

SOME ASPECTS OF SIGNALS IN THE I.A.F.*

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I shall try to tell you something about the Signals Branch of the Indian Air Force, what it aims to do, some of its difficulties and some of the instances where we feel it is not as efficient as we should like it to be.

The purpose of an Air Force Signals Organisation is to provide communication and radar facilities which will assist the Air Commander to exercise efficient control of his forces and to develop and apply their maximum fighting strength.

These various facilities comprise—

- (a) Wireless communication system,
- (b) Radio Navigational and runway approach aids,
- (c) Aircraft control, early warning and identification systems,
- (d) Airborne search system,
- (e) Radio warfare system.

The ground wireless communication network utilises the familiar W/T system and is hand operated. All units of the I.A.F. are linked together into networks and in a manner appropriate to the chain of command.

The traffic handling capacity per 24 hours by this W/T system is about 8,000 words—a word or group as it is called is taken as equalling 5 letters.

The traffic handling capacity

During peace time the traffic to be cleared is within this handling capacity. Peace time signals traffic is usually concerned with either routine administrative matters or air training matters and the hand operated W/T system is quite satisfactory for this. However, during war there is a huge additional quantity of traffic which has to be passed. There are many and ample reasons for this but to be as briefly as possible, it can be said that as the Air Commander can only be in one place at a time, he must, therefore, send speedily clear and often detailed instructions to his Operational Squadrons. These instructions are themselves conditioned by intelligence reports, much of which flows back from the Squadrons to the Commander. Finally for the Squadrons to be able to act on their orders they must be assured of a constant flow of technical and other supplies. All this adds up to a heavy increase of Signals traffic. In addition to these vital messages there is of course the additional burden of signals traffic caused by the Air Force expanding to form new operational units as fast as possible.

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The situation, in my opinion, is that the hand operated W/T system although adequate for normal peace time working is likely to hamper seriously the Air Commander in time of war. In all probability he would be obliged to use aircraft, which perhaps he could ill afford, to fly an air despatch service until the problem could be overcome a better way.

There is a better way. By replacing the hand operated W/T system by the radio teleprinter. One W/T channel converted to radio teleprinter raises the handling capacity from 8,000 Groups per 24 hours to 50,000 Groups per 24 hours.

Our need for such a method is great and I venture to suggest that it applies similarly to both the Army and the Navy for their vital links. To be worthwhile, however, this equipment must be kept in a perfect state of working which entails dust free operating rooms and regular attention by skilled mechanics.

I foresee a great future for radio teleprinter systems in India both for static locations and in vehicle form for mobile operations. It is far cheaper than laying telegraph cables except over short distances and has the great advantage of flexibility in that the equipment can be moved or added to keep pace with requirements. I appeal to delegates from Universities and Technical Institutions to encourage any young men who appear to have an aptitude for radio teleprinter techniques, to continue their studies so that one day they can play their part in developing this important industry in India.

Telephone switch boards

I turn now to another subject, telephone switch boards. In large Air Forces and indeed any large Government or private industrial establishments we find the Private Branch Exchange or PBX. These vary in size from say the 25 line worked by one man upto huge banks of instruments needing six or more operators. I believe there is a requirement for automatic systems in many of our static establishments. An auto system allows for more use to be made of a given number of landlines because operating time is reduced very considerably. The caller either gets his number or the engaged sign in a matter of seconds. Compare that with our daily experience in dealing through a PBX. We have the example in all parts of the world where whole cities or parts of cities have fully automatic telephone systems.

I believe there is a need in the Service in India for a small size auto system to cater for the static establishments requiring 50—100 or more extensions. Only one operator would be needed to deal with outside trunk lines to manual exchanges and he could also combine the duties of enquiries and information. Perhaps the P. & T. are already thinking on these lines and have plans for the manufacture of these equipments in India. In any case some member of the Defence Science Organisation may like to discuss it with them.

Air traffic control

I turn now to a feature concerning Air Traffic Control. The system we use in the I.A.F. entails an operator noting down all radio

telephone conversations between the Air Traffic Controller and Aircraft approaching the airfield to land and those preparing to depart. These conversations are concerned solely with regulating the flow of aircraft in as safe a manner as possible. World statistics show that the highest incidence of aircraft accidents occur at or in the vicinity of airfields. This is not so much because of major disasters but the number is built up due to minor accidents whilst taxiing due sometimes to brake failures or tyre burst and sometimes just carelessness on someone's part. Even these minor accidents cause wasted operating time and use up skilled men and material in repairing them.

Speech recording

In our constant struggle for perfection it is essential therefore to investigate all accidents major and minor and also near accidents. The enquiry always entails a scrutiny of the log books of the radio telephony system and provided this is absolutely accurate and complete, the picture of the circumstances leading up to the accidents can usually be built up and the cause determined. Unfortunately those log books are rarely both complete and accurate. Sometimes several radio telephone conversations occur at the same time and the operators miss important phrases. Occasionally slackness and even dishonesty has prevented the full story being written down. I must not give you impression that it is solely an Indian problem. It is not, it is a world problem in both civil and Military aviation circles.

The answer is to use one of the systems of automatic recording of speech with play-back facilities. This could be used either partially, that is to say, the Air Traffic Controller would switch the instrument in during busy periods and during bad visibility when the accident risk is increased. But as this entails keeping operators to log by hand during the other periods there is no real saving of man-power. It would be preferable to use automatic recording continuously. For economy in material it should be possible to cancel out the recording every six hours or so and use the recording medium again (unless it is required as important evidence) for accident investigation. During less busy periods perhaps some voice operated relay would switch the equipment on and off.

Three types of equipment seem to be most favoured, the wire recorder, tape recorder and the photo electric film recorder but each of these is expensive. I have not heard of a good installation imported from abroad costing less than Rs. 16,000 and every airfield in India will, I think, eventually need one. Surely the task of solving this in a cheaper way is possible in India. This perhaps is one of the problems the I.A.F. could suggest to the Defence Science Organisation.

Aerial navigation

Let us consider now a problem of aerial navigation. There is as yet no satisfactory long distance navigational aid for use in all weathers and in darkness. The sailor and the airman, when more than a few hundred miles from the coast, still have only the sun and the stars to guide them with any accuracy and then only when they can be seen. For the airman these aids are never easy to use. Radio has practically solved medium range navigation that is for

distances up to 250 miles from a ground station but to extend any one of these systems to give a pattern of cover the size of India would entail in the provision of the necessary radio navigational ground stations, a formidable expense. So, the aviation world is waiting patiently for a new aid which will provide accurate fixing, speedily, up to a 1,000 miles range. This new aid must not be prone to fading, it must withstand atmospheric interference and must not be too expensive.

A great deal of study is being devoted to this problem in the West and some feel that the answer may be found among the very low radio frequencies—a few hundred cycles per second or less.

Could India join in this search? I think she should.

Air-conditioning

Now before concluding, I wish to appeal to any delegates who are concerned with industrial physics in its application to refrigeration and air conditioning.

Because of radio frequency over-crowding and also the desirability to beam transmissions to avoid wasteful dissipation of energy in the unwanted directions, higher and higher radio frequencies are being utilised. This calls for not only more precision in radio manufacture, it calls also for temperature and humidity control in apparatus roofs and absolutely dust-free surroundings.

Many of our technical failures in India to-day are caused because of the absence of one or more of these three controls and new apparatus working in the ultra high frequencies will tend to become more temperamental unless we provide the controls.

Quite apart from the important needs of radio apparatus and components for a dust-free dry and stable temperature, there are the needs of the personnel who operate and maintain them.

It surely cannot be disputed that the human machine runs smoother and for longer hours without attention if it also is similarly protected whenever practicable. The atmosphere in some of our radar control rooms in summer can scarcely be imagined. So far we have achieved little more than to provide a fan which blows hot air over the operators' face. He cannot work well for even an hour at a time at present.

I do not think that study into these problems of air conditioning has yet gone far enough to turn theory properly into practice and I venture to suggest that in the years to come, radio technicians will cry out to industry for a more plentiful supply of cheap, reliable, silent and efficient air conditioning plants for static use and in portable form for use in aircraft and in radio vehicles.

These then are just a few of the problems confronting our Air Force to-day. There are countless others and many are small and easier to solve than those I have mentioned.

The Air Force Staff Officers and Unit Commanders in India are already more than busy in coping with day to day problems. It must be remembered that the Air Force only really commenced to expand in 1947 and we have large numbers of airmen to train up to standards of efficiency. We have little time and not always the ability, to study abstract technical problems. It is to the scientist that we must look for this assistance. His balanced outlook, his analytical mind, his ability to look at a problem from many points of view unhindered by rank consciousness or regimentation which affects all servicemen to some extent or other, will enable him to grasp and solve many of our technical problems. But first of all he must come and live and work amongst us not only in our Headquarters but in our Units in the field.

In this way he will acquire the experience to foresee our future technical and operational requirements and what is perhaps equally important help us to use what equipments we now have to the best advantage.