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THE IMPORTANCE OF
LONG RANGE AERIAL RECONNAISSANCE
IN SUBMARINE WARFARE

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Translated by:
A.H.B.6. AIR MINISTRY,

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I. Introduction:

It is the purpose of this study to discuss the value of long-range reconnaissance at sea by the Luftwaffe in relation to submarine operations against the maritime supply lines of the enemy. By means of examples, and conclusions, we hope clearly to show how these two complementary weapons of war are suited for close co-operation on the high seas, the one for reconnaissance and the other for attacks on the surface or under water, and to cause such losses to enemy shipping as to disrupt Allied plans.

The "Battle of the Atlantic" has shown the vulnerability of the enemy in this field, and the efforts he has made to escape a stranglehold. This study will attempt to show to what an extent the enemy has realised the value of the Air Force in long-distance reconnaissance, and how he has used this weapon defensively to ensure that he may win the 'Battle for Supplies'.

It is very easy, after the event to criticise our own High Command for missing opportunities, but this is in no way the object of this article, which is to show by certain premises, which are within the bounds of possibility, what significance air reconnaissance has in submarine warfare and what significance it will have in the future.

The aim of co-operation between Reconnaissance and Attack is the sinking of as large a number as possible of ships laden with supplies for the enemy. English war plans are entirely dependent on the smooth functioning of supply traffic bringing raw materials for the Island's industries, finished goods and the necessary foodstuffs for the populace from abroad. This traffic is of just as much importance in the supplying of existing war fronts and campaigns.

It is the first consideration of Great Britain to keep these sea routes across the Atlantic free from the interference of her opponent in the form of reconnaissance and the harassing and disruption of this traffic. The greatest menace on these sea routes is the submarine, which can be regarded as the actual weapon of attack.

As in World War I., the convoy system has proved itself the best method for the enemy to organise his supply traffic. In order to understand the difficulties with which submarines are faced before they are in a position to attack a convoy, it will be necessary to learn something of the tactics employed with this weapon. The weaknesses of these tactics will be clearly brought out, in order to indicate how effectively the Air Force could eliminate them.

II. Submarine Tactics.

Supplies from abroad flow to the British Isles through three main arteries:

- 1) America - England
- 2) Mediterranean - England
- 3) Africa - England

On these routes lies the chief field of activity for submarines. Before they can attack, however, they must find their target. On first thoughts, this finding of targets does not seem to present much difficulty, as it would seem clear that adequate information about enemy shipping movements would be available from numerous sources and that submarines could therefore be employed against those convoys which promised the best results.

In actual fact, the position was quite different. It was admittedly possible, at the beginning of the submarine war, to intercept convoys by radio intelligence. At that juncture unfortunately, it was not possible to undertake mass attacks as the number of available craft was insufficient, the large scale building programme not having yet taken effect.

This information on convoy routes ceased with the passing of time, so that now only departure and arrival times are known, and the actual route must be guessed. To this must be attributed the fact that the chief task of the submarine became that of reconnaissance, as our own air reconnaissance did not embrace the Atlantic. The suitability of submarines for reconnaissance is however questionable. In good visibility their range of vision is roughly 30 kilometres. This is maximum distance and hence, with the use of a considerable number of craft, only a relatively small sea area can be covered.

The best formation for reconnaissance is the "Reconnaissance Line Abreast" formation, in which the largest possible number of submarines are, with a necessary sacrifice of formation in depth, placed next to each other with their areas of vision overlapping. In this way it is possible to cover comparatively large sea areas. It is occasionally possible, however, that a convoy can slip through this reconnaissance strip at night. To avoid this the whole strip moves to and fro so that in all probability it will sight the convoy moving along its estimated route by day. This means that at night the strip must move on the estimated course of the convoy at a speed designed at all costs to keep it ahead of the convoy. In daylight the strip proceeds once more towards the convoy.

This strip formation may sound very advantageous in theory; in practice, however, gaps will appear in individual strips through inaccurate navigation. In bad visibility, fog, rain or storm, the situation may become even worse. It is thus possible for a convoy to slip through the line or discovering its presence in the vicinity, to avoid it altogether by a wide detour.

It is not difficult to realise how small an area a strip of 25 submarines can cover, compared with the area in which convoys move. Clearly it is possible for a convoy to avoid interception, even without taking advantage of poor visibility.

Our policy in submarine warfare is only to attack a convoy when a large number of craft is available for the assault, the aim being to destroy the core of the convoy, i.e. the valuable merchant vessels, by penetrating the escort forces in a simultaneously launched mass attack with the largest possible number of submarines.

The concentration of a large number of craft is only possible with the aid of flawless shadowing. In aerial reconnaissance it is at times difficult to maintain contact with a shipping target in the face of bad weather conditions. For submarines these difficulties are incomparably greater. The concentration of the flanks of the strip may take as much as 48 hours and then is only possible in that time if the convoy maintains a steady course, and the submarines are in a position to steer for a point of interception.

In reality this is never the case, as the target is always moving on a zig-zag course, i.e. at intervals of 3 - 15 minutes, it alters course up to 20 degrees, so that the fixing of its mean course is no easy task. In addition, the convoy will endeavour to shake off any shadower by wide alterations of course, carried out usually during the hours of twilight between dusk and darkness. In daylight the shadowing craft must remain just within sight, to be able to make out the convoy,

and yet remain undetected for as long as possible. Should it be discovered, the enemy will take all possible measures to force it under water. Submerged, a submarine is very slow with a speed of only 4 knots, so that the target is then faster than the pursuer.

For the above reasons it is evident that, even when the target has been located, there are still many obstacles to be overcome. Above all, however, it is also clear that the submarine can only fulfil its true purpose, the torpedo attack, after completion of very uneconomic reconnaissance operations. Simultaneously with the recognition of these difficulties, there grows a realisation of the value of air reconnaissance in relieving the submarine of this task.

The disadvantages suffered by the submarine of low eye-level, short range of vision and lack of mobility do not apply to the Air Force, which thanks to its technical equipment, is in a position to cover the wide spaces of the Atlantic and to survey all shipping movements. The task of air reconnaissance is therefore to find a target, report it, shadow it and direct the submarines on to it. The submarines can then remain out of range of any land based air formations and away from areas in which strong anti-submarine patrols are reported, until a target has been found and, for the actual attack can be directed to a position suitable for the favourable simultaneous mass attack at night. By means of this coordination it will be possible to create the most favourable conditions for the attack, and without serious losses to inflict the heaviest damage on the enemy.

Having discussed the theory of air-sea co-operation and shown the need for it, we will next deal with the actual situation in submarine warfare in 1942 as proof of the necessity of air support. Up to June 1942, our submarines operated chiefly in American coastal waters, as it was there possible to achieve the largest number of sinkings under the most favourable conditions. From June 1942 onwards, however, the enemy had, here too, organised convoy defences. The weight of the attack therefore shifted into mid-Atlantic between America and England.

As can be seen in the attached appendix, the number of sinkings was reasonably high. This was possible because our strip reconnaissance succeeded, often by sheer luck, in locating convoys in a position favourable for the attack. Nevertheless, this high number of sinkings can still not be regarded as satisfactory, if one takes into account the fact that only one third of the total number of torpedoes available for use against the enemy was actually fired. This means that only one third of the potential strength of an average of 100 submarines employed in the Atlantic had been utilised. Conditions at that time could be considered as favourable to the defence, compared with the present, and losses, some 2 - 3 U-Boats for every 100,000 G.R.T. of shipping sunk, were on the whole within reasonable bounds.

The strength and effectiveness of the defence had nothing to do with the non-utilisation of available resources. The absence of air reconnaissance was the sole reason why the full force of our submarines could not be brought to bear on a sighted target, and why they often returned to base after an abortive trip still fully armed with torpedoes; and this at a time when the loss of every single freighter was keenly felt by the enemy.

The most outstanding example is to be seen in the month of January 1943. In this month, seven convoys, averaging 200,000 G.R.T. each, were able to pass between America and England and vice versa without any serious interference from our submarines. The use of two wide reconnaissance strips of 30 submarines each had not made it possible to come to grips with the enemy in the Atlantic. One submarine did succeed

in sighting a convoy, but the rest were in such unfavourable positions that only five were able to take part in the attack and sink three ships of 23,190 G.R.T. Apart from this, enemy convoys were able to proceed along this route unmolested. The month of January 1943 has purposely been chosen, as being an outstanding example of the effect of inadequate reconnaissance reports on the figures of enemy shipping losses.

It is evident that considerable damage might have been inflicted on enemy shipping if, with the aid of air reconnaissance, it had been possible to concentrate all submarines in that area, and thus to make the fullest use of our whole submarine strength.

After careful study, in which all possible factors have been considered, the conclusion reached is that the sinkings in the convoy battles could have been increased by 100% - 150%. Unbelievable though these figures may sound, the following examples from convoy battles will show what can be done.

In December 1942, a submarine belonging to Gruppe "Spitz" sighted a convoy of 32 ships approximately 1500 km West of Cape Ortegal. It succeeded in bringing up the rest of the reconnaissance strip in good time, and in a five day battle, of the 32 ships, 19, totalling 102,000 G.R.T. were sunk, and a further 5 totalling 21,000 G.R.T. were torpedoed. Hence $\frac{3}{4}$ of the whole convoy was destroyed.

In the following month, a submarine sighted a convoy of tankers bound for the Mediterranean, roughly 1000 km West of the Canary Islands. In operations lasting several days, 15 tankers, totalling 141,000 G.R.T. were sunk and 6 more were hit. Once again it had been possible almost completely to destroy the target attacked.

In March 1943, a convoy of 83 merchant vessels from America was sighted by chance. It was possible to bring into use 38 submarines, which managed to sink 34 ships, totalling 2000,000 G.R.T. and one destroyer. Nine more ships were hit but their sinking could not be observed.

The success of these particular convoy battles was due to the timely discovery of the target and to the resultant possibility of bringing up sufficient submarines for a mass attack. The forces engaged, although only a part of the total strength deployed in that sea area, inflicted extensive damage on the convoys. The participation of all the available forces, made practicable by the use of air reconnaissance, would have ensured the complete destruction of the convoys attacked.

III. The Importance of the Azores and French West Africa as bases for Long-range Reconnaissance at Sea (Ju 290).

In the foregoing sections, an attempt has been made to point out the need for air reconnaissance in support of Naval operations against enemy shipping.

In the following pages, we will investigate the probable consequences, had the value of co-operation between air reconnaissance and submarines been recognised, and had a Gruppe of Ju 290's been used for long-range reconnaissance at sea, right at the outset of the large scale submarine campaign. At the same time, it is intended to discuss the possibilities presented by the possession of the Azores, French Morocco and French West Africa as 'jumping off' bases for the Atlantic battle.

At the beginning of the war, Germany obtained access to the Atlantic by occupying the Norwegian, Danish, Belgian and French coasts,

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and thereby basically altered her whole strategic position. In the same way that the submarines were able to penetrate into mid-Atlantic by using bases nearer to their field of operations, so the Luftwaffe, with long-range aircraft operating from new bases, could have extended its reconnaissance far into the Atlantic to cover the supply traffic to the British Isles. British convoys, in the last part of their journey before entering the North Channel, would have been well within the range of Ju 290's based on Norway and France. In this area, then, these "air-sea" tactics could have been employed during the convoy battles of 1942.

If we extend this idea of winning 'jumping off' bases on the Atlantic, we next come to Spain, whose participation in the war we failed to achieve in 1941. Going further southwards we come to the islands of the Azores and to French Morocco and West Africa. The political and geographic position of the Azores is unique and, can only be compared with that of Hawaii. The coast of French Morocco and West Africa is of almost equal importance. Based on Dakar the field of operations would stretch far into the Atlantic, which at this point is narrowed down to 2750 km by the American coastline.

Remote as these considerations may seem, they were nevertheless quite possible. Our opponents long ago realised the important influence of air power on political geography, and have exploited this realisation in their conduct of the War. The Air Forces of the British Empire and, in particular of the U.S.A. span whole oceans and continents in proof of the intercontinental nature of this weapon. Enemy long-range aircraft are in an advanced state of development and his air crews have long been practiced in the technique of long distance flying. With the aid of bases they cover the greater part of the globe. New York and London are the starting points of a system of bases which stretch via the African continent, through the Near East, India, China and Australia, back to the American continent. In particular, the lease of British bases in the Caribbean and the Western part of the Middle Atlantic as far as Trinidad and British Guiana, enables the American Air Force to penetrate right up the African coast.

Hence it would not have been extraordinary if, in this age of intercontinental Politics and War, the Reich had seized the Azores and French possessions in West Africa, in order to obtain bases for the offensive against enemy shipping. From these bases the Ju.290's could reach almost to the American coast and enemy convoy traffic would be under the constant observation of the Luftwaffe for the greater part of its crossing. The immediate result would have been a great increase in sinkings.

In order to demonstrate the full consequences of intensified anti-shipping warfare, a note follows on the British supply system and the dependence of Allied war plans on supplies.

IV. The Dependence of Allied War plans on supplies.

In 1937, British imports totalled 71,000,000 tons - 55,000,000 G.R.T. In 1942, this figure dropped to 36,000,000 tons. This quantity Britain had to import in order to cover her minimum essential requirements.

These 36,000,000 tons comprised:-

15	Million tons of raw materials and partially manufactured goods.
10.5	" " " foodstuffs.
10	" " " mineral oil.
1	" " " manufactured goods.

As has been mentioned before, the range of the Ju 290 is sufficient to enable it to obtain information of convoy movements

before they enter the North Channel, and therefore to bring up submarines for the attack. By using airfields in the Azores it would be possible to extend air reconnaissance almost as far as Newfoundland. Above all, however, the routes to the Mediterranean pass well within range of Azores based reconnaissance, many days before reaching the Straits of Gibraltar.

The sinking of 2,000,000 tons in 1942 would undoubtedly have been possible if full use had been made of the submarine weapon and auxiliary air reconnaissance. Defensive measures had not at that time been developed sufficiently to impede our submarine attacks to any great extent, and the British Air Force, today our chief opponent, was still being built up and could not exert the decisive strength in the Atlantic that it does today. In addition submarine detection devices were not as yet fully effective.

Everything depended at this time, therefore, on using every means of intensifying the shipping war so that, despite new constructions and the mobilisation of all shipping reserves, the decrease of the total enemy shipping space became so great as to have a catastrophic effect on the British supply situation.

British and Allied war plans are entirely dependent on supplies from abroad. It follows, therefore, that a victory for Germany in the battle of the Atlantic would have far reaching effects on the air and land war in Europe.

With the sinking of 2 million G.R.T. a month, the enemy would be compelled to limit himself entirely to supplying the British Isles. That is to say, there would not have been a single ton available either for any large scale invasion or for the supplying of existing war fronts.

These attacks on shipping are a means of destroying an important war potential with the smallest effort and losses. Nowhere is there such a concentration of war material as in a convoy proceeding from the production centres of America to the war fronts of Europe. This was particularly true to 1942, when every shipload was eagerly awaited by the enemy.

Taking into consideration that a ship of 9,000 G.R.T. carries a load of 12,600 tons, for which 860 goods trucks carrying 15 tons each would be required, the vast quantity of supplies necessary for the Allied war effort in Europe from overseas can be imagined. Surely it would be more economical to destroy this material at sea, than to await its appearance on the battle field?

Malta, whose existence hung on a fine thread during the German air offensive, was able by keeping its sea approaches open to defy all the efforts of the Axis powers. Similarly in Libya, the British 8th Army after initial defeats, was re-armed with supplies sent by sea, and was able to achieve final victory.

With the aid of a considerable shipping force, the Allied landings in North Africa were successfully accomplished. The convoys heading towards the invasion beaches in North Africa were not spotted by aerial reconnaissance in time for enough submarines to be assembled to inflict losses on the landing force. It is in this connection that the Azores should be considered as a dominating position from which to control all the sea routes leading to Gibraltar. From this point it would have been possible, even after the successful landings in North Africa to direct a concentrated submarine attack with air support on the arteries leading to this theatre of war. The effect of this on the war situation can be expressed quite briefly: the defeats in Tunisia, Sicily,

Southern Italy and the consequent penetration of the European defences from the South, with its disillusionments and losses in men and materials, would have been avoided.

If the enemy succeeds even partially in eliminating the submarine menace, a huge concentration of forces and materials could be effected in the British Isles. To guard against the danger of invasion and the establishment of another major front in Europe, strong German forces have had to be held in readiness.

The lack of these troops made itself felt throughout the whole German war effort, and particularly on the Eastern front, where the present position is characterised by the numerical and material superiority of the Russians who continuing their summer-offensive, are attempting to crush the German defences. In the course of these operations, the enemy has already succeeded in crossing the 1939 German-Russian demarcation line in Poland. Further South, his spearheads are already approaching the Carpathians prior to a thrust into the Balkans.

Our own forces are meagre, and can only be reinforced to the detriment of other fronts. In the West, however, strong German forces are tied down by the threat of an invasion, and cannot therefore be dispatched to the Eastern front. Similarly, strong defence forces are required against the overwhelming air offensive on the Reich.

These concentrations of men and materials, and the deployment of the Air Forces in Great Britain, depend to a great extent on sea communications. Had it been possible to disrupt these, the forces required to meet the "menace" in the West would have been available for defensive, and ultimately for offensive purposes in the East. At least the establishment of a Western front would have been delayed long enough to make it possible, by the full exertion of our total war capacity, to eliminate the enemy in the East. The danger in the West could then have been dealt with separately.

Our great opportunity in the war against England was so to reduce enemy shipping space by the fullest use of all available submarines aided by air reconnaissance, that in quite a short time, and even with the mobilisation of all possible reserves, the total enemy tonnage would drop below the 10 million level; with this reduction below the absolute minimum tonnage necessary, the time would have come when the German blockade of British sea approaches would have proved fatal.

V. Conclusion:

In the preceding pages, an ideal solution has been offered to the problem created by the demands of the Navy for air reconnaissance, in order to show that the Luftwaffe should be employed in support of the submarine campaign. The aim has been to investigate the value of this co-operation, and, by means of examples, to demonstrate its decisive results in the anti-shipping war.

The present position is marked by a decline in the successes achieved by the German Navy in this concentrated campaign. The chief weapon in this battle, the submarine, has been severely limited in its power. In 1942, conditions were, in general, favourable to the sea and air defence of shipping targets. In 1943 the enemy succeeded, by a great effort, in developing new submarine detection and other devices which caused a big rise in submarine losses. Above all, the steady development and expansion of the enemy Air Force has made it the main weapon of shipping defence.

As a result, the tactics used in the convoy battles of the North Atlantic and described in a previous chapter, have had to be temporarily abandoned to avoid crippling losses. The enemy has appreciated this position. In his announcements on the war situation, the successful defence against submarines and the resultant gain of shipping space, had been given first place. These facts, and the past course of the war show the decisive effect which the submarine campaign has had on enemy war plans.

By the 31st May 1943, Anglo-American shipyards had produced 15.3 million tons of merchant shipping which alone must have used an estimated total of 10 million tons of steel. This means that the U.S. ship-building programme for 1943 requires an eighth of the total steel production of the U.S.A. Just as remarkable are the amount of material, and the number of personnel absorbed by anti-submarine operations.

The disappearance of the submarine menace would release an immense war potential for use against the Reich. German war plans must, therefore, ensure that the war on shipping remains effective.

Measures necessary for the re-establishment of submarine power have been initiated and it is to be expected that in this race between defence and attack, the submarine will once more win the lead. Even if our submarines cannot overcome the present difficulties and do not, therefore, reach the goal set for the number of sinkings in 1942, every assistance must still be given to them.

By their employment, a vast enemy war potential can be destroyed or neutralised, a fact which, in view of the numerical and material superiority of the enemy, is of the utmost importance. To accomplish this it is, above all, necessary to give the submarines "eyes". That is, adequate air reconnaissance by the Luftwaffe.

Our aircraft industry is set no easy task. The lack of suitable bases must be met by the development of a long-range reconnaissance aircraft with a radius of action of roughly 5000 km. Each aircraft must have sufficient defensive armament to counter enemy air superiority, so that failure cannot be caused by the attacks of the enemy's defence forces.

The present position of the Luftwaffe is that of being slowly forced back on the defensive by the ever growing material superiority of the enemy. Germany's shipping offensive is, at the moment, without any air support worth the name, in contrast to the Allies, who have large numbers of aircraft with special equipment to wage the war at sea.

The enemy has clearly recognised that this sea campaign is the weakest link in his war effort, and he rightly sees in the menace to his sea communications a menace to his very existence. The German High Command must therefore endeavour, in clear recognition of this weakness of the enemy's, to allocate more aircraft, - after due consideration for the needs of the defence of the Reich, - for bombing attacks and reconnaissance so as to lend effective support to our submarines. They must make and carry through these plans, regardless of the objections and opposition which seem always to obstruct any decision before it is executed.

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U-BOAT RECONNAISSANCE-FORMATIONS

DIAGRAM 1.

THEORETICAL FORMATION
FOR RECONNAISSANCE

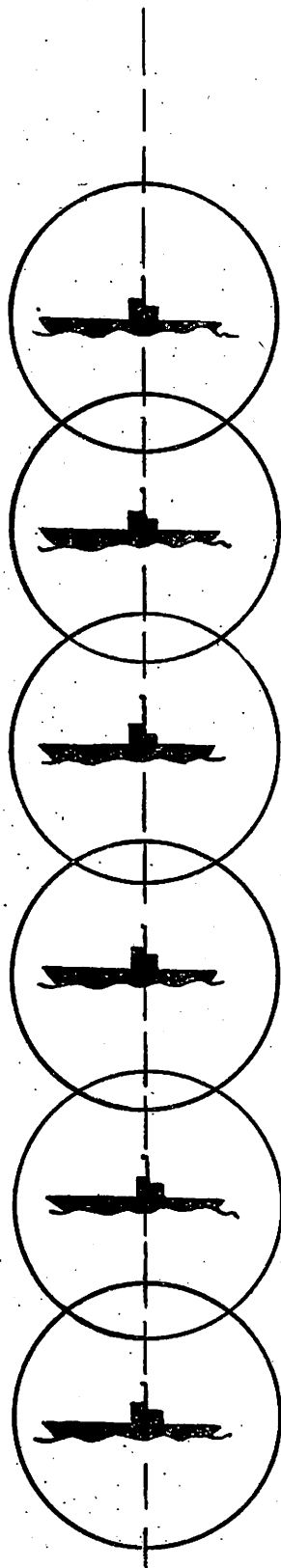
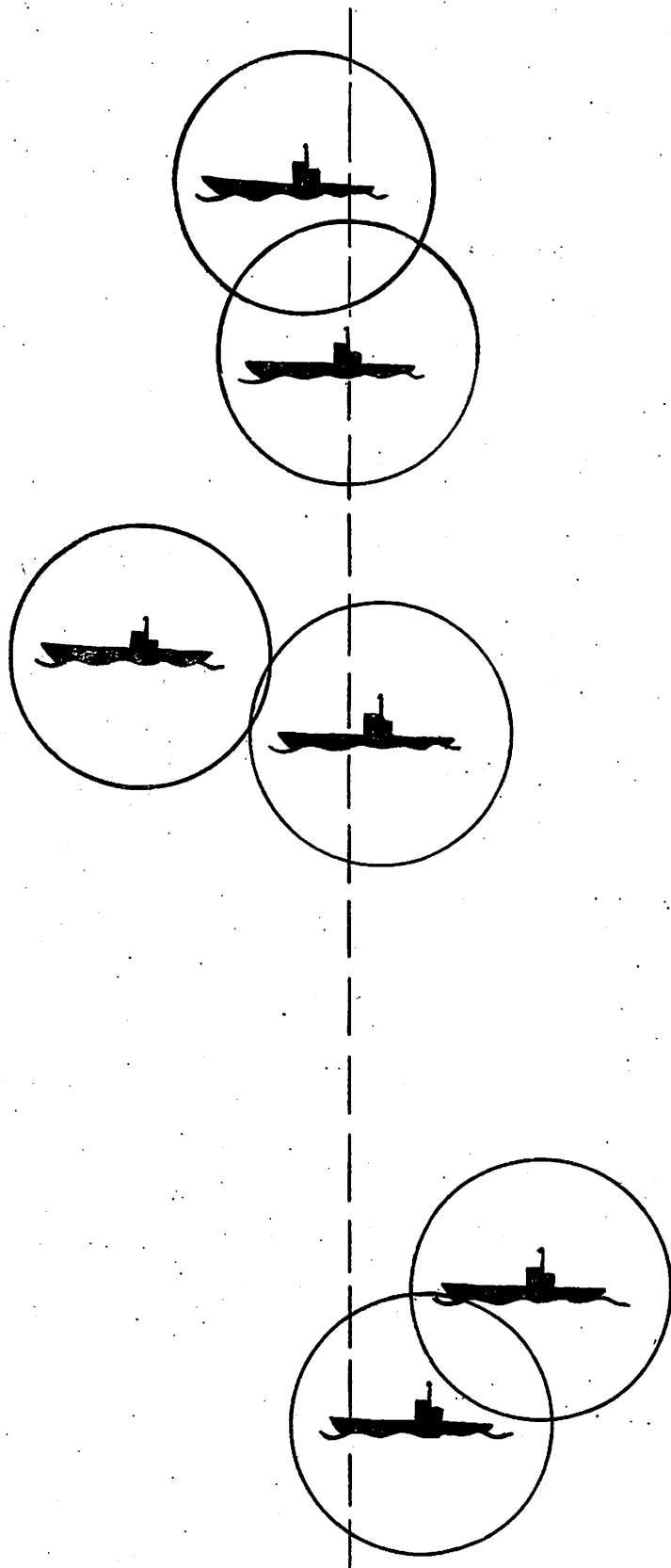


DIAGRAM 2.

FORMATION IN PRACTICE



GRAPH SHOWING CONSTRUCTION AND SINKINGS.

