

Paris to pick up passengers. The "freedom of the air" will have to be discussed because the question of cabotage will arise. An important item is the facilities to be provided, I don't think that the Customs will agree to checking passengers on the roof of the Heliport. I am quite sure that we shall have twin-engined helicopters with at least 40 passengers long before this facility is available. The licensing of personnel should be taken up within I A T A.

Mr Masefield (*Chairman*) We have listened to a quite fascinating description on the way to go about such a pioneering enterprise as Sabena has tackled. We have heard too some very interesting thinking for the future. One cannot help feeling that in a small country like Belgium they have in some directions made more progress, and got on with action faster than we have over here. It is also nice to think, that when the British Aircraft Industry has done its stuff on the large helicopter specification, there will be a second customer for the large fifty-passenger helicopters. I am now going to call upon Mr ROWE to open the discussion.

Discussion

Mr N E Rowe (*Member—Blackburn and General Aircraft Ltd*) I think we have listened to an extremely valuable account of what our Chairman for this evening has described as a "pioneering operation" and although the Lecturer asked for our tolerance for his English, he did not really need it and I congratulate him on his presentation because one heard every word and there was never any doubt that we obtained the full value and meaning of what he had to say. I was interested particularly to hear of the enterprising steps the Post Office in Belgium were prepared to take to sign up a contract for five years. I think it was good. I was doing something similar in BEA—our own Post Office were enterprising but they did not sign a contract for five years! They signed up for three months and then one for six months and then ceased, finding it all too expensive. What a help it must be to the Operator to have that sort of solid foundation to go forward on. I was extremely interested to hear that the objective apparently of the Belgian Post Office is to carry all the mail at night (Mr Vernieuwe interjected and said "That is correct, except newspapers")—that really is a very fine ambition and I hope that it will fire our own people to do the same in this country and fire others to provide the aircraft very rapidly. It would take a lot of carrying and would be a very fine thing to do.

There are so many points of interest I would like to comment on, but I must restrict myself to one or two that interest me especially. Mr Vernieuwe referred to regularity and that it was extremely good. Could I ask him what are the causes of irregularity in his operation? In the BEA experiment the main causes of irregularity was low visibility, while high winds caused poor punctuality. We concluded that visibility and wind were particularly important, since this form of transport, which really should be as regular as the surface transport with which it competes, must be able to operate under all but the most exceptional circumstances. If he has the figures with him, I should rather like to hear them. Then he refers to navigation specifically, and also indirectly, in the Airways Scheme. On the black-board he brings the helicopter into the general airways scheme as operated for fixed wing machines whereas I think our conclusion had been that the helicopter might be best served by the Decca Flight Log to show the Pilot where he is at all stages of his flying and therefore should be able to help him to operate in the lowest conditions of visibility. On that point would he tell us if Sabena (or the corresponding MCA Authorities in Belgium) have any idea what the limiting visibility might be with multi-engined helicopters? I think it is a very important point because it will have repercussions on the navigational aids. I think if one considers that matter then operations should be possible in such low visibility with multi-engine equipment that the approach is made on instruments entirely, this implies that one needs a precise navigational aid, and the aircraft must have the qualities that allow blind flying to be done at comparatively low speeds which I think is one of the great difficulties.

One last point which really is of the very greatest significance to the future use of the helicopter is this matter of alighting platforms and their size. We gave a good deal of thought I remember, whilst I was at BEA to this question—is a structure to

be called upon to bear a crash on the top of the roof, or only for a rather heavier landing because one of the engines is out? The figures that Mr Vernieuwe has quoted are extremely interesting—I think it works out to about £1,000,000 per G (Mr Vernieuwe interpolated with “1,000,000 francs per G”) That is rather expensive in terms of acceleration but the point is that there are no data and it should be, I suggest, a matter of concern, almost internationally, that such data should be obtained to enable the sizes and strength of landing platforms to be determined nationally and hence for economical structures to be designed. Otherwise the buildings and platforms are going to be so expensive that they will not be built. Helicopters will then be forced to the outskirts instead of the city centres and one would lose one of the greatest benefits of their use. I think this is a point of very great importance, namely the realistic study and practical experimentation and research into loads which will be applied to roofs and such platforms from helicopter operations.

Mr Vernieuwe (*in reply to Mr Rowe*) The causes of irregularity are given in Tables 1 and 2. One mechanical trouble was the failure of the engine fan which we had to change. We changed the engine basket (*sic*) which was supposed to be good for 600 hours—we designed one for 2,000 hours.

We feel that for the type of operation we do in Belgium the Decca Log is the only answer. We could not fit it for all our flights due to the way in which we are limited in the pay load.

The figure I gave as to the cost of stressing the roof for different loads is smaller than you think. To give you the real figure, the building of the Sabena Airways Terminal in Brussels will cost 180,000,000 Belgian francs and for a roof stressed to 2G, the extra cost is 2,000,000 francs or about 1%.

Group Captain W N Cumming (*Member—Eagle Aviation Ltd*) I feel that this is becoming not so much a discussion as a study in emulation. We feel that Belgium has been striving harder and has got considerably further than we have managed to do. Quite apart from any question of discussion, I feel that it is bad enough to be the second speaker on the list after the principal speaker, but it is still worse when we have such a brilliant Chairman between the main speaker and the first of the discussion leaders, who disposes by himself in two minutes, of the three points I had carefully noted down during the delivery of the lecture.

I do feel, however, that a very high compliment was paid to BEA by the Lecturer, namely that the departure from Brussels of the Helicopter Service was arranged for 11 20 a.m. with the BEA plane arriving at 11 05 a.m. I think that is the highest compliment that can be paid to any air line.

The first contribution to the discussion after this lecture, given by Mr ROWE, automatically jumped to the first point which, in fact, I had noted down before even I had the pleasure of listening to a most interesting lecture—the fact that not only for the purposes of helicopter development but for the ordinary purpose of air mail, we are having a day to day battle with the Post Office of the United Kingdom for rates which will make it practicable to fly air mail and help the Air Lines to pay their way. So far from supporting the development of helicopter services, where they can be of very considerable advantage to the community, our Post Office says it costs far too much.

There is one point which cannot be made too often, which ought to be pressed and stressed and brought out to *ad nauseum* until the Authorities realize that the only method by which we can develop vital new services is by spending money on them, but spending in such a way that a tangible result is shown for the expenditure of money and that they are not merely supporting some nebulous project which may or may not bring fruit in the long run.

I think one point which is most interesting, and which also was covered by the previous speaker, is the size of the landing area required for helicopters. Mr Rowe, the Chairman and myself, who have all been sitting on the Helicopter Committee, have had many and long discussions, helped out by a great deal of expert opinion, as to the size which is requisite for the landing of helicopters. I must say that the figures given by the Lecturer are considerably below those which have now been accepted as the minima necessary. That is a very important point, not only from the point of view of space available but from the point of view of actual cost of making space available, whether on the ground or whether on top of a large building. This is one of the most important problems of the development of helicopters and one which we would do well to re-examine in the light of information given us tonight. In this

connection, I was rather amused by the complete, almost complacent, assumption by the Lecturer that the roof of the Sabena Brussels Air Terminal is going to be the helicopter landing ground in Brussels. That is a very admirable attitude to take but, of course, BEA have no comparable roof in the City of London.

On the subject of the approach to the Capital, Mr Rowe made some interesting remarks in connection with Decca and I myself have always felt that one of the inherent qualities of the helicopter is that it need not conform to the pattern of flying as envisaged for fixed wing aircraft. Whilst airways may be useful as a guide in certain circumstances, I cannot see why the helicopter should have to use the airways at all except for the immediate approach to the City. The helicopter as such should keep outside of the heights required for the operation of fixed wing aircraft, and thus forms no problem except in a Central Zone.

With regard to terminal landings, we have always felt that the prime requirement is that the helicopter should make its rapid and final approach to the nearest possible centre point of the City. Thereafter it could, if necessary, withdraw to the borders of the City for refuelling and for maintenance. It is obviously impossible in a restricted space, particularly if it is on top of a building, that there should be full facilities. But so far as the approach to the City and the delivery of passengers and air mail is concerned that should be the first objective. After that the helicopter may withdraw to an appropriate point for refuelling and maintenance.

I think, Mr Chairman, these are the main points I have to make and I would like to join with the other speakers in thanking the Lecturer very much for a most interesting and instructive lecture.

Mr Vernieuwe (in reply) To answer Group Captain CUMMINGS on the question of airways. I do not see how one is going to control a helicopter flying on instruments otherwise than in airways or controlled areas. If you keep, let us say, the air from ground level, up to 4,000 ft for helicopters to fly on instruments, the position of each helicopter will have to be controlled, and it will have to be given an altitude to fly at, that is the way we come to the airways with fixed wing aircraft.

Dr W E Ripper (Founder Member—Pest Control Ltd) We feel a little bit like the Yokels from the country when talking here—our helicopter operation on crop spraying is as different from an airline as ‘Chalk from Cheese’. We can claim that we have operated helicopters as long as you have, and we have found that helicopter operation for crop spraying is a far heavier strain on the pilots as well as on the aircraft. We find this particularly true in the tropics and my colleagues and I should be very grateful if you would tell us more about the SABENA Congo operations. We know that you treat marshes against malaria-carrying mosquitoes using DDT vapourizing equipment. We would like to know the extent of operation—its success—whether you do it on Government contract or whether it is operated like a Public Utility, more or less like our spraying work. We carry out crop spraying in England and in some African territories entirely without any big Government contracts—we went to the British farmers and we got their support for crop spraying operations, it probably speaks very much to the credit of British farming that we encountered none of the difficulties of which my English Colleagues spoke in connection with the Post Office.

Flying helicopters for crop spraying close to the ground, two or three feet above the crops, is an even greater strain on the pilots than flying the mail, and we would be very interested to know whether the Lecturer has any methods by which he assesses the fatigue of the pilots. I was interested to hear Mr Vernieuwe mention that his pilots fly 85 hours a month. Is this the total of their employment or have they their desk duties apart from that?

Finally, may I ask how SABENA arranges spares cover, are these provisioned according to the aircraft manufacturers’ specification or are they arranged according to SABENA’S operating experience?

Mr Vernieuwe (in reply) Dr RIPPER mentioned that I did not talk about the operation of the Congo. I did not do so for two reasons, the first one being that it is a very young organization—we only started in the Congo a few months ago—we have flown less than a thousand hours with our three Westland Sikorsky helicopters. The second reason is that, we air lines look at the helicopter as a replacement of our fixed wing aeroplane for routes of small stages like Brussels—London, Brussels—Paris, and so on.

I am sorry that I cannot answer Dr Ripper on the problem of fatigue. We have been discussing fatigue for pilots of fixed wing airplanes for the last five years and we have still no way of assessing it. If the pilot flies in pressurised aircraft, if he flies with large craft with big aircrew, if he flies away from home, if he goes back to his wife who is running away—there are so many factors involved that you cannot assess fatigue.

I mentioned that the Belgium M C A put a limit on the flying time of helicopter pilots at 1,000 hours a year and 85 hours a month. I did not say I flew that number—during the last two years when acting as pilot, I flew 75 hours per month.

Dr G S Hislop (*Member—British European Airways*) The Chairman suggested to me some minutes ago that I should buckle on my pads and prepare to go in to bat. I'd like to carry the metaphor a little bit further if Mr VERNIEUWE follows—I must congratulate him on the deft way he has fielded the shots that have come his way from preceding batsmen.¹

My impression was that the Lecturer brought up a great number of points which we in B E A have followed with the greatest of interest. I have not had the opportunity of visiting Belgium to see this operation in being, but I hope that before too long such an opportunity will present itself.

Now, I will just touch on one or two points and perhaps raise some queries.

First of all, the question of roof strength for elevated rotor stations. We in B E A have looked into this question quite a lot and were somewhat discouraged at first by what seemed to be rather an ominous feeling among some authorities that the roofs should be tremendously thick and strong and would be very costly indeed. However, we have had a number of informal discussions with civil engineers and others and I am glad to say that the situation seems to be changing somewhat. One has the feeling that, given a lucid requirement by the would-be helicopter operator a civil engineer would find no particular difficulty in meeting the roof strength required for helicopter operations, even if the roof has got to be capable of absorbing crash landing loads. If one is operating from a roof, it is not much good if, by an accident, the helicopter makes a crash landing and not only puts the heliport out of action, but seriously affects any business which is carried on underneath, because the roof cannot withstand crash loads.

However, I think one would agree that this is a matter into which we really want to bring civil engineers and constructional engineers as soon as possible and say "Here is the problem—what is the most economical solution?"

Another point of interest is Mr Vernieuwe's views on the need for, and if he accepts the need, the characteristics of, an approach aid which would be needed for low visibility operations into the main and satellite rotor stations, to which he has referred. Does Mr Vernieuwe consider that a special radio aid is needed, or would he favour an adaptation of ILS or GCA, or, provided the minima were acceptable, that high intensity lighting or FIDO would give all the necessary guidance to the pilot making the approach under those conditions?

He referred to the strain on the pilots of helicopters as being rather greater than on the pilots of fixed wing aircraft, in the ratio of 1200 to 1000 maximum permissible flying hours per annum. Would he attribute that to the characteristics of the existing Bell helicopter—this single rotor aircraft is not very stable—and if so would he consider that the fixed wing standard of stability—if achieved on large helicopters—would lessen the strain? Or is the strain associated with operations under low weather minima? I should like to hear Mr Vernieuwe's views as the matter has a considerable bearing on the requirements which one may put forward into the specification of a big machine. We feel that helicopters ought to be made perfectly stable in cruising flight and should be to the same standard as fixed wing aircraft. There is no particular reason why this should not be achieved and if done will undoubtedly lower the strain on the pilot, which seems to exist at the moment.

Another point which I'd like to make concerns the use of the airways and is one which strikes me very forcibly, as we need to have them in all parts of Western Europe. One is forced to use the airways as a sort of refuge from the military aircraft—which like to range far and wide. It is only with the greatest difficulty that the Military can be persuaded to keep away from the airways at all and if the helicopter operators hope to ask for complete freedom of operation, even at low altitudes, I think the problem of integrating civil and military traffic would become even greater than it is now. Hence, I think that the lowering of the bottom of the present airways to accommodate helicopter traffic, especially in busy areas, is attractive.

The other final point in these last few minutes is—everybody has felt how lucky the Belgians are with their Post Office—I will heartily agree that they have got a very co-operative Post Master General and I only wish that we were in such a fortunate position, not only for helicopter mail traffic, but also for fixed wing aircraft. I note he said that the co-operation which he gets from the Post Office does not extend to the Customs Officers carrying out their activities at the rotor station. There will be a lot of heart burning among passengers if, after arriving from abroad by helicopter at a rotor station, they have to depart to a fixed wing aerodrome to clear customs.

Mr Vernieuwe (*in reply to Dr HISLOP*) We have not yet had much experience of instrument flying, but I feel myself that in flying a helicopter on instruments (we have only flown the Bell on instruments) there is no problem at speeds down to 35 m p h. There is no reason to hover on instruments. The answer would be to have an approach system of high intensity lights, which at low speed on instruments can give visual contact on the worst visibility. I have made myself quite a few GCA approaches with the Bell 47, on one occasion with 100 ft ceiling and at 35 m p h, and I do feel that even in conditions of very low visibility with high intensity lights you could easily go on flying down to hovering condition. I believe that the best thing would be to have the beacon in line with the rotor station and the high intensity lights. I feel that the GCA in England could easily bring you within sight of the high intensity lights.

With regard to the question of pilot fatigue, the figure of 1000 hrs p a for helicopter pilots was decided before we had any helicopter experience in Belgium. We do not have enough experience at the moment to make any kind of comparison between the two but I feel that flying the DC6 or Convar for five or six hours is nothing compared with flying a helicopter for three or four hours. The Bell type with auto pilot would be different. I sometimes do a circuit myself, it takes about 4½ hours and is very tiring because of the instability of the helicopter. The reason why the Bell is so tiring is, I think, mainly due to meteorological reasons.

The Chairman We are running out of time and going to wind up at 7.25 p m and I would like you to limit yourselves to two minutes. I am going to put the “red light on at two minutes.”

Mr J S Shapiro (*Founder Member—Consultant*) As one who has contributed to the formulation of safety requirements, I am anxious to correct an impression left by Dr HISLOP. If we are to think clearly we must make the distinction between a safe emergency landing and a crash landing. If that is so, we can define a safe emergency landing of maximum severity. Most helicopter designers will agree with me that a safe emergency landing exceeding 4 G is not a sound design requirement. Hence the maximum which a landing roof site will have to withstand can be foreseen. I am particularly gratified by the simplicity of the town rotor station as envisaged by the Lecturer and I am very glad to know that Sabena have now come to the conclusion that every direction is a wind direction relative to the rotor and you do not have to have more than one strip. I hope that development will continue to favour really simple stations and not giant establishments like present railway termini.

Mr A E Bristow (*Member—Airwork, Ltd*) As a professional pilot I would like to thank Mr VERNIEUWE for one of the most interesting and encouraging lectures this Association has ever received. All too frequently the papers read before this Association are overcrowded with mathematical formulae, and their scope restricted to quite a limited number of technicians, designers, etc.

It has been refreshing to listen to a distinguished professional pilot and international airline executive, recount what can be achieved with obsolescent single engine helicopters, the payload of which are in the region of 500/600 lbs.

The Sabena inter-city mail operation has been tackled enthusiastically, fearlessly and with proper Post Office and Government support, features which I regret to say are barely apparent any longer in this country. Sabena has set our helicopter operators a fine example. Let us remember this lesson and realise the challenge that will surely come from across the channel with the advent of large 15, 20 and 40 seater helicopters. Before my two minutes slip away, I should like to ask Mr Vernieuwe two questions. Firstly, does he consider that the standard instrument panel as used in airliners today would be suitable for use in helicopters for blind approach to within 100 ft above a landing platform or ground site? Secondly, does Mr Vernieuwe believe rotor blade de-icing equipment to be essential to all weather helicopter operations?

In closing and with regard to his comments on pilot fatigue, may I say that this major problem looks like being solved to a large extent by the introduction of servo control systems and auto pilot installations, although I believe the solution should be sought after as an inherent design requirement in helicopters of the future

Mr Vernieuwe (*in reply to Mr BRISTOW*) We do not have any trouble with our instruments—we flew 400 hours with them, vibration in the Bell is not too bad. The only thing which is not suitable is the artificial horizon, for which we require an adjustable pitch datum. The turn-and-bank indicator is also useless.

Mr J L C Briscoe (*Ministry of Civil Aviation*) The size of the roof of the Sabena building is stated to be about 215 ft by 70 ft which is considerably less than the length of a tandem rotor helicopter. When there is a strong wind across the length of the building, does the lecturer consider it unnecessary to build up an even ground cushion which would be impossible if the helicopter was landed into wind or would the helicopter be landed along the length of the building with a big sideways airspeed? And the second point which I should like to know is, have there been any complaints about noise? In the recent test on the South Bank we had quite a large number of complaints about noise with small helicopters whose maximum noise is about 100 to 104 db. Most of the complaints have come from the North Bank and we think that perhaps we may have to limit helicopters in the centre of the City to a maximum noise level 85 db at 150 feet distance. What is the Lecturer's view?

Mr Vernieuwe (*in reply to Mr J C L BRISCOE*) The building is in line with the prevailing winds and what we intend to do is to approach when the wind comes sideways, from the main direction and land turning the helicopter into wind to land. I hope you understand what I mean. Your other question was the noise—up to now we have landed just on 2,000 times in the centre of Brussels—we have had no complaint at all.

The Chairman Mr President, Ladies and Gentlemen, we have now run out of time and so I must put a closure to this most interesting discussion. No doubt we can continue it with a glass in our hands a little later on.

I do agree with all the people who have discussed this lecture—it is really a most outstanding contribution, practically the first time someone has brought the helicopter down—or up—to a mundane Airline level. We have had no “air-y-farey” business at all but we have had the real honest to goodness stuff by someone who is doing a job.

Incidentally, I should just point out this to Alan Bristow, Sabena is State controlled—not private enterprise—but it operates with all that public enterprise which certain other Corporations also try to achieve.

I would like to join with Mr Rowe who congratulated the Lecturer on his English.

There was, I thought one really memorable phrase when he talked about the penalty of a “grosser weight”—I think it is a magnificent phrase. And whatever we heard about “heliports” at least we have heard nothing about “airstops”.

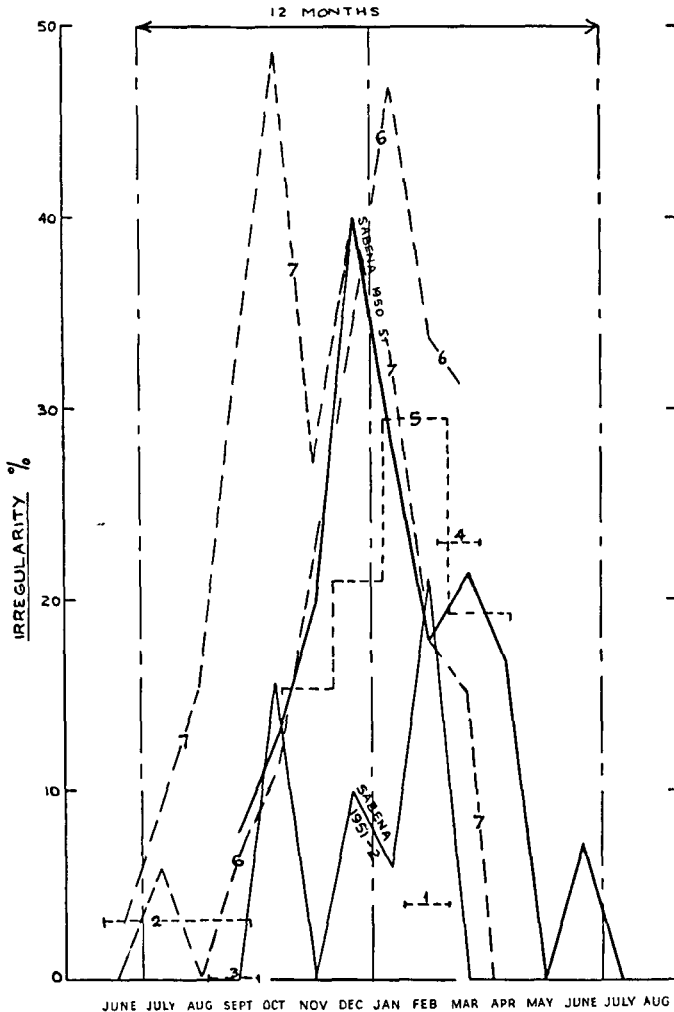
We all feel, I am sure, that this lecture has been a most important contribution. The Lecturer summed up his theme, I thought, when he said that Sabena is looking on helicopters as a replacement for the fixed-wing aircraft on short stages—that is a tremendously important statement. We agree with him it is a future to which we are all looking forward. I ask you to accord a very hearty vote of thanks to the Lecturer.

Written contribution by Mr R H Whitby (Member—British European Airways)
Listening to Mr VERNIEUWE'S lecture, I was struck by the similar results which were obtained by B E A in the United Kingdom. A comparison of the regularity achieved in these various operations is most readily made by means of a figure (Figure 1), where irregularity is plotted against calendar time. The results of the SABENA operations are shown by solid lines and those of B E A by dotted lines, the various stages of the latter being numbered according to the following key—

- (1) Daylight dummy mail, Dorset, 1948
- (2) Daylight mail, East Anglia, 1948
- (3) Night Trial, East Anglia, 1948
- (4) Night Trial, East Anglia, 1949

- (5) Night mail, East Anglia, 1949/50
- (6) Day passenger service, Liverpool/Cardiff, 1950/51
- (7) Day passenger service, Birmingham/L A P , 1951/52

Most interest resides in the seasonal variation of regularity and the effect of the type of country over which the services were flown The schedules were chosen,



after consideration of statistics of local winds, to give an acceptable percentage punctuality, a small allowance being made for last-minute mechanical delays For this reason figures of percentage punctuality have no intrinsic interest The overwhelming proportion of irregularity was due to weather, the mechanical reliability of the aircraft used in all the B E A operations, Sikorsky S 51s, being very good

Operation 1 was in a hilly region, in a period when very strong winds were encountered This did not effect punctuality seriously, since a circuitous route was flown Visibility was good and irregularity was only 4%

Operation 2 was in a particularly flat area in the summer months, and most irregularity arose from low visibility, particularly on the one day of the week in which a start was made at 07.30.

Operations 3 and 4 were preliminary trials of night flying. Although the aircraft was equipped with instruments, en route weather had to be taken into account, since they were single-engined, and regularity was not as good as it might otherwise have been.

Operation 5 was a six months winter night mail service, in which much of the flying was under fully instrument conditions.

Operation 6 took place in hilly country, but the route chosen was fairly favourable from the point of view of weather. Summer regularity was good, but in the winter it fell off to a very low level. With Operations 6 and 7 which were of a point-to-point nature, nearly half the irregularity is due to the aircraft being out of position. This largely accounts for the markedly higher figures of irregularity as compared with previous operations. An additional factor is that, for Operations 6 and 7, passengers were being carried and this possibly led to a more cautious approach when pre-flight decisions, as to whether the service would operate, had to be made on the basis of the weather forecast.

Operation 7, between Birmingham and London, lay over country with poorer weather than that of Operation 6 and it took place in a particularly bad summer. It was also timed to commence at 07.00 hours and many cancellations were due to early morning mist at the starting point, since the service was such that long delays could not be tolerated. The effect of making the starting time later is shown by the improvement in November as compared with October.

All the results presented in Figure 1 indicate clearly the necessity for instrument flight if reasonable regularity is to be obtained throughout the year, and in addition point the need for multi-engine aircraft if en route weather can safely be ignored.