The Fifth Arm

A great deal is being written at the present time about the value of air craft in future wars. The enthusiasts are inclined to claim that man's ability to navigate the air will completely revolutionize warfare. The sober student, however, of military history and military operations in general does not agree to this. Nevertheless, air craft (aeroplanes and dirigible balloons) are going to exercise a very important influence in all future wars between civilized nations. The following extracts from two different periodicals furnish food for thought for the engineer, the artilleryman, the cavalryman, and the infantryman:

THE HIGHWAY OF THE AIR AND ITS MILITARY ENGINEERING PROBLEMS*

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To the military engineer dealing with fortifications (earthworks and obstacles), communications (roads and bridges), and with mines and demolitions, the flying machine particularly beckons, as the change of conditions will mean to him a reconsideration of present methods and ideas.

The New Material.

The flying machines of the present day are either gas supported (dirigibles) or heavier than air (aeroplanes). The former are either "rigid" (having internal solid skeleton) like the *Mayfly* and the *Zeppelin,* or "non rigid," like the *Parseval, Gross,* and other military balloons.

The rigid dirigible has a speed of 30 miles per hour, with a range of 1,000 miles, carrying fifteen passengers without descending; though this was under most favorable weather conditions and not to be expected during hostilities.

It is unreliable in windy weather, and the fact of so many being storm destroyed proves it must be protected by a kennel; and, furthermore, the difficulty of emerging or entering its house during wind necessitates that the kennel be turntable, either mechanically

*By Lieut. G. A. Taylor, Australian Intelligence Corps, New South Wales. Extracts taken from the *Commonwealth Military Journal,* Melbourne, Australia, for March, 1912.

or by placing the same on water; hence it must always act from a base. The "non rigid," however, can be deflated, it is thus more transportable; and where railways are available its gas plant can be brought near the arena of operations.

But the value of a military weapon depends on its being utilized under all conditions in which an enemy can operate, and in this respect the aeroplane comes nearer the military ideal. It can travel horizontally twice as fast and rise three times as quickly as the dirigible; a vital factor in aerial tactics; and certain types can be flown in winds up to 40 miles an hour.

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How Aerial Tactics will Affect Military Engineering.

The military engineer, in considering aerial tactics, will find for reconnaissance purposes the aeroplane provides a new field of observation. It has advantage over mounted patrols, inasmuch as it covers country at a greater speed; but it has the disadvantage of breaking the great commandment of true reconnaissance, that is, "See without being seen."

The aeroplane, I noted, during the recent flight at Liverpool Military Camp, could be observed 5 miles off, though the camp must have been visible to it from a farther distance. From a height of a thousand feet, a distance of 33 miles can be seen; but for accurate reconnaissance, and no other is worth considering, closer approach must be made; hence reconnaissance information from an aeroplane, to be of any value, must be instantly transmitted.

If the aeroplane has to return and maneuver to safety, land, and deliver the message, the enemy would have time to change its formation, and in that respect new problems in strategy will engage military engineers; and Stonewall Jackson's advice to "always mystify and mislead the enemy" will take a wider meaning.

Trap formations will be made on even grander scales than Napoleon's formation trap at Austerlitz. It is well known, yet its repetition is worth while.

He took up a position behind cover with his left flank touching the northern of two ranges, and a great gap between his right and the southern range. Through this gap it would seem easy to penetrate and so turn his right flank and cut his communications. His enemies fell into the trap. Napoleon attacked their right wing to let the left get well away on its great outflanking movement, he then threw 30,000 men at their weakened center, seized their strong tactical point, cut the army in two, and smashed nearly half of it.

The military engineer will have to be prepared for many such schemes of deception and surprise.

In the first battle of wits in aeroplane military tactics, the ground engineer won out over his aerial brother. By painted tree trunks and dummy earthworks, the reconnoitering aeroplanes in German maneuvers (1909) were hoodwinked, returned to their base with misleading information, their army falling into the trap.

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By the most mobile of the forces will the information be turned to best account, so to the advanced mounted troops will the reconnoitering aeroplanes be allotted. The aeroplanes, however, can not give the best indication of tactical strength—an aeroplane observer, for instance, can not say if a house is occupied, hence negative information from the air is unreliable. A forest may screen an army, yet a body of light horse could go through that forest like a rake.

The aeroplane will precede the advanced patrols, giving the most advanced strategical information, yet it must be remembered that aerial observation from a height is at times misleading. As one rises from the ground, the horizon rises also, the ground below sinking, the country forming, as it were, a cup, hills first appear levelled, and then are almost unobserved except in sunlight, being then distinguished by their shadows. Aerial reconnaissance from a height practically only gives horizontal plan—vertical elevation must be obtained by low flying or by mounted troops.

Reconnaissance from a height is at times misleading. Take, for instance, a view from the top of a monastery at Kensington, 250 feet high, looking towards an enemy occupying a ridge between Long Bay Penitentiary and Botany Bay.

The foreground from that height corresponds to the view of an aeroplane observer a mile off at a vertical height of 1,000 feet, the ground appears fairly flat, without any cover worth considering, and any kind of a frontal attack seems absurd. A close ground study, however, reveals a deep gully running well up towards the position, and offering splendid cover for infantry, with opportunity for a frontal attack in extended order through the scrub, whilst the enemy's flanks could be kept active.

The aerial engineer, for reconnaissance, will have to fly low and take risks.

In naval tactics, the aeroplane will precede the destroyers, locating the enemy's submarines, and acting as advanced aerial patrols.

Aerial Attack.

In attack from the air, the military engineer will have to consider possibilities of aerial bombardment. Both dirigibles and aeroplanes can be utilized for aerial attack—bombardment from dirigibles being the more accurate and having greater effect, for, being stationary, there is best chance of accuracy, and heavier bombs may be carried; but with an aeroplane, given the height by aneroid, speed by anemometer and horizontal distance, accuracy of hits is but a simple matter of the parallelogram of forces, and a target can be quickly picked up by running fire from a bomb dropper (quickly worked by foot pressure) like an aerial machine gun.

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The value of sudden aerial attack is very great. Surprise has been the greatest factor in almost all the grand strategical combi-

nations of military history. The first and last thought of every great general is to strike where he is least expected, and it is through such possible surprises that the engineer in the past, with his field defences, has nursed the fighting spirit of the soldier, and kept at a distance that spirit of demoralization that stalks every army, that spirit that watches every opportunity to wreck the moral force of the fighter, for more armies have been routed by moral effect than by shot and steel.

It was the moral effect of Jackson's counterstroke that won the battle of Bull Run: "Reserve your fire till they come within 50 yards, then fire and give them the bayonet, and when you charge yell like furies," and that yell rang in the ears of 12,000 Federals and chased them to Washington.

It was the moral effect of Napoleon's tactics that won the Battle of Ulm, when 23,000 surrendered without firing a shot, when Napoleon said: "My army can fight with its legs."

Consider the moral effect of a screaming aeroplane shooting into and scattering the ranks of an army, marking its track with explosives. Consider the effect the possession of swiftly moving airships will have upon an army not so armed, who would watch with fear each hovering cloud to see if it screened the aerial terror that was smashing them with smokeless noiseless guns!

It will be to counteract in some degree the moral effect of aerial attack that the engineer will have some problems to solve.

Aerial Defence.

Aerial defence may be summed up in excess of speed—horizontal and vertical, and the use of smoke, cloud, fog or mist cover. Organization must be perfect; and aerial engineers, pilots, observers, and mechanics must be well trained in the use and possibilities of all arms.

Ground Attack.

The attack from the ground will take the form of high angle fire, and in this respect the engineer will consider the best means of assisting field guns to rapidly allow for swift aerial movements, by devising special elevating carriages. The elevation of present mountain guns is but 15 to 30 degrees, howitzers, 45 degrees, and the new Krupp gun 70 degrees.

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High explosive shells will have a very marked effect exploding in the locality of an aeroplane. The air concussion of gun fire is sufficient, as is known, to break windows in the vicinity, the concussion effect of the shell will, therefore, be much greater in the air as there is no ground friction, and it will be in the study of the concussion effects of certain explosives that the engineer will have some problems to consider.

In this respect an interesting accident happened recently during the maneuvers on the Mexican frontier. Simon went out to locate

three batteries of artillery. He discovered two and flew over the third without locating it. As the artillery had orders to fire blank cartridges at any machine within range, they let go at Simon, who was flying at height of 800 feet. The air concussion almost upset him. Here was an instance of an ordinary field battery blank fire having an effective range of 1,600 feet diameter.

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In attack from the ground, much ammunition will be wasted, hence the engineer will facilitate mechanical arrangements for speedy supply. In late wars it has been estimated that 1,000 to 3,400 cartridges and 80 to 100 shrapnel shells have been expended for every man put out of action. The aerial attacker justifies still greater expenditure. It has, therefore, been allowed that 8,000 cartridges are justified for an aeroplane with one observer. Therefore, if one company can fire 1,500 rounds per minute, success in ground attack of aeroplanes will depend on the expenditure of much ammunition, and with several companies maintaining requisite rate of fire; sights of rifles and machine guns being altered to allow of aerial elevation and deflection.

Automobile guns are now in use; but having to keep to the roads are under a disadvantage in following aerial movements (see illustration), particularly as aerial attackers may seek cover in clouds, and under the best conditions, remain but a short while in range, and then suddenly change their direction on apprehending danger. And it is in this superiority of direction over roads and such present lines of communication that the aeroplane has the advantage. Take a road in the stress of war. It is the life line of the army, it holds it to its supplies, and along its well-tramped length rush the cheering reserves to replace losses—the food transports, the ammunition carts, hospital supplies, all rush ahead in a cheering, wildly excited line; but coming back there crawls another line of wounded soldiers, dejected prisoners, empty wagons—two opposite moving lines struggle along, hedged by the sides of that road; each has to make its way unimpeded or the army suffers. The protection of that road has been the main concern of the campaign; cut it ahead and the army is checked; cut it at the rear and the result may be more disastrous. The fate of a nation may depend on the break of such a line of communication. Napoleon made good roads his first necessity. In fact, till to-day "the road" has been the fulcrum upon which the fates of armies have been balanced. Yes, till to-day, for the aeroplane knows no road, and so will be difficult to follow up in ground attack.

It, however, must alight to replenish its store of petrol and oil, and when down, it will be like a tortoise on its back.

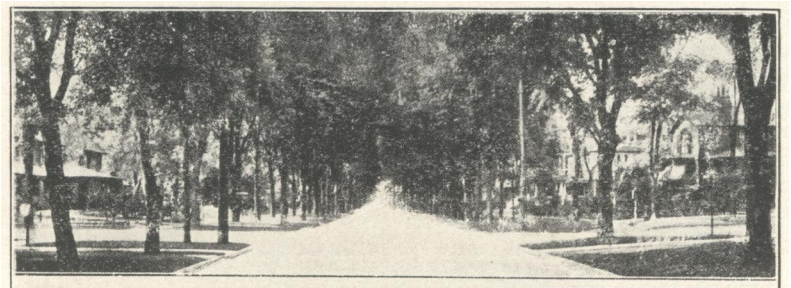
The alighting base, therefore, will give its position away, and it will be rushed by the mounted troops, and petrol stores located. The military engineer will, therefore, devise overhead and hori-

zontal cover for stores, and see that they are not concentrated, but well scattered—before they are scattered by an aerial visitor.

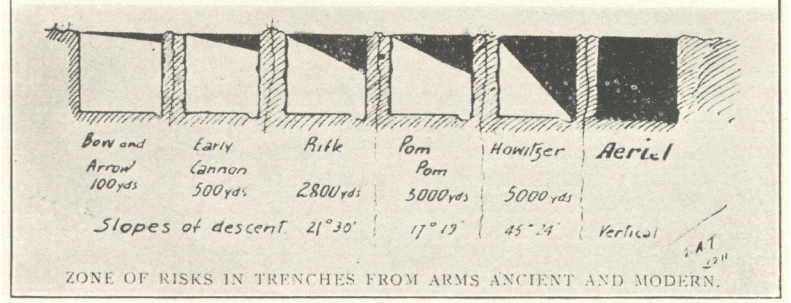
Ground Defence.

It is in defence from aerial attack that the military engineer will find some of his greatest problems.

The first principle is that field defences be so constructed as to conform with the tactical plan of operations, and as the tactical plan of operations of aerial attack means sudden surprises, quick arrangements for overhead screen and cover must be considered.



A TYPICAL ROAD IN THE AIR AGE.
(The excellent overhead screen will be noted.)



ZONE OF RISKS IN TRENCHES FROM ARMS ANCIENT AND MODERN.

Fig. 1 (top); fig. 2 (bottom).

Hitherto the weapons reckoned with in devising works of defence have been rifles, machine, and quick-firing guns, heavy artillery and howitzers.

Looking through development of modern weapons, we find field defences have been gradually getting more unsafe.

Of rifles, the slope of descent is 1 in 2½ at 2,800 yards. The greatest slope of shrapnel is 1 in 4 at 4,500 yards. The greatest slope of howitzers is 1 in 1 until with aerial bombardment we reach the vertical. * * *

I have heard military officers say that the dropping of explosives

from aerial machines can be prohibited by a Peace Conference; but the Hague Conference, 1907, refused to continue such prohibition, as it was felt that as aerial vessels would be used for reconnaissance, it would be unfair to deprive them of means of retaliation if attacked. Even if future rules of war prohibited dropping bombs, they could be fired down from guns of small carrying power.

Bombardment, however, is a wasteful method of getting results. The bombardment of Paris, though it practically used up all the German ammunition, only killed 96 people, and in an aeroplane ammunition is particularly limited, but the speed of the latter can enable it to quickly replenish.

The military engineer will, therefore, seize every opportunity to devise overhead screening and defensive cover, and no better screen will come to his hand than that devised by Nature since the beginning of things—trees.

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The advantage of trees as natural overhead screen was shown at Liverpool, where the Bristol machine flew over the bush unknown to the Light Horse squadrons maneuvering beneath.

Active steps will be taken to screen our roads with wide-spreading shade trees, and the military engineer, in times of peace, will be engaged in planting avenues of great and beautiful roadside shade trees, and be blessed by those who come after for bringing the lungs back to the earth again.

It will be remembered that during the Japanese War, Kuroki, under cover of night, transplanted a fir forest along the side of the road to Wiju, so that his army passed unobserved to the Russians on the hills beyond, an excellent example of tree screening from horizontal vision; but the roads of the future will be screened also from vertical observation. (See illustration.)

From the aerial attacker new cover will be devised, and the Japanese painted screens of the late war may yet be wisely imitated.

Infantry will study shadow throwing. In bright sunlight the shadow of a pole will screen a few, and the shaded side of a gutter will screen many.

Lying down shadows will be studied, lying in the direction of light giving least shadow, and so less chance of observation from the air.

Some experiments I tried in this respect from the Randwick wireless tower, though only 230 feet high, were really surprising.

Open country will, as far as possible, be avoided by mounted troops, except in the widest of extended order.

Speed and movement, like modern life, will quicken up warfare.

In bridge building rapidity will be the main point, and the type of bridge built over George's River during the recent maneuvers, will have a special value, being quickly constructed, having less

chance of being hit, and suiting troops in extended order. (See illustration.)

The Lessons of the Air Age.

Time will more than ever be everything. It will be annihilated with wireless telegraphy. Aeroplanes and advanced patrols will carry portable sets for quick transmission of messages and sketches. We shall see the last of those maneuvers with the flanks out of touch with their center, because visual signals had failed. Wireless will

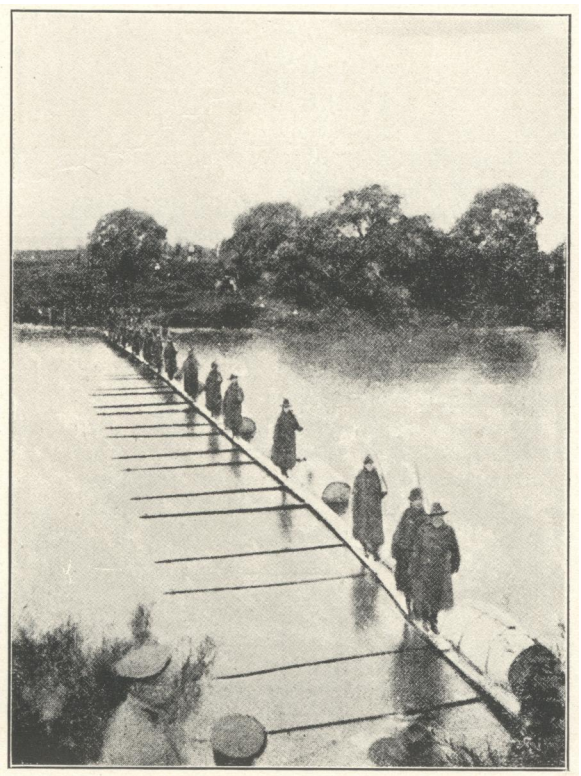

Fig. 3. An air age bridge.

operate either in flat or bushy country where visual signalling is almost impossible, and during cloud, fog, or storm, when the helio is out of action.

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The coming age will be the age of initiative. The history of warfare has shown how initiative has extended through the forces. Time was when armies marched to war, each man a trustful unit doing only what he is told to do, and unable to do anything he had not been told—into war he has gone a pitiful fighting animal trust-

ing the initiative of his commander like the two mules of Frederick of Germany.

"See those two mules," he said, "they have been through twenty campaigns, and—they're still mules."

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Henderson points out that the initiative of German subordinate officers was the real cause of the swift destruction of the French army and the secret of German strength.

In the war of the future, this initiative will still further spread; in fact, every soldier will carry his entrenching tool.

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War will become the world's greatest science, and victory will remain with the nation best trained. The fighters of the future will not come from our football or cricket fields. The future Wellington will tell a different story than that of Eton playing fields.

The battles of the future will be fought in our universities and engineering colleges, and the nation best educated in that respect will win out in war as well as in peace.

To-day the soldier in almost every nation is the plaything of politics. His necessities are regulated by political exigencies. Defence estimates are butchered to build up financial statements.

The average layman is ever ready to put his opinion against that of the military expert.

The world denies to the highly trained military officer that specialism it readily recognizes in doctors and other scientific men; but in the coming age the public, in its utter helplessness against the aerial terror, will grimly recognize the importance of the military expert, and honor him accordingly.

MILITARY AIRCRAFT.*

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Flights to be Expected on Service.

There are very few cases of accidents due entirely to the wind, and a well-designed, strongly-built machine has probably very little to fear from the wind so long as it has room in which to recover. Starting and landing are the dangerous periods. There is, however, the physical fatigue of the pilot to be considered; some machines are heavy on hand, and I have seen pilots utterly exhausted after half-an-hour's fight with the wind. Cold is another factor; no amount of clothing seems to keep one warm on some days, and a pilot has very little control over a machine once he gets really numbed.

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*Extracts from a lecture given at the Staff College, October 26, 1912, by Maj. H. R. M. Brooke-Popham, Oxfordshire Light Infantry, Royal Flying Corps. Reprinted from *The Army Review*, London, January, 1913.

Dual control is now fitted to many aeroplanes, but nearly all pilots disconnect it before they do any flying. One will want to have great confidence in the other pilot before trusting oneself in the air in a dual-control machine.

During the first week of Cavalry Divisional Training this summer, the conditions were as bad as they were on any other week during the year, but there was no day on which one of our three machines did not cover a distance of at least 40 miles, and, of course, we should take far greater risks on service. But aircraft may have too choose their time of day, and we have not yet arrived at the stage of being able to order out a machine as one would a cavalry patrol. Also pilots can not fly continuously even under good weather conditions, and it is unsafe to count on a pilot flying more than ten hours out of three days.

Then we shall be lucky if we ever have more than half our machines in action at any one time on service, and even to do this we shall want a large number of spare parts and reserve machines. The French, I believe, intend to keep for every six aeroplanes at the front, two complete machines and three more without engines, instruments, or petrol tanks, the idea being to take these out of damaged machines. We must be careful to avoid drawing false conclusions from maneuvers; when an aeroplane comes down, then, inside the enemy's lines during a field day, all the pilot has to do is to telegraph to the field base; a car with mechanics and spare parts is sent out, and the aeroplane is flown back in the evening ready to go out the next day. But we can not do this in war; if anything goes wrong then, the pilot and observer will spend the next day *en route* for a prisoner's concentration camp.

An Italian officer, who has been flying in Tripoli, was quite certain that no man could go on flying in war for more than three months at a time; and they had no hostile aircraft to contend with.

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Judging by our experiences this year, the utility of aircraft in war is more likely to be limited by difficulties of observation owing to mist and low clouds than by inability to go up owing to the wind. It is as well to remember, however, that England is noted for fog, and so we are likely to find aircraft of even more value on the Continent than at home. On a clear day it is quite easy to carry out observation at a height of 3,000 to 4,000 feet, and this is better than lower down, because objects can be kept in view for a long time and so it will be easier to identify the exact positions of troops on the map. In misty weather, however, or when the clouds are low, we should have to come down and take our chance of being hit by fire from the ground.

At 3,000 feet on a clear day individual carts can be seen and horsed vehicles distinguished from motors. Individual squadrons and companies marching along a wide road can be seen 2 or 3 miles off, but troops on narrow roads with high hedges may escape observation. Artillery can be distinguished from transport by the

number of horses, and, as a rule, the gun itself can be seen. Bivouacs are very easy to see, especially if shelters of waterproof sheets are put up, and individual companies in bivouac can be found without difficulty. If a bivouac is disposed neatly, with nice regular intervals, it is a simple matter to count the number of units. Empty bivouacs can be recognized if the fires are left burning. Troops in billets are hard to find so long as the men stop inside the houses, but individual squadrons can be seen forming up in villages. Detrainments can be seen.

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Avoiding Observation from Aircraft.

To keep hidden from aircraft I suggest making use of low-lying roads, and taking advantage of the morning and evening mist. When halted, troops should get inside woods or houses, or close up against the hedges of the roads. If time is of less importance than concealment, it might be possible to have special men with whistles on the look-out for aircraft, and for everyone to halt and make for the nearest cover as soon as a danger signal was blown, but guns and transport will be a difficulty.

If forced to halt in open fields, all regular formation should be avoided and the field chosen so as to correspond with the color of the uniform. I do not think marching by night can be kept up for many days in succession owing to the fatigue caused to men and horses, nor does it seem practical to hide in a forest waiting for a storm.

Tricks may be practised on aerial observers, such as marching at large intervals so as to greatly exaggerate the length of a column, painting wagon covers and putting on an extra pair of horses to make transport look like guns, marching along one fork of a road for a little way in the evening and turning back along the other fork after dusk.

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Dirigibles.

I should like to say a word here about dirigibles, because we in this country are rather inclined to under-rate their value.

Observation from them is much easier than from aeroplanes; they can hover over any spot and can drop bombs with considerable accuracy. Athough they do not travel as fast as aeroplanes, they can carry a long range wireless equipment and so get their information back quicker. Their radius of action is much greater than that of aeroplanes, and, provided they can get out of their sheds, they can go up in as bad or worse weather.

On the first day of our maneuvers this year the *Gamma* was out on a four-hour reconnaissance at a height of over 4,000 feet, and was in wireless communication with headquarters the whole time, every message being received correctly. Airships may also be of great value by night, when they seem very hard to spot. Last

autumn, for instance, a French dirigible, *L'Adjutant Reau,* sailed over Verdun by night, and though the garrison of the fortress were on the look-out for her and had searchlights going, they failed to discover her till she had got out of range.

The latest German airships, which are about four times as long as our *Gamma,* can remain in the air for 2½ days, rise to 6,000 feet in 5 minutes or less, have a speed of 50 miles an hour, and can carry enough fuel to travel 1,500 miles at a reduced speed. They could substitute explosives for some of the petrol and oil, and drop at least 600 pounds of this at a time without upsetting their stability. Experiments have been tried with several different kinds of bombs, incendiary and otherwise, including some called by the expressive name of "stinkbomben." They carry wireless with a range of 250 miles, have two machine guns in the car, and an observer with another machine gun on the top of the envelope. I am afraid that such a vessel would not be so much at the mercy of an aeroplane as we are inclined to think. Germany has five of these under construction for her navy, and I believe two for the army. She also possesses ten of a slightly smaller size. France has just given orders for four vessels of much the same type.

I may add that Germany now possesses about 120 aeroplanes, all of them made in the country, except a few experimental ones. She will have nothing to do with French engines, but relies partly upon Austrian firms and chiefly on her own. The observers are systematically trained both in observation and in mechanics. Although Germany has produced no great flier, the average of skill is probably as good as that of the pilots who were flying on our maneuvers this year. The subscription fund in aid of German aviation now amounts to £300,000, that of France being about £120,000.

Aeroplanes in War.

It is doubtful if aeroplanes have much to fear from rifle fire if at a height of 3,500 feet, and if a chance bullet does hit a machine it will not necessarily disable it. An Italian officer in Tripoli had his machine hit on seven different occasions while at a height of 2,000 to 2,500 feet, but it was never disabled. Bullets, curiously enough, seem to have but little effect on a propeller.

Several types of anti-aircraft guns have been made. Germany has some mounted in motor cars, which can be elevated to 72 degrees and have a range of 10,000 yards horizontally and 6,500 yards vertically. The shell leaves a smoke trail.

Whether fire from the ground is effective or not, it is inconceivable that the army which has the better pilots and more numerous machines will rest content with a mere exchange of information and not make serious attempts to destroy the hostile aircraft with their own. Fighting in the air will undoubtedly take place, in all probability with firearms. Ramming seems almost too drastic a method of procedure, and although one aeroplane may upset another by the backwash from its propeller, it will probably not

get to sufficiently close quarters if the other machine carries a man with a gun. There are several types of aeroplane already in which the observer could use a rifle or automatic pistol.

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* * * Suppose the enemy tries to cover some particular area, of concentration, for instance. If he keeps aeroplanes on the ground they will take a long time to get up to 3,000 feet—15 minutes at any rate—and by that time our scouting machine should have seen all it wants to, and if it has superior speed it can get clear away. Airships can get up quicker, but our aeroplane, given superior speed and hardiness, could keep out of range and still do its reconnaissance.

Can the enemy keep his aircraft up in the air and form a defensive ring? An enormous number will be required; 20 miles square is not a very big concentration area, and that means a perimeter of 80 miles, for, of course, it is no good merely putting out a line in front.

The machine required for long distance reconnaissance seems then to be one with a speed of perhaps 90 miles an hour and a radius of action of 300 miles.

Things will be somewhat different as the hostile armies approach each other. Collisions between hostile aircraft will become more frequent, and the type of machine required will not be the same. It need not have such a large radius of action, 200 miles say; it can be content with a slower speed, say 70 miles an hour; but it must be armed and able to use its weapon efficiently. This will mean the propeller behind and a man in front with a firearm, perhaps a rifle, perhaps a machine gun, possibly some special weapon.

It seems probable that there will be a succession of duels between machines, or perhaps pairs of machines, when the opposing armies are within two or three days' march of each other, and that command of the air will result as the cumulative effect of a series of victories in such combats. Once gained, command of the air will be complete, not so much from the destruction of hostile machines as by the effect on the nerves of the surviving pilots.

We thus arrive at two main types of military aeroplanes, the scout and the fighting machine, and this seems a more logical grouping than biplanes and monoplanes, or single seaters and passenger carriers.

What the future may have in store it is impossible to say, but one type can not do both duties as yet; we can not combine speed, endurance, and fighting qualities, chiefly owing to the want of a good high-powered engine.

Possibly a third type may be required for intercommunication, a light quick-rising machine capable of landing on bad and restricted ground.

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There seems no satisfactory method of distinguishing hostile from friendly aeroplanes. Colors can not be distinguished from

the ground if the machines are over 2,000 feet. There seems, however, a tendency to develop along national lines, and probably a trained man could distinguish aircraft much in the same way a sailor can distinguish ships. Then, of course, there are occasions when secrecy is all-important; when our aircraft would not be used and all seen treated as hostile. On August 16, 1870, it would have done Alvensleben little good to have known every detail of the French disposition, but it was of the greatest importance for him to conceal his weakness.

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Aeroplanes and Cavalry.

Aircraft are of little use in fog, darkness, or stormy weather. Troops may escape the notice of aerial observers, or we may lose command of the air. Aircraft will certainly not render cavalry useless even for reconnaissance. But they will save the cavalry much waste of energy by doing most of the long distance reconnaissance to the front or flanks and in preventing their being sent out on useless missions searching for the enemy where none exist. There can be no question of aircraft *versus* cavalry, but only of aircraft and cavalry, each supplementing the other, and the former enabling the latter to carry out its work to greater advantage.

There was a good instance of the combination of cavalry and aircraft on the second day of maneuvers this year. The bivouacs of the 2nd Red Division were not located, but the cavalry found their outpost line and an aeroplane saw all their divisional train 2 or 3 miles to the north, so we knew the main body was somewhere in between.

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Much of the value of aircraft will be lost if the information which they can get so quickly takes a long time to reach headquarters. If possible, machines should always land near the commander, say within a quarter of a mile, and I think the position of headquarters should be chosen with this in view. If it can not be arranged, very complete arrangements for communication with the aeroplane park must be made.

As regards the issue of orders to aircraft, I think the freer hand the commander has the better, and they should be much after the style of those issued to the commander of independent cavalry.

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Then I would ask you not to spoil us. There seems rather a tendency now to make undue allowances for the Flying Corps, and anyone who thinks himself entitled to special treatment is generally a man with a grievance. I am afraid this sounds very ungrateful. There are times when we want everyone's sympathy. I am glad to say we do not look for it in vain, and in no branch of military service is sentiment of such importance as in aviation. But on ordinary occasions we ought to be judged by results, and if we

bring back no information, or, still more, false information, we deserve censure even if we have been up in bad weather. It is very pleasant to be petted when one is young, but a spoilt child is apt to develop into a very objectionable type of man, and we mean to grow up soon.

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Aircraft are not going to win a campaign by themselves; they are merely an auxiliary. It is the fighting troops, the man behind the gun or rifle, the man with the bayonet or sword, that is going to win our battles. They are not going to transform a bad general into a Napoleon, an inefficient staff into a good one, nor enable infantry to march quicker.

There may be in the future rather a tendency to wait and see, to find out exactly what the enemy is doing before we act.

Cavalry will have more battle energy left and may be of greater value than ever during and after a fight.

The movements of transport may indicate the intention of the enemy to retire before the troops move.

The railheads being used for the movement of supplies may give a clue to the enemy's future movements or to a change of base.

The movements of armies of ostensibly neutral States may be discovered without incurring a *casus belli* by sending cavalry across the frontier.

To take advantage of the information available, the general must make up his mind at once, the staff must get out and distribute his orders quickly, and the troops must be prepared for longer and more rapid movements. War has not been made easier, at any rate, for the regimental soldier, as the only way in which a commander can hope to surprise his adversary is by outmarching him. There will, in fact, be a general speeding up all round, and the relative value of mobility and efficiency as compared with numbers will be greater than ever.

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