

Problems Relating to the Installation and Operation of Radio Equipment in Helicopters

*Five Papers presented to The Helicopter Association of Great Britain
in the Library of The Royal Aeronautical Society, 4 Hamilton Place,
London, W 1, at 6 p m on Friday, 8th November, 1957*

Wing Commander R A C BRIE (*Vice-President*)
in the Chair

Introduction by the Chairman

The CHAIRMAN said they were to have a departure from the normal lecture because they had what amounted to a Symposium, with five specialists speaking on the subject. It would be introduced by Mr D W Griffiths, Radio Supervisor, Airwork Ltd.

Radio was a "must" for aircraft. The Symposium would deal not only with the installation of radio sets in aircraft but also with aeriels, and each of the Authors would speak from the background of their own experience.



General Introduction

By D W GRIFFITHS, M S L A E

Mr Griffiths, a member of the Association, has been with Airwork Ltd since July, 1946. In 1926 he joined Burndept Ltd, as a radio apprentice. During the war he served with H Q 60 group, Radar Command, and for a short period was seconded to B O A C.

It is proposed at this evening's meeting to try and discuss in as non-technical language as possible, the very many problems which assail us when we attempt to incorporate radio facilities in helicopter aircraft, in the form that we know at present. Everyone here this evening, realises fully the tremendous relationship between the aircraft and radio industries today, without which the operation of aircraft in the present phase would be virtually impossible. It is appreciated, however, by the speaker, that radio itself is such a specialised matter that many of the visitors will have little or no knowledge of the actual services provided, and therefore, I propose to spend the first five minutes in a brief explanation of the various radio facilities available to the aircraft industry today. After this we will discuss the systems which most closely effect the helicopter and its operation.

V H F —THE CURTAILED SYMBOLS OF VERY HIGH FREQUENCY COMMUNICATION

The V H F system is unquestionably the most useful and versatile system employed in aviation today. The frequencies employed are between 100 and 156 megacycles per second, *i e*, 150 million cycles per second, which produces wavelengths to allow the employment of small aerials, usually of whip pattern which have tremendous advantages over the conventional long wire systems.

Likewise, the inductances and similar components fitted inside the equipment are of small dimensions thus allowing a complete transmitter-receiver equipment to be fitted in to a unit such as the Murphy or STR9X equipment displayed here.

Naturally, there are some disadvantages, the major one being the range of coverage is limited. This range normally is up to eighty to a hundred miles. On main line aircraft it is therefore reserved for local control and area flying facilities. This limited range can be of great assistance however, due to the fact that interference and ambiguity do not occur over long distances. Each area can be allocated its own channels without fear of overlap.

Operation is simplicity itself and examples of modern control units are displayed here tonight.

A D F —AUTOMATIC DIRECTION FINDING

This system is often referred to as *Radio Compass*, to my mind this is very misleading to the layman on radio.

As its title implies an A D F system will provide indication of the relative bearing of any continuous radio transmission to which the receiver is tuned. No transmitter is employed in the aircraft, but, the receiver is of special design and two aerials are required, one a loop and the other a fixed or SENSE aerial.

Several successful installations have now been completed in helicopters, whilst in large passenger aircraft it is probably the most important navigational aid and it is common practice to fit two A D F receivers and employ them in various manners. Display meters can be of single or dual pattern and again we have several examples on display.

As stated previously an A D F will give bearing indication on any normal transmitter usually in the frequency band 150 K/cs to 2,000 K/cs. The OMNI-Directional beacons fitted at airports are normally used, but broadcasting stations can be usefully employed. It must be clearly realised that the bearing shown on the dial is relative to the heading of the aircraft and is *not* a magnetic bearing. To provide more information additional equipment can be employed such as Radio Magnetic Indicators, but these and similar items are outside the scope of this discussion.

Without doubt the systems most applicable to the helicopter are V H F,

A D F , and Decca All these greatly assist helicopter operation from the angles of

Economy , Safety , Regularity when on scheduled services ,
Manoeuvrability , Accessibility on special operations

However, having decided on the specific services desired for the particular machine, our real problems now commence when we attempt to install the necessary apparatus on the aircraft, and this reason is the primary purpose of our discussion tonight , raised in the hopes that a far greater degree of co-operation in future design of installations may be realised

Since the war there has been some pre-discussion between the two industries on new aircraft projects and we would cite two examples

The Marconi AD97-108 installation on Dove and subsequently Heron aircraft

The S B A C Racking system

Although this latter has led to a great improvement from the installation angle it still leaves much to be desired, and modification will undoubtedly take place as time goes on

Unfortunately, the helicopter presents even greater problems than normal aircraft The main reasons are these

The present size and shape, not to mention the available space in the helicopter

The difficulty in siting of aeriels on the aircraft due to its general outline and dimensions

The effect produced by two or more rotors and the position of the power plant

The provision of accurate control and indication to the pilot

The serious problem of vibration

I would like to conclude by quoting examples where considerable amounts of time and money have been spent in installing even the simplest radio equipment into a lightweight helicopter The first was when Air Service Training and Fison Airwork both purchased Hiller series 12 machines, and, desired to fit basic V F H communications The kind of difficulties experienced were unbelievable , we would mention such points as interference created by the actual structure of the airframe Murphy Radio gave us considerable assistance on this task A second instance was when Helicopter Services Limited desired to fit a medium power V H F equipment, namely, Standard Telephones and Cables STR9X into their Bell 47D machines There was absolutely no space available for the apparatus and Airwork had to design a container that was fitted externally behind the cabin to accommodate the transmitter-receiver Here the problem of weather-proofing and vibration involved considerable time and expenditure

The final example is the very great amount of experimental work that has been done by Marconi and Westland Aircraft, together with Airwork, in trying to find a really satisfactory method of installing A D F (Radio Compass) in the series S55 and subsequent machines