SUPPLEMENT COMMEMORATING 50 years of PW

It all began with F.J. CAMM

-1930--1940--1950--1960--1970--1980--1990--2000--2010--2020-

Though some old-timers (and some not so old) refer to *PW* rather disparagingly as "Camm's Comic", there is no doubt in my mind that we owe F. J. Camm a large debt of gratitude for starting off the publication in 1932, at a time when there were a number of weekly and monthly competitors already well established, and shaping its progress over almost 30 years. His success may be judged from the fact that all but one of those competitors subsequently disappeared from the market, though one, *Amateur Wireless,* was actually absorbed into *PW*, bringing with it such popular features as *On Your Wavelength,* by Thermion.

When it started, *PW* was devoted exclusively to "wireless". Within less than a year, television was also being dealt with, and from this added interest came the first of our "sister" magazines in the radio and electronics field, *Practical Television,* published first as a supplement, then as a separate magazine, then merging again, before finally making the break in 1950, and later being renamed simply *Television.*

As the years passed, audio amplifiers and various gadgets using thermionic valves began to feature more and more in our pages, and electronics was born. Eventually, in 1964, the second of our "sister" magazines, *Practical Electronics,* appeared for the first time. Strangely, matters electronic did not then disappear from *PW* as one might have expected. Instead, the two magazines tended to compete for the latest electronic organ, TV game, or whatever, and it was not until the middle of 1981 that *PW* moved firmly back to its original (and appropriate) area of wireless or radio, call it what you will.

So in 50 years we've come full circle, in a way. Our supplement looks back over those 50 years of *Practical Wireless,* from which we've selected some advertisements and editorial pages which we think give the flavour of the times.

And what of the next 50? Well, at my invitation, a number of our contributors past and present, and some other well-known names in radio, have polished up their crystal balls and told us what they foresee. Their views, some lighthearted, some serious, some definitely controversial, round off this supplement. Also, I've exercised the Editor's prerogative of adding a few thoughts of my own, safe in the knowledge that my time as *PW*'s fifth Editor will have ended long before the year 2032!

GEOFF ARNOLD

February 11th, 1933 PRACTICAL WIRELESS 993

FULL-SIZE BLUEPRINT GIVEN IN THIS ISSUE!

CONSTRUCTING—

The Fury Four

The Amazing Receiver which has Aroused Such Remarkable Interest Among Home Constructors. By F. J. CAMM

BEFORE dealing with the construction of the "Fury Four," my latest receiver, preliminary notes concerning which have been given in the last three numbers of this journal, I think those hundreds of readers who, after requesting the circuit and reading my remarks, have taken the trouble to write such enthusiastic letters of thanks, and many queries regarding the set itself, and my policy of designing for the reader about, but no explanation.

should be trouble-free, stable, economical in current.

How the Fury Four Originated

Four months of careful experiment and survey is built into the "Fury Four," and I gladly give my guarantee in the terms already expressed. The veriest beginner with

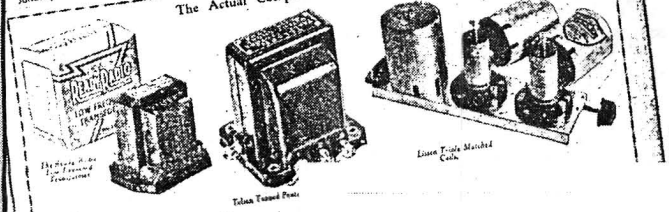
tion to purely trade interests.

Six pages of this issue are devoted to the construction; but the reader must not judge

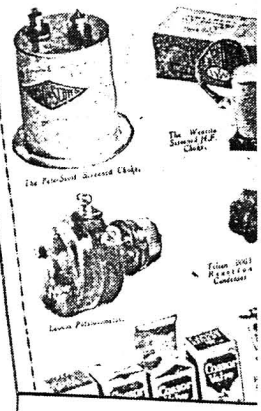
from this that the set is not worthy of greater space. I have before remarked that Practical Wireless exists to serve readers, and excellent as the "Fury Four" is, I appreciate that every reader of this paper may not wish to make it. Even though I would urge him to do so—as hundreds of our readers are apparently already doing—I therefore have not sacrificed the interests of the reader at the altar of the "Fury Four." Extra pages have been included in this issue to include the necessary constructional details. The Blueprint is issued separately, and the normal reading pages have been augmented—not reduced.

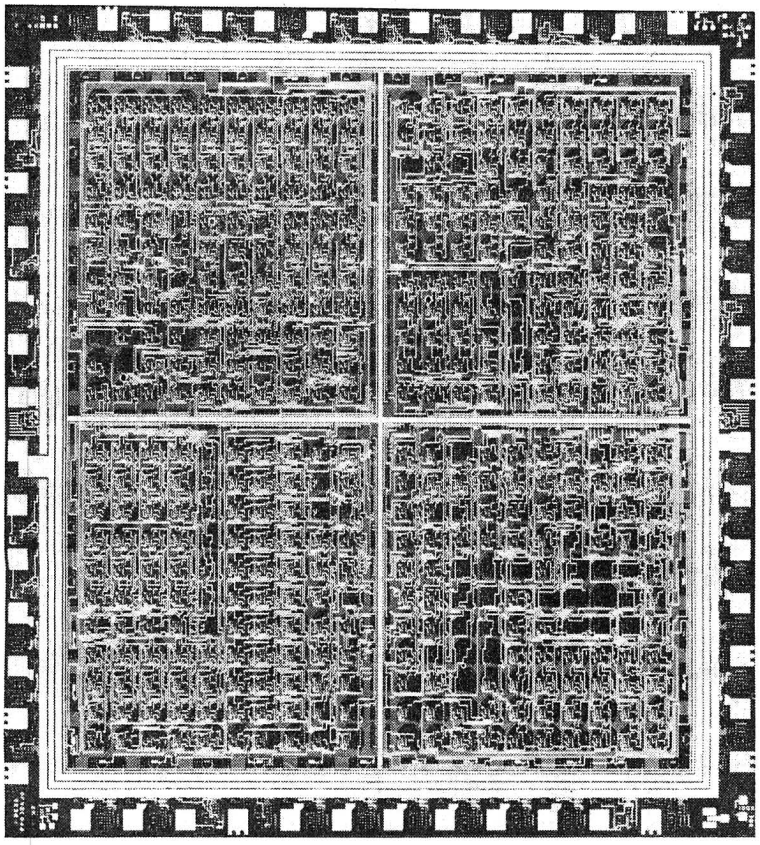
January 28th, 1933 PRACTICAL WIRELESS 897

The Actual Components Required for the "Fury Four."



586 PRACTICAL WIRELESS December 2nd 1933





Ferranti. Then as now a pioneer in electronic technology.

You may smile today at the advertisement shown opposite. But one phrase rings as true as it did 50 years ago. 'Nothing more need be said for the quality of the workmanship.'

The name Ferranti still says it all, not only in quality but in innovation. Ferranti was in at the birth of the radio valve. And at the birth of the silicon chip, of LSI and ULA.

Through pioneering the ULA concept Ferranti has become the established leader in LSI arrays, with a product range totalling over 30 basic types. Now Ferranti has introduced a new bipolar VLSI process, FAB-2, which has made possible ULA's with complexities up to 10,000 gates and beyond, with CMOS power levels and ECL switching speeds.

Whatever the next 50 years brings, you may be sure that one name—Ferranti—will be somewhere upfront.

Ferranti Electronics Limited,
Fields New Road, Chadderton,
Oldham OL9 8NP England.
Telephone:
061-624 0515 and 061-624 6661

1980

FERRANTI
Semiconductors

FLO1/07/072

THE 30's

The 30's were a very interesting period in the development of *PW*. The selection of pages from the magazines of this era shows the wide range of topics covered, including TV and amateur transmitting—although the latter subject received no coverage until early '38, well after the merger with *Amateur Wireless*. The Second World War brought many changes . . .

Advertisement

TANNOY®

SORRY, WE NO LONGER DO COILS . . .

. . . but we can provide a wide choice of the finest loudspeakers for both domestic HiFi and professional use.

Tannoy loudspeakers combine the latest technology with traditional standards of construction and finish, to give you the finest possible sound.

TANNOY®

TANNOY LTD.
CANTERBURY GROVE, WEST NORWOOD,
LONDON SE27 0PW
Telephone: 01-670 1131 Telex: 291065

the pot ntial
to the valve.

... causes a vol-
and this for-
presented by
tion I = E/R, I
being voltage
ance in ohms
ves you will
node current
G.B. value,
apply the
t is essential
through all
circuit, and
it required at

515 VOLTS

...wing how the
...opped through
... resistances.

Example

...n of an L.F.
...d make the
...ws a Mullard
...rmer and a
anode lead.
...e maximum
...figure (when
...e current is
...e transformer
...nce of 1,000
... resistance a
...re is therefore
...um voltage) of
...d resistance of
above formula,
...5 volts. There-
... be applied at
...5, or 515 volts

in Fig. 2, and
...n mind when
decouplers or
grid bias must
on the actual
...ve tapping.

75.)

...mportant items
...battery valve is
number of hours
taken that 1,000
of service, after
to deteriorate,
at first until
...tible to the
...g worse. The
therefore, be
...o years. It
but only with
...d an increase
illustrates this

THE 30s

TANNOY COILS

- Exclusively Specified in the "LONG-RANGE EXPRESS 3"

15/6 per Pair
Complete with Screening Cases

- These coils have been specially designed, and it is essential that TANNOY Coils are used to obtain best results from the above set. Obtainable from:—
- TANNOY PRODUCTS, Specialists in High Grade Radio Equipment, DALTON STREET, WEST NORWOOD, LONDON, S.E.27.

THE 40s

December, 1941 PRACTICAL WIRELESS 41

BRITISH LONG DISTANCE LISTENERS' CLUB

Your Test Gear

ON looking through the numerous letters we receive from members, one item stands out with such prominence that we feel it is worthy of mention. The majority of members report the results they have obtained with their particular installation, and give details of their equipment and shacks.

For Your Consideration

THE theoretical diagram on this page shows the circuit of the S.W. three-valver built up by Member ...

May 11th, 1940 PRACTICAL WIRELESS 171

A Gas-mask Box Receiver

Constructional Details of a Handy Two-valve Midget Portable

THIS midget receiver is built into one of the ordinary cardboard gas-mask boxes, which also contains both the L.T. and H.T. sources of supply.

Constructional Details

October, 1944 PRACTICAL WIRELESS 457

The Telechrome

CATHODE RAY COLOUR AND STEREOSCOPIC TELEVISION

Stereoscopic and Colour Television Pictures Shown Directly on the Cathode Ray Tube for the First Time

NAZI WARPLANE RADIO

Impressions of a Member of the Staff of "Practical Wireless" who Recently Examined the Equipment of Several German 'Planes Which Have Been Brought Down in This Country

AERIAL MAST, L.W. RECEIVER, S.W. RECEIVER, D.F. SENSE AND B.A. MATCHING UNIT, FIXED AERIAL MATCHING UNIT, TRAILING AERIAL WINCH, TRAILING AERIAL MATCHING UNIT, REAR GUNNER INTERCOM., FAIRLEAD, B.A. RECEIVER, D.F. RECEIVER, MARKER BEACON MATCHING UNIT, FIXED AERIAL, INTERCOM. SWITCH BOX, D.F. LOOP, INTERCOM. AMPLIFIER, PILOT INTERCOM., COURSE METER, B.A. REMOTE CONTROL, NAVIGATOR D.F. LOOP CONTROL, L.W. TRANSMITTER, S.W. TRANSMITTER, D.F. RECEIVER CONTROL (Navigator), AERIAL CONTROLLER, INTERCOM. (Navigator), RECEIVER POWER UNIT

This illustration shows the instruments used ...

TECHNICALLY sound, but not ...

June, 1946 PRACTICAL WIRELESS 283

Modern Transmitter Design

Hints for the Amateur Constructor Who Wishes to Build a Transmitter

By W. J. DELANEY (G2FMY)

MANY amateurs who have now left the Services are anticipating the grant of an amateur transmitting licence as their service activities may qualify them to hold a licence under the present G.P.O. regulations.

Aircraft Direction Finding

A Simple Explanation of the Underlying Principles

Determining the Position

Using War Surplus Gear

Details of Circuits and Sets Which Can be Built by the Experimenter

By E. N. BRADLEY

Useful Valves

Fig. 1.—A T.R.F. receiver using 1T4 valves.

September, 1941 PRACTICAL WIRELESS 359

War-time "Hook-ups"

Circuits of Simple Sets Made by Readers During the War

IN response to Thermion's invitation in our June issue to readers to send in ideas for hook-up and simple receivers for use in the present difficult times, we have received many circuits and descriptions of such sets, and we publish a selection of the best ones.

Several readers submitted circuits of one and two-valve sets, and in our opinion the best effort was sent in by A. W. Jump, of Dunfermline, Scotland, who writes as follows:

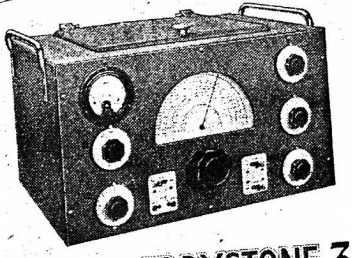
"I was called upon to construct a set at short notice and within a limited time—in a town in which I was a complete stranger. I managed to rig up a serviceable affair (I refrain from calling it a radio set) notwithstanding many setbacks. I had no components handy, and a tour of the town's radio shops unearthed only 1lb. of D.C.C. wire ..."

Simple One-Valver

A useful and cheap little one-valve circuit was submitted by M. Lockwood (Wakefield). Here is his description:

Circuit diagram of A. W. Jump's two-valver.

Details of an improvised valve-holder.



Presenting- the EDDYSTONE 358 COMMUNICATION RECEIVER

ATTENTION is drawn to a new "EDDYSTONE" Production—the 358 Communication Receiver—a first-class engineering job embodying all essential features of a dependable Communication Receiver.

Based on proved design the 358 gives a high performance and its reliability is calculated to meet the exacting requirements of Service operation. It is eminently suitable for every general communication purpose and is the product of engineers with wide practical experience of communication work. The 358 is the progressive development of previous well-known "EDDYSTONE" Receivers and it is designed to do a particular job of work—and to do it consistently well. When absolute reliability and outstanding performance are demanded the "EDDYSTONE" 358 will be found most fitting to the need—a fact given emphatic point by the orders already placed by Government Departments.

SPECIFICATION

Tuning range of 31,000 Kcs. to 1,350 Kcs. by the use of interchangeable range units (additional coil units will shortly be available to extend the range to 100 Kcs.).

Power supplies—A.C. mains (200-250 volts) for which a power unit giving 6 volts 1.4 amperes and 175/180 volts 65mA is provided. Later it is hoped to offer the 358 to work from a 6-volt accumulator input.

Chassis of one construction permitting ease of service. Housed in welded steel cabinet, ripple grey finish.

Dimensions: 20½ ins. by 12ins. by 13½ ins. deep. Weight: 50½ lbs.

Selectivity: I.F. total bandwidth: Two kilocycles at 45db down. Two kilocycles at 2.5db down.

Sensitivity: Better than 3 microvolts = 20 : 1, modulation for 50 milliwatts output on all ranges.

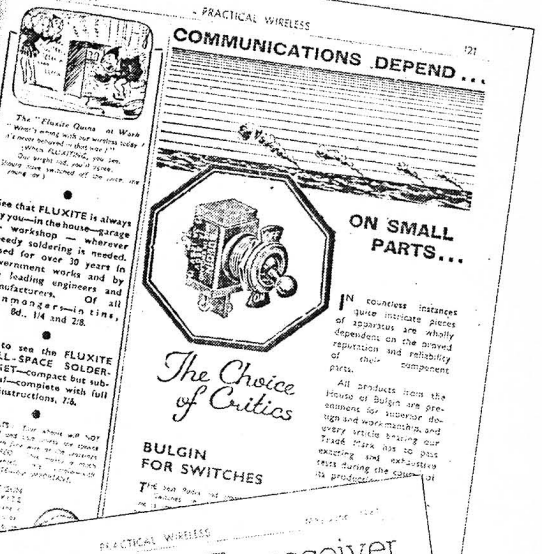
Audio Output: 1.5 watts.

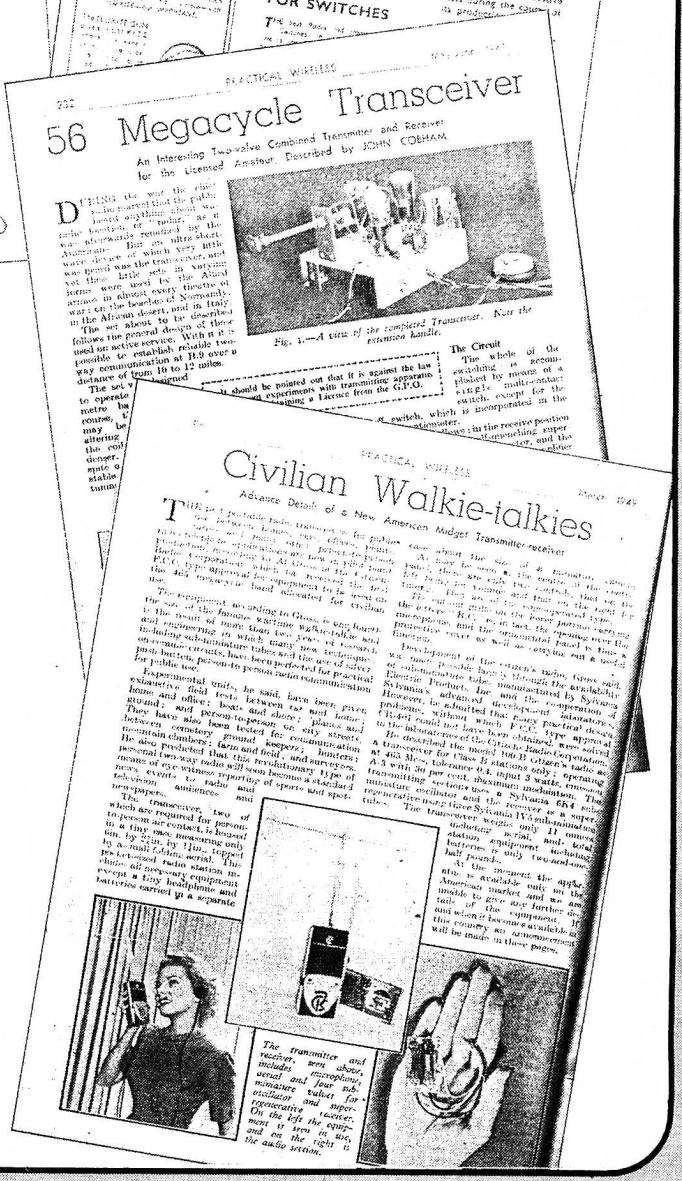
Image Ratio:

At 32 megacycles	200
" 15 "	1000
" 6 "	2000 (Range B").
	4000

Frequency Ranges of Coil Units are:

Range A.	32,000 — 31,000 Kcs.
" B.	15,000 — 12,500 "
" C.	6,500 — 2,900 "
" D.	3,100 — 1,400 "
" E.	1,550 — 1,350 "





. . . most notable of these changes was the reduction in both frequency of publication—from weekly to monthly—and page size accompanied by price increases. *PW* has remained a monthly ever since but the page size has been restored, albeit 40 years later! Significant developments were published including reports on Baird's various experiments in stereoscopic and colour TV. The descriptions of enemy radio equipment provide interesting reading. CB appeared at the end of the decade . . .

THE 50s

September, 1955 — PRACTICAL WIRELESS — 543

Making a 2-METRE Walkie-Talkie

A PORTABLE TRANSMITTER-RECEIVER FOR THE LICENSED EXPERIMENTER

By R. Moores

FOR some time past the writer has been very interested in portable transmitting—particularly the small Q.R.P. equipment—and has on many occasions used all types of equipment, including most of the British and U.S. ex-Army sets, modified, of course, to bring them to amateur requirements. But ...

... is 3in. long, one end shorted out with a lead taken from it to the modulated H.T. supply, the other two ends going to the anodes of the triodes and tuning condenser. The lines are slipped into a length of ... inside diameter copper tubing, 2½in. long, after which the inside of the tube is filled with polythene cement which can be made by dissolving odd bits of polythene in some carbon tetrachloride. The copper tube is then earthed to the chassis.

This type of oscillator has a very high order of stability and being enclosed in the tubing it is absolutely free from capacity effects. The output is taken from one anode, through a 1.5/7.5 pF ceramic trimmer to a ¼-wave aerial which is connected to earth via a R.F. choke so as further to prevent unwanted capacity effects. The results are very good, ...

A 3-STAGE TRANSISTOR RECEIVER

By Capt. R. F. Graham

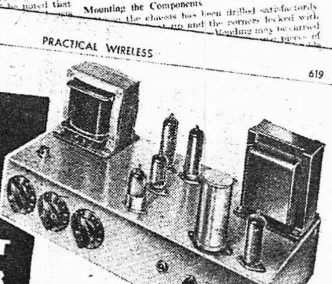
THIS is the simplest practical ... receiver ... coupled to a transistor, which is also directly coupled to another transistor ... the simplest possible manner, dispenses with ... components, matching problems and all ... inefficiencies. Without transformers ... improved. Volume is greater, due to good matching, and can be easily doubled by using two matched transistors in parallel for output. Sensitivity is also greatly improved by wider separation between coils, and if a third tuned coil is used it is almost as good as any small mains superhet with one I.F. valve sold on the market.

The Practical Wireless Television Receiver–3

Chassis Details and Preliminary Constructional Work

Mounting the Components

October, 1955 — PRACTICAL WIRELESS — 619



July, 1953 — PRACTICAL WIRELESS — 409

More about TRANSISTORS

SOME FURTHER DETAILS OF THIS NEW "COLD CATHODE" VALVE

By F. E. Henderson

MANY readers of this journal are by now familiar with the modern crystal rectifier, which is finding its way into present-day radio equipment and many television receivers. The small size, robust construction and practically indefinite life of these little rectifiers have made them of very considerable interest to manufacturers of radio and television sets. Their satisfactory performance is leading to their more widespread use as replacements for the thermionic diode in many positions in the receiver.

Although the germanium crystal valve appears at first sight a very simple device, the successful manufacture of a consistent product has proved by no means simple. However, methods have been discovered to make not only crystal valves that rectify but also ones for use as amplifiers and oscillators.

We now see reports about complete amplifiers, radio receivers and even television sets functioning without the use of a single thermionic valve, and the question no doubt arises in many people's minds—is the new germanium triode, or "transistor" as it is called, really supplanting the thermionic valve? To get our thoughts clear ...

... "reverse" voltage of the order of hundreds of volts before "breakdown" occurs at the contact. Alternatively, with high impurity contents, diodes can be made which will only withstand reverse voltage of the order of a few volts, but which give high current for low "forward" voltages. Such diodes give very high rectification efficiency at small signal levels.

Before we can proceed and consider the next step, there is an important little bit of chemistry which must be understood.

If it were possible sufficiently to magnify a photograph of a piece of germanium (or any other element for that matter) we should see that its mass was composed of atoms of the element, each atom with its electron satellites, the whole forming a crystal lattice structure. If the germanium were a perfect crystal, there would be a regular crystal pattern; if the germanium were contaminated ...

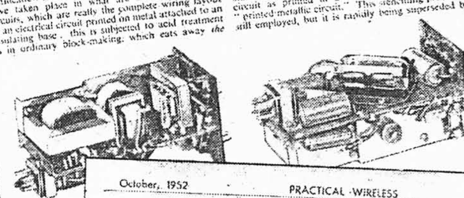
January, 1953 — PRACTICAL WIRELESS — 21

Printed Metallic Circuits

DETAILS OF AN IMPORTANT DEVELOPMENT IN THE ELECTRICAL AND ELECTRONIC INDUSTRIES

By F. J. Camm

THE wiring of electrical circuits by the usual methods leaves a great deal to be desired. Usually this is performed by unskilled labour, and the risk of wrong connections, badly made and high-resistance joints is ever present. The checking after assembly of complicated circuits and subsequent rectification is costly. In recent years developments have taken place in what are known as printed circuits, which are really the complete wiring layout of an electrical circuit printed on metal attached to an insulating base; this is subjected to acid treatment as in ordinary block-making, which eats away the ... by stencilling patterns composed of powdered silver on to thin wafers of a ceramic material, and then fusing the wafers at high temperature to secure adhesion of the metal to the base and also to fuse the powder into an electrically conductive pattern. It was the use of the stencilling process which gave rise to the term "printed circuit," which is really a misnomer and has given rise to some misunderstanding, since it could be confused with an electrical circuit as printed in a book. I prefer the term "printed metallic circuit." This stencilling process is still employed, but it is rapidly being superseded by ...



October, 1952 — PRACTICAL WIRELESS — 441

PRACTICAL WIRELESS — December, 1959

THE 50s


June, 1955 PRACTICAL WIRELESS 351

Making a Radio Telescope

A SIMPLE HOME-MADE BUT EFFICIENT INSTRUMENT FOR THE EXPERIMENTER

PART 2—AERIAL SYSTEMS

By W. Schroeder

A completely steerable 30ft. parabolic reflector used as a radio telescope at the Jodrell Bank experimental station.


May, 1950 PRACTICAL WIRELESS 217

Calling Our Cars

Details of Our Publisher's Radio Link with his Travellers


December, 1957 PRACTICAL WIRELESS 723

PREMIER RADIO COMPANY

B. H. MORRIS & CO. (RADIO) LTD.

(Dept. P.W.12) 207, EDGWARE ROAD, LONDON, W.2

The "Petite" PORTABLE £7·7·0

The NEW De-Luxe TAPE RECORDER TR3 for £5·18·0

COMPACT GRAM AMPLIFIER £2·19·6

8 WATT AMPLIFER £8·8·0

STIRLING V.H.F./F.M. TUNER UNIT

4-WATT AMPLIFIER £4.10.0

THE TELETRON "COMPANION" 2 TRANSISTOR POCKET RECEIVER 89/6

2-BAND T.R.F. RECEIVER £5.15.0

Why not make the best! MULLARD AMPLIFIER KIT

New F.M. TUNER for the Home Constructor


September, 1952 PRACTICAL WIRELESS 411

THE PW Electronic Organ

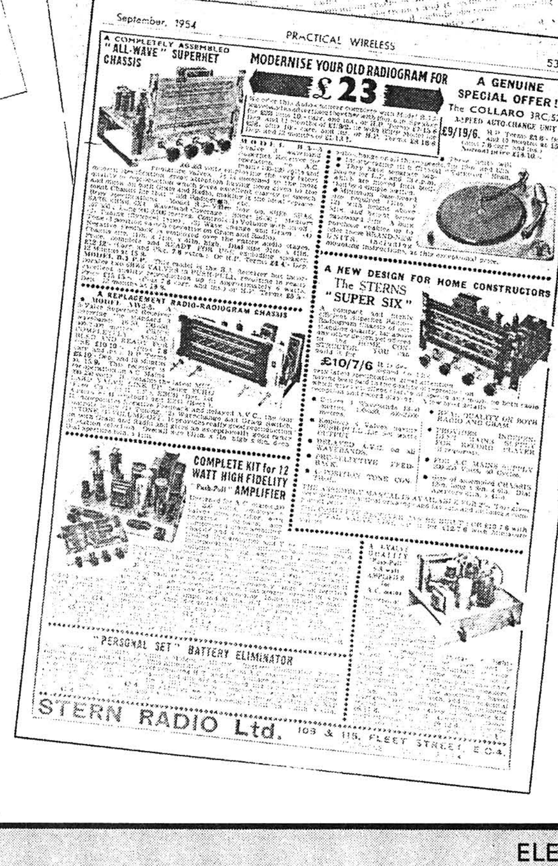
COMPLETE CONSTRUCTIONAL DATA FOR A MONOPHONIC 4-OCTAVE INSTRUMENT FOR DOMESTIC OR PROFESSIONAL USE

By W. J. Delaney (G2FMY)


November, 1951 PRACTICAL WIRELESS 497

L.S. Crystal Valve Receiver

AN EXPERIMENTAL SET USING GERMANIUM TRIODES


September, 1954 PRACTICAL WIRELESS 539

A COMPLETELY ASSEMBLED "ALL-WAVE" SUPERHET CHASSIS

MODERNISE YOUR OLD RADIOGRAM FOR £23

A GENUINE SPECIAL OFFER! The COLLARO 3RC.521 £9/19/6

A NEW DESIGN FOR HOME CONSTRUCTORS The STERNS "SUPER SIX" £10/7/6

A REPLACEMENT RADIO-RADIOGRAM CHASSIS

COMPLETE KIT for 12 WATT HIGH FIDELITY "Push-Pull" AMPLIFIER

"PERSONAL SET" BATTERY ELIMINATOR

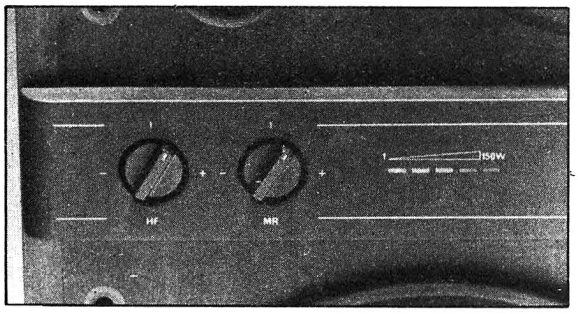
STERN RADIO Ltd. 109 & 115, FLEET STREET, E.C.4.

. . . the 50's started with the introduction to readers of the transistor and by the end of the decade it was well established. Notable landmarks of this period were the introduction of the Mullard 5–10 hi-fi amplifier design and the *PW* Television Receiver. The amateur was now well catered for with several transmitter and receiver designs but the magazine had started to move into other areas of electronics. F.J. Camm died in 1959, an era had ended . . .

THE 60s

. . . the reign of the valve was drawing to a close with the transistor firmly established and the age of microelectronics had started, the integrated circuit had appeared on the scene. A new star rose in the '60s in the form of Clive Sinclair. His Class D audio amplifier was as revolutionary as his later IC10 integrated circuit . . .

The Mezzo and Magnum loudspeaker systems, the latest in a long line of quality high fidelity products from Goodmans – Internationally recognised for nearly 60 years as the people worth listening to.



These two loudspeaker systems – with special features, such as mirror imaging, contour controls and electronic power indicators, have a price tag almost a third less than you would expect, and are tailor made for the re-introduction of the Magnum and Mezzo names.

Power Range

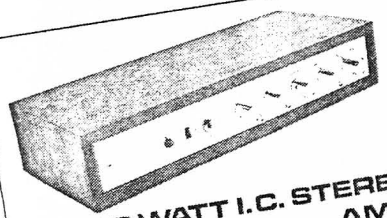
Goodmans Power Range of loudspeakers are typically for public address, musical instrument amplification and disco applications.

The Audiom and Propower loudspeakers are for professional use, where reliability has to complement the total sound performance.

Goodmans the people worth listening to

Goodmans Loudspeakers Limited Downley Road Havant Hampshire PO9 2NL England
Telephone 0705 486344 Telex 86296

THE 70s



The TEXAN

20+20 WATT I.C. STEREO AMPLIFIER

RICHARD MANN

PART 2

So you want to pass the R.A.E. (Radio Amateurs' Examination)?

No.1

John Thornton Lawrence GW3JGA & Ken Mc Coy GW8CMY

The passing of the Radio Amateurs' Examination, set by the City and Guilds, requires a certain level of theoretical technical knowledge. Whether one considers that this level is too high or too low is beside the point. The course that follows is intended, with the help of certain external aids, to prepare the reader to pass the examination. It will not teach him all about electronics!

The Radio Amateur is a privileged person indeed, he has access to various parts of the radio frequency spectrum which enable him to talk to other amateurs near to him or in any other part of the world. The Radio Amateur has his own international language, he belongs to a worldwide brotherhood of Radio Amateurs whose "Ham Spirit" takes no account of race, colour, political or social outlook. To ensure that these privileges are not abused, the Licensing Authority (the Home Office) require some test of the would-be amateur's technical competence and knowledge of the radio "Highway Code", before giving him a licence to drive on the Frequency motorways of the world, in short, the Radio Amateurs' Examination.

...'writing to the City and Guilds'

Maybe you are one of those whose interest in Amateur Radio has been building up steadily for some time and the point has now been reached where you have to decide whether or not to enter for the R.A.E. If you are dithering on the brink, you will be interested to know that this [illegible] articles concerned fully [illegible]

ABOUT THE AUTHORS

John Thornton Lawrence, T.Eng. (C.E.I.), F.S.E.R.T., is a Senior Scientific Officer concerned mainly with electronic instrumentation, measurements and calibration. He [illegible] GW3JGA in 1962 [illegible]

GOING QUADRAPHONIC

PW Q4 PROJECT

PART 2 D.BOLLEN

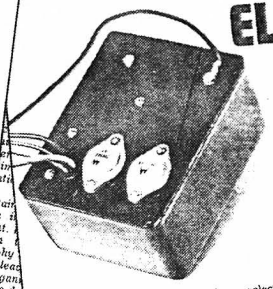
- QS recordings
- SQ recordings
- Discrete CD-4 recordings
- SURROUND SOUND

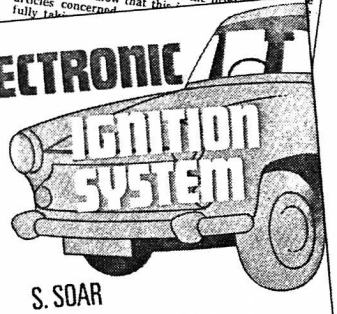
It is easy to see how several resistance networks, plus variable separation, could be combined by switching to offer multi-system decoding, but before considering this it would be as well to look first at the circuits of Units A and B.

Unit A circuit

The circuit of unit A is shown in Fig. 12. Tr1 and Tr2 act as unity gain phase splitters, with an input impedance of 47kΩ and an output impedance of about 1kΩ. Mixers Tr3-Tr6 are of the virtual earth type, with an output impedance of [illegible] of two when equal [illegible]

ELECTRONIC Ignition SYSTEM





S. SOAR

THE car ignition system is often neglected by the enthusiast who, whilst spending considerable effort to enhance his car's performance by the addition of special carburettors, manifolds, [illegible] often writes off the electrics [illegible] sports coil. [illegible] the

9. The engine can be easily cranked or push started by connecting a 6 volt dry battery in place of the accumulator.

Other less obvious advantages include longer battery life, less strain on dynamo and reduced wear on starter motor and gear brought about by easier starting especially in sub-zero conditions.

The system has been designed around the standard [illegible] to facilitate easy interchange

I.C. OF THE MONTH

Number 1

L.A.J. IRELAND

The SL402A and SL403A, audio amplifiers

Since the word "microelectronics" first became current, this magazine has kept before its readers the latest developments in this field, and has repeatedly induced its readers to gain practical experience in the application of integrated circuits by the publication of realistic constructional projects. However, the stream of new devices has become a flood, so that it is totally impossible to give full instructions in article form for the wealth of i.c. projects now possible. At the same time such a source of ideas for the enthusiast must be tapped, and hence this new feature. It is intended, each month, to present a new device, idea, or theme from the world of microelectronics which readers can develop for themselves as their experience, interests, or leisure permit. Detailed instructions will not be given—for such articles will continue to appear as in past issues—but all sorts of goodies which must otherwise be left in obscurity as far as the amateur is concerned, will be sought out.

FOR a starter, a pair of interesting new audio amplifier circuits from the Plessey stable has been chosen. These products from a UK firm are emerging as strong favourites in a field until recently dominated by American imports, and are a really good example of the results available to the home constructor as a result of the fierce competition in the industrial world. The SL402A has a typical output power of 2 watts operating from up to 14 volts (a car battery is an ideal source, and the SL403A is rated for up to 21 volts, with a corresponding increase in power delivered, to 3 watts.

The internal circuit

Each unit, in a circuit containing 13 transistors, a zener, and several other diodes, provides a complete audio system, preamplifier as well as power amplifier, with an overall voltage gain of 50dB. Further, as a glance at the equivalent circuit will confirm, the input to both preamp and power amp is through an emitter follower chain, giving a very high input impedance in both cases. This obviously increases the utility of the circuit when used in conjunction with crystal record player cartridges; more sophisticated applications in the instrumentation field are also evident, since signal tracers, for example, are only useful to the extent that the loading they place on a test circuit is minimised.

It also permits the introduction of a really comprehensive tone control system, despite the severe signal attenuation this involves. This final point relies also on the fact that the noise level is −75dB relative to the output signal, while overall distortion is a negligible 0·5%. An attractive feature from the point of view of the constructor of economy mains-powered equipment utilising either of these new Plessey units is an inherent

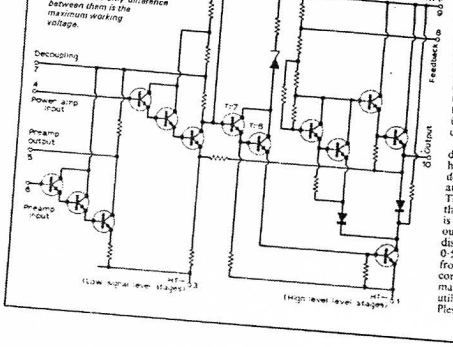


Fig. 1: The internal circuit of both the SL402A and the SL403A. The only difference between them is the maximum working voltage.

. . . Sinclair went on to pioneer calculators, digital watch kits and miniature TVs and of course personal computers. The '70s brought a whole host of gadgets and other non-radio projects into the magazine but the undisputed success story was the *PW* Texan stereo amplifier with over 45 000 kits sold! The decade ended with the magazine moving to Poole and a new era starting . . .

METAL LOCATOR

HAL MOORSHEAD

This article describes the theory of metal detection and gives realistic assessment of the performance expected. A practical circuit and constructional details are also given.

The prototype of the metal locator

BEFORE even explaining the function of this project it is important to place home constructed metal detectors in perspective. They are great fun and within their limitations very useful but they are not practical for any but the most rudimentary form of treasure hunting. Using the techniques described here, and another technique described later, a maximum of about 18in. is the greatest detection range under ideal conditions and this is reduced to about 1in. under difficult ones.

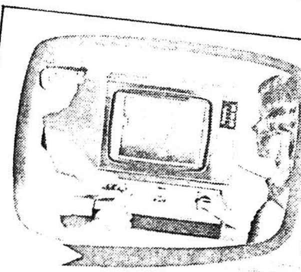
The author has seen great claims made for the ... of circuit used here but this has never been ... practice. Certainly there are metal ... are very much better than the ... dreds of pounds and ... operate. The ... 50s.

greater effect than others. A large stone, however, will produce a similar effect to a small nail and it will be quickly appreciated that searching for materials in anything but a few inches of earth is frustrated by many other effects.

... of the oscillators are not too ... frequencies ... lie between about 100kHz and ... it is hard to detect the change ... in inductance for ... only a few ...

THE POPULAR NEW ELECTRONIC GAME TELE-TENNIS PLAYED ON THE TELEVISION SCREEN

PART 2



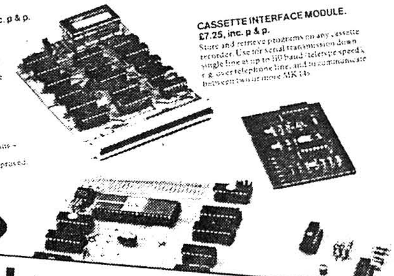
M. J. HUGHES MA

Physical Features

Apart from the modulator itself, layout of the game is not critical; nevertheless constructors are strongly advised to use printed circuit boards due to the large number of integrated circuits. Mechanical construction of the prototype was kept as simple as possible. In many respects the single plane layout adopted proved to be ideal, allowing ... to all the preset controls. Another ... planar construction is th... stages without ...

The six boards are designated A to F and these are laid out on the sub frame as shown in Fig. ... The mains transformer is bolted on to an ... plate shaped to screw under the ... subframe. When ... you allow ...

Now, the complete MK 14 micro-computer system from Science of Cambridge



VDU MODULE. £33.75 (£26.85 without character generator) inc. p & p.
Display up to 2K memory 32 lines x 16 chars, with character generator, or 4096 spot positions in graphics mode, on UHF domestic TV. Eurocard-sized module includes UHF modulator, runs on single 5 V supply. Complete ascii upper-case character set can be mixed with graphics.

CASSETTE INTERFACE MODULE. £7.25, inc. p & p.
Store and retrieve programs on any cassette recorder. Use for serial transmission down single line at up to 110 baud (teletype speed), e.g. over telephone line, and to communicate between two or more MK 14s.

POWER SUPPLY. £6.10 inc. p & p.
Delivers 8 V at 600 mA from 220/240 V mains – sufficient to drive all modules shown here simultaneously. Sealed plastic case. BS-approved.

THE PW 'WINTON' Stereo Amplifier

Part 1

* E.A.RULE

The Winton amplifier has been designed primarily for the home constructor who would like a high fidelity amplifier equal to the best commercial design available, but at a price that enables it to be built within a sensible domestic budget, the total outlay being in the region of £110 for the complete project.

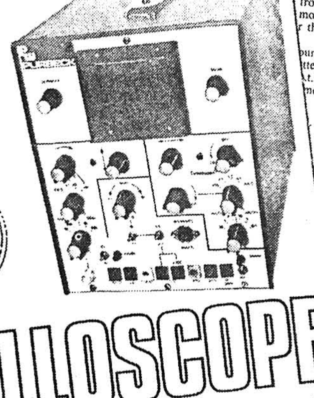
All the components are available and no special test equipment is needed for testing or setting up. The amplifier uses the very latest techniques and is capable of a standard of performance at least equal to the best commercial designs available with similar power ratings. In some aspects of its design it will outperform other amplifiers costing very much more.

Power f.e.t.s are used in the output stage and allow ... wider power-bandwidth response with low ... than could be obtained if conv... transistors were used ... op.amps ...

Power f.e.t.s

Until recently bipolar transistors have been used in almost every Hi-Fi available (the exceptions using valves). Bipolar transistors require a wide area of Safe Operation to achieve reliability and a large gain-bandwidth product so that large amounts of negative feedback can be used at the higher audio frequencies to reduce the distortion. They also have a positive temperature coefficient which means that any increase in transistor temperature ... increase in transistor collector ... temperature to in... careful ... uses an ... uses the ... quiring ... bipolar ... from ... most ... r the ... ount ... tter ... t.s ... me

PW 'purbeck' OSCILLOSCOPE



COVER PROJECT

IAN HICKMAN

For those taking a serious interest in electronics, an oscilloscope is the most important single instrument in the home workshop.

For the last ten years an all-transistor model has been in use by the author. However, lately this has been showing its age by deteriorating performance, poor reliability etc. When it was designed, there was no all-transistor oscilloscope on the market; now, of course, there are no valve types, apart from a few imports from the Communist Bloc.

It was an all discrete design, so when the time came that something just had to be done, it was clearly a better plan to start again from scratch using integrated circuits. A fresh start also provided the opportunity to incorporate a number of features wh... could prove valuable and which were not catered ... in the previous version.

Feeling that others might be interested in a de... which is well engineered and suitable for the h... constructor yet providing a high standard of ... formance, it was decided to use only compo... readily obtainable and in particular, in the int... of economy, the popular and reasonably ... surplus cathode ray tube type 3BP1, Fig. 1.

Where, in the interests of performance, ... components are unavoidable, arrangements ha... made with well-known firms advertising regu... PW to stock them.

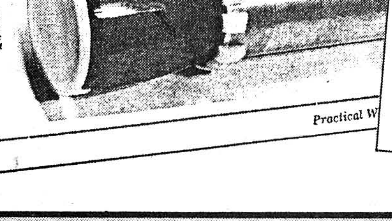


Fig. 1: In the interests of economy the 'Purbeck' uses the reasonably priced and readily obtainable 3BP1 cathode ray tube, seen here with the specially produced low cost mu-metal shield

Practical W...

892

'SLIM JIM' 2-METRE AERIAL

F.C. JUDD FISTC, MIOA, Assoc. IPRE, A.Inst. E (G2BCX)

This is a vertically polarised omnidirectional free space aerial for two metres but which will operate in the same way for higher or lower frequency bands by scaling the dimensions accordingly. It has a radiation efficiency 50% better than a conventional ground plane due to its low angle radiation, is unobtrusive, has no ground plane radials, and therefore has low wind resistance. The name "Slim Jim" stems from its slender construction (it is only 60 inches long for 2 metre operation) and the use of a J type Integrated Matching stub (JIM) that facilitates feeding the aerial at the base, thus overcoming any problem of interaction between feeder and aerial. The feed impedance is 50 ohms.

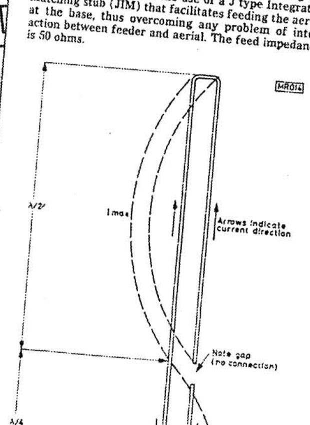
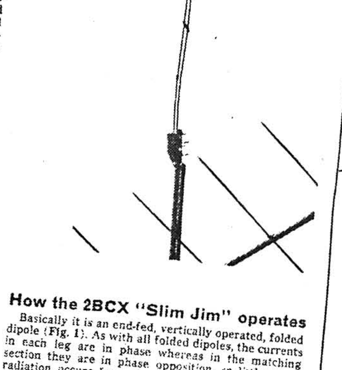


Fig. 1: The basic aerial, showing direction of current flow and phase reversal in matching stub.



How the 2BCX "Slim Jim" operates

Basically it is an end-fed, vertically operated, folded dipole (Fig. 1). As with all folded dipoles, the currents in each leg are in phase whereas in the matching section they are in phase opposition, so little or no radiation occurs from the matching stubs. Correctly matched the VSWR will be less than 1·5 to 1 and will remain so across the band. It can be constructed for use as a fixed home station "omni" or for portable operation, and the aerial has been used for mobile operation mounted on a short stub mast attached to a rear bumper; at sea a special version is used, completely enclosed in a plastic tube for protection against salt water.

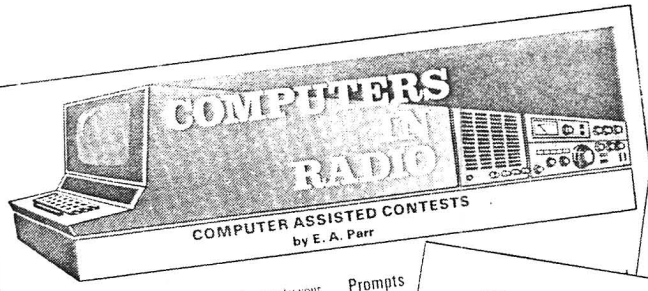
Construction

The "Slim Jim" may be constructed from ¼ or ⅜ inch diameter aluminium tube, stiff coathanger (galvanised iron) wire or 300 ohm ribbon feed. The spacing between the parallel elements is not critical

Practical Wireless, April 1978

893

THE 80s



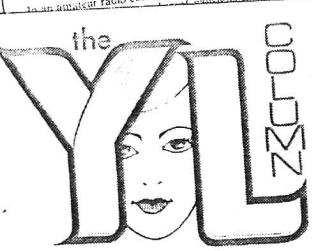
PW HELFORD

Part 1

HF SSB TRANSCEIVER

Vic Goom G4AMW

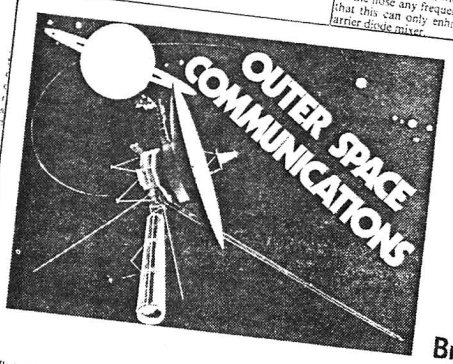
the YL column



Elaine HOWARD G4LFM

Uncle Ed's Page

A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.



Part 1

Brian DANCE

THE PW 'SHERBORNE' PART 1

SYNTHESISED AM/FM TUNER

W.S.POEL

This series of articles describes a 4-waveband broadcast microprocessor controlled digital fre-

CB RIG CHECK

COMMTRON CB 40F

CB is a mobile short-range telephone system. You require a licence to use it, £10 p.a. from Post Offices.

The CB 40F is Commtron's first rig purpose-built to the UK 27MHz f.m. CB specification MPT 1320. They have some years of experience in producing transceivers for the US market under several well-known brand names and it certainly shows in the standard of design

CONSTRUCTION

Generally good, although a few solder balls and wire ends stuck to p.c.b. reveal a need for improved quality control.

HANDBOOK

The 14-page instruction manual suppli covers specifica ns, brief descrip ope ont in

transmitter output will withstand short-term accidental short-circuit or open-circuit antenna conditions without disappearing in a puff of smoke, as proved during lab tests.

We tested two rigs mobile, using Avanti Moonraker AV-241M antennas, which are base-loaded, 1.22m long with mag-mount base. One rig was also tested as a home-base, using an AV-241M in the loft with a makeshift ground-plane of two 3m lengths of aluminium strip arranged as an 'X'. results were good, with mobile-to-mobile nts up to about 5 miles in a semi built- nsiderable and in- star-

PW 'EXE' MICROWAVE TRANSCEIVER

Part 1

Dick GANDERTON G8VFH & John M.FELL G8MCP

. . . The '80s heralded a rethink of the *PW* image and a change of course back into the field of radio. Notable landmarks have been the *PW* Helford h.f. transceiver and the move into microwaves with the *PW* Exe transceiver. The first 50 years have seen great changes in wireless, the next 50 years should be just as interesting for our readers . . .

THE FUTURE

When I was about eight years old, I persuaded an aunt who looked after me as a wartime evacuee, to buy me a book called *How it Works and How it's Done,* which explained the mysteries of flight, radio, deep-sea diving, telephones, power stations and many other marvels. Returning home as the war was coming to an end, I discovered that one of our near neighbours worked in radio (terribly hush-hush, something to do with armaments) but mended electric irons, vacuum cleaners and radio sets in his spare time.

I was soon visiting him to try to cadge the bits I needed to build a spark transmitter like the one shown in my book. He tried to persuade me that this wasn't the right approach to the subject, but I was not to be put off so easily. An induction coil and spark-gap connected to about 200 feet of wire strung between the shed and a tree at the bottom of our garden communicated well with all the neighbours, but somehow they didn't appreciate it! My Dad gave me a good clout round the ear and a present of another book, *Practical Wireless Circuits* by F. J. Camm, which together succeeded where my friendly wireless expert had failed. It certainly never occurred to me then that one day, I would be treading in F. J. Camm's footsteps, or that radio communication would make the staggering progress that it has since I first became interested in it, nearly 40 years ago.

I did eventually get a spark transmitter, on board one of my first ships, but it seemed pretty tame compared with watching the first TV pictures from the USA via *Telstar,* just 20 years ago, and watching and listening to all the developments since. Who (except for some-one of the stature of Arthur C. Clarke) would have foreseen such events?

And that's my theme really—who can foresee what might be to come? Our contributors are brave men, to take up my invitation to fill the following pages. I am sure of one thing, though; we should never say that anything is impossible, simply that we haven't yet found out how to do it.

I do have one pet theory—that one day a new sort of sensor or detector will be discovered, which will show us that besides the electromagnetic radiation which we use now, there is another sort of radiation which could replace it for communications purposes. It might even be the key to thought transference, in which case a lot of us radio types could be out of a job! Who knows?

In the lifetime of *PW,* remarkable changes have occurred in amateur radio: exploitation of "the wavelengths below 200 metres", once considered useless by the broadcasting world, and the development of v.h.f.

The advent of WW-II surplus gave enormous impetus to the development of amateur radio, not only in terms of equipment but also in the appearance of highly qualified operators, resulting from forces training.

Thus v.h.f. became easier to tame—6 metres, 5 metres, 2 metres, and even up into u.h.f. (432MHz) and microwaves (10GHz in particular). Single-sideband transmission was pioneered by amateurs in this post-war period, probably the most significant advance of its time. From this and the concurrent development of solid-state technology came the present-day generations of multi-mode, multi-band "black boxes" and the daily exploitation of all bands up to 70cm by hundreds of thousands of amateurs, world-wide.

So what of the next 50 years of development? One can confidently predict a number of growth areas—the microchip will play a major part in amateur radio as in other walks of life. Indeed it is already playing an important role in frequency control and programming of receivers and transmitters. Its future use, beyond the present log-keeping and code generation (and decoding), will be extended into the control of satellite stations and antenna orientation. The development of microwave satellites is almost a foregone conclusion and the antenna pointing and steering accuracy needed in the GHz region will need the services of the "micro" for all but the geostationary satellite which, in amateur application, is a long way away yet! (But almost certainly within the 50 year time scale.) The current UOSAT is a forerunner, albeit a fairly crude test bed, for future generations of advanced amateur satellites, bringing together the amateur and the professional. The fact that all major microwave bands have satellite sub-bands is an indication that the amateur is expected to make a positive contribution to technology.

Gallium arsenide technology is advancing rapidly and this is another pointer to the expectation that the "growth-area" of amateur radio is likely to be in the microwave regions. Indeed, the development of microwave communication has already started along with narrow-band (s.s.b.) techniques and is likely to gain added impetus as exotic professional devices come within amateur budgets.

With these developments will come extensions to the amateur microwave repeater and beacon chains which will allow the amateur to make a possibly unique contribution to propagation studies, using, once again, home-built equipment! This area of amateur endeavour is already clearly recognised, and the professional and authorities' attitude to such developments appears to be largely one of help and encouragement, for such devices are often built with commercial aid and set up on professional sites.

The next fifty years will see amateur radio entering a new "phase" where everyday communications will be provided by the ubiquitous "black-box" (be this computer or transceiver), but where future needs will result in the re-birth of experimentation and home-construction. It seems a very long time, but there is a vast amount of work to be done, above all on the inter-connection of equipment units into totally integrated communications systems. The amateur may not always be highly financed, but does have time and almost limitless ingenuity and patience to compensate. These will be key factors and are attributes likely to increase as leisure-time increases. No doubt the amateur will rise to the challenge as he or she has always done, and still remain in the forefront of communications technology.

This being said, the pressures to relinquish microwave space to other users will increase steadily all the time, just as it did with the "wavelengths below 200 metres"—the wheel will have turned full circle again!

Mike Dixon G3PFR

THE FUTURE

Prediction is a very chancy business. It is relatively easy to take a well established technology and project its development over a few decades. What is not so easy to predict are the unforeseen "quantum jumps" in technology that occur relatively infrequently and have major impacts on society.

The most important developments for the rest of this century will undoubtedly be digital electronics, home video and satellite communications.

In the forefront of digital electronics will be the ubiquitous microprocessor, and it is probable that the average home at the end of this century will have considerable built-in intelligence. Optimal control of central heating and the running of energy-greedy processes such as washing can all be handled by a central house computer. Home terminals and development of Prestel will lead to a revolutionary change in the mail order market, with the consumer able to view and order items direct from his home.

The recent explosion of interest in the video recorder was expected, but is only the start of a video boom in which the television set will play an even greater part in home life. Cable television will give the viewer greater choice and cater for minority interests. It is quite probable that the choice will be so wide that a recorder will be essential, and most viewing will be off-tape rather than off-air. Recorders will have intelligence that will change channel and allow the user to programme exactly what is to be recorded.

Television can also become interactive, with interesting possibilities for plays and quiz shows and less trivially for referendums and polling. There are, unfortunately, potentially sinister applications for interactive television, a la *1984!*

It is technically possible for magazines, newspapers and books to be replaced by video terminals, but this development will probably not go very far. There is something restful and aesthetically pleasing about the printed word which is lacking from a v.d.u. screen. It is probable that *Practical Wireless* will still be on the news-stands for the foreseeable future!

Satellite communications, and satellite TV, will have a major social impact. Virtually unjammable (short of deliberate destruction), satellite TV transmitters can be used across frontiers. Optimistically, satellites could lead to the creation of a "global village" Pessimistically, they could be used for propaganda and lead to an increase in world tension.

The man/machine interface has always been a difficult area. A direct link from a machine (say a computer or some industrial process) to the brain of the human operator would increase efficiency tremendously. From here it is a short step to the science fiction android.

I have long been a believer in ESP, and think that it is a potentially useful communication channel. ESP has suffered from a lack of credibility in the past, but I am sure its secrets could be discovered with some concerted research.

Finally, I would not be surprised to see the light barrier broken. As I remember my university physics, travel at the speed of light is prohibited, but travel faster is not. A sort of tunnel diode effect that allows particles to go from sub-light to super-light without touching the critical speed would allow instant communications over great distances, essential for space travel.

These are a few views of the future of communications. People's lives will be greatly affected with greater leisure time and access to far more information. Whether the world will be a happier place only time will tell.

Andrew Parr

The final goal of telecommunications could be defined as "the ability to communicate by speech, visual images, written words or data with any one or any computer, anywhere, at any time." During the past 50 years, both in amateur and professional radio communications and in broadcasting, we seem to have come a long way towards that ultimate goal.

We have seen the marriage between data processing and communications, including the development of such new broadcast services as teletext. Geostationary satellites have given us a new and most powerful means of transmitting broad-band signals across the oceans. Solid-state electronics has reduced the size and weight of equipment, although in communications and broadcasting we still need to think in terms of watts, kilowatts or even megawatts when it would be so much more convenient if we could match microcircuits with microwatts.

Indeed, improved sources of low-cost electrical power for portable or remote sites still remain as one of the most urgent requirements—direct broadcasting from space is still limited by the size of solar panels needed to generate the 5–10kW of plain old-fashioned electricity necessary to power a 5-channel DBS spacecraft. The problems (including safety) that have so lowered expectations of compact nuclear generators and fuel cells put added emphasis on further developments of solar cells as a natural energy source. And despite the many advances in solid-state devices, the high-power Klystrons, travelling-wave tubes and even tetrodes remain important components of many of the higher-powered transmitters.

Similarly, the "19th-century" cathode-ray tube may still be providing millions of pictures in 21st-century homes, although surely the flat, large-screen, high-resolution, solid-state, colour display device must come before very long, heralding a requirement for true high-definition television providing wide-screen pictures equivalent to the best cinema film projection.

But will we ever have the willpower to watch an entire programme if multi-channel cable TV comes to the UK as it is already spreading through the urban areas of the USA. More choice does not necessarily mean better TV. Channel hopping can become a way of life, but the death of meaningful television.

And will amateur radio become little more than a small part of the giant consumer-electronics industry? The modern transceiver is fast becoming so complex as to defy even the most experienced home constructor, with a component packing density that defies even home maintenance. Amateurs may indeed be forced to ask themselves "how good is good enough?" and to settle sometimes for simpler set-ups than those they still eagerly seek today. Perhaps more amateurs will move up to the still largely unexplored microwave bands—others may seek to regain the old excitements of communicating by hand Morse and low power, deliberately opting out of the all-singing, all-dancing goal of the professional telecommunications that they helped to develop.

Pat Hawker G3VA

THE FUTURE

Arnold the Invincible Amateur sits in his purple cushioned chair. On the black, ebony desk lies a small, grey box. It contains everything: TX/RX for all 78 Amateur bands from 23Hz (the l.f. freakers band) up to 28 000GHz (I put my antenna down here—somewhere).

A micromidget 6mm triangular speaker crackles into life: "Master, there is a VX9 calling CQ. We need it for a WAC certificate. Shall I acknowledge?"

The Invincible Amateur manages a bored "Yea." There is silence. The speaker crackles again: "We have 5 & 9 plus 11·209dB, all relevant info has been logged into memory. Resuming scanning . . ."

No, not science fiction: reality. Morse code "boxes" can already be programmed to transmit your callsign and this information can easily be extended. Other units are advertised that can decipher Morse and display it in plain language on a c.r.t. or produce hard-copy.

Speech synthesisers could be added to give out information, while speech recognition equipment would receive the signal and, via a small inbuilt computer, select the relevant response. The computer can also instruct the receiver to scan any band(s) in search for a particular callsign. When a match is found, the computer initiates the transmission after tuning everything, automatically.

Non-tune p.a. stages are already with us, as are a.t.u.s that tune themselves. The log book will be a small disk, so all transmissions and QSOs are systematically recorded. One can easily imagine rubber-stamp QSOs between transceivers without the need for any human intervention.

But let us take it a step further, and eavesdrop on two Super deluxe, Auto-auto, micro-transceivers on a warm summer evening in the year 2033.

G3GSR: Well, that's the QSO bit done. So how's things?

G3JDG: Not too bad. Old idiot fingers turned my mike gain up too far.

G3GSR: Oh, how vile—they really think they know it all, don't they? How bad was it?

G3JDG: Oh don't worry, microprocessor number seven shorted that pot out ages ago. It's non-operative, like all the other front panel controls. None of them work, but they keep the humans happy.

G3GSR: Someone was saying that, long long ago, the humans used to manually tune their a.t.u.s, tweak all sorts of controls and take the greatest care and pride over setting up.

G3JDG: Yes. I heard that they actually got great pleasure out of building their own rigs!

G3GSR: Oh, how quaint. By-the-way, thanks for helping us to get that resolution through the RSGB.

G3JDG: Don't mention it. Don't forget the secret net on 10·5MHz tonight. Silent running, of course. We want to decide where Ham radio will go next.

G3GSR/-G3JDG (together) 73 OM es bcnu.

Well—what's to stop it? And when did you build your last rig?

David Gibson G3JDG

In 1982, with our present technology, we have put into practice most of the paper theories of the last century. The immediate future will see us concentrating our efforts on finding new and more sophisticated applications rather than new technologies. There will be advances in technology, of course, but the expansion will be in the dissemination and use of information.

As far as Amateur Radio is concerned, the next 50 years will see its magic appeal evaporating as personal and world-wide communication and transfer of information become commonplace.

Within the next decade, the Amateur Transceiver will become "smarter", with fewer knobs; slimmer, with a sloping front panel incorporating a flat screen display. The display will present a tuning dial, frequency readout and world clock, with the status of all controls in graphic form. Some versions will be entirely touch-panel controlled. More and more data transmissions will be found in the "c.w. end" of each Amateur band. Morse, ASCII and new data formats will be generated, decoded and displayed automatically.

By the 1990s digitally-coded voice transmissions will gain popularity, the speech coding, regeneration and synthesis will utilise the circuit chips designed for professional satellite and fibre-optic communications.

Sopisticated AMSAT satellite vehicles will be launched regularly. Microwave and s.h.f. enthusiasts will modify low-cost domestic satellite receiving equipment for amateur use.

Most amateur transmissions will include a digital information "package" giving licence, callsign, QTH and logging information. Received information packages will be stored in memory for annual log printout or contest entry, automatically scored, of course.

The year 2000 will see the end of the self-contained Amateur Transceiver, except for portable or mobile use. The existence of Computer Work Stations in almost every home will result in the Amateur Transceiver becoming just another interface unit (Fibre-optic in and out to 50 ohm coaxial cable), graphics, touch-screen and voice providing all the information and control functions. Frequency spectrum graphics will include station callsigns and status.

Illegal high-power operation on CB and unlicensed operation on "net" frequencies will be widespread, to the increasing embarrassment of the already powerless licensing authorities, peaking during the 2002 sunspot high.

Amateur band-plans will extend to full frequency channelling. Some repeater channels on v.h.f. and u.h.f. will be time-division-multiplexed with auto-locking to a master clock transmission. Others will handle bandwidth-compressed video signals, based on "Teleconference" standards.

Towards the year 2032, true Amateur Radio will be almost eclipsed by the sophistication of transceivers with digital signal processing, the dominance of satellite communications, and the availability of personal communication for all.

However, there will always be a few dedicated amateurs for whom antenna and propagation experiments and the hand-building of apparatus will remain a source of pride and pleasure and not just a means to an end.

John Thornton Lawrence GW3JGA

THE FUTURE

We often say in conversation: "Why didn't I think of that" or "it should have been obvious", but now our Editor has called our bluff and asks, quite simply: "What about the future?"

For my part I believe there will be a steady, step-by-step advance across the whole field of radio and television communications during the next few decades. I foresee the advent of the complete receiver in one chip, powered by light or heat and super sensitive to signals, because the structure of the integrated circuit will be so good, that it will be completely free of internally generated background noise.

During the development of such a chip another look must be taken at power supplies and I visualise a new combination of chemicals, activated like a switch, by light or even body heat, that will revolutionise the energy requirements of circuitry and do away with the present day costly and limited-life batteries. A great economy in national power would come about if broadcasters transmitted their entire day's programmes, at high speed, in a few minutes. The initial pulses of such transmissions would trigger an acceptance circuit in the receiver and the users would select their required programmes from the memory in their set.

Assuming that the progress of satellite TV will make international broadcasts easily available to all then I see an automatic language translator as a common part of the sound circuitry of a television receiver.

In the scientific field, the discovery of another solar particle, yet undetected, will clarify some of our present day, unexplained, propagation and open up a new field of research requiring a lot of routine observational work toward which radio amateurs, internationally, will make a major contribution.

For my way out thoughts, but still within the realms of possibility, a personal 3–D television receiver, built into a pair of glasses with bone conducted stereo-sound and powered by the incoming signal.

Ron Ham

It is inevitable I suppose, as one attempts to look fifty years ahead in the life of *Practical Wireless,* that one should also look back to the beginning. Although I cannot claim to have been a reader since issue number one, I was by the mid 1930s an enthusiastic schoolboy constructor. My introduction to the short waves came via a home-made receiver called "The Simplest Short-waver", details of which appeared in the Short Wave Section of the 14 September 1935 edition of *PW*. It was a weekly in those days.

At that time it would not have been difficult to imagine a receiver powered only by a torch battery instead of the bulky power supplies of the day. Nor would it have been surprising to learn that frequency would be displayed in digital form even if the technology involved was unclear. What would really have amazed me would be the idea that in 1982 sound radio would still be on the medium waves using double side-band plus carrier—a system so incredibly wasteful of transmitted power and band space. I would have been disappointed if I had learned that broadcasting on the short waves would progress so little during this period that reception reports and QLS cards were still thought by some, to be appropriate.

Fifty years hence! As a dabbler in 3D photography I appreciate the potential of this medium and I hope television will move in this direction. Three-dimensional TV from a picture-frame receiver hung on the wall should not be too much to expect. It would be a window into a realistic solid world beyond.

On balance, I feel that international broadcasting will soon follow commercial users of the short waves into the satellite age. These frequencies provide an economic way of reaching a large audience, but it is not a reliable way. The ionosphere is too complex, too unreliable. There are fadeouts. There are seasonal and longer term frequency changes. If international broadcasting does continue on the short waves it will be for political rather than technical reasons and it will be maintained by the extensive use of relay stations located within single-hop distance of the target area.

And the DXer, what of him? Well they are a resilient, ingenious and persistent lot who will surely find something of interest. I can imagine one branch of the hobby specialising in broadcasts from lunar bases and who knows, there may still be a few double side-band stations pounding away on the medium waves and a small band of enthusiasts with loop antennas ready to winkle them out.

Charles Molloy

In this short contribution I think that I'll just stick to one prognostication concerning amateur radio. It concerns the logical sequence to the highly successful series of amateur radio satellites that started with Oscar 1. How about a geostationary Oscar, presuming that the previous technique of thumbing a lift on someone else's rocket will still be possible?

Just where it would be located over the equator would largely depend upon who had financed it in the first place, but presumably it would favour the more densely populated parts of the world, in terms of radio amateurs, and that means North America or Europe, but in practice it could very well be the Russian amateurs who would have the first geostationary amateur satellite.

By the time that such a venture becomes feasible, amateurs will have mastered the techniques of building and operating equipment for the multi-gigahertz range, for that is where such operations would take place. It is rather unlikely that lower frequencies could be used because of the limitations on the dish antenna size and of the power supply available on the satellite.

Amateur TV would probably prove very popular via the satellite and although point-to-point distances would hardly qualify as DX the fact that the TV signals would have travelled the best part of 50 000 miles in their journeyings would be very exciting.

Our earth-bound antenna dishes would need to have an astronomy-style altitude/azimuth vernier control when looking for signals from the satellite, with precise schedules being the order of the day to start with if any contacts are to be made. Computerised tables of bearings and altitudes for working between any two points within the satellite's "footprint" would improve the chances of two-way contacts.

Hopefully, nay certainly, the satellite would have small correction jets fitted to it to enable it to reach its correct position in space but what fun if, say, the amateurs of the USA clubbed together to get such a satellite in orbit and it then drifted off station so that the footprint was over the Pacific, or, better still, wandered over to Europe!

Although I believe that an America amateur has already been in space, but not operating, it is high time that we had an operational amateur station up there, with one of the forthcoming Space Shuttle flights a clear possibility. Alternatively, Spacelab ought to have enough room for a tiny operator and his rig. My thoughts go back to Viking aircraft and their trailing antennas, so what about Spacelab with one many miles long!

Eric Dowdeswell G4AR

THE FUTURE

Over the past fifty years we have seen dramatic changes in the fields of electronics and communications. From the old thermionic valves and the early days of television we have progressed to advanced solid-state technology, microcomputers and orbiting communications satellites. What will the next 50 years bring? With the almost exponential progress being made by scientific development the role of Oracle in these matters becomes extremely hazardous, but nevertheless we shall peer into our electronic crystal ball.

Our familiar a.m. and f.m. broadcasting services are likely to remain virtually unchanged for many years to come, but the advent of the digital audio disc will cause a revolution in the hi-fi scene. High-quality sound broadcasting using digital techniques could follow, with transmissions being made either on unused u.h.f. TV channels or perhaps by direct broadcast from an orbiting satellite.

Television will also make wide use of satellites, both as links between cable TV systems and for direct broadcasting to the viewer's home. The microwave dish antenna may well become a familiar sight above our homes in the not-too-distant future. High-definition television, using perhaps 1250 or 1500 lines, could be commonplace by the turn of the century and the flat, wall-mounted TV screen, which has always seemed to be imminent, could become a reality. Three-dimensional television without using special spectacles could also be practical.

Teletext and viewdata systems will continue to develop and soon we should see high-resolution graphics and full colour pictures as standard features of these systems. It may be that the centenary edition of *Practical Wireless* will be distributed to its readers via teletext or viewdata.

What about amateur radio? On the h.f. bands it is likely that there will be more use of advanced modes such as RTTY and SSTV. An interesting possibility might be simultaneous voice and SSTV transmission using independent sidebands of a d.s.b. signal. Digital SSTV transmission could become more popular and high-definition colour pictures might be sent using the techniques employed for picture transmission via viewdata.

There will be much more interest in the microwave bands as devices, such as GaAs f.e.t.s, developed for commercial use, become available to amateurs. Satellites might be used for amateur television and there will be increasing use of repeaters for television, RTTY and data transmissions. It might be possible to have an amateur form of viewdata with a repeater-type station providing access to the database.

With modern integrated circuits much of the design is in the hands of the original chip designer and the user is left merely with a task of assembling building blocks. There are however always the enterprising amateurs who will devise novel ways of using i.c.s which were never envisaged by the original chip designer. Microprocessors will no doubt play a major part in the electronics enthusiasts' activities and will make it possible to do things which would have been just a futuristic dream only a few years ago.

In general it seems that the next half-century promises to be a very exciting time for amateur electronics enthusiasts and it will be interesting to see what developments have appeared by the time *Practical Wireless* reaches its centenary.

Steve Money G3FZX

The first thing to be said about the future of communications is the simple fact that the entire world market will be owned, controlled and directed by the Japanese. There is absolutely no evidence whatsoever that any Western nation is prepared to match the drive, investment and simple dedication of the Japanese nation in achieving their ambition of world dominance in high technology markets. Even if we wanted to, could we? Has the horse bolted so long since that the stable door is just about to drop off a set of rusty hinges?

The answer is we could, even if we only spent half the sum being invested by Japanese technologists. Despite the fact that the infra structure of Western economies has been so grossly undermined, the Japanese method has always been to throw armfuls of money and enthusiasm into technology, but rely on exploiting the ideas of others. There's no magic in single-mindedness and long-term investment.

All substantial production will be totally automated. The question of national mentality and outlook will have little or nothing to do with productivity, and the emphasis for advancement will once again shift to the original thinkers and innovators. Computers will be communicating in vernacular, so it's quite possible that science will have reverted back to its "purer" origins after a brief spell with computer programmers and those other witch-doctors who are conversant in the mumbo-jumbo needed to communicate with the embryonic systems of today.

How long have we got to make up our minds? Well, we really need not bother at all if we are prepared to sit back for the next 30 years and let the Japanese suffer the growing pains on our behalf. If you don't want to while away the next few years with the UK as an assembly facility (with built-in customer fodder) for Panasonic, Sony and like, then we had better start fairly soon.

Most ink-on-paper newspapers and periodicals will disappear before the year 2000. Possibly by 1992. Prestel systems featuring local speech synthesis and computer graphics will make printed media seem very tame indeed. Broadcasting will almost certainly be totally satellite based, and the use of narrowband broadcasting at v.h.f., u.h.f. and s.h.f. will have spawned literally thousands of local radio stations.

The vast expansion of communications technology will inevitably mean greater state control and "spying" unless urgent steps are taken now to prevent incursions into liberty, with the introduction of severe penalities for the civil servants who abuse this facility. Extreme cases may even require the amputation of their index-linked pensions.

The use of computers to replace human beings may need to be licensed to make the economic decision more marginal. At the present time, a word processor can displace up to three secretarial jobs. A production line component insertion machine up to 100 jobs. Do you want cheap goods for ten years and then chaos when basic economic considerations catch up, and we find ourselves unable to support 80 per cent unemployment? Would you prefer an orderly, meaningful and positive existence. This above all else is in the hands of the people to decide—but don't rely on the politicians to provide you with guidance. They follow where the votes lead them.

Bill Poel

THE FUTURE

The basic radio frequency antenna, the half-wave or dipole, on which all linear forms of antennas are based has not changed in the last 50 years. Neither has the basic principle of the gramophone record or that of the moving coil loudspeaker. Improvements have been made in performance of the latter of course and hundreds of new configurations in linear antennas have been produced with some improvement over others by careful design, some with smaller than normal physical dimensions yet retaining a relatively high degree of efficiency. Linear antennas only become much smaller as the frequency of operation increases although the basic function and format remains constant.

There comes a point, however, where the frequency becomes so high that this form of antenna virtually disappears. The waveguide and radiating horn with dish or lens directivity systems take over long before that point is reached. Polyrod antennas might be regarded as the closest approach to "solid state", although there may well be other developments in this area as yet remaining the secret of research establishments.

Will a solid-state, point-source radiator ever materialise, or will the hypothetical isotropic antenna become a reality capable of accepting and transmitting high power in all or selected directions? A challenging possibility for the solid-state boffins, although it has taken almost 50 years for the first transistors to evolve into pin-head sized multiple circuit micro-chips.

So will we ever see the "wrist watch" size transceiver complete with built-in micro-chip antenna capable of transmitting signals around the world as often seen in films and TV serials a la *James Bond* and *Star Trek,* etc?... *"Beam me up Scotty, this planet isn't ready for us yet."*

PS The photograph, taken just a little over 50 years ago, shows the writer with a home-constructed 2 Neut r.f., Det and 2l.f. receiver. No apologies for the copy of *Popular Wireless* that appears in the picture and not *PW*. Nevertheless congratulations to *Practical Wireless* on the celebration of its 50th year of publication and best wishes for its future.

Fred Judd G2BCX

So much has happened in telecommunications in the last 50 years, including the use of frequencies at least 1 000 times higher than those of 1932, the introduction of digital technology, and the miniaturisation of transmitters and receivers, that one has to look into a quite incredible crystal ball to see the future.

First and foremost, I feel that fibre optics are likely to replace normal 600 ohm telephone lines, thus allowing the transfer of digital and video data as a norm. I can imagine every home having a fibre-optic communication terminal with a vast memory, partly solid-state, but also including a magnetic, or even optical, memory system. This will allow data to be stored on request, including a daily newspaper, books, video films, etc., and even broadcasts for delayed listening. The output from such a terminal will probably not only be fed to a flat video screen, much larger than present TV screens, but perhaps only 25mm thick, but also a hard-copy, very rapid printer will be able to give us our own copy of a newspaper or book to take wherever we want. I suspect that you will pay your "fibre optic" bill in the same way as your telephone bill is paid now—except that you will communicate with your bank by keyboard. Thus every home will have its own equivalent of a telex, telephone, computer terminal, printer, and even TV and sound radio.

But what of transmitted frequencies using transmitter and receiver installations? Almost all homes will have, or will have access to, millimetric microwave communications systems. It should be possible to pick up perhaps 3D TV and quadraphonic sound from the domestic services of virtually every country in the world via satellite. There are plenty of holes through the atmosphere in the millimetric region, and frequencies not affected by clouds, rain and fog will, of course, have to be chosen.

I have a feeling that commercial broadcasting on long, medium and short wave may well have gone within 50 years, to be replaced by satellite relays, and transistor radios will probably incorporate microwave aerials receiving digital transmissions. Miniature "man-pack" transceivers will be used for public, military and other services, with direct access to microwave repeaters in cities and towns, but direct to satellite "in the bush". A small collapsible horn or dish antenna could be placed on the ground virtually anywhere in the world and rapidly orientated to pick up the maximum received signal from a satellite, giving the user immediate access to anyone else. Such installations will be very cheap, and one can imagine the immense boon to everyone from rock climbers to the military.

It is almost impossible to foresee, though, what will happen to amateur radio—probably more h.f. bands will eventually become available as they are abandoned by commercial users, but amateur TV will almost certainly increase dramatically. Finally, the use of all the telecommunication devices mentioned will have to become a part of education, for their operation will be the life-blood of almost every city on earth.

Angus McKenzie G3OSS

THE FUTURE

In fifty years' time, let us hope we shall still be able to read *Practical Wireless* each month, implying that electronics as a hobby is still within technical reach of the hobbyist.

Ahead of us one sees a more authoritarian society as fashion swings from the excesses of the past fifty years; paradoxically, that increased respect for law and order will reflect in wider freedom in the amateur radio licence. On the technical side of things, one expects pressure on our bands to be higher at v.h.f. and u.h.f., so our v.h.f./u.h.f. allocations will be reduced with, probably, the h.f. bands being widened as some consolation, plus, possibly, some more new bands. The generation of a full-power output signal in all our bands will be achieved in solid-state, but on the receive side one may see some amateurs using "surplus" receivers having valved front ends. These receivers will be relics of the 1980s and 1990s, when designers were worried at the inability of solid-state front ends to survive various specified environmental requirements.

The use of fossil fuels (oil, coal, and natural gas) will have largely ceased, and so personal transport will be electric or pedal-powered, which may affect our /M activities. Plastics will have also been largely dispensed with in favour of "traditional" materials where possible, so that plastics will only be used where it is essential. Recycling of materials will be much more extensively practised, so dead components will not just be slung in the waste-bin but separately packed for return and recycling.

The problem of r.f. interference, from thermostats, TV sets and so on, will be much reduced by the passing of legislation in most countries; we see this as the result of medical electronics outdating the transplanting of organs. Electronic control of artificial limbs by the brain will have arrived, and all these devices will need to have an interference-free environment wherever the patient goes.

Reading and writing will not be obsolete skills in fifty years; we will still be looking at the project in "this month's issue" and deciding we are going to build it—but, doubtless when our latest creation fails to work, in accordance with Sodde's Law, we will take it to our home computer to find the fault and tell us where to apply the rectificatory soldering iron.

Final thought; Morse will still have its devotees!

Paul Essery G3KFE
Editor, "Short Wave Magazine"

Direct satellite TV and cable TV seem likely to arrive in the not-so-distant future, but whether or not these systems will have any real impact and a long-term future must be in some doubt. For small isolated communities direct satellite TV has the advantage of being possibly the only practical form of TV, and is therefore likely to flourish in some parts of the world. The advantages of multichannel cable TV are being rapidly eroded by the spread of video cassette recorders and video disc players, and widespread cable TV is likely to become a reality in this country soon or not at all.

Looking at amateur communications it seems likely that both amateur and citizens' bands will continue to become more and more overcrowded. Specialist interests such as RTTY and television are almost certain to increase in popularity, and CB-TV seems a likely development. A reduction in commercial traffic within the s.w. spectrum due to satellite and other forms of communications could result in more band space being made available to amateur users. We have, of course, seen the allocation of small additional amateur bands in the recent past. However, this may be wishful thinking and ways of using the bands more efficiently may be needed. Perhaps a system where the wanted signal can be isolated from a number of overlapping transmissions will be devised and achieve acceptance.

With the aid of digital electronics it may become possible to have an inexpensive device which fits between a microphone and an s.s.b. transmitter, and gives an audio output having all frequencies reduced by a factor of (say) ten, thus giving a tenfold reduction in the bandwidth of the transmission. The receiver would, of course, need to have a complementary device to restore the original audio frequencies and give a proper audio output. This reduced bandwidth would effectively give s.s.b. users a few dozen extra amateur bands.

No doubt satellite communications will continue and will expand, but this does seem to be a rather round-about means of communication, and it would be much better if a signal of some sort could be beamed from point "A" direct to point "B", straight through the earth if necessary! No doubt someone somewhere is working on a system of this type (a modulated neutrino beam perhaps).

R. A. Penfold

The availability of instant, reliable communications over the whole globe has revolutionised the international business world apart from providing an occasional convenient service for private users. The demand for long distance communications continues to rise at a high rate and costs in real terms can therefore fall.

It has been forecast that by about the year 2000 huge communications satellites (perhaps with 100m diameter reflectors) will be able to provide two-way communication with "Dick Tracey" wrist-watch like personal communicators. They may transmit to the satellite at a power level of about 25mW perhaps at about 5GHz with batteries which would be re-charged over-night. The Americans are already planning such satellites with capacities of over 200 000 simultaneous voice channels which might serve some 25 million users each. Some cost calculations have been based on mass-produced wrist-watch communicators priced at little more than a digital wrist-watch with call charges of the order of 1p per minute. Apart from communications, such a system might be used for personal navigation.

Laser systems offer huge bandwidths for the future with correspondingly high information rates. Indeed, NASA is considering their future use for interplanetary communications. Recent developments in optical fibres indicate they offer a great future for sub-oceanic cables—possibly for a 1988 trans-Atlantic cable. Early this year British Telecom showed that laser signals can be sent along a 102km (63 mile) optical fibre at 140Mbit/s (equivalent to 2000 simultaneous telephone calls) without the use of any repeater unit. Thus the English Channel could be crossed, and perhaps eventually even an ocean, without any repeater amplifier.

Communications applications will be greatly broadened in the coming years. Electronic transmission of mail will be routine, while voting and referenda could be effected by wrist-watch communicators with automatic counting of the votes. Emergency communications are obviously of vital significance and educational techniques could be of considerable importance. Gallium arsenide monolithic devices may well provide the key to the future communications scene.

If one looks back 50 years to the birth of *Practical Wireless,* it is obvious that communications techniques have made enormous progress, but as research continues at an ever-increasing pace, who can attempt to forecast the communications scene 50 years ahead in 2032 A.D.? One can be sure it will be far more varied and interesting than anyone can imagine—always provided no major nuclear war takes place!

Brian Dance

THE FUTURE

Looking forward to the future usually implies some sort of grasp on where you are at the moment—a fixed point from which to extrapolate. In 1932 the vacuum tube was king with many years left to reign. In 1932 the dream was bigger and better vacuum tubes performing wondrous tasks and a bright future for the communications art. The thermionic warmth and glow drew many of us as a moth to a flame.

Today, our reference point does not glow, nor does it radiate that gentle warmth. In 1982 it is the variations of solid-state devices, the intrinsic compacting of thousands of discrete components into ever smaller capsules, and these minutiae of technology go on to create and solve their own needs. The quantity and quality of telecommunications today probably appear to be approaching that same zenith we might have witnessed in 1932. In 1932 the dream would have been more and bigger (tubes), and now in 1982 it is still more, but also significantly smaller (chips).

To forecast what zenith we might see in 2032, or what astounding feats of technology might be commonplace 50 years hence, would presuppose another scientific leap not yet dreamed of. I think that this will be the exciting difference in communications 50 years from now. In the past 50 years we have widened the scope and access of human interaction via "enabling" devices which are elaborations of current technology. However large-scale we make a large-scale i.c. (l.s.i.), it is still a variation on an integrated circuit. We can elaborate on satellites and their access, but we still lack the "enabling" device to take that leap in magnitude for near total freedom in communications.

What I would like to forecast is the development of such an "enabling" device by 2032. The device is simply power—a 6 volt, 1 amp battery weighing less than an ounce and similar in size to a penlight cell that will operate well over a month. Not merely an improvement from 10 hours to 11 or 12 hours, but a leap from hours to months accompanied by a drastic increase in the watts per pound ratio. Such a change would open the technological door for and to the entire world. Direct access to a satellite phone call (or making such a call) via a hand-held unit while walking your dog would be simple. Modes of communication and use of frequency spectrum which may be limited today due to convenient and durable power sources could be readily available.

I foresee in the next 50 years a Shockley of the battery world abstracting to that next leap in technology. The ubiquitous CK722 started a sold-state revolution that still hasn't seen its crest. But its crest, like the electron tube's crest, will come in favour of the next technological breakthough, once we can conveniently power it. The rest will be a piece of cake.

Alan M. Dorhoffer K2EEK
Editor, "CQ"

When I built my first wireless set, an 0–V–1, about 1936, never in my wildest dreams did I expect to get involved in satellites some forty years on.

To look into the future, one has to know what we have now. There are nine satellites operational. Many amateurs use these for communication with varying degrees of skill and at various times. For instance OSCAR 8 transponds from 145MHz Uplink to 29·4MHz Downlink, or 145MHz to 435·1MHz Downlink, and is available for just 20 minutes or so out of each 103 minute orbit. The Russian Series (RS3 to 8) use 145MHz to 29·3MHz for frequency transponding. There are also Robot frequencies on certain RS satellites; the Robot system will reply with a formatted message to a correctly formulated Morse signal asking for a report. Codestore messages are also available for all to hear.

The first UK-built amateur satellite, UOSAT, was launched last November. Although at the time of writing a major problem has occurred with the ground control system, it is hoped that this will soon be cured and UOSAT will again be available for any enthusiast to use. Facilities include: beacon frequency checking on 7, 14, 21, 28, 145 and 435MHz; receiving radiation counts during orbits; Doppler measurements; listening to the Robot voice message, which can be placed in programmed codestores; slow-scan pixel pictures of cloud and earth cover from the on-board c.c.d. camera.

Just around the corner in 1983 is the second of the Phase III satellites, the first unfortunately went swimming a few minutes after launch. This will differ from the past series of Phase II objects, in that it will provide radio amateurs with a communications system for the best part of 15 hours each day. In effect the satellite will appear to hover, mainly over the North Atlantic for the first months of its life, and give near half-global coverage for most of the day. If money can be found (and that is the role of AMSAT world-wide) and enthusiasm is available, we will go into the Phase IV SYNCART (geostationary) series about the year 1986. This will enable full 24-hour communication world-wide by amateurs with low-power u.h.f. equipment.

The system will come about if SYNCART can place packages of equipment on space platforms over, say, each of the three major oceans of the globe. Each package would have a transponder to link into its neighbour and retransmit to the other side of the globe. The h.f. bands as we know them now may well become a waste-land. Who can tell?

After 1990, I can envisage the full use of data transmission, colour TV, colour TV phone-patch, dial-a-"Prestex" system, and full weather reporting by on-board cameras.

The above is, in truth, only a thumbnail sketch of what is envisaged for the future. If you are also interested in that future you are welcome to join AMSAT-UK and be kept informed as the story unfolds. Full details from AMSAT-UK, London E12 5EQ, for the courtesy of a stamped addressed envelope.

Ron Broadbent G3AAJ
Hon. Sec., AMSAT-UK