MILITARY AIRSHIPS.

ON Monday evening, March 4th, the Aeronautical Society held another very successful meeting at the Royal United Service Institution, when Lieut. C. M. Waterlow, R.E., of the Air Battalion, read the following paper on military airships. Col. Sir Charles Moore Watson, K.C.M.G., was in the chair :—

Airships are rather under a cloud in this country at the present moment. Putting aside those who are working on this branch under the Government there is scarcely anyone who has a good word to say for them. The reason is not far to seek. Only eight airship pilot certificates have been issued by the Royal Aero Club, and of these all except one, are, or were, held by the Army. Most of those who have been in a position to speak authoritatively on the subject, have therefore been debarred from defending in the Press the attacks that have been made against this type of aircraft, and it has therefore been very largely a one-sided argument. I hope to bring forward, however, sufficient facts and evidence to show that airships have a very valuable part to play both on the battlefield and in civil life.

It has been generally assumed that the question of military aircraft is one of aeroplanes *or* airships: I submit that the proper way to regard it is, aeroplanes *and* airships. The Commander-in-Chief on a modern battlefield should be able to appreciate the values not only of the aeroplane and the airship, but also of the man-lifting kite and the captive balloon.

It is, of course, necessary to take account of the difficulties with which airships have to contend in order to judge of their utility; these may be classified under weather, transport, and hostile aircraft.

An airship is inherently stable and has nothing to fear from gusts. They cause pitching and tossing of a more or less severe nature, but they would seldom cause a pilot to refuse to make a flight.

Rain, snow, hail and mist increase the weight of the airship, and necessitate the sacrifice of ballast or the use of swivelling propellers. An adequate supply of ballast is, therefore, one of the essentials to successful airship navigation.

Lightning is a vexed question, some declaring that it is harmless unless the airship is directly connected with the earth, while others assert the opposite. There is, of course, a natural disinclination to make practical experiments, and thunderstorms are, in any case, best avoided.

An airship is perfectly safe so long as it is in the air, and I doubt if a vortex wind would do any real harm. It is when the airship is on the ground the danger of winds is most severe. A wind of uniform strength and direction can be coped with fairly well, but such a wind seldom exists for long. In variable winds an airship is extremely difficult to handle on the ground, and if allowed to get broadside-on disaster is almost certain.

Abroad, airships are housed in colossal sheds, and except when the wind is blowing along the axis of the shed, the airships wait indoors for fine weather. This is a very severe limitation, as a wind of only ten miles an hour blowing across the mouth of the shed prevents the exit of the craft.

Two methods of overcoming this difficulty have been attempted, one being to make the shed revolvable, and the other to shelter the exit by means of a wall. The first is expensive and impracticable for the British Army, which would be mainly concerned with overseas work. The latter is satisfactory, but cumbersome.

In the early part of 1911 the Aircraft Factory and the Air Battalion turned their very serious attention to this problem, and in the summer of that year, having noted the method of mooring the naval airship by its nose, a device was constructed by means of which airships could be anchored to a swivelling device mounted on the top of a portable steel mast. The mast is of steel lattice work, and is made in three pieces. It rests on a block of oak and is supported by four steel cables. On the top is a vertical axle, about which is mounted a hollow cone somewhat resembling an umbrella turned inside out. This is made of wood covered with canvas, and on the inside it is padded. As a whole, it is free to revolve about the mast, and in its centre is a pulley drop attached to a heavy steel cable, one end of which is held by a capstan at the foot of the mast while the other end is made fast to the nose of the airship. The strain is distributed by a system of ropes, over the whole circumference of the envelope. The attachment can be made fast and released without bringing the airship to the ground. On February 19th and 20th the army airship "Beta" was moored to this mast for 23 hours. A guard of three men was in charge, but generally only one man was on duty at a time. A rope ladder was adjusted to give access to the car, which was inspected every half hour by the sentry, whose duty was to ascertain that the gas pressure was maintained. While the airship was thus moored the weather was extremely unfavourable, rain fell during most of the night and there was almost a gale of wind about five o'clock in the morning. During the whole period the envelope received no gas, the pressure in the balloonette was maintained by a fan operated from the ground, and discharging through 60 ft. of a 4-in. hose. This is a most important fact, because it shows that the airship is not crippled immediately if the gas supply temporarily breaks down.

The gas supply for a dirigible in the field is one of the difficulties that I classify under transport. In continental armies the equipment includes a portable shed for each airship, but our mast can be dismantled and carried on a single lorry. When reconstructed in a modified form, I believe it will be possible for a dozen men to erect it in a few hours. Also, I believe that the same number of men will be able to moor any airship up to 200,000 cubic feet to the mast. The volume of "Beta" is only 33,000 cubic feet, and that of "Gamma" 90,000 cubic feet. The average daily gas consumption of "Beta" is 466 cubic feet, or less than 2 per cent. of its volume.

In connection with the leakage of gas, osmosis has to be considered, which is the diffusion of air into the interior of the envelope, causing a loss of lift. In a period of three weeks the lift of "Gamma" decreased by 200 lbs. Gold-beater's skin, of which the envelope of "Beta" is made, offers extraordinarily high resistance to osmosis, and after a month and a-half the lift of this airship had not appreciably decreased. For a medium-sized airship, in the order of 150,000 cu. ft. capacity, I think we may expect to lose 2 per cent. (3,000 cu. ft.) per 24 hours. This quantity can be replaced by six tubes of compressed hydrogen. Each tube is 9 ft. long, and weighs about 2 cwt. They are at present transported on a wagon capable of holding nine tubes at a time, but a good motor lorry would carry fourteen tubes, or, say, 7,000 cu. ft. of gas, which would be enough to keep such an airship fully inflated for two days. Thus, we should only need two lorries for the proper attendance of an airship in the field.

The new French unit, *Escadrille* consists of eight aeroplanes and a transport of twelve motor cars, some motor tractors, a motor-driven repair wagon, and a fast motor car. This represents about two motor vehicles per aeroplane, so that the airship transport requirements do not compare unfavourably.

Other stores required by an airship are a portable ladder, repairing materials, wire and hemp cordage, leak detecting instruments, spares for the engine, and tools. The most bulky articles are the spare propellers. I think the full equipment would require two motor lorries, one for the stores and mast, the other for the gas supply. The necessary detachment men, would consist of 10 to 20, and of course they would require transport for their kit.

Before dismissing the question of gas supply and equipment, I wish to make a remark about hydrolite. Hydrolite is a chemical product composed of hydrogen and calcium ; it is, in fact, a hydrite of calcium.

In some ways it is similar to calcium carbide ; it gives off gas when put into water, the gas, however is hydrogen. Sixty-two lbs. of hydrolite added to 62 lbs. of water will produce 1,000 cubic ft. of hydrogen, which has a lifting capacity of 70 lbs. The product of the chemical process is 100 lbs. of calcium hydrate. Thus, such an equipment on an airship would increase the lift and at the same time retain most of the ballast ; unfortunately, 1,000 feet of gas thus produced costs, at present, about £4.

The next point I shall discuss is the hostile attack of an aeroplane. Generally the argument is that the airship's tactics will simply consist of running away or seeking security at a greater height. I think no airship should go on service without a weapon, such as for instance, a gun capable of discharging a ½ or ¾ lb. shrapnel shell with an automatic fuse setter in the breech. The setting of the fuse would be altered by the sights, the loading would be automatic, and every fifth or sixth shot might be a tracer shell, leaving a smoke trail to assist in making rapid corrections.

The aeroplane has three vital parts—its crew, its engine and its propeller. The latter for artillery purposes, is a disc of from 6 to 8 ft. in diameter, and cannot be protected by armour plate. I think that a propeller would be immediately shivered if struck by a fragment of shell, and in all probability this would put the aeroplane out of action.

The aeroplane can attack in three ways, (1) by getting above the airship and dropping something on to it, (2) by firing at the airship from the same level, (3) by ramming.

The airship will open fire on the aeroplane as soon as it is within range, and will probably manœuvre broadside-on to the aeroplane for this purpose. As the distance decreases the airship would make full speed ahead to clear the aeroplane's track. If the aeroplane opens fire with a rifle, the airship would manœuvre end on, and as the distance decreases would make a vertical ascent, which can be done very quickly. Personally, I think that such a fight would by no means be so much in favour of the aeroplane as some critics have made out. The airship has superior manœuvring power in