

House Dinner.

THE third House Dinner of the Institution was held at the Engineers' Club on 8th April. Among the special guests were Lord Thomson (ex-Secretary of State for Air), Mr H E Wimperis (Director of Scientific Research), Mr F G L Bertram (Deputy Director of Civil Aviation), Major Mayo (Technical Advisor to Messrs Imperial Airways, Ltd), and Mr J D North (Messrs Boulton & Paul, Ltd)

The Chair was occupied by Captain A G Lamplugh, M I Ae E, A F R Ae S, who in his opening remarks referred to the question of amalgamation between the Institution and the Royal Aeronautical Society, and expressed his pleasure that members of the Society were present. The Chairman then called upon Captain Courtney to give some of his impressions and experiences with the Auto-Gyro.

The main points of the discussion were as follows —

CAPTAIN COURTNEY In discussing the question of the Auto-Gyro generally it is rather difficult to put into a few words an explanation of the machine and what it can do, and at the same time avoid the tendency to exaggeration which has shown itself in some of the press accounts. What I will therefore try to do is to give an account of the application of the machine as it is now known it can be applied, and to mention a few factors which will have to be studied in connection with its subsequent development.

The press accounts have drawn attention chiefly to the fact that the Auto-Gyro is a peculiar machine with revolving wings, and I think the development of the machine has to some extent suffered from the fact that it is peculiar and that it is a success. A great many people have imagined that Senr LaCierva has attempted to devise a different type of flying machine from those already in existence, and have voted it a failure because that does not appear to be the case. What, however, he has succeeded in doing is to overcome some of the fundamental difficulties of the aeroplane. Everyone has seen in the press reports an explanation of the objects of the Auto-Gyro—to prevent stalling, and the runs necessary for take-off and landing. If the machine solves these three problems, then the main difficulties of heavier-than-aircraft have been surmounted. Landing in confined spaces has been demonstrated, the fact that the machine cannot and will not stall, because the wings maintain a high speed even when the machine is stationary, has been demonstrated. Take-off in a confined space has not yet been demonstrated, simply because the only thing necessary to show this is the initial rotation of the wings, which means a careful mechanical investigation. There is nothing in the whole system which shows that the development of the mechanical side will be any more difficult than the design of a new engine, but for the time being other problems have had to come first.

It has been asserted by people who know nothing about it that the Auto-Gyro is hopeless from the point of view of performance, one person who has made a competitive device stated that the thing is very interesting but cannot get forward

There is nothing to show that the Auto-Gyro cannot attain the same performance as any ordinary machine. It is thought that because its wings cover a greater distance than the wings of an ordinary aeroplane, it must necessarily be less efficient. On the other hand, it is well known that the wings of an ordinary machine for the greater part of its flying time are working at a very inefficient angle. It can be shown that the Auto-Gyro can be designed so that the wings are working at a much more efficient angle and under much more efficient conditions, so that the increased efficiency in that direction will more than counter-balance the decrease in efficiency caused by covering a greater distance. In this connection it is interesting to note that the mathematical work on the Auto-Gyro was more or less in agreement with Senr LaCierva's original calculations—at any rate sufficiently near to show that the performance of the machine could not be very bad.

Some people have thought that with the Auto-Gyro one can throttle down the engine and sit there for ever, but that is true only to a small extent, what is actually true is that one can go up very slowly if the H P is sufficient, by going at what in the ordinary aeroplane would be full throttle. In the ordinary machine designed for 200 h p one can fly much more slowly. If you are considering the Auto-Gyro from the point of view of slow speed you must also consider it from the point of view of high H P, and not from the point of view that it is one of those beautiful things beloved of the Press.

Considering the Auto-Gyro from a military point of view we find that many arguments arise. To a large extent manœuvrability is required, and it should be able to manœuvre in the ordinary way. When it comes to excessive performance a different problem arises. To be able to do a roll is not an advantage, but there is something wrong with a machine that cannot roll. The fact that the Auto-Gyro cannot roll does not imply a fault, it simply means that it may be able to take advantage of the fact that it is not necessary to roll. For ordinary military purposes the question of vulnerability comes in, there is a great deal of work now being done in the development of the Auto-Gyro with a view to greatly strengthening the structure. In the early machines there were cables carrying the wings, and if these were shot away considerable trouble might arise. Cables will therefore probably form no part of subsequent Auto-Gyro machines.

The greatest problem of the Auto-Gyro from the military point of view seems to be the question of being able to fire through the wings. In an aeroplane with six wings you could not shoot through them, and in the Auto-Gyro you have a revolving structure covering a large field within range of fire. If something on the lines of the Constantinesco gear can be devised which will enable you to avoid the wings in firing, then the Auto-Gyro will be a great advantage over the ordinary aeroplane for military work.

I think the future development of the Auto-Gyro will be very interesting from the point of view of what has yet to be done. In the first place, there was a structural failure a few weeks ago, and some people think that has proved it to be quite hopeless. Actually, it would have been remarkable if the machine had not broken at some time or another, and that applies to all kinds of new devices. In any case, the occurrence has led to a very clear perception of the necessity for a

rather closer investigation into the structural features of the Auto-Gyro. There is nothing abnormal about that, because in any structure involving unknown loads it is quite a usual procedure to investigate the actual structure.

Unfortunately, mathematics have found their way into this beautiful scheme, and some people after one look at them have got alarmed and have gone out to seek fortification in the way of liquid refreshment, because those mathematics have been too complicated for anything. All the same, the mathematicians at Farnborough, notably Mr Glauert, have done some really marvellous mathematical work. At the same time, it is good to know that one can fly the Auto-Gyro without going into a mass of abstruse mathematics. People seem to think that the Auto-Gyro has made mathematics, and not that mathematics has made the Auto-Gyro. It does not follow that because the mathematics of an invention are abstruse, the invention itself cannot be quite simple. Actually, the mathematics that have been done have been merely in the direction of future development, and Senr LaCierva has himself (and, I am convinced, with complete success) managed to simplify very greatly the mathematical aspect of the Auto-Gyro.

In conclusion, I feel convinced that the future development of the Auto-Gyro is no longer a matter of abstruse aerodynamics or mathematics, but simply and solely a matter of ordinary structural development such as would apply to any other mechanical device.

LORD THOMSON. I am very incompetent to deal with the scientific side of this extremely new development. Like some 8,000,000 others, I watched, with admiration, Captain Courtney take it up at Hendon last year, but I must disavow any technical qualifications whatsoever. I cannot possibly discuss the details of the Auto-Gyro, I can only say that as a man who knows very little about aviation except from the administrative point of view, it seems to me that something on the lines of the Auto-Gyro has got to come. I do not think we shall ever overcome the fears of the public until they feel that some device of this kind has been produced, and I am one of the hopeful people who believe that, whatever the technical difficulties may be, they will be overcome, not so much by the scientists and mathematicians as by those practical people who will eventually convince the scientists and enable them to prove that what has happened is scientifically sound. That has been my experience in many departments of life, including strategy and politics.

I am very glad to be here to-night, not only because I have met you all at a very enjoyable dinner, but I do think that the presence of several others and myself here does mark the arrival of that amalgamation which most of us who have the interests of aviation at heart do so passionately desire. It is my fate in life to have been bitten by the microbe of aviation. I came to the Air Ministry as Secretary of State with a very open mind, and Bernard Shaw has described the open mind as an empty mind. He says the full mind is generally full of trash, and is not very capable of receiving new ideas. I led a sort of charmed life at the Air Ministry for the first few weeks, I was always meeting people with new ideas and great energy, who were very charming, and it was the human side of the business that charmed me most, and charms me still, because I am sure that is the way we are going to make aviation play the part it should play in our national and imperial life.

There are many forces arrayed against us, and to my mind it would be a disaster if we allowed ourselves to be trammelled by anything approaching a division of our interests. Because this thing is new, because it is absorbing, because it is uncomfortable, because it upsets our old ideas, we will not, like King Canute, forbid the tide to rise, and thus commit a dis-service to our country and empire. There are King Canutes in every land, and there are vested interests in every country, therefore when I see anything like schism in the ranks of those who are taking up aviation, I am sorry for it, and when I hear that they have definitely decided to amalgamate, then I am glad.

Mr H G WIMPERIS I listened with great interest to what Captain Courtney had to say. He has been most courageous and painstaking in the work he has done in connection with the development of the Auto-Gyro.

The Auto-Gyro is one of the most important flying inventions that has been produced in the last ten years—perhaps the most important—I venture to think, more important than anyone can realise. I say this because I think that the future of flying depends in the aggregate on the attitude of the ordinary man towards it, and I do not think private aviation will become customary with the fixed wing type of machine, I think that the rotating type, with its freedom from stalling possibilities, and its ability to make an almost vertical descent, has advantages that will receive first consideration for private flying. I do not say that for military or civil transport flying the rotating wing is going to displace the fixed wing, for military work nobody knows at present what the possibilities of the Auto-Gyro are, but further experiments will be interesting.

I think that in large countries, where the roads are rather winding, and where big rivers have to be crossed, etc., the run-about which can hop over and give about the same mileage per gallon as an average motor-car, is going to be of fundamental importance. I do not say that I think very much use in that direction is likely to take place in this country, and I hope that will not be the case, but there are enormous possibilities in the rotating wing machine for those wide spaces.

Regarding the accident to Captain Courtney at Hamble, people say why do these things happen? They are bound to happen with any entirely new invention, and we ought not to expect to get through the pioneer stage of a new device without them. You may ask, why did not those responsible for the design of the machine anticipate that those very parts would give way? I do not think we can expect the inventor to do this. When we first watched that machine flying, we realised how the blades must revolve, and then realised that they were revolving in the opposite direction to that in which the Auto-Gyro was flying, and that no one knew why it was so, therefore I think you will appreciate the position. You could hardly expect anyone faced with a new design to work out every detail. I am very glad that the experiment which Captain Courtney made the other day, happened when it did because if there was the potentiality for that in the design, the sooner it was discovered, the better. It is interesting to note that the machine came down at very little increase of speed over its preceding design with four blades.

There is another consideration. My scientific staff have tried to find out how this thing works, and they have been successful to a large extent, but an explanation

is still wanting as to why the machine performs as well as it does in a vertical descent. As far as we can see, it ought to come down something like twice as fast as it does, if the habit of always being ahead of the clock persists, the invention will have greater scope.

We have had some very good effects from tests with models, which would seem to indicate that the full-scale machine might be expected to give a much less safe rate of descent than it does. On the other hand, the work of Captain Courtney and others seems clearly to indicate that the machine does certain things. There is not much doubt about it, and we have to try to hold the balance between two different theories, so that one feels inclined to say, with Macheath, "How happy could I be with either, were t'other dear charmer away." That situation is a very fortunate one for the machine, it does fulfil the best predictions we can make, and we hope it will continue to do so.

We built a number of these machines in order to try out its possibilities as thoroughly as we can. I feel that the work Captain Courtney has done, and the recent difficulty at Hamble, show that there is structural weakness, and that we shall have to go very carefully into that point. It will lead to a modification in the design, but we do not yet know what the result will be. In the meantime we have had to suspend the flying of these machines until this particular point is cleared up. I do feel that in comparison with other mechanical inventions, Senr LaCierva has made very good progress in the time he has had, and I repeat that I think it most probable if the machine makes good at all that it will have a very big effect on private flying, in which we are all very interested, although, as I have already said, I fervently hope that in this country we shall not see too much of it.

MR F G L BERTRAM. I find it very difficult to follow such an able speaker as we have just heard, particularly as I am in no way a technical expert, my work has been on the administrative side in connection with commercial flying, and also civil private flying so far as it is at present developed in this country.

One had the experience of seeing Captain Courtney flying this machine, and one was filled with wonder as to how it worked, and why it did what it appeared to do, and ever since then one's mind has been considering the question of the possibilities of the machine in the future.

I have been very interested in hearing what Mr Wimperis has said as to the very practical value of the development of the Auto-Gyro for private flying. I have often wondered whether with the large commercial machine it will ever be possible for an apparatus something like this to be carried, not exactly to be used continuously, but something in the nature of a parachute apparatus for the machine as a whole, rather than an impossible or useless apparatus for the individual passenger in an unsafe cabin. I do not know whether this particular aspect of the machine is in any way a possibility. I can conceive of its being carried, and then if the aeroplane as such proceeds to behave in an unstable way, the Auto-Gyro being brought in as a safety contrivance for the machine as a whole. One might also begin to think of the possibilities of which Mr Wimperis was speaking, when he described the conditions in countries of wide spaces with rivers that were difficult to cross with a motor-car. I am wondering whether a future development might not be in the way

of attaching it to a motor-car, so that when it reaches a river it will be able to lift itself over it instead of going through it

Major MAYO I should like to express my very great appreciation of the kindness the Institution has extended to me in inviting me to be here this evening, and I appreciate it more particularly as a member of the Council of the Royal Aeronautical Society I sincerely hope that the Institution as a separate entity will come to a speedy end, because I look forward to the amalgamation of the two scientific institutions in aeronautics at a very early date So far as I can see there is nothing now in the way of it, and I very much hope that the formalities that have to be gone through will be terminated within the next few weeks, and that the next function of this nature will be a combined one between the two societies

Coming to the question of the Auto-Gyro, I should like to explain that, as perhaps some of you here know, I am personally very much interested in the Auto-Gyro from the point of view of its influence on the safety of flying generally I am also interested in any other device or apparatus which will improve safety When I say this I am referring to my position as representative of the Daniel Guggenheim Fund for the Promotion of Aeronautics As you may know, the Trustees of that Fund have made their first object the encouragement of effort in the direction of improving the safety of flying By the safety of flying I mean the aerodynamic safety of flying

They consider that there are many fields in aeronautics in which they can usefully spend their money, but they have come to the conclusion that the most useful is in the direction of improving the aerodynamic features of aircraft, as being the most needful requirement towards the progress of aviation The great snag in aviation is the liability of present-day aircraft to stall, and in order to encourage effort in overcoming this great obstacle to progress they have decided to run an international competition for the encouragement of safer aircraft, and one of the particular objects will be to produce an aircraft which is not liable to the fundamental danger of stalling It is hoped that the Auto-Gyro will be one of the chief competitors in this competition, because it has demonstrated its ability to fly at very large angles of incidence without stalling, and to fly at those exceptional angles without loss of control If the Auto-Gyro can persevere in this way, and at the same time demonstrate its ability to carry a reasonable load and fly at a reasonable speed, then I think that it should have little difficulty in winning the competition, because it has already demonstrated its great superiority over almost any other type of aircraft in that vitally important point of being able to maintain a large angle of incidence and to descend at a very steep angle without loss of control It only remains for it to demonstrate that it can take off correspondingly and fly at a reasonably efficient speed, for it to prove itself an immense step forward in aeronautics

Captain Courtney railed against mathematicians who have stated that the mathematics of the Auto-Gyro must necessarily be worse than for the ordinary type of aircraft The way I would look at it is that, as some very distinguished experts in aerodynamics have pointed out, in the very nature of things, a machine with rotating wings cannot be expected to have quite so good an efficiency as a machine with fixed wings, because, as Captain Courtney said, the wings must

travel through a greater distance, and the power absorbed in head resistance must necessarily be somewhat greater than with the fixed wing type. I think it will be admitted from the experiments with the Auto-Gyro, that that is the case, and there must be a slight loss of efficiency, but I think that does not matter if the Auto-Gyro can give us those other advantages which are rightly claimed for it. If we can get a machine that is capable of overcoming the fundamental dangers we have so far experienced, then we can afford to sacrifice a little efficiency in order to obtain these results.

I should like to ask Captain Courtney if it is possible to fly the Auto-Gyro with multi-engines. I regard safety in flying as coming under two main categories, one is that we must have aerodynamically safe aircraft which are capable of descending under any conditions in a small space, whatever happens to the engine. The other problem is that of reliability, and it seems to me that we shall never achieve real success until we have solved both these problems. In the first place we want an aircraft which can safely be dropped down anywhere, and in the second place an aircraft which will not come down until we want it to come down. I do not think a single-engined aircraft is safe, great progress has been made with regard to reliability of aircraft engines, but however far we go in this direction we have to face the question that an internal combustion engine, or any other type, cannot be made absolutely reliable. We cannot hope to make aviation safe if we use a single engine in one machine. In the case of ordinary aircraft it is easy to fit a multiplicity of engines, and I think the arrival of three-engined machines represents the most practical development at the present time. I should like Captain Courtney to say how that principle can be usefully applied to the Auto-Gyro. I have just had the good fortune to make a flight from London to Cairo on one of the latest types of three-engined machines, and I must say that throughout that flight I had the greatest confidence in the aircraft. I should like to express my appreciation of the fact that we are to hear Mr Stack's account of his great flight to India. As far as Cairo he flew the same route as we did, but his machine had only one engine, and I take off my hat to him for his courage and determination in undertaking a flight with a single engine. His success is worthy of the very highest praise, but at the same time I should like to say that I entirely disapprove of the risk involved in such an undertaking.

Mr J D NORTH. It is a great pleasure to me to be here to-night, as Captain Courtney and I have been associated on and off for some fifteen years, and I might say that I am of his aeronautical godfathers. When he first entered aviation he came into my drawing office at Hendon, and that pleasant association was renewed later when he was the test pilot for my firm.

I regard the Auto-Gyro as one of the two aerodynamic inventions of the decade, and whether those inventions turn out to be of first or second-class practical importance does not in any way deteriorate from their merit. It is also I think a very healthy sign to see that some of these machines are being ordered by the Director of Scientific Research. It is unfortunate that the greater part of the aircraft industry is engaged in producing different general arrangements instead of producing new aircraft, and on that account I think that the fact that

Auto-Gyros are now being constructed by several firms in this country, shows that a very great advance is being made in aeronautical engineering

I cannot altogether sympathise with what Captain Courtney has to say about the mathematical investigations that have been made into the Auto-Gyro. He says they are very complicated, although I understand that only one variable is involved. However, I keep a mathematical man in the office, and when I want to find out about the Auto-Gyro he will tell me.

I should like to sound a note of warning to those people who seem to imagine that the economic solution of flying is one of safety. I do not think it is, and I do not think the majority of people in this country believe it. I think that what prevents people from making greater use of the London-Paris services is the comparatively small saving of time, and the high cost. I do not say whether the Auto-Gyro will or will not be a more or less economic machine than the present aeroplane, but I do think that the question of safety in flight in its relation to the public use of flying, has rather become exaggerated.

Captain SAYERS. I am afraid the Auto-Gyro is a very difficult thing to discuss, in spite of the fact that it does work.

The fact that the Auto-Gyro has wings that travel through a longer path than does the fixed wing aeroplane, and therefore it must absorb more energy, looks quite conclusive. On the other hand, it is not impossible that if you are going at a very high speed the Auto-Gyro may score heavily. It is a most interesting study, but at the present moment, before we can usefully discuss it, could Captain Courtney tell us what it really does? Until we know a little more about it I do not see what we can say.

CAPTAIN COURTNEY'S REPLY TO THE DISCUSSION

Referring to the remarks of Mr Wimperis, there is very much more to be noted than might appear at first. To begin with, Mr Wimperis was originally responsible for observing the potential value of the Auto-Gyro and getting it tested, and so bringing into prominence what I believe to be the greatest development that has happened since the Wright Brothers first flew. Therefore, when Mr Wimperis speaks on the subject of the Auto-Gyro he is entitled to much more serious attention than almost anyone can expect. He was solely responsible for the making of a purely cold-blooded decision as to whether the test was worth the expenditure of public money, and I think that he more than anyone is to be thanked for the encouragement and interest that has been shown. Therefore, when I speak apparently disrespectfully of some of his staff I am very far from attempting to disparage their work, because with a new thing you have to convince not the inventor or anyone like that, but all the sceptics, who are ready to turn down on sight anything that is new.

With regard to mathematicians and the Auto-Gyro, the question does not arise as to whether their mathematics are accurate or not, the main point of interest which can be shown by mathematicians is that they have taken an entirely new structure and tried to reduce it to something they can show to the ordinary enquirer. Therefore it stands to reason that any work they may have done on it may or may not be accurate, but it has to be done, and it is to be admired, because

we of the Auto-Gyro stand to obtain a certain amount of credit, but the people who do the mathematics stand to make nothing but criticism, if their calculations are right, everyone says so, but if they are wrong they are told they are fools. What they are trying to do is to give prospective purchasers some kind of idea of what the machine should do, and even if their results turn out inaccurate, their work deserves the greatest credit.

The most interesting point Mr Wimperis raised was the question of the parachute application of the Auto-Gyro. If I may I can give a very good instance of the effect of the parachute value of the Auto-Gyro. Before the crash at Hamble several models had been tested, and it was shown that the vertical descent of the Auto-Gyro was something that was really impossible. It was a much better parachute than a real parachute, and it was doing something much greater than had been expected, therefore it was quite reasonable to assume that the vertical descents done were not really vertical, and that the amount of forward speed left was quite sufficient to account for the difference between the theoretical vertical descent and the vertical descent which was illustrated in the actual machine. I was not surprised that the wing came off, but as the machine was rotating with only three wings I was shaken about and could not do anything. I estimated at what time I should hit the ground. After a long time I caught one glimpse of it at just about the time that was calculated. I then saw the ground when it was still about fifty feet off, and found I had not been dropping as fast as I expected. I then saw the ground about twenty feet off, and the rate of drop in that case, with the engine shut off, must have been very much less than would have been expected from something with three or four wings. I think therefore, that the total evidence that the parachute effect of the Auto-Gyro is much greater than the theoretical calculations, is very much less than is to be expected. Senr LaCierva has gone into detail considerations of the vertical descent of the Auto-Gyro, and has got out a series of tests which not only show that the full-scale effect is different from the model effect, but also that the descents done in actual practice are really normal, and can be expected to remain normal. I have done two long drops of the Auto-Gyro, and the fact remains that the rate of descent in a vertical drop is not so fast as existing theory would show. I think, therefore, it can be definitely stated that the Auto-Gyro as a parachute has brought in new factors which make it a really reliable form of parachute.

The question of three engines in a simple one. The Auto-Gyro must essentially have a wide undercarriage, because if you are descending with a slow rate of forward speed, then your cross wind effect is much greater, and your Auto-Gyro must have a wider undercarriage. That is quite a structural point. If you have a wide undercarriage you must have wide fuselage, and you cannot have three engines unless you have a wide fuselage.

Captain Sayers asked what the Auto-Gyro does, I thought he knew! It flies, but the main thing it really does apart from landing and taking off in a restricted space is, that the ordinary problems of flying do not arise. Stability and non-stalling are inherent in the design. If an ordinary aeroplane went up with an old lady as a passenger, and the pilot got out in a parachute and left the old lady in

the machine, she would not like it. If you took her up in an Auto-Gyro and told her to sit there while you jumped out, she would be perfectly safe. That is a simple illustration of the enormous difference made in the heavier-than-air machine by the use of the Auto-Gyro.

At the conclusion of Captain Courtney's reply, Mr Neville T Stack gave an interesting account of the flight to India which he and Mr B S Leete carried out on "Moth" machines, a report of which will appear in our June issue.

The proceedings concluded with a hearty vote of thanks to the speakers and the Chairman.