April 2015
Volume 69, Issue 4

The Cat's Whisker!

The Wanganui Amateur Radio Society Inc., Branch 48 NZART

www.zl2ja.org.nz

Club Officials 2014-2015

Position	Name	Callsign
Patron:	Strath Davis	ZL2AAJ
President:	Jason Wallace	ZL2FT
Vice President:	Jeff Howe	ZL2THO
Secretary:	John Love	ZL2JEL
Treasurer:	Jeff Howe	ZL2THO
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	Ivan Horn	ZL2ATU
	Mike Newman	ZL1BNB
	Colin Wilson	ZL2WM
Contact Person	**Jason Wallace**	**ZL2FT**
Checker:	Leo Boyle	ZL2BGE
Newsletter Editor:	Colin Wilson	ZL2WM
Awards Custodian:	Ivan Horn	ZL2ATU
Webmaster:	Colin Wilson	ZL2WM

The Next General Monthly Meeting will be held:

Monday 4th May, 2015

at the Hunters and Stalkers Hall, Peat St.

At 7:30pm

Business: General, NZART Remits!

Don't Forget to Bring Your Copy of the March/April Break-In!

All Very Welcome!

Don't Forget to Bring Along Your Outgoing QSL Cards to the Meeting Too!

"Just the Cat's Whiskers"

THE WANGANUI JUNK SALE

Saturday the 2nd of May!

See Second to last page for details...

The Creation of Policy

In the very beginning there was the Plan. With the Plan, there were objectives and a specification. But the objectives were without form and the specification was meaningless. Thus there was darkness upon the faces of the Engineers.

The Engineers, therefore, spoke unto their Project Leaders, "This is a crock of shit and it stinks."

The Project Leaders went unto their Unit Managers and said, "It is a pail of dung, and none may abide the odour thereof."

And the Unit Managers spoke unto their Section Managers, "This is a vessel of excrement and none may abide its strength."

And the Section Managers spoke unto their Divisional Managers," This vessel is full of that which makes things grow & the characteristics thereof are exceedingly strong."

& the Division Managers spoke unto the Vice President, "The contents of this vessel are very powerful & will promote strong growth of the company."

And the Vice president went unto the President of the corporation:-

"This powerful new plan will actively promote growth and efficiency of the division and this department in particular."

And the President looked at the Plan and saw that it was good, and the plan became policy.

From the Newsletter Editor

Hi and Welcome to yet another Newletter.

Thanks for the leads some of you have sent in, if it's not been used, I might being holding it over for next month or still waiting on permission to republish. So far that has fallen into two camps, “Yes” and “can't be botthed to reply”. No-one, as yet, has said “no”!

I have got to maintain a page count that is divisible by 4 for print fomating. i.e., if need to add a page, I have to find content for another 3 pages!

Colin ZL2WM

The Cat's Whisker (or point contact diode) was the most commonly used diode detector in early radios around WWII.

What Digital Radio? *by Bruce Simpson*

I can recall with fond memories the time I spent as a young boy, barely of school age, playing with germanium diodes, crystal ear-plugs and long lengths of wire strung out the back of the house on poles.

This was the era of radio -- before the arrival of TV in this part of the world and a time when life seemed so technologically simple by comparison with today.

Thanks to the simplicity of AM radio, any young lad could cobble together their own "no batteries required" AM receiver and indeed, I've written about my "crystal set" exploits in previous columns. However, times change and it's now the middle of the second decade of the 21st century.

So how come we still have that old, crackly, low-fidelity AM radio system that is already being phased out in other parts of the world?

A new "digital" system, known as DAB has been slowly rolling out around most of the Western world, replacing noisy, interference-prone but exceedingly simple AM and FM radios with a far more up-to-date system based on bits and bytes.

Not only can more broadcasts be squeezed into the same amount of radio spectrum but those broadcasts can be of higher quality and supplemented by a digital stream of additional information not available with old-school analog technologies.

Even our cobbers across the ditch have DAB radio -- but here in NZ, we seem to be a decade or two behind the times.

Just as we were one of the last countries in the developed world to introduce FM radio, it seems we're also slow to get onboard the DAB bandwagon.

In fact, some more "up to speed" countries such as Norway are about to completely shut down their analog broadcasting in favour of digital... and we haven't even left the starting blocks -- which is surprising when you consider that NZ is one of the most "radio'd" nations in the world. We have more radio stations per capita than any other country in the world, yet we're still living in the analog world.

Now there are pro's and con's to DAB so all might not be as negative as it sounds.

Firstly, if our analog radio broadcasting system is doing the job... why fix it?

The cost of throwing out our old "trannies" and replacing them with new digital radios would be quite high, especially when you consider that virtually our entire vehicle fleet is equipped with analog radio receivers that would be rendered useless by a forced switch to digital.

We're also increasingly seeing people switch to digital streaming for their radio and music content, that material arriving by way of their broadband connection rather than by way of a broadcast system. It may be that digital broadcasts will be redundant before they even get to NZ -- so we will have saved ourselves a lot of money and inconvenience for a very short dalliance with DAB.

I recall that when I was running 7am.com (back in 1998 or thereabouts), I hooked up a small FM transmitter to one of my computers so that I could listen to some interesting streaming radio stations throughout the property. My portable FM radio would allow me to wander the house and outside environs while always remaining tuned in to a radio station that was half a world away.

So I guess the question for Aardvark readers today is...

Does NZ need digital radio?

Source: http://aardvark.co.nz/daily/2015/0420.shtml

ZL100ANZAC [*from NZART "Infoline Special Issue 48S*]

Special event call sign ZL100ANZAC has been issued to commemorate this important event.

Radio Spectrum Management have given permission for this extended call sign to be allocated, however due to restrictions in SMART, the call sign only appears as ZL100ANZA. Rest assured it has been allocated and can be used from 26 February until 26 May.

Many articles have been circulating regarding ANZAC day and the role amateurs played, more importantly how you can all get involved with the special event.

To celebrate the ANZAC centenary in New Zealand ZL100ANZAC will be activated by a group of ZL operators, all of whom responded to the call to register interest in operating the callsign. Operation will start on 25 April at midday NZ time and will last of one month. Each operator will determine the time, band and mode they wish to operate - so there can potentially be simultaneous operation taking place in different modes within the same band, or on different bands. A booking system for operators has been implemented by Mark, ZL3AB.

All logs will be collated by John, ZL1ALZ and regularly posted to both Logbook of the World and Club Log to enable other operators to check their QSOs.

The QSL manager is Phil, ZL3PAH. OQRS will be available via Club Log for both direct and bureau cards, and is our preferred QSL method. Cards sent to the QSL manager directly or via the bureau will also be accepted.

A QRZ.COM page will be activated shortly before operations begin.

If anyone is interested in operating please contact Phil ZL3PAH at phil@cliftonbay.co.nz to register interest and for information on the logging requirements necessary for this multi-operator activation."

The ANZAC commemoration takes shape

The Wireless Institute of Australia (WIA), the New Zealand Association of Radio Transmitters (NZART), and the TelsizveRadyoAmatörleriCemiyeti of Turkey (TRAC)have joined together to mark the Centenary of the WWI battle at Gallipoli.

The radio amateurs in these countries particularly remember the heavy losses in war, and pay honour to all war veterans. Throughout the world there will be other related activity, with a major focus beginning on ANZAC Day, April 25.

On that day the three IARU member societies remember the original Australian and New Zealand Army Corp (ANZAC) and the Ottoman Empire soldiers who did battle at Gallipoli in Turkey.

Australia, New Zealand and Turkey recall that battle 100 years ago, with ANZAC troops also leaving a lasting impression on the Western Front of Europe. Born out of that experience was ANZAC Day that commemorates all servicemen and women.

Many radio amateurs played a key role in war-time communications. To show respect, Amateur Radio has a range of events that include the use of commemorative callsigns that will be much sought after on air throughout the world.

In Turkey at least two commemorative callsigns have been allocated. TC100GLB is for Battle of Gallipoli while TC100GP is the Centenary of Gallipoli.

In Australia on ANZAC Day alone there will be eight ANZAC-suffixed callsigns - from each state or territory and the national capital of Canberra. The WIA website www.wia.org.au has nearly 40 events listed.

These include some battles, incidents, recorded voices of ANZACs, museums, memorials, Victoria Cross recipients, and all pay honour to those who served their country.

All VK radio amateurs may also use the alternative callsign prefix AX on April 25-26. The WIA recommends that those who do also have a special QSL card.

Across the Tasman the NZART will have ZL100ANZAC on air for a month.A team of 20 DXerswill be on air in DX-style from ANZAC Day.

While ZL100ANZAC is for one calendar month, the WIA 100 program continues until 20 December. On that day in 1915, Colonel John Paton was in charge of the 'rear-guard' while the ANZACs, after suffering heavy losses, quietly evacuated Gallipoli by ship.

- Jim Linton VK3PC.

Gallipoli ceremonies have Amateur Radio access

Australian and New Zealand radio amateurs travelling to Gallipoli for the ANZAC ceremonies on April 25, ANZAC Day, will have VHF and UHF frequencies available, including Echolink access.

The TürkiyeRadyoAmatörleriCemiyeti (TRAC) has set-up repeater TA3EC at Gokceada Island on EchoLink 433.850 MHz 88.5 Hz CTSS, with Yagi beam coverage to the commemoration areas.

TRAC President Aziz Sasa TA1E says the intention is also to be listening nearby on 145.550 MHz and 433.550 MHz, as the VK and ZL visitors disembark from buses and pass through a security check point.

He says TRAC has already dealt with the embassy to allow hand-held radios to be taken to the commemorations. Under the CEPT rules the guests can operate freely by identifying as TA1 slash their home call.

A little hospitality and international friendship is being shown by TRAC to all radio amateurs from VK and ZL.

Among those attending is June Sim VK4SJ, a first generation daughter of a Gallipoli Veteran, who will be joined by her son Anthony VK8NCS, at the Dawn Service, and the later service at Lone Pine.

There are others attending and we wish them all well during what will be a very respectful observance and commemoration of the WWI battlefield, where the ANZAC and Ottoman Empire soldiers fought during WWI.

(Jim Linton VK3PC)

ANZAC 100 program gets world attention

TheWireless Institute of Australia (WIA) ANZAC 100 program detailed on its website (www.wia.org.au/newsevents/anzaccentenary/about/) has numerous commemorative callsigns, awards and events, now being joined by many local and overseas activities.

The ANZAC Centenary is a milestone of special significance for Australia, New Zealand, Turkey and other areas throughout the world.

The major commemoration starts on April 25, 2015, which is when Australian and New Zealand Army Corp (ANZAC) troops landed at Gallipoli 100 years ago.

ANZAC Cove on the Gallipoli Peninsula in Turkey, became famous as the site of WWI And helped define us as people and as a nation.

At this time we particularly remember not only the original ANZACs, but the century of service by Australian servicemen and women.

The commemoration encourages all radio amateurs to reflect upon and learn more about Australia's wartime involvement, the costs and its impacts on the nation.

The WIA ANZAC 100 program is in close cooperation with the New Zealand Radio Amateur Transmitters (NZART), the TürkiyeRadyoAmatörleriCemiyeti (TRAC), and IARU member-societies generally.

An official opening broadcast on ANZAC Day from Canberra will primarily involve the WIA, NZART and TRAC.

The VK100WIA broadcast will be heard at 4.30am NZ time on HF if possible, and via the Internet if propagation conditions do not allow a contact. All ANZAC-suffixed callsigns are expected to remain silent until after the broadcast. It will be re-broadcast marking the different time zones in Australia.

In Australia on the ANZAC Day weekend eight different ANZAC callsigns are to be on air. Additionally, radio amateursare able to substitute their normal VK prefixed with AX on both April 25 and 26.

The New Zealand Amateur Radio Transmitters (NZART www.nzart.org.nz) has made available to its branches and member clubs ZL1, ZL2, ZL3, ZL4 ANZAC callsigns for a month.

In addition, the Kordia National System Award has been themed for the ANZAC Centenary, aimed at war memorials and further encourages ZL-ANZAC station contacts.

In Turkey there are ANZAC event stations including TC100GS, TC100GP, TC100KT, TC100VKZL, TC100A, TC100TC, TC100A, TC100B, TC100E, TC100K, TC100GLB.

To commemorate "Gallipoli" 100 years ago, look for Team Papa TC100GLB that is QRV until April 30, on the HF bands using SSB, RTTY and PSK.

Another is TC100GP (GP for Gallipoli http://www.teampapa.org/archives/316) on air and looking particularly for ANZAC related stations.

Summing up nicely the sentiment of the commemorative activity, TC100GP said that its message is one of 'peace to the world'.

Dear fellow ANZAC's & AR colleagues

Given the significance of Australian submarine HMAS AE2 in the unfolding of the Gallipoli Campaign & the Anzac Legend, we are proud to provide early notice that a team has been formed to activate VK4AE2 as a specific centenary commemorative callsign during 25-30 April 2-15.

Multi-mode, multi-band (630-10m) operation has been scheduled across that period & the operators are:

VK4QS Mike: ex-RAN Electronic Warefare Systems operator 40-10m LSB/USB

VK4MIK Mike: ex-RAN Hydrographer 80m CW/LSB 40-15m LSB/USB

VK4SN Alan: ex-RAAF 40-10m CW

VK4RJ Bob: 20m USB

VK4QC Peter: ex-Coast Station operator England & Australia 630m & 20m CW

VK5BUG Doc (as VI4AE2/5): ex-RAN Radio Supervisor & ships' Radio Officer on European Ice-breakers 630m & 160m CW

Please see QRZ.com VI4AE2 for further information & details regarding modes, bands & the projected extensive hours of operation will be posted closer to the event commencement.

Inquiries may be directed to the event organiser VK4QS via mikevk4qs@gmail.com

War Cemeteries and Memorials

Many who left the shores of Australia to serve in WWI did not return. The same happened during WWII. One of the war graves and memorials for fallen Australians is Polygon Wood in Belgium.

There are many overseas sites of significance including those in France, Malta, The Philippines, Malaysia, and Papua New Guinea.

At Polygon Wood a large mound known as the Butte used for training by the Belgian Army before WWI, now stands a memorial to the 5th Australian Division. Polygon Wood was destroyed in the battle. It has been re-built with walking tracks, and to honour those who served the Great War, it has a large cemetery. It contains the graves of many soldiers, in fact 2,103 burials have been conducted with full honours, and 428 are identified.

Work on the cemetery by Australians began at Polygon Wood soon after the Armistice was signed on November 11, 1918. Many Australians now visit Polygon Wood, its 'Brothers in Arms' memorial and stop at the ANZAC Rest Cafe, often tracing the footsteps of family members who served in the area in WWI.

To honour those at Polygon Wood, a commemorative callsign OP0PPY will be activated on April 25, ANZAC Day. Philippe Haverhelst ON8PV reports that a lot of remembrance occurs at that time, that will be joined by OP0PPY using an ICOM 7400 feeding a Hexbeam on CW and Phone.

The memorial at Polygon Wood is similar to that commemorating the Australian 1st Division at Pozieres on the Somme. It is a tall obelisk with the rising sun emblem of the Australian Imperial Force, and underneath a large plaque which reads 'To the Officers Non-Commissioned Officers and Men of the Fifth Australian Division who fought in France and Belgium 1916 - 1917 - 1918.' Beneath these words is a list of the battles, which include of course Polygon Wood. At the bottom the main inscription is repeated in French. In 1935, the memorial was visited by the Prime Minister of Australia, Joseph Lyons, when he toured the Western Front.

Prepared By Jim Linton VK3PC

Installed on Sunday at the Moutoa Quay carpark the result of Left Bank Art Supplies 2015 Big Paint was proudly mounted on the wall. The painting, made up of 100 individual squares, each painted by a different artist, is a rendition of the famous artwork "Simpson And His Donkey", and is in commemoration of Gallipoli in this historic ANZAC year. Well done to all involved - it looks great! (CIW 2015_IMG_7001)

New Device Combines the Advantages of Batteries and Cupercapacitors [*Gizmag*]

Source; http://www.gizmag.com/high-energy-density-supercapacitor/37075

By Dario Borghino

Scientists at UCLA's California NanoSystems Institute have developed a new device that combines the high energy densities of batteries and the quick charge and discharge

rates of supercapacitors. The hybrid supercapacitor is reportedly six times as energy-dense as a commercially available supercapacitor and packs nearly as much energy per unit volume as a lead-acid battery.

Batteries can store a lot of energy in a small and light package, but they can't charge or discharge very quickly or last a long time the way supercapacitors can. A single device that combines all of these positive attributes could change the entire technological landscape of today, leading to lighter, compact phones and electric cars that charge in seconds instead of hours.

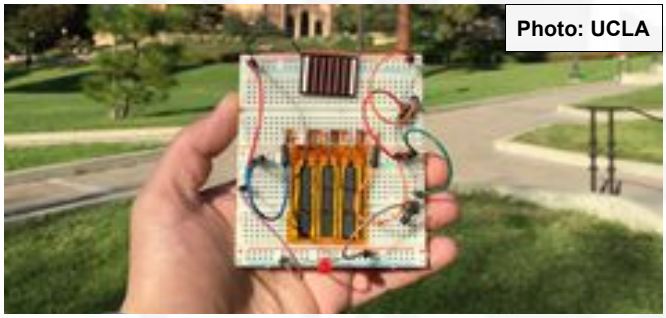

Photo: UCLA

Professor Richard Kaner and Dr. Maher El-Kady have made an important step in this direction by creating a high-performance hybrid supercapacitor. Like other supercapacitors, their device charges and discharges very quickly and lasts more than 10,000 recharge cycles. But, according the scientists, their invention also stores six times more energy than a conventional supercapacitor, holding more than twice as much charge as a typical thin-film lithium battery in one fifth the thickness of a sheet of paper.

The amount of energy that can be stored in such a device depends in large part on the contact area between the electrolyte and the two electrodes: the greater the contact area, the more energy can be stored. Previous hybrid supercapacitors used porous structures in the electrode to maximize this area, but the pores were simply too big, and therefore too few, bearing relatively little effect on performance.

Kaner and El-Kady used manganese dioxide (a material used for alkaline batteries) for the electrodes, but also added a special three-dimensional laser-scribed graphene (LSG) structure. Crucially, this graphene structure was specifically designed for high conductivity, porosity and surface area, allowing the device to pack much more energy per unit volume and mass

"Even though our electrodes are thin (around 15 microns), they are capable of storing more charge than the 100–200 micronmeter thick commercial supercapacitor electrodes mainly because our hybrid LSG/MnO2 electrodes are very energy dense," El-Kady told Gizmag.

According to the researchers, the supercapacitors can reach energy densities of up to 42 Wh/l, compared with 7 Wh/l for state of the art commercial carbon-based supercapacitors. Their device also provides power densities up to around 10 kW/l, which is 100 times more than lead acid batteries and on the higher end of performance for commercial supercapacitors.

"The LSG–manganese-dioxide capacitors can store as much electrical charge as a lead acid battery, yet can be recharged in seconds, and they store about six times the capacity of state-of-the-art commercially available supercapacitors," says Kaner.

Supercapacitors are usually stacked on top of each other and packaged into a single unit, but the researchers have been able to take advantage of the thinness of their device by integrating it inside a solar cell array. In this application, it was found that the supercapacitor could quickly store electrical charge generated by a solar cell during the day, hold the charge until evening, and then power an LED overnight.

This is just one of many potential uses for the technology.

"Let's say you wanted to put a small amount of electrical current into an adhesive bandage for drug release or healing assistance technology," Kaner said. "The microsupercapacitor is so thin you could put it inside the bandage to supply the current. You could also recharge it quickly and use it for a very long time."

Kaner tells us his team is now exploring using these electrodes to build hybrid supercapacitors on a large scale.

The research is described in the journal Proceedings of the National Academy of Sciences.

Source: UCLA

"World's First Battery-Powered Rocket" Readied for Launch

Source; http://www.gizmag.com/electron-rocket-batery-satellite-launch-vehicle/37060/

By David Szondy

Though there have been tremendous advances in space technology in recent years, when it comes to getting into space, we're still like cavemen trying to get beyond the breakers on a floating log – at least, that's the view of New Zealand-based company Rocket Lab. In the hopes of increasing the number of satellite launches to over 100 a year and placing constellations of small satellites into orbit numbering in the thousands, the company has developed a "battery-powered" rocket engine to lift its Electron launch vehicle at almost a tenth of the cost of conventional boosters.

Liquid rocket engines are hungry beasts that require huge quantities of propellants for every second of flight. To manage this, engines use turbopumps to feed propellants into the combustion chamber. In a conventional design, a centrifugal or axial-flow turbopump is driven by a gas turbine. This has done the job very well since the first rocket turbopumps were developed in the 1940s, but they're complex, heavy affairs that need their own fuel systems to operate.

Rocket Lab's idea for making a lighter, simpler liquid rocket is its Rutherford engine. Named after New Zealand-born physicist Ernest Rutherford, it's an electric turbopump engine that burns a mixture of liquid oxygen and RP-1 rocket fuel, which is a highly refined type of kerosene. Unlike conventional engines, in the Rutherford, the gas-powered turbine to run the pump is replaced with a brushless DC motor and lithium polymer batteries, and provides enough fuel for the Rutherford to generate 4,600 lbf (20,462 N) of thrust and a specific impulse of 327 seconds.

The company says that the Rutherford is also notable as the first oxygen/hydrocarbon engine to use 3D printing for all its primary components, including the regeneratively cooled thrust chamber, injector, pumps, and main propellant valves.

The Electron itself is a two-stage rocket measuring 1 m (3.2 ft) in diameter and 20 m (65.6 ft) high, and is designed to lift a 100 kg (220 lb) payload into a 500 km (310 mi) Sun-synchronous orbit. This is due, in part, to its extremely light carbon-composite construction, which, according to Rocket Lab, gives it a dry weight that's lighter than a Mini Cooper. These composites not only allow for bespoke construction with the tanks and other components designed with strength only in the needed directions, but also for tanks compatible with liquid oxygen combined with a proprietary thermal protection system for the cryogenics.

According to Rocket Lab, there are not only nine Rutherford engines in the first stage producing 34,500 to 41,500 lbf (153,464 – 184,602 N) of thrust, but the second stage uses a variant of the Rutherford engine designed to work more efficiently in the vacuum of space. The vacuum variant differs only in nozzle shape, with the same basic engine design for both stages providing for faster production.

Another innovation for the Electron is its two-axis thrust vector control system for launching in strong winds, and its advanced avionics system weighing 19 lb (8.6 kg). The launcher also uses a plug-and-play system to prevent cascading delays and allows customers to provide alternative payloads at short notice.

Rocket Lab says that when the system is up and running, the Electron booster will be able to lift a payload into orbit using less fuel than a 737 flying from New York to Los Angeles, and will cost US$4.9 million per launch. This is a 91 percent saving on current launch costs, with Rocket Lab using an all-in-one launching service by providing not only the rocket, but also the commercial launch facility in New Zealand.

The first flight of the Electron launch system is slated for later this year with commercial operations targeted to begin in 2016.

ANZAC 100 Program Gets World Attention

Source: *http://www.southgatearc.org/news/2015/april/anzac_100_program_gets_world_attention.htm*

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Republished with permission

Transparent Butterfly Wings Could Inspire Low-Reflectivity Displays

Source: http://www.gizmag.com/kit-glasswing-butterfly-reflective-displays/37151/

By Chris Wood

Researchers from the Karlsruhe Institute of Technology (KIT) in Germany have studied the wings of glasswing butterflies in an effort to determine what causes their low-reflective nature. It's believed that the findings of the study could lead to less reflective screens on mobile phones, tablets and other devices.

The wings of the glasswing butterfly reflect hardly any light (Image: KIT/ Radwanul Hasan Siddique)

A flat pane of glass will reflect between eight and 100 percent of light that falls upon it, often making content difficult to view on glass-fronted displays such as those found on smartphones and tablets. The need for less reflective display technology will be readily apparent to anyone who has attempted to use a glossy-screened device in direct sunlight.

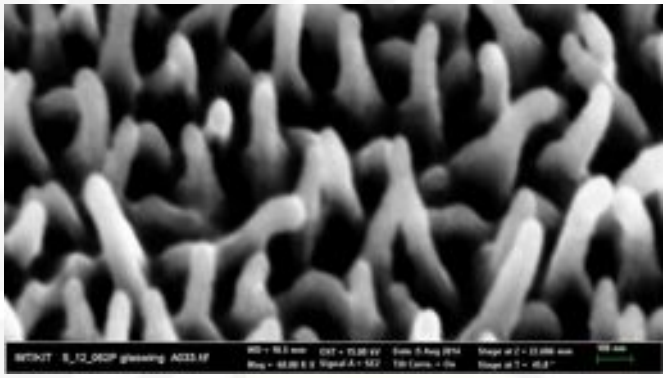
Increasingly, scientists have been turning to nature in an attempt to solve the issue. The transparent surfaces on certain animals, such as the eyes of a moth, have been found to reflect significantly less light than glossy man-made surfaces, but only when the viewing angle is vertical to the surface.

By contrast, the wings of a glasswing butterfly reflect between two and five percent of light, regardless of the viewing angle of the observer. The surface of the wings exhibits a low reflection of both visible light, as well as infrared and ultraviolet spectrums visible to certain animals. This makes the butterflies more difficult to track during flight, allowing them to better avoid the clutches of predators.

The KIT researchers set out to solve the mystery of this unstudied phenomenon, scanning the butterfly's wings via an electron microscope.

Previous studies have revealed that a series of regular pillar-like nanosctructures are responsible for the low reflective nature of transparent surfaces on animals, and similar structures were found during the KIT observations. However, unlike the uniform pillars previously observed, those found in the butterfly's wings were of varying height (between 400 and 600 nanometers) and randomly spaced, some 100 to 140 nanometers apart.

Following the observations, the researchers mathematically modeled the irregular nanopillar arrangement, with the findings matching up perfectly with the behavior of the observed light.



"In contrast to other natural phenomena, where regularity is of top priority, the glasswing butterfly uses an apparent chaos to reach effects that are also fascinating for us humans." says doctoral student and team member Radwanul Hasan Siddique.

Having solved the mystery, the team believes that the findings of the study could lead to the development of less reflective surfaces for mobile phones displays, glass lenses and more.

The results of the research have been published in the journal Nature Communications.

OLD TECHNOLOGY RELATED TO A DRAKE TR-4C

From Bob Jeffers ZL2AAQ

Some time ago I posted a question, re the Drake TR-4C, to the Drakelist Net and received an interesting reply.

THE QUESTION

Subject: [Drakelist] Drake TR-4C V7

Hello All,

I recently acquired a Drake TR-4C, SN 39893.

On removing the top cover, for a tentative inspection, I discovered that V7, the RF Amp, had been changed from a 12BA6 (Remote Cutoff Pentode) to a Telefunken 12AU6 (Sharp Cutoff Pentode). According to the RCA Receiving Tube Manual both tubes have similar operating voltages. Also, NJ7P Tube Database lists the 12BA6 as a preferred substitute for the 12AU6; I wonder if the reverse substitution holds true?

The TR-4C does receive but, as the circuitry was designed using a Remote Cutoff Pentode, is the use of a Sharp Cutoff Pentode degrading the performance of the Rig ?

Should I replace the 12AU6 with a 12BA6 or leave well enough alone?

E.N. Lurch in 'Fundamentals of Electronics' Third Printing, Aug. 1961; p.83/84 illustrates the differences between Sharp and Remote Cutoff for the 6AU6 and 6BA6 tubes. The graphs on p. 84 show quite clearly what happens but, as an amateur, the significance eludes me. I assume the Drake designers chose a 12BA6 over a 12AU6 for valid reasons.

Any comments please.

Bob ZL2AAQ

THE ANSWER

Subject: Re: [Drakelist] Drake TR-4C V7

The following discussion of remote vs. sharp cutoff just came over the R390 mailing list. Although it specifically addresses the R-390 IF deck, the concepts are the same:

I wrote:

>The 6BA6 is a "remote cutoff" pentode, meaning that it takes a relatively large negative grid >bias to cut off plate current. The 6AU6 is a "sharp cutoff" pentode, meaning that its plate >current cuts off with a much smaller negative grid bias.

Remote cutoff tubes are generally used in stages with AGC control, to provide a proper linear AGC action.

In any case, all of the tubes on a common AGC bus should have the same cutoff >characteristic, so the IF gain is distributed properly between the stages.

To elaborate a bit:

With 100 V on the plate and screen a 6AU6 is cut off with a grid voltage of -4.2 V (all tube parameters, voltages, and currents mentioned in this post are approximate).

Cutoff is defined on the datasheet as a plate current of 10 uA or less.

In typical operation, the 6AU6 with 100 V on plate and screen operates at 5 mA with a grid voltage of just over -1 V and a transconductance of 3900 umho.

The transconductance does not change radically with grid voltage around this operating point, although it does change very rapidly between cutoff (-4.2 V) and the vicinity of the operating point (-1 V).

A 6BA6 with 100 V on the plate and screen is cut off at a grid voltage of -20 V.

Right away we see that it is intended for a different use: in this case, cutoff is defined as a transconductance of 40 umho, not as a particular plate current.

In typical operation, the 6BA6 with 100 V plate and screen operates at 10.8 mA with the AGC wide open (or nearly so), also with a grid voltage of just over -1 V, and a transconductance of 4300 umho. However, it is designed to be used throughout the range of grid voltages, not just at one operating point.

The transconductance of the 6BA6 changes smoothly with grid voltage, from around 5000 umho with a grid voltage approaching 0 to less than 10 umho with a grid voltage of -30 volts or so. Plate current never really does "cut off" -- the transconductance just gets lower and lower as the grid goes more negative.

Because the amplification of a tube is directly related to its transconductance, we see that the 6AU6 is intended to maintain its amplification near a design value with reasonable changes about its nominal operating point, while the 6BA6 is intended to be a variable gain amplifier, with the gain input on the same element as the signal (i.e., the grid).

(There are other possibilities -- gain can be varied by changing the screen voltage of a pentode, or one of the other grid potentials on a multi-grid tube, or changing the effective cathode resistance, for example by using a differential pair of tubes, or lots of other ways).

What does this mean for a radio's IF chain?

The grid bias in AGC'd stages is set by the AGC line.

Let's assume that a radio has typical AGC (for tube radios) that runs around -1 or -2 volts wide open on band noise, and reaches -15 V or more when it is hit with a lightning crash, or your neighbour fires up a kilowatt to call the DX station you are listening to.

Let's also assume you have your AGC set to Slow, just so we have time to analyze what is happening (it works the same with fast AGC, just ... well ... faster).

Your neighbour just stopped transmitting, so the AGC line is recovering from -15 V or more.

As it rises, the gain of the remote cutoff amplifiers increases smoothly, and the band noise (with that buried DX signal) also rises until the AGC stops it at a grid voltage of, say, -1 volts.

Now replace one IF tube with a 6AU6.

As the AGC line recovers from -15 V or more, the gain of all of the AGC stages except that one increases smoothly.

When the AGC line reaches -6 volts, the 6BA6 stages are operating with a transconductance of 500 umho -- about 20dB less than their maximum gain -- but the 6AU6 stage is still solidly cut off, and passing no signal.

So, the IF as a whole is still doing nothing because no signal gets through the 6AU6 stage.

By the time the AGC voltage reaches -4.2 V, the 6BA6 stages are up to a transconductance of 1000 umho -- within 12dB of their maximum gain -- and the 6AU6 stage is just starting to pass signal (if that stage were another 6BA6, it would be operating within 12dB of its maximum gain, too). So the IF as a whole is still doing essentially nothing.

Then, over the next 2 V or so of AGC potential, the 6AU6 suddenly catches up and then passes the gain of the 6BA6 stages.

The net result is that even with just one sharp cutoff tube, the useful AGC range has been compressed from around 20 volts to around 2 volts.

The perceived results will vary according to where in the IF string the 6AU6 is located.

If it is the last IF amp, the radio will be fairly quiet as the AGC recovers and then the band will rather suddenly pop in.

If it is the first IF amp, the internal IF noise (but not the band noise) will increase steadily as the later IF amps increase in gain, then the band will rather suddenly pop in.

As you replace more of the IF amps with sharp cutoff tubes, this "popping in" of the band will get more and more pronounced.

The sharp cutoff stage will also have higher distortion.

All tubes have harmonic distortion (largely second harmonic) because the transconductance varies with grid voltage, and thus the amplification varies from the negative signal peak to the positive signal peak.

However, the much lower change in transconductance per incremental grid voltage of the remote cutoff tube (which goes from near zero to 4300 umho over a range of 30-odd volts of grid potential) compared to the sharp cutoff tube (which goes from near zero to 3900 umho over a range of only 2 or 3 volts of grid potential) means that the sharp cutoff tube will have much more distortion in the region where its transconductance is variable (which is where it will necessarily be operated in an AGC'd stage).

This will not be audio distortion (at least not directly) -- rather, it will generate harmonics of the IF frequency, which may bleed into the RF and IF circuits to cause spurious responses as well as distortion at the detector.

So, using sharp cutoff tubes in AGC stages is not a recommended practice.

Best regards, Don

</quote>

73 -Jim

WANGANUI AMATEUR RADIO
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Branch 48 is pleased to announce their annual
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Saturday May 2nd, 2015. Auction starts at 10am.

Wanganui intermediate School Hall. Dublin St, Wanganui.

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Lots accepted from 4pm till 8.00pm on Friday 1st & 7.30am to 9.30am Morning of the sale.

SALE CONDITIONS:

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Bidders must register with a $5 fee. This will also provide them with a sale catalogue.
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For further information contact Graham Hawtree ZL2AHR
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The Branch 48 Wanganui Award

Wanganui has just celebrated the 100th birthday of the Dublin Street Bridge so, it seems fitting to have a promotion of the Wanganui Award which depicts the Old Town Bridge which was replaced in 1970 and is situated only a few kilometres downstream from the Dublin Street Bridge.

The sketch on the Award is by the late Gerald Weeks, a well admired artist and sculptor from Wanganui.

The award measures 220mm x 190mm and is printed in full gloss.

Qualification is very easy, only 8 points required and the Club Call Sign of ZL2JA counts as two points, as does contact with any Wanganui YL. Contact with ZL2JA is not compulsory. Any mode or any band including repeaters and the National System, with contacts dating from 1st January 1982 from permanent residents of Wanganui. (May be portable)

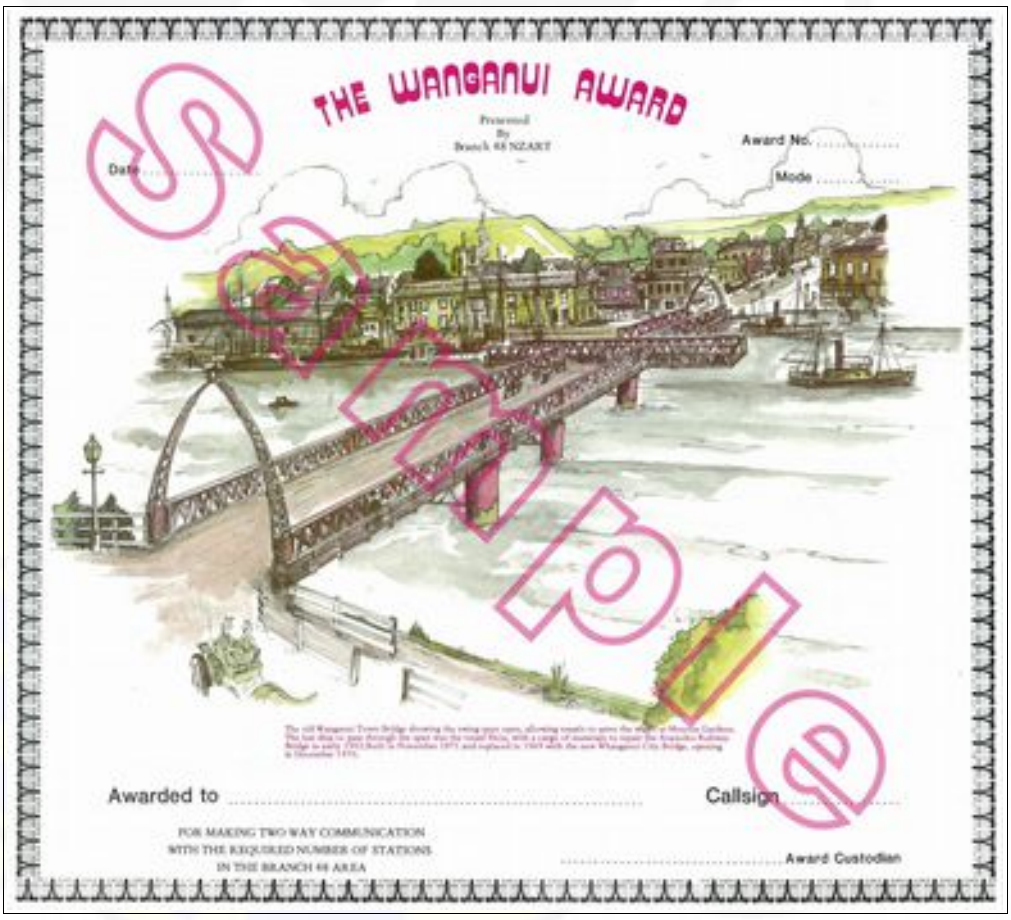
Branch 48 will be monitoring the Awards net on 3.677MHz for two weeks commencing Tuesday 3rd March 2015.

Several Wanganui stations are active on the Old Timers Club net on 3.870MHz on Monday evenings at 8.30pm.

Anyone is welcome to announce themselves and join in and make contacts with Wanganui stations after the net.

Applications for the Wanganui Award can be made by submitting Log evidence to Ivan Horn. Award Custodian, P.O.Box 7250, Wanganui. A fee of $5.00 is applicable.

Ivan Horn
Award Custodian



"The old Wanganui Town Bridge showing the swing span open, allowing vessels to serve the wharf at Moutoa Gardens. The last ship to pass through the span was the vessel Huia, with a cargo of material to repair the Aramoho Railway Bridge in early 1902. Built in November 1871 and replaced in 1969 with the new Wanganui City Bridge, opening in December 1970."

The Back Info Page

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NZART (NZ's National AR Organising Body):
http://nzart.org.nz

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