container by carbon dioxide under pressure. With a proper nozzle the resulting smoke consists of an upper cloud roll with an opaque curtain below formed by the falling F.M. particles.

In light smokers the F.M. is ejected from the tanks by a venturi tube operating under the blast of the relative wind. The resulting smoke consists almost entirely of a smoke roll.

While single heavy smokers have not infrequently laid a screen of five miles in length, yet for tactical estimates 7,000 yards per plane is considered best.

Show slide No. 16 and 16A

Show Heavy Smokers laying smoke screen.

Because of the possibility of one plane failing to smoke, at least two heavy smokers should be detailed for each screen of 7,000 yards length.

A section of three light smokers can tactically be relied upon to lay a screen of 2000 yards in length.

Smoke screens produced by aircraft have several advantages over those produced by surface craft and may be used, not only for the situations in which surface craft screens would apply but also at times when surface craft screens are not applicable.

The principle advantages of aircraft smoke screens are as follows:

(a) Clings to surface better. Surface craft smoke screens are composed of exhaust gases. The usual tendency of these is to rise and dissipate rapidly. Aircraft smoke screens are produced without heating the F.M. material and this, in conjunction with the high specific gravity of the material will cause the screen to cling more closely to the water.

(b) Rapidity of operations. Aircraft smoke screens may be laid in one third the time required for surface craft.

(c) Better chance of successful completion. The dangers attending surface craft engaged in producing smoke screens are well known. Therefore there is grave doubt of the successful laying of smoke screens by surface craft under gun fire.

(d) The exactness as to location. Aircraft smoke screens may be placed in any desired position with relation to surface craft with a close degree of accuracy provided:

(1) the wind is light.

(2) The screen is not laid more than ten or fifteen minutes prior to the time it is to be of maximum use.

(3) Effective enemy resistance is not encountered.

The principle disadvantages of aircraft smoke screens are:

(a) If the wind is strong, accurate estimate of the wind must be made if the screen is to be placed accurately.

(b) Dry air or strong winds militate against complete opacity.

(c) If the screen is laid more than ten or fifteen minutes in advance of the time when the force screened will make the maximum use of it, unexpected maneuvers by the enemy will frequently cause the screen to be improperly placed.

(d) The smoking group commander must estimate ranges accurately by eye or with crude instruments.

The following uses of aircraft <sup>smoke</sup> screens have been suggested:

(a) To aid the battle line.

- (1) To protect it while advancing or retiring through unfavorable battle ranges.
- (2) To aid it in covering retiring movements or in an effort to break off an engagement.
- (3) To isolate a portion of the enemy battle line in order to effect favorable concentration.
- (4) To interpose between our battle line and the enemy.
- (5) To cover turning movements.
- (6) To afford protection against light force torpedo attack.
- (7) To cover an enemy force and thereby confuse his maneuvers.

(b) To aid light surface craft attack.

(c) To aid mine laying operations.

(d) To aid any surface craft in carrying out retiring or delaying tactics.

(e) To protect surface craft from submarine attack.

(f) To protect surface craft from airplane, torpedo or bombing attack.

(g) To protect aircraft torpedo plane attack.

This is one of the principal uses of aircraft smoke screens, as attacking torpedo planes must advance to within a short range of their objective.

(h) To cover a bombarding force.

(i) To cover a landing force.

A proper smoke screen should be laid at from 200 to 400 feet altitude depending upon the speed and weather as follows:

(a) The air speed - the higher the speed the lower the altitude.

In laying a distant screen the smoke should be laid so that the screen is about 8000 yards from the enemy force to be screened at the time the torpedo attack is to be made. The laying of this screen requires the closest cooperation between the Commander of Destroyers and the Commander of the heavy smokers. Available smokers are divided between destroyer forces making the attack and the screen is laid to screen the attacking forces, when directed by Commander Destroyers. Smoking planes fly in echelon, two planes smoke at one time, others taking up where they stop, laying a line screen where it will afford the most protection for ~~them~~ the attacking destroyers. It is always desirable to have one or two planes remaining with full smoke tanks to take advantage of unexpected opportunities ~~to~~ to cover the retreat, after the attack has been completed.



(b) The relative humidity of the air - the more humid,  
the lower the altitude.

Show slide No. ~~17~~

~~[Heavy smokers laying box screen around column of surface ships.]~~

In laying a close ~~box~~ screen around a column of surface ships it has been found good tactics to use not less than nine planes. The close smoke screen should be laid so that the radius of the screen is about 3,000 yards from the force being screened at the time the torpedo planes attack.

*Revised tactics slip.*  
In laying a smoke screen to cover attack by destroyers the smoke screen should be laid as directed by the Commander of the Destroyers making the attack.

*Sight* ~~Sight~~ smokers may be employed in laying any type screen and for any of the uses suggested for heavy smokers, however, the limited quantity of F.M. carried by light smokers and the rapidity of discharge make the use of heavy smokers advisable for all major screening operations.

A most valuable use of light smokers is in supporting a major screen laying operation where they should maintain an altitude of 2,000-3,000 feet above the planes laying the screen and be in readiness to dive down to fill in holes or thin spots in the screen or to continue the screen in event of failure of material in any of the screen laying units.

Light smokers have been satisfactorily used to indicate by a burst of smoke the bearing of enemy forces which are not visible to our own surface vessels. This is accomplished by flying past the ship to be informed toward the enemy and, when on the bearing, laying a short stream of smoke.

Gunnery Observation

Show slide No. ~~18 & 18A~~

~~[ Battleship catapulting observation plane. ]~~

Under ordinary conditions aircraft observation of fall of shot is more accurate than ship spotting especially with regard to distance, low visibility or smoke.

Observation planes are carried by the ships using them and should occasion require may be relieved by carrier planes while the regular planes are being refueled on a battle line carrier.

The requirements of observation formations are:

- (a) Compactness.
- (b) Flexibility.
- (c) Of regular geometrical pattern.

A compact formation is necessary both for mutual protection as well as to assist in protection by the fighting plane escort. Whatever may be the armament of observation planes, mutual protection will best be aided by flying in a fairly close, compact formation.

As regards flexibility, an observation formation must be sufficiently flexible to permit of minor maneuvers within the formation for purpose of gaining better visibility of the target.

The formation of a regular geometrical pattern disposed so as to cover all blind angles will better aid observation planes to protect themselves.

The observation formation hereafter described is designed to fulfill the above requirements.

There is assigned an observation squadron for each Battleship Division of the Battleships, Battle Force. The squadron is divided into sections which comprise the three planes of each Battleship in the Division. The sections take their numbers in the squadron formation from the normal order of their respective battleship in column. For gunnery observation each squadron is divided into three groups known as the "A", "B" and "C" groups. Normally the #1 plane of each ship carries the #1 aircraft

spotter and is assigned to the "A" group. Normally the #2 plane of each ship carries the #2 aircraft spotter and is assigned to the "B" group and the #3 plane the #3 spotter to "C" group.

Upon signal to form spotting formation, airplanes will fly an echelon formation on their assigned Group Leader two hundred fifty (250) feet behind, twenty five (25) feet above and twenty five (25) feet to the left of the airplane ahead of it. Group "B" will fly five hundred (500) feet above and to the left of Group "A". Group "C" will fly one thousand (1000) feet above and to the right of Group "A". The #1 plane of the Division Flagship is leader of the "A" group; the #2 plane of the Division flagship is leader of Group "B"; and the #3 plane of the division flagship is leader of the "C" Group.

The positions for the "B" and "C" groups enable them to furnish the best protection for the "A" group by permitting them to maneuver so as to make best use of both their fixed and free machine guns.

~~should be 1019 (airplane type observation plane)~~  
When a battle line carrier and amphibian type planes are available, one group will be absent from this formation much of the time due to the necessity of reservicing these planes.

Having formed his squadron the squadron leader conducts it to its observing station. The best position for gunnery observation is vertically above the target. The formation will, however, rarely be able to maintain this ideal position. It is believed that the position which the formation will usually be forced to assume will be at the head and the stern of the column, tangent to the shell trajectories and advanced toward the enemy columns as far as circumstances will permit. While keeping the best altitude with good visibility and maintaining station, the formations cruise around in a loose ellipse.

Relief observing planes should maintain communication at all times, listening in to make sure that material is functioning properly. In case of casualty to one plane it should pull out and the relief plane dive in and assume spotting.

The importance of the mission of gunnery observation planes should dictate the provision of a protective escort of fighting planes if possible. Even though observation planes are equipped with fixed and free machine guns they cannot adequately make use of them while carrying on observation duties. Protective escort of fighting planes should provide adequate protection at all times including catapulting, rendezvous, proceeding to or returning from spotting and while on station.

General *Remarks - 15*

After the completion of the assigned task during fleet actions, aircraft groups shall, unless specifically ordered to the contrary, report completion of the task and then, pending receipt of orders, act as follows:

- (a) Fighting types: operate to destroy enemy aircraft encountered in the battle area. Those planes whose bombs are not expended, or which have unexpended machine gun ammunition may, without further orders, attack enemy light forces in positions threatening our important forces.
- (b) VT types: Return to carriers at once to reload.
- (c) Scouts: if operating as scouts, continue to scout until required to return to carrier by their orders or by depletion of fuel.

All types as they return to their carriers or ship shall endeavor to join other friendly aircraft, returning simultaneously for their mutual protection.

Break off Action - 146

If our fleet maneuvers to break off the action, our aircraft will take the offensive against enemy planes, seeking to delay this movement and will attack those enemy vessels which offer the greatest menace to our retirement.

Pursuit

In pursuit action aircraft should be used primarily to locate undamaged enemy ships which are seeking to escape rather than to destroy damaged vessels which may be overtaken by superior forces of our surface vessels. ✓