O. N. I. Publication No. 46

Confidential

KITE BALLOONS IN ESCORTS

NAVY DEPARTMENT
OFFICE OF NAVAL INTELLIGENCE

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OFFICE OF NAVAL INTELLIGENCE,
Washington, November 1, 1918.

Upon the recommendation of Operations-Aviation this study of the use of kite balloons in escorts, made by the planning section, is published for the information of the naval service. This pamphlet is confidential and for the use of commissioned officers only.

ROGER WELLES,
Rear Admiral, U. S. Navy,
Director of Naval Intelligence.

KITE BALLOONS IN ESCORTS.

PLANNING SECTION—MEMORANDUM.

PROBLEM.

Kite balloons being available for use with escort vessels, the following questions arise:

1. Should kite balloons be used by vessels escorting convoys?
2. If escort vessels use kite balloons, what are the principles governing their use?

In considering these questions all available publications and reports have been carefully studied and freely used in the notes that follow.

The following information is pertinent:

(1) In July, 1917, experiments were carried out with a kite balloon by a destroyer. It was found that a kite balloon could trace the submarine after her movement could no longer be seen from the bridge; but it is doubtful if a kite balloon observer can follow a submarine that seeks to escape by diving more than a minute longer than the same submarine could be followed from the bridge. When the submarine is leaking oil the kite balloon is more useful in the chase than at any other time.

(2) In July, 1917, the Grand Fleet Destroyers made an experimental hunt for submarines. The submarine was discovered on the surface 8 miles away. Later, two periscopes were discovered, distance not stated.

(3) Later two other submarines were discovered in the same hunt by the kite balloons, distance not stated. No result of the contact, except that the submarine remained submerged during daylight.

(4) On July 12, 1917, H. M. S. *Patriot* sighted a submarine on the surface at a distance of 28 miles. The submarine submerged when kite balloon was distanced 6 miles. Submarine came up when kite balloon was 4 miles away and immediately submerged. *Patriot* was directed to the spot by the kite balloon and an attack was made; submarine was probably destroyed.

(5) On May 27, 1918, a convoy was attacked while escorted by a kite balloon. The attack was delivered five minutes after the balloon was hauled down to change observers. This was the first instance on record of an attack on the convoy while being escorted by a kite balloon. A second convoy was attacked on September 3, 1918, when escorted by a kite balloon; one vessel was sunk.

The British believe that enemy submarines feel that they incur no great danger while being sighted from kite balloons at a distance. British publications give the visibility of kite balloons in clear weather at about 20 miles. Visibility varies with light, background, color of balloon, relative positions of balloon and observing vessel.

(6) It is known, of course, that even when convoys are not accompanied by kite balloons, submarines as a rule sight convoys before they themselves are sighted.

(7) At twilight in clear weather a kite balloon becomes increasingly visible from all bearings, and remains so until it is quite dark. Under these conditions it is probable that a submarine can come to the surface at some distance from the kite balloon and follow it without fear of detection.

(8) Observations from kite balloons are much less efficient when wind is blowing.

(9) When there are white caps on the water the chances of seeing a periscope from a balloon are small.

(10) Recent records covering British operations indicate that a kite balloon has to cruise over 30,000 miles to sight a submarine. The conclusion is, of course, that as a rule—

1. The submarine sees the kite balloon first.
2. The submarine submerges very soon after the kite balloon is sighted.

Considering now the questions to be decided, viz:

1. Should kite balloons be used by vessels escorting convoys?
2. If escort vessels use kite balloons, what are the principles governing their use?

It is evident that the answer to question (1) depends in part upon the answer to question (2), so we shall investigate the principles governing the use of kite balloons first.

The kite balloon has but one *direct* use and that is *to get information;* it has but one drawback that need be considered here, and that is that it *gives* information to the enemy. The real problem for the kite balloon therefore is to get as much useful information as possible, and to give as little useful information as possible to enemy vessels.

The indirect use of a kite balloon is measured by its effect on enemy submarines. They nearly always submerge in time to avoid being seen from the balloon while they are still on the surface, and thereby voluntarily limit their maneuvering power.

There are two ways of using kite balloons:

(1) In close escort positions. Here the kite balloon vessel zigzags close to the convoy.

(2) In extended patrol positions. Here the kite balloons are at visibility distance from the convoy in thick weather and at about 12 miles from the convoy in clear weather.

The functions of the kite balloon in close escort positions—where it usually zigzags across the front of the convoys are—

(1) To sight any submarine which through a bad lookout or through taking chances, stays on the surface with the kite balloon in sight.

(2) To sight submarines that attempt to attack in time to give warning and to direct a counter attack.

(3) To warn convoy of browning shots.

(4) To limit the submarines maneuvering area on the surface so that if the submarine be in the rear of the convoy it will have to make a very wide detour to get ahead of the convoy in position for attack, undiscovered.

(5) To prevent trailing of convoy by dropping astern of convoy just before dark.

(6) To keep submarines submerged after an attack.

The close escort position is the one that gives the maximum information to the enemy submarine. It makes a conspicuous marker of the convoy's position and thereby enables the submarine to communicate the convoy's position and movements to submarines better placed for attack. It is also quite possible for the sighting submarine itself to gain a position for attack by a wide detour.

The principal advantages of the close escort position are:

(1) Readiness for counter attack.

Comment.—Unless the submarine is leaking oil the kite balloon will probably not guide the attacking vessel more efficiently than it could be guided from the bridge for more than one additional minute—once the attack is delivered.

(2) Protection against browning shots through warnings.

Comment.—Taking into consideration: (*a*) That the kite balloon has not over two observers.

(*b*) That the browning shot torpedo will not be in flight more than three minutes, and more often two minutes.

(*c*) That an appreciable interval is required to give the warning.

(*d*) That the warning can not tell each vessel the relative bearing of the torpedo.

We conclude that the extra protection given by kite balloons against browning shots is about one minute's earlier notice of danger to the convoy.

(3) Bluffing the submarine.

Comment.—Recent evidence indicates that this element may soon be negligible.

From the above in conjunction with the operating experiences of kite balloons in the presence of submarines we conclude:

That it is not profitable to use kite balloons in close escort positions except in waters where convoy routes are well known—and during weather when visibility is very limited.

The extended patrol for escort of convoys is discussed in various publications. Attention is invited particularly to O. N. I. No. 29 of February, 1918.

The functions of the kite balloon in extended patrol positions are similar to those in close escort positions.

Every convoy carries with it an area within which a submarine may maneuver submerged into position for attack on the convoy. The width of the area is twice the visibility of the convoy from the submarine's periscope—about 14 miles in clear weather plus the length of the convoy front. The area extends an indefinite distance ahead of the convoy.

The afterside of the area is bounded by an irregular line dependent on the formation and speed of the convoy, the speed and radius of the submarine when submerged, and the range of the submarine torpedoes.

This area is called the "diving danger area."

A similar area known as the "surface danger area" includes and extends beyond the "diving danger area" on the flanks and rear by an amount equal to the difference in visibility of the convoy from a submarine submerged and from a submarine on the surface. In clear

weather the "surface danger area" may be taken to be 22 miles in width.

The flank boundaries of both the "diving danger area" and the "surface danger area" are determined by visibility from the submarine, because the presumption is that the submarine can not maneuver for attack when it can not see. The development of listening apparatus may in the near future extend the "diving danger area" by the flanks—to twice the listening radius rather than to twice the visibility—provided the submerged radius of the submarine keeps pace with the listening radius.

Extended patrol vessels are vessels stationed at visibility distance from a convoy with the object—

(*a*) Of limiting the submarine's freedom of action on the surface and of preventing the submarines from sighting the convoy.

(*b*) Of sighting any submarine that does not dive immediately upon sighting the patrol vessel.

If the patrol vessel carries a kite balloon the principles of extended patrol are not thereby altered.

If the patrol vessels are stationed inside the "diving danger area" they may sight a submarine but the submarine may still be able to maneuver submerged so as to attack. If, however, the extended patrol vessels are stationed outside the "diving danger area" and in such position as to sight any submarine in or near that part of the "surface danger area" not common to the "diving danger area," any submarine there sighted will have to dive, and by diving will lose all chance of successful attack on the convoy, since it will have dived without sighting the convoy and without knowledge of its whereabouts.

When the convoy is escorted by antisubmarine vessels it is reasonably safe to assume—for all except the slowest convoys—that no submarine will be able to maneuver submerged successfully for attack if it first sights the convoy when the convoy already has the submarine abaft the beam.

In stationing extended escort vessels care should be taken that the range of vision astern is such that no submarine can reach the "diving danger area" on the surface without being observed either by the extended patrol or the close escort.

The following table gives the bearing in points from right ahead on which the extended escorts should be from the convoy guide:

Speed of convoy.	Visibility.			
	4 miles.	6 miles.	8 miles.	10 or more miles.
7 knots	7	6	5	4½
9 knots	5	5	4½	.....
11 knots	4	4	3½	3½
13 knots	4	3½	3½	3

The extended patrol vessel with kite balloon, must keep convoy in sight—closing in for this purpose as weather thickens. In clear weather kite balloon may be about 12 miles from convoy.

POSITION OF KITE BALLOON VESSELS.

(1) *In very clear weather*—

(*a*) *With two kite balloons.*—One on each bow, in extended escort, positions given above, to make wide zigzags outward from extended escort positions.

(*b*) *With but one kite balloon.*—On one bow, in extended escort position crossing occasionally to the other bow and never lingering ahead of the convoy.

(2) *With moderate and with low visibility*—that is, when kite balloon will not be seen farther than convoy is seen—

(*a*) *With two kite balloons.*—One in each of the close escort positions, zigzagging so as to cover the front of the convoy and the wing columns.

(*b*) *With but one kite balloon.*—At close escort distance, ahead of convoy and covering the whole front with zigzags.

With regard to the above designated positions, when there is but one kite balloon it should as a rule be stationed:

(*a*) To windward of the convoy.

(*b*) On the sunny side of the convoy.

(*c*) On the side nearest the moon.

(*d*) On the opposite side to the rising sun at dawn moving around to other side at sunrise. (*a*), (*b*), and (*c*), to be at such distance from the convoy that the submarine must dive before sighting the convoy and be unable to come to the surface between the balloon and the convoy without being seen.

At twilight kite balloons should drop back by the flanks as the light fails, to positions on the quarters of the convoy, keeping as far away as possible without losing touch and not closing up until quite dark. If convoy alters course after dark, kite balloon should stand off on a different course and not rejoin until quite dark, then take close escort positions.

If in sight of land, or if the area ahead of the convoy is being patrolled, kite balloons should be stationed in the close escort position in all visibilities.

Extended patrol should not be used until the minimum requirements of close escort have been met.

Considering now the use of the kite balloon in extended escort positions we find—

(1) That it does not betray the presence of a convoy and therefore gives practically no useful information to the enemy.

Comment.—A submarine seeing a kite balloon can make one positive deduction and several tentative deductions.

Positive deduction.—That a surface vessel is towing a kite balloon in a certain general direction which the submarine can determine.

Tentative deductions—

(*a*) That a convoy may be near the kite balloon and that it it is more apt to be astern of the kite balloon than ahead of it.

(*b*) That the kite balloon is near antisubmarine vessels—whether a convoy is near by or not—since kite balloons are used in hunting as well as in escort operations.

(*c*) That the surest way to approach the convoy if there is one near by, is to approach the kite balloon—if possible getting ahead of the kite balloon.

The submarine can make these same deductions if it sights a single vessel of war; so that practically the only information which the kite balloon gives to the submarine is earlier information of the presence of a vessel in a given direction, and correspondingly early information of the general course of that vessel. This earlier information is measured by the relation of the two circles of visibility (1) of the vessel, (2) of the kite balloon. The atmospheric conditions modify very greatly the relation of these circles of visibility. In clear weather the kite balloon would probably be sighted twice as far as the vessel. In thick weather the vessel itself might be sighted first.

(2) That the submarine sighting the balloon will very likely be attracted by it even to the extent of voluntarily leaving the "diving danger area."

(3) That all submarines outside the "diving danger area" will be prevented from entering that area except by chance.

(4) That the trailing of convoys will be prevented.

(5) Any submarine sighted can be kept submerged until convoy has passed or until dark.

We conclude—

That it is profitable to use kite balloons in extended escort positions in accordance with the principles already explained.

The practicability of using kite balloons in bad weather or on long voyages has not been considered. We assume that decision in each instance as to whether or not to take balloons in tow will be based upon operating experience to date and a forecast of conditions likely to be encountered.

SUMMARY.

As to question (1), it is not profitable to use kite balloons in close escort positions except—

(1) In waters where convoy routes are well known.

(2) During weather when visibility is very limited.

It is profitable to use kite balloons in extended escort positions in accordance with the principles already explained, viz—

(1) On the bearings given in the table at the bottom of page 8.

(2) At visibility distance from the convoy, except that in clear weather this distance shall not exceed 12 miles.

(3) *In very clear weather*—

(*a*) *With two kite balloons.*—One on each bow, in extended escort positions given above, to make wide zigzag southward from extended escort positions.

(*b*) *With but one kite balloon.*—On one bow in extended escort position crossing occasionally to the other bow and never lingering ahead of the convoy.

(3) With moderate and with low visibility—that is, when kite balloon will not be seen farther than convoy is seen—

(*a*) *With two kite balloons.*—One in each of the close escort positions, zigzagging so as to cover the front of the convoy and the wing columns.

(*b*) *With but one kite balloon.*—At close escort distance, ahead of convoy and covering the whole front with zigzags.

(4) When there is but one kite balloon with a convoy, it should as a rule be stationed:

(1) To windward of the convoy.

(2) On the sunny side of the convoy.

(3) On the side nearest the moon.

(4) On the opposite side to the rising sun at dawn moving around to other side at sunrise. (1), (2), and (3), to be at such distance from the convoy that the submarine must dive before sighting the convoy and be unable to come to the surface between the balloon and the convoy without being seen.

(5) At twilight kite balloons should drop back by the flanks as the light fails to positions on the quarters of the convoy, keeping as far away as possible from the convoy without losing sight of it and not closing up until quite dark. If during this time convoy alters course after dark, kite balloons should stand off on a different course and not rejoin until quite dark, then take close escort positions.

(6) If in sight of land, or if the area ahead of the convoy is being patrolled to the limit of visibility of the kite balloon, kite balloon should be stationed in the close escort position in all visibilities.

(7) Extended patrol should not be used until the minimum requirements of close escort have been met.

Approved as a preliminary study of the subject of the use of kite balloons in escorts, paper to be mimeographed, and to be given wide distribution to forces for information and inviting comment, in order that a definite doctrine and plan covering the subject may be developed.

SIMS,
Vice Admiral, U. S. Navy, Commanding.

LONDON, ENGLAND,
September 30, 1918.