

# THE ROLE OF SCIENCE IN WARFARE OF THE FUTURE

A great military leader considers the possibility of war between East and West—and gives his own ideas on how such a war should be conducted.

by FIELD MARSHAL THE VISCOUNT  
MONTGOMERY OF ALAMEIN

**T**HE WORLD IS SPLIT IN TWO and the aims of the two parts, East and West, are in direct conflict. In some areas the conflict is violent and has led to fighting. These local wars are part of what is called the "cold war". A better name would be the cold peace.

History records that from time to time evil men arise, seize power, and attempt to exert their will by force. Hitler was such a man. Therefore the possibility of the cold war turning to a hot war is always with us, and we must be prepared accordingly.

Both are global, the cold war *and* the hot war. In trying to win the cold war one side or the other may miscalculate and bring on a hot war, though neither side wanted it. So once again, war is a possibility.

But as we advance further along the road of development of atomic and thermo-nuclear weapons, guided missiles, and ballistic rockets, it will become increasingly clear that a *hot* war will be mutual suicide for the contestants. Therefore, the great problem regarding the cold war now in progress is how to win it without precipitating a hot war.

Local wars call for the use of conventional weapons, and for a readiness to use new weapons if the circumstances demand it. It is obvious that the use of atomic and thermo-nuclear weapons is going to have a profound effect on the conduct of war, on weapon systems, on strategical and tactical conceptions, and therefore on the organization of forces.

I want to make it absolutely clear that we at Supreme Headquarters Allied Powers, Europe are basing all our operational planning on using atomic and thermo-nuclear weapons in our defence. With us it is no longer: "They may possibly be used." It is very definitely: "They will be used, if we are attacked."

The reason for this action is that we cannot match the strength that could be brought against us unless we use nuclear weapons; and our political chiefs have never shown any great enthusiasm in giving us the number of men to be able to do this without using such weapons.

It all calls for a certain reorganisation of our forces, and in our strategy. We have reached the point of no return as regards the use of nuclear weapons in a hot war.

*Field Marshal Viscount Montgomery, British hero of World War II, now serving as Deputy Supreme Commander of the Allied Powers in Europe, on a visit to Pasadena last month as guest of Caltech.*



In our thinking ahead we need some realistic foundation. Let us therefore consider a war between two powerful groups of nations, and let us call them East and West. You can make any grouping within this broad statement that you think suitable. I would suggest that we include the NATO nations in the West.

We will assume that the West has at present a superiority in atomic and thermo-nuclear weapons together with the means of delivery, but that as the years pass that margin of superiority is likely to decline.

So far as we can see *today* we are not justified in depending on air bombardment *alone*, even with nuclear weapons, to bring a world war to a successful conclusion; still less a local war or disturbance. Wars *today* can be won only by fighting, and, in a hot war, fighting will continue in the air, at sea, and on land until one side loses the will to fight on.

On the other hand, the skillful employment and accurate application of superior nuclear fire-power *in combination* with the operations of streamlined land forces,

can be a decisive factor in the battle on land. The problem will be, how to force the enemy to concentrate his armed forces sufficiently to offer a worthwhile nuclear target, without exposing our own forces to destruction by the enemy's nuclear attack.

I suggest that such a war will have three phases.

*First Phase:* A world wide struggle for mastery in the air and of the oceans. It will be vital during this phase to prevent enemy land forces overrunning and neutralizing Western bases and territories.

*Second Phase:* The destruction of the remaining enemy land forces.

*Third Phase:* The bargaining phase, when the enemy's homeland and all it contains is at the mercy of the Western air power. We will then carry the air attack to the point where the enemy accepts our terms.

The second and third phases may be concurrent.

Against the background of this overall strategy, let us consider the war under three headings: The War in the Air. The War at Sea. The War on Land.

## THE WAR IN THE AIR

It is clear from the strategy I have outlined that the dominant factor in future war will be air power. And that is my very firm belief. But like so many things we do we too often pay only lip service to this great truth.

The greatest asset of air power is its flexibility. The main factors in determining the degree of flexibility are the methods of command and control, the range of aircraft and the mobility of supporting equipment.

Flexibility and centralized control of *all* the air forces in a theatre of war are vital to success. But the West has sacrificed much of its flexibility by basing the air command organisation on the requirements of "direct support" of the land forces, whereas it should be based on the organisation necessary to gain the greatest measure of control in the air.

Air power is indivisible. If you split it up into compartments you merely pull it to pieces and destroy its greatest asset—its flexibility. If we lose the war in the air, we lose the whole war and lose it quickly. We will never win the war in the air with the organisation for air command and control that we have at present. The present organisation is unworthy of a group of nations who claim to have some knowledge of war.

Now let us have a look at the war in the air.

If we maintain the ability to start a tremendous nuclear bombardment of the East *the moment we are attacked*, they cannot afford to do nothing about it.

It *must* affect the employment of their air forces. It *must* force them to devote a considerable effort of their long-range air forces and nuclear weapons to attempt to hit *our* strategical air forces and the installations on which they depend. It *must* force them to expend effort on air defence, no easy problem for them.

Against this background, I suggest there are three successive stages to consider in the War in the Air.

### The first stage

This stage would be if war comes in the near future.

In this period, as I see it, both sides will rely principally on *piloted* aircraft in both the strategical and tactical fields. I see no sign, within this period, of either side being able to create an air defence system which could greatly affect the present balance in favour of the offensive in the air.

The results of this great battle for mastery in the air will have a tremendous effect on the whole war, and we must win it. But we cannot afford to rely on air resources which depend on mobilisation. The air forces we need, together with all the means necessary to keep

them operational, *must exist in peace-time*. And by centralizing Air Command on the highest possible level we must restore to the air forces the flexibility they have largely lost.

### The second stage

In the not too-far distant future, the East may create a sufficient stock of atomic weapons, and the long-range means of delivering them, effective enough for them to strike at the outbreak of war a devastating blow at *our* means of delivering offensive air power. At this stage, as far as I can see, both sides will still be relying principally on piloted aircraft, both for offence and defence.

Before this period arrives, it will be of tremendous importance that we should have developed, and have in being, a highly effective global early warning system, together with the best air defence that the scientists can give us; in order to prevent our offensive air power being crippled from the start by a surprise attack, and to minimize the effect of such an attack.

### The third stage

Later on still, the East may have developed means of delivering their weapons with accuracy, both short-range and long-range, which do *not* rely on piloted aircraft, e. g., the ballistic missile.

Our ability to counter that threat by both offensive and defensive measures will be much reduced, because the targets will be far less vulnerable—whether they are launching sites, or the weapons themselves actually in the air.

We must ask ourselves seriously what, at that stage, are to be the targets of our offensive air power.

Will it then be true that offensive operations by our aircraft or missiles will directly affect the enemy's ability to deliver his weapons against us?

I do not see the aeroplane disappearing altogether. In the tactical field I am sure that there will always be tasks for piloted aircraft in support of land and naval forces. The enemy's aircraft used for these purposes, and their bases, will remain an important target for our aircraft and missiles.

What are the conclusions?

Now that we have solved the problem of endurance in the air, and an aircraft can remain in the skies for prolonged periods and in all weathers, air power is becoming the decisive factor in warfare. We must therefore get organised accordingly. What we must do *now* is to organise the command and control of our air forces so as to retain the greatest degree of flexibility, centralizing command in the highest commander who can effectively exercise that command: so that he can wield the available air forces in a theatre of war as one mighty weapon.

If we are attacked, we must set in motion an *immediate* air offensive on the largest possible scale, directed at the enemy's air forces and at his homeland. The means of delivering an *immediate* air offensive must exist in peace.

We must develop an effective, and global, early warning system in order to have some chance of being able to take the offensive in the air should we be attacked. And we must study air defence urgently; I will say something on this subject later on.

It is vital that our air forces should be able to absorb nuclear attack, and survive to strike back. The principle of dispersion must be explored from every angle. We must get away from the enormous concrete runways of today, and develop aircraft which can land and take off from small pierced-steel-planking airstrips dispersed over the countryside. In this respect "vertical lift" aircraft have very great possibilities.

## THE WAR AT SEA

Now let us discuss the war at sea.

As things stand today, it is my view that the West could not win if it lost control of the Atlantic. If we cannot deploy in Europe the power of the American continent, Europe could fall.

In the open seas the great threats are the submarine and air attack. In the narrow waters, the threat of the mine must be added and attack by aircraft will be more effective.

Naval forces of today require air support in the same way as do land forces. It is essential *in the conditions of today*, that navies called on to operate in the great oceans should have *their own air forces*.

The navies of those nations whose work lies entirely in narrow seas, such as the Mediterranean, or in European waters, are in a different situation; in my view, such navies do not need their own air forces. What I have said about the war at sea is applicable only for today and for the next few years. But the more one considers the future the more the problem of control of the seas becomes difficult to foresee. The question to be faced, and decided, is: "In the future, will the seas be controlled from the sea or from the air?"

When one considers the range and power of aircraft of the future, and the progress that is likely in radar and electronics, I am personally forced to the conclusion that the time will come when the major factor in the control of the seas will be air power.

I consider that the day of the large warship on the surface of the sea is over. The emphasis in the future is likely to be on the smaller type of vessel and on underwater craft.

If it is true that the seas will in the future be controlled mainly from the air, then it is for consideration whether this control would not be best exercised by national air forces and *not* by naval forces. If this is the case, then navies will not in the future require their own air forces.

That time has not yet come. But in my view it will come eventually. If this is true, then we should at once stop building any more aircraft carriers; because they are very expensive and will not produce a dividend.

What it amounts to is that new weapons have not yet rendered the aircraft-carrier obsolete, but they will do so in the future. And I see control of the seas eventually passing to air forces.

## THE WAR ON LAND

To fight successfully on land we need the following four essentials, as a minimum:—

*First:* We must have first-class forces "in being" in peace time, up to strength and ready at all times to act as our shield *without any mobilisation procedure*. These forces must be trained and equipped to the highest pitch: mobile, hard-hitting, offensive troops of magnificent morale, very highly disciplined, under young and active commanders. These are the troops and the commanders who have got to stand firm in the face of the horrors and terrors of the opening clashes of an atomic war, and they will stand firm only if they are highly trained and highly disciplined.

*Second:* We need reserve forces, well organised, capable of being mobilised in echelons, and each echelon receiving sufficient training in peace to ensure it is fit to fight at the time it is needed.

*Third:* Our forces, active and reserve, must be backed by a sound logistic and movement organisation, which should exist in peace to the degree necessary to ensure success in the opening weeks of war.

*Fourth:* We must have a sound Civil Defense organisation in each national territory.

The whole philosophy underlying these needs in land forces is, that the active forces "in being" in peace will make it impossible for the East to launch an attack successfully *without a preparatory build-up of their forces*, which we would know about; it would be difficult for the enemy to surprise us.

Our *active* forces will prevent the Eastern forces from reaching our vital areas, while we are assembling and moving forward our *reserve* forces.

Let us have a last look at the war in the air, at sea, and on land.

## The war in the air

We have got to win the war in the air. We will not win it unless the air forces are allowed to regain their flexibility and unity, and unless air command is organised according. *It is vital that this matter be tackled at once on the highest political level.*

We *must* maintain in peace the ability to launch an immediate offensive in the air against anyone who attacks us.

The West is vulnerable to nuclear attack. Great offensive power is wasted unless it is married to defensive power and can be launched from a secure base.

## MONTGOMERY . . . CONTINUED

As time passes and the offensive capability between East and West levels out, the advantage will go to that side which has the greater defence strength, which can protect itself against attack, and can survive to strike back.

There is at the present time no sure defence against the aeroplane or ballistic rocket. Indeed, so far as we can see today, trying to get a secure defence against air attack is rather like trying to keep the tide back on the sea shore with a picket fence. This situation must not be allowed to continue.

The best scientific brains we possess should be gathered in to help in the task, working in close cooperation with air forces. I say "air forces" because I hold the view that air defence should be organised and handled by air forces, and that Antiaircraft Commands should be handed over to that Service.

### The war at sea

Today, the navies must handle this war. They must be given the minimum means to ensure control of the seas and of the approaches to essential ports, and no more. *It is essential that they should not dissipate those means on tasks which do not affect the war at sea.* But we must not be hide-bound by past traditions. I give it as my opinion that the time will come when the seas will be controlled from the air. If this is true, the future must be planned and organised accordingly.

### The war on land

In the organisation of land forces the emphasis must be on strategical and tactical mobility, and on simplicity of weapons systems. We need Divisions that can be moved rapidly by air; this will necessitate suitable aircraft for the purpose.

To gain full advantage of the immense fire-power that nuclear weapons have provided, and to avoid destruction by enemy nuclear attack, armies must develop a more lively and opportunist type of battle leader than exists at present, in both junior *and* senior ranks. Such a leader must have the imagination, the daring, and the resource to seize fleeting local opportunities; he must be trained to act independently and immediately within the framework of a general plan, rather than on precise and detailed orders, or only after reference to a superior.

I should add that these qualities in a leader apply equally to navies and air forces.

Land forces must become *less* dependent on roads and *more* capable of cross-country movement. The supply system of land armies must be streamlined. They must become much less dependent on fixed lines of supply such as roads and railways, which involve frequent transfers of load.

Armies need a simple line of supply based on an air

lift. Today, when supply lines are cut by enemy action, armies cease to operate efficiently. The system of the future should provide air supply to forward maintenance areas from Base Depots many miles to the rear, and well dispersed.

The air lift from Base Depots to forward maintenance areas must be by some type of "vertical lift" aircraft, which can take off and land vertically, and which fly at a fast speed like an ordinary aircraft in level flight. The air supply must be capable of being maintained in *all* weathers, and by day and night.

I see Base Depots being replenished by large freight-carrying aircraft which can land and take off from pierced-steel-planking airstrips.

There is clearly a tremendous future for "vertical lift" aircraft. It is my opinion that this vast air organisation for the land armies will be best handled by the air forces, since you cannot separate an air transport system from air operations.

Such a supply organisation would do away with the vast array of units and headquarters which today constitute the enormous "tail" of a modern army. It would be the first step in restoring to armies the "freedom of the countryside," and the tactical mobility, that have so largely disappeared. By simplifying the tail we shall get more bite in the teeth.

The armies of today have to a large extent lost their mobility; they are becoming road bound and are weighed down by a gigantic administrative set-up in and around them. Staffs are far too big; the amount of paper that is required to produce even quite small action is terrific. We seem to have lost the art of command, other than by paper. No ordinary man can read half the paper that is in circulation; I doubt if the other half is worth reading.

### The gist of the whole matter

We stand today at the cross roads, not knowing which turning to take.

Absolute defence against air attack will be impossible in the future. A deterrent, the means with which to hit back instantly, and to give more than you receive—this is the surest way to make an aggressor think twice before he attacks. The West must build up such a deterrent, capable of being delivered immediately by air forces which must be "in being" in peace time.

It is then vitally necessary to guard against a surprise attack, and against treachery, and to be able to hold such an attack long enough to enable nations to spring to arms behind the shield and mobilise their collective strength.

The Western nations must also retain the ability to absorb atomic and thermo-nuclear attack, and must ensure that their means of instant retaliation are not compromised by surprise or treachery.

Political, financial, and economic considerations will make it impossible for armed forces to have all they want, or do all they would like. It will become more

important than ever to concentrate on essentials and to have our priorities right.

In the scientific age into which we are moving, which is also an age of ever-increasing costs, Governments have got to ensure that their armed forces and security measures are built up within a framework of economic realities and against a background of sound inter-Service responsibilities.

If what I say has validity, then the priorities will call for the following:

- (a) Bigger air forces.
- (b) Smaller and more immediately-ready regular armies with great strategical and tactical mobility. Better organised and more efficient reserve armies.
- (c) Smaller navies.
- (d) The organisation of the three fighting Services based on more atomic and thermo-nuclear power, and less manpower.
- (e) A Civil Defence organisation which exists in peace to the degree necessary to ensure it can operate in top gear in an emergency. It must be understood in this respect that while great destruction may be caused at the point of burst of a nuclear weapon, tremendous saving of life and property will be possible on the fringes.

## CONCLUSION

I would like to put some points to you in conclusion.

1. We are living today in an age of great scientific progress. The possibilities that lie ahead are almost limitless. If ever war should come again to this distracted world, which God forbid, the key to our success will lie in your hands. I would put forward the following points for your consideration.

The scientific advances of today in civilian life, and in the realm of defence, are creating a demand for highly trained technicians and engineers in ever-increasing numbers. Most nations are falling behind more and more in the attempt to meet this need.

I have been told that Russia is producing more of these technicians than the United States. It is not important whether you produce more technicians than Russia. It *is* important that you have enough to meet your needs for defence and to keep ahead in new developments. And your needs are also the needs of the free world.

I believe there is a further problem in the field of science that needs to be watched. Your nation has earned a great reputation as a mass producer and for your ability to take an idea and improve on it. I suggest that you want to have the same reputation in basic research. Basic research has given us some near-miracles in the past, and we want more in the future. I suggest you concentrate on this and lend your assistance, so that you gain for the United States a reputation in basic research

that matches your reputation for production and applied techniques. The survival of the free world may well depend on your success in this vital matter.

2. What is needed today in every nation is a clarion call and a roll of drums. That call must be one to discard out-of-date doctrines and methods of past wars, and to organise our affairs to take full advantage of the progress of science.

We see today the rise of air power and the emergence of the Air Forces as the decisive arm in warfare. We see the big warship disappearing from the seas. We see the day of the aircraft carrier approaching its end.

It is no good trying to fight against the inevitable, as some people do. Do not let us be mesmerised by what worked in past wars; it will not work again. We must take off our hat to the past and roll up our sleeves for the future.

Service chiefs must cooperate closely with the scientist, put their problems clearly and simply to them, and give them all possible help in solving those problems.

We require a fighting machine which is backed by a sound logistic organisation. Both of these, the fighting machine *and* the logistic organisation, must be planned in full accord with scientific progress. There will be much opposition.

The citadels of vested interests must be swept away; out-of-date procedures and techniques must be discarded. All this will require courage, and decision.

And the first courageous decision will be to acknowledge the dominance of air power, and to place air forces in the position of being able to play their part as the decisive weapon in future war. This decision must be taken at once; delay will be dangerous.

3. In the past the defence programme of a nation has often been decided as a result of compromise decisions by Chiefs of Staff. If this practice is followed in the future we shall fail.

The vital thing today is to produce a military weapon which is in all respects adequate for the national needs and for the collective security system of the free world.

In the Navy, the Army, and the Air Force each nation has a team. By themselves the individual members can achieve little. The team can achieve victory if it is properly constituted. The progress of science is likely to change the former responsibilities of the three members in certain directions. Parts of the load are shifting from the shoulders of one Service to the shoulders of another.

In particular, the air is coming to the front as the dominant factor in war and the decisive arm, as I have already said. This is going to introduce difficult problems and in solving them do not let us bother unduly about the colour of our uniform: dark blue, light blue, khaki.

What is vital is to find the right answer and the one which is best for the nation, and to reach that answer without ill-feeling and inter-Service quarrels.

**Finally**—The key to the future lies in the hands of the scientists, and in Institutes of Technology such as yours. I am confident you will not fail us.