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Friday, March 11, 1881.

ADMIRAL SIR GEOFFREY T. D. S. BORNBY, K.C.B., President, Royal
Naval College, on the Chair.

ON NAVAL TACTICS.

By Vice-Admiral DOWELL, C.B.

I FEEL that some apology is due from me for appearing before you to-day to read a paper on a subject which has been the theme of Prize Essays and treatises by Officers far more talented than myself. But I have ventured to accept the Council's invitation, having been one of those fortunate men spoken of by Admiral Randolph, who have had an opportunity of serving in our evolutionary squadrons. Twice I have held command in the Channel Squadron under Officers who rank among the first masters in the art of fleet evolutions. In virtue of experience thus obtained, I with great diffidence submit to you my views of tactics to be employed in our future naval engagements.

If in anything I say in this paper, I repeat the opinion of other Officers, I wish it to be understood that I make no claim to originality. I merely state the conclusions at which I have arrived, as the result of practical experience and study of the subject.

I propose to deal with naval tactics in connection with squadrons composed of ironclad ships, &c., occupying the place of the old ships-of-the-line. In doing this we have to consider the composition of our squadron, its armament, its organization, and the most effective method of bringing it into action, which last I propose to illustrate by a few plans of attack.

Future naval actions will differ from those of the past in being entirely independent of wind, and the fact that vessels can move in any direction will necessarily increase the value of a thorough knowledge of the signal books, and the capabilities of the squadrons and vessels composing our fleets. I have heard it said that seamen are no longer required, and that ironclads might be manned and fought by engineers, stokers, and artillerymen; so far from this being the case, I believe seamanship in the truest sense of the word is more than ever necessary. The Officer who best knows the capabilities of his ship, and has the nerve to put his knowledge into practice, is the man most likely to succeed in a naval engagement.

Our future actions will be battles of manœuvres. An Admiral will have arranged certain plans of attack (dependent on the formation of the enemy) with the view of obtaining the utmost advantage possible from his deadliest weapon, the ram. He will also be desirous of renewing the attack, after the first collision, in order of battle with those of his ships not disabled or not still engaged with an adversary. I do

not, therefore, agree with an opinion sometimes expressed that no signals will be required after the first signal to engage is dipped, or still better hauled down, when repeated. Still, however definite an Admiral's plans may be, I imagine he would find it necessary to give great freedom of action to his Captains, saying indeed to them, as Lord Nelson said to his, that no man can be wrong in laying his ship alongside—in these days in ramming—an enemy whenever an opportunity occurs.

The Composition of the Squadron.

Our ironclad Navy consists at this moment, I believe, in all of forty-seven vessels, including the "Polyphemus," the three vessels of the "Nelson" class, and all ships which have been laid down more than a year.

Of these, eleven are what may be considered serviceable broadside rams, eight of them being in commission, two of which are flagships on foreign stations; the others being ready, or those that could be got ready, for sea in a short time.

Thirteen, including the "Lord Warden," are what may be considered obsolete ships, which would not be employed in war time, while more modern vessels were available; ten of these thirteen are in commission employed in the Channel Squadron and First Reserve.

Eleven are effective turret ships, three of which are in commission, including the "Inflexible," whose Captain has been appointed; three are building, and four are, I believe, ready, or in a forward state.

Eight are turrets of the "Glatton" class, including the "Rupert," "Hotspur," "Belleisle," and "Orion," which would be considered Home defence ships, rather than seagoing ironclads.

The three frigates, "Nelson," "Northampton," and "Shannon," are formidable, and might be considered worthy of a place in the line of battle. But in view of the absence of armour from their batteries, I think they should be reserved for the purpose for which, I believe, they were built, namely, as cruisers for the protection of trade.

There remains but one vessel to be spoken of, the "Polyphemus." I believe she is not yet launched, but if she at all comes up to her designer's expectations, she will prove a most valuable auxiliary to a squadron. And it may be hoped that the day will come when every squadron will have one or two such fast handy rams and torpedo-vessels attached to it.

This being the present state of our Navy, I think, seeing that in case of a war it would probably be necessary to have three separate squadrons in different places, we may consider that each squadron would not be composed of more than eight or ten ships. There would probably be a mixture of broadside ironclads and turrets. And each squadron should have at least two fast look-out vessels attached to it.

Whilst speaking of the composition of the squadron, I will add that I think it of great consequence, as Captain Fremantle, I believe, suggests, that every ship should be painted alike, with a distinctive mark, such as a white streak, or some other badge, to distinguish our ships from the enemy. Also that the mastheads of all vessels

should be painted alike, with a distinctive mark besides the vane ordered to be carried. A waterline, visible as the smoke lifted, would also be an advantage. Black and white appear to be the best colours.

The Armament of our Squadrons.

In considering the armament, we have the ram, the gun, and the torpedo to fight with. In point of effectiveness, I consider the ram and the gun nearly on a par, whilst (for the present, at all events) the torpedo can only be considered as an auxiliary. I place the gun and the ram so much on an equality because of the range of the gun, and its capability of being trained. No enemy can escape a well-directed broadside, whereas it is possible, by the use of the helm, by increasing or decreasing speed, to avoid the ram, though this, when it takes effect, is the deadlier weapon of the two. In the use of the ram every Officer should know the turning power of his ship, the diameter of her circle at different speeds, and her time of turning. But in action it will be impossible, not knowing the enemy's speed, to judge exactly where he will be when the ship has turned eight points. The endeavour should be, therefore, to give the ship sufficient room to turn to deliver the ram with the helm eased, so to speak, to steer into the enemy. Most modern ships, even without steam-steering gear, will turn eight points in 300 yards. I would, therefore, lay down a rule that one and a-half cable should be the distance allowed if possible; that is, supposing the ship to be rammed is one mile ahead, I should bring her to bear three-quarters of a point on the bow. Here it is that a seaman's eye will come in. A ship can only effectually be rammed, except it is by chance, by steering for the ship herself, for it must be remembered that the enemy has command of helm and steam as well as ourselves, and even if he cannot increase his speed, he can always slacken it, or stop, or turn to avoid being rammed. He will, moreover, have studied tactics as well as ourselves, and probably, simultaneously with our manœuvre to attack, will be his for the same purpose. In naval actions now almost more than ever, will the balance of advantage tend in favour of the party who can deliver the first blow.

With regard to the guns of the present day, though they have a range of two or three miles, and though in the contest between guns and armour the gun has decidedly had the advantage, yet we must remember that their effectiveness is limited by the armour they have to pierce, and the angle at which they must therefore strike. Fire should be reserved, except on special occasions, until the distance is less than 1,000 yards, and the bearing as nearly as possible at right angles to, or on a line with, the adversary's keel. Of course, cases may occur, such as an enemy attempting to escape, when bow fire would be of use at greater distances to damage, if possible, his steering gear; but such, I think, need not be considered here.

Whilst speaking of the use of guns, it is also necessary to consider the mode of firing them. All ships are now fitted with electricity, one of the most valuable inventions of modern times, provided, so it

appears to me, it is confined to its proper use. I should say that electric firing should be used at all times when a broadside is required to be delivered at ships rapidly passing, or when the ship is herself turning. In this case the Officer at the director, being able to see all round, can watch a vessel and be prepared to press the firing key the moment she is on with the points of the sights, whereas the Officer in the battery and the captain of the guns will only see her a few seconds before she is in the line of fire. Thus, in a ship failing to ram and passing astern of her adversary, the Officer at the director would be in a position to fire at the effective moment. When, however, the object to be fired at is not rapidly altering its bearing, I think it would be a grave error to allow the Officer at the director to assume the functions of the Officers in the battery and the captains of the guns.

An opinion has been expressed that the points of the director should be brought to bear by moving the helm. A very serious mistake this seems to me. Where would be the limits to which the ship's head might be turned? and what would be the position of a squadron at the end of a few minutes of such work?

With respect to torpedoes, we have to consider two descriptions of these weapons—the Whitehead and outrigger torpedoes. The Whitehead torpedo is a very formidable weapon, and must constitute in future a considerable factor in naval engagements. But, from what I have seen of the practice with these weapons, I should be inclined to limit the distance at which they should be fired to 400 yards.

It is only within the last year or two that the use of outrigger torpedoes has been considered available for large ships, and never having seen the experiments tried, I feel that my opinion on the matter will have little weight. I confess that this weapon does not commend itself to my judgment. The idea of a ship going into action with her lower booms in the air, and a big charge at the end of each, to be lowered for use, on passing close to the enemy, is not prepossessing. It must be remembered that when lowered there will be at least 18 feet of boom with its bulky charge at its end in the water, with a ship going eight knots! I doubt whether it will often be got into its proper position. However, I am very glad to see by a late circular that the system is to have a fair trial. But, I think, that to ensure this exercise being really effective, it will be necessary that the booms should be marked to show when they are sufficiently immersed, and that care should be taken that the charge is not exploded unless it passes at its proper depth under the target. To me, the success of the outrigger torpedo seems more than doubtful. As a weapon to be used in naval actions from ironclad ships, I fear it will never be really successful.

I have not reckoned on torpedo-boats taking any part in an engagement between ironclad ships in the open sea.

The Organization of a Squadron.

In organizing a squadron of mixed broadside and turret ironclads, I think it would be desirable to put the ships of each class in separate

divisions, though if the classes are unequally divided, there can be little reason why they should not work in the same divisions and groups.

Ships throwing the heaviest weight of metal should be the leaders of divisions and subdivisions, the same ships being group leaders. Some difficulty may arise, I fear, in this arrangement, on account of the seniority of the Captains. In our evolutionary squadrons leaders are generally and very properly selected according to seniority. It often happens, however, that the most powerful ships are not commanded by the senior Captains. I do not see how this is to be remedied. Captains, except in special cases, are appointed in turn, and would be unwilling to wait because the relative power of the ship vacant did not correspond with their relative seniority. Nor would it be for the benefit of the Service that Captains should be frequently changing round, to ensure the squadron being commanded by seniority from the heaviest ship downwards. But the consequence is that when an Admiral organizes his squadron for real service, it may not be in his power to make Officers leaders according to seniority, though it would of course be necessary to avoid placing an Officer in a group, where the leading ship is commanded by a junior Captain. Whatever the difficulty, I am sure that squadrons must be organized according to the power of the ships composing them.

Great difference of opinion has been expressed upon the subject of groups as to their form, utility, &c. The present Signal Book settled the form by adopting what is known as the "Channel Squadron Group" slightly modified, it may in future be called the "Service Group." The addition of group order to group formation greatly simplifies group manœuvring.

Captain Fremantle, in his valuable essay, expresses an opinion that groups are useful for evolutionary purposes, but are not a formation adapted for order of battle. In this I differ from him very decidedly. For evolutionary purposes we have divisions and subdivisions in any number the Admiral may think desirable. Groups for this purpose would be an unnecessary addition to the signal books, whilst I consider them to be the formation most applicable for order of battle; and for these reasons:—Group order affords the Admiral the most rapid method of altering his formation, as it takes but a couple of minutes to change from group order to group formation; in groups ships obtain the greatest freedom to use their guns and rams without injury to their friends; groups give them the fullest power of combined and independent movement and mutual support; and in groups, three ships can conveniently attack two—a desideratum in naval warfare. There is an advantage also in the irregularity of this formation, an enemy will be less able to judge of the position of our ships and consequently be less able to attack successfully.

Naval tactics can hardly be discussed without an allusion being made to the signal books. It is manifestly imperative that every Officer should possess a thorough and practical knowledge of them. But I do not consider it my duty to criticize them even if I felt competent to do so. They have lately been revised by a very efficient

Committee of Officers, and I gladly take this opportunity of adding my tribute of respect to the memory of the gallant Officer who was the Chairman of that Committee.

With his ships in close order an Admiral has the power of moving his squadron in any direction at a moment's warning. I consider that close order is the best at all times for the individual safety of the squadron, though at night, or in crowded waters, or in heavy weather, it is desirable to put the ships in open order that they may have more room to sheer to avoid merchant vessels.

Here, perhaps, I may be permitted to remark on the absolute necessity of station-keeping, addressing myself to the younger members of our profession. The efficiency, if not the safety of a squadron, depends on its units being in station. With the ships in station the squadron is a machine, which can be moved at once in any direction required with perfect safety; with the ships out of station, it is an irregular mass, which an Admiral would be unable to move for fear of accidents. Whatever excuse there may have been in former days when ships were dependent on wind, and when an alteration in the ship's trim might throw out the calculations of the Officer of the watch, there can be none now in our ironclad squadrons; they always have command of steam, and a few extra revolutions will preserve station at all times.

It is customary for the Admiral to make the signal at what rate of speed he intends to proceed, but it must be remembered that this speed is merely given as a guide. All ships other than the flagship should have command of a knot at least more speed than is ordered. As a rule in large ships it is advisable to have one boiler more than the number of revolutions absolutely required; this is economical, as it avoids the necessity of pressing the fires when an increase of speed is necessary. Of course when there is any prospect of meeting an enemy's squadron, all ships will be prepared to use full power, though I agree with Admiral Randolph in considering the speed most advantageous for engaging an enemy would be from 7 to 8 knots. This allows a sufficient margin for increasing or decreasing speed as may be necessary to effect or avoid a ram; it is fast enough to obtain the best results from the helm, and it gives more time to mature the plan of attack than a higher speed would allow.

But I decidedly think that in all plans of attack the ships should turn the same way to ram. It appears to me there would be considerable risk to our own squadron, if the ships of each division attacked in opposite directions, however carefully a plan was arranged to avoid it.

Where the question is open, an advantage would be gained by attacking to leeward, in order to avoid the smoke that hangs so long to leeward of a ship, and would obscure one's own vision rather than that of the enemy.

I quite agree again with Admiral Randolph that it is our duty to capture if possible, not to destroy; but I doubt if boarding will be a feature in naval actions of the present day, certainly not after ramming. A ship having effected a successful ram will go astern at full speed im-

mediately to disengage herself, and to be prepared to evade any other of the enemy's ships which may attempt to take advantage of her stationary position.

In future naval actions some ships are certain to be sunk, and I think it should be an understood thing how far we are prepared to take measures to save life. I have said before that I consider every squadron should have a couple of fast unarmoured frigates or corvettes attached to it, and my suggestion would be that these ships, taking no active part in the engagement, should be prepared to assist any of our own vessels which might be disabled, and to save the crews of any enemy which might be sunk. I believe in the great naval battles at the beginning of the century it was an understood thing that frigates were not molested in such work, unless they in any way joined in the action. Such I think should still be the etiquette in the present day. Battles now will be fought at such a speed that any vessel disabled will soon be left behind, and there would, therefore, be no temptation to disturb the frigates in their endeavours to save life.

Preface to the "Attacks."

An Admiral will probably have arranged at least eight plans of attack, to be used according to the formation in which he finds the enemy. I content myself with proposing four, namely: for an enemy in single column, line ahead; in single column, line abreast; in pelotons (or equilateral groups), line ahead; and in pelotons abreast.

I will begin by saying that I do not for a moment imagine that an enemy would allow me to make these attacks without performing evolutions to frustrate or avoid them, and probably to retaliate. Nevertheless, even with the certainty that the plan will not be carried out in its entirety, I hold that a settled plan is necessary for every formation in which the enemy may be found, and that our squadrons must act on the offensive, not defensive.

I have, before entering on these four attacks, drawn out a few figures, in which I have allowed the enemy to be the attacking party, for the purpose of exemplifying one of my reasons for adopting the group formation, namely, that I consider it the best adapted for resisting any counter-attack that the enemy may bring against me.

In these figures I have made no attempt to move my ships until the enemy has moved a minute. I call my own ships A, and those of the enemy B. A's object is to ram B, and B's to ram A; but their mutual endeavour is to avoid a direct collision stem to stem. The speed in all my diagrams is supposed to be about eight knots.

In Fig. 1, the enemy being in line ahead, on his starboard bow, A's ships are in starboard group formation. B decides to ram A2 with B1, and to throw B's 2 and 3 on A1. I have placed the nearest ship of my squadron one and a-half cable from B's line. It takes B1 after his helm is moved about two minutes to reach A2, and B's 2 and 3 two minutes and thirty seconds to reach A1, whilst they require thirty seconds more to reach A3.

A's movements, therefore, are as follows:—A2, when he sees B1 is turning, can avoid being rammed by putting his helm to port, and

FIG. 1.

Scale $\frac{1}{2}$ of an inch = 1 cable.

possibly by an increase of speed may succeed in ramming him on the quarter; if not, he will pass astern. While B1, if he continues his course, will just meet A3, who by decreasing his speed will be in a position to ram him.

B's 2 and 3 will have to put their helms over within forty-five seconds of each other, and A1 will have a minute and a-half to prepare for them. If A1 goes full speed he will pass ahead of B2, and will be in a position to steer into B3; but he would probably, by putting his helm to port, endeavour to ram B2.

FIG. 2.

In Fig. 2, A's group is in port formation.

B decides to ram all A's ships. It will take B1 two minutes to reach A3, B2 three minutes to reach A2, and B3 two minutes and thirty seconds to reach A1, after their helms are put over. A3, when B1 has had his helm over a minute, can, by putting his helm to port, avoid B1, but, by increasing speed and steering at B1, he will probably ram him on the quarter, or, if not, pass astern.

B2, in attempting to ram A2, will have given him two minutes' notice, by taking advantage of which, by increasing his speed and porting his helm, A2 will be in a position to ram him.

A1 by putting his helm hard to port and increasing his speed, may ram B3, if not, he will pass astern of him. N.B.—I should, when the enemy are on the starboard side, adopt the starboard group formation, and *vice versa*.

FIG. 3.

Fig. 3 is a small diagram I have drawn out, to show the superiority of quarter line at five and a-half points (60°) to quarter line of four points.

As 1 and 2 are two ships in quarter line of 60° at two cables, B at one and a-half cable on the starboard bow steers to ram A1. If he misses her, in forty-five seconds he is just ahead of A2, and a very little increase of speed on her part will effect a satisfactory ram.

FIG. 4.

In Fig 4 the ships are in the same order, but A2 is at four points. B attempts to ram A1; he just misses her; but finding A2 directly ahead of him, he would in all probability, by helm and increase of speed, ram him.

I think this shows that in quarter line at 60° No. 2 is a much better support to his leader than in quarter line at four points. For this reason I should never use the indented line or quarter line of four points; and, in attacking equilateral groups, I should not attempt to ram the leader. Also in the service groups I should prefer No. 3 should be four cables from No. 1.

Case 1.

I begin now to describe my four cases of attack.

In Case 1, A's squadron of six ships sights an enemy's squadron B, also of six ships, at four miles distant, in single column line ahead, steering a nearly opposite course.

CASE 1.

A's Admiral decides to attack in columns of groups in quarter line; attacking B on the starboard or port side, as from the position of the squadrons he thinks most advantageous.

I presume the attack to be on the starboard side. A's Admiral makes the signal for starboard group formation; No. 2 group forming in quarter line, A4 being seven points abaft A1 at five cables.

A steers a course so that A5 should pass one and a-half cable on B's starboard beam. If B continues his course, A1 will pass B1 at a little over three cables. On arriving at this position A1 fires his electric broadside at B1, and, reloading, is ready to fire his second at B3 a minute and a-half afterwards. A1 then puts his helm to port, and steers to ram the last of B's ships, that is B6.

A2 reserves his broadside for B2, firing it by electricity when abeam, putting his helm over and steering to ram B5.

A3, firing her electric broadside at B1 when her guns will bear, steers a lasking course so as to come up astern of A2, ready to ram B's 5 or 6, if either are missed.

A's second group continues its course until A4 can fire an electric broadside abeam into B1. A4 then puts his helm over to ram B4.

A5 puts his helm over to ram B3, firing an electric broadside at B1, when his guns will bear; while A6 steers a lasking course to come up astern of A5 ready to ram B4 if A4 misses, firing a broadside at B1 when his guns will bear.

All A's ships fire their bow guns before ramming, and those who fail to ram discharge their electric broadsides and torpedoes into the stern of their opponents and proceed about four cables, then turn eight points to starboard and re-form groups. It must, however, be remembered that sight being absolutely necessary to effect a ram, bow guns should not be fired until the ram is safe.

When the order is given to prepare to ram, guns should be laid abeam with extreme depression to discharge a broadside into the adversary's stern, if the ram fails.

The question now is, what B's Admiral would do to resist the attack?

B might steer so as to pass through A's line between the groups. In this case A's first group would be turning inwards, and so might take B's leading ships on the flank; whilst A's second group would not have turned, and probably A's 5 and 6 might have a chance of ramming B's ships to port.

Supposing that B elects to turn, so that B's 1 and 2 should ram A's 4 and 5, B's ships will have to continue their course until B1 is within two minutes of A5, and B2 within two minutes and thirty seconds of A4.

Before they can reach them, these ships will already have put their helms to port, and the case becomes exactly what is depicted in Fig. 1.

B's 3 and 4, if intended to ram A's 1 and 2, will have to put their helms over about a minute before A's 1 and 2 will have put theirs over to ram B's 5 and 6. These ships will therefore pass each other unless the A's, by a rapid alteration of their helms to starboard, may catch the B's sterns, whilst A3 will be on the watch for B3 when the latter has missed A2.

If B's 5 and 6 have continued their course, a ram may still be effected by A's 1 and 2. But if the B's have turned to starboard, A's

ships, by giving starboard helm, will bring their broadsides to bear on their sterns.

I will here state that my plan of attack would be the same if the squadrons consisted of double the number of ships formed in two columns of divisions in line ahead. My formation would be in columns of divisions of groups in échelon, as before, the distance between the columns being regulated by the distance between the enemy's divisions, the leader of A's second division being six points abaft the beam of the leader of the first division.

Case 2.

The enemy's squadron is observed to be in single column line abreast. A's Admiral makes the signal—"Form groups to starboard, "column of groups abreast, leaders four cables apart." A1 steers to pass half a cable on B3's starboard beam, and A4 the same distance on B1's starboard helm.

When about three cables from the enemy the signal to engage is dipped.

A1 delivers her electric broadside and torpedoes on passing between B's 2 and 3, and A4 one broadside on passing B1, their guns being trained 5° forward, at the same time they put their helms apart to pass astern.

When B's 2 and 4 bear two points about five cables on the bow of A's 2 and 5, the latter fire their bow guns at B's 1 and 3, immediately put their helms over, and steer to ram B's 2 and 4, firing

their port broadsides also at B's 1 and 3 as these bear abeam, their starboard broadsides and torpedoes being ready to pour into the stern of their adversaries in case they fail to ram.

When B's 1 and 3 bear one point about four cables on the bows of A's 3 and 6, these ships put their helms over to ram B's 1 and 3, A3 firing her bow guns, when she puts her helm over, at B2, and her broadside when she bears abeam; and, of course, like their consorts, being ready to fire into the sterns of their adversaries, if they miss their ram.

In this case A's leaders, having at first continued their course unchanged, would probably have deceived B's Admiral as to A's intention of ramming.

It is difficult to decide what B's evolution would be to frustrate A's attack; but whatever his movement, A would be prepared to counteract it.

If B's Admiral decides not to continue his course, but to endeavour to ram A's ships, his own ships, being in line abreast, must all move simultaneously.

Supposing he turns to starboard, intending to ram A's leaders, he would have to alter course before A's 2 and 5 had moved their helms; these would, therefore, continue their course a little further. A's 1 and 4 would at once put their helms over to avoid being rammed by B's 1 and 3. A's 3 and 6, increasing their speed, would steer to ram B's 1 and 3, while A's 2 and 5 would have a chance of ramming B's 2 and 4.

If, on the other hand, B's squadron decides to turn to port, A's groups, by increase of speed, would probably succeed in ramming, as originally intended. They would certainly not themselves be rammed.

Case 3.

The enemy's squadron of six ships is observed to be in column of equilateral groups (pelotons) line ahead.

A's Admiral decides to attack on B's starboard side in the same formation as if B's squadron was in single column line ahead, namely, starboard group formation, the second group to be seven points abaft the beam of the leading group at five cables.

A steers so that his nearest ship may pass half a cable on the beam of B's starboard wing ship, intending to ram B's 5 and 6 with A's 1 and 2, and B's 2 and 3 with A's 4 and 5.

A1 fires his starboard broadside at B1 when abeam, and another at B2, a minute and a-half afterwards, as his guns bear after his helm has been put over to steer to ram B5.

A2 fires a broadside and torpedo at B1, and also another at B4 when his guns will bear as he passes to ram B6.

A3 steers to come up astern of A2, to assist either her or A1. She fires broadsides at B's 1 and 4 when her guns will bear, and endeavours to ram B5 if A1 misses.

A4 continues her course until it is time to turn to ram B2; and A5, the same to ram B3, firing at B1 as she passes.

CASE 3.

A6 steers to come up astern of A5, to assist her or A4. She fires a broadside at B1 when her guns will bear, and endeavours to ram B2 if A4 misses. All ships fire their bow guns before ramming, and have their broadsides and torpedoes ready in case they miss their ram, to pour into their adversaries' sterns.

B's first movement would probably be to close up his rear group so that B4 should be two cables from B's 2 and 3. This would hasten the movements of A's leading group, and save B's 1 and 2 from two direct broadsides.

B4 would then be in a position to ram A4 if this ship missed B2; but A4's helm would probably be hard to port in his endeavour to ram B2, and by keeping his helm over and going full speed he would still pass ahead of B4.

If, however, A4 saw the position in time, he might give up his attempt on B2, and by starboarding his helm, steer to ram B4, supposing A2 had succeeded in ramming B6. If he had not, A4 by passing astern of B4 might succeed in ramming B6.

If again B decided to steer to break through A's groups, he would hardly from his formation succeed in ramming any of A's ships; but A's rear ships might be able without injury to their friends to effect a ram on the rear ships of B.

Case 4.

The enemy is observed to be in pelotons, line abreast, steering towards A's squadron.

A's squadron in group formation, column of groups abreast, steers so that its leaders of groups shall pass half a cable abeam of B's 2 and 5.

A's 1 and 4 fire an electric broadside 10° forward at B's 1 and 4, putting their helms over at the same moment to pass astern of B's 2 and 5, firing their torpedoes at these ships when abeam, and a second broadside as they pass their sterns.

A's 2 and 5 fire their bow guns at B's 2 and 5, putting their helms over to pass close under the sterns of B's 1 and 4, when these bear one point on their bow at three cables. They fire their port broadsides by electricity into B's 2 and 5 when their guns will bear, and

their starboard broadsides into the starboard quarters of B's 1 and 4, reloading immediately to be ready to ram B's 3 and 6.

CASE 4.

A's 3 and 6 continue their course until B's 2 and 5 bear about a point on their bow at four cables. They then put their helms over to ram these ships, A3 firing her port broadside at B3 when her guns will bear.

In this case B's 1 and 4 might endeavour to ram A's 1 and 4, but to do so they must cross the bows of B's 2 and 5, and risk being rammed by A's 2 and 5, and also by A's 3 and 6 if they miss A's 1 and 4.

B's 2 and 5 can hardly ram A's 1 and 4, to do so the four ships would put their helms over together, and the result would be that they would graze past on their starboard sides.

From the position of B's 3 and 6, their ramming would be out of the question, and even firing from them would be doubtful.

B's groups might turn together to break through A's groups, but they would still run the risk of getting one ram at least from A's rear ships.

Conclusion.

I will conclude by observing that the immense importance of exercising squadrons can only be fully realized by men who have served in them. To make a squadron thoroughly efficient the Admiral must have confidence in his Captains, the Captains in each other, and the Lieutenants in their brother Officers. It has been my good fortune to serve in squadrons where this spirit of *camaraderie* existed to perfection. I remember once going into a narrow harbour where some of the rear ships had to pass the headmost ones after these had let go their second anchors. I had to pass close under the stern of one. Her Captain said to me afterwards, "You were very close! You would

"not have cleared me if I had come astern." "But," I said directly, "I knew I was quite safe that you would not!"

So it should be with all Officers in a squadron. The Officers of the watches know well their opposite numbers. If there is a bad Officer of the watch, it is known by many in the squadron besides his own Captain.

Of course it is true that we cannot keep up the same squadrons in peace that we should want in war. But we can do, and I am happy to say are doing, something towards it. We have now three squadrons, the Mediterranean, Channel, and Detached, the last two of which should always consist, I think, of at least six ships each.

I believe that no portion of the country's money is put out to better interest than that spent in training naval Officers and men to fight our ironclad squadrons. Large sums are spent on coast and harbour defence, no doubt wisely spent; but our position as a nation will be lost when the safety of the country depends upon those defences. Our true defence lies in our ironclad squadrons, and every sacrifice should be made to keep these thoroughly efficient.

Admiral RANDOLPH, C.B.: It is impossible to enter into this subject, or to follow the gallant Officer through his admirable lecture, with anything like detail. It is too complicated a question to deal with offhand, but I am quite certain that the lecture to which we have just listened will form a very interesting and instructive study for our leisure hours. On approaching the subject, at first sight we meet with a difficulty of this description, that to lay down any system of tactics, it seems to be necessary first of all to know the character and power of the force which will be at your disposal, and it is utterly impossible for any Officer at the present day to foresee what will be the composition of that fleet, or any squadron of that fleet, which will be sent to sea at the approach or the breaking out of war, to represent the majesty and might of England. It will not be a fleet of "Minotaurs," nor of "Monitors," it will not be a fleet of "Dreadnoughts," neither will it be a fleet composed entirely of "Inflexibles," of "Nelsons," or of "Téméraires." One and only one thing seems to be quite certain,—it will not be a homogeneous fleet, it will be excessively heterogeneous, and the ships that are superior in speed and power will be compelled to tone themselves down to the level of the inferior ships; and it is almost impossible to construct a system of tactics which shall develop the best powers of the ships, individually or collectively. In military affairs we are quite aware that the great improvement in arms of precision has necessitated a change in tactics. The military are perfectly acquainted with the powers of their weapons, but we, on the other hand, are not so favourably situated. When any invention is introduced with regard to guns or rifles, it is subjected to the most exhaustive series of trials, and then to the adjudication of competent Committees, composed of the most experienced and practical Officers, and their opinions decide upon it. With us, on the contrary, it is different. So far as the ordnance are concerned, we are on the same footing, but when we come to what is not in the least bit less important, the question of gun-carriages, that is, the ships to carry them, it is totally different. They are not subjected to the same criticism, to the same examination or experiment, or to the same sort of tribunals to decide upon them. In what I am going to say I emphatically repudiate any desire to make the slightest reflection on the authorities at Whitehall, and still less upon that excellent and most efficient Board of Construction, than which I do not believe a better or more efficient Board exists in any country. But I do not think that they can be fairly held responsible for the vessels which they produce. It is hardly too much to say that some of them are produced and built in spite of them, the "Captain" for example, and the designs, before they are adopted, do not seem to be subjected to professional criticism, or founded always upon a distinct and proper principle. Take for instance the case of the "Inflexible." I believe the "Inflexible" is designed upon

the principle of carrying the heaviest artillery beneath the cover of the heaviest armour, but I do not think it was apprehended what specific object or duty that ship was to carry out when she had accomplished this. What is the specific duty which that ship is able to carry out, as well as or better than two other ships of half her size? Is she considered the most efficient ship to attack one of her sister monsters? Will she conduct that attack more efficiently than two ships of half the size, carrying together the same armament? Is she considered to be more efficient, say to force the passage of the Dardanelles—a question which I think our gallant Chairman is able to answer better than anybody else—is she considered more effective to effect the passage of the Dardanelles than two other ships would be carrying equal armament? I understand you may say yes, because of her invulnerable armour, but to that question I will refer by-and-bye. What I ask further is, is she as a unit of a seagoing fleet likely to be more efficient than two other vessels which I will call two subdivisions of herself, carrying conjointly the same artillery? or is she more efficient as a ram than those two vessels would be together? Undoubtedly 11,000 tons will convey a very much heavier shock than 6,000, but I apprehend that even ships of 6,000 tons will do all that is necessary in that respect; and if that be so, the rest is just so much superfluous waste of power. Then what are the objections to that ship? It has its disadvantages. First of all there is the question of cost, which I believe cannot be a farthing under three quarters of a million. I would not complain of the cost, if we had value received, but at that cost is she not just as liable to destruction by a torpedo as a vessel one-fourth her size? Is not her draught of water sufficient to exclude her from shallow seas, where vessels of less draught could operate with safety: and does not it expose her to greater danger of getting on shore? Again, is not she, with her complicated machinery, and, I believe, as many as fifty steam-engines, rather more liable to those casualties which are incidental to the best regulated ships, as well as families? And in her case a small accident, anything going wrong with the steering gear, for instance, or any other trifling cause, throwing her out of service for even half an hour, might produce a very disastrous effect on the operations of a squadron. Then again, about her armament. There are two turrets in échelon, designed with the object of enabling her to fire all four guns right ahead and astern. I am the last person to make any objection to end-on fire but I think it is obtained at too great a cost. In her case I apprehend the fire of the sternmost turret, passing close to the foremost one, or *vice versa*, would be very apt to interfere with the fire of that other turret. If kept up continuously, firing over the deck would soon shake the deck to a serious extent. But if she has the advantage of a superior end-on fire, look at what a sacrifice it is of bow and quarter fire! I think it will be found, from the size of her turrets, and their close position to each other, that including the funnels, they obstruct each other to at least 55° or 60°, just one-third round the compass. Then of course the smoke of one will interfere very much with the firing of the other. Besides that, if a ship has turrets in line with the keel, and is exposed to end-on fire, one protects the other, but instead of protecting each other these turrets are a source of mutual danger. They are so placed as to reflect the shot upon each other, so that the same shot may strike both. The same thing applies to fire from a little abaft the beam on one side, or a little before on the other. With respect to her armament, I have very great belief in the efficacy of shell-fire, even small shells bursting over the uncovered tops of open turrets, which are common in foreign navies, or guns *en barbette*, or the hide-and-seek guns of the “*Téméraire*,” or in the unprotected batteries of the “*Nelson*” and Northampton class. The broadside of the “*Alexandra*” would probably fire three rounds to two of the “*Inflexible*,” that is, eighteen shot to eight. I think that is a very important consideration. What then is the ship adapted for? Is she a ship that you would select to blockade the Baltic, or any other shallow seas bristling with torpedoes? Is she particularly adapted to bombard batteries, or for blockading the coast of America? Or is she the ship that you choose as the unit of the sea-going fleet? If not, I submit this is a vital question. The way to look at it seems to be this: First consider what are the objects that you will have in view in the event of another war breaking out. So far as it is possible to foresee them, they will be not singular but various, and the various means

by which those objects are to be accomplished must be provided accordingly. But some of them are optional: for example, it is optional whether you choose to blockade an enemy's fort or attack his batteries. Other objects may vary in importance, but there is one supreme object, one object so paramount and superior to all the others, that every other one ought to be left altogether out of consideration until this is provided for. It is one which has been alluded to by the gallant lecturer. It is one to which even the protection of our coast is secondary. That object is maintaining the freedom of the high seas. I think that object should be first considered, and all the rest will follow. The protection of your coast is hardly worth a moment's consideration in comparison. For the country must surrender at discretion under starvation if that object is not effected. The German coasts protected themselves in the last war against the French; so will ours. I think in designing our ships of war that single object has not been carried out. You should apply yourselves first to making a sea-going fleet, and I do not believe the "Inflexible" is the best class of ship for that purpose. I think such ships should be smaller, of a moderate size, of good speed, and homogeneous to a great extent, pretty nearly the same speed and manœuvring power, and built in large numbers, the more the better. When a ship is produced, I think she ought to be subjected to some sort of ordeal analogous to that which ordnance is always submitted to, as it is not a bit less important. When you have a fleet of such ships, there will be no difficulty in arranging a system of tactics which will be satisfactory, and which should be practised diligently and unremittingly. I would ask permission to return my individual thanks to Admiral Dowell for his most interesting and instructive lecture, and I would ask him to reply to two questions. In alluding to electric firing, he says, "When, however, the object to be fired at is not rapidly altering its bearing, I think it would be a grave error to allow the Officer at the director to assume the functions of the Officers in the battery and the captains of the guns." The question I should like to ask is, is it possible in the *mêlée* of an action to revert backwards and forwards from one system to the other, and if so, by whose orders is it to be done? Suppose you commence with electric firing, who is to give the order when it is to cease, and *vice versa*, when you change it to independent firing, who is to give the order when it is to be discontinued? I should also like to ask, with reference to the diagrams, whether the lecturer assumes the B's to have the same speed as the A's, and whether he allows them to have the power of reducing or increasing their speed at their discretion.

Captain GERARD NOEL, R.N.: In the presence of so many Officers who have studied and are experienced in tactics, I rise to address you with great diffidence. I take the greatest possible interest in naval tactics, and look upon the mastery of the subject in all its branches as the highest aim to which a naval Officer can aspire. We are sometimes told that we shall have no more fleet actions. We have also been told at various times that we should never again have wars, and we know to our cost how erroneous a theory this has proved. I apprehend the day will come when the fleets of England will have to fight for England's very existence, and if in those days our fleet is not in proportion to that of other nations, more powerful than it is at the present moment, we shall indeed require tactical skill on the part of our Officers. Admiral Dowell speaks of forty-seven ironclads; our neighbours across the Channel have even a greater number, some of them rather old, no doubt, but their later ships are equal in power to our own. French naval Officers study tactics, and they have a name for managing their ships with great skill. I do not mean to say that our Officers are less skilful, but I think, comparing the two nations as naval Powers, we have considerably less practice in manœuvring. In our bulldog obstinacy and pride, we are apt to neglect practice, and it is this that will very likely bring upon us reverses. So much in favour of the importance of naval tactics. Now I should like to make a few remarks on the paper we have heard read. I am sure we must agree that Admiral Dowell's advice upon the subjects of keeping station, his opinion as to the use of the boom torpedoes, the importance of signals, the best speed at which to go into action, the selection of group leaders, his high appreciation of the group system, of the ram as the weapon upon which to base a plan of attack, and his humane remarks on the help to be afforded to the sinking, are of the greatest value and interest. I am delighted to hear Admiral Dowell

support the system of groups. I think if fleets go into action, it will be found that the group system is the one of all others the most to be depended on, and in a small fleet, say, under ten ships, if you bring your fleet into action "in single column of groups in line ahead," I think you will have the advantage of every formation that the enemy can bring against you. (Of course, if you had a larger number of ships, the circumstances would be different.) If your fleet is in such good manœuvring order, that you can approach the enemy showing a broad front, and at the last moment bring your groups into single column line ahead, and double on your enemy, so much the better; but you must be in really good manœuvring order, and have full confidence in your Captains; then at the last moment the group that is told off to lead, will lead, and the others will follow in its wake, and in that way you deliver all your broadsides, all your torpedoes, and you have the advantage of the enemy. There is one point in which, perhaps, I may be allowed to differ from the gallant lecturer, on the question of ramming. He says A and B should mutually endeavour to ram, and yet to avoid direct collision, stem to stem. I am strongly of opinion that if you determine to ram the enemy, you must at the same time make up your mind to meet him bow to bow, if he is equally determined to ram. If he flinches, then you go into him; if you flinch, then he ought to go into you; I think there is no way out of it. I do not apprehend for a moment that two vessels well built, meeting bow to bow, would do more harm than rub each other's sides well down; and I may here remark, that I look forward with dread to the day when the strong advocates of breech-loading and *long* guns place such guns in our ships that they cannot be run in clear of the ship's side, for we shall have them all dismounted, one after the other; it would be a very serious thing if we ever put guns into a ship that could not be run in clear of the ship's side. I do not think there is any other safe way of ramming. If you attempt to turn and ram, or ram from abeam, you find yourself in the position that Captain Colomb has often spoken of here, of it being merely a matter of 50 yards, whether A rams B, or B rams A. I think that if you intend to ram, you must, when close to him, keep your bow on to the enemy. As regards groups in the matter of ramming, if they are opposed to line ahead, I take it the leading ships would rub, the supports would ram, and that is where the group has the advantage of the line ahead. If it was not for that, I think the single line ahead is the strongest of all formations, but in the matter of ramming, the leader of the line ahead, being disabled, would upset the whole line. There is another question about groups, which I mentioned on a former occasion, when we discussed Captain Fremantle's essay. It is that of turning. What Admiral Dowell called the "service group," is a group where the rear ships are nearer the wake of the leading ship than we have had in former groups, and I think that carries with it a great advantage. Again, I must say that I entirely agree with Admiral Dowell about the rear ship; I think a constant distance of 4 cables is the best position of the rear ship, especially as Nos. 2 and 3 ships of a group are now nearer the wake of No. 1. On the question of turning, I mentioned a suggestion that it would be best, if you required the groups to turn more than a certain number of points, that 2 and 3 should come into the wake of 1, and I proposed that directly the signal is made to turn, they should do so without any further signal, and that, when the new course has been attained, they should re-form in group. Since that time, Admiral Hood has tried the turning of groups by bringing the other vessels into the wake of No. 1 by signal, and he then turned and re-formed the group by signal; and I believe he saved seven minutes in turning through sixteen points, and re-forming the group. As to torpedoes, I think so far as they are fired from ships, we must as yet ignore them in a fleet action. Whether we shall be able to ignore them after the first severe battle, I do not know, but at present I think we have not had sufficient proof of their value to be able to give them a prominent position. On the other hand, if torpedo-boats are brought into action, they will very much influence, and perhaps alter tactics. The swift boats which our present ironclads carry, and which no doubt will be lowered into the water before the action, and kept steaming alongside their respective vessels, to be shot out ahead before the ships themselves engage, will very much disturb the enemy, or very much disturb us if we have to act against them. Admiral Randolph spoke rather about ships than about tactics; there is no doubt it is very necessary in

tactics that we should know what ships we have to fight with before we can arrange how we are to fight them. I should like to see three recognized types of vessel: one for coast defence and attack, such as the "Dreadnought," and smaller mastless vessels of that class. Then another class of ironclad cruisers, of which the "Nelson" is a very fine type. Perhaps she might have her armour a little higher, as high as the port sills, and do away with the armoured deck. Then the third class should be ordinary cruisers; the last two classes heavily masted. Here we must bring in seamanship. Seamanship in the present day I hold is more important than ever it was. Our fleets must keep the sea. Our fleets cannot keep the sea under steam only, but what they will have to do is this, they will have to be under sail the greater portion of the time, and when they sight the enemy, they will have to douse the sail smarter than they have ever done it yet, in order to catch him. I think the great basis of our system of regulating the masting of ships should be with a view to reducing everything that offers resistance to the wind as quickly as possible, so that our vessels from being under sail can be prepared for steaming head to wind in the shortest conceivable time. A well-known Captain was very fond of bugle sounds, and his signal for getting up steam, down screw, and shortening sail, was "Polly put the kettle on." I should like to see that "Polly put the kettle on" brought to perfection. In conclusion, I think the Institution, indeed the whole Service, owes thanks to Admiral Dowell for so ably bringing this subject under discussion, and if I may be allowed to say so, I am sure every one will be delighted when they hear, or, if they are present, when they see, Admiral Hornby in the chair.

Lieutenant BETHELL, R.N.: I do not presume to rise in any spirit of criticism with regard to the interesting lecture which we have heard, but nevertheless there is a question about which I wish to ask for information, and that is, as to the speed of vessels or fleets in going into action. I would ask Admiral Dowell, supposing one of those ships (conditions on diagrams) chooses to increase its speed to 12 or 14 knots, what must be the result? Would his enemy let him come at him at that speed whilst he was only going at 8 knots? It seems to me that the enemy, on seeing an increase of speed, will himself increase his speed, that is to say, one vessel has the power of forcing the speed of its adversary. Another observation I should like to make is with reference to the idea that ramming, on the whole, is objectionable, in so far that our object ought to be to capture and not to destroy. I do not for a moment propose to argue that as a metaphysical point, but it seems to me that it is our duty in war rather to destroy a whole shipload of our enemy than to risk the life of one of our own men; and if this destruction is most quickly effected by ramming our enemy, it should be done as soon as possible. There is a subject which has been only touched upon, and that is signalling. I know it has been held that on the signal for action being hauled down, there would probably be no further necessity for signalling during the action; but I am told that that idea is going out, and it seems it must be so, for as we improve in our power of moving these great masses about at high speeds, it will give enormous power to the commander of a squadron to be able to signal with great rapidity what he wishes. That being so, I will just point out how ineffective the present system of signalling is for this purpose. Orders are required to be conveyed to Captains in the least possible time, and if it were possible to have the telegraph for that purpose it would not be too quick. On the contrary, what have we? We have a system of flags, and we know how slow flag-signalling is; and not only that, but when the flags are up they are difficult to distinguish, and to manœuvre them a great number of men are required to be exposed to the enemy's fire. Surely, then, that must be a bad system. I do not propose now to suggest a substitute, but still the extended use of the semaphore has been spoken of here, and I think it is a very valuable idea, properly placed I believe it would be of the greatest importance. I cannot help thinking that, when the day of battle does come, that commander who comprehensively grasps every detail of the action will bitterly regret a system which forbids him, at the critical moment, to convey those orders which will secure victory, or possibly save a fleet from defeat.

Captain LONG: In common with those who have already spoken, I feel very grateful to Admiral Dowell for the trouble he has taken in bringing this subject before us. I do not propose, however, to follow him through his diagrams, for that

would be indeed quite beyond my power, but I shall study them in the Journal. I have also had the advantage of reading the "Manual of Manœuvres of Her Majesty's Fleet;" a work which filled me with admiration, and from which I derived a great deal of knowledge. There are one or two things in it which I may with propriety speak about: they do not concern the superstructure of naval tactics but rather the bricks and mortar which form the foundation of it. First, there is a statement to the effect that if a ship has her helm hard over and is going at a certain speed, if you increase the speed that ship will occupy more space in turning. I doubt the accuracy of that statement. Then there is another statement with regard to rectangular and oblique formations; the conclusions arrived at appear to me to be perfectly sound and most admirable, but in the reasoning which precedes, there is a decided flaw which I think should be corrected. It is there stated that the higher the speed the longer will be the change of formation in execution; that I venture to believe is not the case. I have investigated the matter so far as I am able, and it appears to me the time occupied in altering from one formation to another by the oblique method will be found to vary directly as the number of ships and inversely as the product of the sum and difference of the speeds of the ship going at the greatest rate and the ship going at the slowest rate, and that consequently, for the same difference of speeds, the higher the upper limit the shorter will be the time of performing the manœuvre. Since the late Mr. Froude's researches, it is well known that the resistance of a ship at high speed varies in proportion to the fourth power of the speed, whereas at low speeds it only varies as the square; it consequently follows the speed will be reduced much more rapidly if you are going at a high speed than a low one. It appears to me, as young Officers are very properly now required to study these matters, and as they are matters of the very highest importance, we should be exceedingly careful that everything we put before them is tested by actual experiment. There is one other point I should like to mention. In 1873 a paper was read here by Captain Bridge, and some very valuable remarks were made on it by the late Commodore Goodenough. One of his remarks struck me particularly, that we who are what I might call "paper tacticians," who have not had the advantage of serving in a fleet, may do something towards aiding the study of these matters by suggesting sound definitions. Now the "Manual of Manœuvres" does contain a vast number of definitions, but there are none to define the qualities of a formation. A formation has qualities like everything else, and I think if we get terms to define precisely the qualities of a formation, we are more likely to get accurately in our minds what the value of the formation is. For instance, one very essential quality of any formation is "to be easy to maintain." I should distinguish that quality by the term "coherent," and I should say that a formation which ships found no difficulty in maintaining was a "coherent" formation. Again, an important quality of a formation is that you shall be able to alter course in it without being a long while out of your formation, because if a formation has any value you must be able to alter course in it, and that very quickly. I think a term might be selected for that particular quality of a formation, and perhaps the best term would be "flexibility." I hoped to study the subject further, but have been prevented. Then there is, of course, a strong formation, one in which all the powers of the ships forming it are developed to the utmost. There is one point on which nearly every speaker has touched, and that is, with regard to the speed. I should not pretend for one moment to say what is the best speed at which to go into action;¹ but I do hold, as I did two years ago, that that squadron which can manœuvre at the highest speed, and on the smallest arcs, will have the advantage, and that the enemy will either have to conform to his movements or fly. I think, therefore, it is very important to this nation that money should be found for naval autumn manœuvres. Those manœuvres should be carried out by Officers who have the experience and are well known to possess the ability to conduct such manœuvres properly; and I yet hope we may live to see every formation of a fleet tested by actual practice at high speeds. I was very much struck on reading the able essay of Lieutenant Campbell, who gave the times of altering course in groups ascertained

¹ It appears to depend upon the powers of the ships and the efficiency of the Officers.

by actual practice at 5 knots; and it was stated that at 10 knots the time would probably be one-half. Now, I should like to ask any person who has been accustomed to manœuvre at a speed of 5 knots, how he would feel if he were suddenly told to manœuvre at a speed of 12 knots? I think that if one fleet chooses to steer straight at the enemy, he compels the enemy to steer straight at him. I therefore hold with Admiral Sir George Elliot, "Whatever he does, I go straight at him;" that is my theory of naval tactics.

Captain CURTIS, R.N.: With respect to ramming, and you are going straight at the enemy, if you go straight at him the quicker you go the better, inasmuch as a tallow candle will go through a two inch¹ deal board when fired from a gun. One thing that commends itself most to my mind in Admiral Dowell's lecture, is that he is looking after those who are interested in picking up the wounded; and I think the dispatch vessels and some other boats from the squadron might be detailed to look after that matter, and they might have the title Blue Cross of the Sea for the time being. I wrote to Captain Gurdon some time ago, and he thanked me for writing, in respect to a new system of spar torpedo on which there are only two guys, a fore-guy and an after-guy. I do not know whether I should be correct in describing the whole thing here, because there may possibly be some naval Officers belonging to other nations, and it would not do to let them know. If you see an enemy ramming at you, all you have to do is to turn on the steam capstan and run twelve or fourteen spar torpedoes out. After the danger is over you release the capstan, and the spar torpedoes come alongside. There are no topping lifts required about it, and if you are going to sea for a long voyage, or in peace time, you can unship your spar torpedoes and lay them in-board. I am almost tired of hearing of home defence ships, because the enemy are supposed to be kept to their own ports, and not to come to us; and, moreover, Colonel Hill at the Board of Shipping Interest, on the 18th February last, told the shipping interest that the value of England's mercantile fleet is 100,000,000*l*. Can England afford to have 100,000,000*l*. of shipping to be unemployed? Is it not the fact that as her wealth increases her responsibility increases also? If I have a house with nothing but plated goods in it the burglar won't come to me, but if I have it full of gold and silver he will come. Just so with the enemy, if our riches increase our responsibilities increase. I imagine that at present the expense of the Army and Navy does not increase in proportion to our responsibilities; and I should like to see the colonies welded to the mother country, and bearing their proportion of the expense of the Navy. The colonies do not pay for supporting their trade on the ocean, and as I have said before, our Navy is the Imperial police of the seas, and their duty is to defend our merchant shipping. If we have not a Navy sufficient for the purpose we must create one out of the mercantile marine, and the sooner it is known the better. We require 1,200 ships to support our commerce over 80,000 miles. Captain Colomb told us in 1878, going as straight a course as possible from one port to another, the whole distance is 80,000 miles. Colonel Hill the other day, at the Board of Shipping, said that we have 17,500 reserve, and that will give you about 17½ men to each one of those thousand ships. I think the general public are not aware of the insufficiency of our naval police. I agree with other speakers in thanking Admiral Dowell for his lecture, but I still think he has not sufficient respect for spar torpedoes.²

Admiral LUARD, C.B.: This lecture upon naval tactics we must all agree has been a very interesting one; and, perhaps, one thing which it has brought out, is that there can be no consensus of opinion as to the best mode of naval tactics at present. If anyone could have convinced us, or myself individually, of the value of working a fleet in groups, I have no doubt my old friend and companion, Admiral Dowell, would have done it; but I cannot help thinking the service group

¹ The penetration of the board is due to the momentum of the candle and the board not yielding, if fired against a cotton pad the candle will be compressed to a lump.

I should like to call attention to "Clerk's Tactics," which, I think, are not sufficiently known and appreciated. See "Essay on Naval Tactics," by John Clerk, Esq., of Edinburgh. London, 1801.—J. C.

deserves the title which has been so happily invented on the present occasion of "incoherent." It seems to me that it is wilfully throwing away the advantage which we may obtain from working ships in pairs, whereby we could utilize the whole of the practice of our ancestors in naval warfare; and I would suggest that for our next naval essay a more admirable subject could not be proposed than the relative merit of groups of three and pairs for taking ships into action. I am afraid that we sometimes imagine that manœuvres are the basis of tactics, whereas tactics, I take it, should be the basis for our manœuvres; and whatever advantage there may be in exercising Captains and Officers of ships in evolutions with groups of three, I have yet failed to discover any advantage it offers for taking ships into action; and I believe if this subject were proposed for the next naval essay we should induce a far greater number of Officers to take a part in it than by giving them any much more abstruse or abstract question. I am afraid the time at our disposal is almost exhausted, and I am in great hopes that we shall hear some instructive remarks from our Chairman, who is more experienced in this matter than anyone in the Navy, and therefore I will not detain you any longer.

The CHAIRMAN: The very wide range of the subject which Admiral Dowell has brought before us in this lecture, is shown by the fact that each gentleman who has spoken has chosen a separate detail on which to speak. I think the Admiral in his lecture adhered to several very valuable principles, and, recognizing the difficulty that there is in forming any system of tactics at the present moment, for reasons which have been pointed out by several speakers, we should be very careful to adhere to principles, and to stick to those laid down as principles of war by our own Admirals, notably by Lord Nelson. Lord Nelson's name has been alluded to, and I think as to tactics we must continue to do as he did. One of his principles was this, double on your enemy. Now, Admiral Dowell has not attempted to show how in squadrons of equal force he would enable one to double upon the other. Doubling is simply this, that you take one part of the enemy's squadron in detail first. Lord Nelson, when he was attacking at the battle of the Nile, overwhelmed the van of his enemy. At Trafalgar he sent his ships in two columns, destroying the centre of his enemy, and then proceeded to deal with the van and rear. The same possibility exists in some of the groups we have had described to us to-day. Take Case 3. As those red ships are approaching the blue, it is perfectly clear if both squadrons continue their course, the whole weight of the red squadron will be thrown upon two or three ships of the blue, and the Admiral that could do that would have great advantage. Nos. 3 and 6 in the blue group must practically be out of the fight altogether if he can do that; they do not fire a shot, much less are they able to ram. That is one illustration showing that we should stick to the old principles. Admiral Randolph in his remarks drew attention not so much to the matter of tactics as to the basis upon which our fleets are formed, and he has complained that our ships cannot work together because they are not homogeneous. Now, I think we cannot expect to have a brand new fleet every year; we must make use of the fleet we have got. We therefore come to the principle that Admiral Dowell laid down, and which is most important, that the ships should be paired or joined together in threes, formed into separate bodies according to the nature of the ships, and not according to the seniority of the Captains. The last Signal Book has given the power of doing that. Speaking of groups, it says that the principle of the group is that "of a small body of ships united under one leader." That is a very excellent principle to bear in mind, and considering the difficulty experienced in action owing to the confusion, the smoke, and so on, it will be very difficult for an Admiral to command each of his ships; and if he can rely on the very able men he has around him by selecting the ablest and putting him in charge of two or three as he may think best, he would get the best results. The Captains in command of such groups, though they might not be able to see the signals of the Admiral, would still dispose of a large force, and if they only succeeded in throwing it upon one of the enemy's ships, they would carry out Lord Nelson's principle. I think as we have these ships, all we have to do is to use them. Our forefathers had not similar ships, but they used to bring their ships together and manœuvre them as a fleet. In our case we have some very long ships, such as the "Agincourt," and undoubtedly what is to be done is to put the handiest ships

next to her. So with the "Inflexible;" make the most of her, and make her take care of one of the weakest ships. What we must see to is that we are banded together. Admiral Dowell very properly pointed out that nothing made a fleet so strong as mutual confidence between Admirals and Captains, and that ought to be cultivated by all means. The result is this (and I am now speaking from experience), if you are to have mutual confidence you must be a long time together. Mutual confidence is more engendered by your getting into difficulties and getting successfully out of them, than by anything else. You cannot help making mistakes, but it is the person who, when a mistake is made, pulls his friend through, or is pulled through by his friend, that imparts or imbibes most confidence; and there is nothing so good as that mutual confidence. If that is to be done, you can only get at it by people serving long together, and that is going dead against the principle which appears to hold so much favour at present at Whitehall. At the end of three years, ruthlessly, every Captain is taken out of his ship, however good he may be; and they are now talking about having a new Admiral in the Channel Squadron every two years. I think we ought to look round and see what are the principles for successful action adopted elsewhere. There has been no greater success obtained in late years than that of the German armies. Do they adopt in the German armies a principle of that kind, or one exactly opposite? I take it, it is one exactly the opposite. We never heard of Count Moltke suggesting that an able General should be removed so as to give an opportunity for somebody else to become efficient; on the contrary, their Generals are retained, and when they are tested in war they are found efficient. I think what we should do is to try and select the ablest men, and give them every opportunity to continue at sea, and to serve together, so that we may make the best possible use of our men. Admiral Randolph addressed one question to me about the "Inflexible," which I have no hesitation in answering, because it seems to me that he rather ran counter to a very well established principle of warfare in proposing to divide the "Inflexible," namely, the concentration of force, and you can bring all your force to bear upon one spot more easily when it is combined in one ship than when it is divided into two. In the particular case of attacking a fortress, clearly the one ship with equal force is better than if that power is divided between two ships. Take the case of the forts of the Dardanelles. The great difficulty there is that the water being very deep you must anchor very close to, and consequently if you have to surround one of those forts in order to bring a superior force of guns on it, you must put your ships very close together. My idea if we unfortunately had had to attack those forts was to put the ships at a distance of one cable apart, therefore if I had had two vessels carrying the same armour as the "Inflexible," clearly I should have required double the space in which to put them; the "Inflexible" would have gone in her own length and one cable, but the other two ships must have occupied a great deal more, *i.e.*, their own lengths and two cables, and the force would have been distributed over a larger space. That of course would be to diminish the fire upon the fort.

Admiral RANDOLPH: Would you allow me to make an explanation, and also to supply an omission I made. Our Chairman has rather misunderstood my reference to the "Inflexible." I was speaking with reference to forcing the passage and not to attacking the forts of the Dardanelles. When I alluded to the "Inflexible's" defensive armour, I said that I would say something about that subsequently, but omitted to do so. Now, I have not the faith in that armour that some people may have, because I think it is perfectly clear that it is no use pelting a church tower with marbles or pills, and that an enemy would not be so foolish as to throw his shot away in attacking that armour: what he would do would be to attack her before and abaft it—before by preference—and if he managed to fill a few of her compartments, he would destroy her trim, her speed and manœuvring power, possibly expose her crews, or bring them near the surface, diminishing their power, and then, I think, she would fall an easy victim to two rams.

Admiral DOWELL: With regard to Admiral Randolph's question about electric firing, as I understand electric firing, the Captain gives the order himself: and I imagine that when ships are turning and going to ram, it is not likely that there will be frequent change from one system to the other. It appears to me that the great difficulty of electric firing is the communication with the battery—that is the

one thing which shakes my confidence in it—I have never yet seen any communication between the Officer, the director, and the battery with which I have been satisfied. Mechanical arrangements I have not seen to work satisfactorily. A voice-tube I do not believe in in action. In the “Black Prince” I found the communication between the bridge and the engine-room was a voice-tube, and one day we were performing steam tactics when the ship was necessarily going as slow as possible. I was on the poop and said to the Captain, “How many revolutions are we going?” He said “Thirteen.” Her stern was shaking, and I said, “You must be mistaken,” and we found out that she was going at thirty-three. He said, “I spoke down the tube and they answered me ‘thirteen.’” So the mistake arose, and if that is a sort of thing that would occur in steam tactics, in action it would be worse; therefore I do not believe in it. A messenger would be too slow, in turret ships particularly. But I hope to see this difficulty of electric firing corrected. I am glad to have this opportunity of saying I believe in electric firing for ships in rapid motion and turning, and I think if the electric principle could be extended a little further and used for the communications it would be greatly improved. As to the speed at which my ships are going, of course I must put them at a certain speed, and those ships are put at a speed of 8 knots. You cannot control your enemy’s speed, you must take it upon guess-work, or as nearly as you can judge. As to finding it by the sextant, I do not think in action that will ever be possible. It is there that seamanship will come in. You have this advantage in going at 8 knots, that you can have at least 4 knots at your back in a moment, whereas if you are going 12 knots, you can only reduce your speed, and I hold that to reduce speed is wrong if it can possibly be avoided; I would increase, but I would not reduce. Lieutenant Bethell spoke about ramming: now, I agree with Admiral Randolph, that it is better to take ships than to sink them, and he understood me to bring that forward as an argument against ramming. Now, my whole principle is ramming, but I do not believe that because a ship is rammed she is certain to sink; it will not always be the case of the “Vanguard.” The very fact of the “Vanguard” having been lost has improved our ships in this respect and those of other nations. The result, I believe, will often be, you may make a great hole in her side and disable her, and you may take her if you defeat the others; what I mean is, that is not the time for you to take her. When you have rammed her you get away clear at once. As to signals, I think I ought to say a word about them. The custom has been to keep the signal to engage the enemy flying during the action. I am happy to say it has been my good fortune to see No. 1 flag, “Engage the Enemy,” flying at the masthead for hours. But I do not see any advantage in it; I believe other signals will be required, and that you do not want to crowd your mastheads with flags. It is, no doubt, often difficult to see a flag, but there is a greater difficulty in finding a substitute. We have heard of a masthead semaphore, but I doubt its answering; besides, the enemy have Gatling guns, and they would much more easily knock your masthead semaphore to pieces than they could damage your flags; therefore, though flags are difficult to see, I do not think we have yet arrived at anything to supply their place. I have to thank you very much, and also to thank Admiral Hornby especially, for coming here to-day.