

NAVAL TACTICS.

Mahan, A.T. Fleet battle tactics.

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FLEET BATTLE TACTICS,

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Lectures at the War Cheve,

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Fleet Battle Tactics.

Weitten in Mil- May

It is trite to say that in approaching the study of Naval Warfare under present conditions, we have before us a problem that is not one wholly new, but also one as to which we have to guide us little or no practical information, on which to base any certain conclusions.

We have three recognized weapons, the familiar Gun, Ram and forpedo; familiar in name, but save one, most unfamiliar in use, in place of the one with which our forefathers had to trouble themselves; for as to boarding, when it came to that, the hour for science was over and that of simple prute force was begun.

Of our three weapons we have experience in the use of one, the Gun; experience I mean, to a greater or less extent, under the actual condition of use at sea; although there is doubtless a tendency on the part of many of us to choose, for our little expenditures of ammunition, conditions of wind and weather which will favor a good target report. Still we must all have had forcibly impressed upon us the fact that our guns are on a very restless platform, and must have imbibed a certain indifference to the wonderful accuracy of modern guns at very long ranges. Their great advantage to us lies in the flatness of their trajectory at moderate ranges, in the increase of the point blank and low elevation ranges. There is lack ing to our service experimental knowledge of the comparative accuracy of guns fired nearly in the fore andaft line in a sea way; the Intelligence Office has no data as to the comparative accuracy, under the same conditions, of guns fired in broadside and those fired at targets ahead or astern; nor am I aware of any adequate reports from more advanced navies. It seems probable, however, that the greatest source of bad firing, that which springs from frequent and rapid changes of elevation of the piece through the rolling of the ship, would be much lessened in those pieces. Even in the position most unfavorable for broadside guns with the sea abeam or a little forward of it, the guns lying fore and aft would be comparatively steady, the axis of the bore would swing through but a small vertical arc.

As regards the ram it is hard to see how practical tests of a very satisfactory character are to be made. We have been told that ramming drills have been instituted in Russia between launches or very small vessels, and such drills must be very much better than nothing at all. It (must be something, nay it) is a good deal to have learned the difficulty of hitting another boat on the wing, and a very salutary lesson to have found your enemy in such a position that you cannot dodge him. But from these mimic combats it is a long step to the pilot house of a ram meant for the line of battle, and handling her at a high speed among other ships. Nevertheless good working maxims for ramming contests may be deduced from these mimic contests.

The torpedo admits of more thorough practical test, without risk of doing damage. Its range, time of flight, accuracy under varying conditions can all be settled, everything but the personal equation When discharged from a large ship, or a ship in contest with an equal, there should be no greater demand for nerve than when firing a gun from the same; in an attack by small torpedo boats, or by vessels very vulnerable as compared with the ship assailed, the strain on the nerves will be greater. In all sham battles of torpedo boats against ironclads, I should, in estimating the resulus, be inclined to allow largely for the fact that the men in the boats know they would not be sunk; not that there are not plenty of men bold enough to carry through such enterprises, the history of torpedo warfare, young as it is, shows this fully; but I think it may be safe ly said, and the whole history of warfare proves it, that all desperate enterprises which require not only courage, but skill used with coolness are peculiarly open to failure; the men who, holding their lives in their hands, with the chances against them, can seize the right moment, neither too soon nor too late, are exceptional. In a navy relying to any extent on torpedo boats, large practise should. be lead to find out the good shots; then it would be necessary to count uponha large percentage of failure among these good shots, f from various causes, in time of battle.

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I think from such considerations as I have mentioned, and there

are doubtless many more that might be brought forward, the absolute and relative value of these three weapons must as yet be considered matters of opinion. That a 12" or 16" shell striking fairly on the turret or water line of an ironclad would be most disastrous; that it would likewise be disastrous to be rammed squarely in your largest compartment; or to have a torpedo explode under the most vulnerable part of the hull may be fairly conceded; and the question may yet remain, in determining your choice of your principal weapon, which of the three is likely to hit most often and most fairly, and at the same time expose you yourself to the fewest chances of danger.

In weighing this question here, I will define the subject; perhaps I should rather say exclude those operations which, though belonging to the navy, are not here touched upon.

The subject allotted to me is more particularly that of handling comparatively large squadrons; and does not involve the Tactics of single ships, unembarrassed or unhelped by comrades, nor on the other hand the question of the attack or defense of Coasts directly. Whatever views I may advance have reference then to a sea going fleet, to its composition and movements; and I would like to take advantage of this particular place to disclaim any intention of speaking with authority or with any but the greatest diffidence. I have tried to arrange and digest such matter as has come in my

way, to reflect upon the conditions of the problem now before us, and to apply to it such principles and maxims found in standard works on war in general as seemed of universal application.

The problem before us then has several successive steps for solution.

lst. To ascertain the real capabilities of each arm and to estimate its consequent probable value in action.

2nd. To deduce therefrom which is the real backbone of the fleet and which the accessories.

3rd. To determine, within limits the relative proportions of each in a given fleet, keeping in view of course the special duty of such fleet.

4th. Having thus the components of the fleet to deduce the best dispositions for developing the full power of each arm, and for combining all there at any stage of an engagement; so as to bring out the fullest power of the fleet as a whole. This involves a study of the various orders possible and the feasibility of passing from one to another in presence of an enemy. As a corollary to the 4th., we will have to examine the various means of forcing or avoiding action; of making or receiving an attack.

5th. There will be the question of chasing, both from the side of the pursuer and the pursued, as well before action, as after a more or less decisive battle.

It is obvious that, when men of rank and merit are still disputing about the weapons, any answer to the above questions can as yet claim to be only an attempt, more or less worthy at solution of the problem.

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Our three weapons may all be considered as projectiles. In the case of one you hurl the ship herself, in the other two you hurl something out of her at your enemy.

I may point out that the Torpedo has something in common with the other two. When ejected from the ship as an auto mobile torpedo, its effect resembles that of the gun in being transferred to a distance. When dragged or driven against the enemy, by the close approach of the assailing ship, the mode of attack is little different from ramming. Undoubtedly, however, it has more family likeness to the gun. (The tendency since these words were written 22 years ago has been to discredit contact torpedoes) In decideing which of the three will do most injury to the enemy, we must consider

that injury:	lst	as to	certainty
	2nd	as to	character
	3rd	as to	extent
	4th	as to	frequency
	(**) I		

5th from what distance (range)

Though I have enumerated frequency separate from certainty I incline to think it an element of certainty, for the more often you use your weapon, the greater the possibility of its taking effect. It enters however as an element both into the character and extent, and so may properly be separately mentioned.

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The gun can be used more frequently, and it can be used efficaciously at a much greater distance, than the torpedo. Taking the extreme case of a vessel having torpedoes only, and one having guns only, the relative advantage is seen at once. On the other hand it may be said that within its range the auto-mobile torpedo is not so liable to lose its effect by a glancing blow. An attack made by several torpedo boats on one cruiser or iron-clad should doubtless be effective, one of them should succeed with absolute certainty in inflicting a most serious injury, but it is not to be presumed that such a concentration will be permitted, (under the conditions to which my subject is limited, excludes attacks from ports i.e.) in the face of a fleet which must be assumed to have its own small cruisers, or whatever other means the nation whose flag it carries has provided against a perfectly well known mode of attack. The first phase of this subject assumes fleets in presence practically equal; else one will fly. Concentration undoubtedly will be attempted, for concentration is the essence of scientific warfare; but in order to obtain it by our party we are not authorized to assume apathy or folly on the other. Such an advantage, 1.e. of several torpedo boats concentrated on one ship, if obtained in the face of both fleets, is not to be considered as an advantage inherent in

the weapon, but as due to the superior tactics, skill or fortune of one side.

The accuracy of a projectile in actual use depends upon several important factors.

lst. There is the maximum accuracy : or practical accuracy attained under the most favorable conditions in the hands of experts - (on the range ground)

2nd. The standard of accuracy thus fixed is subject as we all know to painfully large reductions under the inevitable difficulties of actual service at sea and in battle.

the gun labors under the difficulties of an unsteady platform, and probably rapidly shifting target, the principle difficulty being due to the former (unstead iness) which causes large vertical errors in the trajectory.

In the particular of rapid shifting the target is the same as for the gun, for the ram and torpedo, but there is nothing in them corresponding to the vertical errors due to unsteady platform. The auto-mobile torpedo, when it has settled down to its flight, mai maintains a practically flat trajectory; the trajectory of the ram regarded as a missile corresponds always with the surface of the ocean.

The case is reversed when we come to lateral errors. The highest speed as yet claimed even in idea (within my knowledge) for

the torpedo is 25 knots which equals 42 feet per second. The muzzle velocity of the gun may be conceded as 1800 to 2000 feet. A range of 1000 yards will be crossed with this velocity inside of two seconds in which time no large ship can move her own length across the line of fire.

As for the difficulty of hitting a ship which possesses equal speed with one's own, a telling reference may perhaps be made to a professional audience to the difficulty experienced at times by new hands in picking up a floating target moved by the wind and sea. We are all inexperienced in the handling of rams.

The lateral errors so far considered are those due to the moving of the target for which it may be claimed that allowances can be made on the sight bars by sliding scales or otherwise. I shall concede the claim partially, alluding only to the confusion incident to frequent changes by which alone such corrections can be maintained.

There is another source of lateral error due to the medium through which the projectile moves in the one case through the air, in the other water.

The currents of air to which a projectile is exposed, differ not only from day to day, but in an action they will be continually changed relatively to the line of flight, according as the positions of the combatants change.

The water through which a torpedo moves at the depth to which it is set should ordinarily be quiet and currentless. If in a tideway,or other current,both projectile and target will be equally affected, and no error ensue.

To such sources of error as do obtain, however, the torpedo opposes a comparatively low momentum, due to its low speed, and the same slowness exposes it longer to the action of deflecting causes.

Another element affecting certainty of inflicting injury is found in the facility of taking up a position from which you can or fire at all with advantage.

To take up such a position, there is needed not only range of projectile which, by enlarging the area of action, increases the facility of choosing a position; there is also needed such disposition of the weapons in the ship as enables them to be discharged without undue reference to the way she heads. This comes under the head of Installation.

With the gun we have now secured "all round" fire and that for a respectable proportion of the entire battery. The torpedo as y yet is less fortunate; both beam and stern fire for it are encompassed with difficulties not yet wholly overcome, and there is for them under all circumstances of installation considerable dead angle.

The inferiority of the ram to the gun in this respect is evi-

dent. Not only is her target one that moves rapidly but there is alos only one spot in the field of battle where the ramming ship can be to act efficiently, and that is precisely the point where her adversary is; and there only open bearings of the keel which are efficacious and that is directly towards the enemy, within a limited angle of impact.

This facility for firing is undoubtedly an element of accuracy though it affects of course the frequency of firing as well. In fact the division which I have indicated under heads, though convenient if not necessary to a logical discussion, does not obtain rigidly in practise, the different elements crossing and affecting one another.

My own conclusions are that the gun is superior in accuracy of result, due to the greater number of positions of the ship from which it can be efficiently used; and to the greater velocity of the projectile by which its momentum is greatly increased, so rendering it less liable to deflection, and the time during which it is exposed to deflecting influences is minimized.

The torpedo boat or cruiser bringing up its torpedo alongside therefore may in my opinion be put in the same category as the ram in the point of <u>certainty</u>. Now the ram has but one blow; if it extricates itself uninjured it will begin again and have another; but as regards any moment of the action it may be regarded as hav-

ing one blow in its pocket, and it is not likely that it can make many thrusts good or bad in any one battle, without serious injury to its prow.

Upon the whole I conclude that for range and certainty of execution, including in the latter the possibilities due to frequent repetition, the gun has decided advantage over the torpedo and the ram.

I would here venture on a parallel; for a parallel is sometimes useful in developing a thought. The auto-mobile torpedo in its present state of development has some resemblance to the carronade in shortness of range and smashing effect. When the carronade first appeared it seemed about to revolutionize naval war, and it did seriously modify it. A navy that had a large proportion of carronades had to seek close quarters.

As between the torpedo cruiser and the ram, both of which are designed to act at close quarters, or nearly in contact, the torpedo will have more blows in its hand and should not run the same risk of injury from the use of its own weapon; but I incline to think the the ram more certain of execution.

So much for the certainty of doing some injury. Now for the character of the injury done. The modern gun aims at penetration; for the moment crushing or smashing effect is laid aside by those who are directing modern armaments. The parts of the enemy's ship

open to the shot from the gun, are wholly above the water line, except those, which though usually submerged, may be temporarily exposed by the movement of the sea, or by injuries on one side admitting water, and such cannot be looked upon as normally part of the target for the gun; moreover these, as well as all other parts of the hull, near the water line, are heavily clad. When you add to these considerations the fact, that vessels for many reasons will probably prefer to bring the bow and not the broadside to bear on the enemy, and that the shape of the bow greatly favors the glancing of a shot, the chances of penetrating the hull near the water line are seen to be very small, until within, or at any rate not far without the torpedo range. If this last assertion is valid, the question may be raised whether it is well wholly to abandon the hope of racking with the gun. To debate such a question is hardly within my present province which is to reason upon facts as they now actually are; but it is certainly not amiss to point out that racking is now committed to the torpedo had the ram and attempted under water only, while the gun is confined to penetration. Now penetration means comparatively small injury to the hull, much injury to the inside; and then chiefly to the personnel.

Above the armored belt, the target for the gun is larger and fairer. Under its least favorable presentation, i.e., end on, it may be taken as being in length equal to the beam of the ship, with a

height of, say, 12 feet, to which may be added. How squarely this may be presented to the enemy will depend upon the class of the ship; a thwartship bulkhead would be most favorable, with a circular turret ; about half the shots that strike at all will be at or within an angle of 30 to 45 degrees from the perpendicular.

Such is not the most promising target in the world but a good shot, under moderate conditions of wind and sea which will generally be found in fleet fights; with clear weather; and with the modern gun of flat trajectory lying fore andaft would probably be able to hit it somewhere, two times out of four, at a distance of 2000 yards Of these half will strike so as to penetrate up to a greater or les less proportion of their absolute penetrative power.

The injuty done by projectiles penetrating will mainly be confined to the personnel or the battery, the chances of a shot disabling the motive power of a well protected ship are too slight to be considered. How great the injury to the fighting power of the ship of one or more successful shots will vary greatly. An English admiral says that no fight will be left in the men among whom a shell loaded with 37 pounds of powder has burst, and he is probably right. A one turreted ship under the supposition would be wholly disabled, unless she had a full relief crew for the guns. A ship receiving a heavy shell full on the pilot house, a perfectly possible chance, would be runned for the moment; she would have literal-

ly lost her head, and would be helpless till a new commander had control both of the ship and the situation.

The character of the injury done by the gun then is to the personnel principally, the battery possibly in case a shell do not explode. In the old sea fights when penetration was effected the damage was mainly to the personnel. A ship was rarely sunk by the enemy's fire, rarely incapacitated by injuries to the hull. The determining injuries were those to the ship's company and to the masts. Incidentally damage must be done to parts of the hull, but with high velocities, the structure will not have time to resist other than locally and is likely to receive only than local harm. In the case however of revolving turrets, which cannot call upon the whole frame of the ship for support, there may well be sufficient displacement or disarrangement to disable them for the rest of the action. I remember reading some years ago, that the force o of impact of one of the Duilio's shot was sufficient to lift the turret in which it was, as high as the main top. If the calculation was correct it introduces an element of very serious injury which I have not claimed for the gun. How that force would be taken up is an intricate question, upon the solution of which would depend the character of the injury done and its extent as regards the life of the ship.

For obviously the ship, as a person, can receive a very extensive

wound which is still of vastly less consequence than one much smaller, but of a different kind or in a different place. A small hole under water is much more dangerous than a big one well above.

And this remark leads naturally to considering the character of the injury done by the ram and the torpedo.

The two have this in common: that the injury done by each is mainly below water. In other respects they differ.

The effect produced by the ram is that of the impact of a large body moving slowly, and its blow, however instantaneous in appearance is really progressive in character. When specially fitted with the spur there will be penetration first, followed by pressure of the whole weight of one ship ggainst the side of the other; the result depending upon the strength of the latter. For if it resist successfully i.e. if the side is not driven bodily in, or torn away (Harrington), the injury though serious in its nature will not be comparatively extensive; penetration will have been easy and circumscribed. If on the other hand the side yield, if plates are displaced and frames give, the danger is evidently greater.

The shock of the torpedo is instantaneous. There is here no question of velocity. However the torpedo gets in place, if it explode, its effect is the same; and with dynamite is literally instantaneous. It can with the auto-mobile be delivered farther under water than the ram and for the same size the hole is propor-

tionally more dangerous, while from the amount of the charge carried, a successfully exploded torpedo is likely to be far more destructive than the ram.

Whatever proportion of the effect reaches any part of the ship, exerts its power without there being any time for the parts to accommodate themselves. The only question for any part reached is how much of the strain has been taken up in doing other damage. All this is opposite to and worse than the blow of the ram, which allows any elasticity in the hull, time to work. Moreover, if the torpedo is planted well under the bottom, the water, which can yield only in the direction of the air, will yield very little and the hull will receive the full injury of the charge.

The effect of a torpedo not auto-mobile, forced up against a ship's side, is similar; but from a torpedo boat or cruiser, or towed in the open sea could scarcely be carried so low and would proportionally lose in effect.

There seems therefore no avoiding the conclusion that granting the blow has been fairly delivered in both cases, i.e. granting equal "certainty", the injurious effect of the torpedo must be expected to be much greater than that of the ram. The general character of the injury is the same in both, that is: it is done to the hull of the ship and below the water line, whereas that done by the gun is above the water line and mainly to the personnel and the battery.

The former attacks the life of the ship, her power of keeping above water; the latter attacks her fighting power (but in one element only) the injury being mainly confined to the personnel.

The life involves the fighting power, and if lost carries it down with it; but equally a ship of war has lost her life when she has lost her fighting power. It is told of Admiral Pellew that when his bhip was in danger of foundering he refused to throw the battery overboard, looking upon the ship as worthless without her guns.

However it may be from the point of humanity, there can be no question from the military point of view. A ship which has lost her guns, has lost her power of offense beyond the range of her torpedces, which as yet is, and probably always will be, much more circumscribed than that of guns. She is at the mercy of any vessel of equal speed with one efficient gun remaining.

The ram and the torpedo must therefore remain under one great disadvantage when compared with the gun, they are essentially short range weapons. To this must probably be added a much inferior oractical "certainty" or accuracy, owing both to intrinsic difficulty in handling, and much smaller frequency.

In estimating the character and extent of the injury inflicted both by the ram and torpedo it must be remembered that the vulnerability of the target against which they are directed is not the

same everywhere. We can no more count upon lodging a torpedo under the great central compartments, than we count upon every shot that hits at all hitting squarely. The same is true of the ram. To this uncertainty of hitting is to be added another arising from the numerous expedients in construction designed to baffle the effect of the blow of the torpedo or ram when successfully delivered, the greater or less penetrability, if I may use the word, of the submerged target that a ship presents. In the question of armor and guns we have a large series of experiments upon single plates, under different guns, from which we may draw approximate conclusions as to what may be expected under certain conditions. With regard to the ram the casualties of the sea supply from time to time impressive lessons as to its power; but on the whole the result is, in my mind adverse to the belief that a small thrust of a ram is likely to be fatal. The accident to the Arizona running into an iceberg some years back, the result of the collision of the Oregon still recent. seem pretty fair tests of this. In the latter case more particularly the blow was probably delivered by a very heavy vessel, considering the load, in a singularly vital point, and to a ship certainly not prepared as a ship of the line will henceforth be prepared to resist ramming; yet the ship was long kept, or rather remained afloat. With regard to the torpedo, I am not aware of any conclusive experiments. It may probably be assumed that be-

yond the limits occupied by the engines, a single torpedo will not cause a ship to sink; (under the central compartments?)

All the same however, a ship cannot receive such an injury in any part of her body and remain, for the time as efficient as she was before. Her speed, and possibly her hand mess, can hardly fail to be affected, even if no worse come of it. Will she be a ship sunk, or will she be as a ship of olden days who has lost her topmasts? or again will she be as one who has lost all her lowermasts? a more, or less, crippled ship - no longer able to follow the movements of the fleet, perhaps unable to keep up with a retreat, a burden and not a source of help to the Admiral. Crippled ships, and the unwillingness to sacrifice them, have brought on many sea fights and caused the failure of great enterprises; a very conspicuous instance being Rodney's victory over DeGrasse; a collision between two French ships here probably saved Jamaica to the English. In Lord Howe's action with the French on May 31st.1794, the effort of the latt r to rescue crippled ships lost them the weather gage, and enabled the English to bring on the decisive action of the next day. (Tourville at La Hague)

I have now presented to you the various considerations that have passed through my own mind affecting the actual and relative efficiency of these three arms under the heads proposed, viz: 1st. the certainty of attaining their object, or accuracy of aim; 2nd.

the character and 3d.the extent of the injury inflicted; 4th, though rather incidentally, the frequency of delivering the blow which affects both the certainty and the extent of the injuries inflicted; 5th, the distance at which they each can be used, in other words the range.

Upon these considerations and such others as may come into your own minds, you must form your own conclusions. Mine is that the gun is superior in certainty and frequency, as it undoubtedly is in range; that it is inferior in the character and extent of the single or individual injury inflicted, to the torpedo and probably to the ram; but that in actions between fleets, assumed to be practically equal, this inferiority is more than compensated for by its range and accuracy, and that it must under present conditions remain the chief weapon, and the vessels carrying it the backbone, of the deep sea fleet.

This conclusion I have thought worth working out for myself. Practically, whatever the relative stress laid upon either weapon by this or that person, the common sense of all services has decided that those ships which may suggestively be called line of battle ships, however different in type they are from the picture that word brings up, must have all three arms. The same common sense, or logic of experience, has decided that the ship shall be protected against the gun by armor of iron or steel, covering the vital parts

i.e.battery, motive and directing power, wherever exposed, above the water, whether that exposure be constant or only occasional; and against the torpedo or ram by a system of minute internal subdivision, which shall as far as possible confine the entrance of water to the region immediately perforated by either weapon, also other palliations.

The modern line of battle ship, the mainstay of the fleet, that which gives to it solidity and momentum, is therefore a heavy ship, carrying two batteries; one long range above water, the other of short range but below the surface; and provided with a ram that can be only used in collision, however its use may have been manoeuvred for at a distance. As well as its predecessor of 80 years ago it has its long guns, its short guns and its boarding weapons. (Quote Peter Simple as to running aboard and carrying away a jibbeem and foretopmast.) This ship is primarily meant to work in co-operation with other ships and will only accidentally, and for a time be found alone, bearing on Harrington's problem. Its great size, weight and extensive provision for offense and defense indicate that it is meant for the days when great stakes are to be played for; the fate of a war, or a nation, perhaps to be decided. Its size and cost are unnecessary for minor issues, and too much of the nation's wealth and power are involved in one to be risked for a trifle. There must be smaller and lighter vessels for other

uses. The question will come up whether these can be used in fleet actions to advantage; whether from any point of view, or in any combination, they can be thrown against the heavier ships of an enemy's line (Single Type if possible)

The first consideration that strikes one is that these line-ofbattle ships, whatever speed they may individually have, can but rarely and for short periods put forth that full speed when acting in concert. Not only is the speed of a fleet that of its slowest ships, but there must be a certain reserve of speed to enable irregularities of position to be corrected. (Jouett's statement.) The difficulty also of maintaining any order increases rapidly as high rates of speed are attained; and although a high maximum of fleet speed may be reached by constant practice, yet such constant, or even frequent practice, will perhaps not be had under the expense and difficulty of maintaining the coal supply. The speed of some of the great new ironclads is given as 16 knots; but it may well be questioned whether ten of them could stand down upon an enemy and maintain any given order at a rate exceeding twelve knots. (Jomini cavalry p.306; also difficulty of line abreast - Suffren &c.) Yet it must certainly be feasible to put afloat vessels that will steam 18 knots in any weather in which a fleet can steam twelve, or in which fleets will be likely to engage.

Again: an attack made upon another fleet, in whatever order

drawn up, whether awaiting attack or standing down to meet it, must be made partially on its front, and if partially outflanked the flank will not be found wholly without torpedo defense. For 500 yards, the range of the Whitehead, in every direction the torpedo must be feared, and in case of the pursuit of a retiring fleet probably contact torpedoes must be looked for. Will not prudence dictate that this space should first be crossed by vessels capable of much greater speed in smaller groups, and the crippling of which will be of less consequence than that of a line of battle ship. Besides these smaller ships can inflict as much damage with the torpedo; and as certain, though doubtless less extensive, damage with the ram, as the more bulky. (This paragraph is very obscure and should be re-written. The gist of it is that the approach within torpedo range should when possible be given to rams &c. A.T.M.)

Again look-out vessels are imperative for a fleet and they must be sufficiently numerous to spread over a large area ahead and on either side, perhaps also astern of the fleet. It would not be tee much perhaps to say that in some directions the line should be double. The number should be sufficient to allow of despatching in search of distant information of the frigate fulfilled all these purposes and that of the cruiser and commerce destroyer as well; not much faster than the normal ship of the line, unless in light

airs, she was handier and at all events could be spared in case of a foe turning up unexpectedly, while the heavier ship could not. Whether the ordinary cruiser be attached to the modern fleet, or whether a special ship be built for the purpose, swift look-out sh ships are of the first importance. Accurate and speedy information is always of the first importance in war, on sea or land. The most conspicuous example of this necessity yielded by naval history is that of Lord Nelson before the battle of the Nile. (Such illustrations taken from history are valuable!) He had first been sent with three ships of the line and some frigates to watch Toulon when Bonaparte's expedition was preparing, with a destination wholly unknown to the English. While on this station he met with a violent gale in which his flag ship was dismasted, and nearly lost, and the squadron dispersed. The senior captain of the frigates reasoned that Nelson would have borne up for Gibraltar and accordingly went thither to seek him. Meanwhile Nelson, having refitted was joined by a detachment of ten ships of the line more, but with no other frigates and so started in pursuit of the French, whom he had reason to believe had gone to Egypt. He did not dare to detach any of the large ships to any great distance, lest he should fall in with the enemy in their absence; he had no frigates; and so though he spread as broad a clue as he could and still keep his ships within call, he actually passed on beyond the great French fleet of over

a hundred sail in that narrow sea, reached Alexandria before it, and beat back up the Mediterranean to Sicily, again, without seeing it. There is curious room for speculation as to what the result would have been to the fortunes of Napoleon had Nelson then had the frigates, the want of which he declared was graven on his heart. The result to Nelson nearly was the ruin of his career so great was the popular clamour. He would have been lost had they had telegrams in those days.

Doubtless it is not necessary to appeal to so signal an example to convince military men of the necessity of an efficient putpost and detached service, but the question awaits us in this day, shall the vessels for it be a class by themselves, mere dispatch vessels; shall they be ordinary cruisers detailed for the occasion, or shall they be vessels capable of taking a part, and a necessary, perhaps even decisive part on occasion. Shall the theoretically perfect fleet comprise only ships having chiefly their weight and solidity, or shall it also have those whose strength shall be in their speed and mobility? The old frigate had no aggressive part in the old fleet fight. To repeat signals; to take in tow disabled ships; at one short period to embark the commander-in-chief who was to direct his fleet from a central position better fitted for seeing, such were its principal functions. They did not even fight among themselves in fleet actions, and it is said to have been a

part of the courtesy of the sea for ships of the line not to fire upon them, unless they made themselves obnoxious.

The decision of the question raised will depend upon the part which may be proposed to assign to such swift and mobile vessels. Granted that you have them, what duty can be given them? what work can they do that cannot be quite as well done by the ship of the line proper. If there be such a duty, and if by their doing it the more important vessels will be economized, there can be no doubt that such vessels will be useful and in fact indispensable to the theoretical efficiency (practical completeness) of the fleet.

Let us suppose two fleets of equal numbers say twelve (12) lin line of battle ships in presence of each other and intending to fight. The object of each will be to come into battle with some advantage already gained over its opponent at the moment of close (decisive) action. This advantage must have been gained either by manoeuvring, or by some injury previously inflicted upon the enemy, by which the efficiency of some of his ships has been diminsished. I leave out of consideration the chance of disability developing in the enemy's line by accidents, as belonging to the category of those chances which though they must be allowed for, cannot be counted upon in war.

Advantages to be gained by manoeuvring simply, I lay to one side for the moment; they are not of decisive consequence to the

question immediately before us. In what ways may injury be inflict ed before the close contact of main bodies of the two fleets?

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In the first place from a distance most obviously there is the artillery fire, as to which the effort must be to bring into action as many of your best guns as you can, without taking up a vicious formation for your fleet. In the second place there may be the opportunity of a sudden blow, depending for its success upon celerity and unexpectedness, with the torpedo or the man at close quarters (Jomini cavalry P.306) It might be, probably would be, most imprudent to hazard any of the ships of the line in such an attack; in which the risks are great and in which regularity of order must yield to rapidity of onslaught.

(Diagram) As an example of what I mean let us suppose that by your fire, concentrated by signal or previous instruction mainly upon them, you have seriously injured the third and fourth ships from one of the enemy's flanks; exactly the nature of the injury you may not know, but there is evident confusion in them. The two flanking ships are thereby separated from the body of their fleet, not only by the interval but, by the interposition of these crippled vessels. Not only does the injured fleet labor under these physical disadvantages, but there concurs with them that most inestimable of the chances offered by war to an assailant, the few moments of uncertainty and paralysis which follow immediately upon a sudden mishap during which the assailed dont know just what to do. The supposed very swift rams or torpedo vessels could cross the interval with a speed unattainable by the ship of the line, thus best seizing the flitting moments; they could **returniwi**th equal speed if balked; they could when so returning, follow a route which would interpose an unwarrantable gap in the line of heavy ships, if such had been employed. The movement as described need by no means be isolated; on the contrary it would evidently be the game of the uncrippled fleet to stand down at once upon the eight remaining ships, in such wise as to separate them from those on the crippled wing, while the lighter vessels occupied and perhaps despatched the latter.

Whether such an attack could be made upon any position of an uncrippled line may be doubtful, though I think it could not be pronounced hopeless. Unless the fleet attacked should reserve its fire with very great coolness until the rams wereclose aboard, the great prependerance of chances are that vessels steaming in groups of three or four, and not hampered in their speed by the demands of order, would cross the interval without serious injury. (Jomini Cavalry P.306). The Board upon Harbor Defenses assumes as certain in its report that a fleet of vessels can pass any fortifications if the channel be unobstructed; that is that projectiles wont stop them and I apprehend the remark will be found generally true of underwater projectiles as well; and if ships can pass guns on

on steady platforms, a fortiori pass them when mounted on shipboard

Even if not carried into effect, as a demonstration made up on the flank, or looking toward the rear of a flank, such a use of rams or torpedo vessels might well have a very distracting effect upon the enemy. His ships of the line could not be directed to their attack, nor under the suppositions catch them if they were.

All such operations are of course subsidiary ton their general character, and though they may be of capital importance in a particular instance. The rami and the torpedo 1 consider, as I have already said, inferior weapons to the gun.

But I think it can be laid down with great positiveness, as a 1 rule almost never to be departed from, that the ships of the line must not be separated from one another by intervals that will give a chance for an enemy to push between; yet that such work as 1 have indicated should be done, and that there should therefore be special vessels to do it.

As to the character of those vessels we have these considerations: There is wanted first great speed and second to act closes to the enemy; these are their main characteristics. They will have therefore the ram and the torpedo, close quarter weapons, for their particular offensive work; and the gun becomes then to them a secondary weapon. It follows that the gun need not be protected and to save weight any battery they carry should be unarmored. In making a dash, the guns crews should be withdrawn below, and the captains' attention wholly fixed upon collision. This ship de-

pends upon her legs and eyes; and I should be inclined, besides a specially thich armor on the pilot house, to further protect it by a semicircular breastwork from either beam round by the bows, so as to put the life of the captain beyond all peradventure. The engines must likewise be protected, but not extraordinarily; beyond this I would trust for defensive safety to speed and to making the target as small as possible. For the latter object if meant only to work with the fleet, I might be willing to sispense with the guns (Query would not their guns be a useful addition to the artillery fire?) but when detached they must be able to cope with cruisers of equal size. The use of vessels of this class in keeping on the heels of a retreating fleet embarrassed with crippled ships, in following the latter if they attempt to separate from the main body is obvious. (They would resemble modern cavalry which is now dismounted and fought as Infantry when an opportunity of ers fers.) The condition of exceptionally high speed carries with it the necessity of size sufficient to maintain their relative advantages in that respect in moderately rough weather.

I should favor therefore two principal classes of vessels for the fleet. One forming the chief reliance, the heavy armored ship, with the gun its main weapon of offense, and relying on its ram and torpedoes as secondary; the other smaller, armored only so as to protect the motive and directing power, expecting to act chiefly at close quarters, the ram and the torpedo forming the main weapons, the gun secondary. Speed is a prime requisite to both classes,

but the latter to have it in excess.

(A comparatively new class of vessel is now being developed represented by the English Polyphemus and the French torpedo-ramcruiser Tage. The latter is 390 ft.long: 52 ft.beam,7,045 tons displacement,mean draft of 23 ft. 10380 horse power, and intended o to steam 19 knots. Has armor plated decks, battery bulkheads and armor belt.

The Spanish government has contracted with Messrs.Yarrow & Co for two first class torpedo boats of the Falke type - speed at deepload line 23 knots. Running light 25 knots - the highest speed yet contracted for. S.B.L.)

Granting that both classes of vessels be required, can any relative proportions be established as representing a probable maximum of efficiency?

Let us take the number of twelve ships of the line as a basis, how many close action ships should be assigned to such a fleet?

There does not seem any function of caring for the ships of t the line,aiding or protecting them in any way, except from vessels of the ram class, which could guide us as to the proportions. The probable number wanted must be sought in the ranks of the enemy rather than in our own, with a margin for detachments.

We may assume that the fleet will not come to an open issue with one much superior to itself in numbers. We may therefore assume the opposing fleet to have about the same number, possibly

two more or two less, but we will say the same, viz: twelve.

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It is evident that not less than two rams can attack a ship of the line and three would probably be a better number for a wholly, isolated ship. Take however the case, supposed above, of two flank ships separated from the main body; it is likely that not more t than two rams could attack each, for they, the two isolated ironclads, ought to be in supporting distance and their inner flanks so protected. Again, suppose a ram attack to be made upon a line, or battle order of the enemy, not yet broken by artillery or other causes, such attack must be made upon a limited portion of that line, while the artillery engages the remainder. How large a portion can be so attacked to advantage? I suppose we may say that an admiral would think he had made the very best disposition if he succeeded in attacking with his twelve line of battle ships, from one half to two thirds of the enemy's fleet - say from o to 8 ships. In a preliminary attack by rams, supported or not, 1 should say 4 at the most, probably not more than three, of the enemy's line would be aimed at. These would call for not less than . six rams, eight would be much better and should be the number fixed This number has reference only to the moment of action; if it be contemplated to employ the ram class of ships for detached duty, ct. out of reach of recall when battle is imminent, the numbers must be proportionally increased.

In the two classes of vessels I have looked only at those

which will be able to maintain their relative speed, and be handle with certainty, in all kinds of weather in which a decisive fleet action is likely or possible to occur; say up to a single or court double reefed topsail breeze, such will undoubtedly be and continue the principal factors in all naval tactics. A large vessel always has had, and always will have, the superiority over numerous small vessels, because the former is power concentrated (in the hands of one man) the latter is power diffused. Near a hostile coast, under favorable circumstances, a large ship may be overwhelmed by an immense preponderance of numbers, just as frigates in rare instances have been beaten down, when becalmed, by a multitude of funboats; or as large corvettes at anchor and carelessly handled watched have been cut out by a multitude of armed cutters; but vessels thus taken have usually been paid for more dearly, in lives at least, than when captured in a more usual manner. Still the clouds and swarms of torpedo boats (and torpedo cruisers), as it is common to speak of them must be considered. It will be remembered that we are dealing with deep sea fighting, between fleets that are cut loose from their home ports and harbor resources.

HERE I DISCUSS <u>SMALL</u> TORPEDO BOATS IN COMPARISON WITH HEAVY TORPEDO-RAMS.

The torpedo cruiser, being a sea going vessel, I need not further consider. If not in detail, in general principle, it is the same as the ram I have advocated, possessing very great speed and operat-
ing at close quarters. I should fear for it a loss of speed in fresh wind and sea from insufficient bulk. A combination of larger and smaller rams <u>might</u> offer equal advantages with increase of economy.

(The English Hecla" - Torpedo depot ship, carries 6 or 8 torpedo boats, in cranes, somewhat similar in manner to the way a Whaler carries her boats. Attached to a fleet the "Hecla" could drop these swift torpedo boats (steam up) as needed. S.B.L.)

I labor here under the grave disadvantage of not being acquainted with the details of the methods by which torpedo boats are to be got into the water, nor of knewing what success has attended the practical working of these methods at sea. It seems to me however, that it should not be at all impracticable, nor even very hard, to put these boats into the water in any weather in which they can be usefully handled. I should feel however, very doubtful about getting them out of downwauccessfully in the heat of action, and very particularly doubtful of getting them out quickly enough to seize one of the flitting chances of battle.

With favorable weather it seems to me the little brood of torpedo boats must be got out as one of the preparations for action, and it may be remembered-remarked in passing that the care of them after action may very well hamper a fleet and prevent a victory from being followed up. While the battle rages, the small fry may be left to sink or swim as best they can; but when victory has de-

cided, the victors cannot leave them to their fate; the vanquished can.

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When they are down, what part are they to play? what particular sphere is to be asigned to them? Are they first to open the attack or second to hover on the skirts of the battle watching their chance to pene rate with their small and hardy dimensions; or third when certain results more or less decisive, have obtained, more particularly the crippling of some ships, are they to give the coup de grace? as the French valets used to kill the horseman their master had dismounted.

The torpedo boat must come very near its target. If experiency should justify its use in the open sea, ships of all nations will be alike supplied with them. Precisely where they will be placed in the order of battle need not here be discussed; the first question is where, how and with what chances of success they can attack the enemy's line.

In the first place I suppose we may say they will not attack the whole of it, but will concentrate, hoping to reach their aim unhindered by the enemy's boats. So far as opposition by their equi equals, other torpedo boats, the chances are neither worse nor better than in the case of any other equals contending. Compared with the class of large Rams, they are smaller undoubtedly, as targets, and the speed may be considered as the same.

Nevertheless I think, despite their greater numbers, that the

chances are decidedly against them as compared with the Ram. I' Though harder to hit, their motive and directing power, 1.e. their engines and their captain, are vulnerable to a score of projectiles where the ram is open to one. In addition they are weak in the best means of defense, offensive power. Put aside their torpedo, efficient only in contact, and what have they to use against their gigantic opponents?

The fleet attacked will doubtless be arranged with a view to minimize its openness to attack, and to concentrate its machine guns on the front or flank attacked. Intervals will be closed as much as possible and covered by a second indented line forming narrow cul de sacs, lined on both sides and at the end withinto which it would be heroism run mad to penetrate. When it is remembered too that not the full number of boats is making the attack, but only the margin over and above those which have been thwarted or overpowered by the boats of the assailed fleet that can attack, I think it must be felt that a direct attack of the kind does not promise well.

Having discussed attack by small torpedo <u>boats</u> before battle joins, I now take up what they may do in the heat of action.

As the Combat deepens

2nd. When the heat of the battle is established, when smoke and confusion have brought about a certain degree of that obscurity, which is the proper field of the torpedo boats activity, there

will be a much better chance of using them with success. The torpedo boat is a child of darkness, and the more conditions resemple its native element, the more success it can hope for. Nevertheless the conditions of action however close, will be far less favorable than those of night; in truth they will be much more like those attendant upon the open attack which we have just considered. The ships which they are to attack will be fully on their guard, and we may assume as certain that the crews of the machine and light guns, will need no stimulant to keep a look-out for their little enemy; there will be no waiting to see if an attack is meant on the particular ship, but the little ones will be shot at on sight whenever a glimpse is caught of them. (Danger from their own fleet. Whiting at Mobile. Mast troops at Trafalgar) It must always be kept in mind likewise that they will have their own kind to contend with in the enemy's ranks.

Take such an attack as that which I have imagined, upon a flank by Rams. There if ever would be a field for the Torpedo boats of the assailed fleet; but equally of course the assilants would cover the movement with their own boats, which would keep under the lee of the Rams till called to meet their kind.

What exactly close action may mean in the future is open to doubt. There will not probably be any great obscurity when more than a thousand yards separate the fleets. Within that distance,, whatever the nature of the attack or defense, it is not likely that

ships will remain in such nearness, or in such a melee, as to greatly hamper their power of manoeuvring. When ramming or rammed, at the moment of collision and until way is again gained, a ship will be more or less helpless; and other moments of embarrassment will occur. In such a torpedo boat, large or small, certainly will find a good chance, and the samller will be the more handy; it will also be the more easily sunk.

It will be conceded then, under the second possible sphere of action for torpedo boats, that the chances in their favor increase with obscurity and with the intricacy of the positions of one or both fleets, or of the individual ships. This brings to the third case:

3rd. WHEN-AND - AB - and - and

risky to the boats than it would be to the class of vessels I have called Rams; even though the main battery remain uninjured, to be fired against the Rams.

In truth the torpedo boat, being wholly vulnerable, depends for its escape from harm ont not being seen or at least not steadily kept in sight. The Ram on the contrary, depends upon the difficulty of hitting a small mark; which, moreover, is as nearly as possible impenetrable. She may be struck here, there and elsewhere without harm, provided only the engines are untouched and the Commander's senses not knocked out of him. The ideal attack of the Torpedo Boat is by night, unseen at all till close by, and then elusively by the glare of the electric light, which makes the outer darkness blacker than night itself. It is aided by the distraction caused by numbers. An attack of this kind is very feasible from a port, for suitable weather can be chosen, and the attack made in great numbers. Will you say that such a night attack might be made by one of two hostile fleets at sea? Possibly; on a dark quiet night such an undertaking, however desperate, will have to be guarded against. The difference between this contingency and the conditions of lying off a hostile port, is that in the latter case it is supposable that a great prependerance of boats may be brought against you; a supposition excluded by our problem, which deals with the encounter of nearly equal fleets.

In case of an attack by daylight, the torpedo Boat surrenders

the main element of its defense as distinguished from the Ram, viz: its invisibility. It keeps its speed which the Ram also has, and the smallness of the target it presents; but this smallness as compared to the Ram's, and with reference to the number of missiles directed against either, disappears. It is absolute, not relative, smallness. For one shot that can hurt the Ram, as I have said before, a score can be directed at the Boat. Further, the necessary multiplication of Boats increases the size of the target. Firing at a Ram is like firing with a non-repeating rifle at a bird in rapid flight; firing at a swarm of Torpedo Boats by daylight will be like firing small shot at a flock of reed birds.

My own judgment it will be seen, is adverse to the utility of the Torpedo <u>Boat</u> as a weapon in the open sea. Nevertheless i know that only experience can dispel the illusion, if it be one. The idea of disposing of a huge iron-clad, costing millions, by means of a torpedo costing a few hundred dollars, placed by a boat costing a few thousands, has the fascination which cheap bargains always have had in the eyes of mankind; we have all felt it. There is however little reason to doubt that the experience we have yet to gain in this will be like the experience the world has always had heretofore: that up to a certain point size, and with size concentration of power offensive and defensive, will have the advantage over the same power diffused in small bodies. In the days of sailing ships, which have made nearly all naval history so far, the

74 and 80 gun ship was found to be the , though larger ships powerfully re-enforced portions of the line. Vessels of smaller calibre were gradually driven out of the line by the teaching of experience. French and Spanish ports swarmed with gunboats in the wars of the French Revolution; but what did they ever accomplish What did our own gunboat policy result in? For the first half or more of the last century, France del iberately adopted the policy of small cruisers, with the result of filling English prisons with French seamen and abandoning the Empire of the seas. Finally to take the weapon that most nearly foreshadowed, by the terror to which it gave rise, our modern torpedo, the fire ship with all its fearful accompaniments; the fireship of which, in the days of Pepys.men spoke as destined to rule the sea, gradually dropped out of use, not from any scruples of humanity, but because it was not found efficient. Two hundred years ago, and for some time, the fireship was a regular component of the fleet; there were cases of its successful use in action; but for the most part the blg ships were so successful in subduing them that they were discarded. It was in placing them that men failed; the problem of bedling the Cat is ever difficult.

No exception, however, can be taken to iron-clads carrying torpe do boats in proportion to their size. Whatever doubt may be felt as to their usefulness in fleet actions, there can be none as to that which they have in many other ways that may easily offer.

Until the question of their usefulness is decided in the negative it will also be necessary to consider their place and function in the order of battle.

I now come to my order of battle; but, before going on to discuss the orders of battle, let us recapitulate the various arms of the service which are to be stationed.

First: There is the large ir on-clad ship, pre-eminently of the line, which acts with others always; and which with its consorts form the body, the main strength, of any order. While fitted to fight both at long range and at close quarters, it will prefer the former when it can be maintained. I will fix, arbitrarily long range at sea as all over 1000 yards.

Second: There is the <u>large</u> iron-clad Ram; by which I mean those vessels which from exceptional speed, and smallness of target offered to shot, are peculiarly fitted for closing with an eneny, and and peculiarly able to retreat from such proximity unscathed. They are fitted with the Ram and Torpedo, and find their special sphere in close action. They are as the arms of the fleet, stretched out for a sudden blow and as suddenly withdrawn; or stretched out in advance of the body of the fleet when in pursuit., if they carry guns, it must be in such weight as not to interfere with ther their prime object; within that limit they might powerfully re-enforce the artillery of the fleet in an artillery duel. (I have a passion for classification and outline).

There may be a smaller vessel of the same general de-Third: scription, corresponding nearly in point of size to the Torpedo cruiser now advocated. The question between this and the second class is purely one of degree and detail, and may be thus stated: Wishing to have a sea-going vessel, smaller and less expensive than the iron-clad, which can deliver a blow at close quarters, with comparative certainty, what qualities do you want and how much size do you need? my reply, as you know, is, there is needed exceptional speed, protection to the engines and very special protection to the persons of those directing her movements; for if the captain is stunned, the intended stroke is probably lost. Now while comparatively small vessels, say 1500 tons, can obtain the speed in smooth water, will they be able to maintain it against a double reefed topsail breeze; and can they bear the necessary armor? Where shall the line be drawn. I incline to think the Ram should be of 3000 tons.

(Since writing this the discussion started by Admiral Simpson during Harrington's lectures as to the cepth of immersion of the ram in order to strike under the armor belt, has led me to increase my estimate of size to 4500. Iron-clads 6500. This is distinctly a distinct instance of tactical idea. On the other hand Gatewoods lectures take boldly the ground that side hull armor will be abandoned for inside protection in future battle ships.)

However the question is decided the duties of the two are so

similar that I shall treat of them all as Bams simply, and leave the size for future determination by experts.

Fourth: There is the Torpedo Boat - not sea going, and borne at the davits, in the cradles or within the ironclad ship.

These are the three types of vessels to be given their place in the Order of Battle.

The Order, or Orders, for Battle must lie at the basis of any system of Naval Tactics. All ord rs for sailing or steaming, to whatever other end they may conduce, must be set with reference to facility for passing quickly to the Order of Battle. The two kinds of orders, for marching and for fighting, with the manoeuvres for passing from one to the other, constitute Naval Tactics, in the general acceptation of the phrase.

An Order of Battle requires that the different arms, and the so individual vessels of each arm should be stationed that (Note that these principles run in couples)

First: Each vessel and the entire fleet may freely use its own offensive powers to the best advantage.

Second: That each vessel and the fleet in its entirety should present the smallest and least favorable target to the enemy's fire, or to attacks by ram and torped o.

Third: That each vessel in addition to its own passive power of resistance should be defended by the offensive action of the others upon assailants; which is what we mean by mutual support

among the vessels of the flect. (Recall here the two kinds of defense, passive and active).

Fourth: That entire or partial concentration by manoeuvring of any erm, or all arms, may be made with the greatest possible ease upon any part of the enemy's order; or conversely, upon any attack made by the enemy upon your own order. (This would seem to include, and so make unnecessary the separate mention of freedom for manoeuvring)

Fifth: That space given to facil state changes of formation, should not be so far extended as to allow an enemy to separate the parts of the fleet. This will assume considerable dimensions when we remember that there is to be guarded against not only the enemy passing through a particular formation, but cutting off a part of the fleet because in a particular manoeuvre it has so much ground to passover.

To give a special case: "Forward into columns from a flank ship", the greater the width of front, the further from the eneny's line must it be performed or the rear ship of the column will have the eneny upon it and its beam, before the order is complete.

In general, open order will require more time in simple orders but it will be necessary in complex orders. (I must look into the matter of time and space for making changes of direction by wheels.)

Sixth: That means should be taken to keep in hand a reserve

force, which should be so posted as to be carried to the support of any critical point, whether offensive or defensive, more easily than so a part of the main line could be carried.

Changes of formati on made in the near presence of the enemy are always critical; nevertheless it seems most probable that some such must be practised owing to the different kinds of arms employed and to the necessities of concentration at special moments. They should be as simple as possible; but it would generally be better to attempt concentration by manoeuvre, rather than at once throw in the reserve in order to bring a superior force on part of an enemy's line. The reserve shold be kept in hand, until the condition of the fight is such that, by bringing it into play, the scale will probably be turned finally in your favor; or of course until the converse is seen: that if you dont throw it in you will lose the day.

1.4:1: 400 14/ 400 290 1.4/200/1.4

16/2000 16/60 (3.75 48 37 120 410

1.1

12 knots 1 h per 3° min . 400 yds per m

24/60 (2/2

1 " per 6 min 10 kurts

In drawing up an order of Battle we will assume the fleet to have twelve ships of the line and eight Rams. (Each ship of the line will carry four torpedo Boats).

Of this total three ships of the line and two Rams will be kept as a reserve; leaving for the main Order of Battle nune of the line and six Rams.

The enemy, supposed to be of equal force, has been made out and the fleets have neared each other enough to allow the numbers and probable force of the individual ships to be made out, as well as the formation of each if any has been taken up. If this knowledge has been picked up by lookout wessels, the distance may be ten m. miles, if from the main body of the fleet any degree of certainty could hardly be had at over six miles.

Assuming that the speed of the ships would admit of standing down, in a well kept order, at the rate of twelve knots, the distance of six miles would be covered in half an hour if the other fleet did not withdraw. The advantage of sailing in order of Battle, or in an order of sailing quickly changed into Battle Order, is evident.

Granting on the part of one fleet the intention to force an engagement if it can, the other fleet may mean to stand down, to meet it with purpose equally offensive; or it may decide to await the attack, that is to fight a defensive battle, with possible hopes of taking up the offensive after obtaining some advantage; or it

may intend to avoid a decisive engagement, for strategic reasons, connected with the general plan of campaign as well by land as by sea.

(A fleet can hardly await an attack for the reason that it must keep in motion. A fleet cannot stand still; it must keep steerage way on, at least, to prevent falling into disorder.

Hence, as in Cavalry tactics, all movement and formation must be based upon continuous motion.

A fleet for certain reasons might present its rear to an attacking force, keeping up a fire from the <u>after</u> guns and dropping torpedoes in its wake &c.&c. Thus:

A - Fleet steaming ahead at low speed firing stern chase and dropping torpedoes in pairs connected with a

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the dis -

B - Attacking fleet at full speed, firing bow guns.S.B.L.)

It is well to keep in mind that there are two kinds of animus with which naval warfare may be waged, according as the intent of the two combatants is to control the sea, or simply to cover their aims upon the land. The latter, at any rate since the year 1700, has been the French system. The fleet has been to them simply one of the armies, indeed scarcely more than one of the arms of the army, conducing to the general aim of a cambaign. The common word

for fleet in French writers was army, as for admiral they often use general; and, such is the powerful effect of words on the minds of men.it is quite possible this nomenclature may have seriously affected the feelings of the French people and the policy of the Fr French government. However that may be, in reading French naval history after the date named, 1700, one cannot but be struck with the part assigned to the French navy, and the effect upon the spi-, rit, not the courage, but the spitit animus (I know no exact equivalent) of French officers, a spirit often deplored by their professional historians. Until the peace of 1763 the navy was much neglected both in numbers and discipline, so that the lesson is less striking; but when sent to sea we find it always, with rare exceptions, making a running fight; accepting, not giving action; neglecting to follow up advantage; there was always something else to do than to fight and crush the enemy's fleet. This period was followed up by one of much naval activity, and when the war broke out known to them as that of 1778, but which to us is inextricably entwined with our Revolutionary struggle, the French navy opposed formidable numbers and able men to England. Then Spain threw her sword into the scale, and the combination so strained English resources that they were almost everywhere inferior in numbers. Nevertheless, the story remains always the same. Hampered by orders from home, and by a tradition which had acquired the force of a system, the French navay had always something to do other than

whipping the English fleet - there was always some strategic consideration which made it necessary to economize the fleet; and fair advantages, partial successes, were allowed to go unimproved. The same continued over into the wars of the Republic and Empire. French fleets watched their chance to slip to sea unseen; their orders were to get somewhere and do something, but, in order not to fail in doing that something, to avoid action which might cripple their force. This line of action, aided doubtless by other causes, brought about a degree of professional proficiency and morale which ended in the Nile and Trafalgar and drove the Fremch flag from the sea.

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The English policy during all this time was wholly different. They aimed of course to possess the land; the sea in itself is but a barren highway; but they aimed to possess the land through the control of the sea. More or less distinctly seen from the infancy of their navy, the idea took shape more and more clearly, till it became the ruling passion of the people and the guiding principle of her statesmen. English armies fought all over the world; but the reason they did so was that they might win new extension for her commerce, new naval stations on which to lean her fleets; and the fleet, or the sea if you will, was the base of operations. Yet even the possession of new ports and fortified harbors, valuable as they were for naval bases, was secondary to the great principle of her naval warfare; which was to attack and destroy the organ-

ized forces of the enemy wherever she found them in numbers that justified the fighting. This, though probably rather instinctive than the result of reasoning, was adopting for the control of the sea, what Jomini calls Napoleon's favorite objective: "the destruction or disorganization of the enemy's forces without giving attention to geographical points of any kind". Even now there must be something inspiriting to an English officer, as he reads that the signal for the enemy is sight was always followed by that for a chase and an increase of sail; but upon the seamen of the day andtheir morale, the influence must have been very great. Hence though many of the English admirals were mere fighting men, while the French, with their passion for system, had evolved a very clever plan for giving a few hard raps andthen hauling out of the fight, a plan which they practised often with success, the result was that the English obtained that which it was no mere boast to call the rule of the sea, whatever may be thought to be the case now. From the year 1700 up to Waterloo, and for years after, she held that rule rule; a rule of iron, often used with tyrannical disregard of others others' rights, a rule which at times strained her every resource and even then seemed to totter, but which she never lost up to the end of the last of the great sea contests which the world has as yet known. It has been said by a writer, who should have had means of knowing, that Napoleon, though he continued rebuilding the French Navy after Trafalgar, did so only because the English were thus

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forced to keep up blockades and spend money which otherwise have gone in subsidies to his Continental enemies.

I have let myself be drawn into a long digression, because it came about naturally and it was not misplaced at the beginning of a discussion of Naval Orders of Battle and Plans for action under our changes conditions. The whole history of the French and English Navies is a powerful illustration of what is one of the accepted maxims of war in all ages and under all conditions: the advantage gained by the initiative, whether in the general policy of the war, or in individual Battles; upon the land, or upon the ocean at large, or in limited portions of it.

The English fleets got first to sea and blockaded the French in their ports; if they slipped out they cleared them; if they were found they fought them. To this the English added the observance of another plain rule, they kept their navy superior in numbers, equipment, and discipline to any one other navy. If our peo ple really mean, what some among them say, to enforce a Monroe doctrine, or to control the Isthmus; it behooves them at once to decide what part the United States Navy is to be ready to play in the Gulf of Mexico, and by what numbers that part is to be sustained. (But they wont).

To return now to our imaginary fleets - and first to the one that has made up its mind to attack; in what order should it stand down, being on the supposition about six miles distant from the enemy?

It is no part of my task to discuss the best type of battery for iron-clad ships. It will be sufficient to assume, what will not be disputed, that a very considerable portion of the total artillery fire will be available right ahead, and another large fraction right astern. This bow and stern fire will also be available on the broadside, but it may be worth while to point out that the desire for weight of fire ahead and astern involves of necessity, from the proportions of beam to broadside, the abandonment of many medium, for a few heavy guns. Consequently greater need for skill and coolness in the gun captains.

The first two principles laid down are that each vessel and the the entire fleet, should be able freely to use its offensive powers to the best advantage, and (la) also present the least favorable target to the enemy's fire.

In thus standing down for the enemy and until within the distance when torpedoes of any kind may be seriously feared, the only weapon to be used is the gun; the only attack to be feared is from the gun, or from a sudden dash of the enemy's rams.

In order that each vessel may use its artillery to the best advantage, it seems that a direct approach bows on, will give greate er steadiness of gun platform and freedom of fire; in order that all the vessels may enjoy it, none of them should have another immediately or nearly ahead of it. This would indicate a <u>line</u> abreast, or a slight modification, to be a proper formation, and a

line ahead or column, directed toward the enemy to be a vicious for mation, during the period that the fleet is confined to its artillery. (Reconcile my formation with Meigs.)

(Formation in line can only be <u>abreast</u>: hence the word <u>abreast</u> is superfluous.

Column has but one meaning. Would it not be well to discard the term Line ahead? S.B.L.)

In order that the smallest and least favorable target should be presented by each ship and by the fleet, the same formation is indicated. A long thin line, at right angles to the enemy's line of fire and rapidly changing its distance, is as poor a target as can be devised. The most difficult element in aiming is the elevation, and there can be little doubt that a large proport ion of the enemy's shots would earn that absurd commendation we so often hear: "A good line shot but over", which is an entirely worthless shot. From the same regard to the target offered, the advance in column is seen to be vicious, as deep columns have always been found to be. They invite concentration upon the head and offer facilities, increased many fold, for shots ranging too high to find a billet in the rear, while a serious injury to a leading vessel will involve confusion in the order and possible collision; in a word disaster.

The advance in line abreast being generally indicated, will any

modification of it be advantageous? In replying to this question we may observe that as soon as we begin doubling up our single line, and making an angle with it, we begin to approach the formation in column with its defects. If the centre of the line is kept advanced and the legs thrown to the rear, you approach a double column on the centre; if the flanks are kept on the original line and the centre retured, two single columns are formed. In the one case you pass through a series of salient, in the other of re-entrant, angles. With regard to the offensive power of the

D C B B

salient angle, you will observe that when it becomes at all pronounced, the fire of one flank of the assailants becomes more and its more restricted to the flank of the enemy immediately in front; in other words the order is unfavorable for concentration of fire. On the other hand when looked at with reference to the target presented to an enemy's line, it will be seen that the flank A is more or less enfiladed (raked) by the flank D, and the flank B by the flank C; it is a direct invitation to the enemy to concentrate by a cross fire upon the vertex of the angle. Crippling the leading ship of such a double echelon does not entail all the harm done to the head of a column, but it does involve an ugly gap in the centre of your order of battle, at the point nearest the enemy's line, and where the fire of few of your ships in this order would bear.

Let us turn now to the series of re-entrant angles, and first: Note in passing that the intervals between the ships must be great er than in the line abreast, unless indeed an attempt is made to diminish the front; a remark trues also of the salient formations. With regard to offensive power, when the angle formed by the two flanks is at all acute, the front must be much diminished, and concentration upon the enemy's line, though possible, will be circumscribed; it can hardly fail, too, that the centre ships in the rear will be embarrassed by smoke. As regards the target presented, by the two sides of the angle will be subject to enfilleding fire from the enemy's flanks, which however, so far as it is a cross fire, at the point most remote from the enemy's line, and where a gap, if effected, would be very thoroughly protected by cross fire from the ships on either side.

This last consideration of an interior crossing fire has had much weight with me in considering a moderatelrementrant angle as a beneficial modification of the line abreast, at this period of the attack. Equally with the line abreast it will admit of fire being concentrated on a point of the enemy's line, and when of very moderate inclination, not exceeding 20° of either wing from the line abreast, will not be found to expose a more vulnerable target. It advances the flanks and holds back the centre, which I believe to be a correct practise. The centre is defended by cross fire of both flanks, and the flanks, which are the exposed feature of the

line abreast, reciprocally cover each other against the direct advance of rams or torpedoes, to a degree unattainable by the line abreast. In case of a wide detour of Bamsto come in square on the beam of the flank ships, a manoeuvre almost impossible from lack of time, a re-entrant angle is at no disadvantage whatever as compared with the line abreast, while if the detour result in the rams coming in at all abaft the beam, the flank ship has the stern guns of its wing of the fleet to assist its proper defense.

In case of a salient formation of approach, it is evident that such a direct attack by Rams would be resisted by the guns of the vessels of the same flank which being nearer than the other flank would be more efficient; but while I present this consideration, it seems to me by no means to outweigh the disadvantage of the salient formation.

In assigning 20° as the maximum deviation from the 1 me abreast I have given an arbitrary figure. The amount of inclination must depend upon the character and position of the ships' batteries, (and the intervals???between the ships). The object to be attained is that the forward guns of each wing should have clear play across the bows of the ships of its own wing; for the defense of the opposite flank, and that the fire from the stern guns should have clear sweep up to the flank ship of its wing, as aid ing the rear defense.

59 A line office line of fire

Re-entrant angle - 20 from line abreast - Intervals 200 yds. Ships Lengths 3000 ft.

The wing AO's fire from forward can converge on B while passing clear of bows of ships in same wing. Fire from after battery will have a concentration not far from the beam of left flank ship A while passing clear of sterns of other ships of the wing.

Query would it be an improvement to keep 0 on line abreast of the two ships next him?

(No. It would screen his fire abeam and prevent that <u>mutual</u> <u>support</u> so essential in military formations. See Sir Howard Douglas on mutual defense. S.B.L.)

Keeping these conditions in view, the formation should approach as nearly as possible the line abreast, which has advantages of its own, which should be sacrificed as little as possible.

To complete this discussion the case of a simple echelon or oblique line should be considered.

D If the approach is made squarely on the front of the opposing line, as in the figure it is evident that the line

A

AB is advancing in the formation of a re-entrant angle, in which the wing AO has been sacrificed, and the whole wing AO has lost in its power of concentration by its greater distance from the enemys line. The increased fire upon a rearrattack from AO does not make up for these drawbacks.

There is a very possible case however in which an advance in simple echelon might offer great advantages to a quick and skil-ful initiative.

Let us suppose that by accident or as the result of manoeuvring - the two lines of equal front are approaching so that the flanks lap (Fig 1). If AB throw his right flank well forward as in (Fig 2) while still steering a course perpendicular to the front of CD, it is evident from an inspection of the figure that the right wing C, of CD is further from A than any part of "AB's line is from the left wing D. If CD continue on the same course permitting the same relative positions to remain, AB may throw his right wing still farther forward as the moment of contact draws nearer - the

left wing slacking speed as far as prudent, and probably diverging to the right together so as to draw more upon the line of bearing OB'. Of course we cannot count upon CD failing to change the disposition of his line, but if he postpones doing so until the proper moment for AB to push his right wing forward, he

A

will be exposed to the chance of ahving his own left wing attacked both in from and flank by nearly the whole force of his enemy.



In Fig.3 AB is throwing his right wing forward, while the left wing inclines to the night with speed materially below that of the right wing. The left wing thus retiring will pass on to the continuation

of OB' or even in rear of that wing, which

will then head to take CD on the flank. As OA thus retires it will keep up its fire upon the enemy's flank attacked and also upon the other flank which must attempt some movement of relief. If that movement take the shape of throwing forward the wing C, the formation becomes similar to the enemy's, but with the advantage of distance in favor of AB. The ground in front of AO is interdicted to the wing C, and as for attacking the flank A, the distance AO is less than AC. (The proposed movement of AO is that called refusing a flank in land tactics.)

At the end of this manoeuvre the first example of what is called Grand Tactics or a combination for Battle, I say a word &c. I made similar remarks in my lectures on Strategy.

In bringing at this point this lecture to a close, it is fitting to <u>say a word</u> as to the kind of criticism that is legitimate upon any proposed formation or manoeuvre.

If two fleets are precisely equla in number and efficiency of

ships, if all the captains are equally skilful and equally brave, and if the two leaders have precisely the same endowments as leaders. it is evident that the results of battle must be precisely equal, until some chance destroy the equality and allow one to preponderate. Battles are won because one side is less numerous, or less efficient, or one leader less skilful than the other. Discussions, such as we are now engaged upon, are not expected to result in a precise formula, like a druggist's prescription or the rule of three, for ensuring victory. They aim simply at examining the comparative advantages and disadvantages of certain positions to the fleet or fleets occupying them. The more numerous the positions so examined, and the more accurate the appreciation of their comparative advantages, the better fitted will an officer be to seize the opportunity which chance, or his own skill, or the blunder of his opponent, has placed within his reach. This fitness, or facility (coup d'oeil) implies quickness of decision, itself an inestimable gain in the lightning speeds of our day; and I may observe that from the comparative simplicity of situations, it depends less entirely upon natural aptitude and can be more easily got, through study, by the sea officer than by his brother on shore.

It is not therefore, necessarily a reply to the claim of advantage for a certain position to say: "Oh, but if your opponent does so and so!" If the position is such that by your opponent doing a thing wholly in his power, your advantage is changed into a dis-

advantage - then you have misapprehended your case, and instead of a good combination, you have made a bad one. But if your advantage is real, and your opponent can do no more than neutralize it, by immediately changing his order, then you have developed a useful idea.

END OF 1ST.LECTURE.

LECTURE 11.

The discussion of the case of the simple(or single)echelon has been carried a little beyond the strict limits of the question in hand,viz: the formation for bearing down while still confined to the use of the gun as the chief weapon of offense. This formation has been considered from the double point of view of developing the utnost power of the iron clads singly and collectively, and of offering the least favorable target to the enemy's fire. After trying to give the reasons pro and con in each case, I have express ed my preference under these heads for the line abreast, modified by giving to it slightly a re-entrant form. (The crescent of the galley period.)

I have indicated as a next requisite to a good formation that each vessel, in addition to its own powers of resistance, i.e. its armor and other sources of structural strength, should be defended by the offensive action of the others upon possible assailants: in other words there must be mutual support.

Under the conditions, that is that we are not yet in torpedo range, the torpedo is out of the discussion. By this I mean the auto-mobile torpedoes of the Ironclads themselves. Torpedoes launched by other sea-going vessels (as distinct from torpedo boats) I consider under the general head of Rams, as close quarter weapons. We have to consider the Gun chiefly, the Ram secondarily.

For mutual support against the guns of the other fleet, I see nothing better than an order which permits each ship to throw the weight of its artillery upon any point of the enemy's order. Such an order is complete and the one already proposed fulfils the demand for a fleet bearing down to attack, and yet outside torpedo range; unless it should be determined to bring to at a suitable distance for broadside action, an improbable contingency, but one which will have to be discussed in the proper place.

Turning then to the Ram and taking first the order so far preferred, the slightly re-entrant, it is plain that the two flank vessels are the most exposed, the least supported. The flanks of the other vessels may be considered as sufficiently protected by those outside them. If an attack in front is attempted by rams on any point of the line, putting aside any other defense than that of the ironclads themselves of the first line, the stern fire of one wing can always be concentrated upon them.

From my point of view, it is not to be believed that an attack upon the flank should be made by ships of the line detached from

the main body. The party assalled would of course depart from any previously conceived plan andgooble them up as quickly as possible Such an attack, audacious in any case, could only be made by ships with speed sufficient to retire successfully (if folled or not), and the loss of which in any event would not be vital. The number so sent out would be measured by the disposition of the rams of the fleet assailed; as that disposition has not yet entered into the discussion, which is still confined to the ships of the line, we may say they could not be less than two.

The re-entrant angle seems to combine the ships for mutual support against Rams, by artillery, as well as can be done, in front and rear together, and all round, except upon the flanks of the wing ships. Is there any other formation, or any modification of this one which will protect the flank ships further, without losing more than the gain made?

Defense for a ship against ramning, confined, by the conditions of a fleet, to a certain course and bearing, can come from no where so well as from astern. The reason for this is that the vessel coming next rams the ram. Shall we diminish our front by withdraw ing one shipsfrom the line and placing it in rear of the flank ship; and how do this?

The simplest way probably would be to drop the flank ship herself in the rear of the ship next her, "break it to the rear". Of course in that position she is herself equally exposed, but she

protects the ship that has become the proper flank, and there are presented to the assailant the broadsides, both of guns and torpedoes, of two ships instead of one as heretofore. This putting of two ships in column has all the vices of the column form of attack but is simple of execution. If the defense afforded by rams of the first line is not deemed enough, it may be used to strengthen it; but I am decidedly of the opinion that it should only be resorted to when Rams mean mischief; a mere threat should not induce the withdrawal of the flank ships to the rear. (Here mention my disposition of the Rams).

As to any other order it must be in columns, single or double, or triple if you will, or a salient angle. The latter presents f lank ships unsupported on the f lank equally with the re-entrant. With columns, the rear ship of each is unsupported; but if the column be deep, detached assailants would perhaps scarce pass so far to the rear. But shall the fleet for the reason under consideration, give up so much of its artillery fire, by thus narrowing its front, while still beyond torpedo or Ram offense.

I should say not, and the re-entrant line seems to me still to present the best formation i.e.for the point of mutual support.

The third condition demands that entire or partial concentration of any arm or of all arms, may be made with (the greatest attainable)ease upon any part of the enemy's order; or, conversely to repel any attack which the enemy may make upon your own order.

This, in the portion of the problem at present being considered, means that the order in which the fleet stands towards the enemy, while still at artillery distance, should not only be the best for that particular period of the action but shoulf also allow change to any other order that may be thought more suitable for direct collision, involving the use of the close range weapons, to be made quickly, and without confusion or risk of fouling among your own ships. Such close approach, imparting increased accuracy and effect, even to the gun, leads to decisive action.

It is not yet proposed to discuss what is the best order for such collision; but only in a general way the question of changes of order and the facility for making them, afforded by the line abreast and its modifications. It must also be noted that the question now is not whether the line abreast, more readily than another, allows such changes; but whether, being nest suited for the beginning of an action, it admits changes with sufficient ease.

We may say that there are two extremes of formation, one with the greatest front and least depth, which is the line abreast or simply the line; the other with the least front and greatest depth which is the line ahead, or single column. (Here define difference between "change of formation" and "a change of direction" which may involve no change of formation. Echelon combines both.)

Any change of formation, putting aside for the moment changes of direction, from one present line of attack, must be in the nature

of a smaller front, for we have in the line the widest front. The flank ships may be broken to the rear, giving a front of 7, the front may be reduced to four or five making a column of wings, or to three, making a column of divisions, ships three deep, or to two making a double column, or finally to a single column. (Diagrams of all these formations as being those to which the fleet may pass for collision.)

It is not necessary to say to my hearers, all of whom are familiar with the simple movements involved in these changes, that the line abreast presents no difficulties, above any other, in makin them. The re-entrant angle, however, does offer a difficulty of its own, which must be accurately weighed before finally accepting it.

It may be safely inferred that any diminution of front is made with the hope of concentrating a relatively deep mass of your own fleet upon a relatively thin line of the enemy. Thus if the



fleet AB is standing down upon the fleet CD, and,as the moment of collision approaches,throws the left wing AO behind OB,it will necessarily be with the purpose of passing through the half of CD with the whole of his own fleet,compell-

ing each ship attacked of the enemy to pass un-

der the guns and torpedoes of two of his. Now it is evident (Diagram) that the ships from 0 to A can pass to the rear of 0B,untrammeled by any of the ships to the right of them, but the fronts

of the two wings not being square (parallel) to CD, the vessels in each will not have the simultaneousness of attack desirable.

The only reply to this objection is an appeal to the reserve of speed that must be supposed in each ship, as before argued. Either the line can be straightened up before the manoeuvre, which is not necessary; or, during its progress, the left ships of the right wing can increase their speed; rectifying the bearing. If the centre ship "0" go to the rear, it can at once keep along a course at right angles to the original, and the others can do the same.

Not only does the difficulty of bearing exist, but, if any change of direction be intended, it must be in order to bear the attack still more upon the enemy's flank opposed to the one of your own which is re-enforced. Thus in the case considered, it could never be intended to bear toward the flank C, though the line OB is directed that way. If it should be intended to carry the attack toward the extreme D, the formation becomes yet more objectionable, and it would be a question for the leader, whether he wo would depart at all from the line abreast in his original formation.

If the line be doubled on the centre, the intervals will be too small in consequence of the protuberance to the rear. I believe however that in the reserve of speed is found a sufficient remedy for the difficulties presented, and I am not aware of any other difficulty in the way of changes of <u>formation</u> from the re-entrant line.

So much for changes of formation.

As regards changes of direction, we all know they are more easily made by a single column than by any wider front.

Changes of direction are of two kinds, the (direction (of) front) may be changes and the body move directly to the new front, which is more or less of a wheel; or the front being kept the same, the different ships may move together in the new direction which is an oblique. If you wish, for example, to move toward a point 45° from the perpendicular to your right flank, you may form on a new line, or you may oblique.

The change of direction of a single column is the simplest and easiest manoeuvre in tactics; as you increase the front, the difficulty increases, and when you reach a long line, the manoeuvre is perhaps the most difficult for either a battalion or a fleet to make.

As regards a change of direction by an oblique movement, if it be not too long continued we may assume that it can be made without difficulty.

In order to decide whether a change of front by a wheel is necessary or safe when two fleets are rapidly nearing each other in line, we will have to consider as briefly as may be, what kinds of attack aiming at concentration can be made, and how such attacks can be met. In other words what kind of changes of formation wil take place, and how extensive they will be. (The discussion aims
at being exhaustive.)

If the enemy await your attack, or allow you to be the assailant, in line, you may attempt your concentration upon one flank or upon the Centre; on the other hand, he may first attempt such concentration upon your flank or centre. For this concentration, no change of direction is needed or at most a moderate echelon or oblique movement. If he persist in maintaining his order in line it would be possible to pass by one flank. in column thus concentrating your fire, by successive vessels upon one or more of the flank ships. (There is a defect here in that the enery is assumed to be in front or nearly so. If he should be made out on a flank or to the rear, the front must necessarily be changed. This last case emphasizes the need of look-out ships.) This though it in-

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volves a change in the line of bearing of your fleet, does so by a simple change of formation of the easiest kind. If you consider that this attack has too much concentration of one kind and lengthens your fleet too much, and prefer to at-

Vole here 18-Entrant A

tack the wing D in front as well, you may keep a certain number of your ships A' on the original line of bearing and let them pass through the enemy's line; or you can resort to a manoeuvre indicated above (P.68) and pass through in column of divisions. lf ground is to be gained to the flank in order to make those movements feasible, it may be done by obliquing, or in the very act of

forming as in Fig. If you direct your attack upon the centre, instead of a flank, you may do so by double column or by column of divisions or any analogous form but there is no call for anything approaching the wheel in these. (The <u>point</u> is that no wheel, which is a difficult movement, is required.)

If the enemy instead of coming in line, come to meet you in an order of one or more columns, or columns of any front, his approach will be directed toward one of your flanks or your centre; you not having yet changed from line abreast. Unless you have allowed too much time to slip away, in case, that is, you have time to manoeuvre, you can at worst make the same formation. If he tries to pass by your flank, as above, CD can form line ahead on D, and the two fleets pass on parallel lines in opposite directions. If he attack your



centre with columns of broad front, you can use the like, or with safety pass your fleet on

the two sides of his column.

The best defense of CD is to put himself on the line DD' which is reached more shortly and with less confusion by the sides than by the hypothenuse DD', in other words by movement in column rather than by a wheel. This reduces itself to passing

in opposite directions by columns. CD, if equally numble with AB, might form by his left flank in double column to pierce BA' toward the rear of column.

An attacking fleet at the moment of launching its vessels forward may wish to use an echelon formation; throwing for instance its three right vessels against the enemy's left,followed closely by the next three, and then the last three. This formation would M p be somewhat more difficult than the formation of the same column by a flank movement of the left divisions, but it is more rapid, and it might keep the enemy longer in suspense. He may move to

cl

A' meet it by throwing his five or six(six best be-A come BOWHI charBencause B' will pass our ship outside of flank er D) right ships on the C'M or even to C"M. This would und cubted ly be a wheel but the second position at least would be more quick ly and safely reached by moving M forward and the others in its wake, while the other is but a half wheel. The best plan would be to refuse the threatened flank.

It is scarcely conceivable that an enemy in order of columns can be awaiting an attack; his purpose must be, sacrificing as he does by such an order his artillery fire, to attack you by concentrating upon some part of your line. You may, however, while holding on to your line abreast as long as safe, purpose yourself to concentrate upon him. This may be done on the head of the columns on wither flank, or on the rear. The figures are intended to illus trate certain plans. It would perhaps be an advantage if you could pass all your ships on one flank of a double column; In the

Figure, if the single column AB pass the double column CD,C'D' in opposite directions, the fire of all out the leading ships of the column CD is greatly hampered, if not wholly masked, by the column C'D'. Even an indented column, under such conditions, must be inferior in security and range of fire, to the single column which has

nothing in its way in the direction of the enemy. What is true of the double column, is yet more true of a triple column under the same conditions, and there would seem incedentally to follow here the remark that the further you depart from the single column in the direction of a line abreast, the greater the disadvantage in passing outside a flank, when coming to close action.

Concentration upon the head of a moving column is doubtless most dangerous to the assailant. The head of a column has always been recognized as the strongest part of it, and if for no other reason, because the rear is pointed fair and coming up to its aid. If the positions of the two fleets permit it, a double column passed on the two flamks of a single column, embracing it under fire from both sides, would be a serious and dangerous concentration. In the Figure the leading ships D are under a double fire; and although it is true that in the end nine ships will have passed unf^{A'} der the fire of nine, yet the action will begin with the chance of serious disaster, by the crippling of one of the van ships D, which would throw confesion into the whole line CD. There is 10' more advantage but I am not, however, here discussing the rela-

Fig

tive advantages of different formations for close action, but only whether those elese actions formations can be reached, from a line abreast, simply and without confusion. The single or double column can be so formed from wither flank or the centre.

Concentration could be practised on the head of a column by moving off your ships after they had declined their fire on the enemy's leaders. There can be no question as to the comparative risk run by the two fleets thus acting. The two leading ships at

C,

VD

- 7 A

10

B

D should be crushed by the combined gun and torpedo fire of AB, nor should there be much danger from the ram of CD until the rear B has taken the new course after which it will become a question of speed till A can countermarch. But whatever the merits or de-

merits of the attack, it presents no difficulty in being effected from the line abreast, being only a simple column. Concentration on the head of a column might be practised in a column of squadrons, in double echelon, which would be more applica-

c_dable to a double than to a single column of the enemy. Such a
file' column of squadrons may be equally well called a double line
abreast; and illustrates the transitions from columns to line
and vice versa, of which indeed it may be called the transition phase. The formation permits a powerful concentrated fire upon the enemy's leaders up to the moment of colfision (passing) and maintains it throughout. (NOTE: the
9th.ship should be in the leading squadron, and should be

in the leading squadron, and should be in the rear of the double columns and between them.) The point here under discussion is whether the formation can be made simply and without confusion from our purposed line for artillery fire. The reply is that the leading squadron is already nearly in the required formation if we attain it by breaking to the rear the two flank ships; or to express the same in another way, if we form double columns on the centre.



When the energy approaches with a front of three or four ships, in column that is of squadrons or of divisions, I believe that passing by the flank of a single, or double indented, column is the best form of concentration because the fire of the two squadrons farthest from you, and their rans too, are masked; concentration on the head of such a formation seems to me unwise. It is powerful for attack and particularly in the direction in which it is ale" , c' , c ready standing; in other words powerful at the head. To i meet it on the head, with the same formation, is simply to accept battle on equal terms, a theory not to be accepted; to meet it with a wider head and less depth, is to invite the division of your fleet by this order breaking through. A fleet passing in single column con the flank will bring nine ships' fire upon them; but, inasmuch as so long a line will be exposed to be broken through, if the enemy wheels, either by successive divisions or all ships together, a better arrangement fo AB would be a double column; at any rate at the head. Supposing CD to have changed from as in the figure, AB being $\mathcal{L}' \rightarrow \mathcal{L}' \rightarrow \mathcal{L}' \qquad \bigwedge' \qquad in two columns is more manageable. His six$ $<math>\mathcal{L}' \rightarrow \mathcal{L}' \qquad \bigwedge' \qquad 1$ leading ships readily meet the front CD, C'D' $\mathcal{L}' \rightarrow \mathcal{L}' \qquad \bigwedge' \qquad 1$ leading ships readily meet the front CD, C'D' $\mathcal{L}' \rightarrow \mathcal{L}' \qquad \bigwedge' \qquad 1$ both in front and in flank by the three rear $\mathcal{L}'' \rightarrow \mathcal{L}'' \qquad \bigwedge' \qquad 1$ both in front and in flank by the three rear $\mathcal{L}'' \rightarrow \mathcal{L}'''$

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The question naturally arises here, though it will not here be discussed, whether three lines deep have such an advantage over two lines as to justify the narrowing of the front.

The general truth may here be pointed out that, as you narrow your front, you lengthen and expose your flanks, while strengthening your centre.

My impression seems to have been, and now is, that if an enemy approach to attack in a single or double column, concentration should take place upon the head which being narrow is weaker, while the flanks being long are stronger; but:

If the enemy approach in treble column, or column of divisions, it will be better to pass his flank in single or double column because in such formation the head is stronger and the flank weaker, therefore concentration should be upon the latter.

Without claiming to have discussed all, or even the greater

part of, possible formations suitable to meet the various contingensies of close battle, I think we may say that enough have been considered to warrant us in saying that they can, as a rule, be formed from the line abreast with so little difficulty that no argument hence will be against it as a primary formation. In its modified, re-entrant, form the only objection sustainable is not insuperable, nor sufficient to outweigh its advantages. Where a change of direction, or of the line of bearing on which the fleet is ranged, has to be made, it can nearly always be made without wheeling, by passing from line to column in the required direction. Here perhaps should discuss the question of an enemy appearing on either flank or astern, or on any bearing more than 45° to the side of the course steered.

With regard to concentrations upon the reat of the enemy, they can only be made at sea under present conditions, after passing round one of his flanks, unless he is in retreat; they will therefore need no attention here, as bearing upon new formations from the line abreast.

I conclude therefore that there is no such difficulty in passing to other formations from a well formed line abreast, or re-entrant angle, as will constitute an insuperable objection to it as a primary formation for artillery contests.

In yesterday's lecture, after laying down the requisites, six in number, for a satisfactory order of battle, I went on to seek a primary order, which I defined to mean an order for that stage of the action where artillery from its range alone is used. By the "Inferences" which I have distributed to you, you know that I regard a change of order, for the purpose of coming to close action, imperative. As far as my reading gnethe subject goes, I differ here from other writers on tactical matters, who tend to form their order of battle once for all, and contemplate no change of order until collision ensues. Under this bias, almost all prefer the line, my primary order, for the order of collision; one or two, however, expressing a preference for the column on account of its greater flexibility for changes of direction. A fleet in column can head quickly to the right or left, and so, at the last moment, change the point of attack without changing the formation.

As far as I can recall, Commander Hoff, who has gone extensively into the literature of the subject and produced a compilation of matter exceedingly valuable for purposes of reference, did not cite any plan, which, like those I have submitted to you, contemplates a change, just before collision begun but completed. Admiral Randolph's plan was for an order complete and to be changed <u>while in</u> collision, a scheme I conceive to be more difficult and hazardous than my own which nevertheless is risky enough.

To facilitate such a change before the decisive charge, an order elastic and open is necessary ; a close or complicated order

will not allow this. I was led, therefore, inevitably to discuss the primary order with reference to the way it would lend itself to such conversions as I thought desirable for obtaining an advantage. It was in this way, and not because I wished here to discuss the orders of collision on their respective merits, that I was led to bring before you certain forms of concentration. (You will see (Table I) that my complete scheme contemplates a full discussion of orders and their parries.)

Nevertheless I did bring forward certain plans which necessarily invited criticism. I wish to say about them two things. First that I have not yetgiven them exhaustive study, and am unable to assert that they are not open to a parry which will put the assailant in a worse position than before.

Second that these plans seem to me upon the whole to conform to a correct principle, which I did not formulate as I wrote them, viz: the concentration they propose is made upon the weaker point of the enemy's order. E.G. When the enemy approaches in narrow column, the concentrations proposed are first upon the head which is weak; whereas when he comes on in column of broad front or in line, concentration is attempted on the flank which is weak, because the formation is shallow, avoiding the head. (Germs for Thought.)

The essence of my system, I think, lies in adopting a formation which while good for artillery fire, distinctly contemplates a change which the enemy cannot foreknow; and which lends itself to such a change by its elastic character.

will not allow this. I was led therefore, inevitably to discuss thesuchmacqueers convise fetbreghe desthap wayfor would nlegdantad fantage. It was in this way, and not because I wished here to discuss the orders of collisions

The aneral a character provide the shear which and to ballow dor-

Suppose, instead of the line, you had adopted the column for a primary formation. You must either attack with it, or, if you change to a broader front, the rear ships being farther from the enemy, must catch up with the van to form it, imposing a loss of speed upon the van. Whereas in the line all ships are equally, or nearly equally distant from the enemy.

The Fourth requisite laid down for such a primary formation is that the space taken up by it to facilitate manoeuvring should not be so far extended as to allow an enemy to separate the parts of the fleet; to which must be added that, unless the fleet be very numerous, the two extremities should not be so widely apart that the enemy could attack one in force, without having to fear a serious diversion (retaliation or counter attack) from the other. In the sailing ship line of battle, the rear was always weak as compared with the head; partly because of the inevitable straggling of a long column as the rear is reached, and partly because the van had to wear or attack in order to come to the assistance of the rear.

This Fourth Demand upon our primary artillery formation, assumes considerable dimensions when we remember that we have to guard, not only against the enemy piercing that formation itself, from its own weakness, but also against his cutting off any part of the fleet while performing a particular evolution.

To illustrate what I mean. In the evolution: "Forward into column from a flank ship", the greater the width of the front, the

further from the enemy's line must it be begun; or else the rear ship of the new column may have the enemy down upon its beam beforeit has reached its place.

All along their lines of men or ships tend to open out too much; a tendency that can be minimized by careful drill, but can never be wholly overcome. This tendecy is sometimes varied by another to crowd together, but the former prevails for obvious reasons. Men will prefer upon the whole to be a little too far from, rather than a little too close to, their next ahead or abreast. This preference will be more marked in column than line as is easy to see; a small movement of the helm will divert you from a ship alongside steering the same course, and you have time to think; but if you are too close to your next ahead, and he suddenly stops or slows you are into him at once. (Not so, see below.)

(The reverse of this is the case in all except flank ships in line. example:

B finding himself crowded by C would gladly open out but for A He finds himself wedged in with no way of escape save by stopping and letting the others pass ahead. But if in column of three, this even is not free from danger, for he finds the next division or squa

A. B Con him. ron astern crowding up divisions this space equals 600 yours 11 mars would be intolerable

In column you can easily avoid your leader even if he should stop suddenly. (S.B.L.)

For this reason Commanders, especially when unaccustomed to fleet sailing, will feel less anxious, act with more coolness, and keep off from their neighbors less, in line abreast or in echelon, than in column; and while the intervals in line abreast must ordinarily correspond more or less nearly with those to be observed in column, so that transition from one order to the other may be made with a simple simultaneous movement of the helms, yet it may be considered whether for an imminent occasion, and bearing down for action is such an one, the normal intervals may not be reduced, not only with safety but with great advantage.

We must assume throughout a highly drilled fleet. Perfection is our aim, and we must be granted reasonably perfect ships, reasonably drilled and commanded, to achieve it. Hence we are entitled to expect that the captains, being aware of the general plans of action which their chief entertains, and having his signals repeated by one or more repeating ships, properly placed in rear of the line, the helms will move together when the signal goes down and the ships in turning will describe parallel paths. This is expecting a good deal; but the machines will do their work, if the men have had practise enough to gain confidence and to reduce the errors due to the personal equation.

It will not surely be too much to expect that such a fleet can maintain a line ahead, with intervals of 200 yards, for the short time of steaming three miles or so. The nerve that is to carry a modern ship through the exigencies of a modern naval action can

surely be educated up to that point. Let us assume then, for the nonce, 200 yards as our fighting interval; 2000 yards being a sea mile. Nine ships in line abreast, eight intervals, will occupy a front of 1600 yards from flank to flank. When your line is nearer than that to the enemy's, he can reach one of your flanks with part of his force sooner than your other flank can come up to it; it must be your business to see that he cannot reach it with greater It is very possible that the movement by which he will numbers. seek to concentrate upon one flank will be begun while he is as yet more distant from your front than the length of that front, but his aim will be to approach the flank while your other flank ships are more distant from it than he. Not only, under these circumstances, is your enemy already nearer to the flank supposed attacked, but he is nearer still by the fact that he is heading for it while your other flank must change direction 8 points to come to its aid.

In the same way, if you wish before attacking to change your own order to our involving the column, you must begin your evolution at sufficient distace from the enemy to complete it, not before the two vans encounter, but before your last ship or ships which have not completed their evolution can be intercepted in the flank movement. The extreme case would be to move forward into column, a flank ship, say the right, leading. If the enemy's left ship stand directly on, uninjured, she will intercept your left ship before her movement is completed unless the evolution began con-

siderably outside of 1600 yards; for the enemy has not lost time in turning. This cutting off, moreover will be in a disadvantageous way for your ship, which to complete her manoeuvre should stand on presenting her beam to the enemy. This she would scarcely do; but her only escape would be by passing through the enemy's order, supported only by the ships, two or three perhaps, that have shared her mishap.

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The question thus presents itself as one of the effect of exof front upon the distance range, up to which you can maintain the order most favorable for artillery. Your wish to hold on to the latter may be very great, because you think yourself superior in it, or because the enemy's order, say in column of some kind gives great advantage to artillery. Our study must therefore turn to the shortest method, in distance and time, for passing from the order in line abreast to column, as well as to other devices for maintaining artillery distance; but first we must consider another bearing of the length of intervals upon the strength of the line (abreast). (Omit with a prief reference.)

Although I have been led first to discuss their effect upon the total extent of front, my actual first thought of them was as gaps by which an enemy could penetrate. Being averse to a close engagement in single line, this consideration lost some weight with if me; but as all may not have the same aversion, let us consider, the interval so far discussed, 200 yards, could be lessened.

If the intention is to engage in line, it undoubtedly can . Six

hundred feet represents ten breadths of an average modern first rate; andas a ship suddenly stopped would be instantly passed, no danger could be feared from that, if the interval were lessened by one half. On the other hand, it would be quite possible for two firm men to lead a double column of the enemy through a gap of 600 feet. It might for instance be thought desirable to lead through the third interval from the right; the right column of the attacking force raking the enemy's left wing, while the left column, aided perhaps by rams, attempted to crush the three separated ships. While standing down the attacking double column is exposed to the powerful artillery concentration which has been mentioned as the vice of a formation in column; but as the attacking columns close, the advantage of enfilading fire becomes transferred to them. The

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"" attack thus indicated could scarcely be attemp ted upon a gap of 300 feet.

Again a narrow front, under supposition 800 yards or less than half a mile, presents a tre-1 mendous concentration upon the depth of a column or upon any point nearly

opposed to its centre; and although as opposed to a similar line more open and extended, the flanks of the latter tend to enfilade

the sides of a re-entrant angle Fig,

-D this advantage will not come into

play till the approach is very near.

But can the interval now considered be

thought sufficient to allow a simple deployment to be made quickly and without confusion. Few will allow 300 feet, a scant ship's length, to be enough interval, in any crisis, in line ahead. How will you increase these intervals? By a gradual divergence, or oblique from any one ship ? That may be simple but is certainly not rapid Would you venture to put all the helms over together ? Scarcely. Whatever you might risk if <u>caught</u> in such a formation, you will not seriously argue for it as thing to be purposed beforehand, or to be done without great chance of confusion and accident.

It is pretty sure that if six hundred feet be too great an interval, and I do not think it is, three hundred will be too small. However a fleet that is fighting in retreat, with a fleet speed equalling its enemy's, could observe close intervals and could open them at will by any of the <u>forward</u> movements commonly used by skirmishers.

Now if the line (abreast) can be maintained at intervals either of 300 or of 600 feet, it cannot be said to be in itself liable to severance by cutting; while the quickness with which, when drawn up with 600 feet interval, it can be changed into column, while still out of range of the enemy's rams or torpedoes, preserves a sufficient mobility.

Let us here digress for a moment and examine, a little more closely, this point, viz: How <u>quickly</u> the order in line can be changed into column, and up to what point the full artillery fire may be held on to without too great risk of being caught in a

flank movement. To do this let us analyze the movements in the extreme cases, viz: 1st.forming single column on a flank ship which is the longest; and 2nd.forming column of squadrons, which is the shortest. (These are the two cases in the diagram)

In forming column forward on a flank ship, say the right, the left ship A to reach its post in rear of the new columnemust pass to the right a distance of eight intervals which is equal to 1600 yards, and make two wheels first to the right, next to the left.

The speed of the advancing line is 12 knots, and in the absence of other data, I take the turning performance of the English ironclad Thunderer, with an initial speed of 10.44.

The right ship advancing, the others wheel together to the right 8 points; in doing which they gain 1000 feet (333 yds.)towards the enemy and 700 feet (233 yds.)to the right. Eighty nine seconds ($l\frac{1}{2}$ min.) is needed to assume this new formation in which they are formed in line ahead (column) on their old front, and are thus moving to the flank with the enemy heading toward them.

In this 1± min.the enemy steaming 12 knots, has advanced his front 600 yards. Total approach of the two fleets 333+600=933 yds that is they are 1000 yds.nearer than at first position; or are 2200 yards apart now.

The left ship of your fleet has thus gained in wheeling,233yds to the right; in order to wheel properly into column, she must begin her final wheel when 333 yards (1 interval) to the left of the column. To gain the point for beginning her second wheel, she has

thus to move to the right 1600 yards-566 yards= 1034 yards in a straight line.

The enemy's front therefore should be distant from her line of flank movement, where this begins, not less than 1034 yds the time needed for her to wheel into column $(1\frac{1}{2} \text{ min.}) = 600 \text{ yds.} = 1634 \text{ yds}.$

To find at what point your whole movement must begin, you must add to this 1634yds.the mutual approach of the two fleets during the first wheel which is 933yds; giving 2567yds.

This distance will have to be increased by another allowance for the loss of speed in the wheeling ships in turning; allowing this to be reduced to 9 knots for the whole distance, quite an outside allowance 370yds should be added to the total=2937yds.

We may then say that assuming equal speeds of 12 knots, the evolution must be begunsomething less than 12 miles from the enemy's front, and will so go clear of his ram. But it must be observed that a fleet which thus manoeuvres, is at a disadvantage as regards speed, compared with the other; for not only does it lose speed, in wheeling, which has been allowed for, but also while moving to the flank in column, it cannotincrease speed as fearlessly as its adversary approaching in line. On the other hand while thus runnung by the flank, it continually has its broadsides directed toward the enemy and is under no disadvantage in point of weight of artillery as compared with its first formation unless the sea now make the gun platform more unsteady.

Further discussion of the comparative advantages of the two

fleets is out of place here where we are examining only the distance up to which the line abreast, from its extent, can be maintained before beginning a change into column.

In the figure AB and CD are the first positions of hostile

fleets, 320 yds.apart. C'D' one fleet has advanced in line at 12 knots and is just being passed by B', van ships of other fleet in column, rear ship at A', C"D", B", A" third positions of the two fleets.

Time of ABS evolution equals (Two wheels+ 1134yds at 12 knots) =3 min.+ 3 min.= 6 min; to which is to be added an estimate allowance of 1 min.for loss of speed in wheeling. Total 7 minutes.

In 7 minutes CD steaming 400yds per minute comes abreast A". In 8 minutes CD will have reached the first position of AB.

(The ships which wheel all perform the same evolutions and maintain their distances. The van ship however is moving ahead at 12 knots, while its next astern is making two wheels, which two wheels will carry it 1700 ft equals 566yds to the right, nearly two intervals past the right That is, the two ships to the right have noground to gain to ship. the right, but the reverse.

What shall be done - the Thunderer's figures give 56 sec.say 1 minute for the time to change course 45. In one minute B will

B"

7B'

Fig

have run 400 yds ahead; the second will have been transferred 300 feet and advanced 600 (my estimate). In another half minute B will have run 600 yds and the second advanced, on a course of 45° 200 yds which will be 140 ahead and 140 to right; total advance 340 yds; total transfer 240, which would place him 260 yds astern of B and 40 to the right of him.) (May not B also have to head to right a little to pass clear of D ?) The half wheel to left to bring him into column would leave a gap of 540 yds between him and the leader, besides placing 240 yds to the right. If B do not shorten speed, there will be a lengthening of 600 yds in the column mainly between the leader and next, two astern.

This supposes the enemy not to have exceeded twelve knots, a supposition which I think probable, if not absolutely safe.

In making this change to single column upon a flank ship, the fleet, except the leader and two followers, moves at first on a line parallel to the front of the enemy. While so moving, the whole broadside battery is brought into play maintaining therefore a fire quite equal to the bow fire which was surrendered. As fast as each ship comes into column, this advantage is given up. When the enemy's front is 1600 yds off, half the evolution is performed, half the fleet are in column standing toward the enemy, the other half in column standing parallel to his front. The fleet that is able to hold on to its line abreast and full artillery fire to the last moment, that is, that is capable of performing the evolution

and that whether the enemy continue in line abreast till the moment of contact or feels obliged to form its order of attack at a greater distance. If the enemy continue in line abreast your ships have been drawn more and more away from the fire of one flank,, and your own fire more and more con-

centrated on a portion of his line, with the advantage in prospect of filmg by his flank. If he has already formed an order of columns for attack, you retain your full artillery fire till the last moment, and as your fleet crosses his front, (if it do so) it keeps up that fire in a diminishing ratio until the last ship is in column. Plainly, however, if the enemy had already developed his plan so far as to form (D D') two columns attack before you begin your manoeuvre, you would be at liberty to pass on either flank. NOT the least of the advantages held by a fleet whose experience enables it to manoeuvre rapidly and with precision at a critical moment, is that it can conceal its plans longer, and develop them enly so as to leave the least chance for the opponent to counteract This advantage is greater at sea when the plain and open them. character of the field of action, leaves scarcely any other concealment for a leader's plans than the chambers of his brain.

Beginning then at 3200 yds, or a little over a mile and a half, to make the formation in question, at 1600 yds half your fleet will

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C

have their broadsides concentrated upon such point as you wish in the enemy's order, together with the bow fire of the leading ship of the fleet. The rear ships in the line ahead will find their fire on the probable point of concentration, much masked, but will use it as previously instructed by the admiral on the other flank of the enemy, or what would be better still, reserve it for left wing of enemy.

If the leader of AB prefer, as he probably would, to attack with double column, a front of two ships, the ship A would have 200 yds less distance to steam, (i minute less time) to reach her place in column. This difference is not worth considering under all the conditions of the case as affecting the distance at which the evolution will be begun, and could scarcely be correctly estimated. The effect of forming double column from the flank wouldbe that the close distances in line abreast can be maintained, when wheeling together, while in making the second wheel in succession to come into double column, the ships forming alternately in rear of one or other column are at double distance from their immediate leaders which makes the evolution less hazardous. On the other hand the intervals in double column will be increased to 400 yds. Four hundred yards equals 1 minute in time at twelve knots; such a double column cannot be pierced.

Let us pass on to analyze the formation of columns of squadrons while advancing toward the enemy in line abreast to see with what ease it can be done and how far the line abreast may be kept.

(Two extreme cases of Breaking from Line into column, viz: single column and column of divisions with widest front.)

The fleet of nine ships is steaming in line abreast at 200 yard intervals. Front 1600 yards. Five ships will form the van squadron, which will be in this case the Right in Front.

The four left ships must each be transferred four intervals, (800 yards) to the right, making two successive wheels, first right, then left. Using the same figures as before, each of these wheels will take $l\frac{1}{2}$ minutes (together 3 minutes) from time of putting helm down.

932 40

Scale 4fold 800yds = 3200 1000ft = 333⁷⁵ = 1332 700 = 233 = 932 234yds = 936

The two wheels independent of any other movement will move each ship 1700 feet to tight, and 1700 feet to the front. (See Fig); that is 566 yards in each direction. There will remain (800 - 566) 234yds to be gained to the right to bring each ship astern of her proper leader, this is the space B'B" in the figure (Fig). Allowing for speed to have been reduced in the wheeling to 9 kno**ys**, we will give 1 minute for traversing this space. The total time for performing the evolution will be then 4 minutes.

During this time the van squadron OB and the fleet CD have each been advancing toward each other at the rate of 12 knots, I.E. 1600yds in four minutes. In order that the evolution may be complete by the time the van BO meets CD, it must be begun at a distance of 3200 yards.

During the four minutes the van advances as has been said 1600 yards; the rear gains to the front, in its two wheels, 566yds. Hence the space separating the two squadrons in column will be (1600 -566) 1034 yards, half a mile, the movements of the screws of the ships not having been astern. This space will be covered by the rear squadron at 12 knots in 22 minutes. If this interval be considered too long to intervene between the shock of the first and second squadrons on the enemy's line, the van squadron by slowing down to 8 knots can reduce the interval by 400 yards = 1 min, and leave itself still 400 yds in which to meet the enemy at maximum speed. One and a half minutes only will intervene between the shocks of the two squadrons.

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From these two examples there seems no reason to think that the formation in line cannot be changed, into any other probable mode of attack, with sufficient quickness and order, by a thoroughly well equipped fleet accustomed to act together, and unmenaced by a force of Rams watching to strike at a flank movement. The question of the effect of such a division of lighter vessels, not tied down to the very precise movements of the ships of the line, upon such flank movements, must be considered later, either their own head, or in the discussion of the comparative advantages and disadvantages, under all points of view, of different orders for battle The mention of any such order up to the present has been only casual, and only, as far as connected with the question of the pest primary order, while the fleets are approaching one another but not yet in striking distance. This primary order has now been discussed under four heads.

First. How to obtain the utmost advantage for each ship. Second. How to obtain the utmost advantage for the Fleet as a whole, in the use of its as yet only available weapon, the Gun; combining at the same time with this offensive power the presenting of the smallest and least favorable target to the foe.

Third. The obtaining musual support among the ships of the fleet.

Fourth. The keeping withal the power readily to change this order to another more suitable for attack and concentration at close quarters; i.e.facility for manceivring, or a reasonably open order.

Fifth. That this pliable open order should not involve such intervals as would lay the fleet needlessly open to separation while in it, or to attack while trying to pass another order.

This examination has been confined wholly to the ships of the line, and has resulted in my mind in favor of the line abreast, or a slight modification of it, as most suitable for a primary order for a limited number of ships. As the number is increased, the front becomes more extensive and the extreme changes of formation which have been analyzed must be made at greater and greater distances from the enemy; and this, having regard to conditions of firing at sea, amounts to saying that they become less and less feasible. There is therefore a limit in the nature of things to the extent of front, independent of the numbers of the fleet. A thin line of ships must not be indefinitely spun out; and a point will be speed ily reached when the growing separation of the flanks must be met by strengthening the centre which connects them. This surplusage of ships over the number that can advance in line abreast, though by no means identical with a reserve, brings us to our sixth point, the disposal of the reserve when advancing in line.

The purpose of a reserve is to have a force at hand ready to throw into the scales when they are trembling on the balance or when the defeat of the enemy is to be changed into disaster. It should therefore be so placed as to be as little exposed as may be, and yet capable of being carried rapidly to any probably critical point. Regard must be had both to your own intended point of at-

tack, and to the weak points of your formation as inviting attack from the enemy.

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The conditions of the sea do not afford shelter such as dand land may determine the posting of a reserve. A central position, nearly underway between the two flanks of a line abreast, sufficiently far to the rear to lessen the danger from shot and shell and not so far distant as to be liable to be cut off or seriously threatened before the lines meet, will best meet the conditions. As I do not present the reserve in such position in a diagram, I would like you to remember it.

If your intention is to continue on in line abreast and meet your enemy in that order, a wholly unscientific, not to say Darbarous, attack, you will change the position of the reserve. It must be brought nearer the main body and must not be left in the centre if the enemy comes on in the same order; for you are meeting him on equal terms and if you throw in your reserve it ceases to be such, even though it be strengthening part of your order. Its place would be on one flank, somewhat to the rear, where it would be sheltered from all but chance shots, far enough to judge accurately of the state the enemy is left in by the encounter, but not far enough to be cut off. Having in view the chance of profiting by his disorder to attack his flank, it would naturally be in column o or slightly echeloned, so that a wheel of not over 90° would be enough to bring it in line abreast.

800 In order to determine the distance of the reserve, both on the flank and to the rear, we will remember that it is composed of three iron clads which, if there be any choice, will be the fastest and strongest in the fleet; the duty of the reserve calls specially for high speed. To bring an equal force against these three, under the best circumstances, the three nearest ships of the enemy in line abreast must instantly on clearing your own main line, put their helms over. In a minute and a half they will all be 333 yds in rear of your line and the nearest 233 beyond the reserve flankthe farthest 400 yds in his rear. In the same 12 min the reserve, if maintaining the normal speed, 12 knots, will have passed forward 400 yds. Consequently if the enemy attempted such a move, his flam flank ship could only meet the reserve if it were (400+333) 733 yards in rear of its main line and not more than 233 on the flank Granting the enemy's flanker to have 12 knots speed on completing his wheel (which he could not) 400 yards more on the flank would give the reserve a minute more to advance. Let us say then for an extreme case 733 yards to the rear and (400+233) =633 on the

99

A A

Fig

BA

700

RA

flank and to make the position quite safe 700 yards to the rear and 800 on the flank. (Echelon leaving the rear ships of reserve on other flank of their leader would give more time).

In the very probable event of the enemy attempting to pass by column <u>between</u> the flank B and the reserve R, thus concentrating by defiling on B and cutting off R, it is to be noted that the probable course followed by AB to counteract this move would be to advance into column from his right flank B. In that case the reserve R, will be 1050 yards from the angle B, while the rear ship A is 1600; R will therefore have no difficulty in joining the column

An alternative course would be to move forward the left flank forming echelon on B bringing the batteries of the left vessels to bear more fairly and longer on the approaching column. In this case B must slow down and R will have no difficulty in gaining the rear of the echelon.

By our hypothesis of 16 knots maximum speed the reserve has a reserve speed of 4 knots in excess of the main line; but this excess will not be sufficient to ensure his gaining the rear of the line before the enemy's van passes it. If the commander of AB intends to keep straight on in line, and with undiminished speed in any event, he cannot leave his reserve so far off.

It may be noted that a column that succeeded in defiling by the flank of a line, would be tempted to keep some distance off and not to risk its advantages of artillery concentration by coming within torpedo range.

If the enemy make his attack in any order of columns, the reserve will naturally be on the opposite flank of your own, or at least so far as to be out of harm's way from the immediate collision. If however the chances of the day are such that you have subjected part of your own force to concentration by the enemy, the reserve may be needed to save it. Thus if you have allowed an enemy's column to file past your flank, the reserve may partly redeem the day by forming in column close behind but not on the extreme of the flank threatened. In the figure CD is filing past \mathcal{D}

Ar + r + r + r + Fig Ar + r + r + r + R(r) ktee + r R' + C' + r R(r) ktee + C R' + C' + r + R(r) ktee + C R' + C' + r + r + C'

the flank B with the advantages indicated before. In such a case the reserve must cease from its first object of keeping out of harm's way and must support the threatened flank as well as possible; under cover of the main line it can form column at R. If on the other hand the enemy attack in column of squadrons C'D', the reserve must again be placed so as to be ready to support ships possibly crippled and to annoy the enemy as far as possible as he passes to the rear. (The position R' should be more to the rear

than R - and proportionately on the flank) - and in both cases the reserve column should be in rear of an interval in the main line. In case the enemy has made a successful concentration, the reserve must be called on to support the part threatened.

Advancing in column the position of the reserve would be on the off flank and near the rear of the column. The rear of a column is recognized as its weak point, mainly if not wholly from the fact that to be supported from the van, the ships must turn round. Consequently in former fleet actions the rear was the object of attack, and when such attack developed, it was usual to meet it by going about either together or in succession. Here must be noted however, that the rear of such a column was really a flank, and so accessible. It would be nearly impossible to reach the rear of a column approaching your front now. In a column of 1600 yards long maintaining a speed of 12 knots, the van ships would need 22 minutes to turn round, in order to be pointed fair for the rear, involving a loss of speed of 3 knots at the end of the evolution; whereas in the same time the rear would have advanced toward the van 1000 yards, had the attack been forward. To this is to be added the possibility of confusion which attends any change of order made under fire, and particularly a going about together, which is the speediest means of carrying the required help.

Such a position that after wheeling 90 a slight advance would bring the reserve up with the rear, would be most generally suitable. Using the figures heretofore employed, we find that a wheel

of 90 of the reserve toward the main column would take 1s minutes, involving an advance of 333yds and a transfer of 233. In the same time the rear advances 600 yds. If then the reserve were 233 yds on the flank and 264 ahead of the rear ships, a wheel of 8 points would bring it right on the rear. We may conclude that a position of 400 to 500 yds on the off flank, and the same ahead of the rear ships would be generally suitable. If however the attack of your

main column be directed on the enemy's centre intending to penetrate it, the reserve must form in rear of the main column of attack. It may be in if close connection, or possibly so far separated as to give it a clearer view of casualties that have followedin track of the columns. I do not myslef favor such separation. (Speak here of sep

aration between the columns of squadrons as being a <u>large</u> detachment.)

The positions assigned to the reserve are such as can be easily maintained in line abreast and can be readily gained by the reserve in case of change of order. In fact the only difficult, perhaps impossible, change of position is that which moves the reserve from the rear of the centre to the flank in a line abreast which can only be done while the speed of the main body is very moderate. (At 12 knots it cannot be done.)

The question of the speed to be maintained in a general action or in different phases of it naturally arises here. The first

general consideration which presents itself is that, while advancing and before developing your intended attack, your approach may De slow, in my judgment should not be very fast; unless special, want of order in enemy. Other things being equal, moderate speed is conducive to good firing and to precision and safety in manoeuvring. As soon hewever as you develop your attack however, the greatest speed that can be kept with safety should be employed, to thwart as far as may be any attempts of the enemy to counteract your plans. This should be carried so far as to give him no clue to your purpose by any previous dispositions. It is hardly necessary to say that you must make no calculations upon his rate of approach except such as may fairly be based on necessary 1 mitations - such as possible speed in good order, conditions of wind and sea &c. You cannot as a rule count upon what he may choose to do, though even here knowledge of the personal character of the enemy's admiral, and of the efficiency of his fleet are legitimate elements in your plans; (as they were in Nelson's.)

The discussion so far has been confined to fleets of iron clads, ships of the line, only; vessels of the same class and consequence even if not homogeneous in type. It will I think tend to clearness to have discussed separately such an assembly of ships for combined action, without supposing it attended by the lighter, swifter and less costly ships which I have included under the general name of Rams. Under any circumstances the ships of the line

are the back bone of the fleet, indeed it may be said the very fleet itself; other vessels are adjuncts to them; necessary adjuncts, it may or may not be said, but still adjuncts. Before examining the effect which the presence of such adjuncts on either or both sides, may have upon the possibilities, in the way of manoeu vring, for the ships of the line, it will be well to fix the sphere and uses of the Rams; and hence their necessary, or best position in an order of battle.

The general character and functions of these ships have already been stated somewhat at large. They are exceptionally fast ships,fitted for close action with either ram or torpedo, or both. Their use will be to move, at a speed unattainable by the ships of the line (at least in good order) for a rapid attack, lst.either upon a naturally weak point in the enemy's order as the flank of a line or the rear ships of a column; or 2nd.upon some faulty, or transiently exposed, order such as a flank movement made too near; or 3rd.upon some weak point developed in the enemy's order by your fire, or your manoeuvring forcing him toachange of order, always a critical moment.

They thus chiefly open the way for the ships of the line to attack with advantage, or they snatch up any transient opportunity made by the latter, improving it and turning it to a permanent gain They may also be found, on further examination, to have a useful place in the main attack guarding or strengthening points of the order (of attack).
(Cavalry is good at the beginning, in the middle, and at the end of an action. JOMINI.)

Although a repetition, I will say here again that such a type of ship, of about 4500 tons, will be better fitted for this service than the ships of the line; because faster, less tied down to order and less loss to the fleet, and in money, if cut off or crippled.

As to their position these ships mustimot, like the reserve, be kept to the rear. On the contrary they must be as near as possible to the enemy so that if needed, they may reach him as rapidly as may be; on the other hand they must not be in the way of the ships of the line; must not hamper them either in their fire, their manoeuvres or their attack, and must as far as possible support any weak point of the line, must be close to the line, yet not in the way..

Being subsidiary, they cannot be allowed to determine the main features of any order adopted, though they may possibly induce modifications in it. Therefore having decided that the line abreast is best for ships of the line, for the first advance and while confined to the gun, we will not change it to suit the Rams; but will simply examine what is the best place for them in connection with it.

For the development of their offensive power individually it is essential that they should have free access to the enemy's order in all its parts, while for the exertion of their <u>united</u> powers they should be together.

A position in front of the line being out of the question, because masking the fire of the gens - there will remain for consideration the rear of the line and the flanks.

The rear of the line will allow the Rams to get at the enemy either by passing through the intervals between the ships of the line or by passing round the flanks, either of which movements they can make by their far greater speed. Passing through the interv vals, however, necessarily brings with it the shutting down the fire of the main line, which may not follow in case of passing round the flanks. In other words, if in rear of the line, the rams will advance more easily, and with less emparrassment to the ships, by being stationed behind the flank, than from behind the centre of the line. If numerous, however, the rams stationed behind a flank must either be drawn up in column which will greatly increase the distance of the rear rams from the enemy, (besides the other vices of a column as a formation under fire); or else must spread so far along toward the centre as to necessitate some of them passing through intervals. This would seem to compel dividing them into two parts, one to be stationed behind each flank, if the rear of the line be chosen as their post. Taking the number of rams, six, assigned by our hypothesis to the main body of nine ships of the line, two being in the Reserve, three stationed in rear of each flank could pass round the flank, or at worst through the extreme interval, with ease.

Placing the rams in rear of any part of the line, however, has

disadvantages as compared with placing them in, or nearly in the prolongation of the line. It is a mild kind of column formation, placing ships behind others when under artillery fire; thus deepening the target, which should only be done when unavoidable. Furthermore the fire of the eneny's ships of the line will naturally be directed mainly against those of their own class, and you should not give them the chance of hitting one of two birds with the same shot. But if they do give any attention to rams on the flanks, so much is diverted from the pron clads. For all these reasons, rams are better on the flanks.

(Why not have the Ram and the Torpedo boat (sea-going torpedo boat) auxiliaries as it were to the ship of the line thus?

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- A Iron-clad
- B Ram
- C Torpedo-boat.

That is to say each heavy ship of the line has these powerful adjuncts. The latter operate from under the cover of the heavy ship. They form together a very strong group for offensive and defensive operations. They move together as a unit. This is merely suggestive. S.B.L.)

My opinion on this is that it is better to combine the different classes of units among themselves, rather than with the other units. i.e. Rams with rams &c. These groups of vessels of different kinds were tried.

There are further reasons. If in rear of the line they must be close to it so as to be near the enemy, and must get out of the way when any flank movement is made. Also, as has been pointed out the weak point in the mutual support of ships drawn up in line abreast or in re-entrant angle are the flanks of the line (the two flanking ships); but when placed in rear of the ships the rams do not contribute to the utmost to strengthen the flanks nor the order in general.

There seems little doubt that when thus advancing with front toward the enemy, the proper place for the rams is on both flanks, nearly in propongation of the line. This position causes the least embarrassment to your own offense, offers fewest advantages to the enemy, tends to the mutual support of your fleet, and gives the rams fullest liberty of action.

There yet remains to consider the order and detailed position of the three rams on a flank.

The best support for a ship threatened by the enemy's ram and tied down to her place in line, comes, as has been said, from the rear. On the other hand and in opposition to this consideration, a ram advanced beyond the prolongation of the line is by so much nearer the enemy; one of the objects that condition the station of rams.

If there were but one ram available, the support of the flank ship would override the other object and compel the ram to be placed on the outer quarter of the ship; but with three it is pos-

sible to combine both ends remembering that protection of the flank of the line of battle takes precedence of other considera-

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tions. F_{ij} $E_{ij} = \frac{1}{2} BB''$ $F_{ij} = \frac{1}{2} BB''$ $F_{ij} = \frac{1}{2} BB''$ $F_{ij} = \frac{1}{2} BB''$

Let B be the left flank "" ship of a line abreast; T a ram, placed on her beam and heading the same course. E is an enemy's ram steering "a course at right angles to that of B and T. The speed of the line is 12 knots, that

of E 18 knots; but while B is tied down to her 12 knots, T is capable of a speed equal to that of E. Now if E has reached such a position that EB"= 12 BB" it is plain that E will reach B at B". T is entrusted with the defense of B against this. So long as E bears 45° or less forward of the beam from T (as in the positions E and T & E' and T') the latter is nearer B's line of advance than E; for E'T" and T'T" being equal, T can always travel by the shortest path T'B". This is true of any position on E'T' or its prolongation. Consequently below the bearing 45, T can, and probably s should, keep his place and the fleet speed; but as that bearing is reached T's speed should be increased to 18 knots, so that E cannot cross his bows and get in B's path to his annoyance and possible injury. So long as T can command speed equal to that of E, the latter cannot cross his bows, if not permitted to draw ahead of the 45 bearing. If by T's neglect, E is allowed to reach the position

E",where E"B" = T'B", the race of the two ships for B becomes equal; and the ship of the line must quit her place, leaving the ship next her unsupported, or a collision will take place in which the enemy will sacrifice a second class to disable one of the first class.

The position on the beam of the flank ship seems to be conmanding as well as natural; nor is the precise distance, TB, between the flank and the ram of great consequence. It should be great enough to make B quite at ease in case of any conflict of rams on her flank, and to permit your own rams to manoeuvre readily, unhampered by the main fleet; but not so great as to separate them from it by a large time interval, nor yet increase materially their distance from the enemy. (The ratio of ram speed to fleet speed is about the same as that of the hypothenuse to a side when the angle is 45. (1.4) The time interval by ram speed of the gap on the flank will therefore be the trme necessary to join the main line if needed. If the separation be 600 yards in one minute the fleet will advance 400, the rams 600 on a course of 45 which will give 400 ahead and 400 to the side). From 300 to 500 yards will probably be a good interval.

The flanking rams should be so far from the fleet as to materially aid the flank against torpedoes, by keeping enemies outside of torpedo range of the fleet. The fleet in its entirety will then have a very strong, if not quite invulnerable, disposition against torpedoes; the ships of the line sweeping the front with revolving cannon, while the flankers watch the two sides.

Referring again to the figure, E, finding himself unable to cross T's bows, and so reach B, may decide either to attack him (T), or to pass under his stern and so get at the flank of the line. The flank defence from such an attempt should be given to a second ram, which will be either astern or on the outer quarter of T. The latter position will be more favorable as being in echelon and equally well placed to ram E. It is likely the latter will not persist in a course which brings no advantage; but if he does the second ram should (I think) bring him on a bearing of 45 so long as he does not by so doing get on the inner quarter of T. (Probably as E and T approach they would turn toward each other, which would bring the rear ram yet more on T's quarter. T however having B on his mind must probably wait E's initiative) The distance between the Rams if in echelon need not exceed half a minute, 300 yards at 18 knots. (Three quarters of a minute at 12 knots).

If the rear ram is on the outer quarter of T, and the latter turn from his course to meet E, a very rapid change will be needed on the part of the rear ram. It would perhaps be better then to be astern, and sheer the opposite way but in that case T loses his backer. The whole shows the extreme, almost superhuman quickness that must mark the ram captain. If T diverges too soon, he lays B open; if too late E rams him at his ease. His protection must be in the rear ram. At all events the echelon is best for general use.

Assuming a distance of 300 yards and a bearing of two points, the interval between the rams measured on the line prolonged will

be 100 yards and the rear ram will be 280 yards behind the line. If the same bearing be maintained for the leading ram, all three will be in one line to be enfiladed by the nearest flank of the enemy; therefore the bearing of the leader from the second is made from points placing him midway between that second and the flank of the line.

The flank ships are seemingly sufficiently covered by the two leading rams from any side attack from ahead of the line while the

 $T_{2} + \frac{1}{400} + \frac{1}{B} + \frac{1}{1} + \frac{1}$

rear ram protects its leader and B's quarter.

T7

The rear ram is unprotected save by itself, and this suggests that if there be any choice it should be the most manageable of the ram body, and at the same time the vessel whose loss would be least felt in general action, however valuable otherwise (Torpedocruiser). In passing it may be noted how valuable the right-ahead torpedo fire of the rear ram would be.

The search for the best arrangement and position for the rams, while not so formally conducted as the examination made for arranging the ships of the line, has nevertheless proceeded on the same lines. We have provided or tried to provide such a position

as that:

lst. **Each** Ram should be able to use its powers to the best advantage, by giving it open way to the enemy, while leaving the rest of the fleet free to use the guns unimpeded. At the same time (la) we have been ware of placing them so as to give a needlessly good target to the enemy. The conditions of the ram power however necessitate an approach to the form of a column rather than a line.

2nd. The mutual support of all the vessels in the fleet has been kept in view, and of the whole formation only one ship (two viz: the rear rams) has not other support than itself.

We have now to consider whether the arrangement proposed will interfere with the

3rd. condition wiz: the concentration of the fleet, both ships of the line and rams, for the purpose of making or meeting an attack.

It has been assumed before that such a concentration must take the nature of a column of some kind; as is evident enough besides, for the fleet is already deployed and with reasonably small intervals.

For any movement forward into column the rams, being already wholly away from the front already, offer no impediment. If a movement be made by the right or left flank the rams can take up the new direction also, and five of the six can form on <u>either</u> flank without the smallest difficulty. Thus if the movement were

by the right flank T2 and T3 can readily place themselves on the right flank as can all of those at the rear of the column. T,by his superior speed could, if necessary, pass ahead of the column but it would probably be better to pass round the rear. If the rams were wanted on the left flank of the new column, T3 could pass ahead of the column with ease, being pointed fair.

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Since the rams will not hinder the ships of the line in their movement, are they also in the best position for aiding it, so as to bring the whole force of the fleet to bear in the most powerful manner in the new formation.



