OTN

Old Timers' News

Journal of the ***Radio Amateurs Old Timers Club Australia Inc***

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Contents

Radio Amateurs Old Timers Club Australia Inc

Established 1975 Incorporated 2002 Member of the WIA

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OTN Journal

OTN Journal is published twice yearly by **RAOTC Australia Inc** and is mailed to all **members in March and September of each year.** *OTN* **is dependent upon material supplied by members and all contributions are most welcome,** particularly those describing your experiences in your early years of amateur radio communication.

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RAOTC Membership and Fees

With the objectives to maintain the interest and original pioneer spirit of amateur radio, honour the history and heritage of our hobby, and encourage good fellowship amongst all radio amateurs, **Full membership** of the **RAOTC** is available to any person who has held, or has been qualified to hold, an Amateur Licence for a minimum of 25 years.

Associate membership is available to any person who has held, or has been qualified to hold, an Amateur Licence for a minimum of 10 years. Associate members are entitled to all the privileges of Full membership except the right to vote or to hold office.

Membership subscriptions, which fall due on 30th April each year, are: a $5.00 joining fee for new members (to cover the cost of a membership certificate, recording of membership, and initial postage); $18.00 for a one year membership; or $32.00 for a two year membership; or $375 for a Life membership.

An RAOTC member, on achieving 90 years of age and having been a member for a minimum of 10 years, automatically qualifies for a free Life membership.

The **address flysheet** accompanying your mailed copy of *OTN* journal shows your **RAOTC** membership number and your membership financial situation in a line immediately above your name and address. In addition, if your membership subscription is due, a reminder notice will appear in red ink below your name and address.

Application forms for membership of the **RAOTC** are available from the RAOTC, PO Box 107, Mentone VIC 3194 on receipt of a stamped self-addressed envelope, or on receipt of an email request to *raotc@raotc.org.au* or as a download from the RAOTC web page at *www.raotc.org.au*

Enquiries will be welcomed by Membership Secretary Bill Roper VK3BR on 0416 177 027; or by email to *raotc@raotc.org.au*

RAOTC Broadcasts

VK3OTN, the offical callsign of the RAOTC, transmits news and information sessions for the benefit of members on the first Monday of each month (except January) at the following times and frequencies:

10.00 am	Victorian time (all year)	VK3REC on 147.175 MHz FM, plus 1.825 MHz AM, and 7.146 MHz LSB.
08.00 pm	Victorian time (all year)	VK3REC on 147.175 MHz FM.
08.30 pm	Victorian time (all year)	3.650 MHz LSB.
		Interstate relays
10.00 am	WA time (all year)	VK6OTN on 7.088 MHz LSB and NewsWest FM repeaters.
01.00	UTC (all year)	14.150 MHz USB beaming **North** from Victoria.
07.30 pm	Tasmanian time (all year)	via the VK7RAA network across northern Tasmania and the VK7RTC network in southern Tasmania.
08.30 pm	Local time (all year)	VK7AX Video Stream via BATC - *www.batc.tv/streams/7ax*

Check the RAOTC web site regularly for any broadcast variations plus other broadcast and beacon relays including DMR and D-Star. Call back sessions follow many broadcast transmissions.

RAOTC web site: *www.raotc.org.au*

From the committee . . .

Greetings from the 'bunker', down south of Melbourne. At the time of writing, we are enjoying the benefits of a Stage 4 lockdown with all sorts of controls thrust upon us. However, our hobby of amateur radio has benefits in these restrictive circumstances.

We are still allowed to get on the air and fiddle around with restoring or building equipment and antennas, and so on. I'm lucky in that I have the ability to work simplex on 2 m FM to at least half the Melbourne amateur population.

Generally, I put one of my 2 m transceivers on scan to have a listen around and see who is discussing what. There's generally always something worthwhile to hear during the day.

With HF conditions being so unpredictable in recent times, it gives a little respite from all the pandemic gloom and doom to hear some technical discussion.

When I find something particularly interesting, I halt the scan and listen to the rest of the QSO. I may even break-in on rare occasions.

One QSO I heard back in July 2020, between our editor, Bill VK3BR, and fellow RAOTC member Ron VK3AFW, was the discussion of the final flight of the remaining QANTAS 747 aircraft.

The discussion then moved onto the 787 Dreamliner and other fond memories, with Bill describing a guided tour of a cockpit on one of his visits to the USA whilst the aircraft was in flight.

This led me on to ponder. I worked for 26 years at what was formally called the Aeronautical Research Laboratory in Fishermans Bend, close to Melbourne. Incidentally, this is where the black box flight recorder was invented by Dr David Warren, three years before I was born (see article *The black box flight recorder* in *OTN* March 2020).

It dawned on me that, having worked in the area of structural fatigue testing, I know something about this subject and there was probably something in my working life that may interest other readers.

Therefore, to fill in all the spare time I seem to have recently, I should really start on a couple of articles. It won't be a full-on highly technical article around the subject of Fracture Mechanics, but more from my perspective as a technician.

This leads me on to one of the other benefits of our hobby, or more specifically that of being an RAOTC member.

Most of us have done something useful with our working lives, usually with some type of technical vocation, and there's probably someone else that would be interested in reading about it. So why not, if you have the spare time, fire up the keyboard and start putting something down for others to read?

It may take you a couple of weeks as you revisit your article to get it right, but who's in a rush?

You don't have to be too worried about putting down a fully polished article, the editorial team will clean it up, and turn 'Iron' into 'Gold'!

Photographs are always desirable to illustrate an article, but not essential.

So what's stopping you?

Andy Walton VK3CAH
RAOTC member No 1599

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From the editor . . .

Once again I have been able to produce an issue of *OTN Journal* full with 24 articles covering a wide range of subjects.

Many thanks to those Club members who submitted these interesting articles. However, I must admit it was a close run thing as to whether I would have enough material to fill this edition of *OTN*. Fortunately, a few late arriving contributions saved the day.

At the time of writing, I only have three articles prepared and ready for publication in the next edition of *OTN*, one by prolific contributor Herman Willemsen, one by Ken Morgan VK3CEK, and one by myself.

So how about it, readers? Make sure I have enough articles to fill the next edition of *OTN*. Everyone of you has at least one or more interesting stories to tell of your adventures and experiences in electronics and radio; or any other subject of interest to Club members.

Incidentally, as always, many thanks to Clive VK6CSW for his invaluable assistance to me with his outstanding proof-reading of all articles published in *OTN*.

How many of our Club members listen to the RAOTC monthly news and information broadcasts?

These regular broadcasts are available to listen to on a multitude of frequencies as well as on the internet. Details of many of the broadcast frequencies are at the foot of the previous page of this journal, and full details can be found on the RAOTC web site at: *raotc.org.au*

Our thanks go to the many volunteers who relay these broadcasts each month on a

(continued on page 45)

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Front Cover Photo

The RAOTC's hard working broadcast team Ian Godsil VK3JS (nearest camera) and Bruce Bathols VK3UV recording a monthly news broadcast.

Photo by Bill Roper VK3BR

From our members ...

The bombing of Darwin in 1942

Reading Lloyd Butler VK5BR's article *The early Australian south to north telegraph line* in the September 2020 edition of *OTN Journal*, particularly the sidebar *The 1942 attack on Darwin Post and Telegraph Office* which appears on page14, prompted me to write about me and my parents' adventures in and around Darwin at that time.

I was a 'war baby', born on 20th January 1941 at Bethesda Hospital (now Epworth) in Richmond Victoria. At six months old, I was taken to Darwin to meet up with my Dad, who was in the army stationed there at the Larrakeya Barracks. He was a Warrant Officer Armourer in the RAEME (Royal Australian Electrical and Mechanical Engineers) and, because he was an 'officer' and married, he lived in married officers' quarters, and so was allowed to have his family with him. Dad had previously served in Townsville as a weapons trainer, then later served in Papua New Guinea, and the Solomon Islands.

Mum and I were flown to Darwin from Adelaide in an old Douglas DC2 plane. The DC2 stopped at many stations on the way to Darwin, and I believe the overall trip took several days due to the stopovers and fuel stops.

On the last leg to Darwin, the plane went off course and missed Darwin. It was late afternoon/early evening and Dad was in the control tower listening to the radio traffic when mention was made that the plane was lost and it would probably crash because it was low on fuel.

The pilot asked if the searchlights in Darwin could be turned on and shone vertically. This was done and the DC2 pilots were able to see the search lights, which enabled them to establish they were 90 miles off course and way out to sea.

By this time the fuel in the plane was so low that the pilots shut off one of the DC2's two engines to conserve fuel. Mention was made in the control tower that, "They are goners - they will never make to back to Darwin". Dad heard this comment! Naturally he was quite upset and exclaimed something like, "You have to do something! My wife and six month old son, whom I have never seen, are on that plane!".

The plane only just made it to the airport at Darwin. As it landed it ran out of fuel and the sole engine on which it had been flying stopped. It was a close run thing!

We were evacuated in December 1941, as the army had become aware of the impending bombing of Darwin, which eventually occurred on 19th February 1942. Mum and I were shipped home via Sydney on the SS *Zealandia*, a merchant ship. It had on board the women and children from Darwin and a number of other places.

The trip from Darwin to Sydney took six weeks and was very trying for Mum. From Sydney she then had to get the train home to Melbourne.

After returning to Darwin, the SS *Zealandia* was bombed and strafed in the Japanese attack on 19th February 1942 and sank in Darwin harbour leaving only her masts clear of the water.

Later, in the reports of the bombing of Darwin, the authorities covered up the actual damage and loss of life that had occurred. During WWII it was reported that only a few people were killed, but post war it was eventually revealed that several hundred perished in the bombing.

Bruce Bathols VK3UV
RAOTC member No 1090

Some interesting URLs

Perhaps a semi-regular 'www address box' in *OTN* could be worth thinking about for those who wish to reflect on the past.

As a starter, here are four sites which I found most interesting. I hope *OTN* readers enjoy the nostalgic trip, if they have not already seen these sites:

S/W Broadcast stations' tuning signals
http://www.garlinger.com/QSL/qsl.html
Mullard Radio
https://mullard.org
Digital Signal Identification
https://www.sigidwiki.com/wiki/Database
Eddystone Radio
https://eddystoneusergroup.org.uk/

Peter Wolfenden VK3RV
RAOTC member No 1484

Friendly amateur radio

From 1969 to 1972 I was in Tonga and had the call sign VR5LT. While I was there, Darleen and her husband Gene visited us. They were both US radio hams and operated from Tonga for a while.

Unfortunately, while they were on their way to visit another island, Gene had a massive heart attack and died. It was naturally quite a shock for Darleen who had to arrange the funeral. I asked Darleen if she would write a bit about this experience in Tonga for *OTN Journal*.

Darleen A Magen, WD5FQX, ex HC2YL, JY9DK, and many other call signs in Europe, Asia, South America, etc wrote the short account below:

"My husband, Gene Souligny, was a Senior Law Enforcement Coordinator for the State of California under Governor Ronald Reagan back in 1971. It was a time of great turmoil in our country and we wanted to take a vacation to a place that would be peaceful and quiet, and one in which we might be able to operate amateur radio.

We were very fortunate to get in contact with Bill Toussaint VR5LT, who was living in Nuku'alofa and teaching. Bill was very helpful in getting our amateur radio licence and assisting us in finding a location from which to operate. We made many contacts with Bill and arranged to bring a few things from the States for he and his wife, Dorothy.

"Once we arrived in Tonga, Bill and Dorothy showed us around and we were able to visit the school at which Bill taught. We stayed at the Beach House which was a bed and breakfast type establishment and Gene was able to put up an antenna. We enjoyed many hours talking to friends all over the world via our radio using the call sign VR5DK.

"While there, we made friends with a lovely couple from Austria and a gentleman from Australia and together we made plans to visit another island for the day. Shortly after the boat left the harbor Gene fell down and I thought he had tripped on something but the

Austrian lady who was travelling with us realised he had collapsed from a massive heart attack. The boat immediately returned to the harbor and Gene was taken to the hospital. However, after several unsuccessful attempts to revive him, he was pronounced dead.

"He was then returned to the Beach House bedroom in which we were staying. Many of the gentlemen in the neighbourhood came and sang hymns all night and drank kava and gave me the kava root. Since there were no funeral homes there, people had to be buried right away, so arrangements were made for him to be buried in the cemetery adjacent to the Royal Palace. The King of Tonga sent a beautiful wreath.

"Needless to say, it was a very difficult time for me and I had to pass along the sad news via amateur radio to my family and friends. At that time the airlines were using the old DC3 and there weren't any seats available. Therefore I had to stay for about two weeks before returning home.

"I will forever be very grateful for the warmth and love the Tongan people showed me during this time of grief. I am sure that is the reason they call Tonga, the Friendly Islands.

"It was my intention to return to Tonga and place a headstone on Gene's grave. I left California in February and travelled by ship to Tonga, via Fiji and New Zealand, and was able to place the headstone on his grave and operate amateur radio for a short period of time.

"While there I made many friends all over the world and ended up taking an unplanned trip around the world and operating amateur radio in many countries and islands.

"The highlight was the invitation I received from His Majesty, King Hussein of Jordan, where I spent ten very enjoyable days sightseeing and operating under the call sign of JY9DK.

"I am so thankful to all the wonderful hams I met all over the world for their kindness and hospitality. It has been a pleasure to renew my contacts with Bill Toussaint VK6LT via e-mail. Modern technology is great but I miss the old amateur radio days."

There is no doubt in my mind that amateur radio is one of the greatest means of establishing and maintaining international friendships, as Darleen's story above illustrates.

Bill Toussaint VK6LT
RAOTC member No 1561

OTN Stewart Day Award 2020

Bill Roper VK3BR
RAOTC member No 978

Noel Ferguson VK3FI is the winner of the 2020 award!

As the editor of *OTN Journal* I regularly receive positive feedback from Club members about how much they enjoy reading *OTN*.

The success of *OTN Journal* depends almost entirely upon the articles and photographs submitted for publication by the members of the RAOTC.

Members of the RAOTC have been involved with radio for many years in one form or another, and all have many interesting stories to tell of their experiences, whether those experiences were in the armed forces, with commercial radio, aeronautics, the merchant marine or with the many and various aspects of amateur radio.

The articles published in *OTN* are a varied mix of club members' own experiences and historical items relating to electricity, electronics, communciation, wireless and radio.

This award, entitled the **OTN Stewart Day Award** in order to honour the late Stewart Day's service to the RAOTC in producing *OTN Journal* over a long period of time, is in the form of a colourful certificate. It is presented each year to the RAOTC member whose original contribution to *OTN* has been judged by the RAOTC committee to be the best published in that calendar year.

Incidentally, a list of all past winners of this prestigious award can be found on the RAOTC official web site - *www.raotc.org.au* - under the subheadings 'OTN Journal' and then 'Stewart Day Award'.

Again in 2020, as we have come to expect year after year, there were many excellent contributions published

in *OTN Journal*. This made the task of the committee in selecting the recipient of the 2020 award rather difficult.

However, after much deliberation, it was finally decided to present the OTN Stewart Day Award 2020 to Noel Ferguson VK3FI for his outstanding article aptly titled *A radio journey*, published commencing on page 43 of the March 2020 edition of *OTN Journal*.

In making this decision, the RAOTC management committee would like to compliment all of the contributors of material to *OTN* published during 2020, particularly to our most prolific contributors, Herman Willemsen ex VK2IXV, Lloyd Butler VK5BR and Clive Wallis VK6CSW.

Remember, without the sterling contributions of Club members, RAOTC would not be able to produce such an interesting and popular publication.

As always, as editor I am always looking for more stories and anecdotes of your experiences and adventures in radio!

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The Junker Morse key 1931 - 2014

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

In 1926, Joseph Junker, after a very successful career as a much decorated Captain and Engineer in the German Emperor's Navy, founded a factory in Berlin in which he made radio equipment as well as general equipment for submarines. One of his earliest products was the Junker telegraph key.

Does the Junker look a bit like an American J-38? Maybe slightly, but the Junker is a much more precision built and superior key. It definitely has its own personality.

The Junker key was patented and made in 1931 and called Junker Morsetaste (Morse key) type MT. Junker straight[1] keys weigh close to 1 kg and are probably the most famous German-made Morse keys. This is a good example of German gründlichkeit (thoroughness and carefulness).

Joseph Junker, circa 1945.

In 1945, at the end of WWII, Junker moved its factory from Berlin to Bad Honnef [2], a spa town near Bonn, situated on the river Rhine. Joseph Junker died in 1946, aged 64, but the company bearing his name continued making Morse keys until November 2014, when the company went into liquidation. The business premises are now occupied by a car company.

Detailed information about Junker keys is hard to come by and certainly received a setback when, in 1993, severe flooding of the river Rhine inundated the cellars of the Junker factory. Almost all the archival records, which were housed in the cellars, were wrecked. In addition, when the Junker factory closed down in 2014, it would appear that the liquidators did not keep any of the remaining records.

Junker keys don't all look the same; over the years they showed slightly different mechanical and electronic features.

The early Junker straight keys were produced without a flip-top lid and one model had a narrow base fitted to a knee-clamp for mobile operations. Junker keys came in different colours, with three or four contacts on the back, with a variety of markings on the keys, with different filter circuits to combat radio interference and spark suppression. Often, but not always, its slightly recessed concave knob had a round rubber disk fitted inside.

Junker keys made before 1945 are marked 'D.R.P. Junker'[3]. Additional markings are: 'Entstört' (suppressed), '0-9', 'Feder Spannung' (spring tension) and Bakelite registration/certification imprints inside the concave knob and below the lever.

The more common Junker keys, made after WWII, are marked 'D.B.G.M.'[4] and 'Junker Honnef/Rh'[5].

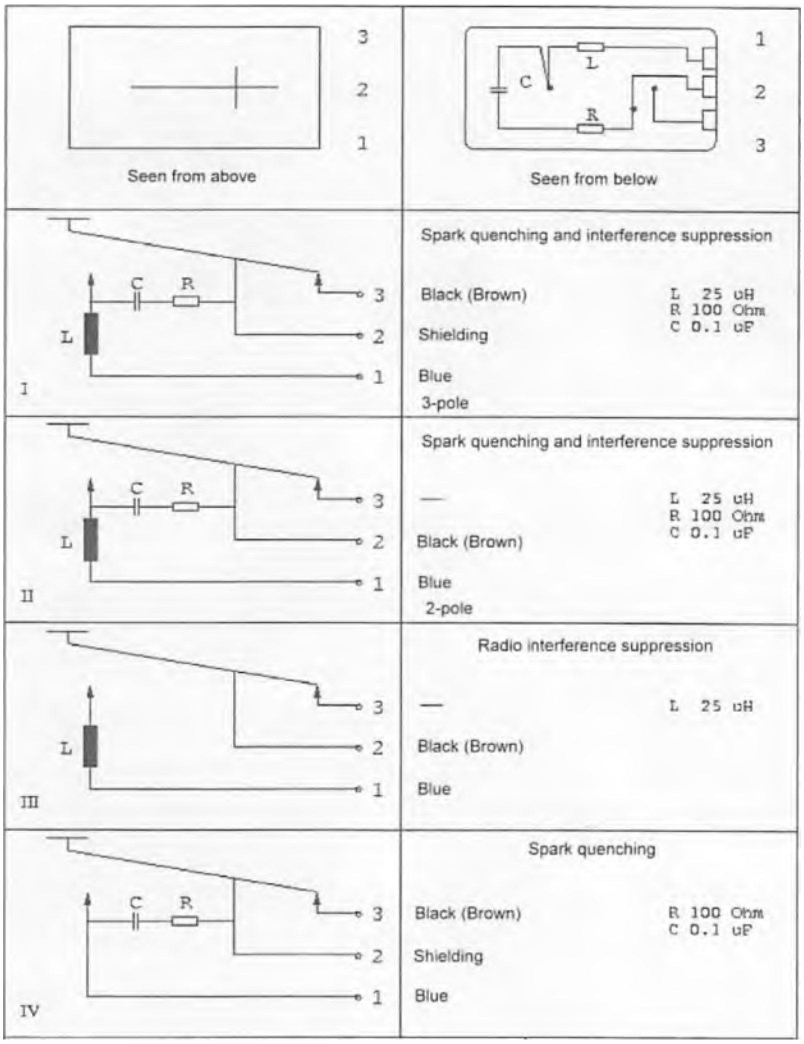
A post WWII DBGM Junker key.

The spark suppression coil comprises of many turns of hand-wound - later, machine-wound - insulated copper wire, tied into a loop and neatly fitted into a circular recess in the base of the key. It is interesting to observe that DBGM Junker keys were ordered with or without the spark suppression coil, depending on the needs of the buyer. According to a German amateur radio operator, those filter circuits (see circuit diagrams on next page) were useful in the past, however modern transceivers do not need them.

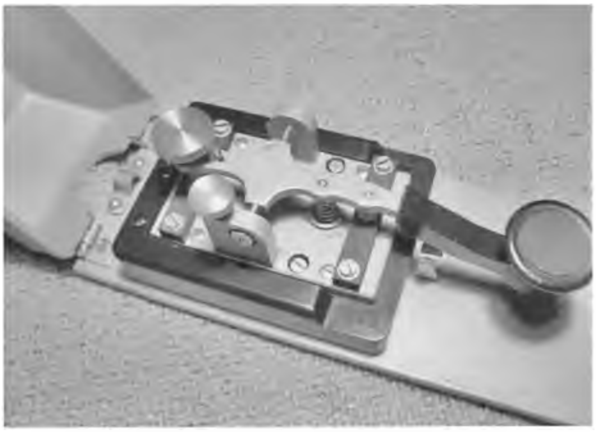
The two adjustment screws on the Junker keys are as follows:

1. The rear round contact gap adjustment thumb screw (diameter circa 2 cm) provides front contact spacing in 0.1 mm click-stops, made possible by a tiny spring-loaded ball bearing which slots into a small cavity in the underside of the round thumb screw. The contacts meet perfectly and are machined hard silver for long wear and high conductivity. On the DRP version this thumb screw is engraved with '0-9'.

2. A smaller round thumb screw (diameter circa 1.2 cm) runs through the left-hand trunnion. On the DRP versions it is engraved with the words 'Feder Spannung' (spring tension). When you turn it, it raises or lowers a little platform under the lever spring. You can actually see the conical spring go up or down when you turn this spring tension knob. Rather than compressing the spring from the top of the lever, it is compressed smoothly from the base up into the lever.



Diagrams of the various filter circuits for the Junker keys with the notations in English.



A DBGM key with the protective flip-flop cover open.

The protective flip-top covers were initially made from cast aluminium, but from the early 1980s onwards they were made from synthetic resin, whilst also introducing some minor design changes. At the same time the gap click-stop adjustment mechanism was replaced by a rubber 'O' ring, both changes likely introduced as cost saving measures.

Contacts on the back of a Junker key

Electrically the key usually has three brass connections, with their terminals embedded in the rear Bakelite wall.

Looking at the back of the key from left to right: 1 = hot or front contact. 2 = common or ground (earth) connection. 3 = rear contact, often not connected internally. The three contacts on the Junker with a knee-clamp were provided in the form of raised external binding posts.

Junker keys often used only two of their three contacts, but there are always exceptions to the rule.

Radio-Holland had their Junkers custom-made by the Junker Company with a fourth contact. To quote Professor Julius Sumner Miller, "Why is it so?"

The exact reason is unknown, not even Radio Holland could find out, but I believe that it had something to do with the electrical separation of the make (front) contact and the break (rear) contact, as required by the Dutch Telecommunications authorities, which made this Junker key compatible with Radio Holland transmitters used at that time. It appears, therefore, that customers in the military and marine industry would order a Morse key from the Junker Company especially made for use with their particular transmitters.

For ordinary operation with a DBGM Junker on a modern transmitter you can safely use contact terminals 1 and 2.

On older valve transmitters and some home-brew transmitters, with cathode or high voltage keying, the voltage across the key could be 100 V plus. In that case it is recommended to use the common/earth contact as well. However, it is always a good idea that, before you connect to live equipment, you check the connection pattern with a multimeter.

Colours and additional information

DRP Junkers were used by the Kriegsmarine (German Navy) and are in general a 'sandy' light grey or a light olive green colour.

DRP Junker keys were the standard Morse keys used in the radio room of WWII German U-boats.

A DRP Junker key and connecting cable with plug from German WWII submarine U-1102.

Underneath a Radio Holland DBGM Junker key with four contacts.

However, as far as I can establish, only the origin of two have been identified[6]. After the war the Junker Company made their DBGM straight keys in a variety of colours, depending upon the customer.

Junker keys used by the Dutch Merchant Navy and by Coast Radio Stations in the Netherlands, Australia and Germany, were a flat 'battle ship' light or dark grey. When NATO[7] was established, they used dark olive green (Army) or silver coloured (Navy) Junker keys. Other Junker key colours are silver grey, metallic grey and even black for its British customers. A dark non-olive green version was used by the German border forces, whilst a green hammertone version may have been a special order for a distinct commercial or other interest group.

As I mentioned before, Junker keys were one of the keys used on Dutch merchant ships.

They were provided by Radio Holland, a Dutch Marine Radio company which furnished Dutch Merchant vessels with radio equipment and Radio Officers. Radio Holland added their own name tag to the German Junker keys and called them SL5 (SL is short for sleutel, the Dutch word for key).[8]

The author, during his days at sea, in the radio room of MV *Straat Cumberland.* Note the two Junker keys.

Buying a Junker key

Up to 2009, Morse Express in the USA sold DBGM Junker keys for US$99.95.

At present the cost of a Junker key varies between AU$180 - 400 and depends on its origin, history, patent, age, particular version, overall state and, last but not least, on how much the buyer wants it and how deep his or her pockets are.

As mentioned in *OTN 40* of March 2008, the Junker key may look like a heavy Panzer tank, but its dull military appearance belies its precision machining and its smoothness of operation. It almost guides and corrects you when sending Morse code.

Footnotes

1. From 1962 to about 1970, the Junker Company also made a semi-automatic key, a look-alike of the American Vibroplex Lightning Bug.

2. Bad Honnef is home to a mineral spring, which was discovered in 1897. This discovery made Honnef, as the town was called at the time, change from a wine-growing town to a Spa town, adding the prefix Bad (German for Bath or Spa) to its name.

3. DRP = Deutsches Reichs Patent = German Empire Patent. A patent has usually a term of 20 years from the date of filing of the application.

4. DBGM = Deutsches Bundes Gebrauchsmuster = German Federal Utility Model. A Gebrauchsmuster differs from a Patent in that it only protects products, not designs. In addition, its term is 10 years from the date of registration.

5. Honnef/Rh = Honnef am Rhein, the spa town of Honnef, situated on the river Rhine.

6. One is from U-boat U-269 (1942-44) marked UT (Unterwasser Telegrafie = Underwater or submarine Telegraphy) and one is on display in a German Museum. The other one, from U-boat (unterseeboot = submarine) U-1102 (1944-45) is marked Mar.N.I/4-20- (Marine Nachrichtengeraete = Navy Communications Equipment N.I/4-20-) and is in the Morse key collection of John Snell G0RDO.

7. NATO, with HQ in Brussels, stands for North Atlantic Treaty Organisation. It was formed in 1949 to provide collective security against the threat posed by the Soviet Union.

8. Radio Holland also supplied the Dutch-made Observator key (SL6) and the Swedish key Pedersen/Amplidan (SL8) to Dutch merchant navy ships. These were apparently preceded by a Marconi key, but I have no further knowledge on that. Radio Holland was not the only company that bought custom-made Junker keys from the Junker Company and attaching their own nameplate to those keys. Redifon in the UK and Elmer in Italy did the same.

Sources

- Jan van Ooijen PA3EGH's collection. See: https://www.pa3egh.nl/morse-keys-from-europe/morse-keys-germany
- Morse Express (Milestone Technologies). See: www.morseex.com/junker/junker2.htm
Its manager, Marshall Emm N1FN, sadly passed away on 17 February 2020.
- Gregor Ulsamer/DL1BFE, writer of the books (in German) *Faszination Morsetasten* and *Faszination Morsetasten - Supplement.*
- For more details see website of John Snell G0RDO at: http://morsemad.com/044.htm

Acknowledgements

Kees van der Spek, Junker Morse key collector and connoisseur, Canberra ACT; Lloyd Butler VK5BR; Bill Roper VK3BR; Jan van Ooijen PA3EGH; John Snell G0RDO; Thomas Kraemer DL4PY; Gregor Ulsamer DL1BFE; and Martin Odenbach DK4XL.

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The Hermannsburg transmitter used a Ford Model T coil

Rodney Champness VK3UG
RAOTC member No 1086

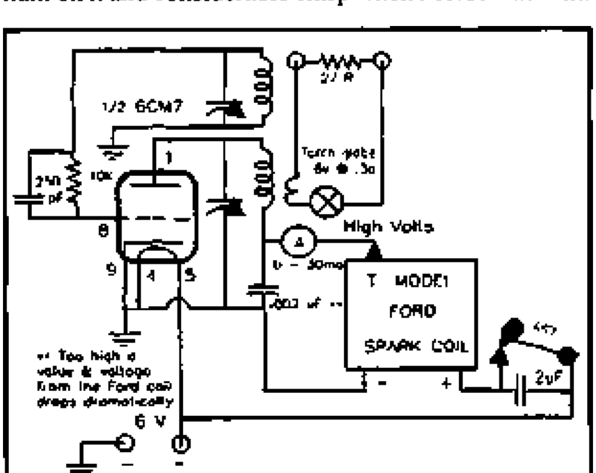
Rodney VK3UG wrote in stating that he enjoyed the September 2019 edition of *OTN Journal*, adding that he thought readers could be interested in some more information about the use of the Ford Model T coil. Rodney made some test transmitters for his book *Outback Radio: From Flynn to Satellites*[1] and achieved some interesting results. One of the experiments was to build a test transmitter using the Ford Model T ignition coil. Rodney wrote it up in his book and the section on these experiments is reproduced below. *Bill Roper VK3BR editor*

The Hermannsburg transmitter

To assess the likely performance of the Hermannsburg transmitter, a test transmitter was built, similar in circuitry to the Hermannsburg unit, and then adjusted to operate in the 3.5 to 3.7 MHz amateur band. It is almost identical to the circuit drawn of the Hermannsburg transmitter, except that the frame of the plate tuning capacitor was earthed, and a modern low gain triode valve (6CM7) designed for vertical deflection television work, was used. These valves have quite a high voltage rating, which is needed in this instance to prevent internal flashover. The original valves are unavailable, and if obtainable would be very expensive and of doubtful quality. A milliammeter was placed in the HT supply lead to observe the amount of current drawn.

Initially, a high voltage DC power supply was connected to the transmitter until such time as the circuit adjustments were made for reliable operation. It was necessary to have quite close coupling between the grid and plate coils to achieve oscillation. The output link coil was wound over the plate coil and its position adjusted for maximum brilliance of the dial lamp in the output line. This also required adjustment of the grid and plate tuned circuits which also changed the output frequency. The 'aerial/earth' was a carbon resistor in series with the lamp. This network is commonly called a dummy load, and takes the place of the aerial/earth network for testing purposes.

The signal as heard on a nearby receiver had some hum on it and considerable chirp when Morse was sent.



Circuit of the Hermannsburg test transmitter using a 6CM7 triode.

It would not be considered a quality signal on the amateur radio bands.

The transmitter was then connected to the output of the Ford T ignition coil. When first switched on, the tuning capacitor in the plate circuit flashed over continuously. This had previously been tested to 1000 volts with no flashover. The output from the Ford T coil is far from a pure sine wave and, although the total energy in the positive and negative excursions of voltage is the same, the peak in one direction is considerably greater than in the other. By reversing the polarity of the 6 volt supply to the coil, the flashover of the tuning capacitor ceased. The transmitter valve acts as a half wave self-rectifying oscillator and, as such, one half wave (the negative part of the wave) is applied across the whole circuit. So, in the first instance, the voltage across the capacitors and the valve amounted to well over 1000 volts negative to plate and positive to chassis/frame. In a short time all of these components would have been damaged.

In this circuit the transmitter emits what is called Interrupted Continuous Wave (ICW) signals, an outmoded, outlawed type of emission. As the waveform from the Ford T coil is very spiky and irregular by nature, it is not possible to directly measure the output power of the transmitter. This is due to cheaper power meters responding to peaks of energy rather than the mean output power. To obtain a reasonably accurate power output figure an identical 'dummy' load was made to that used in the transmitter and supplied with variable voltage direct current. It was adjusted for the same perceived brilliance with the two globes side by side. The power through the network was calculated and hence the radio frequency output power of the transmitter was obtained. The peak power varied by up to 10 decibels according to the wave forms shown on a spectrum analyser.

The signal as heard on an AM receiver is broad in that it can be tuned over a small distance across the dial, and is raucous and unpleasant to listen to. It would have been reasonably easy to find on the band used for the Hermannsburg experiments. This would have been desirable as adjusting either of the tuning controls would cause the transmitter frequency to change. A most unsatisfactory type of transmitter, totally unsuited for use by non technical people.

Here are the technical specifications of the test transmitter, which would be similar to the 1926 Hermannsburg transmitter. With reference to the carrier signal, the sidebands occupy the surrounding radio

(continued on page 12)

James Russell Goding VK3DM

Jim Goding Jnr VK3DM
RAOTC member No 1744

We are shaped by our genes and our environment. Both are provided by our parents. I was particularly lucky and my father, James Russell Goding, had a huge influence on me.

Dad was born in 1915. He was educated at Scotch College and the University of Melbourne, graduating in medicine in December 1938. In 1939 he was Junior Resident Medical Officer at Prince Henry's Hospital when war broke out in September of that year. He enlisted, and following training at Puckapunyal Army Camp, he joined the 2nd/2nd Pioneer Battalion. That year he married Kathleen Patricia Haynes, my mother. His first duties were in Palestine, where there was heavy fighting.

Upon his return voyage Singapore fell to the Japanese in February 1942 and his ship was captured. He remained a prisoner of war in Java until the end of the war in August 1945. The Japanese had plans to kill all the prisoners if the home islands were invaded and forced the prisoners to dig a large pit in preparation. There seems little doubt that the atomic bombs saved my father's life.

Dad rarely talked about his time as a prisoner of war. What little I know is mainly from other sources. I do know that he had been interested in radio and electronics since boyhood and that the prisoners built a secret radio hidden in a chair. If it had been discovered it would have meant certain death. He arrived back in Australia emaciated but in reasonable health considering what he had been through.

I was born in July 1946, followed by my brother Ian in 1948 and my sister Meredith in 1950 - archetypal baby boomers. My brother Peter was born in 1956.

Dad began training in surgery while supporting the family by working in general practice. Working outside an academic or hospital environment, he had difficulty with the very tough surgical exams. He failed Physiology - a real irony since he ended up being a physiologist with an international reputation.

A friend suggested that in order to improve his chances of success in these exams he should contact the legendary Professor 'Pansy' Wright in the Department of Physiology at Melbourne University. Pansy's response was, "We don't give tutorials, but why don't you come and sit in on our research group?" He did so, and became bitten by the research bug.

Before long he reduced his clinical practice to part time and soon became involved in full time research at the Howard Florey Laboratories (later, the Howard Florey Institute). His income must have dropped dramatically. How he managed to support a growing family and send the children to private schools is a miracle, although I do know that his bank overdraft was always maxed out.

Soon after his return to Australia he built the famous 'Williamson' amplifier with twin 807 output valves. The power supply was on a separate chassis and it also drove the electromagnet in the speaker.

I must have shown an interest in all things mechanical and electrical from an early age, and at six or seven I was given a Meccano set. I have memories of him coming home with beautifully machined brass gear wheels in his sports coat pocket. He must have bought them from Herbert Small's camera shop on the corner of Elizabeth and Collins Street, Melbourne. I used them to make gear boxes and differentials. One birthday party was memorable because my birthday cake had a hidden speaker inside it. The music that issued forth was no doubt via the Williamson amplifier.

The rather grand Victorian house at 24 Prospect Hill Road Camberwell, about 1956.

In 1953 we moved into a rather grand but run-down Victorian house in Prospect Hill Road, Camberwell. What a thrill for a seven year old to live in a house with a tower! The tower room became Dad's study, but after he obtained his limited ham licence as VK3ZGG it became his radio shack. He decided to concentrate on the 2 metre band, and built a 10 element Yagi antenna on a pole supported by a timber beam bolted to the balustrade. The flagpole obstructed 360 degree rotation, so he hoisted it up slightly and cut a foot or so off the bottom end and lowered it back down. Adjusting the stub on the driven element for minimum SWR, pronounced "swer", required climbing up a step ladder on the balcony, a hair-raising sight. If you look carefully at the photo you can see the top of the ladder leaning against the balustrade.

In those days, all equipment was home brew. The transmitter was crystal-controlled and amplitude-modulated, with the final stage comprising an 832A dual tetrode with a power of perhaps 20 watts. The receiver had a home-built converter but I can't remember what followed it. In later years, Dad became interested in teletype. He acquired a huge, heavy, noisy Model 15 Teletype machine and a punched tape system.

1957 was designated the International Geophysical Year and in October the world was shocked by the launch of Sputnik 1. The following year the USA launched their first satellite, Explorer 1. Many followed and before long 'ballast' space became available and project OSCAR (Orbital Satellite Carrying Amateur Radio) was initiated. Transmission was on the 2 metre band with Morse HI being repeated at a rate that reflected the temperature in the transmitter. Dad tracked it from the tower with the Yagi and used the Doppler shift to work out its trajectory.

We had lots of fun with mobile ham radio. Dad had an elegant green MG Magnette with a walnut dashboard, but he treated it with minimal respect. He had a tow bar installed to haul a heavy wooden clinker-built sailing boat filled to the brim with camping gear, but the engine was not up to it and gave a lot of trouble. For some reason he decided to install an army disposals altimeter. When we went camping the 10 element Yagi perched on top of all the other junk on the roof rack. Later we acquired an old VW Kombi and I punched a hole in its roof to accommodate the pole for the Yagi.

Dad's enthusiasm for radio and electronics was infectious. Soon I was building crystal sets, and then mucking round with 'acorn' valves bought at Waltham's Army Disposals in Elizabeth Street, Melbourne (otherwise known as Ned Kelly's). These had 1.5 V filaments and could be run off batteries. The circular ceramic sockets were a bit rare, but you could solder directly onto the pins.

Together with my friend John Dobson, we made modulated oscillators and super-regenerative receivers and played pirate radio in Wattle Park. We knew it was illegal to make unlicensed transmitters and were terrified of the 'RI' (radio inspector) whom we imagined to be a big bruiser who would get us into serious trouble, but nothing happened.

Jim Goding (senior) about 1970 in his radio shack. Note the teletype machinery.

While Dad's radio shack was in the tower, I had a workshop in the basement. On one occasion we built a modulated oscillator using two 7193 triodes (with the grid and anode connections at the top), and John spoke into the microphone: "The f---ing thing isn't working". Dad heard it on his receiver in the tower and rushed down shouting: "Don't use language like that!"

TV came to Melbourne in 1956, when I was 10, and *Radio and Hobbies* began publishing articles on building a 5 inch TV using army disposals radar tubes (5BP1 and VCR97). By the age of 12 or 13 I had built my own TV based on the published design. We broke all the rules. The rectifiers for the high voltage were 6H6 dual diodes rated at 150 volts but they managed to cope with 1,000 volts without failing. By the age of 16 I had dismantled the 5 inch TV and built a 17 inch model which served as the family TV for many years.

Left to right: Deane Blackman VK3TX, Jim Goding senior VK3DM and Michael Owen VK3KI. About 1970; portable location unknown.

Dad's connections with the Department of Physiology at Melbourne University created many opportunities for me. He became friends with David Dewhurst, who ran the 'shielded room' for electro-physiological experiments. I had the privilege of spending summer vacations working with David and greatly increased my knowledge of basic electronics. I was allowed to borrow a huge Tektronix 531A oscilloscope for the weekend, lugging it into Dad's car. It allowed me to discover that when a circuit behaved strangely, it often was due to it 'taking off' (uncontrolled oscillation).

I was allowed to sit the AOCP exam (theory and regulations) at the age of 15, but you had to be 16 to get the licence. Dad secretly visited the PMG (as it was in those days) and managed to persuade them to give him my licence on the condition that I would only receive it on my 16th birthday. It was a wonderful birthday present.

At about this time, the amateur radio fraternity was excited at the prospect of being able to communicate by bouncing signals from the moon. It was right at the very edge of what was technically possible and therefore a hugely enticing challenge. The first to achieve it was Sam Harris. We visited his place in Rhododendron Swamp, Massachusetts, where he had a 30 foot dish and his equipment in an old orange school bus.

Dad was so inspired that he began his own project. It got as far as welding a series of concentric circular lengths of steel electrical conduit on the tennis court at 24 Prospect Hill Road, but was abandoned when we moved house. I can't imagine what the buyers thought, nor can I imagine my mother's thoughts at the prospect of the dish being placed on top of the tower...

Around 1965 Dad decided to leave the Howard Florey Institute and change his line of research into reproductive biology. He accepted an invitation to spend a year in the Worcester Foundation in Massachusetts with Gregory Pincus, who developed the biological basis of the contraceptive pill. I was 18 at the time, and was allowed to defer my medical course at Monash University to take what is now known as a

Left to right: Jim Goding, Professor 'Pansy' Wright, and Howard Florey, who won the Nobel Prize for penicillin. Taken in the mid 1960s

'gap year' working in Pincus' lab as a junior technician. Four merino ewes would be transported to the USA for the project. I was to help Dad load the sheep into the Kombi from the loading dock of the Howard Florey Institute, but all four escaped and ran into the rush hour traffic in Royal Parade. It must have been an astonishing sight for the evening traffic. No one got out of the cars to help - they just laughed. Eventually we caught all the sheep and they arrived safely in the USA.

At the time, the Monash University medical course had an eight week 'elective' period in fifth year where students could do just about whatever they liked. Most chose clinical projects, but I spent the time in Dewhurst's laboratory learning to program the PDP8 digital computer, which was 'state of the art' at the time. It had a basic memory of 4096 12 bit words, and a memory cycle time of about 1.5 microseconds. By the end of the elective I was able to write a program that could extract a repetitive signal from a noisy background. During this time I also learned about analogue computers and operational amplifiers, including MUDPAC (Melbourne University Dual Package Analogue Computer). Nowadays the great majority of computing is done digitally, but analogue computing is still used for some specialised applications.

In 1973 Dad planned to spend a year in Paris with Professor Etienne Baulieu. By this time he had obtained his full licence as VK3DM. Long distance phone calls were expensive and the Internet did not exist. I taught myself Morse and obtained my full licence with the aim of keeping in touch via amateur radio, but it was not to be. In the middle of that year both Mum and Dad were diagnosed with metastatic cancer and had to urgently return to Australia. Dad died a few months later, and Mum early the following year. They were only 57.

It is nearly 50 years since Dad and Mum died, and I still think about them nearly every day with gratitude. When I notified the licensing authorities of Dad's death, I asked if it would be possible for me to take over his call sign. I was pleasantly surprised that the request was granted.

Together, Dad and I witnessed an amazing march of technology. In about 1957 he brought home one of the first germanium transistors, an OC71, which cost about £5.00 ($10.00). Integrated circuits came on the market in Australia in 1966. I used to drive to Croydon near Mount Dandenong to buy them directly from the Fairchild factory. I still have a pulse generator that I built in 1969 using RTL ICs (914 dual gate and 923 JK flip flops) and it still works! Later I built a frequency counter using TTL ICs and later still I started playing round with op amps.

I sometimes fantasise about what my father would think if he came back now. He would find the world almost unrecognisable, with the Internet, GPS, mobile phones, a computer on every desk and several in every home, gene cloning and sequencing, genetic engineering, robotic surgery, the list goes on...

Given what has happened over the last 50 years, what the world will be like in 50 years' time is unimaginable.

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The Hermannsburgh transmitter used a Ford Model T coil

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spectrum as follows. The signal is 5 kHz wide at the -10 dB points, 15 kHz wide at the -20 dB points, 40 kHz wide at the -30 dB points, 60 kHz wide at the -40 dB points, 90 kHz wide at the -50 dB points and 350 kHz wide at the -60 dB points. This signal is around 100 times wider than a good quality Morse (CW) signal today!

The harmonic outputs are:- 2nd -25 dB down; 3rd -35 dB down; and the 4th -50 dB down with reference to the carrier frequency. The harmonic output energy is much higher than would be allowed today. Today, in the high frequency region, transmitters up to 1 kW must have no spurious or harmonic energy output greater than -40 dB down, and in the case of citizens band (CB) radio the figure is -60 dB down on the fundamental frequency. The average plate current drawn is 15 mA. The estimated effective plate voltage is at least 500 volts. The radio frequency power is about 3 watts. The transmitter would have an estimated efficiency of around 40%.

Footnote

1. The book *Outback Radio: From Flynn to Satellites* was published in November 2004 and is still available from several sources (Google the internet) including from the author, Rodney VK3UG, for $30 plus $5 postage in Australia. Rodney can be contacted at *rodlynn6@bigpond.com* or on 03 5825 1354.

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My time in the Adelaide University Radio Club

Brian Tideman VK3BCZ
RAOTC member No 1184

Way back in 1957, at the old Unley High School in Adelaide, there was a group of young guys that found that they had a common interest in operating on one metre using the set-ups as described in *Radio and Hobbies*. This group has previously been mentioned in the pages of *OTN* regarding fox hunts on bicycles and Holden car batteries and simple one metre transceivers. Most of these guys went on to Adelaide University and joined the university radio club.

However, given recent publicity to subsequent events regarding the launch of Australis 1 (also known as AO-5) by the group at the Melbourne Astronautical Society, and presumably the amateur radio club VK3ATM, I decided that it was time to recount some of the activities of the Adelaide University Radio Club, VK5UA.

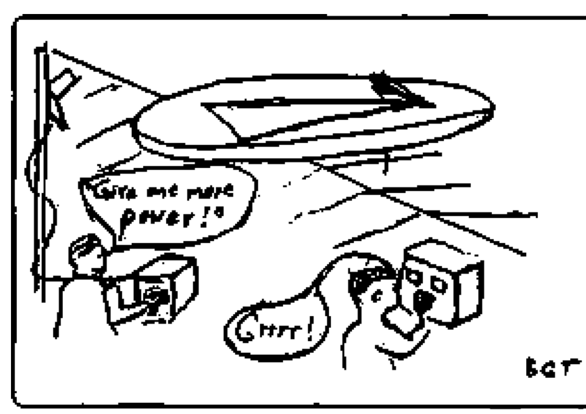
It was apparent that the setting up of VK5UA had been foreshadowed by a final year Bachelor of Engineering student who had repurposed some war surplus gear for a new task. There was a huge 'portable' transmitter that was AM modulated for 3 to 18 MHz paired with a couple of BC348 receivers. The antenna arrangement was probably the main item to be designed by the student. It employed an AT5 antenna coupler driving an end fed wire slung between the engineering building and the nearby Bonython Building. His report examined the resulting polar directivity of the end fed Zepp antenna, and the countries that the lobes of the antenna would service on 20 metres.

I well recall how the club loosely operated by having occasional speakers at special club meetings and how for several years the club advertised for members by being part of the University Prosh Week[1]. We used roving cars with one metre mobile rigs and amazingly managed to enter a float in the annual University procession. The theme adopted that year was the prosecution of someone who used a loud transistor radio on a local train. Our float was designed to look like a railway carriage and featured very loud music and commentary from a tape recorder. As this was in the early days of solid state equipment, we went to the trouble of carting along a mobile generating set to power a high powered modified audio modulator and mains powered tape recorder. The system just managed to work, but it certainly didn't win a prize.

Over the intervening years some of us were distracted from our studies by these on-campus radio activities. However, I still recall a couple of memorable lectures that we arranged on the then fairly new idea of the skeleton slot antenna.

But an even more memorable event followed from the launch of the Russian Sputnik satellite. The father of one our members was Gordon Bowen VK5XU, who had arranged the Moonwatch teams to optically record the time of passing of the satellite. His son, Graham VK5XV, was a very bright student who had delved into the mathematics of space satellite orbits. I well remember at his lecture him saying that the use of rockets to launch satellites had to be controlled well enough so that the orbital velocity was within about one percent of what was theoretically needed. Too low and the satellite would re-enter; too high and the satellite would either go into a highly elliptical orbit or, in the worst case, head off into space.

The use of antennas and transmitters was always a bit problematical. The most amusing and at times embarrassing situation was when lunch time use of, say, 40 metres coincided with Professor Willoughby's antenna testing on the turntable on the roof above the shack. It is not hard to imagine how this occurred as the scale model antennas were being tested over the range 0.2 to 2.0 GHz and the received field strength was measured using a radar diode on a nearby mast. A voice was sometimes heard to say, "Give me more power". A brief transmission on 40 metres would obviously send the field strength reading to full scale.



For a while the club produced its own newsletter called *Splatter*. One notable article was an explanation of how super-regenerative reception or amplification worked. (It was invented and its operation explained by the well known Mr Armstrong.)

One notable supporter of the radio club was Dr Bob Roper VK5PU. Bob was very well known in those days as being that guy in leg irons (due to having suffered from polio) who gave excellent lectures at the WIA SA Division. At the University Physics department Bob did his PhD on reflections from meteor trails. He subsequently moved to Georgia in the US to work for JPL (Jet Propulsion Laboratory) where he continued his work on middle atmosphere winds using modified digital ionosondes[2]. After I retired from the Bureau of Meteorology in 2001, I got in touch with Bob via email and followed his research up until his death in 2012.

Another eminent person connected with the radio club was Professor Malcolm Haskard[3]. I first met Malcolm on 6 metres a few months before I commenced

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A cautionary tale about licence renewal

Bill Roper VK3BR
RAOTC member No 978

I recently received an email, the bulk of which is reproduced below, which emphasises just how important it is that we radio amateurs keep track of our licence renewals and not rely on the ACMA to remind us. Many of us old timers know, or know of, (Professor) Deane Blackman. A number of his excellent articles have been published in *OTN Journal*. Please make sure that what happened to Deane does not happen to you! Here is what Deane's daughter Lisa wrote:

I'm Lisa Blackman VK3FLVB, Deane Blackman's (former VK3TX) daughter. I say former with deep sadness, not because Deane has passed, but because he no longer holds the honour of that callsign. I'm sending you this to highlight to the members of the RAOTC, who indeed hold in honour the callsign they have for a large part of their life, how things can so easily change.

I had the unfortunate experience of reading a recent *Amateur Radio* magazine and recognising Deane's callsign against another person's name. Naturally I made enquiries only to find that indeed it was correct, Deane was not a paid up member and therefore his rare and highly sought after two letter callsign had been reallocated. I am, alas, still a lowly foundation licence holder, but have full intention of expanding that as time becomes more available and Deane, until quite recently, had kept asking me if he thought I could obtain the licence level whereby I could take on his licence. It was an honour to say I would. It meant a lot to the both of us in discussions. I still have his overalls from the Murray River Canoe races in the early 1970s embroidered with his callsign and the years of following the race as a radio escort.

In following up on how this all happened, I had already confirmed through the WIA that the new name I saw was the correct holder of the callsign. My query to the ACMA informed me that Deane's licence had lapsed and therefore been re-allocated. When I asked further about follow up communication they informed me he received a renewal, three months later a reminder, and six months later a notice of callsign cancellation. When I enquired as to how he would have received these knowing his email was not a reliable source, they replied that he received them by post and cited the address.....which was incorrect. They didn't respond after I pointed this out.

Sadly, Deane is now not in the best of spaces which would reflect in his absence from the RAOTC, and I replied to the ACMA that he would be devastated to know this had happened. I found it a travesty that the process was by simply administration rules rather than any personal follow-up for such a long standing and active member of amateur radio. I find it very sad I can't take on his callsign, although I absolutely know I would never do it justice to the level of knowledge and input he gave it, but it would have been an honour to try to do so.

The callsign is reallocated, that can't be reversed. Passing it on as he wanted is not the real issue either. I felt I had to let you know to perhaps make members of the RAOTC aware of how easily this can happen whether it's intentional or not. The fact his callsign was a sought after two letter call is incidental, a callsign for someone who has held a particular callsign for so many years should be followed-up in the event of a lapsing renewal to make sure that is indeed their intent. It's a fact of life that the notion of medical or personal issues arise as one ages and these administrative things can be overlooked so easily, so a simple personal follow up could make all the difference.

My greatest sadness over all of this, Bill, is that when the day comes Deane does pass (and he is in good physical health currently so I'm certainly not expecting that soon) he will not be honoured and respected or even acknowledged as VK3TX, such an active and engaged callsign for so many decades, because how can that be when the callsign is in active use by someone else now.

I had the privilege of accompanying Deane to a number of RAOTC luncheons and met so many fabulous people, including yourself, I couldn't not let you know of my frustration. Deane would be completely shattered to know of this; it was not what he wanted, so I hope he never will. ar

My time in the Adelaide University Radio Club

(continued from previous page)

my studies. I was fascinated by the way he was methodically working through his final year Bachelor of Engineering project on the Costas phase locked loop method of reception of double sideband. Malcolm eventually ended his career in Adelaide after doing great work, I understand, on integrated circuits for Fast Fourier Transforms and other nano scale systems.

On another personal note, I was one who was distracted from my studies and changed from the Bachelor of Engineering course to Bachelor of Technology in that same Bonython Building. I should add that that long wire between the two institutions also became a 160 metre dipole when VK5UA operated on one occasion during the Remembrance Day contest. The antenna worked very well on 160 metres!

Finally, I learnt that the Institute of Technology also had an old wartime transmitter for use on the ham bands. The call-sign was VK5SM, evidently from the days of the old School of Mines.

Does anyone have any knowledge of the activities of that station?

Footnotes

1. Google 'Adelaide University Prosh Week' for information on Prosh Day and Prosh Week activities.
2. An ionosonde is a swept-frequency vertical-incidence high frequency radar.
3. Professor Malcom Haskard VK5BA, RAOTC member No 1107.

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No roses on a sailor's grave[1]

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

In March 2020, a former German Marine Radio Officer drew my attention to an article written in the German magazine *Seefunkkameradschaft*, Ausgabe 1/2020 (Marine Radio Comradeship, Issue 1/2020). The article was titled *Der Australische Kümo Noongah* (*The Australian Coaster Noongah*) and was supplied by Glenn Dunstan.

I happen to know Glenn Dunstan[2] from my days at OTC (Overseas Telecommunications Commission) and after contacting him, Peter Young and many others, I obtained enough information to write this article.

51 years ago, on 25th August 1969, the small Australian coastal vessel MV *Noongah* went down off the mid-NSW coast, eight nautical miles (14.8 km) from Crescent Head.

MV *Noongah*, a small Australian coastal ship.

The MV *Noongah*[4] was built in Glasgow, Scotland, in 1955. Details are: Construction: steel; Engine: internal combustion engine, which generated 1,000 bhp giving her a speed of 9.5 knots (17.5 km/h); Tonnage: 1,464 GRT (Gross register tonnage); Length: 71.6 metres; and Beam: 11.3 metres. She was owned by ANL (Australian National Line); and her Port of Registry was Melbourne.

Her navigation equipment was minimal, with just a magnetic compass and an echo sounder, but no DF or radar. Under the pre-GMDSS (Global Maritime Distress and Safety System) or 'old' SOLAS (Safety of Life at Sea) system[5], the *Noongah*, being under 1,600 GRT, was not legally required to carry Wireless Telegraphy and a Radio Officer. However, she was a 'voluntary fitted vessel', with the radio callsign VMTC. Her radio equipment was as follows:

One mechanical wind-up radio room clock with WT Silence Periods only;

Two battery-powered AWA Australguard 100 W MF Emergency transmitters, of which one can be seen in the photo of the radio room[6];

The Morse code key is a 2-terminal Clipsal 610. Also in the picture is one of her two AWA Marine C6940 LF/MF receivers. The box on the right hand side of the receiver is a vibrator power supply running off 24 volt batteries. The vessel had two 24 Vdc 200 AH battery banks on board.

Although not seen in the photo, she also carried a Duval Radio Corporation Auto Alarm keyer (a clockwork wind-up job) to automatically send on 500 kHz, if required, the Telegraphic Auto Alarm signal of 12 dashes including the ship's radio callsign VMTC. She did not, however, carry an Auto Alarm receiver.

The radio room of MV *Noongah* in 1968.

The other piece of radio equipment on board would have been an AWA PilotPhone III with six VHF channels.

The *Noongah*'s Radio Officer was 21-year-old Stephen Pedemont from Sydney. Stephen had passed all his examinations for the 1st Class Radio Certificate at the age of 17 but had to wait until his 18th birthday to be issued with his Certificate. As he couldn't get a sea posting, he temporarily worked as a lecturer at the Sydney Marconi School of Wireless before he eventually went to sea at the age of 21.

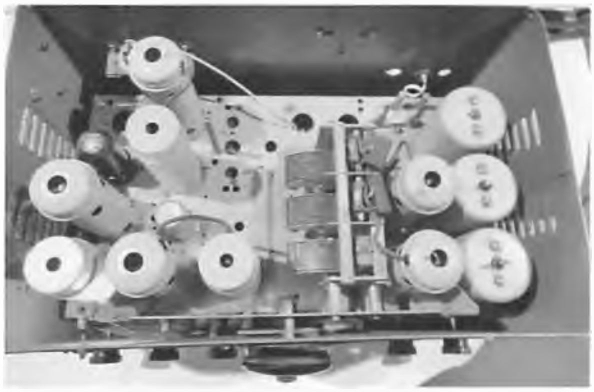
The *Noongah* was Stephen's first ship. He joined her in Port Kembla and sailed on her to Newcastle.

The vessel left Newcastle for Townsville on Saturday, 23rd August 1969 with a cargo of 1,472 tons of steel products. She ran into a severe depression with 60 knot (111 km/h) winds and 10 metre seas off Smoky Cape, near Kempsey.

The ship was rolling violently. She began to take on water and developed a list. On the morning of the sinking, Pedemont was summoned by the Captain at about 0345. At 0352, he sent a XXX urgency signal and urgency message, to the OTC Coast Radio Station Sydneyradio/VIS, stating that the ship had a 15 degree starboard list which was increasing and unable to be corrected.

At 0423, this XXX signal and message was upgraded to an SOS distress signal and a distress message.

At 0437, Pedemont sent the last message from the *Noongah* advising that the ship was being abandoned.



An inside view of an AWA C6940 LF/MF receiver.

The *Noongah*'s 26 crew abandoned ship in the dead of night, just 14 minutes after the distress signal had been transmitted.

At 0440 hours, the ship sank rapidly, head down in an estimated depth of 70 fathoms (128 metres).

The search for survivors, which covered over 2,000 square miles (5,180 square km) of sea, lasted four days and included more than 2,500 people, was one of the greatest in Australia's history. It involved five RAN destroyers, three RAN minesweepers, seven aircraft including an RAAF Hercules, two helicopters and a number of other vessels. Five survivors and one body were pulled from the water but, sadly, the remaining 20 officers and crew, amongst them Stephen, were never found.

It appears that Stephen probably had been unable to escape from the radio room/bridge area before the ship went under.

The cause of the sinking remains a mystery, although several theories floated around, including cargo shifting and seawater entering a forward hold. Marine experts determined that the ship sank because of the weight of water and cargo in the forward hold, but the reason for this could not be established.

Lest we forget.

Sources

Marine inquiry transcripts and newspaper reports.

Footnotes

1. From a German song:

There are no roses on a sailor's grave.
No lilies on an ocean wave.
The only tribute is the seagulls' sweeps,
And the teardrops that a sweetheart weeps.

2. In his professional life, Glenn VK4DU was a Merchant Navy Radio Officer, an Australian Government Marine Radio Regulator and ran a company designing and installing GMDSS coast radio stations worldwide.

3. Peter Young VK3MV was a Marine Radio Officer, a Service and Commissioning Engineer, and later a Commonwealth Marine Radar Surveyor.

4. MV *Noongah* was rivet-for-rivet identical to the coaster MV *Nilpena* (callsignVMPB), also built for the ANL in Glasgow a year earlier.

5. See my article *Morse code no longer rules the Marine radio waves* in *OTN* 48, September 2011.

6. Similar to the Marconi 'Reliance' emergency transmitter. See: http://jproc.ca/britishmarconi/reliance.html

AWA built some equipment, with a few improvements, under licence from Marconi.

Acknowledgements

•Glenn Dunstan VK4DU; •Chris Chapman VK3QB, •Peter Young VK3MV; •Sylvester Foecking DH4PB; •Bernie Nicholson; •Col Christiansen VK2BCC; and numerous others who responded to my advertisement in *VK Classifieds*.

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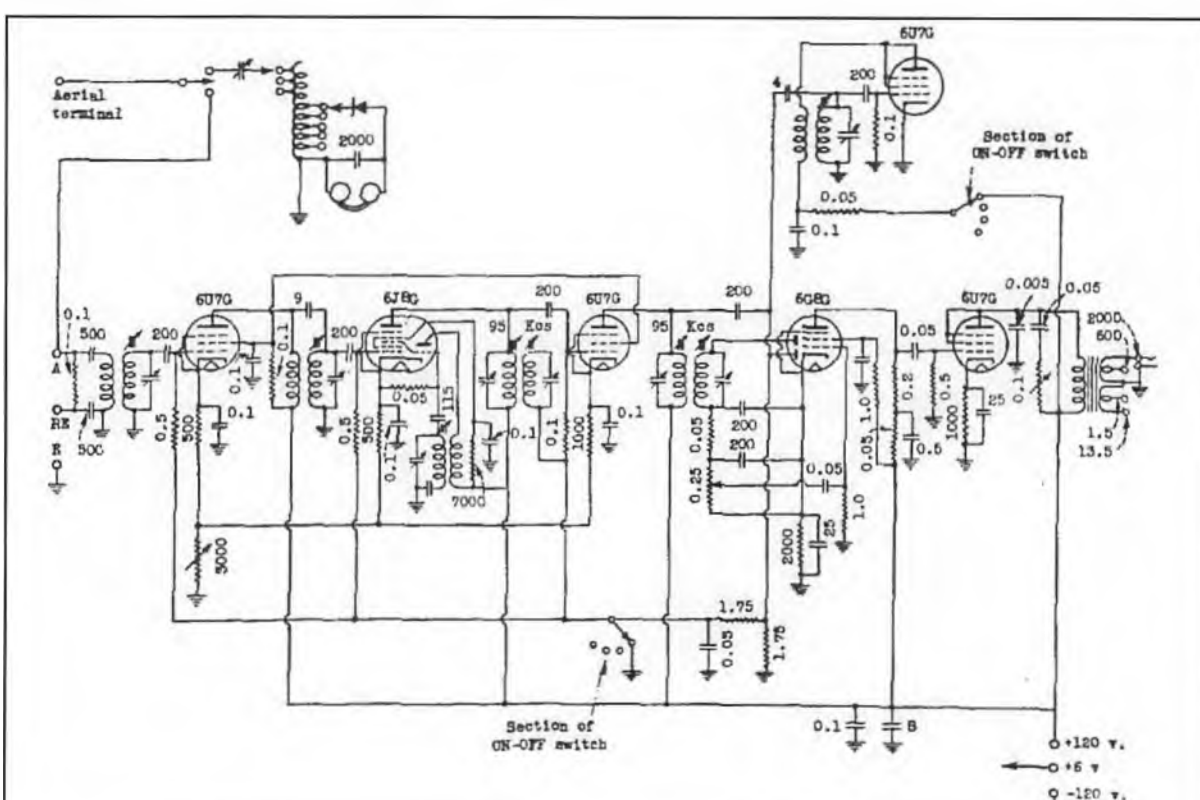

Circuit diagram of an AWA C6940 LF/MF receiver.

Secret wireless intercept war

Steve Mason OAM (SK)

Sadly, the author of this article, a good friend for 60 years, became a Silent Key at the grand age of 96 on 30th October 2020. *OTN* has previously published much of the story of the Australian Special Wireless Group (ASWG) in two previous articles, *A little about the ASWG during WWII* in the September 2000 edition and *The secret war of the airwaves* in the March 2003 edition of *OTN Journal*. The story is well worth retelling and I have précised this article from Steve's papers. Steve was a highly skilled Morse operator, but was able to resist my endeavours to coerce him into taking out an amateur radio licence. *Bill Roper VK3BR*

This story, which concerns the interception of enemy wireless transmissions, is about a little publicised AIF (Australian Imperial Force) unit which operated during WWII. Very little has been written about the work of this Unit. In fact, for 50 years after the war it was kept in the Top Secret drawer and even now, some parts of the work are still under wraps.

The Unit was concerned with the interception of enemy wireless transmissions and the monitoring of Allied wireless transmission.

Wireless interception

Interception must go through a number of stages for it to be of any value. First of all the message must be intercepted. That was not an easy job. The intercepting operator had to locate the transmitting station, identify it, and then he had to concentrate to the greatest of his ability to get the message down on his message pad as accurately as possible.

He also had to contend with atmospherics, fading Morse signals, interfering stations and just plain poor Morse, so it was not easy.

He never had the luxury of asking the transmitting station to repeat if he wasn't sure of any part of the message he had taken! Certainly, if the transmitting station did repeat any part of the message that was a bonus because he could confirm what he had already written.

Once intercepted, the message was sent for decoding and, if necessary, translating, after which it was analysed to determine if the contents were useful to any government department, section, army unit or what-have-you. If so, the sooner it was delivered, the better.

During WWI there was very little interception done. At that time, signalmen came under the category of engineers. Most of the communication was by line which was subject to breakages and bombing, and was difficult to lay in certain unfavourable terrains. With the use of wireless, messages were sent in Morse code but they were open to interception.

Between WWI and WWII some countries continued to develop their intercepting procedures, in particular the British and the Germans.

For a while the Americans were in it, but in the early 1930s a Mr Stimson, who oddly enough later became the US Secretary for War, ruled that the Americans would no longer intercept another country's transmissions because it was 'ungentlemanly' to do so. We can only be grateful that the British were not 'gentlemen'!

The beginning of the ASWG

Come the outbreak of WWII, the Australian Army had no intercept facilities and, in June 1940, took steps towards rectifying the situation. A small Section was formed at Seymour, comprising 99 men. It was self sufficient, with its own wireless operators, cooks, drivers, instrument mechanics, linesmen, electricians and intelligence people so that it could be used independently in any area where it was wanted.

Photo by Bill Roper VK3BR

Steve Mason speaking at a Remembrance Day Service in 2019.

The recruiting of the wireless operators was interesting. Men were sought out who had a Morse background. That meant that many of the operators had worked in the Post Office where they had operated sounder machines, but there were also some ship's operators and there were certainly some amateur radio operators.

In December 1940, the Section moved to Melbourne and embarked on the *Queen Mary* for the Middle East. Morse practice continued on board, interspersed with PT and sport. In Ceylon (now Sri Lanka) the Section transferred to the Dutch liner *Slamat*, arriving in Egypt and setting up camp at El Amiriya where they were taken in hand by the British.

Training continued and operators were drilled on German and Italian message procedures. Some members received advanced training with a specialist signal unit stationed near Cairo. At a new camp, Ikingi Maryut, further training was carried out using Kingsley AR7s, R109 and R101 wireless sets. 30 cwt (1.524 tonne) trucks were provided and those were converted into set trucks which allowed for six operators and a supervisor.

Their first assignment was in Greece and they sailed for Piraeus on the British transport ship *Breconshire*. A camp was established at Glyphada, now a seaside resort

A Kingsley AR7 receiver identical to that used by the Australian Special Wireless Group.

suburb of Athens. They had some more training to do because, although the Australian operators were well trained in Morse, they had more to learn about the procedures, idiosyncrasies and all the other unusual things that happened with German and Italian operators.

They gradually moved up north in the country, finally settling somewhere near Mt Olympus at a place called Elassona. Aerials were erected at Happy Valley, near Elassona, and the Section was in business. All the time they were able to intercept German communications. At that time the Germans were very confident, one might almost say arrogant, so much so that they did not bother to encode many of their messages.

At one stage operators intercepted a message indicating that the Germans planned a coup in Belgrade, then invade Yugoslavia and cross into Greece.

The CO of the Unit was Captain Jack Ryan. In civilian life he was the Chief Engineer of radio station 3AW. His second in Command was Lieutenant Arthur Henry, who was a skilled amateur radio operator and brilliant technician.

Jack let the Commander of the area know about the message and he was very disappointed to get a message in reply from the Commander which read, "You must be mistaken. Everything up here is as quiet as Bourke Street on a Sunday". Well, Belgrade fell, and the Germans invaded Yugoslavia and came into Greece. The Commander was wrong, the Section was right!

Later, the Section was congratulated on the work they performed, but the exercise did underline the need to convince the top administrators that the information was accurate and could be relied upon.

The Allies put up good, stout resistance, but it was weight of numbers which defeated them. That led to a series of withdrawals which the Section was caught up in.

Once, they picked up a message which proved to be very beneficial for the campaign in the Western Desert, and received a commendation for the work they did there.

When they had withdrawn as far as Thebes, a Top Secret message ordered them to withdraw to Piraeus, the port of Athens, and prepare for evacuation.

Of course, all Code Books, secret papers and so forth had to be destroyed. They accessed a bombed house where there was a fire burning in the front room and were able to load their papers on to the fire till it burnt down. They were looking around for a bit of material to burn and spotted a high ranking Greek officer asleep in the corner. Alongside him was his swagger stick. So they extracted the swagger stick and put it on the fire, which gave them a bit of warmth for a while on the cold night until it burnt down just to its knob. They carefully extracted it from the fire, put out the embers, and replaced the knob back alongside the general. He would have received quite a surprise when he woke up!

They embarked on a little ship called the *Else,* the last to leave Greece before the Germans arrived. On board it was chaos. The wireless equipment and stores had been taken on board, together with troops, diplomats, politicians, correspondents and 130 German prisoners of war. The ship went to sea, under pretty heavy air attack, without anti aircraft equipment - maybe a Bren gun and some small arms fire to direct at attacking aircraft.

Again the section was able to be of great value. One of the intelligence personnel, a linguist, overheard the German POWs planning to take over the ship, so warning was given and nothing came of the Germans' plans.

The Section landed on Crete. The defending force was commanded by General Freyberg, a New Zealand General and VC winner. He and Winston Churchill were probably the two staunchest supporters of information gained from intercepted enemy communications. General Freyberg was supplied with a steady stream of operational intelligence, including enemy occupation of adjacent islands, air activity, movement of large numbers of transport aircraft, sightings by the Germans of Allied naval movements in the Rhodes area, and weather reports, etc. German messages were decoded on sight, probably being read as quickly as by the Germans themselves.

The Section intercepted a message that an invasion of Crete would be from the air and that the first target was to be the airfield at Maleme. Freyberg was notified of this information and his first reaction would have been to reinforce troops around the airfield. However, here he had a problem. If the Germans encountered opposition far greater than they could ever have expected when they landed around the airfield, they could well tumble to the fact that their codes had been broken and that would prejudice future Allied operations. So he reinforced the area but not to the extent that he would have liked.

The attack from the air came, German casualties were heavy, but again weight of numbers forced a retreat and eventual evacuation. The section had taken up a position on the cliffs overlooking Souda Bay and had intercepted a message advising that the Germans were to reinforce the troops on the island from the sea and were sending a convoy to do just that. The Royal Navy was notified and three cruisers were put into position, including HMAS *Perth.*

In the ensuing battle, German casualties were given as 9,000. The Section was in the unique situation of sitting on the cliffs watching a sea battle that they knew they had brought about. But again it was retreat - 65 km of forced marching at night over the mountains, led by Captain Jack Ryan. They took some casualties but most of his troops were taken off the island.

With only a brief respite, the Section participated in the Syrian campaign. This was different because, although the intercept operators had mastered the German and Italian procedures and idiosyncracies, they then had to learn the French ones because they were in action there against the Vichy French. The Section was re-inforced and re-equipped and close liaison was established with the Royal Signals. More aerials were used, an extra three 32 foot (9.8 m) masts of white metal, light and easy to erect.

Enigma

Just before the outbreak of WWII, the Poles had been able to 'acquire' a prototype of a marvellous German encoding machine, known as the Enigma. It was the machine the Germans used for the whole of the war, and they had complete faith in it, believing that any message which was encoded by it could not be broken. Well, the Poles handed the machine over to the French, and they did some work on it and eventually handed it over to the British, at Bletchley Park.

Early in the war, the British were able to read probably 70% of the German messages. But then came a dark period. First of all, the Germans broke the British naval code, and then threw an extra cog in the Enigma machine. The result of this was that the Germans could read the British messages but the British could not read the Germans'. The location of the convoys, and the cargo on the convoys, became known to the Germans and the U-boats were sent to do their worst. Thousands of tons of shipping were lost and the British could not do anything about it.

This situation went on for ten long months. Then dawn came. The British naval code was strengthened and the German code was broken. The convoys could be diverted away from the U-boats and the RAF could be notified of the location of the U-boats so that they could go and 'say hello' to them. The result of this was a great decrease in the loss of shipping, supplies were flowing again to England, and the Battle of the Atlantic was won. That was without doubt a turning point in the war.

Colossus

But how did the British code-breakers do it? The main key to this success was the British invention of the world's first computer, the Colossus. It was immense, worked solely on valves as transistors had not been invented, and the work was carried out at Bletchley Park, an old mansion house north of London which was the HQ of British Intelligence for the whole of the war.

Strict security was observed. Not even people living in nearby villages knew what went on there, and up to 12,000 people worked at Bletchley at one time.

War in the Pacific

Japan now entered the war. Pearl Harbour was bombed on 7th December 1941 and Australian troops were being recalled to defend the country. The Section was involved in the recall but, before they left the Middle East, the British again took them in hand and gave them their first introduction to Japanese Morse, the Kana code.

The Japanese Morse was not easy because they used not only the 26 letters of the international alphabet, but they added another 40 of their own, so that an intercepting operator had to have knowledge of up to 70 Morse symbols - no easy task.

Japanese operators on main line stations such as Toyko, Rabaul and Truk, were first class, often sending in excess of thirty words per minute. Australian operators qualified at 25 words per minute, so they were challenged to lift their game to match their Japanese counterparts.

On a ship headed first for Java, then diverted to Adelaide, were the top Australian Army Signals Officers, and it was decided that, because of the success of interception operations in the Middle East, the same tactics would be applied to the Japanese, but on a far greater scale involving up to 1,000 personnel.

The Section, after leave, set up business at Park Orchards, near Ringwood, a suburb of Melbourne, and started to intercept Japanese radio transmissions. There was already a section taking diplomatic traffic and it was based in not-so-far-away Ferny Creek.

It was fortunate that a dozen British intercept operators, who had escaped from Singapore, were attached to Australian forces for the rest of the war. Most of these men were permanent Army operators who had been taking Japanese transmissions since the mid-1930s, based in Hong Kong, Shanghai and Singapore, etc.

Recruiting was the order of the day. Recruits were obtained from Infantry Training Battalions and from recruiting centres in Victoria, New South Wales, Queensland, and later from WA. The job was large. First we had to be made into soldiers, then master the Morse code, then the Japanese version of it.

An early mentor of mine was one of the British fellows, Mick McGuire - a very experienced man. In the mid-1930s he was operating in Hong Kong. When the Japanese station was transmitting I was poised over the message pad with pencil and as something came over the air, I wrote it down. I was a bit alarmed to look over and see Mick leaning back in his chair, rolling a cigarette! I thought, "Goodness, what am I doing wrong!" When I came to the end of the line on the message, Mick slowly picked up his pencil and casually wrote down the whole line of Morse that had come over. He had retained it all in his mind! We certainly had a bit to learn!

With the benefit of the experienced men returned from the Middle East and the English men (with an RSM who had been with the Black Watch), the unit, now based in Bonegilla and renamed the Australian Special Wireless Group, was able to put two fully trained sections in the field against the Japanese within four months of recruitment.

The RAAF took 18 months to put a full section into the field and the Americans took two years. So it is satisfying to now read American historians writing that, "Full recognition should be given to Australian Army Signalmen, who almost single-handedly carried out the job of the interception of Japanese wireless transmissions for the first two years of the Pacific War".

ASWG's role

ASWG looked after the intercept side of the operation, but also checked possible clandestine stations and monitored Allied operators to ensure no breach of security occurred, which could lead to identification of a unit or a location by an enemy interceptor.

Unless the Japanese operators lapsed into plain language, a message started with the intercepting operator, then went to the de-coder/de-cryptor, to the translator, then to HQ, where the message was assessed and the information passed on to the Commanding Officer in the field in the shortest possible time. The intercepting officer had to contend with fading signals, atmospherics, adjacent stations, incompetent wiring, changed frequencies and call signs.

Central Bureau dealt with the next stage of the intercepted work. It consisted of a combination, a team of American Army, American Air Force, Australian Army and Australian Air Force. There were different commands, disciplines and countries yet their intelligence people worked as a great team together. It was unfortunate that neither of the navies participated, though they did have their own operations on a smaller scale.

The Australian Navy was very co-operative, the American Navy was most unco-operative. In fact, sadly, they had cracked a quite vital Japanese code and did not bother to tell their Army. Goodness knows how many American lives were lost as a result of that oversight.

Members of the AWAS (Australian Women's Army Service) were recruited and joined the unit from August 1942, making an immense contribution in Australia in intercept operating, intelligence, driving, cooking, etc. They had to pass the same tests as the men had to pass earlier.

As well as enemy communications, certain Sections covered diplomatic press work. Some Morse was transmitted on high speed automatic and this was recorded on Edison wax cylinders and replayed later.

Operating sites could be in tents, huts or trucks. Operators were required to have driving licences, as set trucks were used extensively, especially by detachments and mobile sections.

Most of the time, for security reasons, operators were not made aware of the contents of the messages, or even if it had been possible to de-code them. Therefore, it was heartening for an operator to see fighter planes taking off and the ack ack being readied, just after information about an impending air raid had been intercepted.

Also, Sections were formed to monitor Allied wireless operators because so much could be given away with breaches of security. The Allies gained much knowledge from Japanese breaches, particularly when a code was changed. Invariably some outlying station wouldn't have, or couldn't, read the message in the new code and would ask for a repeat in the old code. "Beauty"! We had the message in the new code, then we had it in the old code, so away we went until the next change of code.

On our side, Australian operators had to change their habit of finishing their messages with GF (don't know what that means!) because a Japanese intercepting that message could immediately identify it as an Australian unit.

In action

One of the Sections went to Darwin and was able to provide ample warnings of impending air raids, shipping and troop movements. Many commendations from commanders in the field were received.

The other Section went to Port Moresby where different circumstances applied - first against an advancing Japanese army, then a retreating one. Because of the difficult terrain, the Japanese carried no heavy encoding machines but relied solely on Code Books.

This meant that intercepted messages from field sections could often be decoded and translated on the spot by intelligence people. The sorts of things they provided information about included troops, numbers and strength of opposing forces, weather reports, air raids and even the morale of troops, which all proved very valuable to the commanders in the field opposing the Japanese forces.

The Japanese transmitters had to be light, small, and less powerful - sufficient for their local needs, but no good for the interceptors. They couldn't hear them, particularly when the Japanese were retreating - they were getting too far away!

The problem was met with the use of detachments, bodies of men endeavouring to get close enough to the enemy transmitters to take their messages, and then get valuable information back to the field commanders. Detachments were sent to Milne Bay, Bishibutu on the Kokoda Track, Wau, Nadzab and Finschhafen, etc. At all those places they were able to copy the enemy signals and get the information from them.

The Headquarters of ASWG moved to Brisbane, following the pattern of the war. Central Bureau also moved to Brisbane and another section, the 53rd Wireless Section, went from Headquarters straight to Finschhafen. There it was joined by the detachments that were scattered over the other parts of New Guinea. Nadzab, Moresby, Wau and Kaandi were closed and the section was amalgamated at Finschhafen.

The first site at Finschhafen was located right alongside the bomb dump which was not a very healthy spot to be on moonlit nights. Luckily none of the bombs hit it so we got out of that one! The reception wasn't very good there, so we were moved into the mountains, to an area overlooking Cape Cretin, not far from Scarlett Beach.

The Section did good work at Finschhafen. Again we were able to concentrate on the field stuff as well as at the main station, because we were in ample range of picking up the field stations. We provided good information for the Buna and Salamoa campaigns.

From there we set sail, part of the island hopping campaign of MacArthur. We intercepted one vital message that contained information of which MacArthur could not at first be convinced. He was planning to land troops at Wewak and we were able to alert him that this was the most heavily defended Japanese port on the northern coast. We suggested it would be wise to bypass Wewak and land further up the coast. He was not convinced that this information was sound.

It took his four generals to convince him, but he did bypass Wewak and landed further up the coast at Hollandia in Dutch New Guinea. He struck very little opposition and incurred very few casualties, so maybe we saved some lives in that operation.

I must tell you about the great efforts of members of the 9th Australian Division. Elements of the Division had driven the Japanese 20th army out of a little port called Sio. A couple of smart boys there headed straight for what had been the headquarters of the Japanese Army. There they discovered a metal box in the bottom of a flooded slit trench. They dragged it out, opened it up and there was a complete set of Japanese Army code books in it.

They were in dreadful condition, sodden with water and mud, but they took the box, grabbed a lugger on the coast, and took the books back to the intelligence people. There they were dried out and cleaned up, and we pretty well had the Japanese codes for the rest of war! Full marks to the 9th Div!

There was an interesting sequel. Later, the Section intercepted a message from the Japanese general to Tokyo stating that he personally had completely destroyed all the Code Books. Boy, did we find him out!

The Section then moved to Hollandia, where MacArthur later set up his HQ. If we were in the travel business, our camp would be appearing on the brochures! A mile and a half of pure white sand beach, surf never under three feet high, breaking anything up to half a mile from shore - beautiful!

We were camped on an isthmus, on the seaward side. On the other side of Humboldt Bay the Japanese were camped! Interesting!

But the defences were wonderful. Between the two camps was a series of quicksands and hundreds of death adders! So, as far as we were concerned, the Japanese could stay there - they were being starved out anyway. We took a couple of prisoners who got through.

There we were able to provide valuable information to MacArthur who was now accepting the value of intercepted information. He was preparing to invade the Philipines and was assembling the invasion force in Humboldt Bay, so it was vital for him to know aircraft, shipping and troop movements.

A painting depicting the shooting down of the Betty bomber carrying Admiral Yamamoto by a US Lockheed Lightning.

On one occasion an intercepted message yielded the information that the Japanese had discovered there would be an Allied air raid on an assembly of Japanese planes (they were assembling to raid somewhere else) and they were instructed get their planes off and out of the way by next morning. There was immediate action. The Allies bombed the area and it is estimated that they destroyed 250 Japanese planes on that raid.

The Section was camped there until approaching Christmas of that year. It had to move then because of the neap tides when the whole of the isthmus was covered. It moved to higher ground, still in Hollandia.

The next move was to Morotai in the Dutch East Indies and they were there when peace was declared on 2nd September 1945. It took them some six months to return to Australia but it was a pretty leisurely existence once war finished.

Tokyo Rose

I didn't mention our little encounter with Tokyo Rose, the Japanese propagandist. She gave our Section a mention! It was when the detachment was at Nadzab.

She named the section, 55th Australian Wireless Section; she named the location, a coconut plantation named Nazumwappen near Nadzab; and she was very kind and alerted us to the fact we had no hope of winning, and that she knew the nature of the work we were doing. She also told us that when we were captured (not if, when!) we would not be subject to the Geneva convention but be treated as spies.

It was a little alarming to know they knew all that about us and we strengthened the guards, but that was all that happened.

In the belief that the Japanese were using a track near our camp, OC Lt Jim Murray formed a posse one dark night. When a shuffling sound was heard, the troops were ordered to blaze away. Later a torch revealed that the victim was in fact a 20 foot (6.1 m) long tree python which, sadly, was riddled with bullets.

Admiral Yamamoto

The general public has heard about the demise of Admiral Yamamoto. He was the architect of Pearl Harbour, a brilliant strategist who had been given command of a certain area of the Pacific.

He decided to visit all the points around his area of command. He decided his itinerary, including what he liked for breakfast. The message was encoded and sent to all of the stations under his command, but the message was intercepted, decoded and translated.

The result was that seventeen Lockheed Lightning fighters were sent up to wait for the Betty bomber on which he was travelling. When it came, the bomber was shot down and all on board were killed. Wireless interception had caused the loss of a very skilled Japanese campaigner.

Current opinion in recent books, magazines and articles seems to be that Australian Section 51 in Darwin intercepted the vital message. That certainly was so but it was highly likely to have been intercepted in a number of places, almost certainly by the Americans in Hawaii, almost certainly by the British in India, and possibly by the RAAF in Townsville.

It is immaterial. The important thing is that it was intercepted and acted on, with wonderful results as far as the Allies were concerned.

The final stages

Information from intercepts helped in the Philippines campaign and then in the battle of the islands, both for the land and the naval forces.

It was pleasing, later on, to hear an American General say that the interception work performed by all the Allied nations and by all the services had the effect of shortening the Pacific war by about two years.

In December 1945, the Headquarters of ASWG at Kalinga, Brisbane was closed and the remaining troops transferred to Section 52 at the Mornington Racecourse, south of Melbourne. Many members had already been discharged as a points priority system was in use - points for married status, dependants, length of service at home and overseas, etc.

Life was pretty relaxed at Mornington - operators didn't really have their heart in the job as they were allotted tasks covering Russian transmissions. The Section was renumbered 101 Australian Wireless Section and I was discharged in October 1946 after a most interesting and challenging four plus years.

Note

• Part of this account of the AWSG was based on information taken from the book *On Ultra Active Service* by Geoffrey Ballard, and from discussions with many of the original members of the 4 and 5 W/T Sections.

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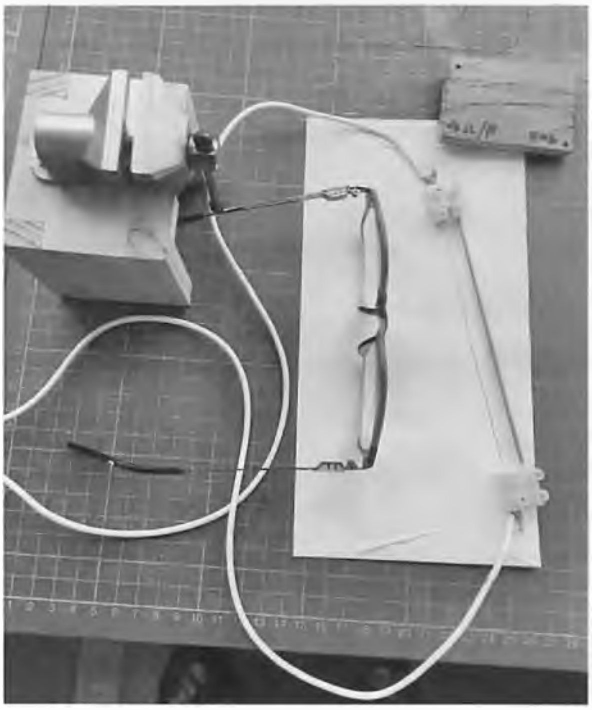
A hot, handy hint for the workshop

Bob Crowe VK6CG
RAOTC member No 1405

Many of us oldtimers need spectacles and from time to time the frames break. Unfortunately, the various glues I've tried don't seem to make lasting repairs. However, I have found that embedded nichrome wire does!

Here's the simple way I recently fixed the frames of my and my wife's prescription glasses.

Actually, I've done this before, years ago - necessity is the grandmother of re-invention! Here is how to do it.



Fix a two-terminal block to each end of a 150 mm length of coat hanger wire - see the pictures. Secure the nichrome wire parallel to this under mild tension in the second connectors of each block. Connect leads to the nichrome wire ends and to the power supply - I used separated mains twin-flex.

5 V at 2.5 A was just right to heat the 0.35 mm diameter, 4 ohm per foot wire (about 13 ohm per metre) to a dull red heat.

DISCLAIMER: Hot things burn!!!

Hold the joint firmly closed, then push the hot wire into the plastic of the frame and across the gap. Two or three seconds should do, then switch the current off (using a foot switch or a helper) and let cool for a few seconds.

Snip off excess wire close to the plastic using side-cutters. Embed a second wire. This really helps the strength of the repair.

Clean up the rough ends with a fine-toothed file and fill any gaps with 2-part epoxy or Perspex cement. When hard, touch up with a felt-tipped pen to disguise the repair.

Any AC or DC supply will do if it can provide the 2.5 amps. I used a 12 V 60 W transformer fed from a Variac as both were at hand. The coat hanger wire may be bent to a crank shape for better clearance. The nichrome wire can be shorter. Both major electronic hobby shops stock suitable wire.

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The many faces of MV Tjitjalengka

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

In April 2020 I came across a story written by Hans Polak, a former Dutch Merchant Marine Radio Officer and former Radio Officer at the Dutch coast radio station Scheveningenradio/PCH. In 1953 Hans was Second Radio Officer on the MV *Tjitjalengka* of the KJCPL (RIL)[1]. His story was about how the ship's Chinese crew engaged in smuggling fake Ronson lighters on the voyage from Japan to Argentina, and parrots on the return voyage from Argentina to South Africa. My story, however, is not about contraband, but about the *Tjitjalengka's* radio room equipment and her remarkable achievements during her 29-year lifespan.

The ship first put to sea in 1939 with radio callsign PKQH, which changed in 1947 to PIAD[2]. She had the following radio equipment on board:

Emergency receiver: HL7, made by NSF-Philips[3], with a frequency range from 15 kHz to 21 MHz in 10 bands. A later variant, H2L7, had an extra audio amplifier valve.

An NSF-Philips HL7 receiver.

Main receiver: a BC-348-R. These reliable, sturdy BC-348 receivers were mass-produced during WWII for the US Airforce heavy bombers, but were also used ashore as well as on Navy and Merchant Marine vessels.

Their tuning range was from 1.5 to 18 MHz in six bands with a MF band of 200 - 500 kHz being added after version E. You can tell which manufacturer made a specific model by the capital letter which follows the number 348[4].

Stromberg-Carlson made version E, M & P; Belmont Radio Corp made H, K, L, R & S; RCA made B, C & O; and Wells Gardner made J, N & Q. Apparently versions A, D, F, G & I don't exist.

Both receiver HL7 and BC-348 weigh about 16kg.

A BC-348-R receiver.

Emergency MF spark-gap transmitter: MZ11.
MF valve transmitter: MZ32 (photo on next page).
HF valve transmitter: MZ33 (photo on next page).

All three transmitters were made by NSF-Philips. The Morse key was a Marconi-365. The type of the ship's Auto Alarm receiver and sender is unknown, but its maker was most likely Marconi Marine. Last, but not least, a 24 V battery bank for emergency power was situated outside the radio hut.

The vessel kept a 24 hour watch on the SOLAS frequencies of 500 kHz (RTG) and 2182 kHz (RTF). She carried two radio officers.

The hospital ship HMHS *Tjitjalengka* in Liverpool in 1942.

The *MV Tjitalengka* was a passenger/cargo ship, built in 1939 in Amsterdam, with a Gross Register Tonnage (GRT) of 10,972, which changed in 1962 to 10,945 GRT. The owners were Java-China-Japan Line (JCJL) and its home port was Batavia (now Jakarta).

The ship's length was 145 metres and it had a speed of 14.5 knots (26.9 km/h). Officers and crew numbered 162 and accommodation was 64 first class and 155 second class cabin passengers. If required, tween decks could house 1,720 deck[5] passengers.

On 6th May 1939 the vessel left Holland, one year before the Germans occupied the Netherlands, and sailed between the Dutch East Indies (now Indonesia) and other Far Eastern countries.

An NSF-Philips MZ32 MF valve transmitter made in 1939.

An NSF-Philips MZ33 HF valve transmitter made in 1939.

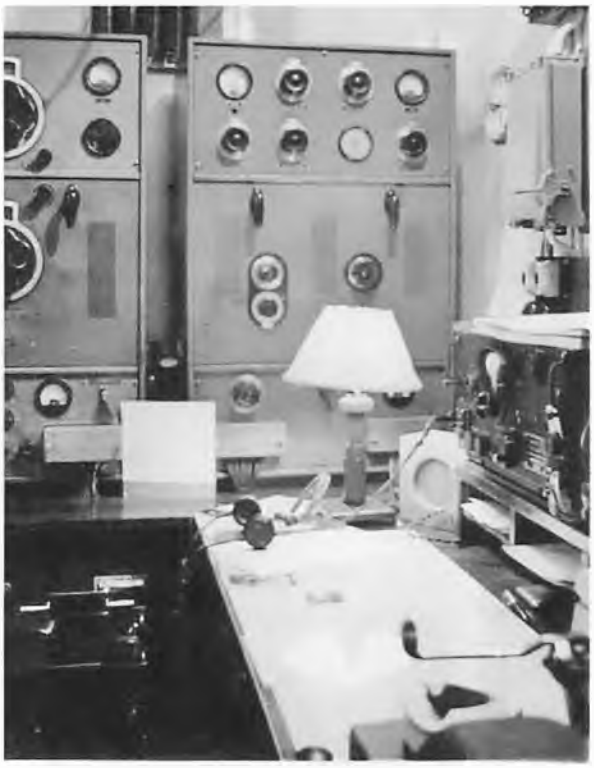
On 21st February 1942 she departed from Tjilatjap (Java) to Australia, escorted by the Dutch warship *Willem van der Zaan* with the gold reserve of the Java bank[6] on board.

On 8th July 1942 the *Tjitjalengka* was requisitioned by the British government and converted, in Liverpool, into a hospital ship with accommodation for 504 patients. On her bow she featured an A-frame structure to which underwater mine clearing paravanes[7] were attached. She became the Naval Hospital ship HMHS[8] *Tjitjalengka* and served in the North Atlantic and Indian Oceans.

One of a pair of underwater mine clearing paravanes, similar to those installed on HMHS *Tjitjalengka*, being lowered for a sweep.

On 2nd September 1945 she was present in Tokyo Bay during the signing of the Japanese surrender and evacuated British, Australian and NZ servicemen from Japanese POW camps back to New Zealand and Australia. On her final voyage as a hospital ship she carried invalids and Royal Navy casualties from Colombo and Durban to the UK.

On 8th February 1948 she was returned to her original owners the JCJL and was rebuilt in Amsterdam.



The radio room on board MV *Tjitjalengka*. Left to right: MF Tx MZ32, HF Tx MZ33, BC-348-R Rx and Morse key (just visible in foreground).

MV *Tjitjalengka* in Nagoya, Japan, in 1963.

On 23rd June 1948 her owners became the KJCPL (RIL). Her radio callsign had changed to PIAD and her home port to Amsterdam. She was placed in service between the Far East, South Africa and the East Coast of South America.

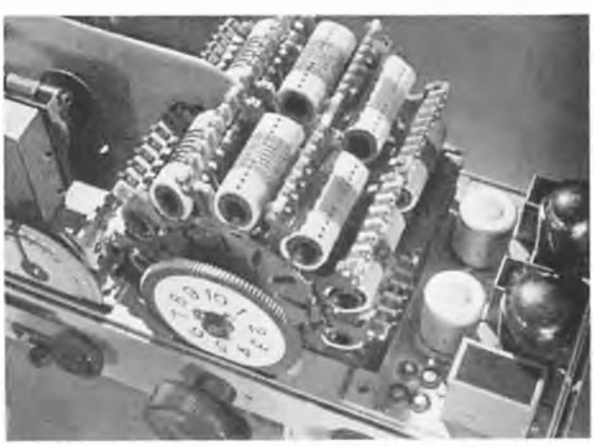
On 26th September 1959 disaster struck when the vessel, battered by powerful cyclone Vera, ran aground on a sandbank in Nagoya Bay, Japan. Although all passengers were taken off the ship, no danger existed to the ship and crew. The sands around the ship had to be dredged, which took three months. Finally, on 16th December 1959, she was refloated and towed to Yokohama for repairs and recommenced sailing on 14th January 1960.

In Yokohama, on 1st November 1961, the cabins of the *Tjitjalengka* were restyled, modernised and fitted with air-conditioning and new plumbing. During her last seven years she sailed on the ASAS (Asia - South America) service.

On 11th May 1968 she met her final fate when she was broken up for scrap in Hong Kong.

Footnotes

1. KJCPL is Koninklijke Java China Paketvaart Lijnen, a real tongue twister for non-Dutch speakers, thus the company's English name was Royal Interocean Lines (RIL).



A close-up view of the coils for the 10 bands of the NSL-Philips HL7 receiver clustered around the bandchange switch.

2. The prefix PK in PKQH indicates that the radio callsign belongs to Indonesia and PI in PIAD points to the Netherlands, because the vessel's homeport changed in 1947 from Batavia (Jakarta) to Amsterdam.
3. NSF = Nederlandsche Seintoestellen Fabriek (Dutch Signal Apparatus Factory) Hilversum. NSF was founded in 1918 by some Dutch ship owners who were interested in shore to ship communications. The cooperation between NSF Hilversum, the experienced transmitter builder, and Philips Eindhoven, the big valve producer, proved to be very lucrative. In 1925, part of the Philips production line was moved to NSF in Hilversum. In the end, NSF receiver building blended in with Philips, but the brand name NSF remained in use for some time.
4. For valve cross reference see:
https://www.nostalgickitscentral.com/info/tubexrefvt.html
5. In Indonesia, travelling on deck was popular. It was a cheap, although primitive, way for pilgrims to travel to Mecca or to travel to and from the many Indonesian islands. When the ship was refurbished in 1961, the tween deck travel facility was no longer available.
6. To keep it out of the hands of the Japanese Empire, which invaded the Dutch East Indies (now Indonesia) in May 1942.
7. Developed to destroy underwater mines, the paravane is strung out and streamed alongside the ship, normally from the bow. The wings of the paravane pull it away laterally from the towing ship, placing a tension on the tow cable. If the paravane tow cable snags the anchor cable of a mine, then the anchoring cable is cut by jaws on the paravane. The mine then floats to the surface, where it is destroyed by gunfire.
8. HMHS stands for His Majesty's Hospital Ship.

Acknowledgements

Former Radio-Holland Radio Officers Hans Polak and Ferry van Eeuwen; Hans Middelkoop and Jan van Dam of the Radio-Holland Historical Material Foundation; and Wim van Alebeek, Master Mariner KJCPL.

References

•Handbook of maintenance instructions for Radio Receivers BC-348-J, N and Q.
•KJCPL information sheet of MV *Tjitjalengka* and the World Wide Web.

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Recollections of Ash Wednesday

Graeme Scott VK2KE
RAOTC member No 789
WIA Life member

I was called out by WICEN (Wireless Institute Emergency Network) to take part in Operation Cleanup after the fires on Ash Wednesday, 16th February 1983. A number of WICEN radio operators were asked to go to Mt Macedon, 64 km north west of Melbourne by road, to assist in the cleanup after the devastation of homes and countryside in the Mt Macedon area.

So we took off early in the morning to drive in convoy up the Calder Highway to the mountain. We all had 2 metre gear in our cars.

On the way we came upon a large semi-trailer which had crashed off the side of the highway. It was carrying water melons to market in Melbourne and a lot of its load had spilled over the roadway. We did what we could for the driver until the police and the ambos came, but the truck was badly damaged and the cabin was crushed. We thought the driver must have gone to sleep at the wheel.

After getting that problem sorted, we continued on our way to the scene of the fires.

On arrival we were strategically placed around the houses and buildings in the area.

The scene was one of utter devastation. The majority of the houses and buildings, along with the trees and vegetation, were blackened and badly damaged.

The plan was for us as radio operators to call up the front-end loaders to come to a particular site. The insurance assessors would go to a site where a house once stood and assess the damage. Once the assessment had been made in consultation with the owner, we were then given permission to call in the backhoe tractor and the rubble was loaded onto a truck and taken to the tip. It must have been a very emotional moment for the householders to see the remains of their home being loaded onto a truck and taken away to be dumped.

I guess, prior to the assessment, the owner would have picked through the rubble to recover anything of value in the way of items that had decorated their home.

When it was a bit quiet between jobs I was able to walk among the devastation and I noticed a few things that were rather confronting.

One was that there were blobs of copper lying on the ground. These blobs were the remains of overhead power lines which had melted! That takes a lot of heat!

I also noticed there were PVC pipes that had been buried in the ground and that had melted, despite having been buried up to 20 cm or more in the ground.

All that remained of one house at Mt Macedon after the Ash Wednesday fire swept through.

The Cross at Mt Macedon after the Ash Wednesday fires.

Even the soil structure had been changed due to the fierce heat of the fires. It was like talcum powder, which was rather scary.

I walked onto the site of one destroyed home and in the garage was a car that had been burned. The glass of its windows were blobs of glass on the ground. And piles of books stacked in the garage were small mounds of ash on the floor.

In another house there was a motorbike in the garage and its engine was a blob of aluminium on the floor, and that was BEHIND a steel roller door!

At times the trees that had been burned flared up and began burning again, so I called on my radio for the firefighters to look at that tree and hit it with some water.

It was easy to see how a fire can flare up again from trees and stumps that had only been partly burned by the main fire a few days ago.

The area had an atmosphere of devastation and was almost like a ghost town.

I also noticed that a few houses had not been burned and one of the reasons became evident once the CSIRO had made some announcements about bushfires. They said that planting European trees around your house will likely save it and I saw evidence that proved that theory.

The whole thing was a very sobering scene for all of us WICEN radio operators. We quickly came to realise the power of a huge bush fire. All the radio operators who were there, I'm sure, had learned a valuable lesson about bushfires.

We also put our 2 metre gear to the test on the sites and I'm sure the authorities were made well aware of what an army of organised, volunteer radio operators can do when called upon.

It was a great feeling to be part of a team who were able to help after a massive emergency.

I worked with a bloke at Hawthorn Institute of Education who had a house at Mt Macedon; he also had a house at Aireys Inlet and both were lost in the fires, so he had a very hard time of it all. I've never forgotten that. ar

An eye-catching replica

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

In 2012, the British artisan Morse key maker Phil Boyle made 12 replicas of the Piergraph No 2 double lever bug, which sold like hotcakes to collectors all over the world[1]. This extremely rare bug, made in Western Australia in 1920 by Robley and Tough, is on show at the Wireless Hill Museum in Applecross[2], which was the first location of the Maritime Coast Radio Station Perthradio, radio call sign VIP. The station relocated to Gnangara, just north of Perth, in 1967[3].

Phil Boyle said that he obtained some dimensional information about the Piergraph No 2[4] from Australia and this, together with analysis of photographs of the key, gave him enough information to produce a good replica. Although I am not fond of replica keys, I must admit that this replica of the Piergraph bug is an absolute beauty.

The replica Piergraph No 2 bug key.

It has a black painted wrought iron base, lacquered brass components, coin silver contacts and red plastic finger pieces.

Compared to other bug keys, the pendulum arrangement of the Piergraph No 2 bug looks 'back to front'. This is because the pendulum's mainspring is fixed to a post between the two terminals at the back of the key's base and the pendulum weight is located at the other end, towards the finger-pieces. It is, therefore, quite easy to slip the pendulum weight on and off. The circuit closer of this bug, shaped as a wedge, works well. Phil not only reproduced the original pendulum weight, but also added an extra (heavier) weight to slow down the dots.

The two weights give this replica Piergraph No 2 bug a more flexible and wider range of speed control. My only criticisms of this otherwise brilliant replica are that the weights can only be shifted halfway down the pendulum as they are blocked by the dot spring, and maybe the garish red plastic fingerpieces could have been made of red vulcanised fibre board, as seen on the original Piergraph bug.

The Piergraph and other Australian-made bugs, such as the Simplex Auto and the Pendograph, use the 'tension release' system. This means that when the bug is not in use, the thin steel pendulum mainspring is kept under tension. By pressing the paddle to the right, this tension is released, and the pendulum starts to swing and makes dots.

This release method was first used by William O Coffe on his Mecograph bug around 1906. By the way, other bugs, amongst them the Vibroplex and the Buzza model 100, use the 'tension-creating' system. This means when the bug is not in use, its pendulum is in a rest position and there is no tension on the main spring.

You can see a demonstration of the Piergraph replica by its maker on YouTube: *http://www.youtube.com/watch?v=Ba37dpNFDso*

The Piergraph Company

The designers and makers of the Piergraph semi-automatic key were Robley and Tough. Around 1920, after years of working as telegraph operators at the Chief Telegraph Office (CTO) in Perth, they resigned from the PMG to establish a company producing telegraph keys. The company was named the Piergraph Company, located in the back of a café in Pier Street, Perth, hence the name of the company.

The only surviving original Piergraph No 2 bug key.

Due to the limited information that we have on the Piergraph, it is unknown how many bug keys were produced by the company. It is puzzling that up to now only one original Piergraph bug has been located. What happened to the rest of them?

For a demonstration of the original Piergraph No 2 on YouTube: *https://www.youtube.com/watch?v=teT2a65gtGo*

Footnotes

1. Phil Boyle made 12 replica Piergraph bugs. However, in 2020 he made one more for an American collector, which makes a total of 13 replica Piergraphs. The first replica Piergraph bug I owned was serial No 8, which I sold many years ago. My friend and fellow Morse key collector, Kees, has replica Piergraph serial No 5, which he obtained in 2018 from German collector Martin Odenbach DK4XL.
2. The Museum's original Piergraph No 2 is one of the 35 keys which the late Dave Couch donated to the Wireless Hill Museum at Applecross several years before he became a Silent Key in 2009. By doing so, he made sure that the Piergraph bug returned to its original home.
3. From 1966-1996 Herman worked for the OTC Coast Radio Service in Papua New Guinea and Australia in various capacities. He was OIC of Perthradio VIP from 1992-1995.
4. There was never a Piergraph No1.

Acknowledgements

Phil Boyle G0NVT; and Kees van der Spek VK1FCLV, Canberra.

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Wairakei Geothermal Power Station in New Zealand

Lloyd Butler VK5BR
RAOTC member No 1495

As a small group touring New Zealand, we visited the Geothermal Power Station at Wairakei in the North Island. It is unique in that it uses a system of operation duplicated in few other places in the world. Placing wells deep into the volcanic earth, steam is extracted and used to drive turbines which produce electrical power. Our guided tour through a power unit was difficult in the presence of high background noise, but much of what was missed has been described in the technical detail of the article.

In January 1979, our group consisting of my wife Margaret and myself together with sailing friends, Pam and Ray, toured New Zealand by self-drive vehicle. Part of our touring included a visit to the Wairakei Geothermal Power Station in the North Island. The Power Station Field covers between 20 and 25 square km and lies 8 km north of Taupo along State Highway 1. Wairakei and its power station are part of the Taupo Volcanic Zone which features several natural geysers and hot pools, and also its many power stations.

The Wairakei power station was commissioned in 1958. The station operates from geothermal steam with 55 wells dug to a depth of up to 660 metres. There are six power generation units of 11.2 MW, three of 30 MW, a single unit of 4 MW and a single unit of 14 MW, making a total of 175.2 MW maximum output. The annual power generated has been quoted as 1365 GWh.

The Wairakei Power Station is the world's second geothermal power station and the first to utilise flash steam from geothermal water as an energy source. Geothermal energy from the power stations in the Waikato region provides about 16 per cent of the national New Zealand electricity supply.

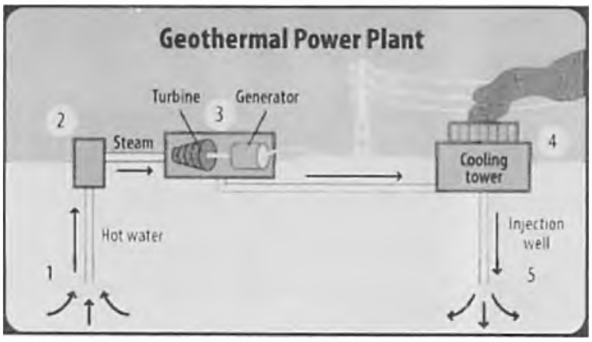
The Field of Wairakei Geothermal Power Station.
(On site photo by the author)

A guide from the power station gave us a tour through one of the power generation units. The noise generated was overpowering and it was difficult to resolve exactly what the guide was telling us in the environment of the high noise level. This can be a problem in touring some factories and other noisy environments where there is machinery or large scale water exchange. But there are ways to deal with the problem. Later on, in a different tour location in which I was one of a party, headphones were provided with pre-recorded information.

The Geothermal Power unit visited.
(On site photo by the author)

However, I have put together some information on how this type of thermal power station operates.

Geothermal Power Plants work by piping hot steam from underground geothermal reservoirs directly into turbines to power the generators which provide electricity. Following powering of the turbines, the steam condenses into water and is piped back into the earth via an injection well. The following diagram gives more detail:



Schematic diagram of a basic Geothermal Power System.
(Diagram from Student Courses EPA Victoria)

Hot water is pumped from deep underground through a well under high pressure. (1) When the water reaches the surface, the pressure is dropped, which causes the water to turn into steam. (2) The steam spins a turbine which is connected to a generator that produces electricity. (3) The steam cools off in a cooling tower and condenses back to water. (4) The cooled water is pumped back into the earth to begin the process again. (5)

Geothermal Wells in Wairakei Power Station Field.
(On site photo by the author)

Geothermal reservoirs are pools of water heated by magma deep below the surface. Water or steam can escape from cracks in the earth in the form of geysers (or sometimes as magma from a volcano). Wairakei reservoir is partially connected to the adjacent Tauhara Field. The Waikato River marks the boundary between the Wairakei and Tauhara fields.

As a visitor to New Zealand we could not miss the spectacular Huka Falls on the Waikato River narrows which are formed from a width of around 100 metres across into a canyon only 15 metres across.

With Lake Taupo in the background, water turbulence in the narrow canyon creates rapids in the Waikato River.
(Photo from a New Zealand travel document)

The Waikato River is the longest river in New Zealand, running for 425 kilometres through the North Island. The Waikato River flows out of Lake Taupo at the town of Taupo in Tapuaeharuru Bay at the northeast end of the lake. It flows northeast past the town, alongside State Highway 1, via the canyon to the Huka Falls. The ring of lakes, tunnels and canals are used to generate hydroelectric power along the way including the Wairakei Geothermal power station.

Huka Falls, following the turbulent rapids created in the narrow canyon.
(On site photo by the author)

The geothermal techniques, as used in the Waikato Power Station, are unique in the world and unlikely to be seen again in our touring around. So it was pleasing to have seen this system on site. But for someone with my interests, I would have been happy to have visited some of the other types of power units in the country. But it was a group decision, no more noisy power stations! But, indeed, New Zealand is an interesting country in regard to how they have applied their natural resources to power engineering.

References

• Geothermal Power Plant - www.energy.gov/eere/geothermal/how-geothermal-power-plant-works-simple

• Geothermal Power Plants - part of *A students guide to Global Climate Change* - Environment Protection Authority Victoria - EPA

• https://www.epa.vic.gov.au

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New RAOTC members

It is with pleasure that we record and welcome the following new RAOTC members:

Name		Call	No	Grade	
Andrew	Clinkaberry	VK3HFA	1792	A	
Alan	Hall	VK3AJH	1793	F	
Marty	Orive	VK3AKG	1794	F	
Rob	Young	VK4QX	1795	A	
Ben	Broadbent	VK5BB	1796	F	
Colin	Schultz	VK3COL	1797	F	
John	Ross	VK3MK	1798	F	
Gary	Dewar	VK6LX	1799	A	
Barrie	Smeaton	VK4ALK	1800	F	*
James	Price	VK6NJP	1801	F	

ar

Silent keys

It is with regret that we record the passing of:

Tom Ivins	**VK4ABA**
Norm Phillips	**VK4CNP**
Rob Bosma	**VK6SB**

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Wanted

More original articles about your radio experiences and adventures.
Come on! Club members want to read about your radio exploits and history.

RAOTC members list

as at 31st January 2021.

Legend: L = Life Member A = Associate Member B = Associate Life Member
* = Licensed 50 years or more + = Aged 90 years or more

	Name	Call	No
	ACT		
L	Ted Peppercorn	VK1AEP	1314*
A	Chris Thompson	VK1CT	1717
L	Ernie Hocking	VK1LK	1260
B	Andrew Robertson	VK1NRO	1611
	NSW		
	Don Hunt	VK2ADY	1141
L	George Paterson	VK2AHJ	1333+
L	Jim Patrick	VK2AKJ	1003
	Alan Whitmore	VK2ALA	1381
L	Max Mondolo	VK2AML	1227
	Max Riley	VK2ARZ	1518*
	Ray Morris	VK2ASE	1763*
L	Tony Mullen	VK2BAM	882*
L	John Trenning	VK2BAR	1226*
	Steve Leatheam	VK2BGL	1498*
L	Brendan Connolly	VK2BJC	1213
	John Pickett	VK2BKP	1748*
L	Ray Gill	VK2BRF	1592
	Dave Rothwell	VK2BZR	1414
	Ken McCracken	VK2CAX	1730*
L	John Clark	VK2CF	903+
	Peter Presutti	VK2CIM	1705
L	Ray Turner	VK2COX	1348*
	Peter Balnaves	VK2CZX	1774
	Dot Bishop	VK2DB	1403
	Dean Davidson	VK2DJD	1423
	Brian Kelly	VK2DK	1645
	Al MacAskill	VK2DM	1277*
	Robert Moldenhauer	VK2DY	1786
	Trevor Wilkin	VK2ETW	1570
	John Boyd	VK2EZC	992*
A	Syd Brooksby	VK2FACG	1736
L	Glen Millen	VK2FC	1180
	Simon Lister	VK2FK	1770
L	Nick Perrott	VK2FS	1327
	Ray Davies	VK2FW	1563*
L	Gary Baxter	VK2GAB	1504
L	Allan Mason	VK2GR	1221*
L	Peter Ritchie	VK2HC	1326
	John Rath	VK2HY	1534*
	Ian Jeffrey	VK2IJ	1571
	Herman Willemsen	VK2IXV-ex	1384
	John Lockwood	VK2JL	1678*
L	Pat Leeper	VK2JPA	1629
	Kevin Parsons	VK2JS	1586
	Graeme Scott	VK2KE	789*
	Greg Hilder	VK2KGH	1375
	Mark Bosma	VK2KI	1767
	Kevin Green	VK2KTG	1769
	Barry Wood	VK2LA	848*
L	Tom Sanders	VK2MY	1393
L	John Gaynor	VK2NCE	1475+
L	William Spedding	VK2NLS	1394
	John Sullivan	VK2OH	1687
L	Mike Rautenberg	VK2OT	1335
L	Peter Mair	VK2PF	1318
L	Roger Conway	VK2RO	1255
	Robert Ward	VK2TAX	1625
L	Robert Taylor	VK2TR	1469
A	Reg Hawkins	VK2TRH	1727
L	Trevor Thatcher	VK2TT	1080*
	Ray Wells	VK2TV	1076*
L	Eric De Weyer	VK2VE	1253
L	Barry Mitchell	VK2WB	1456
L	Keith Sherlock	VK2WQ	1138+
	Brian Rodgers	VK2XFL	1608
	Jack Hodge	VK2XH	1605
L	Richard Cortis	VK2XRC	1474
	Ron Cameron	VK2XXG-ex	1410
	Gary Ryan	VK2ZKT	1267
	John Bishop	VK2ZOI	1404
L	Steve Grimsley	VK2ZP	465+
	Bob Ecclestone	VK2ZRE	1758
L	Robert Alford	VK2ZRJ	1444
	Steve Pettet	VK2ZVG	1752
L	Sam Faber	VK2ZZ	1359
	Victoria		
	Peter Doolan	VK3ACJ	1549
L	Graham Rutter	VK3ACK	1322
L	David Rosenfield	VK3ADM	1622*
L	David Wardlaw	VK3ADW	408*
	Merv Quinn	VK3ADX	1789
L	Ron Cook	VK3AFW	824*
L	Bob Duckworth	VK3AIC	1245*
L	Dave Parslow	VK3AIF	1552
L	Rob McNabb	VK3AIM	829*
	Alan Hall	VK3AJH	1793
	Marty Orive	VK3AKG	1794
L	Ken Young	VK3AKY	1103+
L	Tony Smith	VK3ALS	1521
	David Waring	VK3ANP	1037*
L	Bill Babb	VK3AQB	904+
	Roy Badrock	VK3ARY	1211*
L	David Stuart	VK3ASE	1346
	Ivan Brown	VK3ASG	1669*
L	Max Carpenter	VK3AUA	1489+
L	Ron Mackie	VK3AVA	1478
	Laurie Middleton	VK3AW	1152
	David Swallow	VK3AWX	1747
L	Rod Green	VK3AYQ	1380
L	Roy Thorpe	VK3BAM	1323
	Bob Hillebrand	VK3BAY	1757
	Brian Young	VK3BBB	1058
	Carl Dillon	VK3BBW	1618*
	Tim Humphery	VK3BCN	1620
	Neil Muscat	VK3BCU	1695
L	Brian Tideman	VK3BCZ	1184
	Mike Goode	VK3BDL	1610
L	Digger Smith	VK3BFF	1424
	Peter Cossins	VK3BFG	1257
	Ed Roache	VK3BG	1692*
	Denis Babore	VK3BGS	1756
L	Muriel Plowman	VK3BJO	1511
L	Noel Jeffery	VK3BMU	1021+
L	Alex Edmonds	VK3BQN	1341
L	Albert Hubbard	VK3BQO	1506
L	Bill Roper	VK3BR	978*
L	Stan Roberts	VK3BSR-ex	1272+
	Mark Gillespie	VK3BU	1661
L	Graeme Brown	VK3BXG	1542
L	Andy Walton	VK3CAH	1599
L	John Machin	VK3CCC	1421
	Bob Crockford	VK3CDE	1777
	Bob Crowle	VK3CDV	1588
	Ken Morgan	VK3CEK	1457
L	Mick Ampt	VK3CH	1365
L	Vic Punch	VK3CKD	1250
	Kevin Leydon	VK3CKL	1557
	Colin Schultz	VK3COL	1797
L	Dick Webb	VK3CP	972*
	Clint Jeffrey	VK3CSJ	1648
L	Don Jackson	VK3DBB	1290
	David Dunn	VK3DBD	1252*
L	Mike Pain	VK3DCP	1204
	Helmut Inhoven	VK3DHI	1742
	Jim Goding	VK3DM	1744*
L	Russell Ward	VK3DRW	1376
	Peter Cosway	VK3DU	1447*
	Peter Milne	VK3DV	1546*
	Bill Fanning	VK3DWF	1038*
L	Nigel Holmes	VK3DZ	1435
L	Sarjiet Singh	VK3EAM	1052
L	Dallas James	VK3EB	1238
L	Steve Harding	VK3EGD	1524
L	John Eggington	VK3EGG	1683
L	Mark Harris	VK3EME	1574
	Bob Frencham	VK3EQQ	1684
L	Ellis Pottage	VK3FG	1087+
	Dave Bell	VK3FGE	1339*
	Noel Ferguson	VK3FI	1416*
L	Ernie Walls	VK3FM	1401
A	Robert Ferguson	VK3FPJ	1781
	Peter Lord	VK3FPL	1590+
L	Ray Taylor	VK3FQ	1216
L	John Brown	VK3FR	1407
	Geoff Wilson	VK3GJW	1658*
L	Lee Moyle	VK3GK	1363

	Name	Call	No
	Max Morris	VK3GMM	1265
	Graeme Harris	VK3GN	1630
A	John Piovesan	VK3GU	1235
	Bruce Stokes	VK3HAV	1613
	Brian Baker	VK3HB	1093 *
A	Phil Maskrey	VK3HBR	1387
A	John Kirk	VK3HCT	1427
A	Andrew Clinkaberry	VK3HFA	1792
L	Luke Steele	VK3HJ	1432
L	Steve Bushell	VK3HK	1001 *
	Tony Zuiderwyk	VK3HP	1733
B	Phil Cardamone	VK3HPC	1539
L	Bill Jamieson	VK3HX	1117 *
L	Gavin Brain	VK3HY	1304 *
	Ian McFarlane	VK3IDM	1332
	Peter Collins	VK3IJ	1686 *
L	Tim Hunt	VK3IM	504
L	Ian Palmer	VK3IN	1643
	Don Bainbridge	VK3IT	1766
	Ray Proudlock	VK3JDS	1585 *
	John Frost	VK3JF	1776
L	Graeme Mann	VK3JGM	1274
	Ray Lenthall	VK3JH	1663
L	Anthony Rogers	VK3JIA	1287
	Craig Gliddon	VK3JK	1701 *
	Dave Wilson	VK3JKY	1278
	Fred Storey	VK3JM	1010
	Ian Sturman	VK3JNC	1218
	John Walters	VK3JO	1288 *
L	Ian McLean	VK3JQ	1215
	Frank Nowlan	VK3JR	1286
L	Ian Godsil	VK3JS	1220
L	Bill Magnusson	VK3JT	1342 *
L	Steve Phillips	VK3JY	1266
	Barrie Halliday	VK3KBY	1523
L	Ralph Comley	VK3KDD	1461
L	Jim Baxter	VK3KE	1354
L	Craig Cook	VK3KG	931 *
L	Paul Karlstrand	VK3KHZ	1528
L	Jim Hinton	VK3KJH	1366
L	Reg Lloyd	VK3KK	506 *
	Victor Self	VK3KSF	1254
L	Mike Ide	VK3KTO	1194
	Peter Clark	VK3KU	1573
	Gary Briant	VK3KYF	1779
L	Alan Heath	VK3KZ	1151
	Colin Middleton	VK3LO	1153
	Warren Moulton	VK3LX	976 *
	David Davies	VK3MHV	1293
	John Ross	VK3MK	1798
	Ian Williams	VK3MO	1749
L	Rob Whitmore	VK3MQ	1352
	Peter Young	VK3MV	1400
L	Graeme McDiarmid	VK3NE	1485
L	Neville White	VK3NZ	1343
L	Alan Baker	VK3OA	1646
	Bill Miller	VK3OI	1598
	Jock Mackenzie	VK3OQ	1619
L	Peter Freeman	VK3PF	1443

	Name	Call	No
	Phil Harbeck	VK3PG	1784
	Mark Stephenson	VK3PI	1632
	Stewart Mair	VK3PR	1641
L	Peter Simons	VK3PX	1408
	John Longayroux	VK3PZ	1553
L	Bruce Plowman	VK3QC	1448+
L	Ian Hocking	VK3QL	1594
L	David Learmonth	VK3QM	1765
	Ray Dean	VK3RD	1577
L	Darrell Edwards	VK3RE	1185
L	Blayne Bayliss	VK3RF	1412
	Ron Sutcliffe	VK3RS	1425
L	Peter Wolfenden	VK3RV	1484 *
	Ray Wales	VK3RW	1471
L	Damien Vale	VK3RX	1239
L	Sarah Dowe	VK3SD	1535
	Barry Schrape	VK3SW	1560
L	Barry Abley	VK3SY	1496
	John Sutcliffe	VK3TCT	1589 *
A	Jaimie Hall	VK3TZE	1782
	Colin Durrell	VK3UDC	1244
L	Mike Thorne	VK3UE	1473
	Rodney Champness	VK3UG	1086 *
L	John Blackman	VK3UI	1319
L	Bruce Bathols	VK3UV	1090
	Kev Trevarthen	VK3VC	1115 *
L	Trevor Pitman	VK3VG	1246
A	Jeff Silvester	VK3VJS	1582
L	David Harms	VK3VL	1383
L	Greg Williams	VK3VT	1402
L	Peter Dempsey	VK3WD	1544
L	Brian Endersbee	VK3WP	1491 *
L	Jenny Wardrop	VK3WQ	1656
	Dennis Sillett	VK3WV	1668 *
L	Ian Keenan	VK3XI	1527
	John Cheeseman	VK3XM	1746
	Bob Tait	VK3XP	1689
	Ted Egan	VK3XT	721 *
	Drew Diamond	VK3XU	1140
L	Derek McNiel	VK3XY	1370
L	Tim Robinson	VK3YBP	1617 *
L	Brewster Wallace	VK3YBW	1126
L	Terry McIntosh	VK3YJ	1532
	Jon Nicholls	VK3YKB	1772
L	Peter Godfrey	VK3YPG	1685
	David Ditchfield	VK3YSK	1732
L	Alan Hayes	VK3ZAH	1711
	Ken Benson	VK3ZGX	1377
L	John Horan	VK3ZHJ	1541
	Kevin White	VK3ZI	1568
	Ian Baxter	VK3ZIB	1519
	Don Seedsman	VK3ZIE	1068 *
L	Jim Gordon	VK3ZKK	1262
	Geoff Angus	VK3ZNA	1482 *
	Cal Lee	VK3ZPK	1510
	Peter Mill	VK3ZPP	1788
	Eric Gray	VK3ZSB	1451 *
	Leigh Tuckerman	VK3ZTU	1468 *
L	Bill Adams	VK3ZWO	1356+

	Name	Call	No
	Queensland		
	Terry Stewart	VK4AAT	1739
	Colin Gladstone	VK4ACG	1703
	Ian Saunders	VK4ACU	1390
	Doug Hunter	VK4ADC	1697 *
	Geoff Adcock	VK4AG	1718
	Jim Brown-Sarre	VK4AGF	1640 *
	Barrie Smeaton	VK4ALK	1800 *
	George McLucas	VK4AMG	1675 *
L	Harold Cislowski	VK4ANR	1550
	Glenn McNeil	VK4BG	1633
L	Graeme Dowse	VK4CAG	1417
L	Les McDonald	VK4CLF	961 *
L	Jon Walton	VK4CY	842 *
L	Ian Browne	VK4DB	1283
L	Merv Deakin	VK4DV	1230 *
	Ron Goodhew	VK4EMF	1516
	Ron Kerle	VK4EN	1706
	Bob Lees	VK4ER	1609 *
	Jim Downman	VK4FAD	1659
	Len Eaton	VK4FIAA	1606
A	Bob Coupland	VK4FRC	1759
	Felix Scerri	VK4FUQ	1533
L	Geoff Bonney	VK4GI	969 *
A	Gary Bray	VK4GRB	1775
L	Warren Heaton	VK4GT	672 *
	Daphne Ayers	VK4IA	1647
	Kevin Dickson	VK4IW	1158
L	Gordon Loveday	VK4KAL	707+
L	Andy Beales	VK4KCS	1579
	Tony Dore	VK4KJD	1737
L	Norman Fiori	VK4LD	1296
A	Mike Patterson	VK4MIK	1467
L	Mario Antoniutti	VK4MS	1470
	Mike O'Connor	VK4MW	1603
A	Ray Crawford	VK4NH	1653
	Dick Pietrala	VK4OP	1075
	Ian McCosker	VK4PF	1162 *
A	Graham Hassall	VK4PMM	1773
	Allan Downie	VK4QG	1565
	Mike Charteris	VK4QS	1329
A	Rob Young	VK4QX	1795
L	Rod Rush	VK4RA	1477
	Ron Grandison	VK4RG	668 *
L	Ross Ramm	VK4RO	1433 *
L	Alex McDonald	VK4TE	1411 *
L	John Roberts	VK4TL	1005 *
L	Mick McDermott	VK4TMD	1317
L	Paul Blake	VK4TPB	1514
	Peter Elton	VK4VQ	1790 *
	Ray Thorn	VK4WY	1724 *
L	Chris Bourke	VK4YE	1436
	Nick Watling	VK4YT	1263 *
	Frank Adamson	VK4ZAK	1406
	Philip Tomlinson	VK4ZPE	1624 *
	Kevin Dibble	VK4ZR	1060
	Bill Wilcock	VK4ZWJ	1373
	South Australia		
	Mike Hall	VK5AGI	1615

	Name	Call	No
	Kevin Zietz	VK5AKZ	1735
	Morris Rieger	VK5AMR	1761 *
	Peter Reichelt	VK5APR	1612
	Alan Raftery	VK5AR	1791 *
	Adrian Wallace	VK5AW	1637
	Wolfe Rohde	VK5AXN	1628
	Ben Broadbent	VK5BB	1796
	John Dawes	VK5BJE	1764
L	Lloyd Butler	VK5BR	1495+
	Dick Turpin	VK5BRT	1347
	Barry Williams	VK5BW	1551
	Henry (Curl) Blythe	VK5CL	1654+
L	Brian Condon	VK5CO	291 *
	John Drew	VK5DJ	951 *
	Mac Macdermott	VK5FLEN	1631
	Jeff Farmer	VK5GF	851
L	Paul Spinks	VK5GX	1214
	Colin Hurst	VK5HI	1716 *
	Harro Krause	VK5HK	1275
L	Ian Sutcliffe	VK5IS	1355
	Trevor Niven	VK5NC	946 *
L	Keith Metcalf	VK5ND	1537 *
	Bryan Scott	VK5NOS	1202
L	John Butler	VK5NX	1120
L	Terry Franklin	VK5OC	1430
	Tony Wilkinson	VK5PBB	1453
A	Ron Zimmermann	VK5PCZ	1449
	David Poole	VK5PL	1729
	Peter Russell	VK5PR	1702 *
	Trevor Greig	VK5PTL	1601
	Phil Day	VK5QT	1722
L	Ivan Huser	VK5QV	477 *
	Rob Gurr	VK5RG	1500 *
	Colwyn Low	VK5UE	1361 *
	Rod Cunningham	VK5UV	1694
	Bill Thomas	VK5VE	1321 *
L	Ian Werfel	VK5VJ	968
A	Lyle Whyatt	VK5WL	1680
	Colin Luke	VK5XY	1168 *
	Hans Smit	VK5YX	1517
	Geoff Cleggett	VK5ZAE	1734
	Adrian Waiblinger	VK5ZBR	1614
	Ian Coat	VK5ZIC	1682
	Ian Maxted	VK5ZIM	1562
	Peter Temby	VK5ZJ	1229
L	Peter Whellum	VK5ZPG	1479

Western Australia

	Name	Call	No
	Brian McDonald	VK6ABM	1508 *
L	Barrie Burns	VK6ADI	1273 *
	John Farnan	VK6AFA	1409
	Peter Zwarecz	VK6APZ	1715
L	Mark Bussanich	VK6AR	1334
	Geoff Wood	VK6AT	1721
	Tony Argentino	VK6ATI	1591
	Graeme Smith	VK6ATS	1719
	Anthony Benbow	VK6AXB	1566
L	John Van-Tiel	VK6BCU	1481
	Bob Good	VK6BI	1652
	Richard Grocott	VK6BMW	1555
	Barrie Field	VK6BR	377 *
L	Bob Crowe	VK6CG	1405 *
B	Ken Taylor	VK6CO	1529
	Clive Wallis	VK6CSW	1289
	Clem Patchett	VK6CW	742 *
	Arthur Eder	VK6CY	1303
	Chris Walker	VK6DDX	1750
L	Doug Wells	VK6DEW	1458
	Doug Jackson	VK6DG	1243
A	Noel Fagence	VK6FNAJ	1780
B	Rob Hatton	VK6FX	1708
	Gerry Wild	VK6GW	1112 *
	Phil Hartwell	VK6GX	1494
L	Bob Howard	VK6HJ	1623 *
A	Richard Campbell-Morrison	VK6HRC	1698
	John Tower	VK6IM	1691
L	Glen Hufner	VK6IQ	1072 *
	Peter Scales	VK6IS	1700
L	John Farnell	VK6JF	1297
	Chris James	VK6JI	1587
	Jim Preston	VK6JP	1121
	Keith Bainbridge	VK6KB	1664
A	Dudley Donovan	VK6KBY	1672
L	Chris Hill	VK6KCH	1741
	Phil van Leen	VK6KHV	1655
L	Bob Lockley	VK6KW	1172
L	Glenn Ogg	VK6KY	1358 *
L	Lance Rock	VK6LR	1509 *
	Bill Toussaint	VK6LT	1561 *
A	Gary Dewar	VK6LX	1799
	Cliff Bastin	VK6LZ	1310
	Mike Crack	VK6MJC	1771
	Nick Vitalone	VK6NA	1745
	James Price	VK6NJP	1801
	Lindsay Hirschausen	VK6NO	1714
L	Noel Sanders	VK6NS	1493
L	Alan Gibbs	VK6PG	815 *
	Rob Penno	VK6PO	1111 *
L	Ray Peterson	VK6PW	346 *
L	Phil Zeid	VK6PZ	752+
L	Graham Rogers	VK6RO	1302
	Geoff Matthews	VK6SI	1738
L	Phillip Bussanich	VK6SO	1247
	Lee Thomson	VK6TY	1751
	Bob Knight	VK6UK	1778
	Don Truscott	VK6UT	1212
	Wayne Jefferies	VK6VE	1731
	Duncan Page	VK6VO	1340
	Steve Ireland	VK6VZ	1690
	Brian Green	VK6WG	1783
	Bill Rose	VK6WJ	1463
	John Tuppen	VK6XJ	1525
L	Roy Watkins	VK6XV	1181
L	Eddie Saunders	VK6YA	1762
L	Poppy Bradshaw	VK6YF	1191+
	Trevor Dawson	VK6YJ	1662
	Peter Savage	VK6YV	1671
	Tom Berg	VK6ZAF	1133 *
	Max Shooter	VK6ZER	1431 *
L	Igor Iskra	VK6ZFG	1559 *
L	Phil Casper	VK6ZKO	1445
	Christine Bastin	VK6ZLZ	1311
	Robert Randall	VK6ZRT	1225

Tasmania

	Name	Call	No
	Allen Burke	VK7AN	1270
	Tony Bedelph	VK7AX	1676
L	Nicholas Chantler AM	VK7BEE	1538
	Anne Landers	VK7BYL	1439
	Mike Hawkins	VK7DMH	1597
	Jerry Smutny	VK7EE	1595
	Winston Nickols	VK7EM	899 *
	Tom Moore	VK7FM	1593+
L	Herman Westerhof	VK7HW	1604 *
	Terry Pool	VK7JAI	1785 *
	Chris Holliday	VK7JU	1667 *
	Reg Emmett	VK7KK	1709 *
L	Charles Spiegel	VK7KS-ex	660 *
	Bob Geeves	VK7KZ	907 *
B	Ross Broomhall	VK7LH	1699
L	Rex Moncur	VK7MO	1298 *
L	William Maxwell	VK7MX	1418
L	Peter Dowde	VK7PD	1554 *
	Bob Reid	VK7RF	1666 *
L	Richard Rogers	VK7RO	908 *
	Trevor Briggs	VK7TB	1316
L	Justin Giles-Clark	VK7TW	1712
L	Winston Henry	VK7WH	1526 *
	Ross Bonney	VK7WP	1787
A	Wayne Hardman	VK7XGW	1723
	André Bochenek	VK7ZAB	1725
L	Paul Edwards	VK7ZAS	1324 *
L	Idris Rees	VK7ZIR	1713
	John Jongbloed	VK7ZJJ	1584

Northern Territory

	Name	Call	No
L	Mike Alsop	VK8MA	1743 *
L	Peter Clee	VK8ZZ	1728

Overseas

	Name	Call	No
	Fred Luthi	HB9JW	1760 *
L	Ira Lipton	WA2OAX	1344 *
L	Martyn Seay	ZL3CK	1159

Membership statistics

196 Life members
261 Full members
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23 Associate members
485 Total membership
Including
127 Licensed 50 years or more
20 Aged 90 years or more

MEMS technology - a rapidly growing industry

Clive Wallis VK6CSW
RAOTC member No 1289

If you have a reasonably modern mobile phone or mini handheld transceiver, chances are it has a MEMS microphone. The latest ones may have MEMS loudspeakers as well. Even if you have a fairly old mobile phone it's a MEMS sensor device that tilts the picture or text when you rotate it. If you are unlucky enough to be involved in a bad car crash and an airbag saves you from serious injury, it's almost certainly a MEMS accelerometer that fired the life-saving device.

The acronym MENS means MicroElectro-Mechanical System; an equivalent though less common term is MST, MicroSystems Technology. Both are aimed at transforming traditional mechanical devices into micro-sized versions able to be mass produced surprisingly cheaply yet with extreme accuracy. A rough analogy would be the way that microchips and Very Large-Scale Integrated (VLSI) circuits have reduced the bulkiness of old-fashioned valve and even transistor electronics to almost disappearingly small dimensions yet have dramatically improved the electrical performance.

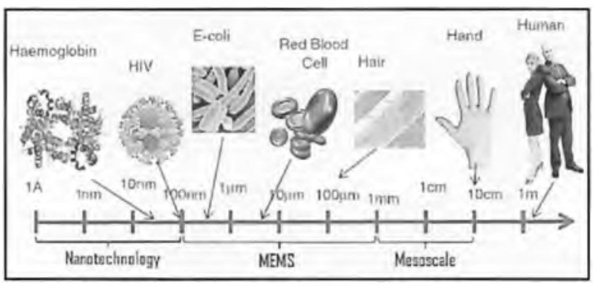


Figure 1. MEMS scale.

Fig 1 gives some idea of the sizes were are talking about; MEMS dimensions are measured in micrometres; NEMS, NanoElectroMechanicalSystems, in nanometres, a thousand times smaller. To give some perspective, the diameter of human hair ranges anywhere from 17 to 181 micrometres. The dust mite dwarfing the MEMS gears, Fig 2, is about 0.25 mm or 250 micrometres in length, while the chain seen in Fig 2a is thinner than most human hair.

Figure 2. A gear chain with a dust mite approaching.

Figure 2a. The chain in this MEMS gear set is thinner than a human hair. Total width is less than 1 mm.

Figure 3. MEMS microphone chip.

Fig 3 gives some idea of the size of a MEMS microphone sold as a surface mount device (SMD). It comes complete with built in amplifier and analogue-to-digital converter and can be bought in small quantities for just a few dollars each. The wholesale price to a mobile phone manufacturer would be even less, just over $US1.00.

Some of the more common MEMS devices are sensors used for measuring weight and pressure; solid state gyroscopes for measuring acceleration forces; actuators such as MEMS micro-pumps, switches, levers and grips; oscillators for frequency control and precise time keeping; tiny generators and power sources known as energy harvesters powered by vibrations; fuel cells and radioisotope power generators; and biosensors for biochemical and biomedical purposes. The list of MEMS devices is almost limitless.

The first MEMS device, in the form of a MEMS pressure sensor, was demonstrated in a laboratory in the 1960s but it was only in the 1980s that significant research into the new technology took place. Serious development and manufacturing of MEMS on a commercial scale took off in the 1990s.

The essential difference between a MEMS device and its full-sized counterpart is that instead of being made out of materials like metal and plastics, MEMS are micromachined from various types of silicon based wafers and substrates. The machining may be either by etching, laser, or both. Additional functional materials can be added to provide various capabilities, such as electrodes or piezoelectric layers.

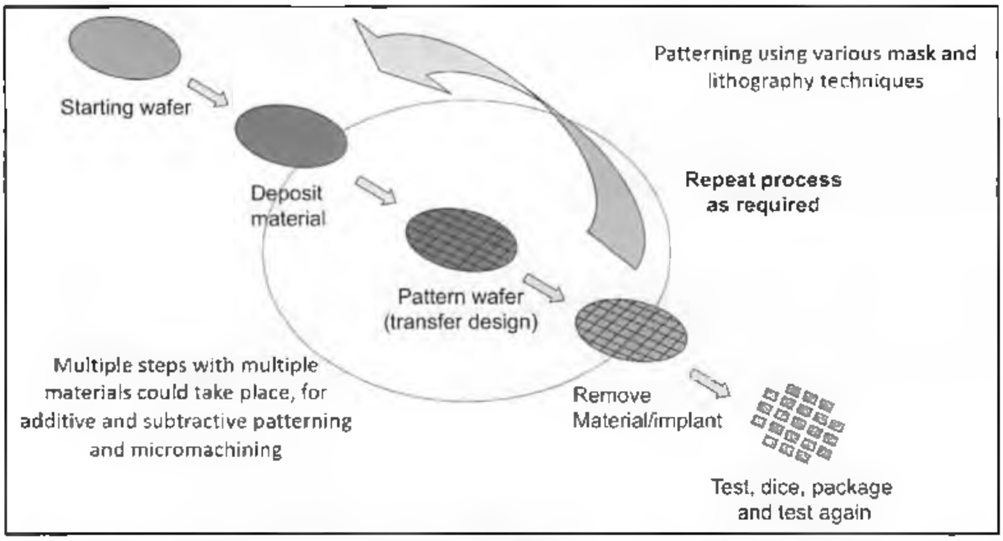


Figure 4. MEMS manufacturing steps.

Fig 4 gives a simplified idea of how MEMS are fabricated in much the same way as are integrated circuits.

Today, almost everyone, probably unknowingly, has MEMS devices in the form of mobile/smartphones, smart watches and fitness trackers. It's the MEMS solid state 'gyroscope' in our smartphone that keeps text and pictures orientated when we rotate the phone, yet these devices weigh less than a milligram and are no larger than a grain of sand. In the event of a crash, the airbag in your car will almost certainly be fired by a MEMS accelerometer detecting the crash forces. The quite large and heavy rotating gyroscopes used in older aircraft instruments such as the attitude indicator (artificial horizon) and rate-of-turn indicator, which together can weigh several kilograms and consume significant amounts of power, can now be replaced with lightweight displays based on MEMS sensors which of themselves weigh but a few milligrams and which require very little power to operate. See Figs 5 and 5a.

Figure 5. Older type gyroscope attitude indicator.

Figure 5a. Modern lightweight Garmin MEMS attitude indicator.

For around $30, model aircraft enthusiasts can purchase a MEMS flight stabiliser, a small unit weighing about 10 grams (about one-third of an ounce), which provides three axes of stabilisation, acting rather like a basic autopilot to make the model more stable in flight[1].

MEMS devices have much lower power consumption and often have higher sensitivity than their traditional mechanical counterparts can physically achieve. No wonder they are becoming so popular but, as with all things, MEMS have advantages and disadvantages.

Some of the main advantages of MEMS are:

- Sensors have extremely high sensitivity.
- Switches and actuators can work at very high frequencies.
- Power consumption is very low.
- Can be readily integrated with microelectronics to achieve embedded mechatronic systems[2].
- Extremely scalable; can be very cheap when mass-produced in large quantity.
- Can be scaled to achieve designs and dynamic mechanisms not possible at full size.

Some disadvantages are:

- Research and development stages can be extremely expensive.
- High set-up costs for fabrication clean rooms and foundry facilities.
- Often requires expensive testing equipment for quality control and performance.
- High initial costs make small production runs very uneconomic.

Transduction is the action or process of converting something, especially energy, into another form. For example, an electric motor is a transducer converting electrical energy to mechanical energy. Similarly, MEMS devices employ various types of transduction mechanisms in order to interact with the world. In our sphere of interest, radio and electronics, mostly these are electrical-to-mechanical or mechanical-to-electrical transducers enabling us to use or control the MEMS device through suitable interface circuits. However, other types of transducers can be used to interact with magnetic, ferroelectric, chemical, light, radio-frequency and other domains.

Two of the commonest transducers used in silicon MEMS devices to convert electrical energy to mechanical energy and vice-versa are the electrostatic and piezoelectric types. This is because no additional specialist material is required for fabrication and micromachined silicon can be doped to provide conductivity.

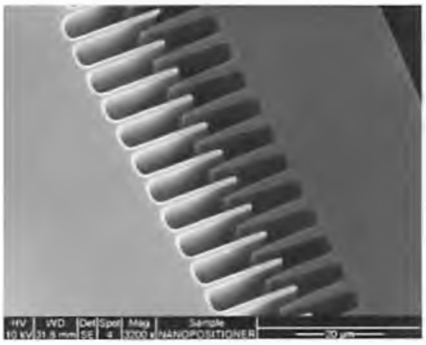


Figure 6. Electrostatic comb drive in a MEMS device.

Fig 6 illustrates the electrostatic drive principle. By establishing an electric field across a pair of capacitive parallel plates, where one plate has a positive charge and the other a negative charge, an electrostatic force can be sustained (just like a charged capacitor). When mechanical motion varies the distance between the parallel plates, an electrical signal can be measured across the plates. The familiar electret or condenser microphone uses this principle. Similarly, by applying a dynamic electrical signal to vary the charge between the plates, the parallel plates can be activated into corresponding mechanical motion. Electrostatic loudspeakers, particularly tweeters, and some inkjet printers use this principle. The 'comb finger' design as illustrated is very popular for MEMS electrostatic transducers because it maximises the capacitive surface area of the transducer.

Earlier generation mobile phones usually used MEMS electret microphones based on electrostatic technology but now the preference is towards piezoelectric technology.

Piezoelectricity (piezo comes from the Greek word for pressure) is the process of using certain crystals to convert mechanical energy into electrical energy, or vice versa, discovered by French physicists Jacques and Pierre Curie in 1880. Applying mechanical energy to squeeze or distort a piezoelectric substance, such as natural quartz crystals or man-made Rochelle salt crystals, creates a corresponding electric charge across the crystal. Practical examples of yesteryear are the crystal microphone and gramophone crystal pick-up. Nowadays special ceramics or other man-made piezoelectric substances giving higher voltages than natural crystals are preferred.

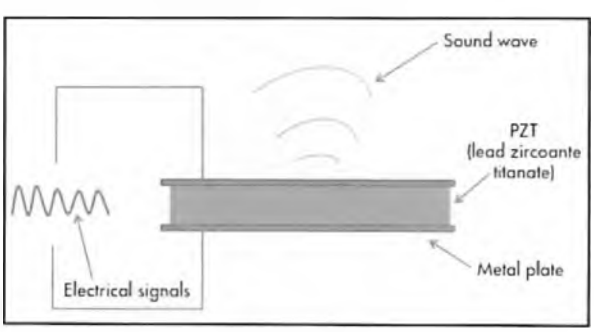


Figure 7. Piezoelectric microphone principle.

Fig 7 illustrates the principle of a piezo or 'crystal' microphone using man-made PZT (lead zirconate titanate) as the energy conversion element, converting soundwave pressure into voltage, while Fig 7a shows

Figure 7a. InvenSense MEMS microphone package.

an actual MEMS RF-shielded piezo microphone package. This 3.5 x 2.65 x .98 mm SMD package is intended for reflow soldering to the printed circuit board and has the microphone port and electrical connections on the underside. The frequency response is from 60 Hz to 20 kHz, and within the housing is the tiny MEMS acoustic sensor, signal conditioning circuitry, an analogue-to-digital converter, decimation and anti-aliasing filters, power management circuit and an industry standard 24bit I²S interface (an electrical serial bus interface standard). Power consumption is a mere 980 microamperes and the package retails over the counter for $5 in single quantity, and around $1.50 each when bought in quantity!

Conversely, applying an electric charge to a piezoelectric material causes it to change shape, a process known as the 'inverse piezo effect'. We are all familiar with the precise vibration of a quartz crystal in a crystal controlled RF oscillator, but a suitably shaped piezoelectric element can be made to twist, bend, expand or contract with considerable force when subjected to an electric charge.

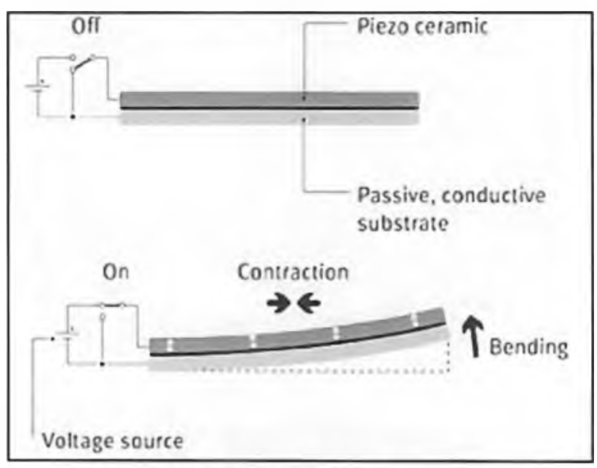


Figure 8. Inverse Piezo effect.

In MEMS devices the inverse piezo effect is important for creating motion and positioning, as well as generating sound and ultrasound. Fig 8 shows how an applied voltage contracts the piezo crystal layer causing bending. If the polarity is reversed, expansion occurs. Applying an alternating voltage creates vibration; MEMS levers can be made to vibrate at extremely high frequencies. Twisting and other forms of motion can also be achieved.

Fig 8a (on next page) shows a tiny yet powerful piezo electric motor which uses expanding and bending piezo 'fingers' to literally push the gear wheel around. Similar devices can be made at the MEMS level.

While MEMS microphones have largely cornered the mobile phone market, one common electro-mechanical device that has defeated MEMS engineers until quite recently is the loudspeaker which, apart from the battery, is just about the largest single component

Figure 8a. Tiny yet powerful piezoelectric motor.

in any mobile phone and one which has largely defined the phone's minimum thickness.

In 2019, the provision of loudspeakers, earbuds and earphones to the mobile phone industry worldwide was worth about US $20 billion, a market large enough to entice someone to produce a better, cheaper, product. It was also around 2019 that the first successful MEMS loudspeakers appeared commercially.

The basic principle of operation of the electrodynamic loudspeaker, a voice coil working in a strong magnetic field to vibrate a diaphragm creating soundwaves, has remained much the same for over a century. Huge improvements in magnets and voice coil design have increased efficiency but the loudspeaker has remained a relatively bulky, power consuming item. MEMS is about to change that.

While the micro-mechanism in MEMS microphones needs to have only enough movement to respond to the acoustic signal, the resultant tiny voltage being easy enough to amplify, MEMS speakers need to move air to transduce electric signals to soundwaves loud enough to hear. Essentially, a loudspeaker is an air pump and the 'pumping power' or sound output depends on the diaphragm area and its movement. At low frequencies the movement needs to be quite large. In general, MEMS loudspeakers use either piezoelectric or electrostatic transducers to obtain the mechanical deflection of a diaphragm needed to generate sound.

Earbuds and earphones need to generate far less output than a loudspeaker so these were the first type of audio transducer to appear as MEMS devices.

Figure 9. MEMS earphone loudspeaker.

Fig 9 shows a MEMS earbud/headphone speaker chip developed by the German research group, Fraunhofer Institute for Silicon Technology. Although only 4 x 4 mm, this chip has a high fidelity frequency response of 20 Hz to 20 kHz and can achieve a sound pressure level of 110 dB, loud enough to sound quite deafening. Fig 10 shows a Fraunhofer device mounted on a board ready to install in a circuit.

Figure 10. Fraunhofer, the German research institute is developing both piezo and capacitive (electrostatic) all-silicon MEMS-speakers. Its CMOS-compatible MEMS speaker is based on electrostatic bending.

USound GmbH is a fast-growing Austrian audio company, developing and producing the most advanced audio systems for personal applications based on MEMS technology. In 2019 they marketed their first MEMS speaker for earbuds and headphones, see Fig 10a, and aim to capture a huge market.

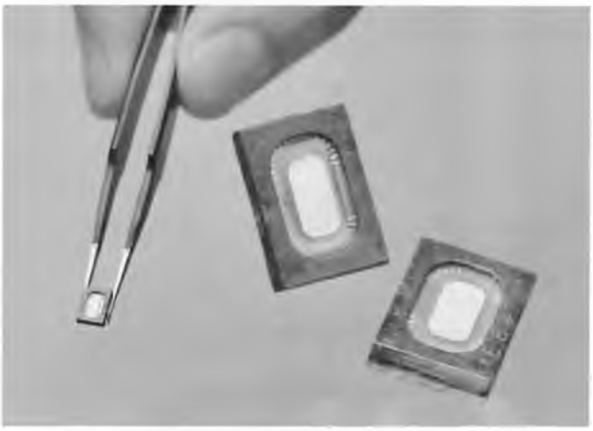


Figure 10a. In 2019, Austrian start-up USound brought their first MEMS microspeaker to market for wearables, headsets and embedded speakers.

As mentioned earlier, piezoelectric ceramics can be designed to move in a variety of ways. In Fig 11 the ceramic element and its conducting substrate can be made to twist up at the long edge.

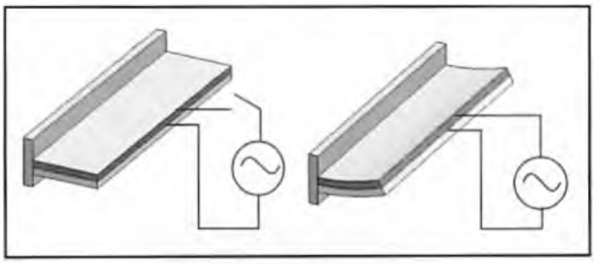


Figure 11. Piezo bending.

By attaching a very thin membrane to this edge and subjecting the element to an audio frequency electrical signal, the membrane would vibrate the surrounding air to produce sound. If we used four elements, one on each side of a square shaped membrane, the sound output would be greater. If we put a number of these

(continued on page 38)

A Swedish beauty

Herman Willemsen ex VK2IXV
RAOTC member No 1384

Sorry folks, this is not about the Swedish-born actress and three-time Academy Award winner Ingrid Bergman, but about a Swedish bug key. In an attempt to speed up the telegraph transmissions during WWII, the Swedish government asked the electronics company SRA to produce a semi-automatic bug key. It heralded the birth of a Swedish bug called 'TYP BUG 140'. The trouble was that the government-trained telegraphists could not use a bug as they learned their trade on straight keys. However, the Army discovered that Swedish radio amateurs could use both bug and straight keys, so they encouraged them to enlist.

I can relate to the above as, in 1958 when I attended Radio-Holland (RH) radio college in Amsterdam, we were taught Morse code sending on a straight key. We did not even know about the existence of bug keys. On board Dutch ships we had to use the Radio-Holland supplied handkeys which were mainly Junker keys but could also be a Swedish Pedersen/Amplidan or a Marconi handkey, all with a Radio-Holland nameplate screwed on them.

When I bought my first bug key in Singapore in 1963 I was conscious of the fact that such keys were not allowed to be used on Dutch ships.

Nevertheless, my fellow Marine Radio Officers and I used them anyway, although discretely. In general, bug keys have a speed of between 20 and 50 wpm. However, because of the pendulum and weight, they are not much good in rough seas when a ship is rolling and shaking heavily.

The same applies when using a bug during bad QRN, QRM or QSB[1] as fast Morse code would initiate too many requests for 'please repeat'. Under those circumstances it was more practical to use a straight key and slower Morse. However, in smoother waters and minimal atmospheric conditions, a bug key was a godsend as it saved time, sent cleaner Morse and was less tiring on your arm.

At all times, however, a straight key was used when slower traffic of about 16 wpm was required during the transmission of Distress (SOS), Urgent (XXX) and Safety (TTT) messages. When a Radio Inspector was due to inspect my ship's radio station, the bug key was temporarily put out of sight[2].

Who was SRA?

SRA, Svenska Radio Aktiebolaget (Swedish Radio Company) was established in 1919. Its owners included L M Ericsson, AGA and ASEA. To ensure SRA had access to international know-how, the Marconi company was also invited to take part. In 1927, Ericsson acquired a majority stake in SRA with Marconi as a minority owner.

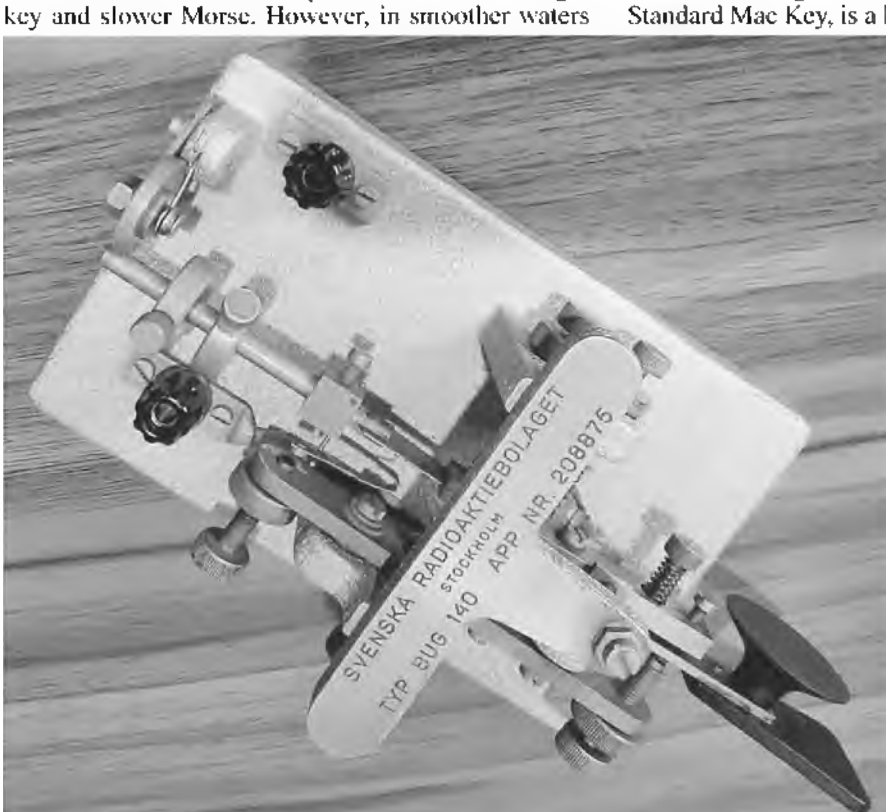
During the war years of the 1940s, SRA produced radio and radar equipment for the Swedish Defence Forces, including a limited run of less than 200 bug keys.

The SRA bug, based on the American 1938 McElroy Standard Mac Key, is a large and sturdy, unpretentious bug key with the name of the company, SRA, engraved in full on top of the T-bar. The cast base measures 153 mm long by 94 mm wide by 13 mm deep, is painted grey crackle and weighs 1.83 kg. The T-shaped bar on top of the trunnion serves several purposes:

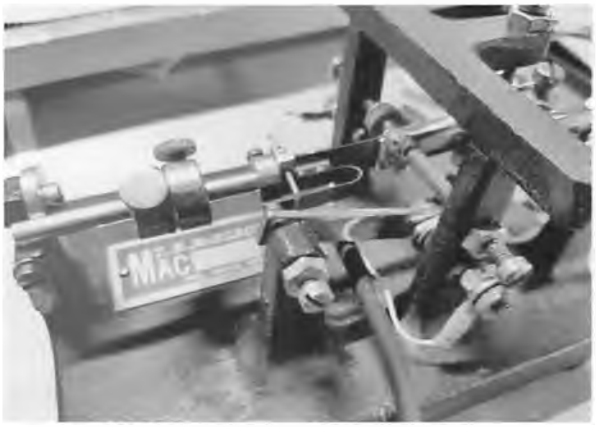
1. It is part of the frame, holding the trunnion pin.
2. The T-bar provided a means for the telegraphist to carry his key to or away from the operating position.
3. Although seldom used, once the pendulum is locked with the damper clip, the SRA bug could be turned on its left-hand side and used as a hand key.

This bug also features a dot-stabiliser to control the dot spring.

Back in the early 1930s, Theodore 'Ted' Roosevelt McElroy[3], a manufacturer of telegraph keys, came up with an innovation he called a



The author's SRA bug Morse key TYP BUG 140.



Dot spring stabiliser on a McElroy T-bar Mac bug key.

dot-stabiliser or dot-tamer, which pre-loads (puts a tiny bit of pressure on) the dot contact spring[4]. It is enough to limit the relaxation of the vibrating dot spring when its tension is released. McElroy's aim was to eliminate the contact bounce which creates scratchy or mushy dots.

Personally, I cannot hear the difference with or without the dot-stabiliser, but it can be clearly seen on an oscilloscope[5].

Most information on dot-stabiliser devices was either lost, or more likely ignored, during and after WWII[6]. These wartime SRA TYP BUG 140s were sold in the 1960s as surplus. Underneath the base is written in handwriting the numbers 9250 and 25/, the latter meaning 25 SEK (Swedish Krona). Today a good SRA bug would set you back about AU$300-400.

In general, SRA bugs feature Bakelite binding post terminal screws, although the one owned by Jan Sköldin SM5LNE has metal terminal screws. It appears that in the 1960s it was these 'Hams' that exchanged the original metal terminal screws for Bakelite ones.

One of these rare[7] SRA keys is also featured in *Morsum Magnificat* magazine No 41, page 25 and is mentioned in *N7CFO Keyletter #28*, page 321.

Footnotes

1. QRN = natural atmospherics; QRM = man-made interference; and QSB = signal fading.
2. See my stories *Bitten by the bug* in *OTN* 38, p14 and *Saved by a bug key* in *OTN* 54, page 47.
3. Visit website: *http://www.telegraph-office.com/pages/mcelroy.html*
Ted McElroy started his career as a professional telegrapher with the Western Union. Later in life he became a manufacturer of telegraph keys. He was an amateur radio operator with radio callsign W1JYN. He holds the all-time speed record for receiving Morse code at 75 wpm.
4. We are looking at a pre-loading of only 0.127 mm. See video at: *https://www.youtube.com/watch?v=OKY2bxTs2R8*
5. See: *http://w0eb.com/DSmain.html*
6. For more information on dot-stabilisers and using a bug as a straight up-and-down key see my article in *OTN* 44, March 2010, pages 32 and 33.
7. So far, only seven are known to exist, although there must be more out there.

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MEMS technology - a rapidly growing industry

(continued from page 36)

devices together, the sound output would be greater still. Although this is a gross oversimplification of how the USound MEMS speaker works, it does give an idea of the basic principle.

Another idea is to use a very thin flexible conducting film insulated and separated from a conducting rigid baseplate, essentially a capacitor with flexible plate. By superimposing an audio frequency signal on a polarised electrostatic charge, the flexible membrane vibrates to generate sound waves. However, unlike the piezo transducer which can operate at low voltage, the MEMS electrostatic transducer does require a moderately high voltage, around 30 V, to operate.

The attraction of MEMS loudspeakers lies in their thinness. An entire assembly complete with driver electronics can be made about 1 mm in thickness, a fraction of that of the smallest electrodynamic loudspeaker, and, in quantity, much cheaper.

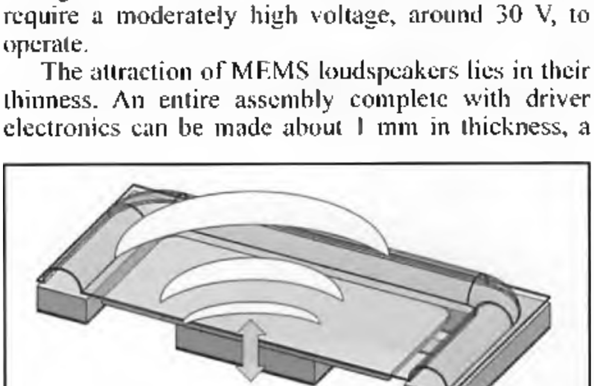

Figure 11a. Complete assembly with driver amplifier below diaphragm.

While this article does no more than scratch the surface of MEMS technology, we can rest assured that these micro-miniature devices are here to stay and will revolutionise many areas of electronics, mechatronics[2] and other technologies, just as the transistor and the microchip have revolutionised the electronics of yesteryear.

Notes

1. See author's *Fluttery - the sincerest form of imitation. OTN* No 54, September 2014.

2. Mechatronics is the discipline that focuses on the engineering of both electrical and mechanical systems, and also includes a combination of robotics, electronics, computer, telecommunications, systems control, and product engineering.

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Visit to the Museum of Flight, Boeing Field, Seattle

Lloyd Butler VK5BR
RAOTC member No 1495

On a visit to the USA in July 1994, my wife Margaret and I were on our way to sail up the inside passage of Alaska. The one-hundred-passenger ship was due to sail from Seattle and we decided to have a few days in Seattle to visit the sights. We first paid a visit to the Boeing Aircraft Factory. This was an eye opener on its own, but our guide suggested that we should also visit the Museum of Flight, which holds one of the largest air and space collections in the United States.

The City of Seattle

Seattle is Washington State's largest city and is situated on Puget Sound in the Pacific Northwest of the USA. It is surrounded by water, mountains and evergreen forests, and contains thousands of acres of parkland. It also serves technical areas such as the Boeing Aircraft Factory, Boeing Field airport and the Museum of Flight, which we visited and are the subjects of this brief article.

Downtown Seattle with volcano Mount Rainier in the background.

Volcanoes

Looking at the picture of downtown Seattle, it can be seen that the city is not far from the Mount Rainier volcano which is located just 59 km south-southeast. This is an active volcano that is part of the eastern rim of the Pacific Ring of Fire. Although Mount Rainier has not produced a significant eruption in the past 500 years, it is potentially the most dangerous volcano in the Cascade Range because of its great height, frequent earthquakes, active hydrothermal system, and extensive glacier mantle.

Mount Rainier's closest volcano neighbour is Mount St Helens which produced the largest eruption in the United States when it erupted in 1980.

When we were flying into Seattle, I took some shots with my video camera of some of the volcanos. One had one side collapsed and I wondered whether this might have been Mount St Helens.

The Museum of Flight

Margaret and I arrived at the Museum of Flight on a Saturday. As it turned out, that day the Boeing Field was having a rehearsal of an airborne air show programmed for the next day.

Not only did we see the amazing display of historic aircraft from the museum, but we witnessed aircraft in flight, taking off and coming in to land, and also some performing acrobatics. My video camera did quite a lot of filming of aeroplanes including the acrobatics.

The Museum of Flight is a private, non-profit, air and space museum. It is located at the southern end of King County International Airport (Boeing Field), in the city of Tukwila, just south of Seattle. It was established in 1965 and is fully accredited by the American Alliance of Museums. Boeing Field is now officially named King County International Airport but Boeing Field seems to be the name normally used.

An aerial view of of the Museum of Flight with Boeing Field at the rear.

From a Museum of Flight Post Card

The picture above shows the Museum buildings in front of Boeing Field. The main building structure is on the right with the Red Barn to the left. As the name of the latter might indicate, it is painted bright red.

The Red Barn

Part of the Museum of Flight is the 'Red Barn', a registered historic site also known as Building No 105. Built in 1909, the building was used during the early 1900s as Boeing's original manufacturing plant. The exhibits in the Red Barn illustrate how wooden aircraft structures with fabric overlays were manufactured in the early years of aviation. It also provides a history of aviation development through to 1958.

The old Red Barn at the Museum of Flight.

From a Museum of Flight Post Card

In 1975, the William E Boeing Red Barn was acquired for one dollar from the Port of Seattle which had taken possession of it after Boeing abandoned it during World War II. The 1909 all-wooden Red Barn, the original home of the company, was barged 3 km up the Duwamish River to its current location at the southwestern end of Boeing Field.

The Boeing 737

The Boeing 737 is a narrow-body aircraft produced by Boeing Commercial Airplanes at its Renton Factory in Washington. Developed to supplement the 727 on short and thin routes, the twinjet retains the 707 fuselage cross-section and nose with two underwing turbofans. The old Red Barn was used as a factory in building the early Boeing 737 aircraft. The Boeing 737 protype, the B737, is listed with those on display in the Museum of Flight (see sidebar).

The prototype 737 made its first flight on 9th April 1967. Boeing used the 737 as a flight test aircraft before it became NASA's Transport Systems Research Vehicle in 1974. This aircraft is on loan to the Museum of Flight from NASA.

The Golden Age of Aviation

Many aviation museums concentrate on military or civil aviation, or on aviation history of a particular era, such as pioneer aviation or the succeeding 'golden age' between the World Wars, aircraft of World War II, or a specific type of aviation, such as gliding.

The Museum of Flight Golden Aviation Row.
From a Museum of Flight Post Card

One section of the Seattle Museum of Flight has part of its Gallery devoted to that Golden age as illustrated in the photograph above of the Golden Age Row. However, the Museum in total covers the broad spectrum of aviation.

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- https://en.wikipedia.org/wiki/
- *History of Boeing Aircraft* - https://en.wikipedia.org/wiki/History_of_Boeing/
- *The Museum of Flight, Boeing Field* - https://www.museumofflight.org

The Flight Gallery

The Museum of Flight has more than 150 aircraft in its collection, including such famous planes as the:

Lockheed Model 10-E Electra faithfully restored by pilot Linda Finch to match the aircraft Amelia Earhart was piloting when she disappeared over the Pacific Ocean.

Boeing 747 - the first flight-worthy B747, *City of Everett*. Its registration number is N7470, and it was named after the city of Everett, Washington. Its first flight was on 9th February 1969 and it was retired in 1990.

Boeing VC-137B SAM 970 - the first presidential jet, which served in the presidential fleet from 1959 to 1996.

Concorde 214 (British Airways) - registration G-BOAG. This is one of only four Concordes on display outside Europe, with the other three being near Washington, in New York, and in Barbados.

Caproni Ca.20 - the world's first fighter plane from World War I. The one on display at the Museum of Flight was the only one ever built.

The de Havilland Comet - the world's first jet airliner. First flew in 1949 and was in production from 1952 to 1964.

Lockheed D-21 - unmanned reconnaissance drone. Displayed mounted on the M-21.

Lockheed M-21 - the sole surviving M-21 - a variant of the Lockheed A-12.

Lockheed SR-71 Blackbird - the surviving cockpit section of 61-7977, an SR-71 that crashed in 1968.

Boeing 737 - the prototype B737.

Boeing 787 Dreamliner - N787BX, the third 787-8 prototype.

Lockheed Martin RQ-3 DarkStar - the second DarkStar UAV prototype.

MacCready Gossamer Albatross II - human-powered aircraft.

Aerocar International's Aerocar - One of five surviving Aerocars (automobiles with detachable wings and propeller).

LearAvia Lear Fan - prototype N626BL.

An airworthy DC-2.

Boeing 80A - flown by Bob Reeve in Alaska.

Boeing 727-100 (E1) - an ex-United Airlines B727-100, the Original Prototype.

Lockheed L-1049G Super Constellation - an ex-Trans-Canada Air Lines Super Constellation.

L-106 Alcor - the world's first pressurised sailplane.

The Museum of Flight Aircraft Gallery.
From a Museum of Flight Post Card

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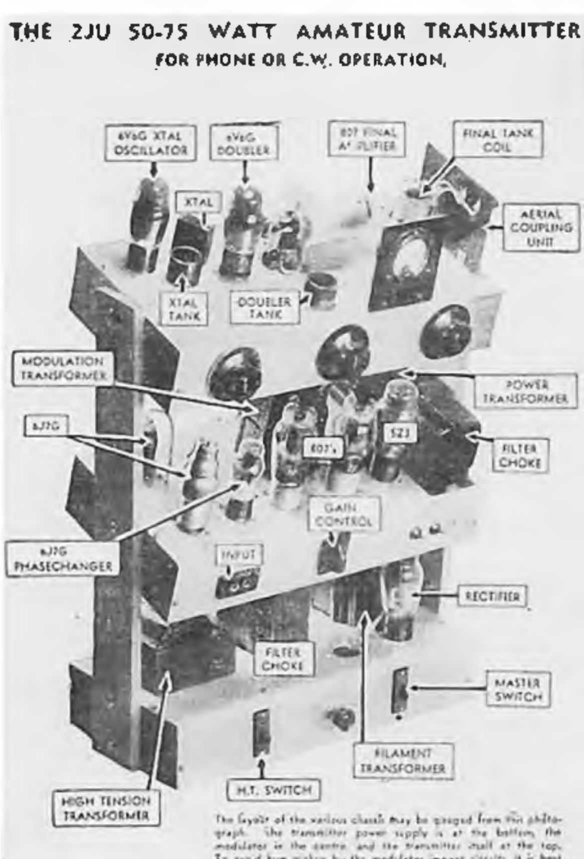
VK2CF - from my first station to my last

John Clark VK2CF, BE, FIEAust
RAOTC member No 903

When I was a child I developed an interest in electricity and wireless, and when I was about ten I was given a Morse code set comprising a simple key and buzzer for Christmas. I remember how amazed I was when I heard it on our wireless. These early interests led to a lifetime hobby of amateur radio, and a successful and rewarding career as a professional engineer.

I obtained my AOCP in December 1946 at age 18 after completing a WIA course and while working as an apprentice, and obtained my station licence in March 1947. I built my station to the design and instructions in *Radio and Hobbies* magazine with components purchased from Prices Radio in Angel Place and Radio House in the Royal Arcade, both in the city of Sydney.

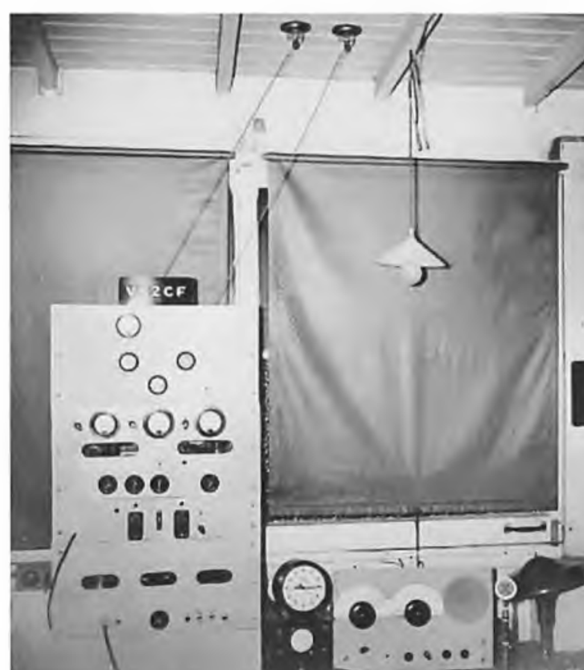
The station was in my bedroom in my home in Bondi. The receiver was a six valve Amateur Junior receiver from the April 1946 edition of *Radio and Hobbies*, and the transmitter, the 2JU 50-75 watt Amateur Transmitter described in the August 1946 edition of *Radio and Hobbies*, was built into a wooden 6 foot by 21 inch (1.8 m by 53.3 cm) rack with the front panels made of masonite.



***Radio and Hobbies*, August 1946.**

In this rack was an antenna tuner feeding a 40 metre end fed Zepp antenna (not a *Radio and Hobbies* design), the transmitter itself which was consisted of a 6V6 crystal controlled oscillator at 7.046 MHz, a 6V6 doubler and an 807 final; the AM modulator using three 6J7s driving two push pull 807s in class AB1; and a power supply with a 5Z3 rectifier and a carbon microphone. Also in the rack was the transmitter 400 V power supply which also used a 5Z3 rectifier.

I first went on the air using CW in June 1947 and then AM phone in August 1947. I made my first purchase of new commercial equipment, an Astatic 600S crystal microphone, in November 1947 and built a modulation monitor using a disposals VCR 139A CRT (cathode ray tube). This is the station shown in the photo below.

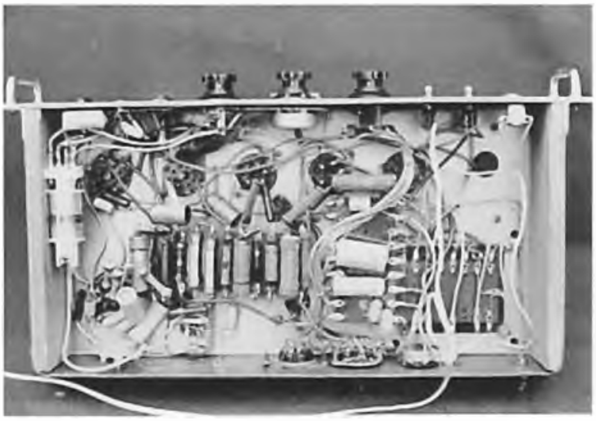


The VK2CF station in November 1947.

In a case of 'marry me and marry my station', I married in August 1952 and changed my QTH to a small flat in Point Piper with limited antenna space.

In the following years I replaced the receiver with an ex-services AWA 3BZ receiver, added a 6V6 buffer to the transmitter to use an ex-services BC-696 3-4 MHz Command transmitter as a VFO, and built a 2 metre converter.

After our first child was born we moved QTH to a larger flat in Bondi with good spaces for antennas. As a first priority I built a new childproof station console.



The underside of the modulator built in 1947 using two push pull 807s in class AB1 (see previous page). That's how we built in those days.

Over the following years I rebuilt the transmitter using an Italian Geloso multi-band VFO exciter and a Geloso Pi output; built an antenna tuning unit and erected a centre fed 40 metre antenna; built a new crystal-locked three valve 2 metre converter; modified an ex-services SCR-522 VHF transmitter for 2 metres; modified the original modulator to switch between the HF and VHF transmitters; and built a four element Yagi beam.

We decided to build a house and, when looking for land, the suitability of the site for my station was a consideration. We purchased a block of land at West Pymble and later, when we started building, I was concerned to see two radio towers had been built at the end of our short street. The towers were for the aircraft West Pymble Non Directional Beacon. They were on the centreline of the main runaway ten miles from Sydney's Mascot Airport but, being VLF, were of no concern. We moved into our new home in January 1966.

I had planned for my station to be in the house but my family had other ideas and I ended up in the garage. I installed the existing rig in the garage and erected a 40 metre Zepp antenna.

Over subsequent years the major changes made were that I purchased and installed a 10 element beam and made a rotator and position indicator from disposals and Meccano parts; built my first solid state device, a 2 metre converter; replaced my HF AM rig with a Yasu FT-200 SSB transceiver; purchased and installed a four band vertical Hy-Gain 14AVQ antenna; replaced my VHF AM rig and beam with an Icom IC-22A FM transceiver and a Kenwood desk microphone; built a 12 V 4 A power supply to supply the FM transceiver; built a 2 metre vertical double extended Zepp antenna; and replaced the FT-200 SSB transceiver with an ICOM IC-740 transceiver and an IC-740 power supply, and added a Yaesu FC-102 antenna tuner.

I retired in July 1987 and, as our children had left home, I moved my station into a spare bedroom in the house.

Although there were long periods when I was not active, over the years I built a console to house my gear, replaced some items and added others, but there have been virtually no changes since about 2010. My final station comprised the following: an Icom IC-740 SSB transceiver; an Icom IC-PS20 power supply; a Yaesu FC-102 antenna tuner; a Hy-Gain 18AVT five band vertical antenna; a Yaesu FT-220 2 metre transceiver; my original home-built 12 V 4 A power supply; an Archer discone antenna; an Icom IC-R72 communications receiver; and a Realistic VHF-UHF scanning receiver.

VK2CF's final station in 2020. On top of the console is the key, crystal, 6V6 and 807 valves used in my original station.

Sadly my hearing began to deteriorate and in 2008 I acquired hearing aids. However, my hearing continued to deteriorate to the stage that in about 2016 I could not copy SSB transmissions and have not worked that mode since. I can, however, with some difficulty and depending on the voice and accent, copy FM signals.

Amateur radio has been a wonderful hobby but it also had other effects on my life. It, in part, influenced me to undertake many years of part time study to obtain a Diploma and then Degree in Electrical Engineering.

I started work as an apprentice electrical fitter in the Sydney County Council that generated and supplied electricity to Sydney. Although working in the power industry I was interested in remote control and signalling systems and also protection and other control systems used in various applications. Due to this, I was employed in increasingly senior positions utilising these systems.

As an engineer I later specialised in these systems and proposed, designed and installed major state of the art systems. In recognition of this I was elected a Fellow of The Institution of Engineers Australia. ar

My electronics journey and radio station 3MA Mildura

Mike Alsop VK8MA
RAOTC member No 1743

In the September 2020 edition of *OTN Journal* I was fascinated to read the article *A history of radio station 3MA Mildura*. I have known the author Noel Ferguson VK3FI for many years and my first meeting with him set me on a course that would see me enter and work in the Broadcast and TV industry for most of my life.

I have recently come out of semi-retirement and re-entered the broadcast industry again, working with CAAMA Radio (Central Australian Aboriginal Media Association) in Central Australia to help them rise out of special administration. I helped these people in the early 1980s to get on air in Alice Springs. I am now bordering on 71 and still love broadcasting!!

But, I digress. Let's go back to around 1960, Mildura, and radio station 3MA. My father, William Frederick Alsop, who was born in 1918, served in the Australian Army in WWII and, in fact, holds the distinction of being the first soldier signed up at the Melbourne Showgrounds on day one of recruitment! He was assigned the number VX54001, the first number assigned after WWI for the army.

My father was taken prisoner by the German forces on Crete and spent four years as a POW in Germany in Stalag 383. After repatriation and subsequent return to Australia, he and my mother (née Betty Margaret Murdoch) married and I arrived in 1950. Dad, a Melbourne lad, had a close affiliation with the Mallee as many of the men he served with, or was locked up with as a POW, came from the Mallee. In fact, he was a famous bicycle racer in Victoria with many awards and trophies, and was a very fit young man of 21 in 1939.

Finally, I get to the significance of the Mallee. Every Christmas for many years our family, including my new brother, John Charles Alsop, did the annual pilgrimage to Mildura to always stay at the Ka-Rama Motel in Deakin Avenue, only a few minutes from the centre of Mildura. My wonderful grandfather, Charlie Cook, had bought me a 'crystal set' (from memory its brand name was 'Hinode') in about 1959 and I was fascinated when we travelled into a town for a few minutes that had an AM broadcast transmitter and I could hear it!!

So, Mildura circa 1960, post Christmas, we were in Mildura at the Ka-Rama and I planned my attack. I could hear 3MA on my crystal set, with its earpiece! So where were they? The staff at the motel told me it was in the main street, between Deakin Avenue and Langtree Avenue. A little help from the locals pointed me in that direction. I could see the antenna on the roof of the T&G building and I had found the target! As a cheeky little almost teenager, up I went to the studio and cockily asked if I could see someone about technical stuff.

Enter Noel Ferguson VK3ZGZ, VK3AGF, as he was in the early days. Noel took me in, showed me the studios and, most importantly, took me to see the 'Big Transmitter', located some miles away from the studio. He also gave me an exhausted valve, an 833A from memory, which I treasured until Cyclone Tracy destroyed it in 1974.

A photo of an 833A transmitter tube similar to the one given to the author by Noel Ferguson, then VK3ZGZ, around 1960.

In 1961, aged 11, I joined the WIA VK3 Division as SWL L1375 and went on to enter the broadcast and TV industry, getting my amateur licence in 1966 as VK3ZYB, my BOCP in 1968 and my TVOCP in 1969.

At the age of fourteen I had started work at the newly built ATV-0 station in Melbourne, having lied about my age. My first stint at ATV-0 was from 1964 - 1968. My father had always wanted me to become a pharmacist, as he wanted to be prior to WWII. However, WWII interrupted his ambitions and my lack of interest in Latin at Aquinas College in Ringwood, Melbourne, dashed that thought.

As an employee for Ansett at ATV-0, I had some 6 m issues working there. But I did end up working at the ATV-0 transmitter on Mt Dandenong with a 100 kW ERP 6 m transmitter!

At about 18 years of age I returned to Mildura to work at STV-8. By this time I had met a beautiful young lady, née Fay Mitchell, who was born in Colac and raised in Mildura. We started a life together in 7th Avenue, planning a wedding ASAP. I had always been fascinated with Mildura and wanted to make it my home.

I had made phone calls from Melbourne to STV-8 to see if I could work there. This was my introduction to

Max Foley VK3GZ. In a quirk of fate, as I travelled to Mildura, Max Foley passed away unexpectedly. It had been a verbal arrangement and, arriving at a time of such family grief, I backed off.

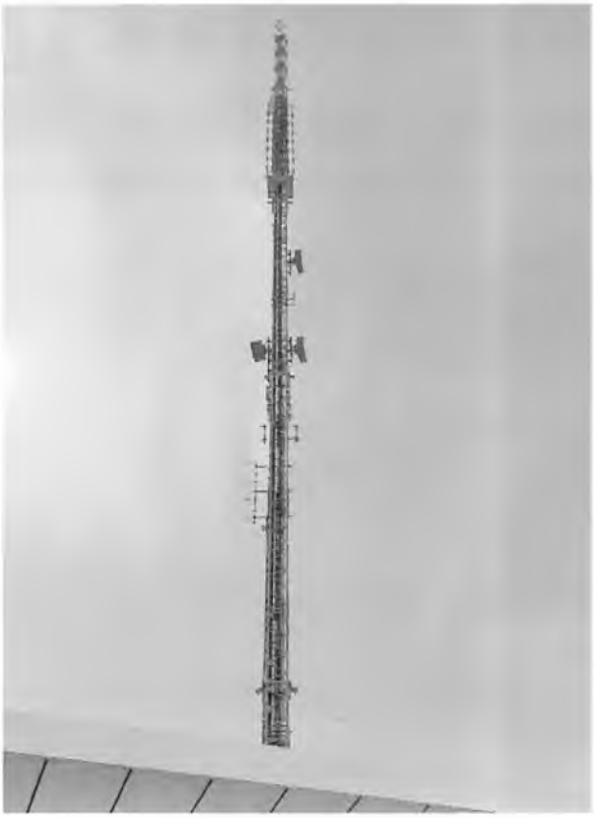
I was told Homecrafts in Langtree Avenue were looking for a technician. They welcomed me and so off I went on an adventure of servicing home appliances and motel room TVs, etc. My work vehicle was a clapped out Commer Van that hated the heat. Everywhere I went in it, it would stall. I would then pull out a bottle of water, pour it on the fuel lines and carburettor and away the van would go again. The problem was fuel evaporation before the fuel reached the carburettor! The income as a service tech kept us alive, but I longed for the broadcast and TV industry I had left.

Finally, it all came together. The PMG (Post Master General's Department) advertised for a technician for their transmitter site out at Yatpool, situated about 20 km from the Mildura CBD. I applied and was interviewed by Jack Carnell, the site OIC. At first he couldn't believe this young 'whipper snapper' could have BOCP and TVOCP qualifications and had worked at the ATV-0 tranmitter site in Melbourne.

However, I was appointed to the vacancy, started, and worked with some wonderful guys including Jim Brown-Sarre, now VK4FGN. Eventually, word of my appointment reached Dave Carson VK3ZUA, the Chief Engineer at STV-8, and the next thing I know I also had a part time job working at STV-8 as a 'Presentation Switcher', the person who puts the programmes to air and inserts the commercials, etc. Life was good!

Jim and I did something that was probably not sanctioned, but was fun. Mildura is in very flat terrain and thus the Yatpool tranmission tower was some 600 feet (183 m) high and guyed. I had an old TCA-1674 in the car on 2 metres. Jim also had a 2 m rig, but the type escapes me.

In those days TV was only on for a few hours a day and this big tower was doing nothing late at night. Jim and I chose a night and disconnected the $3^1/_8$ inch (7.94 cm) solid copper coax to the upper stack of the



The famous 600 ft (183 m) mast at Yatpool.

STV-8 antenna. What an awful match!! We had a $3^1/_8$ inch to type N adapter. Maybe that was SO-239, but we could connect. Jim and I were quite convinced that with the awful match this wouldn't go well. However, from my car, as I travelled way out past Wentworth heading for Broken Hill, we were still talking. We never did test it to the extreme, but what an experience.

My oldest son Brian was born at Mildura Base Hospital on 12[th] September 1970 and is VK2FBRI. My second son Warren VK3FWAL is sadly now an SK, but they both loved amateur radio as I have.

The Transmitter Hall at Yatpool in 2019 with Rex VK3OF.

The original antenna panel for ABMV-4 and STV-8, de-commissioned and waiting to go to the dump.

I have moved all over Australia holding calls VK3ZYB, VK6ZKA, VK5ZMI and VK8ZMA, upgraded to VK8MA. Overseas calls include C21MA, 5U7MA, CU4AX and ZD8MA. I had a special licence in China in 2008 but with very restrictive rules so I never was able to activate it, although I helped organise the very first Amateur Convention at Yellow Mountain in 2008 after I helped advise on emergency communications with the Sichuan earthquake in 2008. My 'licence' was expedited because of this, but never used.

In 2019, on a return trip to Mildura on family business, the Broadcast Australia representative at the Yatpool site, Rex VK3OF, took me through the facility I had worked at 50 years prior. Déjà vu! Now no-one works there, but it seemed to me that this building was haunted by the ghosts of the eight or so hard-working staff who once bustled about there keeping the old valve monsters alive.

The original old STV-8 transmitter was a relic Astor TV transmitter (S/N 14 if my ageing memory serves me correctly) that had come from the UK. It had been worked on hard to extend the bandwidth to our 625 line 7 MHz bandwidth from its original old 405 line bandwidth. Another extraordinary fact was that this transmitter in the UK used positive modulation of the AM TV carrier, while here in Australia we used negative modulation[1]. It did work, but doing testing always left this relic wanting. The old ABC TV transmitter at ABMV Channel 4, an AWA TVH5, just met specifications, if you lied a little….

Mildura and Sunraysia were my baptism into adult life in the TV & Broadcasting Industries after training at ATV-0 in Melbourne. I have strong ties to the area, and hope to visit there again as often as possible.

Katherine and the Northern Territory are my home and love now, but I can honestly say this article would never have existed, and my electronics journey been very different, except for Noel VK3FI letting a young lad in the door and making him feel welcome at radio station 3MA Mildura.

Note

1. Because early British TV used white as 100% modulation it meant that vehicle ignition and other types of pulse interference created a mass of white dots all over the picture. When 100% modulation equates to black, such interference is much less noticeable on the screen.

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From the editor . . .
(continued from page 3)

regular basis. But particular thanks go to the two hard working volunteers who compile and record the broadcasts, Bruce VK3UV and Ian VK3JS.

Sometimes we wonder just how many Club members actually listen to these broadcasts.

How about showing your appreciation of the hard work performed by those who compile and record the broadcasts, and those who relay them, by coming up in the callbacks and check-ins that follow most of the broadcast relays.

Or, if you are only able to listen via the internet, drop a short email to the broadcast team with your comments and appreciation.

As we all know only too well, 2020 was a very difficult year for Australia due to the COVID-19 pandemic.

Melbourne, in particular, suffered from some very stringent lock down restrictions.

One result was the cancellation of face-to-face RAOTC committee meetings and we had to turn to video conferencing. Finally settling on the very popular Zoom program, we found, after becoming used to the very different protocols needed when meeting using video conferencing, that it was a very effective way to hold meetings.

The RAOTC AGM 2020, instead of being conducted immediately prior to the Melbourne September luncheon, had to be changed to a 'Zoom' AGM. And it went quite well with, for the first time, Club members from interstate being able to participate in an RAOTC AGM.

One new innovation to result from the AGM is that, for the first time, we now have an interstate member as a member of the RAOTC management committee. A warm welcome to Peter Clee VK8ZZ.

Let's hope that Peter is but the first of interstate members of the RAOTC committee in the future.

Of course, this means that future committee meetings will be either conducted entirely via video conferencing or by a combination of face-to-face and video conferencing.

(continued on page 50)

The Essendon Airport water tower

Graeme Scott VK2KE
RAOTC member No 789
WIA Life member

I shudder as I write this! The Essendon Airport water tower was not a job we used to relish as electricians. The tower supports a concrete water tank that holds about 100,000 gallons (454,610 litres) of water. This tank was the domestic water supply for the airport buildings and it also served as a water supply for fire fighting if a fire broke out at the airport or, even worse, if a plane crashed at the airport.

As a young electrician working for the Department of Civil Aviation (DCA) it befell me at times to go with a colleague periodically to change the electrodes at the top of the tower. The electrodes were used to signal the pumps to operate and fill the tank with town water, and then to stop them once the tank was full.

The job entailed climbing the tank to remove the old and decayed electrodes, and replace them with new ones.

The water tower was about 100 feet (30 m) high and the 100,000 gallon tank was at the top of the concrete supporting base.

The procedure, I learned, was to climb the tower inside the base and to arrive at a landing where the view in all directions was superb. But then we had to climb the OUTSIDE of the tank on a steel ladder where you faced the concrete tank with your back facing out into space. As you climbed the ladder you had to carry the new electrode holding it with one hand while the other hand was used to hold the rungs of the steel ladder. As I climbed the tank I felt I was in great danger but more was to follow!

The electrode was about ¾ of an inch (19 mm) in diameter and about 2-3 feet (61-92 cm)) in length. As I climbed the tank I would look at the way the ladder was attached to the tank, noticing the slight traces of rust and hoping that the ladder would remain firmly attached to the tank while I climbed!

At the top of the ladder was what I called a steel 'crow's nest' in which there was enough space for two of us to work. Luckily the crow's nest had a guard rail all around it to give some protection and something to hang on to.

Once at the top of the tank I began to realise that there were three possibilities: stay on the crow's nest and do the job; fall off with a 100 foot drop to certain death on the ground; or, in the other direction, fall into 100,000 gallons of water which would probably mean almost certain death by drowning as there appeared to be no ladder in the water to enable anyone in the tank to get back up onto the crow's nest.

So, as you can imagine, we operated VERY carefully and deliberately! Not only that, it would've been disastrous to drop a spanner, screwdriver or the electrode into the water as it would be lost forever!

The brass electrodes, I learned, would gradually rot away over time as the 48 volts DC applied to them set up an electrolysis process in the water and so they had a finite life after which they had to be replaced. More recently the electrodes were made of stainless steel, which gave them a longer life. This electrolysis amazed me as the water in Melbourne had a reputation for being very pure!

The Essendon Airport water tower.

When you are young, danger is often part of the job, but in the 1950s there was very little attention paid to Occupational Health and Safety (OH&S) requirements such as there is nowadays. There was no safety harness similar to those they have on the Sydney Harbour Bridge these days. And the ladder you had to climb on the outside of the tank had no enclosure that protected you from a fall.

As an electrician, I was always conscious of the danger of 240 VAC and the many other places where there was a dangerous voltage, but climbing this tank and working on the top of it in a small crow's nest must rate it as one of the most dangerous jobs I have ever had to do.

I've climbed 40 foot wooden extension ladders, worked on building roofs, worked in confined spaces in underground sewage pumping tanks at Moorabbin Airport and climbed 70 foot (21.3 m) radio towers, but this water tank leaves them all for dead in the danger stakes.

It is interesting to note that, even though the tank was in a very high position, it never seemed to sprout any radio antennas! Installing them must have been a 'no-no' for any radio tech or even a rigger.

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The Siemens brothers

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

In mid 2020 I obtained two brass-wooden Morse keys, both made by Siemens. On the fulcrum of one it says: 'SIEMENS BROTHERS & Co.' and on the fulcrum of the other 'SIEMENS BROS. & Co. Ltd. LONDON'. Because of their similarity, you would say at first glance that both were made by Siemens around the same year. However, I discovered that this is not correct, as the abbreviation Ltd (which stands for Limited) makes all the difference. I will explain this below.

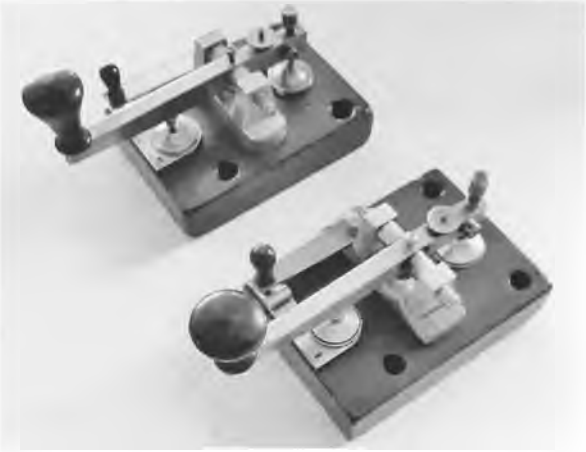
The Siemens brothers Ernst **Werner** (1816-1892), Carl **Wilhelm** (1823-1883) and **Carl** Heinrich (1829-1906), played an important role in the early stages of the development of telegraphy in Europe.

Werner Siemens was born near Hanover, the fourth son of a family of 14 children. His father, a poor lease or tenant farmer, did not have the finances for his son to attend university. Therefore, to get access to free tertiary education, Werner joined the Prussian army in 1835. He was sent to Berlin for a three-year study course at the Artillery and Engineering Academy where he trained as an Officer, receiving tuition in mathematics and physics. One of his tutors there was Georg Simon Ohm, a German physicist, best known for Ohm's Law[1].

Ernest Werner Siemens.

The Siemens Company can trace its history of innovation in the UK back to 1843 when Wilhelm Siemens travelled from Berlin to London to sell a patent for his brother Werner's electro-magnetic plating process. The sale was a success and an agency opened in London.

Carl Wilhelm Siemens, later to become Sir William Siemens.



The two Siemens brass-wooden Morse keys.

In 1844, Werner visited his brother Wilhelm in London and, whilst there, studied the needle telegraph which was invented in 1837 by Cooke and Wheatstone. As a result, in 1847 he produced his own needle telegraph, an updated version of the Wheatstone telegraph[2].

On 12th October 1847, Werner, together with the highly skilled mechanical engineer Johann Georg Halske (1814-1890), started a new telegraph construction company in Berlin called 'Siemens & Halske Telegraphen Bau-Anstalt'. Two years later Werner left the Prussian Army to devote himself to this company, which would eventually become Siemens AG[3].

Johann Georg Halske.

In 1850, Wilhelm established the Siemens & Halske (S&H) agency in London.

In 1853, S&H opened a construction office in St Petersburg, Russia and two years later a branch office headed by Carl Siemens. Carl also travelled regularly to England to assist his brother Wilhelm.

Carl Heinrich Siemens.

In 1858, the London branch of S&H was upgraded by partners Wilhelm, Werner and Halske into an independent company known as Siemens & Halske Co with its own permanent staff, a workshop and a storehouse.

In 1859, Wilhelm, determined to make his home in the UK, married a Scot, Anne Gordon. At the time of his marriage, he became a British citizen, thereby, as he used to say, "confirming allegiance to two ladies, Miss Gordon and the Queen".[4]

In 1863, due to continued expansion, an S&H submarine cable factory was built in Woolwich, a suburb in South East London on the river Thames.

The Siemens cable factory built in Woolwich, South East London, in 1863.

When, in 1867, Halske withdrew his support from the UK business, it was renamed 'Siemens Brothers & Co' with partners Werner, William and Carl.

In 1880, Siemens Brothers & Co converted into a stock company called Siemens Brothers & Co Ltd.

During WWI Siemens Brothers was bought by a British consortium because most of its ownership was in the hands of enemy aliens.

You can read much more about Siemens on website: https://new.siemens.com/uk/en/company/about/history.html

The above story was mainly an introduction to explain about the difference between my Siemens Brothers & Co key and my Siemens Brothers & Co Limited key.

From the Siemens' history I learned that my Siemens Brothers & Co Morse key is extremely rare as it was made before 1880. The Siemens Bros & Co Ltd Morse key, made after 1880, is less precious, but still hard to come by.

Before Australia became a Federation in 1901, both those Siemens keys were used by the Australian Post Office. After Federation, the newly established Postmaster-General's Department (PMG) started making its own Morse keys. When bug keys came into vogue in 1904, those PMG brass-wooden keys featured a jigger jack (bug key input port) at the front of the PMG straight keys.

A close-up of the fulcrum of the rare, pre 1880 Morse key, stamped with 'SIEMENS BROS & Co'.

A close-up of the fulcrum of the post 1880 Siemens Morse key stamped with 'SIEMENS BROs & Co Ltd LONDON'.

Footnotes

1. In short, Ohm's Law ($V = IR$) is a formula used to calculate the relationship between voltage, current and resistance in an electrical circuit.

2. The needle telegraph, a point-to-point text messaging system, was liked by early users who were unwilling to learn Morse code and also by employers who did not want to invest in staff training.

3. AG is an abbreviation of Aktiengesellschaft, which is a German term for a public limited company.

4. After taking out British citizenship in 1859, Carl Wilhelm Siemens became Charles William Siemens. In 1883, after receiving a knighthood from Queen Victoria, he became known as Sir William Siemens.

Acknowledgement

John Daniel of the Kiama Woodcraft Group Inc for restoring the woodwork and circuit closers of both my Siemens keys.

John Daniel making a brass terminal screw for my Siemens Bros & Co Ltd key.

Sources

- The book *Faszination Morsetasten* by Greg Ulsamer DL1BFE.
- Numerous articles on the internet about the Siemens brothers and the Siemens Company.

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Magnetos and their uses

Herman Willemsen ex-VK2IXV
RAOTC member No 1384

It was in mid-2020 when I bought a box of miscellaneous wireless equipment which included one complete and one cannibalized YA1860 Morse key (both fastened on broken bits of brown fibreboard), two incomplete military plug-in buzzer units, two small rusty strap keys and two magnetos. Everything was covered in baked-on dirt and surface rust. Overall not a bad catch,

Some of the contents of the box of miscellaneous wireless 'goodies'.

However, I was mostly intrigued by the magneto generators and was determined to find out where they came from.

The small YA1860 Morse keys and the two buzzer units pointed in the direction of the WWII Australian and British Field Telephone Set D Mk V (see photo on next page). But where did the two magnetos fit in?

The first thing I did was to contact Louis Meulstee[1]. He is the author and editor of the *Wireless for the Warrior* books and has a vast knowledge of WWII British and foreign Army Wireless sets.

The first magneto (see photo next page), marked ST&C and D^D[2], was identified by Louis as being part of a 1940s British Army Field Telephone Type F Mk II.

British Army Field Telephone Type F Mk II.

When I turned the crank handle of this enclosed magneto unit, it showed about 70 VAC on my voltmeter. This voltage increased when I turned the crank handle faster.

The second 2-bar magneto.

The second magneto, a 2-bar (2-magnet) one is marked 1897 and 38 on its back. It is missing its crank handle. Because of its open look, it gave me a good view of its rotating transformer core.

There are not too many 2-bar magnet generators around, as they were unsuitable for long-line use. They were used for short distance ringing and portable equipment, for instance as a generator in a PMG linesman's bag set, in Ericsson miniature wall phones models AB100-105[3], and in Army Field phones or for classroom demonstrations.

A European 2-bar magneto for portable application.

Electromagnetic induction

In 1831, the British physicist and chemist Michael

A WWII Field Telephone Set D Mk V.

Faraday (1791-1867) discovered a phenomenon called electromagnetic induction. He noticed that when a magnet was moved in and out of a coil of wire, a current was induced in the coil[4]. The same happened in reverse. When a coil of wire was moved in and out of, or rotated through, a stationary magnetic field, it induced a voltage across the copper wires. That is what happens in a magneto.

What is a magneto and what is its purpose?

A telephone magneto is a small hand-cranked electrical generator that uses strong stationary magnets to produce alternating current (AC) from the rotating armature (coil). The armature has a primary coil of thick wire and a secondary coil of thin wire wrapped around it in layers.

In telegraphy, magnetos were used to power instruments[5], while in early telephony they were used to generate electrical current to drive the electromechanical ringers of telephone sets. Examples are the magnetos in WWII field radio sets and early telephones, which were either connected directly to each other or via a central switchboard.

The magneto from a 1940s British Army Field Telephone Type F Mk II which the author found in his box of miscellaneous wireless 'goodies'.

The magneto principle is still used today for magneto ignition of some motorcycles, lawn mowers, chain saws and trimmers, etc to deliver the required high voltage to the spark plug.

Footnotes

1. See his website at: www.wftw.nl
2. ST&C = Standard Telephone & Cables; D^D = Department of Defence property
3. Google: Ericsson Miniature Wall Phones - telephone collecting.
4. A good example is a bottle dynamo on the front wheel of a bicycle.
5. For instance, in the Wheatstone ABC Telegraph. See my article *It's as easy as ABC* on page 11 in the September 2018 edition of *OTN*.

References

Bob's Old Phones, the website of Bob Estreich (SK in 2011).

Acknowledgements

•Louis Meulstee PA0PCR.
•John Paskulic. See:
https://oldaustraliantelephones.weebly.com/
•Bob Mills, Secretary, Australasian Telephone Collectors Society (ATCS).

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From the editor . . .

(continued from page 45)

An interesting item that came out of the AGM and the subsequent committee meeting, was to remove the multiple use of 'Secretary' in various committee positions. For example, Minute Secretary, Adminstrative Secretary and Membership Secretary.

It became somewhat confusing, particularly as the law was changed in Victoria so that the role of Public Officer and Secretary were combined and the Secretary automatically became the Public Officer.

As a result, legally, Mike Goode VK3BDL is now the RAOTC Secretary (and Public Officer), but the general secretarial work of the RAOTC is still being carried out by Ian Godsil VK3JS as the Administrative Secretary.

In order to minimise confusion, the title 'Secretary' has changed to 'Officer' except for the legal Secretary position. Hence, you will see on the list of RAOTC Office Bearers that we now have an Administrative Officer, a Minute Officer, and a Membership Officer.

"What's in a name? That which we call a rose. By any other name would smell as sweet."

Does the quote from *Romeo and Juliet* by Shakespeare apply?

Now to put on my other RAOTC hat as the Membership 'Officer'!

Is your membership renewal subscription due this year? Was there a red ink invoice printed on your *OTN Journal* address flysheet?

If so, or you are not sure, please read the item appearing in the bottom half of the back page of this journal.

That's all from me for this edition of *OTN*.

Please inundate me with articles and letters for the next issue of the journal. If you are at all concerned about your ability to tell your story in so-called 'good' English, don't worry. If it needs any 'polishing', I will look after that for you. And don't forget some photos to go with your text!

In the meantime, stay safe and stay well.

Bill Roper VK3BR

International Message Relay System Centre

Allan Mason VK2GR
RAOTC member No 1221

My story starts in the turbulent late 1960s with the transition of telegraph from the electromechanical and the vacuum tube era to fully electronic message handling. I was a technician-in-training employed by the Overseas Telecommunications Commission (OTC)[1] and attended the DCA radio school[2] at Waverton, NSW. At that time, telegrams were the cash cow of international telecommunications. Telex was just growing for business use and telephony was expensive and used sparingly even by businesses.

Under sea coaxial cables were the main links to North America, the UK and Asia; HF radio was the communications telegraphy and telephony medium within the Pacific; and geostationary satellites were slowly being deployed but not all were operational.

In this day of instant global communication via our mobile phones and the internet, who recalls when you had to book an international call and an operator would call you back when it was your turn?

In 1968, during trainee field training, I was assigned to the installation team for the new Sydney Operating Room (SOR) in Martin Place. The old SOR, with its noisy electromechanical machines and five unit perforated paper tape message relay, was located in Spring Street Sydney and connected to the Martin Place GPO via underground pneumatic tubes for the exchange of paper telegrams. The new SOR was state of the art for the day, to be equipped with Raytheon Keyboard Display Units (KDU green screens) for the operators, and conveyor belts to pick up the completed messages headed for archiving.

The KDU was a primitive terminal by today's PC standards; it was an early DTL (Diode to Transistor Logic) integrated circuit design with a vacuum tube mono-scope for character generation and a magnetostrictive wire delay-line memory for the screen character code storage. In SOR and the Melbourne

Univac 418 II circa 1969.

Univac 418 Core Memory.

Operating Room (MOR) there were multiplexers to merge the KDU traffic for transmission to the Message Relay System Centre (MRSC), via 1200 bps from MOR and 2400 bps for SOR - we thought these as high speed data lines in the 1970s!

Little did I know at the time that I would be selected for intensive systems training as a maintenance technical officer on the other end of the international telegram system at the OTC Paddington International Gateway for MRSC - see diagrammatic presentation of the overall Message Relay System on the last page of this article.

The six-month training for the Univac computer system was via reel-to-reel audio tapes that lead you through all the logic and circuit diagrams of the system. In order to speed things up, gain a little free time and overcome the USA drawl of the readers, someone in the class came up with the idea of increasing the tape machine capstan size by winding on sticky tape around the capstan just enough to speed the voice to below the point when it was unintelligible.

The MRSC hardware was duplicated with an on-line system and a monitoring hot standby system. When a software or hardware fault was detected an alarm would sound and the standby system would take over without the loss of telegram traffic - most of the time!

Univac 418 MRSC circa 1969.

The hardware consisted of two Univac 418-II computers, two Fastrand II Drum storage units, two half-inch seven track model 6C computer tape units, and a Univac 1004 line printer/80 column punched card reader[3]. Although the OTC Univac systems were the first, similar MRSC systems with Univac hardware later became operational in London and Hong Kong.

The Univac 418-II computer had a real time clock and was an 18 bit word transistorised discrete component computer with 4,096 (4 k) by 18 bit words core memory modules. Each computer had extended memory to 64 k words and channel interfaces for all of the peripherals. The commercial and scientific computers of that day were typically 36 bit machines, eg the Univac 1108 and IBM 360. The 18 bit machines like the 418-II were intended for dedicated control and industrial purposes. There was a version of the Univac 418 processor that was used in the Vietnam War for artillery and ship-launched missile control.

The Fastrand II magnetic drum was physically a monster storage device, consisting of two 2 ft (61 cm) diameter, 6 ft (183 cm) long, counter rotating cylinders mounted one above the other horizontally. The cylinders rotated at approximately 880 RPM. In between the cylinders was a boom with 64 read/write heads. The boom was moved backwards and forwards across 128 track positions with a very large voice coil, just like an oversized audio speaker voice coil. The track positioning was controlled with an analogue to digital servo-loop between an optical encoder, the selected track address, the current position and the voice coil drive. The 64 heads were lowered with compressed air until they flew just above the drum surface.

If any of the heads touched the surface, the system logic would retract the heads by releasing the compressed air in order to minimise damage to the drum surface. If a 'head hit' did occur, a team of technical officers worked for up to 48 hours to replace the faulty flying head and clean up the drum surface in order to get the storage unit operational again.

I have to say that working on the Fastrand Drum units would not be allowed in our safety-conscious world today. Cleaning up and polishing the large rotating cylinders was done by hand with the cylinders winding up to full rotation speed. The technical staff would remove watches, rings, ties and any loose clothing before opening or working on the drum surface. When cleaning the rotating drum, occasionally the polishing cloth would grab and pull at your fingers; a rather scary experience.

Around 1980, after major damage to the surface of one drum by an errant screw dancing along the head boom, replacement Fastrand II drums were acquired from Hong Kong.

The Univac 1004 was an early 1960s computer peripheral with minimal processing capability. The 1004 was an extremely noisy electro mechanical marvel and at times was a nightmare to maintain with a multitude of safety interlock switches for every maintenance panel, and complex power system relays and contactors.

The 132 character line printer consisted of a rotating character drum and 132 small solenoid-driven hammers that would tap the back for the paper and a large printer ribbon to make a character impression. Being of early computer design, the machine logic programing was via a large wired plug-board and the core memory was used only for short term character storage for the line printer, 80 column card reader and an eight unit paper tape reader. To change the 1004 program, the plug-board was replaced. The seven track magnetic tape units were used for system backup and telegram message archiving onto 2400 ft (732 m) half inch (1.27 cm) computer tapes.

The five unit code input and output circuits for the telegrams were connected to the computers via the communications racks (CTMC). These circuit connections were distributed to the ISTC floor at Paddington for connection to the international telegraph cable network and the PMG for national traffic. Message format conversion with SOR and MOR operator assistance was required between the Australian national and international message due to the different message headers.

The computer system and peripherals were cooled with an under-floor filtered and pressurised air-conditioning system which ran on 110 volt 60 Hz power. This 60 Hz power was supplied by large AC to DC to AC inverters with 60 Hz ferro-resonant transformers.

The on-site technical staff maintained the equipment on site to card level when system faults occurred and, when time was available during preventative maintenance periods, down to component level faults on the circuit cards. The most difficult maintenance items were with the alignment of the computer core memory modules, the cleaning of the drum and alignment of the heads in the Fastrand Drums.

Having worked on this system for ten years in my younger days, I can still recall the system boot loader address, Octal 007763. This address was push-button keyed into a register on the front of the computer to restart the computer.

The technical staff from MRSC Paddington also maintained the Leased Message Switch (LMS) systems at the Broadway international gateway.

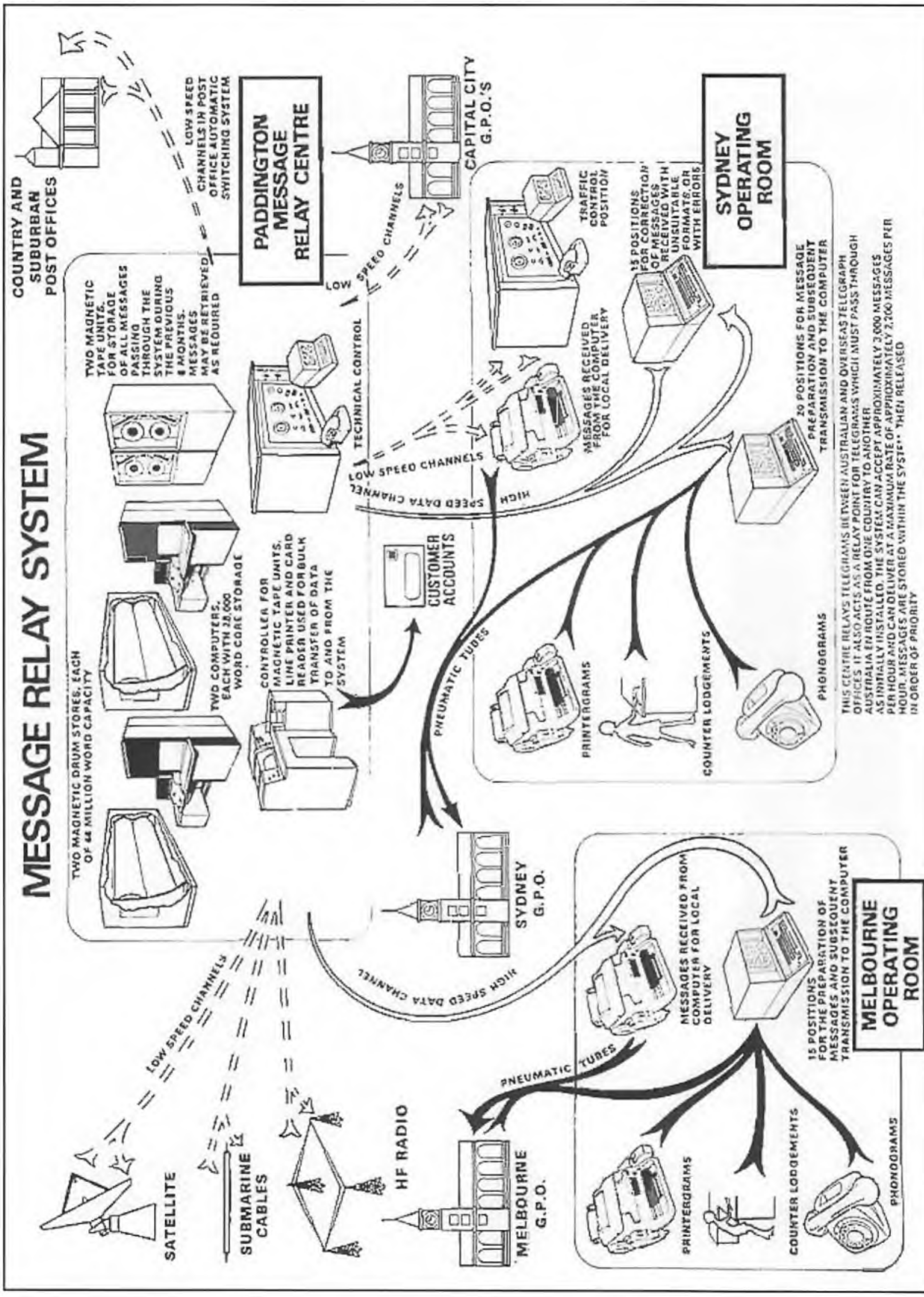
Due to the ageing system peripheral equipment, in the 1980s they were replaced with a DEC PDP11 system with new disk storage. The PDP 11 was channel interfaced to the Univac 418-II computers. After 20 years of faithful operation, the MRSC system was decommissioned in August 1988.

How many of today's computer systems will be operational in 20 years time?

The early experience with telecommunications and mainframe computers gained as a technical officer at OTC has served me well throughout a 48 year career in IT and corporate telecommunications network management.

Footnotes

1. From 1946 to 1989, the Overseas Telecommunications Commission (OTC) was the Australian Federal



Diagrammatic overview of the Message Relay System, originally published in the *OTC(A) Contact Magazine*, first quarter 1969.

Government entity tasked with all international HF radio, cable and satellite telecommunications into and out of Australia.

2. Department of Civil Aviation Radio Training School, Waverton NSW.

3. Google is a good source for further detail on the Univac 418 II computer, the Fastrand II storage drum, the 1004 printer/card reader, core memory and magnetostrictive delay line memory.

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Dangers of electro-magnetic fields

Lloyd Butler VK5BR
RAOTC member No 1495

Over earlier years we have carried on sending radio signals around the surface of the earth at a wide range of frequencies and at some quite high powers, with not too much concern whether electro-magnetic fields could be harmful. However, in more recent times, concern has grown and a lot of people are worried about it. But there are a lot of variables involved in deciding what is harmful to the human body. I thought I would have a look at what could be made of all this.

Foreword

This article commences with the elements of matter, how they form fields in a tuned antenna and the characteristics of those fields. Fields are examined from broadcast stations, mobile phones (including the potential danger to the human brain) and danger to amateur radio operators. There is also a discussion on field strength measurement and body heat build up from fields. One might be surprised at what I have said about the formation of electro-magnetic waves.

Theory on the formation of electro-magnetic fields

In defining the structure of matter we have elements called electrical conductors and elements called electrical non-conductors or insulators. There are also some elements which have both characteristics and are called semi-conductors.

A conductor can pass electrical current which flows into it and it stores energy and creates a magnetic field. From this, the current creates a magnetic field. The component is called an inductor.

At the ends of the inductor two plates may be formed. With an insulator between them, an electric potential is developed across the plates and these create an electric field. The component formed is called a capacitor and this also stores energy.

The process results in separate fields being generated, one from the current running in the circuit and the other from the voltage developed across it. The current and voltage are 90 degrees out of phase with each other and no energy is generated by these components in their own right.

But energy is generated when there is resistance in series with the looped circuit. Energy can also be coupled from an external field through the inductor. And an electric field can couple in energy across the plates of the capacitor.

When the inductor and a capacitor are connected together they form a tuned circuit which, if excited from an external magnetic or electric field, can be triggered into self oscillation called resonance. The self oscillation will occur at a frequency determined by the characteristics of the elements. The resistance in the circuit represents power loss in the circuit in the form of heat.

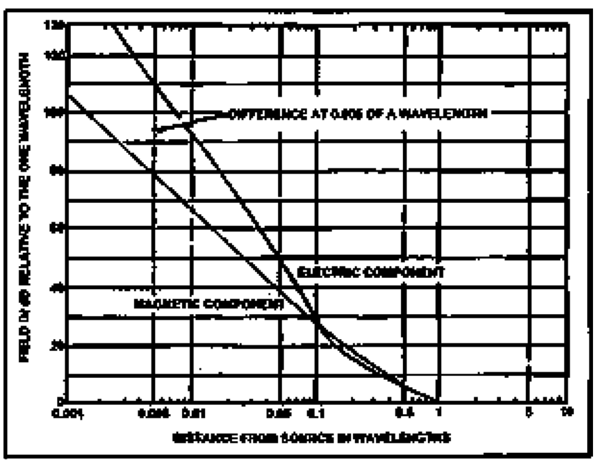
At resonance, energy is stored by the capacitor during part of the oscillating cycle and also returned to the circuit during further parts of the cycle. The ratio of power circulated to power lost is what we call 'Q factor'. If that factor is high, we get high voltage developed across the paralleled capacitor and we get high current through the series loop, including the inductor.

The combined magnetic and electric fields from the resonance make up what has been called an electro-magnetic wave. In the form of a half wavelength tuned antenna, the fields are very strong within the first half wave distance from the antenna's electrical centre. This part of the field is often called the 'near field'. The following algorithms and curves have been prepared from an early text book to demonstrate the high field strength in that first half wave...

1. The electric component of the induction field decreases with the cube of the distance and dB = 60log (d2/d1) where d2 and d1 are the relative distances.

2. The magnetic component of the induction field decreases with the square of the distance and dB = 40log(d2/d1)

The vector sum of the combined electric and magnetic components decrease directly with distance and dB = 20log (d2/d1). In the absence of loss in the transmission path (if this could occur), the curve, if put in the following diagram, would just sit on the X axis as zero field strength.



The near electro-magnetic fields showing their exponential expansion of amplitude versus distance from the antenna centre.

The effect of all this is that, in the near field, the electric and magnetic components continue from the antenna electrical centre for a radial length of about half a wavelength, falling to a signal level where their combined strengths form a near linear slope at the half wave point. In the near field, these two field components are clearly much stronger than beyond the half wavelength.

The fields continue on their way, decreasing in amplitude and in reverse exponential form, continuing towards infinity.

Being 90 degrees out of phase with each other, when the amplitudes are added as vectors, the result is also a sine wave plot of shape giving the appearance of a third field. Text books have listed this as a third field and called it an electromagnetic wave, but it isn't really another field. It is the vector sum of the two individual fields (perhaps we could call it a ghost field).

In terms of time, the ghost field is phased somewhere between that of the two individual fields. I think that if the fields were of equal amplitude, the ghost field would be at 45 degrees to the others. The important conclusion is that there is no third radiation field. The amplitude of the vector addition can be detected and displayed as a sine wave on a CRO but the energy carried is shared between the two fields (electric and magnetic).

Field strength of broadcast stations

But all this leads us further into the fields of powerful medium frequency (MF) broadcast stations and others in the LF/MF region, such as the Homer Beacons (Non-Directional Beacons [NDBs]). Some of these stations run quite high power. Several of the national broadcast stations run power of 50 kW and 100 kW. The near field components of these LF/MF stations would extend up to 1.25 km from the station transmitting antennas for the longest wavelength.

MF broadcast stations in the past have been required by legislation to be consistently staffed by qualified operator/technicians when the stations are on the air. This has put the operators in the position of possible health effects from the continuing radiated fields over the operational work 'shift'.

In the city of Adelaide, broadcast transmitters and their towers have been operated in large building complexes. Workers in those buildings and also the surrounding buildings, would have been affected by the near fields.

These stations in the city have been limited to 500 watts of output power. As time progressed, higher power stations have been relocated to more isolated locations where there is low density housing. Some of these higher power stations were initially also manned, but ultimately they were remote controlled and only needed occasional visits from the technical staff. Hopefully their visits were limited in time. (See later section on **Dangers in lapsed time of fields.**)

Dangers to transmitter staff is one thing but there is also the problem of residents living too close to broadcast transmitters and other transmitting stations, A serious example in South Australia is the national broadcast station at Pimpala, Reynella, SA. First established in 1959 amid open fields, there was hardly a residence in sight from the station which generated 100 kW plus of power. Clearly the station was established by the PMG managers to get away from residential housing. This was fine for many years, but the housing developers finally caught up with the clear land and now there are houses just across the road from the transmitter installation.

Damage to the brain and mobile phones

I have given thought to possible damage to the brain from electro-magnetic fields. This is based on resonance in the brain area and being triggered by microwave radio signals from closeness of the mobile phone. Judging from the dimensions of the brain assembly, resonant frequency would be in the microwave region. But resonance might also be triggered from lower frequency fields from MF transmitters, which have been discussed. But how can the lower frequency of typical broadcast stations, or the homer beacons, excite resonance at microwave frequencies?

To give some samples of this we can go back to microwave frequency theory where they use various types of oscillators such as the laser and where a microwave oscillator is pumped by a lower frequency. Or there is the simple semi-conductor diode which, on rectification, generates copious harmonics. No doubt the brain is made up of basic elements, pure conductors, insulators, and semiconductors. So maybe the brain can rectify the incoming sine wave signal to produce a harmonic which will pump a resonance in the brain.

Getting back to the mobile phone, the phone is normally operated close to the ear which, when transmitting, induces an induction field into the head. The induction field is extremely strong and distance between the mobile phone and the brain is within the half wave near field area. For Australian mobile channels, the strong near field is between about 8 cm (for 5G) and about 30 cm for the lowest frequency channel. All the mobile channels are within the length of the strong near field region, the lowest field strength being at the 5G end.

I do believe that triggered resonance in the brain is a danger from an incoming signal or a mobile phone held to the head. I am suggesting that if the brain has a resonance at the incoming signal frequency (or harmonic of it), it might cause a lot of heating in that area. If that heating is excessive, it might respond with some form of pain, perhaps a headache (or something more serious). (Refer also to the section **Dangers in lapsed time of fields.**)

I believe there are few limits which have been considered for field strength and a lot of testing has been done by telephone companies. But their testing seems to be field tests triggered by public fear of repeaters on towers.

I think that if there is a worry, it is the close proximity of the mobile phone to the brain, right in the near field of the phone transmission, rather than the field of the towers themselves, which are beamed well above the ground.

Danger to the radio amateur

The question of amateur radio transmission is now considered with discussion on how the amateur operator might be affected by strong fields. Looking at the attached field strength curves, field strengths above the 0.1 wavelength point, is the strong near field which is examined.

Danger to the amateur radio operator from his own transmitter obviously depends on the frequency of transmission, the average radiated power, the distance between the operating location and the antenna, and a few other variables. All this may be undefined, but I have nominated eight metres between the antenna centre and the operating location and consider whether the near field lays along this line. It does not attempt to provide all the answers to safety but it is somewhere to start.

The 160 metre band is the most probable one to cause high induction levels from the near field. The radio amateur usually operates with the usual 160 metre antenna above the house. On 160 metres, the near field extends to 16 metres and certainly floods the 8 m distance with a high field strength level.

On the 80 metre band, the near field ends at the 0.1 metre point, so that the band field strength extends downward below the 0.1 wavelength point, If the operator sat a little more than 8 metres away, the person would probably be quite safe.

For wavelengths shorter than the 80 metres, the operator should feel quite safe if an 8 m distance to the antenna is exceeded. But there is one provision! If the antenna is a directional beam, don't point it towards the operating point.

In using the increased wavelengths of the LF/MF bands, one should be very careful. The 630 metre band has a near field radius from a probable non-directional antenna of 315 metres.

For 2200 metres, to predict the danger from an antenna the amateur operator might be able to build for this band, it is not too clear. One might not be able to achieve much radiation efficiency, and not provide much field strength to cause danger. A practical amateur antenna would probably be electrically very short, a fraction of an ohm, and the loss resistance in the earthing or counterpoise much larger than the radiation resistance.

On the other hand, there would be a strong ground current running in the earth below the operator and creating a field above the ground. If one can walk around the radio shack with a fluorescent lamp lighting up in the hand, the field strength is high and dangerous.

Field strength testing

The most practical thing to do in protecting against body damage from excess field strength is to make use of a calibrated Field Strength meter. I down-loaded a copy of the *Australian Standard on Radio Frequency Fields Exposure Level* and this indeed is a complex document.

It has a multitude of variable factors, making it difficult to come up with a general algorithm which can define a general Field Strength level. This, of course, is a level which is considered reasonably safe for those who have need to operate or work within radio electro-magnetic fields.

From what sense I could make of the documentation, there is a safety standard for limitation of field strength as follows:

Maximum field strength = 40TmV/metre.

The character T, standing for Tesla, is a constant defining several of the variables related to the fields. (I cannot say I am confident that the formula I derived is correct. If someone has different information, by all means please contact me.)

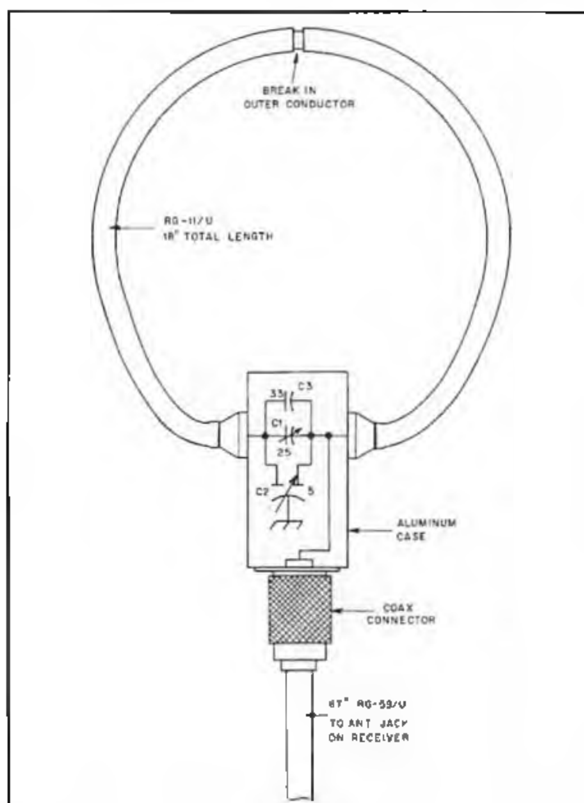
From another source, I found maximum field strength power P is equal to E (200 mV) squared divided by R (R, space impedance = 376.7 ohms). This led to a field strength of 27.5 mV/metre. (I am not all that confident in this formula either).

But on to some practical amateur radio construction. The photo and circuit diagram are of a field strength meter taken from an ARRL Handbook. The ARRL model uses a plug in antenna for each band. A diagram is also shown illustrating the structure of the loop antenna for 28 MHz. I note the absence of a comparison of sensitivity between the different frequency antennas. The illustrations and the reference below, could be a guide for home construction. I think it would be a good idea for someone who enjoys taking on this type of project to build a prototype that others could copy and reproduce.

It is the type of project which radio clubs sometimes set up to distribute models to their members. I am wondering if someone might take this on and in the process perhaps even come up with a simpler circuit.

Of course, to be put into use, each instrument constructed must be calibrated against another trusted meter. Note also that, in the ARRL design, the different band antennas don't appear to be compared for their signal sensitivity. Once a prototype is constructed and calibrated, copies of the unit can be made. Copies should work the same if the components are identical to those of the prototype

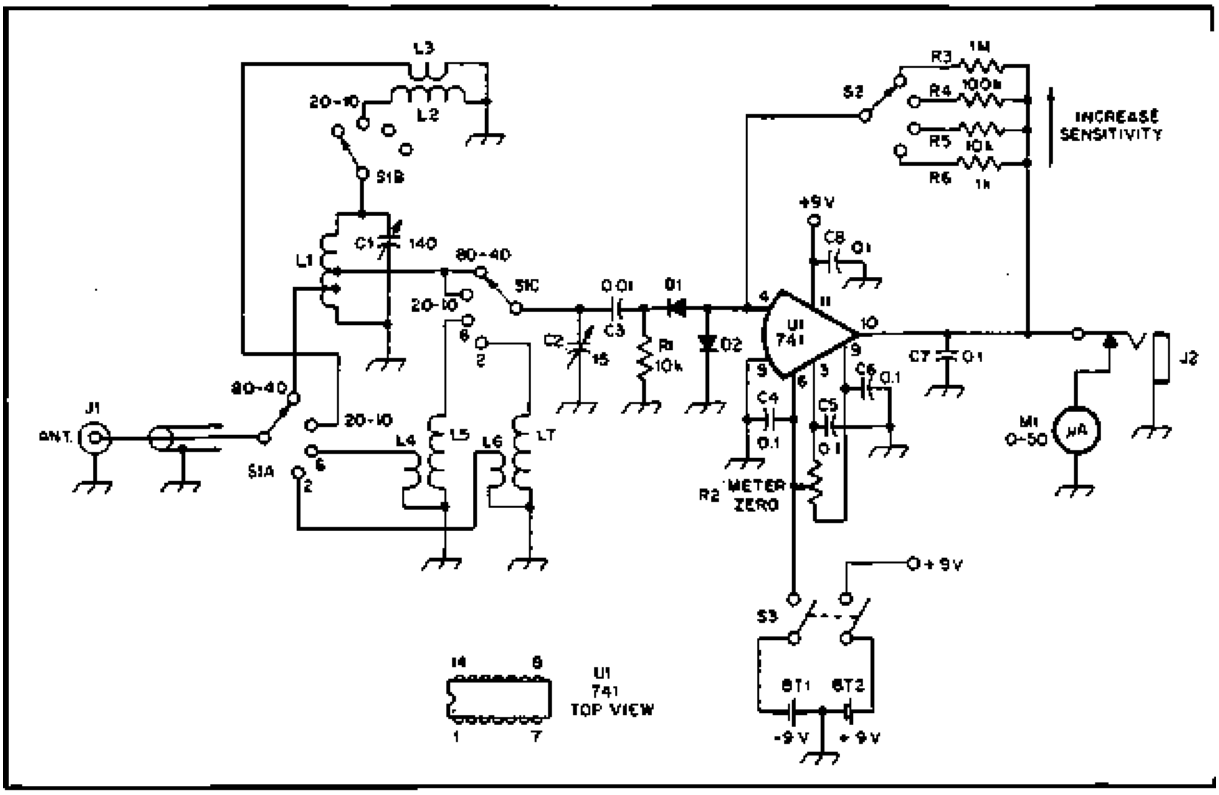
Field strength meter picture (*ARRL Handbook*).



Loop 28 MHz
Field Strength Meter (*ARRL Handbook*).

Time exposure to electro-magnetic fields

A final factor concerning limits of exposure to fields is the time exposed. Heat temperature builds up and can cause some damage. Heat energy is absorbed by the



Field strength meter circuit (*ARRL Handbook*).

body (or parts of it), but energy is also transmitted from the body. The temperature keeps rising until the heat entering the body balances the energy being transmitted. If that point is beyond the field strength time limits, look out for a threat to your health.

Rays from the sun are also electro-magnetic fields. In getting a sample of sunbaking, I observed the following: After exposure to the sun for 10 minutes, I noted that the section of my body exposed was getting tolerably warm. I came to the conclusion that this was a warning that if I persisted any longer, I might get sunburn. So I took a break!

Along these lines, when testing your radio field strengths, you might be able to use a similar idea with radio electro-magnetic fields.

If some part of the body is feeling warm, give the transmitted signal a break for a while. Perhaps you could try 10 minutes or a bit longer.

I think I need to say a few words about mobile phones and their owners. In particular those owners who live with their smart-phones all day, spending hours of continuous time using them without a break, including those who stream and down-load long video files, etc. Again I suggest breaking up extended use of the phone into shorter lengths of time.

Summary

This article is about electro-magnetic fields and the possible danger they pose. I have introduced the article with some theory on the fields and, in particular, those in the near field region. We move on to the fields transmitted by MF broadcast stations and other stations in the LF/MF region, then on to possible damage to the brain by mobile phones, and then to how the radio amateur fares with the fields generated by the personal amateur radio station.

There is a section on field strength testing with a test instrument illustrated which you might consider building or suggesting to your radio club as a project.

And finally, a little about spending too much time transmitting, or too much time living too close to MF broadcast transmitters or other types of transmitting sources.

As you might gather, the information I have researched to assemble the article does not lead to highly accurate mathematical safety limit figures. My main theme has been to point out when the strong near fields appear threatening. But, hopefully, what I have written is a lead in that direction, to improve the safety of those who engage in work or pleasure in the presence of those electro-magnetic fields.

References

1. *ARRL Handbook* - 1989 edition, pages 39-10 to 39-16.
2. Report - *Australian Standard on Radio Frequency Fields Exposure Level.*

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Where is Gordon VK4KAL?

From time to time, the RAOTC loses track of a Club Life member. *OTN* is returned to us from the Dead Letter Office with no forwarding address. A check of ACMA records shows that the callsign has lapsed, so that is no help.

Perhaps the Club member has become a Silent Key; perhaps they have moved into care, but in those cases generally we are advised by family of a new address.

However, I have been unable to trace what has happened to long time RAOTC member No 707, Gordon Loveday VK4KAL.

If you have any knowledge of what happened to Gordon, or where he is, could you please let me know.

Bill Roper VK3BR
RAOTC Membership Officer.

A sweet little Bakelite Morse key

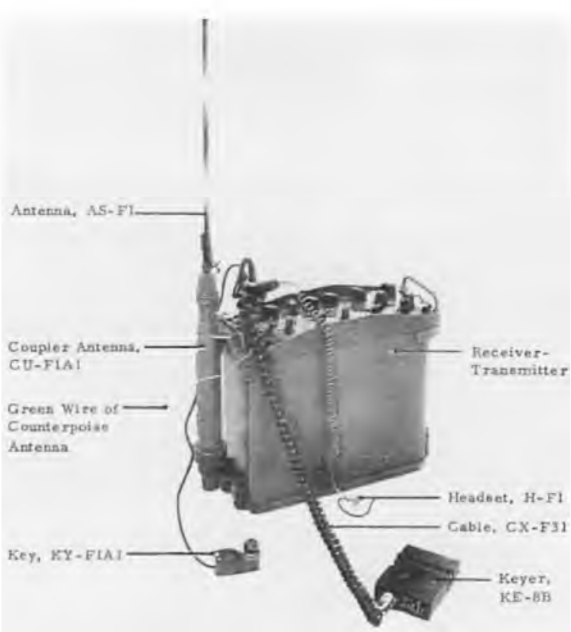
Herman Willemsen ex-VK2IXV
RAOTC member No 1384

It was on a nice sunny Autumn day in mid-May 2020 when I paid a visit to Grandpa's Shed, an antique store in Fitzroy Falls, NSW. The last time I had been there was about eight years ago. Well organised and clean, it was bursting at the seams and literally packed to the rafters with whatever one could think of, including a few Morse keys.

My choice was a well-preserved AWA-made lightweight Morse key. It looked identical to the small 'Key Telegraph Light Weight (Aust) No.1' used with the 1950s AWA portable Wireless Set A510[2], but the numbers and writing on its brown Bakelite cover were different. They read: "KEY TELEGRAPH LIGHT WEIGHT KY-F1A1 028-2839↑ AWA".

The AWA-made lightweight key KY-F1A1.

The writing indicated that this key was used with the early 1970s Australian radio set PRC-F1, a portable field radio set intended primarily as a man-pack station, but which could also be used as a portable ground station or be installed in vehicles and watercraft.



An early 1970s Australian radio set PRC-F1.

The Wireless Set (WS) A510[3] (1955-1965) served alongside Australian forces in Borneo and South Vietnam. But times changed as transistors replaced

Grandpa's Shed.

valves and Single Side Band (SSB) replaced Amplitude Modulation (AM). Thus, the Army was looking for more efficient field radios with a greater operational versatility. In late 1965 the A510 was replaced by the US-made transceiver PRC-64 or AN/PRC-64[4].

A Wireless Set A510.

The WS PRC-64 is a transistorised HF transmitter-receiver used by the Australian and US Forces in Vietnam. It has a frequency coverage of 2.2 to 6 MHz and its operating modes are AM, CW, and SSB. The transmitter produces 5 watts output on CW, and 1.5 watts output on AM. In 1969 the PRC-64 was replaced by the Australian-made Wireless Set PRC-F1.

The PRC-F1 (1969-1995) is a lightweight HF backpack transceiver, operating on CW, SSB and AM compatible mode. Designed and built in Australia by AWA, PRC-F1 sets (originally designated A512) are fully transistorised and operate in the frequency band 2-12 MHz, using digital tuning in 1 kHz steps for 10,000 channels. The high output power is 10 watts PEP on

A Radio Set PRC-64 with a KY-F1A1 lightweight key in the foreground.

USB or compatible AM, and 5 watts on CW. Low power is 1 W PEP on all modes. It is fitted with an internal rechargeable Nickel-Cadmium battery with 22 cells in series producing 28 VDC. Its endurance is six hours on high power and 24 hours on low power. As a fully operational backpack it weighs 9 kilograms.

The Morse key KY-F1A1 is completely sealed and waterproof. The non-adjustable contacts require a pressure of about 283 gm and have 3 mm travel. The small key is grooved on both sides of the base to mount on a key support fixture on the front panel of the PRC-F1 radio set[5]. These, and the other identical looking lightweight keys, were used for sending messages at a speed of about 12 wpm on radio sets A510, PRC-64 and PRC-F1.

Former SAS Patrol Signaller John Trist[6], who was trained on the PRC-64, told me that, in the early 1970s, he and his fellow signallers used the lightweight key upside down, tapping the key on their upper leg or on the palm of their hand.

All their messages were encoded in groups of five letters and it was not uncommon to have, say, 80 odd code groups. They never used the internal key on top of the set as this was merely a back-up key. David Prince told me that a serving Army signaller showed him how he had been taught to use this lightweight key by holding the key in his fist and keying it by opening and closing his fist on it.

PRC-64A and the PRC-F3 (the upgraded versions of the PRC-64 and PRC-F1 respectively) also had the additional facility GRA-71[7] for sending burst messages, which are messages sent at a very high data signalling rate within a very short transmission time.

Troubles with PRC-F1 radios in Namibia

Between 1989 and 1990, Australia sent two contingents of over 300 engineers each to assist UNTAG[8] in overseeing free and fair elections in Namibia, formerly known as South West Africa.

The Australian contingent was equipped with PRC-F1 HF radios. As described above, their output power was limited to 1, or 10 watts PEP. A combination of geomagnetic storms in March 1989, distance, sand, dry atmospheric conditions and the high water table, effectively blocked almost all HF radio communications for the first two months of the deployment. Detachments were often out of radio contact for extended periods. The only alternative to dispatch communications was by courier, which could take days, as the Australian force operated over large distances. Later in the deployment, the United Nations provided the contingent with 100 W powered Motorola Micom-X HF equipment.

MBITR

Nowadays the Army uses the handheld MBITR radio, the PRC-148 Multi Band Inter/Intra Team Radio. It is the most widely fielded handheld, multiband, tactical, software-defined radio used by NATO forces around the world.

Footnotes

1. See *https://www.cryptomuseum.com/spy/prc64/index.htm* where this lightweight key is described as "a sweet little bakelite Morse key". More information about the PRC-64 is in this article.

2. See my story on p59 of the March 2018 edition of *OTN Journal*.

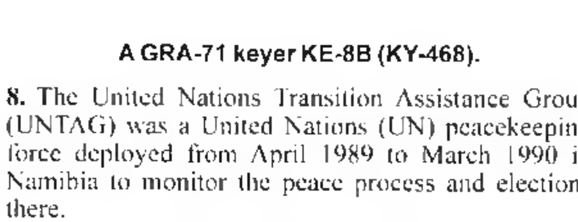
3. See website *http://www.qsl.net/vk2dym/radio/A510.htm*

4. AN/PRC translates to Army Navy/Portable Radio Communications.

5. See *http://www.tuberadio.com/robinson/Manuals/* and look under PRC-F1.

6. For his full story see: *www.cryptomuseum.com/spy/prc64/john_trist.htm*

7. Transceivers PRC-64A and PRC-F3 were provided with a Code Burst Generator GRA-71. Part of the GRA-71 kit was keyer KE-8B (KY-468), which would read Morse coded messages, pre-recorded on a magnetic tape, and modulate the transmitter at a speed of 300 wpm. Compared to the handkey's slow Morse of 12 wpm, this higher data speed used far less airtime, thus avoiding eavesdropping and detection by the enemy's RDF.



A GRA-71 keyer KE-8B (KY-468).

8. The United Nations Transition Assistance Group (UNTAG) was a United Nations (UN) peacekeeping force deployed from April 1989 to March 1990 in Namibia to monitor the peace process and elections there.

Acknowledgements

Ray Robinson VK2ILV; John Trist VK2MOP; Paul Anslow VK2APA; and David Prince VK4KDP.

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Radio Amateurs Old Timers Club Australia Inc

The Melbourne March 2021 Luncheon

of the ***Radio Amateurs Old Timers Club Australia Inc***
will take place from
12.00 noon (for a **12.30 pm** start) on **Thursday, 25th March 2021**
at the
Bentleigh Club, Yawla Street, Bentleigh, Victoria.

The guest speaker at the luncheon will be **Peter Freeman VK3PF** who will present a talk and PowerPoint presentation on **Summits on the air (SOTA) and Parks**. This will be a most interesting presentation and explanation of one of the newest and most exciting amateur radio activities. Can you afford not to be there!

The Bentleigh Club offers a three course meal at a cost of **$36.00** per head. Tea and coffee will be available for free. Soft drink, wine and other drinks can be purchased from the bar at members' prices.

RAOTC members are welcome to bring a friend, but we must have firm bookings to 'RAOTC Luncheon, PO Box 107, Mentone 3194' no later than Monday, 22nd March 2021.

Any queries to be addressed to Bill Roper VK3BR at *raotc@raotc.org.au* or 0416 177 027.

All of the above is subject to no new COVID-19 pandemic restrictions being imposed by the Victorian State government!

Is your RAOTC membership renewal due?

Are you one of the 162 RAOTC members whose Club membership fees are due for renewal this year? If you are, did you notice the invoice printed in red ink on the address flysheet which accompanied this edition of *OTN Journal*?

If your membership fees are due this year - the 30th April is the due date - it's probably a good idea to either pay for the renewal now a couple of months early, or at least diary it conspicuously so that you do pay your membership renewal fee by the due date.

Each year nearly 50% of members forget to pay their membership renewal fee by the due date and a reminder letter has to be sent out, at a cost of around $130 to the RAOTC.

Interestingly, almost all then pay their renewal fee and only a small handful require a second reminder letter, again at further cost to the RAOTC.

Due to good financial management by the RAOTC committee, yet again this year membership fees have remained unchanged. Please do your bit to help the committee keep the administration costs of the RAOTC as low as possible and pay your renewal fee on time.

Membership fees are $18.00 for one year's membership, $32.00 for two years' membership and $375.00 for a paid Life membership.

These fees are detailed in the RAOTC Membership and Fees section on the inside front cover of each issue of *OTN Journal*, along with other information about the RAOTC, and also on the RAOTC's website at *raotc.org.au*

Payment of monies to the RAOTC is much easier these days. Some members still pay by cheques in the post which is perfectly OK (although cheques are almost becoming rarer these days than 'hens' teeth').

However, the majority are now paying by the more convenient methods of EFT (electronic funds transfer) via internet banking (but please ensure you identify your payment with at least your callsign!) or over the counter at Westpac bank branches.

Details of the procedures to be followed are explained in full on the reverse side of the address flysheet that came with this edition of *OTN Journal* and can also be found on the RAOTC web site under the heading 'Payment of money to the RAOTC'.