AVIATION MEDICINE RESEARCH*

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Mr. President, Air Marshal Mukerjee and Friends:

I deem it a privilege to be asked to speak before this distinguished gathering, of experts and non-experts, and I must express my gratefulness to the Society for it. The Chief of the Air Staff and the D.M.S. have just told us about the importance and usefulness of aviation medicine in the efficient functioning of an air force. It is apparent that it should be so. Even the simplest of any apparatus, or system to use a more appropriate term, with which the Air Force is concerned is a combination of a machine and a man, and it is this complex - this integration of man and machine whose performance is the thing which is important. The performance of this complex will be conditioned not only by the capabilities and limitations of the machine but also, and in some situations more so, by the limitations and capabilities of the human operator.

In the case of aviation, the situations to which a flying man is exposed are often so totally different from the usual environment to which we are normally accustomed, that human limitations which are ordinarily irrelevant become significant and sometimes dominatingly so. For instance, the visual response time for an average person is somewhat less than 2 seconds; this is the time taken to see, recognize an object and initiate the necessary muscular response. In this time an aircraft travelling at Mach 1.5 will cover a distance of half-a-mile.

Aviation Medicine, as a separate discipline, is fairly recent, but it has advanced sufficiently to be more or less out of reach of ordinary scientists and engineers, and even medical men. Considerable work has already been done; so much so that, it is not easy, without deep study and understanding of the subject, to select problems for research. What I mean, of course, is not any problem but worthwhile problems.

As we all know probably nothing is easier than to pose a research problem. All that may be necessary is to pick up some recent issue of a research journal, and if we find that someone has determined the effect of, say, an acceleration (positive or negative) of 40 G on rats, we may pose the problem: What will be the result of 400 G on rats or say 10 G on elephants?

Further, some one may suggest the study of the effects of high G combined with, say, fear-response situations, e.g. experimental rats to be exposed to G and cats at the same time. By the way, I may mention as an illustration of G that if two persons collide against each other and the only reaction is "sorry, please", the G during collision would be

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less than 1/10. (If it were as much as 1 G, officers for the time being will cease to behave as officers ought to.)

Take another example: If we come across two oxygen regulators having some special merits, we may suggest the problem "Make an oxygen regulator which will combine the merits of the two."

It is apparent even from these rather trivial examples that nothing is probably easier than posing a problem. Any one can do so, including even a scientist. What is extremely difficult, however, is the formulation of a problem that is worthwhile, one which is within our resources and one which can be completed within a reasonable time. Selection of problems which satisfy these conditions requires considerable study, an insight into the subject and considerable familiarity with our requirements and facilities available to us. We all know that at present we have in this Country very little of research in aviation medicine. We could easily have a lot of this research. That would be easy, but the point worth making is that if research of real value is to be done the first requirement is a patient, sustained and intelligent study with, of course, some amount of associated research. Our first requirement, therefore, should be for a small, but progressive and energetic School for Aviation Medicine. I understand that steps in this direction are already being taken.

A moment ago I said that aviation research is already a rapidly growing subject. As an instance, take the American Journal of Aviation Medicine. It is now running its 28th volume. Even a glance at the abstracts of scientific papers presented at the 1956 Chicago Meeting of the Aero Medical Association shows the extremely wide scope of the subject. It deals with such things as space medicine, including effects of cosmic rays on flying personnel - and this may become very important in the case of space travel - it deals with ophthalmological studies; with accelerations and decelerations; with problems of passenger transportation; with nose and vibration; with pilot and air-crew selection; and the list is not exhausted yet.

Some problems look simple and also turn out to be simple, some look difficult and also turn out to be so. The large majority of problems, I think, look simple, but turn out to be difficult.

Take one or two instances. I select from a field in which members of our Society have been doing some work. The first example is of instrument dials, e.g. altimeter. What should be the form or shape of the dial, numbers, pointers and so on, so that errors of reading are minimised. A recent Canadian study has shown - what at first would appear hardly believable - that as much as 30 percent of all altimeter readings were in error by 1,000 feet or more. To design a proper dial and pointers - that is, proper presentation - for an altimeter, turns out to be a difficult thing. "The number of error readings occurring in even the best of tested instruments (altimeters) makes it imperative that no effort be spared in the development of an optimum instrument for the presentation of altitude information." (Canada: Institute of Aviation Medicine Report, February, 1956.)

Take another example pertaining to the field of vision and perception. We have

done some small work on the recognition of objects when there is a fairly high relative motion between the observer and the object. We have been studying this for some time. Now it is likely that in this case we may have to take account of the effects of *eye tremor* - recently studied by Ditchburn - an irregular rapid oscillatory eye movement of about 30 - 150 c.p.s. and 0.1 min of arc amplitude. This may add quite a new complication - but there also lies the fascination and excitement - to what we have been studying.

Lastly permit me to make one more observation. This I take the liberty of doing on behalf of the non-experts including myself. During the last few months experimental proof has been forthcoming about one of the most far-reaching things in the general theory of relativity. It is this; if a person flies for one hour in a plane flying at Mach 1, on his return he is really younger than us who did not do the flying: he is younger by something like one hundredth of a microsecond (A microsecond is a millionth of a second). This is so small that we do not envy the airman for it, but the significant thing is that this effect is now experimentally established. (Experiments are done with atomic particles, but that makes no difference). With increasing velocities this may one day turn out to be a practical method of keeping down the age, not figuratively but literally. Who knows? Aviation and Aviation Medicine may then become 'the Thing and the Medicine'. But even today its role is important. As has been said "Some pilot error exists in approximately 90 per cent of all aircraft accidents". This does not quite mean that aviation medicine is 90 per cent important and all the rest only 10 per cent important; but it does mean that this subject is vitally important.