FORUM

'The Effective Use of Airspace'

THE following contributions are selected from contributions to the discussion on Wing Commander E. J. Dickie's paper 'The Effective Use of Airspace'. The paper was presented at an Institute meeting held in the Royal Geographical Society's house on 21 March, and is printed in the last number of the *Journal*.

from Group Captain F. C. Richardson

I remember on many occasions in my Service experience undertaking cross-country flights with a large number of other aircraft flying along exactly the same route at almost precisely the same time. These were usually navigation training flights and, therefore, to some extent the errors which arose might not be held to be representative of what one would expect to happen to seasoned airline operators. Nevertheless, it was a commonplace to find on such occasions, very shortly after taking off, that all aircraft became so scattered as often to disappear from each other's view completely. And yet, at each turning point and again at the destination they all arrived at the same time. I am sure that there is something to learn from this particular aspect of flight along identical or parallel tracks. I do not think a simple fore-and-aft radar indicator would provide the safety in flight which we are anxious to establish. I believe that a secondary radar, giving an all-round horizontal view, would probably go a long way to meet the stated requirement; although, of course, only one giving a spherical view could give 100 per cent safety. Even with pilots who can see exactly where they are going, along clearly defined tracks over country abounding in natural navigational aids, it is true to say that the really effective variable is the track and not the timing. This lateral scatter is due to inaccurate steering data and to the many other inaccuracies affecting the actual path of an aircraft through the air, quite apart from wind-finding errors. Even with the best primary navigational aids, tracks cannot be flown with absolute precision. It follows that collisions are at least as likely to arise from errors of track as from errors of timing. So I would suggest that what we really need is a secondary radar which will give us an all-round horizontal view and I think that we must not delude ourselves into thinking that even the finest primary navigation aid will provide an accuracy in the air by which all aircraft proceeding along one route will remain only fore-and-aft of each other.

from D. O. Fraser

(*The English Electric Company*)

THE question of how operators and the air traffic control service could co-operate to relieve congestion arose during air traffic control trials of the Comet I. We found that the Comet captains were capable of informing the Tower quite accurately when they would take off with about 10 or 15 minutes notice and they started engines sufficiently in advance to taxi out and take off at the time indicated. If other aircraft were able to do the same, it would then be possible for controllers to sequence out-bound movements in such a way as to relieve congestion. Instead of having to issue several clearances in turn for aircraft intending to follow the same route, with the necessity of imposing longitudinal separation between them, it would be possible to interleave aircraft bound on different routes so that lateral separation occurred between them naturally after take-off. In the case of the Comet the operator had an economic incentive to plan his departure in order to obtain an unrestricted ground clearance to the take-off point owing to the high taxi-ing consumption of jet aircraft. As the proportion of turbine aircraft increases, more and more operators will have the incentive to cooperate with traffic control in this way and enable the controllers to do efficient short term out-bound planning.

Mr. Dickie referred in his paper to the typical use of radar for in-bound and out-bound sequencing of aircraft near the airports. However, I feel there is a particular feature common to these applications which is very significant, and that is that control of the aircraft is only within defined limits. Aircraft are accepted by the in-bound marshaller when they arrive at the hand-over point or leave the holding stack, and are controlled by radar as far as final approach or the break-off height, after which radar control is relinquished. Between these defined limits the controllers have a limited number of aircraft to handle, and for that kind of operation radar is magnificent and control directly from the radar tube is satisfactory. The same applies to the out-bound problem, the limits then being the take-off runway and the aircraft reaching their cruising altitudes. However, when we consider using radar separation en route, we have to face difficult problems. One is not now considering defined limits; one is controlling traffic along a whole airway. If the airway is broken down into sections there is till the problem of hand-over between one radar controller and another; at the point of hand-over aircraft would probably have to have planned on precedural separations. New difficulties arise when we apply radar control from a radar tube to an airway as a whole.

It seems to me there is no sense in undertaking enormous expenditure and disruption of aircraft movements to eliminate a risk level which is of a much lower order than has to be sustained anyway for other reasons. For example, the size of the present A.T.C. separation buffer is some 1500 million times the volume which would contain a transatlantic airliner. Now the premature failure rate of the turbo-compound piston engines used on these aircraft is a low figure, but I estimate that the safety factor in our A.T.C. buffer is about the same as the chance of three engines failing in turn independently in the course of a transatlantic flight. The safety factor in the A.T.C. buffer is not necessarily a measure of the collision risk level, but I suspect it is of the same order. One may therefore doubt the wisdom of over-emphasizing the need to eliminate this collision risk when it would make an infinitesimal contribution to air safety as a whole.

The significance of the very low collision risk lies in the fact that the actual danger of collision between two aircraft on the North Atlantic may only occur once in five years or more. This means that if a suitable air-to-air collision avoidance device could be developed *it would only need to be used once in five years* as compared with pilots being restricted all the time when separation is effected by ground control. In practice an airborne protection system would probably be unable to select the precise collision case, and in fact would indicate a collision risk more frequently; but certainly it would require action by the pilot much less frequently than does the A.T.C. system which is restricting aircraft movements continually and placing a heavy load on communications and on the flying crews themselves.

from Wing Commander E. J. Dickie (in reply to Mr. Fraser)

THIS, fortunately enough for us in some ways, perhaps less fortunately in another, is a small country, and our defined limits for airways control purposes would be the beginning and end of an airway. We would indeed have planned separation for the beginning and for the end of that airway, whether the aircraft is departing or arriving. And we certainly intend to go on using the flight progress strip, produced mechanically rather than all handwritten. We intend using a flight progress strip as a means of recording the past, the present and the future, but limiting it to these two points at the beginning and end of the airway sector and not having all the information repeated for intermediate reporting points every 20, 30 or 40 miles along the track. We would certainly have to define limits at the beginning and end of the sectors—and we would have planned separation something I suggest like 20 miles for longitudinal separation instead of 10 minutes flight time for those two points. In between, we would hope to provide the radar surveillance system, and it is really much more a surveying or monitoring function here than controlling in the sense that the radar approach controller talks an aircraft round. We would have two radar controllers, on a busy airway, one who would be looking after departing aircraft and the other, arriving. This isn't firm but we feel that this is possibly the best way, one reason being, of course, that it eases, to some extent, the pilot's problems in that he has got one r.t. channel to work on right the way through instead of having to change from one to another.

The radar controllers, then, who would be looking after this traffic along the airway between the 'planned' limits would, I hope, have as their main function one of simply watching and communicating with the pilot. They would have the radio telephone, leaving the planning controller free to deal with the telephone calls. They would have the function, by and large, of seeing that the aircraft which had been planned to flow with, say, 20 miles longitudinal separation did not, in fact, get separated by less than something like 5 miles. Their job would be to watch and see, not that the planned separation were maintained, but that safe separation were not infringed. We would also use the airways in effect as two-way airways, and for climbs and descents through occupied altitudes would use right side or lateral separation. Now this of course is one of the places where a navigational aid comes in. If the aircraft can track accurately down their appropriate half of the airway then the radar controller has that much less to do, r.t. channels are relieved and so on. But for certain traffic density levels, and until navigational tracking accuracy does improve, the radar controller may well on occasions, and, I would like to emphasize, not every occasion by any means, have to give a vector to the odd aeroplane to provide lateral separation during climb or descent.