

March 1944 - Eindhoven, Chelmsford and RAF Bradwell Bay

Chelmsford area veterans may well have been aware of the publicity given last year to the presence at Sandford Mill Museum of the WW II Luftwaffe relief model of the Marconi and Hoffmans complex in Chelmsford. This brought to mind for MVA chairman Charles Rand the copy in his possession of an article that appeared in the county magazine in 1970 (The unknown airfield - RAF Bradwell Bay, Essex Countryside, December 1970). It concerned the history of RAF Bradwell Bay, a wartime base for light bomber and nightfighter operations - Bradwell nuclear power station stands on part of the site of the airfield. Of interest to Marconi Veterans are the paragraphs concerning the Luftwaffe raid on the Marconi works on the night of the 21st March, 1944, involving one of the nightfighter units based at Bradwell, 488 Squadron equipped with Mosquito Mk XII/XIII. (the Mk XII is pictured below - IWM photo).

'During winter 1943-4 No. 488 Squadron gradually built up a 'score' of enemy aircraft, but there is no doubt that the highlight was the night of March 21, 1944, when the Luftwaffe, as a reprisal for the RAF's attack on Philips's Eindhoven factories (which the patriotic Dutch had welcomed), decided to wipe out Marconi, Chelmsford, using a picked force of Junkers 88/188 bombers. Not until long afterwards was it released that Chris Vlotman (the only Dutchman flying night fighters) in shooting down two Ju 88s just off the coast had brought down the leader of the formation and that 488 had destroyed all five of the first 'pathfinder' force, two to Squadron Leader Nigel Bunting and the fifth to Flight Lieutenant John Hall. A prisoner, literally blown out of his Junkers, was captured by the Southminster police and the writer helped to hold him as 488's doctor stitched a gash in his face where the jagged fuselage had caught him as the bomber disintegrated in mid-air.

Later, as the allies entered Germany in 1945, an RAF Regiment officer found on a Luftwaffe base a magnificent model of the Marconi works which had apparently been made for briefing pilots for the attack. This is now in the entrance hall at the Chelmsford offices and Chris Vlotman, now captain of a KLM DC8 jet, flew from Alaska some years ago to be the company's guest and speaker at a charity dinner-dance for the Trueloves school for physically handicapped boys at Ingatestone.'

As indicated in the first paragraph, the model is now of course located at the Sandford Mill Museum in Chelmsford - not all of our heritage disappeared off to Oxford! There is an interesting footnote to this story. Charles Rand didn't know the source of the article, or the name of the author. In the Essex Chronicle at the beginning of January appeared the report of a local aviation historian, Stephen P Nunn, signing copies in Maldon of his newly published book 'Maldon, the Dengie and the battle in the skies 1939-1945'. Your editor made contact with him to find out if could throw any light on the source of the article - he could - and it transpired that he is the son of Peter Nunn who was a production engineer with Marconi Communications at Waterhouse Lane until his retirement in the early 90s. Regrettably Peter died in 1995, not long after his retirement, but Charles knew him very well as did no doubt many other Veterans.



Captain Chris Vlotman, DFC, Netherlands War Cross (left), inspecting the model of the Marconi factories made by the Luftwaffe. With him are Mrs Vlotman, Mr Leslie Hunt, local aviation historian, Mr Neil Sutherland, managing director of Marconi, and 'Dusty' Miller, editor of Marconi Magazine. Essex Weekly News photograph.

The Baddow Tower - update

In response to Roy Simons' item and my editorial comments about the history of the CH tower at Baddow, Veteran Bill Fitzgerald sent me a copy of an interview with him which appeared in the Miscellany column of the Essex Chronicle in June 2005. It reported that he was launching a solo campaign to persuade English Heritage to put a preservation order on it, on the grounds that it is the last structurally secure WWII CH radar tower in the country. English Heritage at that time took the view that it was not at risk, because it was still in use. In the accompanying letter Bill reiterated that it is the last remaining CH tower in the UK, but the tower would obviously be at risk should the site be closed down and sold off.

My enquiries to establish the current situation prior to typing this item triggered a flurry of telephone calls, which included The Essex Chronicle telephoning me, but at the time of going to press there is nothing to add. Watch this space.

Radio officers' memoirs

Bill Godden

The photo below is the installation fitted by Glasgow Depot, at the beginning of 1957 on board the Lyles Shipping Company's MV Cape Horn. I joined the ship at Greenock for her maiden voyage in June 1957. The equipment consisted of Oceanspan VI main transmitter, Reliance reserve transmitter, Mercury and Electra main receivers, Vigilant AutoAlarm, Autokey and Alert fixed 500kc/s receiver. All powered by batteries. One of the receiver power packs can be seen under the Morse key, I don't remember the type number. The ship's broadcast receiver I think was a Dynatron. Of particular interest was that the ship was fitted with one of the few Ultrasonic Antifouling Devices, (a Barnacle Buster), I think there were only ever three fitted. The idea was to set up ultrasonic vibrations through the ship's hull to stop marine growth, barnacles and the like attaching to the ship.

We had a good maiden voyage lightship down to Cuba, where we loaded bulk sugar in Boqueron and Cienfuegos and took it to Tokyo.

On passage across the Pacific I experienced my first hurricane, Hurricane Kanoa. We were in it for about a week during which time I was sending weather reports to San Francisco Radio, KFS I think, every four hours. From Japan we were lightship down to McKay in Queensland where we took on another load of bulk sugar for Liverpool and Glasgow.

It was October when we arrived back in the UK after a good trip with a good crew. Most of us signed on for the next trip which was supposed to be a six week run down to South Africa and back. The Third Mate organized to get married on return to the UK, but it turned out to be a long six weeks which took us to South Africa, Mozambique, Texas, Japan, Canada, Ocean Island, Nauru, Australia and New Zealand, in all fourteen months. After spending most of the time in the tropics we signed off in Hull in January 1959. The Third Mate did get married to the same girl.

We had some good fun and, at that time it, was common for ships to disappear over the horizon for two or three years. Some blokes were lucky to get happy ships, a lot were unlucky and the trip was misery from beginning to end. I was lucky in this case.

Felix Mascarenhas

My career in the Marine Company was varied and commenced on the sea staff during the second world war. The Marconi Radio Officer held a unique position on board ship. Although not employed by the shipping company, he came under the direct jurisdiction of the Master and was an integral part of the crew, enjoying the same privileges as the other officers.



I studied to become a Radio Officer at the Wireless College in Colwyn Bay and having passed my 'ticket' I joined the Marconi International Marine Communication Company in July 1941. During the war Radio Officers were in short supply. A senior and two juniors were needed to maintain a 24-hour watch on all deep sea merchant ships. The examination for the necessary qualification, which was issued by the Postmaster General, was held at the college under the jurisdiction of a Post Office Marine Wireless Superintendent, whose main duties involved surveying the wireless equipment on merchant vessels. The exam consisted of sending and receiving Morse code in plain language, in code and in figures at various speeds, a written paper on electronic theory, fault finding on the equipment, and a knowledge of Q codes and operating procedures. To indicate the shortage of Radio Officers at that time, a Marconi Personnel Officer from Liverpool depot attended the college after the exam and immediately signed up those who passed. I had a medical examination on the same day and was appointed to my first ship and was at sea within a few days.

Not much is known of the part the Merchant Navy played in the hostilities. One in every five of the 180,000 men who sailed under the Red Ensign were lost, and this figure includes over 1,400 Radio Officers who gave their lives in the fight for freedom. On a percentage basis the losses were higher than any of the armed services with the exception of aircrews. A total of over 2,400 vessels were sunk, or destroyed by enemy action.

For added protection, whenever possible vessels sailed in convoys of possibly twelve vessels across and ten or more deep, covering an area of several square miles. The Commodore ship was positioned in the centre of the front row of vessels. The Commodore, who usually was a retired Vice-Admiral or Captain, controlled the convoy via encoded flag messages which were acknowledged by all the vessels hoisting the same flags. Over twenty Commodores lost their lives in the North Atlantic. Because radio signals could be picked up by submarines and surface raiders strict radio silence was always observed. Convoy protection was provided by several naval vessels made up of destroyers, corvettes and armed merchant trawlers.

Radio traffic was transmitted to ships every four hours from naval coast stations situated in the United Kingdom and other Commonwealth countries. To ensure that radio silence was maintained the messages were not acknowledged. Instructions

from the ships' owners and/or the Ministry of War Transport were transmitted in code groups of five numbers. Each vessel had a code book containing pages of groups of five numbers. The first two groups in the message indicated where to commence the operation of subtracting the received groups from the numbers in the book. The resulting groups, after subtraction, were then applied to another code book which translated them into plain language. This work was undertaken by the Radio Officer, whose other duties involved keeping a continuous watch on the international distress frequency, listening on the direction-finder for enemy submarines and assisting on the bridge by hoisting flags and signalling with the Aldis lamp. The only time radio silence was broken was when a vessel was attacked. The SOS distress signal was not used, instead SSS was sent to indicate an attack by submarine, AAA an attack by aircraft and RRR an attack by a surface warship.

Deep sea merchant vessels were reasonably well armed. A 4.7 inch gun was mounted on the stern poop-deck. A naval gun-layer and two or three naval ratings manned this weapon, assisted by crew members. A 12-pound anti-aircraft gun on the stern after-deck was manned by two army gunners. Two Oerlikon quick tracer firing guns were mounted on each side of the bridge and two machine guns were mounted on the boat-deck. These were manned by the ship's crew.

One of my worst wartime experiences happened during my second trip in December 1941. I had been appointed to a very old Cardiff tramp ship. We joined our convoy at Milford Haven but were unable to keep up through lack of speed, probably due to engine trouble, and were left behind. We were ordered to rendezvous with another convoy but again we were not able to keep up due to our poor speed, so we were instructed to proceed to Halifax, Nova Scotia in Canada on our own. The weather worsened, and the storm which lasted for several days was one of the worst that I have ever experienced. We lost our lifeboats, which were slung out over the side for easy access, and our rafts, which were fitted as an extra wartime safety measure, were smashed. The vessel's superstructure was considerably damaged by the heavy seas. The cabin, which I shared with the Deck Apprentice Officer and the gun-layer, was also damaged due to the deck-head having been torn open when a machine gun was ripped off its mooring by the seas. The cabin heating consisted of a cast-iron coal-burning stove called a 'bogie'. The excessive draft from the storm force winds caused it to over heat and glow red-hot, and as the deck was awash with water swirling backwards and forwards and over the stove the cabin was filled with clouds of steam. Everything was wet including our bunks. We slept fully clothed with our sea-boots on. It took the best part of four weeks to cross the Atlantic.

I experienced my first encounter with a fatality on board that ship. One of the naval ratings, on leaving his post, was hit by the sea coming over the ship and was not found until daylight the next morning, entangled in the rigging. His burial, attended by all the crew was a sad and unforgettable experience. The ship heaved too, and his body, wrapped in canvas, was put over the side after a short service conducted by the Master.

Halifax was very cold that December and January. The sea water in the harbour was frozen over. To add to our discomfort, repairs to our cabin deck-head were carried out while we were still on board. A large canvas awning was our only protection from the elements. One night the apprentice and I came back from ashore only to find the gun-layer in his bunk completely buried in snow which had emptied into the cabin when the canvas awning had given away. He had previously had quite a few drinks and was oblivious to his perilous predicament. To this day I have never been able to understand the reasoning why this dilapidated old vessel was made a Commodore ship. The Commodore with his complement of naval signallers joined our already over-manned vessel and we lead an 8 knot convoy back to the United Kingdom, fortunately in calm seas via the Arctic Circle without a gun being fired.

At the end of hostilities, conditions gradually returned to normal: only one Radio Officer was required on most ships. As additional equipment became available, such as VHF and UHF-RT sets, single sideband HF-RT, telex, radar, television, closed circuit monitoring equipment, etc, etc, the Radio Officer's duties increased and became a lot more technical.

I sailed on eighteen different ships ranging from cargo ships, troopships, passenger ships, tankers, bulk-carriers, and tramp ships, during the thirteen years I spent at sea. Each voyage was a different experience. Two of my voyages lasted over two years and two lasted over one year without returning to the United Kingdom. It was an enjoyable and a worthwhile career for a young single man. With some regret I hung up my sea boots in 1953 when I joined the Company's shore staff at Cardiff depot as a temporary Marine Technical Assistant.

Looking back over more than sixty years to those days of my youth when joining a ship for another voyage was always an adventure, I only choose to remember the good times, the parties on board ship, the nights ashore in far flung ports all over the world, the ships on the Indian coast where the officers even had their own butler, and Gordon's gin was three rupees a bottle. I often reflect on the hours spent on the bridge at night with the Second Mate somewhere in the vast Pacific ocean picking out the constellations in the star filled sky and marvelling at the magnificence of the Universe.

With the demise of the British Merchant Navy, and the introduction of satellite marine communication systems, the Marconi Radio Officer, like the lamp trimmer, is now surplus to requirements. At the end of hostilities the Marine Company, in its prime, employed 5,500 Radio Officers and had depots and bases and agents situated in ports all over the world. Sadly, very little is left of the once largest marine wireless communication company in the world, but we still have our memories.

Felix now lives in retirement in Dover and invites former colleagues who might be in the area to look him up.



Derek Griess

Fred Kenyon worked at New Street and was an Installation Engineer on TV Studio Equipment. He now lives in Australia and has sent this appreciation of his colleague and friend.

Derek Griess was first and foremost an engineer who devoted his life to his profession in electronics. He epitomized the old-style dedicated professional engineer who loved his work. In his day the Marconi Wireless Telegraph Company (MWT) pioneered the introduction of communications and broadcasting systems all over the world. The role of a Marconi engineer was a very demanding one.

To arrive in a country on the other side of the earth with a pile of gear crated up in wooden boxes and then to have the sole responsibility to turn it into a working transmission system demanded great skill and dedication. We should perhaps remember that there were no satellite phones and contact with one's base was either very difficult or impossible, telex and telegrams took time and often the man in the field was left to his own slender resources. There was no overtime and it was accepted that work twenty four hours a day seven days a week was the norm.

The staff available to help were often completely raw and needed training and frequently the proposed 'On Air' date had been publicised so an expectant audience awaited the first transmission. After a long day Derek would pound away on a portable mechanical typewriter to send his reports back to Chelmsford often asking for spare parts or seeking a missing shipment. It was in this difficult role that Derek established many friends and admirers throughout the world. The Marconi types were a rare breed and Derek represented the best of them.

He had the ability to communicate with the head of the customer's company or the cleaner, often in another language. To them he was Mr Marconi and that company was indeed fortunate to have such a unique representative. There are many many tales of his exploits. For example during the war in the early forties he played a major role in defeating the German submarines then taking almost total control of the Atlantic. During this period he crossed the Atlantic many times during a very active war. He spent a great deal of time later in the Middle East and there is a story of the King of Jordan presenting Derek with a gold watch in gratitude for installing major communications systems for Jordan. But on his return to London when stopped by customs Derek was astounded when asked to pay duty on the King's gift, so he politely told the customs to keep it.

He was always willing to spend precious time explaining to a new recruit how something worked and never talked down to people. He greatly admired Albert Schweitzer and was very similar in many ways. Even in appearance and mannerisms: perhaps it was his Alsatian background. He loved Bach organ music and Schweitzer in particular. But whereas Schweitzer was very much a dedicated Christian, Derek, with his intellectual background, found faith difficult. But the interesting thing is that he lived his life with devotion to the highest possible ethical principles. His life was full of good deeds and kindness and thoughtfulness to others.

I would like to think that when he enters heaven there will be a big welcoming crowd of his family and friends and that he will be overwhelmed and amazed. I can see him saying now 'But why did they let me in' and perhaps the man in charge might reply - 'Derek, you obeyed the greatest commandment - Jesus said to his disciples 'Love one another as I have loved you'. Derek, you expressed love and help to so many in so many places and expected nothing in return.

Baddow Model Shop memories

Rob Wakefield

After reading the latest newsletter I thought I would send you a few lines about the few chaps I work with at Baddow.

I work in the Model Shop with 5 other skilled machinists. I and two others are all Marconi trained and are still very proud to be part of the Marconi history. The news letter transports us back like a time machine as if it were yesterday. The eldest of us came from Pottery Lane, my other colleague from the Radar company and myself from New Street, Bld 29 R&D. Our total service adds up to 104 years. We are all survivors of the collapse of the Marconi

company and have ended up together at Baddow. When you think we are the only millers and turners left working on an old Marconi site in Chelmsford - there were hundreds of us with machine shops at Radar, Waterhouse Lane and the largest at New Street - it kind of makes you proud!

You know you've had too much of modern living when...

- ...you pull up in your drive and use a cellphone to see if anyone is home.
- ...you don't stay in touch with family because they don't have e-mail.

Military Scout & Wireless Cars

The following is an extract from an article by Harry Edwards which appeared in the Autumn 2004 edition of the *Journal of the Morris Register* (Harry was a mechanical designer involved in studio design, OB and radar displays and was with Marconi Marine at retirement. He is the editor of the *Journal* and the *Register's* historian). A Marconi connection with the manufacture of the kit may strike a chord with senior Veterans.

A number of wooden huts comprised the Signals Experimental Establishment, under Colonel C J Aston, the Officer Commanding at Woolwich Common in 1926, when the development work began on the No.1 Set transmitter/receiver. This was the first design by the SEE to employ both radiotelephony and wireless telegraphy and also the first to be designed to work on the move. It was battery operated and two years later in 1928, it was severely tested by the Oxford University expedition to Greenland.

Although wireless had proved to be of great value to artillery during World War 1, the production of a postwar artillery set was shelved for several years. An experimental radiotelephone set working on the 10 metre band was given a trial. The use of this band was a bold innovation at the time, but unfortunately a little premature, the set had a communication range of three miles, which was not enough and in any case was insufficiently robust and liable to frequent faults. The artillery was without wireless until the issue of the No.1 set in 1933.

By 1929 considerable experience had been gained in the design of radiotelephone sets and a new series of army wireless sets was formulated. Originally six types were proposed, the No.1 set being for infantry and artillery brigades; the No.2 for divisions; the No.3 for corps; the No.4 for armies; the No.5 for the L of C; and the No.6 for worldwide strategic communications. Subsequently this series was extended to provide for armoured fighting vehicle sets and later for infantry, anti-aircraft and special purposes.

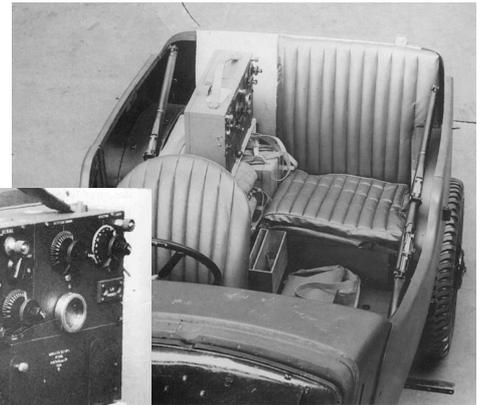
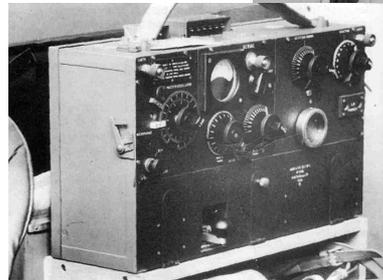
Significant features of the new series were, firstly, the inclusion of radiotelephone facilities in the Nos 1, 2 and 3 sets each covering a relatively narrow frequency band. With an overlap between the Nos.1 and 2, and between the Nos. 2 and 3 respectively the total range of the three sets extended from 6.66 to 1.36 MHz (*presumably converted from wavelength - I assume this means 1.36 to 6.66MHz. Ed.*). It was not considered in 1929 that the use of reflected waves would be feasible for forward tactical communications owing to the vagaries of the skip distance. All these sets were therefore designed to work by ground waves and their communication ranges were limited accordingly.

With the research work and design completed by the Signals Experimental Establishment, it was left to the electronics industry to produce these sets. Manufacturers known to have built and supplied the No.1 sets include Marconi Wireless Telegraph Company, H W Sullivan Ltd, and Aeronautical & General Instruments Ltd.

Around the same time the military began to order small cars for use as scout cars. The first of these appear to have been issued to the 11th Hussars and then other Cavalry regiments, and were the unmilitary-like two seater Austin Seven Gordon England Cup models made at Wembley. An initial order of 65 vehicles was later increased. Early in January 1929 an Austin Seven two-seater with a boxlike boot was made for evaluation by the Army by Page and Hunt. Far more military-like was the Austin Seven two-seater design of 1929 by Mulliners. (Assumed to be Mulliners of Birmingham, a name associated with the Austin Seven.) This two-seater was based on the same lines as the Page & Hunt body with a squared off locker at the rear, within clips were provided for the ubiquitous .303 rifle. In addition to the Austin Seven the overhead camshaft Morris Minor chassis was given the same Mulliner style body in February 1929. So far these vehicles appear to have been used as scout cars. In 1932 a War Department approved design for a two-seater wireless car enters the picture, making use of the No.1 Set.



This same design was used for both Morris Minor and Austin Seven chassis. The boxlike area behind the seats accommodated the radio equipment while a fixed support bracket, bolted to the body side, provided the mounting for the aerial insulator. Published figures suggest that some 176 Austin Sevens of this type went into service, and the writer estimates a total of 169 Morris Minors, most, if not all, based on the 1933 model Morris Minor (see photo left). The writer is not aware of any surviving examples of the Morris versions but a completely restored version of the military Austin Seven, owned by Andy Hodge, complete with the No 1 Set, can usually be seen at the Royal Corps of Signals Museum, Blandford.



The No.1 set, and arrangement of the equipment in the Morris Eight two-seater wireless cars. Bag on left of driver's seat marked 'Bags Aerial Gear, No.2', 6 volt battery MkII in box behind driver, two .303 rifles in clips, No.1 Set

Obituaries

We report the death of the following Veterans, notified to the secretary from the copy date of the last newsletter to 31st December 2006.

We extend our sympathy to the families of those mentioned.

AM Adam, AD Aitkenhead, VF Arnold, LJ Binks, WKC Bloomfield, ER Bradford, HE Brookfield, D Caie, LF Carter, GR Collinson, R Cruise, JA Denny, M Durrant, AC Fagan, J Farr, AJB Fisher, P Fry, CL Gander, RG Giddings, Dr ED Griess, MP Haley, PDJ Haley, BFR Irons, Mrs EG Lang, DH Larkins, EFW Leach, CW MacKenzie, D Mahoney, EG Matthams, HMJ Matthews, R Murrells, G Nash, REJ Pelling, W Phelan, BC Piercy, Miss R Rance, Miss FM Rance, A Roscoe, EHC Rosewell, T Ruddock, PW Saltmarsh, DCA Saville, DC Smith, SS Spraggs, JW Thompson, RV Thorndick, A Troy, DS Tyler, RG Williams.

Nicholas Swarbrick

From Veteran George Cockburn

This contribution was received from George Cockburn, who felt that, although Nicholas Swarbrick was not a Marconi Veteran, he would have been known to some you and so of interest.

I would like to record the death of Nicholas Swarbrick who died on February 2nd aged 107.

Nicholas was a Merchant Navy Radio officer on the Atlantic Convoys during the 1st World War picking up horses in Nova Scotia for shipment to France and later on the Liverpool/New York run ferrying American troops.

He was born in 1898 at Grimsargh near Preston and gained his Certificate of Proficiency in Liverpool. He never married and I would think he would have been the veteran of veterans.

His obituary was in the Daily Telegraph of 8/2/2006 (I have a copy should it be of interest).

Kind regards
Veteran George Cockburn

(I also have a copy of the obituary. Ed.)

Veterans lost and found

Throughout the year individual committee members have come across former employees who have either complained that they had had their long service presentation and Veterans tie some years ago and then no contact from the Association, or that communications from the Association had ceased at some time in the past. There are a number of reasons for these unfortunate situations, including failure of HR/Personnel departments to pass on details of the long service employees details to the association, and failure of Veterans to notify the secretary of a change of address. Whatever the reason, if you know of anyone in this sort of situation do urge them to get in touch with Barry Powell, or pass their details on to Barry yourself. The viability of the organisation depends on a healthy membership roll.

Arthur Adam, 1926 - 2006

Arthur Adam, one of the characters featuring in Eric Walker's reminiscences on page 4, died on the 2nd March 2006. He was the son of a Professor of Chemistry at Southampton University and a mathematician who worked with Neville Shute Norway on the R100 airship. He joined the company in 1946 after reading engineering at Cambridge.

He worked throughout the 50s in Geoffrey Beck's Airborne Navigational Aids Development team at Writtle, and, outside work, pursued his interest in sailing, photography and bird watching. Denys Harrison relates a number of interesting experiences when their perfectly lawful pursuit of these activities brought them to the attention of the law, the maritime authorities and HM Customs and Excise. Perhaps it was that, although legal, these incidents occurred in the hours of darkness!

Arthur judged that the move of all airborne activities from Writtle to Basildon in 1960 would take him too far from his sailing at Maldon, so transferred to Baddow. Writing software for Display and Data Handling Laboratories, he remained there until the mid-70s when because of a slump in contracts and staff reductions at Baddow, he transferred Basildon working in Allan Barrett's team on the comms system for the AEW Nimrod.

In the 80s he retired early due to ill health, but, with his wife Maggie, remained very active. In his closing years he devoted himself to keeping him and Maggie, who he predeceased by only a few months, living independently at their home in Downs Road Maldon. They had no children.



Francis Faulkner, Eric Walker, Denys Harrison and Ray Walls at the Airadio reunion following Arthur Adam's funeral service last March. Photo - Brian Ady

Many of his former colleagues gathered at Chelmsford Crematorium on the 20th March 2006 to bid him farewell, and then afterwards at the Airadio reunion/wake at the Conservative Club in Chelmsford, at the invitation of his closest relatives.