Into a Ninth Decade

This is my story - decade by decade. These years have seen extraordinary developments which had a major influence on my life. My working life was always involved with electronics and computing, and I was fortunate to be in at nearly the beginning, and to have been involved in a very wide range of work. So this account will interweave some recollections of my personal life, with the story of developments in electronics and computing, as they have affected me.

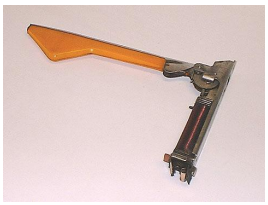
The 1930s

Father and Mother married in April 1931 and I was born in North London on May 30th 1932 (- four years before the 'Turing Machine').Our flrst home was a flat in Muswell Hill, North London. Father was then a teacher at a school in Hackney. These were the years of the huge suburban developments snaking out from London close to the arterial roads - and we soon moved to a new semi in Woodside Park. "Woodside Park Garden Suburb" was a new development with good transport links to Central London. It was close to the Great North Road at North Finchley. At that time, trams were running into London, but about 3 years later these were replaced by the new trolley-bus service. Woodside Park had a station with a frequent LNER steam train service to Finsbury Park and Kings Cross. And for an extra £50 the £800 houses could have a garage for the family car, even though there were not yet many of these. Father soon had an Austin 7 (bought with money given by an aunt). Mother never learnt to drive.

Circumstances meant that I never really got to know my father's family - the Cawseys. Father came from Barnstaple, Devon. He took us there occasionally but it was a long and arduous drive in those days. His connections with Barnstaple were rapidly diminishing; he was an only-child, and most of the family there consisted of aging aunts and distant cousins; most of his own school friends had also left Barnstaple. So the Cawsey side of the family has hardly figured in my personal life - to this day.

It was different with mother's family. She would take me on the steam train to Grandma Hamment at East Finchley (where the new Northern Line tube extension to Barnet was under construction; that would take over the LNER service in 1940). And within a short distance were many more aunts, uncles and cousins. Mother herself was one of four sisters. Bertha, the eldest, was nursing in India in the 1930s On her return to England in about 1938, she brought a foundling, Alison, who she adopted as her daughter and our cousin.

In about 1937, I started school at a nearby private infants/junior school called "Gordon House". A year later, father became Headmaster of Ben Jonson school in Mile End Road, East London. Having slightly more money, he bought a "Morris 8" and I remember it for its 'trafflcators', which needed tinkering with when they got stuck - what a strange invention!



Everything changed in 1939. Father's school was evacuated when the war started, and we went too, flrst to Iver Heath, and then to Eton Wick, near Windsor.

I remember little of my childhood in the 1930s. But the 1930s provides my starting point. Life was incredibly different from today; The Great War and the 1920s slump had slowed progress, and ordinary people lived very much as they had done at the end of the Victorian period. There was no 'consumer society' , and homes and offlces contained very little 'technology'. The Second World War came in 1939, and most of the aspects of life which I now describe applied for the next decade - as I do remember.

Though electric lighting was now widespread, gas light was still a common sight, both in homes, and for street lighting. Central heating was very rare. Open flres in homes were universal, and water heating made wide use of "Ideal" coke -flred boilers.

We all had a coal-shed, usually storing both coal and coke, and the coal-man was a familiar sight. The burning of all this coal - for industry, the railways, and gas-production as well as in the homes - was the cause of the wide-spread pea-souper fogs of autumn days

Food was plentiful enough, but there were no supermarkets or selfservice. There were no frozen or chilled foods, or ready-meals in the shops. Much food was weighed out by the shopkeeper. That included sweets from the large jars in the shops. And there was no sliced bread! Shopping hours were far more limited than today. One could not shop on Sundays, or Bank Holidays, and every town had an 'Early Closing Day', often Wednesday. The seasons of the year had a big effect on what food was available in the shops. We had no refrigerators or freezers at home So other ways were used to store surplus food: 'clamps' for potatoes, 'salting' beans, 'isinglass' or 'waterglass' for storing eggs.

There were no washing machines, and the mangle for drying was universal. Woollen and cotton clothes soon had holes - but these were darned; we did not throw things away. Similarly, worn shoes were taken to the cobbler for repair.

Clocks and watches were valued possessions. On retirement it was common for an employee to be given an engraved watch or clock. Though wrist-watches were becoming common, many people (including railway guards) still used pocket-watches on an 'Albert' chain. All watches (and most clocks, though electric clocks had begun to appear) were spring-powered, had to be wound daily, and were not very accurate.

Very few people travelled abroad - and certainly not for holidays. The great ocean liners were slow. A faster (but expensive) alternative was the "Empire" flying boat service. And the methods of communication with distant (and not-so-distant) places were extremely limited. There was the 'telegram' service, which delivered short messages to almost anywhere - hand delivered by boys. Cities like London had automatic telephone systems, but longer distance calls, and local calls outside London depended on manually operated switchboards.

Huge numbers of people were engaged in manual labour - in agriculture, the coalmines, the docks, the railways, and in textile manufacture. And clerical work was utterly different in those days. Bank statements were still hand-written. Office machinery was in it's infancy. 'Tabulators' using mechanically-read punched cards were the 'computers' of the day, and the companies who made them such as IBM and Powers Samas eventually led the way into modem commercial computing. Carbon-paper was the basic way of producing a second copy of a document. Producing multiple copies depended on creating a wax stencil for a mimeograph (father had one, and using it was a dirty job). And none of this could be in colour. That also applied to mass-market photography; The "Kodak Brownie" was everywhere, but was restricted to blackand-white 'snaps'

Though the days of child-labour had gone, the school-leaving age was still only 14. Childhood was different from today. Toys were few in number - plastic didn't exist then, except for 'bakelite' and 'cellophane'. Ball pens didn't exist, and the 'ink-well' was essential at school. Radio was limited to two BBC channels. The wind-up gramophone was common - with the old 78 rpm records and steel needles which had to be bought by the box and changed frequently.

But even then there were glimpses of the future. Alan Turing had published his description of a "Universal Turing Machine" (1936). Alec Reeves (who I was to meet once much later) had patented "Pulse Code Modulation" (1937), having understood the potential of digital communication. And Claude Shannon had published early papers which would lead to his outstanding work on Information Theory. Few at that time, even in the scientific community, would have recognised the importance of all this early work.

The 1940s

These were the war years, and the years of austerity which followed. I went to the evacuee school in Eton Wick Village Hall for a few months, and then started in the junior class (Form 2) at Windsor County Boys School. I cycled there daily; of course there was little traffic because of petrol rationing. That restricted the few motorists to about 200 miles per month. There were Army vehicles everywhere - and one tipped over in Windsor, crushing father's bicycle when he was only a few feet away! , At Eton Wick we had no electricity and no telephone. Milk was delivered from the churn. The village was 'divided' between 'Church' and 'Chapel'. We went to the Methodist Chapel on Sundays, and I found that acutely boring .. The chapel depended on the dedication and generosity of the Chew family - and the Chew 'girls' became long-term friends of mother and father.

I didn't notice the isolation as a child, but of course we were suddenly away from close family, with no means of direct communication, and only occasional contact..

Like other schoolboys of the period, we all wore short trousers, and the school cap was compulsory wear - with a tassel marking the prefects.. There was a mixed bag of teachers at the school, because some were away in the forces; but fortunately both maths and physics were well taught. There was an obviously fragile relationship between the (left-wing) Physics master (Proctor) and the (right-wing) Chemistry master (Lansbury)!

I was very much involved in school plays - in the later years as a 'lighting electrician'. And as a result I established connections with the "Theatre Royal" and had paid work there in the Christmas Pantomime seasons for several years operating lighting. And I also appeared on stage there as an Arab in "Captain Brassbound's Conversion" in which Dame Flora Robson played the leading role!

.The war ended in 1945, and foreign travel was again possible. I went to Paris, travelling on the "Golden Arrow" train, to stay with a French family. I think this was in 1946.

We moved into Windsor in 1946, my "General Schools Certificate" year. 1947 was the year of the great floods. There was a cold snowy winter, followed by a very sudden spring thaw. Windsor was badly affected; school, quite a long way from the river itself, was flooded deeply - and I remember seeing the 'mountains' created in the classrooms by the ruined floors. But we seemed to get back to school surprisingly soon.

I was then in the 6th Form, taking Physics, Chemistry, Pure Mathematics and Applied Mathematics and two years later got the "State Scholarship" which took me to Cambridge in 1949 - and my first contacts with electronics and computing.

Electronics was still a young science in the late 1940s, even though there had been huge progress during the war. The wireless set had come into almost every home during the 1930s, but was still the only common piece of domestic electronic equipment. All electronics was based on the thermionic valve, whose relative unreliability and large power consumption was a major constraint.

This did not matter too much for domestic radio sets with typically 4 valves, though it did mean that battery sets, essential to those (like us, in the war years) who did not yet have mains electricity, were very heavy because of the accumulators (to power the filaments) and dry batteries (HT and grid-bias). (We would take the accumulators to the bicycle shop to be re-charged each week or so.) The larger radios - and radiograms - were in polished wooden cabinets ('furniture'); smaller sets might be in bakelite cases, or rexine-covered wood The state of electronics pre-1950 had not prevented the development of television,
though there were severe limitations.

1946 Pye D16T 9" (UK)

When TV transmissions resumed after the war, the cost of TV receivers (black & white - with 9" screens) was very high in real terms, and the growth of ownership was quite slow until after 1950. We had a 9" Pye console like this one. The programmes were mainly studio-based. The first live transmission of a TV picture across the channel from France was an 'event' (which I remember).

World-wide telecommunications scarcely existed then. For long-distances, HF 'sky wave' radio (short wave), bounced off the ionosphere, was the only method of transmission, except where the few cables had been installed. And inside the country, the telephone network was still very dependent on manual exchanges, and there was no trunk-dialling

And offices and shops were more as Charles Dickens portrayed! Bank statements were still handwritten. Department stores were festooned with overhead wire systems for catapulting capsules to a central cashier.

Wartime developments had produced the special valves (such as magnetrons and klystrons) which made high-definition radar possible, and by 1950 maritime radar was rapidly spreading to commercial shipping. And wartime needs had already produced specialist 'computers' - such as 'Colossus', though it was not until after the war that the first 'modem' computers (ENIAC & EDSAC) appeared. Even these primitive computers required large numbers of valves, and there really was scant prospect of viable commercial computers until the transistor was invented in 1948.

The 1950s - my early adult life - and the arrival of transistors

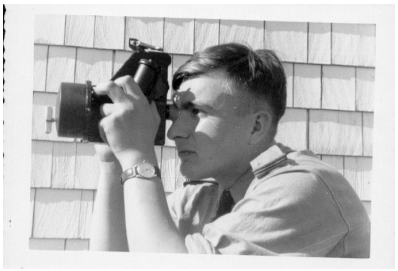
The 1950s were formative years for me.

I was at Cambridge until 1952. Of course I enjoyed it. And I owe much to my education there. It was not so much the factual learning as the instilling of a 'scientific' approach to tackling problems. That has stayed with me when much of the physics is long forgotten.

For Cambridge it was the beginnings of expansion. The small colleges like Christs had their historic buildings which only accommodated one-third (say) of the student numbers. So I lodged with Mrs Peck in Willow Walk for the first year. However the new 'Chancellor's' building in 3rd Court was completed in 1950, and I was one of the first occupants of a bed-sitting room on a corridor (that was newtraditional college rooms had hitherto been 2-room suites on staircases)

Though terms themselves were short, science students returned for additional courses in the 2 'long vac terms'

National Service was still operating when I left Cambridge, and I went into I the RAF, where I was lucky to be selected for Navigator training after the : 'Grading' which included 12 hours flying on Tiger Moths. Air Navigators were important then, since technical aids to navigation were then limited and primitive; so we were taught all the traditional methods of direct-reckoning and celestial navigation



That took me to Canada in 1953. I remember the flight out on a BOAC Stratocruiser from London Airport to Montreal. The London Airport terminals were still in huts close to the Bath Road. And we travelled in uniform, with black arm-bands marking the recent death of Queen Mary. The first hop took us to Shannon where we stayed overnight because of poor flying weather. Then we continued to Gander to refuel, and finally to Montreal 24 hours after leaving London. Then it was a short journey to London Ontario for an introduction fortnight before the long rail journey to Winnipeg.

Leave periods and weekends allowed me to travel in the USA and Canada - mainly hitch-hiking in cars, a fruit truck, and even in a U.S. Airforce DC3 fitted out for paratroopers. There were no 'security' worries then. When I returned from Canada, my final months in the RAF were spent at RAF Kenley - another fortunate posting since Paul Warren was there and I met his twin sister, Kathleen!

I joined Decca Radar in 1954, and worked at Tolworth and then Hersham until 1956. The first stroke of luck was to meet Kathleen Warren again outside Bentalls! And the next was to be invited to apply for a Goodwin Fellowship. That award took me to the USA in 1956/7, as I shall describe.

My own education in electronics had begun at Cambridge in 1950. All practical work in electronics was based on valves, but some lecture courses contained glimpses of the future. Maurice Wilkes, now recognised as a computer pioneer (Sir Maurice Wilkes, who died only recently aged 97), lectured to us on computers; his primitive 'EDSAC' machine was one of the very few computers which then existed.

Solid state physics (on which the transistor is based) was covered in our lectures even though I have no recollection of any mention of the transistor itself. . Experimental work often needed complex calculations; because there were no computers then, hand calculations used tables of functions (log, trig etc), with detailed and accurate tabulation of intermediate steps on paper.

The transistor had been invented in 1948, but few commercially produced transistors were available to system developers for another 5 years. The first transistors were the fragile 'pointcontact' types, and hobbyists could attempt to make transistors with razor-blades as the contacts! Decca (and no doubt some other companies) had the vision to set up a small transistor section in 1954 when the frrstjunction-transistors were appearing in the U.K., and I was in at the beginning of this venture.

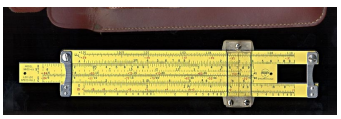
It was an interesting time. Everyone seemed to be trying to make transistors - all the well-known names in the valve industry of the time (Mullard, GEC, BTH, Pye, Ediswan, RCA etc) and many new names. It was a bit like the car industry of the 1920s - many small manufacturers, of whom few would survive. There were all kinds of non-standardised package-shapes. Some of these transistors were disastrously unusable because their manufacturers did not realise that slight contamination could cause unacceptable instability, and early failure.

Transistors like the Mullard OC70/0C71 were based on Germanium. Their frequency response was poor, limiting their usefulness to audio applications, and the high leakage-current meant that stability was an important consideration in circuit design. We used the OC71 initially in a simple transponder - as a learning exercise- and then turned to the design of a radio, and then a radar. The 'pocket' radio worked reasonably well, despite the difficulty in making a satisfactory 'IF' amplifier, but it was never put into production. However a perceptive engineer in a nearby section left Decca at this time and set up Perdio, a now forgotten company which led the way in quantity production of small transistor radios_

Producing a (mainly) transistorised radar was far more challenging, but transistors were improving very quickly. For 'high' frequency work (by the standards of the time), the Philco 'surface-barrier' transistors had appeared. The problem was their delicacy in that they would only safely handle a few milliwatts of power. Designing the radar amplifiers was difficult. I remember my own efforts on 'clever' frequency compensation circuits - successful then, but of no value a year later when transistors had improved by

further leaps and bounds. One of the big leaps forward was the arrival of silicon transistors, Texas Instruments being the pioneer.

All circuit designers were handicapped by the test-equipment available. The ubiquitous oscilloscopes were the primitive Cossor models, though we did acquire an Airmec scope with superior performance - but a tiny screen, viewed in a mirror.



And a further handicap was in facilities for calculation. Of course we were all whizz kids with the slide-rule and with the use of logs and trigonometric tables.

I went to America as a "Goodwin Fellow" in 1956, and worked for the next year on the applications of transistors to process-control instruments. Manning, Maxwell & Moore had a product-line which was built around an electromechanical device called the American Microsen Balance. From today's perspective it seems an extremely weird system. The work itself was not particularly exciting, though it certainly broadened my experience. In the test equipment field, Tektronix had suddenly burst forward with a new generation of oscilloscopes, and I remember making a visit to Yale University simply to use one of the very first of these for some measurements.

Kay joined me in the U.S.A. in January 1957, and we were married in Bridgeport Connecticut. In those days there would have been no thought of family travelling to America. And congratulations reached us by telegram, since telephoning was very difficult in those days. We rented a house for the next six months - close to the beach at Milford, and only a short drive from my work.

We returned to England (and Decca) in summer 1957, and set up home in Addlestone. Christopher was born in 1959 - and Richard and Alison followed.

On returning to Decca in 1957, the next year or so was spent on GCHQ contracts for special receivers and turning gear systems for aerials. From today's perspective the systems look astonishingly clumsy. Selsyns provided a way of coupling a hand-wheel to a remote aerial, but had the dangerous habit of 'motoring'. Magnetic amplifiers provided a 'solid state' (but heavy) solution to motor control, which was beyond the capabilities of the semiconductor devices of the time.

In about 1959 I moved onto high resolution ground surveillance radar - the production of seven prototype systems for Army trials. These were complex valve-based systems - and hence the dissipation of heat was an important part of the design. My own design contributions here - and on some later systems - were concerned with the transmitter. I became expert on 'modulators' - the circuits requiring special valves which could handle 15,000 volts, far and away beyond the capabilities of semiconductor devices at that time. No one knew that microwaves were dangerous then! It was common practice to judge whether power was being radiated by seeing whether your hand got warm!

In the 1950s, telephone systems had been 'modernised'. Before this, automatic exchange systems were generally confined to the big cities - Walton-on- Thames, for example-where I worked for Decca - was a manual exchange until the mid-1950s. Telephone 'modernisation' was based on the electro-mechanical Strowger technology - bulky, noisy, and not very reliable.

Just as this decade was ending, I took a small course on "Computer Engineering", but it would be several years before I actually got any 'hands-on' experience.

The 1960s - the emergence of integrated circuits

We now spent 5 more years living at Addlestone with our young family.

At Decca, after we finished building the Army radars, some smaller projects followed. We did a demonstration project for the Admiralty which incorporated digital electronics in an extremely high speed

mimicking transmitter; we used tunnel diodes as very fast switches. For its time, it was astonishing, and we gained kudos from this work. Another small project was a demonstration radar 'speed gun'. We took this to Stafford and demonstrated it to the Chief Constable on the Stafford by-pass - the first bit of the M6. But this project never went further.

By 1960, germanium transistors had been swept aside by silicon, and valves were only needed for the more difficult tasks such as handling high power or very high frequencies. Various standard logic circuits were the basis for computers. Though they were being built from individual transistors, easier ways were being sought. GCHQ had produced the 'COMBI' elements (standard assemblies of discrete components, potted in resin) which some engineers in Decca were using, but the arrival of integrated circuits soon took over. I was never directly involved in this kind of work, but had some interesting and challenging projects during the next four years or so. Some of these used other semiconductor devices which had emerged: tunnel diodes as extremely fast switches; silicon-controlled-rectifiers (varactors) for power handling; Gunn diodes for microwave generation.

There had been quite large advances in the test equipment field over the 10 years since I had begun work. And we also had calculating machines such as the 'Curta', a small mechanical machine which made quite a difference to hand calculations.

We moved to Shrivenham in 1965. I took on a lecturing post at the Royal Military College of Science (RMCS). For a few years from 1965, we were living in the Army Quarters at "Bower Green". We had a caravan, and used it for summer holidays with the family to distant places in Europe. (France, Spain, Italy, Germany, Switzerland, Denmark, Sweden, Norway) To start with, the only lighting in the caravan was gas, with fragile mantles which broke frequently. Eventually we put in a small fluorescent light, operating from the car battery - quite a step forward!

In 1969 we bought "Vicarage Close" in Shrivenham, which we renamed "The Close". This was half the vicarage - and that half was a 5-bedroomed house together with a stable block and two garages. It was offered for £4950! But because 6 buyers wanted it, the agent for the Church Commission set up a blind auction and we secured the house for £6150. We spent a few thousand pounds on renovations and moved in.

The move to RMCS gave me lot of new work opportunities. In 1965 computers were making their presence felt. RMCS had an Elliot 803 which I could use. Prior to 1965 any programming had been in assembler code - always tedious but high level languages were now on the scene, and the Algol 60 compiler for the Elliot 803 had just arrived. Within a year or two after this, the Elliot machine was replaced by a much larger ICL system. I used this a great deal, but of course the throughput of work was always slow since one usually achieved no more than one run of a Fortran program per day with the punched card batchbased input system. And I don't think that I ever saw the computer itself! Small electronic calculators were also arriving on the scene at about this time - good, but expensive ones from Hewlett Packard, followed by the Sinclair calculators which first put Clive Sinclair on the map.

This decade saw important developments which would bear fruit in the 1970s.. The first minicomputers were available. DEC had the PDP8, though the PDPll was yet to come. Honeywell was marketing the 316, including the rather odd 'kitchen computer'. These machines had very small amounts of magnetic-core memory. But in 1969, Intel produced the first solid state RAM - a lk chip. And within another year or two their first microprocessors were on the market

Of course the lecturing was my main job at RMCS - and I learnt much about telecommunications and radar through having to teach it. And in the earlier years there I led research related into solid-state microwave sources using special devices such as Tunnel Diodes and Gunn Diodes (transistors were

still far too slow for this kind of work). I published a series of papers on this work between 1966 and 1971

Office equipment was still quite minimal. Cutting stencils for spirit duplicators was still the way to produce lecture hand-outs. Fax systems were rare - the expensive and extremely slow Mufax machines were all that was available.

The 1970s: minicomputers and the arrival of microprocessors

In the later years at RMCS my work became increasingly concemed with GCHQ interests. This began with work on 'wavefront analysis'. This was an early example of 'digital signal processing' in which mathematical methods implemented on a computer were used to analyse spatial samples of an incoming radio wave-field and calculate the angles of arrival of components. My work was published, and was also described in Gething's comprehensive book "Radio Direction Finding and Super-resolution". I was also involved in work on HF Over-the-Horizon-Radar. All this work led to a six-month period on temporary attachment to GCHQ, and then I transferred permanently. And that was a good time to move, since computing was really taking offl

By now, minicomputers were on the scene. GCHQ bought many of the small Honeywell machines in the early '70s, but DEC's PDP11 range were to emerge as the leaders. The smallest early PDPlls were difficult to use by modem standards. To start them up one had to manually key in a short 'bootstrap' program which would then suck in the loader program from punched paper tape. Even the more powerful PDPlls were very basic by todays standards. Semiconductor memory did not exist then, and memories consisted of magnetic ferrite rings, threaded with tiny wires. 64kb was a large memory then. These machines had removable hard-disk memory platters, but these only stored 10Mb on each physically large disk.

Just as with transistors, 20 years earlier, many manufacturers came onto the minicomputer scene, of whom few survived. The UK produced some very good machines which are now forgotten. We used the GEC4080 unquestionably technically superior to the competing PDP11/45, but unfortunately not a member of a consistent range of machines. We also used I the Modular One, another innovatively designed machine. Ferranti too, were I producing good minicomputers. We were then moving onto the CORAL 66 language for development, and used this widely for the next 10 years or so.

Our minicomputers were then being used for system control and not for signal processing. Indeed the bulk of GCHQ systems were still employing the RA17 valve communications receivers dating from the '50s, whose performance had not yet been matched by transistorised receivers. In the world of communications, digital signals were already quite common, processed by custom designed logic circuits. But this was still the world of 'skywave' radio. Understanding ionospheric physics was an important skill.

In the mid '70s, microprocessors were appearing, led by the basic, and not very useful, 4-bit processors. The 8-bit processors such as the 8080, Z80, and 6502 then arrived, and thoughts began to turn to the computer-based handling of digital signals, though these processors were still too slow for the bulk of signals. 'Bit-slice' approaches were tried successfully to achieve faster speeds. The transputer was exciting great interest.

At the same time, we were seeing the arrival of personal computers - now that semiconductor memories were available. The first were the Tandy TRS80 (Z80 based) and the Commodore PET (6502) - but memory capacities on these early systems were tiny: 4kb was the basic size.
There was little "Applications Software", and great emphasis on "programming".
So these machines had built-in BASIC interpreters. Along came the Acorn BBC -B (with its superb BASIC interpreter) and the Apple machines, both of which were a

major advance, commonly with 16k memories! And of course there was the cheap (and nasty) Sinclair ZX80. Microsoft were beginning to rise; the first Microsoft product that I used was their assembler for the TRS80. All these early machines used audio cassette tapes for their back-up memory, though the 5.25" floppy disc soon arrived, initially only having a capacity of 100kb.

The Xerox Alto was one ground-breaking machine which I remember being shown, but which I never used. The Xerox Parc laboratories had developed the first Graphical User Interface. Apple then adopted the Xerox technology - and Xerox has been forgotten.

When we moved to Cheltenham in 1975, the children went into the two Grammar Schools, and in the next ten years they all progressed through University into working life. Kay was able to begin a new career! She founded Cheltenham School of English, which was to go from strength to strength during the nest 25 years.

The 1980s - The personal-computer revolution gathers pace

Most of my work had now gravitated to 'real-time computing'. Mini-computers were now at the heart of our systems, and CORAL 66 was still the language of choice (for us). In the world of long-distance communications satellite communications were now dominant. HF communications, previously the mainstay of our work at GCHQ, were dying out rapidly. GCHQs HF 'main' stations were still open, but closure would soon come.

Turning to 'personal' computing, IBM was slow off the mark, and the first IBM PCs were not really a match for Acorn and Apple machines - but of course IBMs name, nationality, and reputation, together with the 'open architecture' ensured their ultimate triumph - even though IBM itself did not retain the initial dominance. Intel's star rose rapidly. The 8080 was succeeded by the sequence of 'CISC' processors which were to lead to the Pentium processors of the '90s. - ever more complex, with smaller and smaller internal structures etched onto the silicon wafers. A battle began, which still continues, between the complex 'CISC' processors of Intel, and the new 'RISC' (reduced instruction set) processors which were beginning to power highpower computer work-stations. Though the most powerful of these were American (e.g. MIPS and SPARC processors), in this country Acorn saw the RISC processor as a route to a reasonably powerful replacement for the BBC machines, through a simple chip consuming low power. This led to the ARM series of processors, starting with the ARM 2 and steadily progressing in performance.

In the early 80s UK firms were still doing interesting things in the computer field - but this did not last. ICLs DRS (Distributed Resource System) was an excellent concept -linking micro-processor based terminals via a wide-band fibre-optic network. It might perhaps have been a world-beater against feeble competition from Wang and IBM. But it foundered.

The rapid improvement in processor performance allowed the installation of graphics-based operating systems, originally devised by Xerox in the '70s, but spearheaded by Apple with the early Lisa and then Macintosh. GEM was another early system which was bundled with the Amstrad PC systems, but was fairly dreadful. Apple led the way for many years, though the Acorn RISCOS became a match for Apple. The (IBM) PC world was for a long time stuck with the MSDOS operating system, partly because the earlier PCs were not powerful enough for Windows and partly because PC operating systems were floppy-disc-resident. But then with the advent of the 486 processors and the arrival of affordable 'Winchester' hard discs, Windows began to take off in the IBM PC world. By the end of the 80s companies such as Acorn, Amiga, Commodore, Tandy, and even Apple, were all struggling.

Acorn had a first class product with the Archimedes, which arrived on the market in 1987. I used these machines for many years, both at work and at home. They not only had a good operating system in

RISCOS, but had good tools for the professional programmer - a good C compiler, powerful library procedures for linking with the windows-manager, and good documentation. There was some good software available too. These were the years before the arrival of office-suites such as Microsoft Office. Word-processors and spread-sheets had become familiar tools, which every computer needed to have. Data-base management was still evolving. The Archimedes had "System Delta Plus", a powerful set of data-base-management tools which could be readily used within the framework of a 'C' (or Basic) program. I made good use of this, as well as the very good desk-top-publishing program, "Impression" ..

I also developed a strong interest in object-based methodologies, particularly related to graphicaluser-interfaces, and this led to a paper that I issued in 1991.

We had not travelled a great deal in the 1970s, but things now changed for me - and us. I made many visits to the USA on business, and also business visits to Canada, Cyprus, Germany and Berlin. These were the days of a divided Germany and the Berlin Wall. We were able to add memorable holidays together to some of my visits to the U.S.A. and Canada.

Since Retirement

As the 1990s began I was soon to retire. It seems such a short time ago to me - and yet it is amazing to realise that so many things which are now part of our modem life have only come into everyday use since 1990.

Digital methods have now become the answer to almost everything! Looking back, I still have a copy of the 1500-page "Radio Designer's Handbook" - an amazing compendium of the electronics design methods of the 1950s - analogue methods, often of great ingenuity, which are of no interest whatsoever to today's designer of digital systems.

Here are just a few headlines:

- In 1990 PCs were still quite limited (compared with today), not only because of speed and memory limitations, but also because of the availability of peripherals. Decent colour systems were only then arriving; early in this decade monitor screens were still mainly green--or perhaps paper-white. Now colour-monitors were universal - but printing still lagged behind. Ink-jet printing had arrived, and the old dot-matrix printers were on their way out.

- Today's computer operating systems were only in their infancy in 1990. Microsoft Windows had been issued in its earliest forms, but it would be several more years before Windows 95 and the dominance that the Microsoft Windows then achieved. Unix had been an important system for larger computers for many years, but Linux was yet to be created (1991).

- Apple were struggling. Steve Jobs had left; he was at NeXT where the Darwin operating system was born. That was to become the basis for Mac OS X when Steve Jobs returned to Apple.

- Applications Software was constrained, not only by the memory restrictions, and the inadequacy of operating systems, but also by the distribution media - sets of floppy discs were only just being supplanted by data CDs. DVDs and recordable CDs were yet to appear. Though networks existed, Tim Bemers-Lee's work on the "World Wide Web" only began in 1990.

- Flash memory had been invented, but it would be a few more years before the now indispensable cheap memory cards and usb pen-drives became available.

- Mobile phone networks were just about beginning to be established. But the very few phones were 'bricks'. Similarly, cordless phones were only just arriving. For telecommunications, microwave link networks, and communication satellites, were still important, but both were being rapidly pushed aside by

the immense investments in fibre-optics

- The first digital cameras just about date back to 1990, but had resolution which would now be totally unacceptable. The very first work which would lead to digital television had only just begun with the formation of MPEG, the Moving Pictures Experts Group, in 1988.

- SatNav would not arrive in consumer products for several more years.

One outstanding British success has been of special interest to me. Back in 1988 I was using the Acorn Archimedes, based on the 'ARM' processor. Very few of those processors had then been made. The subsequent success of the ARM architecture has been phenomenal, and production is said to have exceeded 8 billion!

An ARM processor is now the heart of Raspberry Pi. To me Raspberry Pi has been the (computer) highlight of 2012. How Turing and Wilkes and the other pioneers would have loved it!

What will 2013 bring?