project and it is suggested that a flexible pontoon landing area could be constructed of such units

Conclusions

In a new field like this, where practical experience is still largely to come, it is difficult to draw any firm conclusions Estimates prepared without reference to specific sites are nearly always misleading As a general guide, however, the Rotor Station with the lowest capital cost is likely to be the ground-level one on the fringe of a built-up area, followed by the flexible pontoon, the bridge-platform and roof-top in ascending order But individual circumstances may well change this order, and only a full design and cost analysis will provide the correct solution to any particular case

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INTRODUCTION BY THE CHAIRMAN

Mr L S Wigdortchik Our last Paper this afternoon, which is to be delivered by Air Commodore Harold Primrose, concerns the public user aspect of Rotor Stations Air Commodore Primrose served in the Army in the 1914-18 War as a Captain and towards the latter part of that period was seconded to the R F C, which later became the R A F After a distinguished career in that Service he retired in 1933 and took up the post of Air Mail Advisor to the Post Master General, where he was responsible for initiating the early experiments in mail carrying from the roof top of the General Post Office, London

After a further period of distinguished service in the R A F he went into the aircraft industry and then joined the Ministry of Civil Aviation, where he actively sponsored the helicopter movement The notable first direct flight by helicopter from London to the Centre of Paris will be remembered by us all, and also the helicopter passenger service between London and Birmingham, inaugurated in May, 1950 He was responsible for the organisation of these two notable events He is an Associate Fellow of the Royal Aeronautical Society and, of course, a Member of the Helicopter Association of Great Britain

Rotor Stations—Public User View

By Air Commodore W H PRIMROSE, C B E, D F C

May I congratulate Mr Whitby on his excellent and lucid paper It has filled me with interest and admiration Interest, because the subject is one in which for some time past I have tried, by preaching and propaganda, to interest others Admiration, because, judging by my own reaction, he seems likely to succeed where I have failed

From this well deserved tribute to the lecturer I do not wish it to be inferred that I agree with all he has said on the subject

He has stated at the outset that the " public user " and other aspects are left by him to be dealt with by other speakers—in the case of the " public user " this is my unfortunate self But he nevertheless goes on, in the latter part of his paper under the heading of " Traffic requirements for booking

and handling passengers," to state what the passenger or public user must do to satisfy the operator

Now I have no objection to his shooting into my territory, for indeed it is a very essential part of the operator's planning But as I disagree with a number of his conclusions, I welcome the opportunity this gives me of shooting back at him

But first of all, let us consider, under main headings, what the public user is going to require of Rotor Stations to serve helicopter transport services These all fall naturally under

(*a*) Convenience , (*b*) Comfort , (*c*) Dispatch

Convenience

Helicopter transportation, if it is going to be the success we all believe it will be, should more nearly conform, in its attributes of convenience, to those existing surface transport rather than to those of existing air transport , but with the additional translational speed approximating to the latter

A first requirement, therefore, is a multiplicity of stations in each city or town of say, a population of 50,000 and over The number required for each place would vary in ratio to the population and/or the traffic potential Their siting would be in centres of residence, shopping, business and amusement, and with due consideration to their integration with surface transport local feeder services Their role would be to serve traffic to other centres in all directions

This requirement of a number of moderate sized rather than only one or two large termini serving a wide spread area of populations and traffic from many directions should, in the interests of public users' convenience, have a primary place in all Rotor Station planning programmes

I appreciate that helicopter traffic volume to make the provision of multiple stations an economic proposition will take some time to build up and that they, therefore, cannot be built all at once , but they should be planned, sited and surveyed and built as traffic requirements justify It should never be forgotten that convenience will generate traffic Another point that should be borne in mind is that stations built in excess of immediate requirements can be well utilised as elevated car parks while awaiting the inevitable growth of helicopter traffic

A great attribute of convenience is simplicity But Mr Whitby in his cycle of operations seems to visualise the perpetuation of the bad old normal air travel system with all its complications of pre-booking, hand written tickets in triplicate (with name, address and what not of each passenger), weighing, listing and shepherding passengers by a horde of expensive officials , to say nothing of the registering and storage of baggage Whereas, what is wanted is the simplicity of the train, bus and tube system with the printed and punched ticket, the passenger boarding by himself I agree that light hand luggage only should be taken on passenger services Road motor-coaches and undergrounds do not carry passengers' heavy trunks These can be sent in advance or registered to go by carrier or special baggage freight " copters "

I cannot visualise anything but the elevated roof-top rotor stations for the heavily built-up large town and city areas, though the small towns and rural districts may do with surface sites , but these must be close in to the centres they serve It therefore follows that to make these elevated sites

convenient, there must be access by elevator or escalator What a drop there would be in underground traffic if passengers had to climb all the stairs, and many helicopter journeys will be no longer in time than a number of the present tube journeys

Embarking under cover near the elevator or escalator exits is another essential of convenience but I shall deal with that under the next heading of comfort

Mr Whitby in his consideration of the cycles of operations through which (he asserts) a passenger *must* pass on arrival at the entrance to the Rotor Station, prefaces this by stating that " the shorter helicopter journeys suggest that passenger handling should be of the most expeditious " Well, after hearing what he condemns that poor passenger to go through in his cycle of operations before he can travel for 20 minutes or half an hour, all I can say, as representing the public user, is " God 'elp us " Why, it perpetuates all the worst features of embarkation on a voyage to Australia by sea or air, it is certainly not my idea of convenience Some less expensive, less fussy, simpler and more convenient way must and can be used and if the reply is that most of the complications are to comply with M C A orders and Air Regulations, then these must be changed for helicopter travel or we will have none

Comfort

By this I do not mean the provision of luxury such as powder rooms for ladies, pink gins for the man, or Persian carpets in the passages, but rather the elimination of discomforts First, I would suggest that waiting and embarking at Rotor Stations should be done, as I indicated earlier, under cover This could best be achieved by having the elevated station on two or more floors The helicopter landing and taking off from the roof which would be used solely for this purpose and staffed by the aircraft handling, servicing and control personnel The machines would descend to and ascend from the next (covered) floor by a series of lifts—as on aircraft carriers—where passengers would disembark and embark in comfort under cover I have many ideas on the layout of such a Rotor Station, but speakers, better qualified than I, have spoken on the Town Planning and Civil Engineer aspects and they no doubt have dealt with this in detail

I agree with Mr Whitby that facilities may be desirable in way of refreshments and waiting rooms, etc, and in the provision of car parks or garages But these should be kept to the minimum in simplicity, size and number and for the larger Rotor Stations only After all, bus stops and few underground stations provide them As for the Railway, their's are a standing joke

Dispatches

Again I am in agreement with Mr Whitby when he stresses the necessity for expeditious handling, though I object to the word " handling " Passengers do not want to be handled and when this implies complicated red tape form filling, listing, shepherding and general pushing about envisaged, I just don't believe they will stand for it Speed however in sending them off on their journey is not only desirable but essential

As the passenger arrives at the Rotor Station he wants to find, on the ground floor, a booking office, similar to those on the underground or

railway stations, where he can get his ticket simply by stating his destination and paying his fare Here also he should see the board with the time of departures and arrivals He will then appreciate being whisked to the embarkation floor by elevator or escalator, where he should find signs indicating the platform or assembly points for the departure of the rotor plane service to his destination That, in brief, is my idea of the simple and slick cycle of station service the public user will want and should get at a well run Rotor Station

Discussion

A L Oliver (*A and A E E*) I wish to preface my contribution with the statement that I am speaking solely as an individual

Early in his paper Mr Whitby quotes, under the heading " dimensions and disposition," an approach angle of 35° and a required rotor station length of 400 ft between 30 ft high obstacles The minimum length required must, I agree, be largely a matter of conjecture at present, as we have no experience of the behaviour of multi-engined helicopters, but perhaps Mr Whitby could explain why he has considered an obstacle height of only 30 ft instead of the more usual 100 ft , since this considerably affects the space required ? I was under the impression that 100 ft displaced the 50 ft screen of fixed-wing aircraft because 50 ft was considered inadequate in view of the peculiar properties of helicopters

For any particular " screen " height, the size of the rotor station depends upon the performance and handling characteristics of the aircraft and the techniques employed in take-off and landing

Tests made recently with a current type of helicopter showed that, in still air, the steepest approach angle which could be comfortably attained was about 20°, using an approach speed of approximately 11 kts E A S and a rate of descent of 400 ft /min The pilots did not like a lower airspeed because of less satisfactory control characteristics and poor indication of flight condition, while any small increase in the rate of descent makes the approach rather " rough " Incidentally, if the rate of descent is of the order of 1,000 ft /min , this " roughness " practically disappears, as the aircraft is at low pitch and low power , although the pilots liked it, I doubt whether passengers would appreciate either the descent or the subsequent flare-out landing The angle of the flight path to the horizontal increases rapidly with windspeed—in a 5 kt wind, for example, it is about 35° A limit of about 60° may be imposed, however, by the restriction of pilot's downward view by the aircraft structure The dangers of power-failure are, of course, much greater than in the normal approach, which is only at about 10°

The over-riding factor in defining the size of the airstrip will most probably arise from take-off and not landing, however, as the change of flight path following power failure is much greater A considerable amount of experimental work is necessary on the question of take-off techniques and aircraft behaviour following power-unit failure The angles of climb and glide and the critical heights have to be determined and the handling qualities of the rotorcraft assessed for the various cases

The take-off technique which I personally favour is the normal or " cushion " type, in which the aircraft reaches best climbing speed at about