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### The Development of Sea Warfare on Land and its Influence on Future Naval Operations

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# THE DEVELOPMENT OF SEA WARFARE ON LAND AND ITS INFLUENCE ON FUTURE NAVAL OPERATIONS.

By BREVET COLONEL J. F. C. FULLER, D.S.O.,  
Oxfordshire and Buckinghamshire Light Infantry.

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On Wednesday, February 11th, 1920, at 3 p.m.

MAJOR-GENERAL SIR J. E. CAPPER, K.C.B., late R.E., in the Chair.

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THE CHAIRMAN : Ladies and Gentlemen. Colonel Fuller is kindly going to talk to us this afternoon about the tanks, the latest arm in the land service. There is no man more qualified to speak on the subject than Colonel Fuller, who was G.S.O.I. to the Tank Corps in France, and was very largely responsible for getting out the tactics of the tanks that were used and the improvements that were made from time to time in their use. He was also very largely responsible for the throwing out of the hints on which the training was carried on. No man, therefore, is better fitted to talk on the subject than Colonel Fuller.

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## LECTURE.

IF, a few years before the recent war, I had appeared before a popular assembly and had delivered to it a lecture on the "Development of Sea Warfare on Land," I feel perfectly certain, with all due respect to the intelligence of my audience, that my discourse would have been classed with those of Maundeville and Munchausen. Yet to-day I feel equally certain that, even if I dip too boldly into the future, what I have got to relate to you about land sea-warfare during the Great War will at least hold your attention.

That this is now possible is worthy of careful thought. If four and a half years of war have so completely turned our conceptions—strategical and tactical—upside down, what of the future, what changes will it bring, what developments, what evolutions?

There is a spirit of unification in the air, a new epoch in warfare is dawning. Science has gripped the fighting services and is shaking them closer and closer together, and we see, even now, bulking large on the horizon before us, one defence force in place of three, with one brain behind it which must understand all the intricacies of its bodily organs, for, without such a brain, economy in war will be impossible.

To-day I want you to think in the very simplest terms, for simplicity alone must be our guiding star.

The fundamental principles of war, whether on land or sea, are identical, and in both spheres of operations many of the conditions of war are the same, but a few are different, and these few change the complexion of the two forces—one looks blue and the other looks red—but the material is very similar, and, like a coat, its colour matters little so long as it covers the body—in the present case the Empire—and protects it from cold, wind, and rain—the storms of war.

Scientifically, war, whether on land or sea, is composed of three elements—movement, weapons, and protection—all originated by or from one substance—man.

You must have men, at least two men, before you can have a fight; they must be able to move and they must be able to hit and to protect themselves from being hit.

The first battle on land was the struggle between two unarmed men, their weapons being their teeth, feet, and hands; so was the first battle at sea; but, whilst earth is man's natural vehicle of movement, water is not so, and water perplexed man's brain; it made him think, and thought produced the first boat—that is, a mechanical means of movement.

During the classical period battleships were equipped with oars, and we find oars remaining the chief means of propulsion as long as battles at sea are fought by boarding. Then gunpowder replaced oars by sails, and naval battles are won by wind and fire. Then came steam and the wind is cancelled. Steam enables armour to be carried, armour increases fire power, until we see to-day colossal floating batteries armed with 18-inch guns. The separation from the soldier on land, with his funny little rifle, is now complete.

What stupendous changes since Nearchus commanded a corps at the battle of the Hydaspes, and a few months later, in charge of a fleet, sailed down the Indus and up the Persian Gulf.

Briefly summarized, naval conditions of fighting, compared to those on land, offer us the following advantages:—

- (i) Muscle is replaced by machinery and skin by armour plate.
- (ii) Time is economized and military spaces are enlarged.
- (iii) Weapons of high and low calibre can be moved with equal ease.
- (iv) Weather has less effect on human endurance.
- (v) Communication and supply are simplified.
- (vi) Speed is increased.
- (vii) Command is facilitated.
- (viii) Training can be standardized and ability given great scope.

In short, naval conditions are superior to those on land, with the exception of the following:—Cover from view, security from fire and possibility of surprise. Yet, curious to relate, these very superiorities of land warfare are becoming possible at sea since submersible vessels can now seek cover from view and fire and gain surprise—by water, in a very similar manner as cover by ground and surprise is gained on land.

If now a means can be introduced whereby the naval conditions, which are mainly dynamic, can be super-imposed upon the existing land conditions, which are much more static, an entirely new theory of war can be evolved on land which, in its progress, will completely change the whole practice of present-day land warfare. This means already exists in the Tank, or Land Ship, which, though still in an early stage of development, possesses even now many of the characteristics necessary to accomplish such a change.

What is a Tank? A mechanically propelled battery on land!

What is a Battleship? A mechanically propelled battery on water!

The curtain of the future is rent asunder and that oracle, the "internal combustion engine," conjures up before us, dim at first perhaps, but still discernible, battle forms to come which to-day stagger the imagination!

And now for a moment to return to the common-place.

The winds of the past were the roads and railways of the sailing ship, and naval strategy was built on breezes, just as on land strategy has been controlled by fixed communications.

Wind capacity, seventy years ago, was a vital problem at sea, and as late as the Crimean War sailing ships were towed into position opposite Sebastopol by steam tugs, and naval battlefields began to grow windless.

Road capacity to-day is still the vital problem in land strategy, but the tug, in the form of the Tank, has arrived, which is destined, so I feel, to render the earth roadless; and, as ten years after the Crimean War we find every self-respecting fleet propelled by steam, so do I believe that, ten years hence, shall we find every self-respecting army propelled by petrol. Roads will vanish with the winds, and armies, like navies, will become mechanical.

Steam rendered armour possible, and though Alexander, at the siege of Tyre in 332 B.C., clad his triremes in mail, armour on battle-ships only first appeared in modern times in 1862, when the Confederates built the "Merrimac," and protected her by impromptu armour constructed out of railway irons.

In the same way as Tanks have had their detractors, there was not wanting in those days a number of eminent persons who ridiculed the idea of an armoured ship.

The "Merrimac," however, created, as you remember well, enormous havoc amongst the shipping of the Federals, and the Northerners were compelled to protect their ships in a similar manner before they could fight on equal terms; the result was the "Monitor."

So also will the result of the Tank be the Tank, because it enables—

- (i) Skin to be replaced by armour.
- (ii) Muscular movement to be replaced by mechanical energy.
- (iii) And weapons of low power to be replaced by those of high.

If this is not a well-swung compass which shows us the correct direction towards progress in future warfare, then I must acknowledge myself indeed not a Munchausen but a maniac.

Now I will enter into a little detail.

In modern times the chief considerations for the construction of warships have been—

- (i) Steadiness as a gun platform.
- (ii) Protection by armour of the vital parts.
- (iii) Carriage of guns of sufficient power to penetrate the armour of the enemy's battleships.
- (iv) Mounting the guns sufficiently high above the water line to enable them to be fought in a rough sea.
- (v) All-round fire.
- (vi) Speed to overtake or get away from an enemy.
- (vii) Smallness of the target to the enemy's fire.
- (viii) Manœuvring power to maintain, as far as possible, any desired position with regard to an enemy, and, by manœuvre, to reduce the danger from the enemy's weapons.
- (ix) As large a radius of action as possible.
- (x) Proper provision for berthing of officers and crew.

In other words, offensive power, defensive power, mobility, and human comfort; weapons, protection, movement, and men—the four great factors in war.

These are precisely the chief considerations of a mechanical machine required for land warfare, if rough ground be substituted for rough sea.

For the development, therefore, of mechanical warfare on land, lessons may with advantage be drawn from the history of mechanical warfare at sea, and, in this respect, we shall not be far wrong if we follow the broad principles which the evolution of centuries has shown to be of the greatest importance.

The problems to be overcome are not dissimilar; the ship, navigating on sea, must avoid shoals and rocks, while the Tank on land must avoid swamps and streams.

There are also no inherent obstacles which render the development of mechanical warfare on land more difficult than on the sea; the obstacles to be met with are, in fact, easier to overcome, for, whilst there is a real difficulty in designing a ship which will negotiate land obstacles, there are few in designing a Tank which will negotiate water obstacles.

Though such a Tank has never been built, had the soldier, in 1917, known a little more about the elements of navigation, in my humble opinion, he would not have ordered Tanks into the Ypres swamps; it was tantamount to expecting the Grand Fleet to sail the Goodwin Sands.

Then came the Battle of Cambrai; it was the St. Vincent, the Trafalgar of the British Tank Corps. The problem was how to break the line—a thorough naval problem, and, I am proud to say, worked out on naval lines.

The Hindenburg line represented the enemy's fleet. Up to the date of the Battle of Cambrai we had attempted to break this and

other lines by a parallel action of enormous broadsides followed by boarding. Such action failed, and it failed on land through causes for which no parallel exists in sea warfare.

The guns drove back the enemy's line, but in doing so they tore up the ground to such an extent that it became not only most difficult for men on foot to move over it, but impossible for wheeled transport to do so.

If we liken the army of this period to a sailing ship, the gun-fire created a Sargasso Sea—the army was marooned in a swamp of *débris* in place of sea-weed.

At Cambrai the mechanical warfare tactics were very simple:—

- (i) Break the line.
- (ii) Envelop the fractures.
- (iii) Pour broadsides into the enemy.

The internal combustion engine was too much for German muscle. In twelve hours an advance of 10,000 yards was made; at Ypres it took 2,000 hours to accomplish its equivalent by means of gun-fire. At Ypres we lost 10,000 men in casualties before the battle opened, at Cambrai only 5,000 during the first day of the operation. At Ypres we expended 93,000 tons of shells, costing some £18,000,000, during the preliminary bombardments and on the first day of the battle; at Cambrai there were no bombardments and on the first day only 5,824 tons of shells were expended.

The first real naval action on land had proved one of the most astonishing successes in the whole history of warfare. The "Merri-mac" had reappeared, a new epoch in war had dawned—the epoch of the soldier-mechanical-engineer.

I will not weary you with the relation of great battles such as those which were waged in 1918, for their details are still bright in your memory, but I will describe to you the action of one Tank—a kind of second "Emden"—to show you what was possible of accomplishment with the first type of British light Tank constructed—the "Whippet" or Medium Mark "A" machine.

On August 8th, 1918, Whippet "Musical Box," under command of Lieutenant Arnold and with a crew of two men—Driver Carney and Gunner Ribbons—proceeded into the battle.

The machine had gone about 2,000 yards when "we came," Lieutenant Arnold writes, "under direct shell-fire from a four-gun field battery, of which I could see the flashes, between Abancourt and Bayonvillers. Two Mark V. Tanks, 150 yards on my right front, were knocked out. I saw clouds of smoke coming out of these machines, and the crews evacuate them. The infantry following the heavy machines were suffering casualties from this battery. I turned half left and ran diagonally across the front of the battery, at a distance of about 600 yards. Both my guns were able to fire on the battery, in spite of which they got off about eight rounds at me without damage, but sufficiently close to be audible inside the cab and I could see the flash of each gun as it fired. By this time I had passed behind a

belt of trees running along a roadside. I ran along this belt until level with the battery, when I turned full right and engaged the battery in rear. On observing our appearance from the belt of trees the gunners, some thirty in number, abandoned their guns and tried to get away. Gunner Ribbans and I accounted for the whole lot."

After a short halt Lieutenant Arnold again advanced, his report reading:—

"I proceeded parallel with the railway embankment in an easterly direction, passing through two cavalry patrols of about twelve men each. The first patrol was receiving casualties from a party of enemy in a field of corn. I dealt with this, killing three or four, the remainder escaping out of sight into the corn. Proceeding further east I saw the second patrol pursuing six enemy. The leading horse was so tired that he was not gaining appreciably on the rearmost Hun. Some of the leading fugitives turned about and fired at the cavalryman, when his sword was stretched out and practically touching the back of the last Hun. Horse and rider were brought down on the left of the road. The remainder of the cavalymen deployed to the right, coming in close under the railway embankment, where they dismounted and came under fire from the enemy, who had now taken up a position on the railway bridge, and were firing over the parapet, inflicting one or two casualties.

"I ran the machine up until we had a clear view of the bridge, and killed four of the enemy with one long burst, the other two running across the bridge and so down the opposite slope out of sight. On our left I could see, about three-quarters of a mile away, a train on fire being towed by an engine. I proceeded further east still parallel to the railway, and approached carefully a small valley marked on my map as containing Boche hutments. As I entered the valley (between Bayonvillers and Harbonnières) at right angles many enemy were visible packing kits and others retiring. On our opening fire on the nearest many others appeared from huts, making for the end of the valley, their object being to get over the embankment and so out of our sight. We accounted for many of these. I cruised round, Ribbans went into one of the huts and returned, and we counted about sixty dead and wounded. There were evidences of shell-fire amongst the huts, but we certainly accounted for most of the casualties counted there. I turned left from the railway and cruised across country, as lines of enemy infantry could be seen retiring. We fired at these many times at ranges of 200 yards to 600 yards. These targets were fleeting owing to the enemy getting down into the corn when fired on. In spite of this many casualties must have been inflicted, as we cruised up and down for at least an hour. I did not see any more of our troops or machines after leaving the cavalry patrols already referred to. During the cruising, being the only machine to get through, we invariably received intense rifle and machine-gun fire."

The Tank was now advancing under difficulty. An extra supply of petrol had been stored on the roof of the fighting cab—an act almost

as foolish as carrying oil fuel on the deck of a battleship. Several tins had been perforated by bullets and the petrol was trickling into the cab. The report continues:—

“At 14.00 hours or thereabouts I again proceeded east, parallel to the railway and about 100 yards north of it. I could see a large aerodrome and also an observation balloon at a height of about 200 feet. I could also see great quantities of motor and horse transport moving in all directions. Over the top of another bridge on my left I could see the cover of a lorry coming in my direction. I moved up out of sight and waited until he topped the bridge, when I shot the driver. The lorry ran into a right hand ditch. The railway had now come out of the cutting in which it had rested all the while, and I could see both sides of it. I could see a long line of men retiring on both sides of the railway and fired at these at ranges of 400 yards to 500 yards, inflicting heavy casualties. I passed through these and also accounted for one horse and the driver of a two-horse canvas-covered wagon on the far side of the railway. We now crossed a small road which crossed the main railway, and came in view of a large horse and wagon lines, which ran across the railway and close to it. Gunner Ribbans (right-hand gun) here had a view of the south side of railway and fired continuously into motor and horse transport moving on three roads (one north and south, one almost parallel to the railway, and one diagonally between these two). I fired many bursts at 600 yards to 800 yards at transport blocking roads on my left, causing great confusion. Rifle and machine-gun fire was not heavy at this time, owing to our sudden appearance, as the roads were all banked up in order to cross the railway. There were about twelve men in the middle aisle of these lines. I fired a long burst at these. Some went down and others got in amongst the wheels and undergrowth. I turned quarter left towards a small copse, where there were more horses and men, about 200 yards away. On the way across we met the most intense rifle and machine-gun fire imaginable from all sides. When at all possible we returned the fire, until the left-hand revolver port cover was shot away. I withdrew the forward gun, locked the mounting, and held the body of the gun against the hole. Petrol was still running down the inside of the back door. Fumes and heat combined were very bad. We were still moving forward and I was shouting to Driver Carney to turn about as it was impossible to continue the action, when two heavy concussions closely followed one another and the cab burst into flames.”

Arnold and the two men rolled out of the burning Tank, Carney, the driver, was unfortunately killed immediately afterwards and Lieutenant Arnold and Gunner Ribbans were made prisoners by the enemy.

Such was the action of a Tank of the “Merrimac” class. Luckily for us the German “Monitor” proved a failure.

Though the above incident is an exceptionally dramatic one, I could give you other examples, such as the charge of seven Whippet Tanks at Cachy, on April 24th, 1918, when a whole regiment of German infantry was over-run with a loss of some 400 men; but I

will not multiply these examples for one alone is sufficient to prove the principle that iron and petrol can beat flesh and blood.

There is another side to this mechanical question—supply. Fleets require vast supplies, and so do armies, but the former have the great advantage of being self-contained, that is, ammunition, rations and fuel are carried in the fighting ships, which are, to a great extent, independent of communications as long as their supplies hold out.

An army, compared to a fleet, is a very complicated organization, for the fighters, ammunition columns, and supply columns are all separate parts constantly wearing each other to pieces through friction.

A mechanical army would be freed from many of these inconveniences. There is no reason why a Tank should not be built with a radius of action of 300 or 400 miles and power of manœuvring on its own, free of communications, for at least a week. Such a machine would produce a complete revolution in land strategy.

During the Great War Tanks were short-radius weapons, the heavy Mark V. Tank having a radius of action of only twenty to twenty-five miles and the Whippet of thirty-five to forty. The result was that they had to be supplied by tenders or supply Tanks. Cumbersome as this system was it nevertheless created a minor revolution. Take, for instance, the Mark IV. Supply Tank; this machine could carry ten tons of ammunition or stores; this is the equivalent of a carrying party of 400 men, which, in war, generally means 400 fighting men or over half a battalion. What this alone means in land warfare needs no explanation, and it must not be forgotten that the Tank delivers the goods to the firing line, not to a point one or more miles in rear of it.

Now that I have very briefly shown you how sea warfare developed on land during the last two years of the Great War, I will firstly place before you certain influences the Tank has brought to bear on land strategy and tactics, and secondly ask you to follow me into the future.

Strategy, or the science of making the most of time for warlike ends, that is, of opportunity, will practically cease for that side which pits muscular endurance against mechanical energy.

The possibility of applying naval tactics to land warfare is an entirely new application of the strategical principles of war, which endows the side which can apply them first with an incalculable power. Formerly strategy depended on communications, now communications will become universal, and though roads and rails will not cease to exist, they will become but lines of least resistance to movement in the universal vehicle into which the earth's surface will be turned by all types of cross-country machines.

Strategically the leading characteristic of the Tank is that it is a time-saver. Every principle of war becomes easy of application if movement can be accelerated and accelerated at the expense of the opposite side. To-day to pit an over-land mechanically moving army against one relying on roads, rails, and muscular energy, is to pit

a fleet of modern battleships against one of the wind-driven three-deckers. The result of such an action is not even within the possibilities of doubt; the latter will, for a certainty, be destroyed, for the highest form of machinery must win, because it saves time—the controlling factor in war as in peace.

**Grand tactics.** How does the Tank affect this branch of the science of war? First of all let me make myself clear to you what I mean by grand tactics. I mean the plan of battle and not the moves which lead up to its execution or the battle itself. This plan falls under four headings:—

- (i) Surprise and feints, to multiply striking power.
- (ii) Attrition, to reduce the enemy's endurance.
- (iii) Envelopment to strike at a weak point.
- (iv) Penetration to create a flank to be enveloped.

We have only got to look at the recent war to see what the Tank accomplished.

Before the days of the Tank surprise was almost impossible, attrition most costly, and envelopment and penetration undertakings of the greatest difficulty.

Then, after the Tank had arrived, surprise becomes the foundation of every battle, attrition reduces the enemy and not ourselves, prisoners alone number our own losses; penetration becomes a practical and economic proposition, and with penetration envelopment follows suit.

The war was won on land by the reinstitution of an economic grand tactics, a branch of the science of war which practically ceased between November, 1914, and November, 1917, to be operative.

And now as regards the battle itself; what has the Tank accomplished? (the Tank we had during the war was a machine, remember well, which only had a maximum speed of five miles an hour and a radius of action of not more than twenty-five miles). Let us consider this under the three general headings of defensive power, offensive power, and supply or movement.

*Defensive Power.*—It has nullified the trench and enabled men to move over the open protected by armour; it has reduced wire to mere sea-weed traversable at will, and consequently it has reduced the necessity for field engineering; but above all it has harmonized movement and security.

*Offensive Power.*—It has enabled the soldier to conserve his muscular energy for fighting in place of marching. It has multiplied the power of his weapons by enabling him to carry forward great quantities of ammunition. It has reduced the human target and nullified, to a great extent, the exhaustive effects of weather; but above all it has harmonized fire power and movement.

*Supply.*—It has reduced the enormous expenditure of artillery, ammunition, of road material and of hutting, for Tanks do not require roads neither do they obliterate the forward area as the battle proceeds. It has reduced casualties, consequently the size of hospitals and ambulances. It has facilitated by wireless the supply of information, but

above all it has freed the administrative troops from the shackle of roads.

Compare the above accomplishments to the naval conditions I enumerated at the beginning of this lecture and you will understand why the Tank rightly has been called the Land Ship. It has superimposed naval tactics on land tactics, that is, it has enabled men to discharge their weapons from a moving platform protected by a fixed shield.

Now I will place before you two other reasons why its further evolution is a certainty.

*Firstly*, because the Tank combines, in a high degree, security, mobility, and offensive power. If the "Merrimac"-Mark V. Tank accomplished the above, what will the "Queen Elizabeth" or "Hood" types accomplish in the future? Remember there is nothing to stop five miles an hour growing to twenty-five and the twenty-five miles radius of action to 250 or 500 except lack of money to pay for the best brains.

*Secondly*, another great revolution in warfare faces us both on land and sea—gas warfare. Do not let us minimize its possibilities. Five hundred years ago both soldier and civilian scoffed at gunpowder and declared it to be a devilish invention because it happened to be a new one. Everything new has in its time been attributed to his Satanic Majesty, who, indeed, must be the greatest of inventors. In this capacity I frankly admit myself to be a devil worshipper, and I cannot help feeling that I am at this moment amongst friends and not amongst theologians.

Gas is a projectile which requires little direction, weak propellants, and which hits the tiniest of targets hidden away in the vastest of areas. Further than this gas may be made a humanizer, for it need not be lethal. Gases may be produced which will send the enemy to sleep, make him laugh until he cannot pull a trigger, vomit, sneeze, or be inflicted with internal troubles.

Picture to yourselves a battleship with a sneezing-stricken crew, then a whole fleet gassed by submarines well under the water, each with a hose pipe floating on the surface thirty feet above them.

Respirators are adjusted, but the gas is unknown to its swallows; it penetrates their respirators, for, being unknown, so is its antidote. Fifty thousand sneezing men abandon gun and boiler, and the battle is won not by killing the enemy (how brutal), but by bloodlessly forcing him to sneeze against his will.

Here is a certain antidote:—Don't breathe the outer air. This is very simple at sea, for sailors live in a box which can be made airtight like a submarine; but imagine the wretched infantryman with a salvus set added to his 72 lbs. of kit. Impossible—his mobility will be zero.

Now take the Tank—the Land Ship. It can be made gas-proof much more easily than the submarine can be made waterproof. Its crew can live on oxygen or compressed air, its engine can be run off accumulators. The gas king is dethroned, but only after having driven muscular warfare off the barrack yard and the battlefield.

If we want progress we must seek opposition. The opposition of the critics to the development of the Tank has been the main spring of its astonishing progress, for happily the Tank has had strong supporters whose constitutions have been virile enough to throw off the virus, happily also because, all said and done, the Tank is pre-eminently a common-sense machine.

Let us now become clairvoyant as regards the future. The professional seer looks inside your hat before she tells you your fortune. A very sensible act. She consults the past, gauges your value by the name of the shop you bought your hat at, and then spins you a story on at least one sound foundation—your probable income.

I have shown you the inside of the Tank hat, and I hope you will agree with me from what you have seen that it was good enough value for money spent to permit me spinning you a story.

I see a fleet operating against a fleet not at sea but on land: cruisers and battleships and destroyers. My astral form follows one side and I notice that it is in difficulty; it cannot see; there appears an aeroplane and gives it sight. It says by wireless telegraphy the enemy are yonder. The approach march begins. I see a man in one of the aeroplanes whose head is swollen with the future; he is the Commander-in-Chief of the land fleet. I am following. Suddenly I see the fleet is moving a few points north-east; the Commander-in-Chief has spoken to it by wireless telephony. I sniff the air; it seems impure. Is it gas? The Tanks submerge; that is to say, batten down their hatches. The battle begins.

Out go the mine-sweepers; we are in the enemy's land. A series of detonations show that the act was not executed a moment too soon.

The enemy's fleet concentrate their fire on the gaps made. The Commander-in-Chief is again talking. A small squadron moves to the north, tacks east, and huge clouds of smoke pour across the sky. New gaps are made and the fleet moves through.

Then I see the old scene re-enacted—the contest between armour, gun-fire, and mobility.

The enemy is disorganized, demoralized; his flag aeroplane has been brought down; his brains are paralyzed; it is now the pursuit.

A great river winds across the picture. I put spurs to my astral shell; the enemy must either drown or be pulverized. I rub my etheric eyes; his machines are rushing down the banks, and, plunging into the water, they churn it to foam as they swim through it. Ours follow suit; it is now a race for mobility. I materialize and am in Whitehall, and so I will go back to 1916.

The first Tank operation ever planned was a naval one. The project was to use the first Tanks made in a landing operation on the Flanders coast. It came to nothing, but it was revived a year later when great preparations were put in hand.

The project was an interesting one, destined, however, like the first, never to take form.

The operations at Ypres, in 1917, were, when once Roulers was taken, to be followed by an invasion from the sea between Nieuport and Ostend. Landing troops along this stretch of coast was most

difficult; the water was shallow, the beach was wired, the sea wall was a formidable obstacle some twenty feet high surmounted by a heavy granite coping stone, and beyond were the enemy's guns and machine-guns in great strength, and, further inland still, innumerable dikes and canals.

The grand tactics in this case were based purely on "surprise"; a naval bombardment was out of the question, for, though the sea wall could easily have been destroyed, no penetration inland could have been effected without terrific cost, were the enemy prepared to meet it. It was, therefore, decided to use Tanks.

I might note here that it is a curious fact that, whenever an abnormally difficult operation had to be undertaken during the war, the Army called upon Tanks. Abnormally difficult operations are not the most suited to any weapon, and it was in the easy operations that the Tank effected the greatest tactical economies. This is common sense, but common sense is not always tantamount to common vision.

This is what the Tanks—Mark IV.'s, remember—were asked to do:—

Land from the sea, mount a 20-foot concrete wall with a slope of about  $1/2$ , climb over a coping stone which projected two feet over the top, destroy the enemy's machine-guns and haul up over the wall guns, tractors, lorries, and scores of tons of ammunition and supplies. The initial landing was to take four minutes.

Huge pontoons, some 600 feet in length and pushed forward by two monitors, were to carry the Tanks, troops, vehicles, and stores.

The main difficulty was the coping stone, for though the Tank would just take the slope, directly its nose bumped the projecting cornice the machine slid down into the water.

A facsimile of the sea wall was built and portable ramps constructed which could be carried in front of the leading Tanks. Directly the ramps struck the coping they became detached, and the Tanks, which were fitted with wooden spuds, walked up them like a cog-wheel moving along a ratchet.

A special party of men practised climbing the model wall for some three months and became adepts in this work, but our disasters suffered at Ypres never permitted of this novel landing taking place.

It was a clever scheme, but how clumsy when viewed from future possibilities. Let us glance at these and see how this type of naval and Tank operation may be simplified.

From the naval point of view the main drawback was that the Tank could not swim. What a detail, for as the sailor has created the submersible ship, so can the soldier create the floatable Tank.

Let us all, this time, get into our astral shells, for this is a naval as well as a military operation.

We see a stretch of weary sand—it is the Baltic coast. We see curious ships racing through the Skagarak. They are now standing out a mile or more from the coast, for the water is shallow. There is a rumbling sound, then from their prows squat objects splash into the water—they are moving rapidly towards the shore line; from the water they crawl on to the sands; they are Tanks, and Warnemunde,

150 miles from Berlin, is ours. We materialize and find some commotion going on amongst the enemy's armies on the Western Front.

From the surface Tank carrier the next step is the submarine Tank carrier—a kind of sea serpent which spews monsters on to the beach. What would Olaus Magnus think of this, he who wrote of sea serpents fashioned of skin and blood?

Think now what such possibilities mean to us islanders. No longer will our sailors belong to the Great Silent Fleet but to a fleet which belches war on every strand, which vomits forth armies as never did the horse of Troy, and which will swallow them up again if the land appears unpropitious and carry them safely home beneath the ocean.

Think of the naval bases seized and the landing places protected. Think of the channel which separates us from Europe. It has been called a "ditch"—it may become a veritable tube railway for hostile armies.

Munchausen! Munchausen! Perhaps; but do not let us disparage our inventive genius like a certain Italian alchemist did his own at the beginning of the 16th century. He promised to fly from the walls of Stirling Castle to France. He attempted to do so and, falling, broke a leg. He attributed his failure to the fact that he used for his wings feathers of fowls which, he said, had an affinity for the dung-hill!

It was not his feathers which had an affinity for this unpleasant heap, but his brains. He had been thinking backward of Icarus; he should have been thinking forward in terms of the Wright Brothers.

A lesson. Do not let us now, in 1920, only look backwards to 1914. Let us think forwards to 1930, or we shall become pillars of salt in an arid and unproductive wilderness. Let us look ahead; the world is getting small, but science is vastly huge. Every rational thought is a true thought which may lead to realizable effect. There is nothing too wonderful for science—we of the fighting services must grasp the wand of this magician and compel the future to obey us.

#### DISCUSSION.

DR. MILLER MAGUIRE: Ladies and Gentlemen. It seems that the extraordinary vision of the future which has just been set before us by the learned lecturer has been either too dazzling or too mysterious for the average man, and accordingly, instead of members of the audience jumping up at once to ask questions about the future, they are almost all of them suffering from perennial silence. I merely get up to speak because I am one of the very few people in England who did not invent a tank. Nearly every person of my acquaintance, not only did so, but he is sending in huge claims for damages to a Government which does not recognize the feasibility of his scheme. I think I shall go home and study the future of war from the point of view which has been set forth so brilliantly by the learned lecturer, and try and design some form of tank which will carry on its front a battering ram, such as the ancients used, which will demolish all kinds of obstructions, such as coping stones and walls. A more instructive and scientific lecture it is scarcely possible to conceive. I happened to be one of those who, before the war, suggested that, even as the Romans of the Old Empire, and the Romans of Byzantium, and the Saracens of Mesopotamia

had moving machines with which they could approach fortifications with comparative immunity, having regard to the weapons then used—pikes, bows and arrows, and guns that would not hurt anyone at one hundred yards at the most, such as we had at Cressy, it was extremely likely that in future campaigns somebody would think of another kind of moving machine which would give security as well as mobility to the advance, and that of such machines our army could make use. There is nothing which any army ever did in the past that British soldiers and men, particularly scientific men such as we often have in this theatre, as the learned Secretary knows, need be afraid of. If it is wood, this country had the best oak in the time of Charles II., and the best trees were used by Nelson in the time of Napoleon. If it is iron that is in question, who can make better protective iron than the people of Scotland and Lincoln? and if it is coal that is in question—but perhaps I had better not say anything about that, because I believe the English miner, among his other good qualities, has been so skilful in the past in producing coal that he will not produce the amount that is now required. It is a very singular thing that whereas certain mountebanks, and charlatans, and humbugs and politicians are holding meetings about the League of Peace, we in this room are considering more than ever the destructive antithesis in the shape of instruments of war. For my part, I pin my faith on the gallant lecturer rather than on preposterous politicians. History is with us, and I think it is necessary to look a little at the past. After all, the oracles of time will always guide us. After all, what are the main things we have to consider?—blood, nerve, humanity. You must have a good sound nervous system, a good sound big body, and any amount of brains, and if we have these we can easily get everything else, if the Government will allow us. I would ask the learned lecturer: Can we now, any more than in the days of Napoleon, hope to conquer whether by iron or steel or any other weapon without these inherent intellectual and physical qualities? The learned lecturer said he is not a Munchausen.

COLONEL FULLER : I may be.

DR. MILLER MAGUIRE : I hope you are not. I was taught not to believe a single word that Baron Munchausen ever said, whereas I am beginning to believe every word that the lecturer has said. Although the learned lecturer is not a Baron Munchausen he deals with wonders. Each age has its own wonders. Some of you gentlemen here will remember that, as the learned lecturer said, on a certain occasion in 1862 the Confederates built a boat and protected it with armour which outsailed the Federal vessels. That vessel nearly outsailed the fleet of McClellan coming down to attack the Confederates, but to the horror of the owners of those vessels it completely outsailed them, including the "Monitor." Then we were told that no more fleets would steam on the sea. I had a relative who laughed at the idea, and he went to a gentleman called Armstrong, somewhere in the north of England, I believe, and asked him : Could not he make a gun. He said he could. He asked : "What kind of gun can you make?" Said he : "A gun that will drive that devil"—of whom our friend the lecturer is a worshipper—"back to his own hell." Accordingly the era of the ironclad ship was superseded by the era of the tremendously hard pounding weapon which beats it to bits—the gun against the ironclad. So it will ever be. What one man can do another man can do. The brain of humanity is always changing and working as against other human beings, whether on the land, in the air, or under the sea. The moment I conceive the idea of a watch which is only a silver one, my richer relative conceives the idea of a golden one that will go for ever. That is the contest—in trade, in navigation, in war. That is the model of all human progress from the machine that was referred to by the learned lecturer, who is a tremendous

scholar, at Troy. Ulysses was a liar like all politicians, but he was a working man like the friends of the learned lecturer ; and he devised a horse from whose interior whole hordes of men jumped forth. As Lord Bacon said, military men were always fond of the ladies. A finer illustration of what science can do, what British brains can do, what Scotch inventive genius can do, it is impossible to imagine so far as the construction of the tank is concerned, and that can be done again against any opposition whatsoever. But, remember, the other nations can get a machine too. We had cannon at Crecy ; the enemy then got cannon too, and we had to make better.

I am tempted to go on for an indefinite period, but time does not allow ; and I therefore conclude by expressing high admiration for the variety and range of the learned lecturer's historical knowledge, which he has applied to the lecture in a most skilful manner.

GENERAL J. G. STONE : I have only a very few words to say. Unlike the last speaker, I shall not speak to arouse opposition, because I believe everybody here will agree with what I say. Ten years ago I was at the first Flying Meeting held at Rheims, and I recall the fact that Sir John French and his staff came to the President's box. That week was absolutely the most fascinating week of my whole existence ; I never expect to have the sensations I then had repeated again during the course of my life, as I am too old to see the same sort of thing happen with regard to the tanks. But I remember very well that, as we were going out to see Sir John French and his staff into their motor-cars, General Grierson took me by the arm and said : " I say, Stone, do you really think there is anything in it ? " That is only ten years ago, and it is a very striking fact that such a very short time ago as that some of the best brains in the Army (because I could mention other names but I do not think it would be wise to do so) thought that anybody who took up flying seriously was a little bit " gone in the head." I speak of what I know. My belief and my hope are that now those who take the same line of thought with regard to tanks will not be considered by the Chief of the General Staff and others in authority as being " a little bit gone in the top storey," because I have exactly the same firm belief in the future of the tanks, which the lecturer has so ably put before us, as I had ten years ago in the future of the aeroplane.

MAJOR-GENERAL E. D. SWINTON : Ladies and Gentlemen. After the very illuminating and inspiring lecture we have heard from Colonel Fuller, than whom I need hardly say there is no keener exponent of the future of the tanks, one might be inclined to believe that he, like the quack doctor in the streets, has claimed too many virtues for his specific. To go back just for one moment, I ask you to bear in mind that this new weapon of warfare was originally thought out and designed for one specific purpose, namely, as a cure for a disease which was eating up our British infantry, and it is a rather remarkable fact that, having been produced for that one object—that of meeting the German machine-guns and the German barbed wire—any officer should be able to get up in the year 1920 and suggest that this new weapon will change the whole nature of warfare, as Colonel Fuller has done. I think the difference between his claims and those of the ordinary quack lies in the fact that he has been recommending something that was inherently useful for its purpose, whilst the quack doctor usually, I believe, starts with a pill made of bread or, with a little water in a bottle which is no use to anybody. In regard to some of the developments which Colonel Fuller has mentioned, he specified the suitability of the tank for meeting different forms of attack on the part of the enemy ; for instance, gas. I am glad he did so, because I think it has been rather our tendency up

to the present to look upon warfare from the retail point of view—of killing men by fifties or hundreds or thousands. But when you talk of gas, as Colonel Fuller did, you must remember that you are discussing a weapon which must be considered from the wholesale point of view; and if you use it—and I do not know of any reason why you should not—you may kill hundreds of thousands of men, or, at any rate, disable them. When you consider the use of such weapons in the future, which is certain to take place, the enclosure of men in steel vessels (they may be steel or any material which will give the men some protection which their own lungs and skin cannot give them) will be of vital importance. One point to which the lecturer did not allude is ray warfare. I imagine, from the progress that has been made in the past, that in the future we will not have recourse to gas alone, but we will employ every force of nature that we can; and there is a tendency at present for progress in the development of the different forms of rays which can be used turned to lethal purposes. We have X-rays, we have light rays, we have heat rays. Mr. H. G. Wells, in his "War of the Worlds," alludes to the heat rays of the Martians, and we may not be so very far from the development of some kind of lethal ray which will shrivel up or paralyse or poison human beings if they are unprotected. If that happens, the more machines of the tank type that we have the better for us, and if we have the rays the better it will be for the enemy if they have such machines which will protect them and enable them to live and move. The final form of human strife, as I regard it, is germ warfare. I think it will come to that, and so far as I can see there is no reason why it should not, if you mean to fight. In that case, perhaps the tanks would not be such a great panacea, because, short of previous inoculation, it would not be possible to stop the progress of diseases simply by putting men into steel or any other type of enclosed vessels. With regard to the lecture generally, I consider that it has been the best exposition, the clearest vision, of what warfare is likely to become that I have heard. And from the lecturer's experience of this weapon, from the thought and the deep study he has given to the subject, no one is better qualified than he to diagnose and express tendencies, and it is by tendencies that we must guide our future. What are we going to do about it? There is only one thing to do if we are to be ready, and that is to prepare now. That is a platitude, of course. When I say "prepare now," I mean we must envisage these new forms of warfare, and so far as possible expend energy, time, and money in encouraging our inventors and our scientists to study the waging of war on a wholesale scale instead of thinking so much about counting heads and methods which will kill a few individuals only at a time. One possible development of the tank, which the lecturer no doubt thought of but did not mention, is the eventual three-dimensional machine, which will not only travel on the surface of the earth but will also dive or float and possibly fly. That is only a step further in the evolution of his thesis.

SIR E. H. TENNYSON-D'EYNCOURT, K.C.B. (Admiralty): Sir John Capper, Ladies and Gentlemen. A good deal has been said by Colonel Fuller about the future, and he has carried us far in indicating the possible direction of future development in design, tactics, and strategy. I propose, however, to come down to earth straight away, because there is a great cry just now for economy. There is one point in that connection which Colonel Fuller omitted to mention, namely, that a tank is really a tremendous economy for any army. Quite a small army provided with a comparatively few tanks is certainly the equal of a much larger army without them or with fewer and inferior tanks; in fact, the development of mechanical warfare which Colonel Fuller portrayed is really the greatest help in the direction of economy at the present time that we could

possibly have. I think there is no difficulty in developing designs in some of the directions which he indicated. Up to now the designs of tanks have been limited very severely by the fact that they have had to be carried over the rail. This has kept the dimensions down to very small figures indeed. Once we get away from that, there is no reason why tanks should not develop just as warships have, and become much more powerful weapons. Just as the present battleship with a crew of about 1,000 men is equal to any number of old ones, a big landship will be equal to a very large number of old tanks. Smaller types of tanks will, however, also be required.

I should like to offer my thanks and congratulations to Colonel Fuller on his most interesting lecture.

BREVET COLONEL J. F. C. FULLER, in reply, said: Ladies and Gentlemen. I have very little to add except to thank you for the way you have received this lecture and to thank the gentlemen who raised various points for discussion. I entirely agree with Dr. Miller Maguire that as the basis of all progress you must have brains—not quantity, but quality. Good brains will produce an economical army. In that respect I also entirely agree with the remark which Sir Tennyson-d'Eyncourt has just made, namely, that the tank is an economical weapon for this; indeed, it is only a matter of common sense. To prove it you have only got to go outside and count the number of horse 'buses there are on the streets. How many are there? You will not find one. Fifteen or twenty years ago nothing but horse 'buses existed. Horse-flesh did not pay. It did not pay on the road and it does not pay in an army, and the same applies to all muscular types of warfare. In any well regulated factory how is the work carried out? It is carried out mainly by machine tools, not by hand tools. Why? Because it does not pay to use hand tools for a great amount of the work which is done. I was also much honoured and pleased that General Swinton, who probably—coupled with Sir Tennyson d'Eyncourt—had more to do than anyone else with the origin of the tanks, said what he did. The gist of his remarks was: secrecy in the future. In the past it has been difficult to keep a weapon secret, because weapons were hand tools. Innumerable men and innumerable weapons were necessary, and somebody was sure to "blow" the secret sooner or later. The French, as you remember, in 1870, tried to keep the mitrailleuse secret. They kept it secret, but when the day of battle came nobody knew how to use it, and it failed. In mechanical and scientific warfare it is possible, by replacing to a very considerable extent man-power by machine-power, to evolve and create machines, especially projectile machines like those for gases, of which the man himself who discharges them has not the faintest conception, though their effect on the enemy may be colossal. The future is based on the present: the present is based on the past. If we do not step forward to-day we shall be marking time, and if we mark time now, ladies and gentlemen, believe me, we shall be marking time in our own graves.

THE CHAIRMAN: Ladies and Gentlemen. It now only remains for me to say a word or two in moving a vote of thanks to Colonel Fuller for his excellent lecture. Before doing so, the Secretary desires me to say that the Muesum of the Institution is still without a model of a tank. Perhaps some of the audience could rectify this and present such a model to the Institution. If the Tank Corps, Sir Tennyson-d'Eyncourt, and General Swinton were to ask Sir Dudley Docker and Sir William Tritton to give the Institution small models of the tanks of the two types for which they were so largely responsible, I feel convinced that they would do so. I therefore ask the Tank Corps if they will kindly move in the matter.

What strikes me most about this lecture is that it is extraordinarily wonderful that the Royal United Service Institution, which is a very serious body of military students, should in this year of 1920 be carefully listening to a lecture of this sort, instead of being snuffed out of the room, as I am sure it would have been in 1910. It shows that we are thinking forward, and we have got to think forward. General Stone has mentioned how backward we were in thinking forward in regard to aeroplanes, and we all know what the aeroplane meant in this war. The tank is practically only three years old, and we must use our best endeavours to press forward its evolution, because we cannot afford to be caught napping and to find that somebody else with whom we go to war has got a better machine and better possibilities of making a machine than we have. It is most important to realize that, so far as I know, under the very best conditions of construction that you can get, before you can produce tanks of a new type in sufficient quantity to outfit even a small Tank Corps, you have got to wait a whole year, so that if you are a year behind at the commencement of a war you may be that year behind for the whole of the war, and run serious risk of being defeated. The matter has got to be taken up in time. We must impress that upon our rulers, and, if they will not look forward and believe what we say, we have got to make them believe or tell them that they must go. Ladies and gentlemen, on your behalf I propose a very hearty vote of thanks to Colonel Fuller for the very illuminating and capable lecture he has given us here this afternoon, and I ask you to accord that vote of thanks to him by acclamation.

The resolution of thanks was carried by acclamation.

COMMANDER W. F. CABORNE, C.B.: Ladies and Gentlemen. Before we separate I ask you to pass, by acclamation, a very hearty vote of thanks to the Chairman for presiding this afternoon, and for the very valuable remarks he has made.

The resolution of thanks was carried by acclamation.

The meeting then terminated.

