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THE RADIO ALERT SYSTEM

A modern method of alerting retained firemen

By: B J O'Rourke

1. Introduction

For a number of years there has been an ever increasing call for a modern method of alerting retained firemen. The present system which relies on the peace-disturbing siren, ineffective in certain environmental noise and wind conditions, and the inflexible call-bell, had to be replaced if public ill-feeling towards the former was to be overcome.

Following the sucess of the UHF personal pocket-phone, widely used by the Police, the obvious choice for an alerting system lay in the use of radio. Such a system, properly engineered, would give positive cover over an area within a radius of 3 miles, and provide the retained fireman with a robust yet small and very flexible radio receiver. His movements would be completely unrestricted within the service area.

2. The System

The equipment now in use was developed to a Home Office technical specification which, in turn, was prepared to meet the requirements of the Fire Brigade Service as defined by the Communications Committee of the Central Fire Brigade Advisory Council - CFBAC.

The main points so defined were:-

a. Reliable operation over an area with a radius of 3 miles.

b. Minimal false calls.

c. 24 hour operation, unaffected by mains failure.

d. Operation of base transmitter to be over normal brigade Remote Control Systems, with remote indication of correct function of unit.

e. Provision of test facilities.

f. Personal receiver to be compact and fit into the pocket of a civilian suit.

g. Base transmitter to be capable of alerting one or two crews independently or simultaneously.

There was no requirement and therefore no provision for speech on the system.

3. Equipment

a. To meet the specification an all solid state base transmitter was developed, fig 1, along with a solid state compact personal receiver, fig 2.

b. Working in the 142 to 174 Mhz band the transmitter obtains its power supply from a "float charged" 24 volt battery - 2c - and has an r.f. power output of 25 watts - 2a.

c. Earlier models of the transmitter were produced for single crew working whereas all current models are the dual crew type - 2g. Removable reeds enable the later models to be converted to single crew working where required.

d. Because radio channels are very much at a premium the whole system operates throughout the country on a single 25 Khz channel. Discrimination between installations at individual stations and between two crews based on the same station is achieved by separate audio tone modulation. There are 33 Audio Frequency tone channels, including one test channel, in use within the band 650 Hz to 1600 Hz. To avoid interference the allocation of channels is on a geographical basis with a minimum of twenty miles between stations sharing the same channel - 2b. It is worth noting that to keep "spare holdings" to a minimum every endeavour is made to limit the number of channels allocated to a brigade. However, with the ever increasing demand for the "Radio Alert System" - the programme for 1971 to 1972 contains more than 280 new schemes - it is necessary, in certain areas, to introduce numerous channels.

e. A vertical co-linear aerial is supplied with the transmitter and generally this should be mounted at a low position to avoid interference - 2b. Area coverage tests carried out by the installation technician will indicate the optimum height required for the area in question.

f. Testing of the system is carried out by transmission of the audio channel tone which activates the personal receivers of the single or dual crews; the test tone is continuous for a single crew, and 200 milli-second bursts of test tone Crew A or test tone Crew B for a dual crew - 2e. Facilities are provided for local operation or control over landline systems - 2d. Monitor lamps indicate which crew, either 'A' or 'B' or both, is being called. A "crew test" and "transmitter fault" indication is given by the same method. Tone monitoring is available in the form of a plug-in earpiece, this latter facility is purely for audible monitoring of the transmitted tones. Relay contacts are also available to enable an "operated" signal to be sent back to Control over line operated mobilising systems. On the Post Office VFA system this signal is in the form of a five second tone on the speech channel.

g. The transmitter consumption from the 24 volt battery is 0.100 Amperes quiescent, and 4 Amperes during transmission. In the event of a mains electricity failure the d.c. supply should give three days operation without recharge.

h. The radiating element of the omnidirectional aerial is housed in a reinforced glassfibre tube and is capable of withstanding wind speeds up to 80 mph and a radial ice loading of 0.5 in (13 mm). The aerial has an impedance of 50 ohms, a r.f. power handling capability of 50 watts and a horizontal gain of 3 db relative to a halfwave dipole. The construction is such that it is easy to mount and should have a life of up to ten years.

Function

a. In the single crew system two tones are used, one is the 'test' call and the other the 'fire' call. The test tone is continuous whilst the fire call consists of alternate 200 milli-second bursts of test and fire tones.

b. In the dual crew system three tones are used (A, B, F). The tones are transmitted sequentially and can alert crew A or B or both simultaneously; viz A-F crew 'A'; B-F crew 'B'; A-B-F both crews or, A-B test crew A and B. Again the tone is in bursts of 200 milli-seconds; the pulsing is produced by an electronic clock counter and clamping circuit which forms part of the tramsitter.

5. The Personal Alerter

a. The alert receiver is compact and light-weight (8 oz) and can easily be carried in the pocket of a civilian suit - 2f. It is contained in a robust propathene case with a built in aerial and operates from an internal, easy to fit, 9-volt nickel-cadmium battery.

b. A battery charger is supplied with each receiver (Fig 3). A lamp indicates that the battery is on charge when the alerter is placed in the charging aperture and power switched on. The charger is of the constant charge type, therefore the receiver should not be left in the unit beyond the specified period of time, otherwise the battery will be damaged. Also supplied with the receiver is an easy to fit acoustic hood for use by heavy sleepers or in noisy surroundings.

c. The alert receiver is a precision instrument and it is essential that it is treated as such. Some idea of its complexity can be gained from fig 4. Under no circumstances should this unit be opened up, other than for battery changing, by unskilled personnel.

d. Provision is made for switching off the audible tone(s) - defeating the signal - once the tone content has been identified, eg test or fire call.

6. Function

a. The Personal alert receiver has no 'on - off' switch. Insertion of the battery connects the supply to the set and reversal of polarity is impossible. Statistics have shown that the frequency of fire calls to any one "Retained" station is not very great, therefore it is unnecessary for the receiver to be continually in the "Alert" condition. A battery ecomomiser circuit switches the receiver 'on' for 0.5 second and 'off' for 2.5 seconds. A received signal will 'lock on' the economiser and the receiver will remain on for a further 20 seconds on cessation of the call unless the defeat button is pressed. Once "defeated" the receiver will remain inoperative to further calls for twenty seconds.

b. The tones emitted by the receiver are internally generated on receipt of the correct coded signal from the base station. Therefore the strength of the audio tones will be constant and not governed by received signal strength or affected by fluctuating signals. As stated, the base transmitter test tone is continuous and the fire call 200 milli-second bursts of test and fire tone.

c. Because of the ON - OFF cycle of the economiser circuit the 9-volt battery will give reliable operation for up to 30 hours. It is recommended that a "top-up" charge is given for an 8- hour period in every 24 hours ; equally essential, the battery must not be over charged.

d. The recharge cycle should take place while the user is sleeping, the receiver remaining operational during the recharge period. Fitting the acoustic hood and directing the aperture towards the sleeping user will ensure the audible tones are heard.

A point worthy of note:- Siting the battery charger and alerter during this period can be critical. A dressing table top with a mirror on three sides could completely screen the alerter aerial from the transmitted signal, the mirror behaving as a metal screen.

7. Updating facilities

a. A 24-way charger is available which will facilitate centralised checking and charging of alerter batteries. Metering facilities are provided to give an indication of battery condition before and after charge.

b. Protection against base transmitter failure should be considered. Although this unit is reliable, like all equipment it is liable to occasional failure. An automatic changeover unit is being developed for the Directorate. The unit is mounted on a 3½inch panel and is housed in a cabinet with additional space for two base transmitters and the interconnecting cables; failure of one transmitter will cause the automatic changeover to select the serviceable unit. An aerial changeover relay can be incorporated or two aerials installed and permanently connected to the base transmitters. This equipment should be available in the autumn of 1971.

8. The Programme

a. In the first year of its introduction approximately 130 "Fire Alert" Schemes were requested by various Brigades. The following year this number was increased to over 250 and the quantity of alerters in use was then about 3500.

b. The current years programme calls for more than 280 schemes utilising more than 350 base transmitters and over 4000 alert receivers. Added to this latter figure are additional alerters asked for by brigades. The total number of schemes in service by the end of this current programme will be over 500 using almost 8000 alerters.

9. Equipment Processing

a. After the alerter receivers have passed their initial "running in" period the fault rate is expected to fall to an acceptable level of one per set per year. Consequently, we anticipate a turn-round of 8000 alerters per year increasing to more than 25000 in a few years. Estimates show that on the completion of the 1973-74 installation programme more than 1000 schemes will be operational with over 15000 alert receivers in use.

Coupled with the testing of new equipment maintenance presents a formidable task.

b. To speed up the testing of faulty receivers an automatic test assembly is being considered. When installed and programmed it should be capable of fully testing a faulty alerter every 2½ minutes and ultimately it is expected that 200 sets per day will be checked in this manner. However, checking and locating the fault is only part of the task; fault rectification is time consuming.

10. Conclusion

With a system of the nature described, and such large quantities of equipment involved, some initial teething problems were inevitable. Most of these have been resolved and great importance is attached to ensuring the necessary standard of reliability.

The Directorate is constantly surveying all technical advances which may be applied to improve our radio systems and the service given to brigades.

Mr B J O'Rourke received his basic radio training in the Services, broadened by a period in the Merchant Navy and followed by service with the then Ministry of Transport and Civil Aviation. He joined the Home Office as a technician in 1957 and served in this capacity at various depots. In 1966 he moved to our Central Communications Establishment at Harrow where he was first engaged on Field Installation work followed by a period in charge of the laboratory and workshop, finally becoming responsible for the final testing of Systems. He is currently employed at Headquarters on Fire Brigade planning.

Figure 1

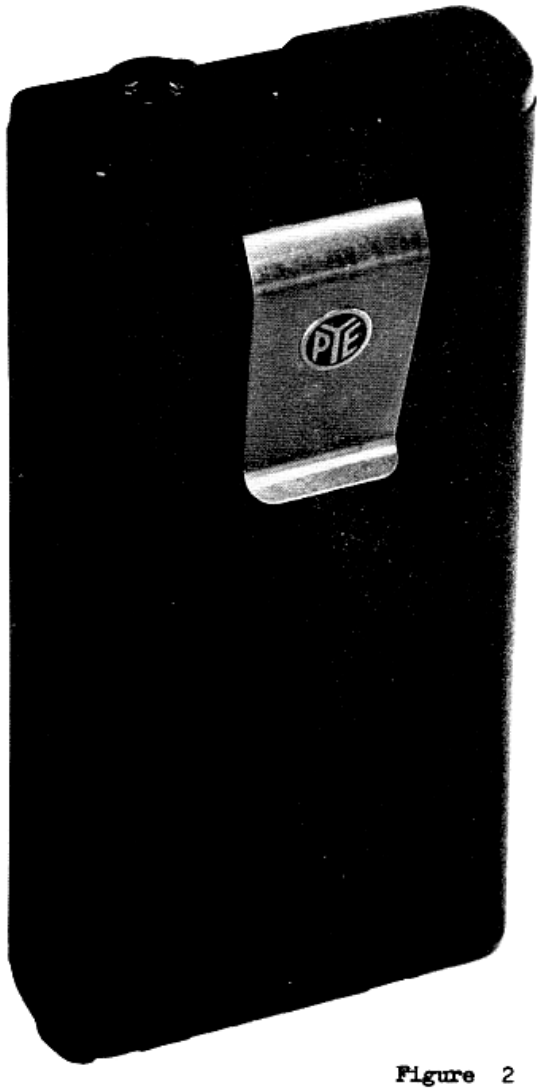

Figure 2

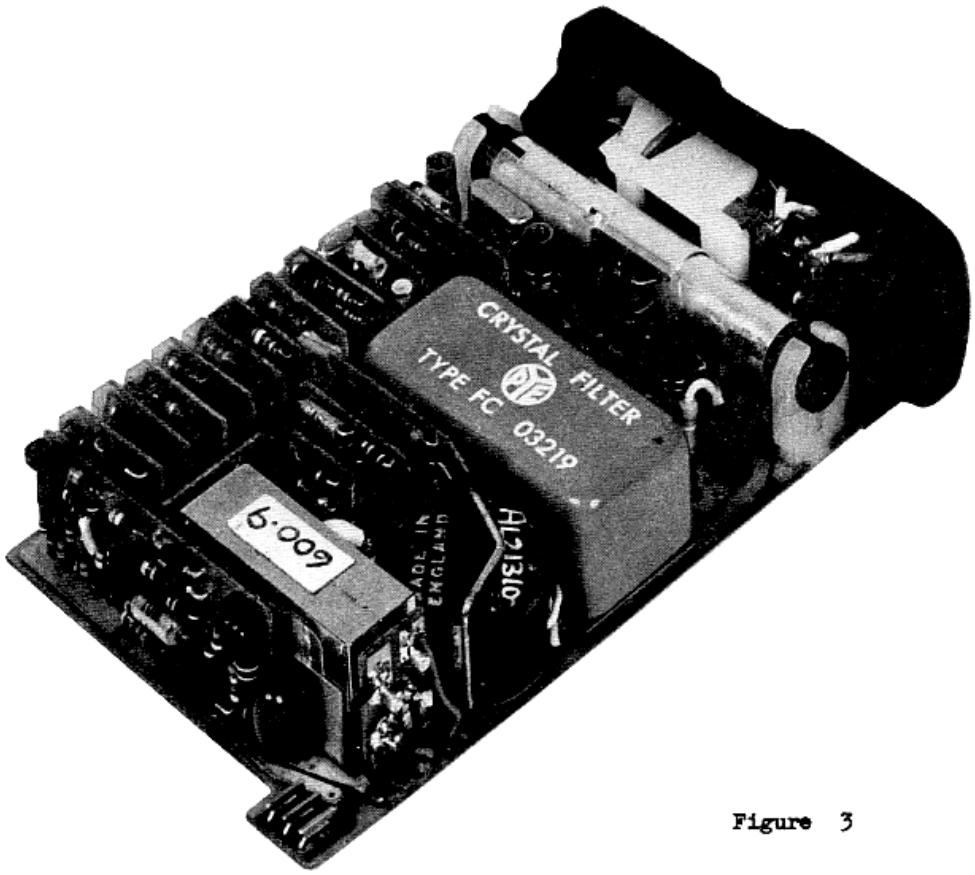

Figure 3

Figure 4

RADIO ALERT SYSTEMS

INSTALLED BY END OF 1971-72 PROGRAMME

PROJECTED INSTALLATIONS

Anglesey

Barnsley Boro

Bedfordshire

Berkshire

Buckinghamshire

Bolton Boro

Burton Boro

Cambridgeshire & Isle of Ely

Carlisle Boro

Carmarthenshire and Cardiganshire

Cheshire

Chester City

Cumberland

Denbighshire and Montgomeryshire

Derbyshire

Devon and Torbay

Dorset

Dudley Boro

Eastbourne Boro

Essex

Flintshire

Glamorgan

Gloucestershire

Gloucester City

Hampshire

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Lincoln City

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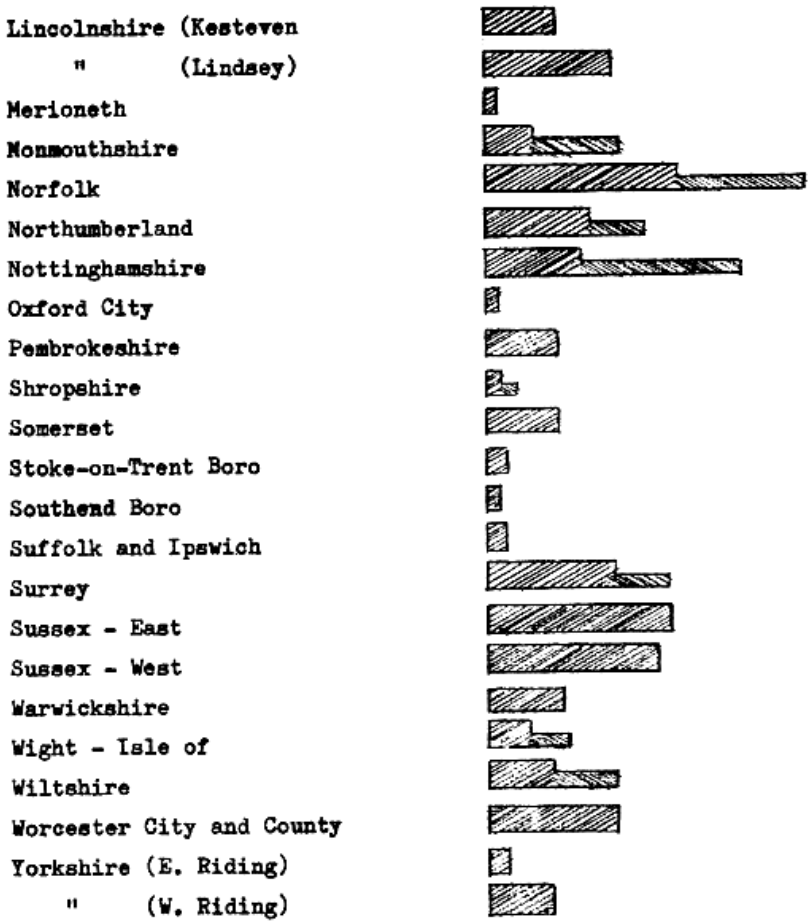

1 INCH = 20 SCHEMES