

IARS The IARS PROPAGATOR

The monthly newsletter of the Illawarra Amateur Radio Society Inc.
Registered by Australia Post publication number :- NBH - 1491

Meetings are held on the second Tuesday each month (except January) at 7.30 pm
in the State Emergency Services building in Montague St. North Wollongong.

Visitors are most welcome.

Number 5 Volume 93

May 1993

John D Lodding



VK2ZLJ

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Carpenter & Joiner

Lic. No. 6440C

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*** Future Events ***

May

There will be a visit to the Police Centre at Warilla on May 16th - that's the Sunday after Our Club meeting.

Don't bother coming to the Tuesday night meeting, it'll be terrible and you'll be glad you missed it.

June

Brian VK2KLH has organised a visit to Mascot Airport. This visit could include the communications centre and the air traffic control tower. Positions are limited to 10, so let me or Brian know. Time and date will be decided at the meeting.

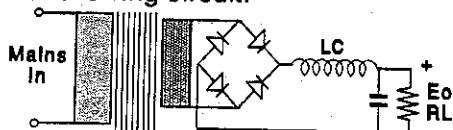
The big night! Time to throw out the old and bring in the new. Who is going to run Our Club for the next 12 months? I certainly hope our President, Treasurer and Secretary stand again - they are doing a great job. The Broadcast Officer's job is vacant and so is my job. I will not be doing The Propagator next year. I certainly hope someone comes along and takes over.

***** Page 1 *****

The Ultimate Power Supply Part 2 - Filter considerations.

Before getting on to the use of regulators to reduce ripple, there is one filter component we should consider - the inductor.

The best rectifier design for the voltage and current ranges we are considering is the full wave bridge. If this is followed by an L-C filter we get the following circuit:-



The inductor acts to inhibit rapid current change. The best E_o / E_i we can get is 0.9 - so for the same E_o as our C input filter, our transformer needs to offer $E_o * \text{SQRT}(2) / 0.9 = 1.57 * E_o$

However, diode current flow is much less 'peaky', and hence physical stresses on the transformer secondary are much less. Thus, there will need to be more turns, but of a lesser wire gauge on the transformer secondary than for a C input filter and the diodes can be less expensive.

Our R_L is unchanged. If we use the same C as before (0.145F), and say a 1 Henry inductor, we assume the transformer has a copper loss of 1% and we go for 10 amp output at 13.8v then $R_L = 1R38$.

Winding power loss :-

$$\begin{aligned} &= 1\% \text{ of } 138 \\ &= 1.38\text{w} \\ &= I^2 R_w \\ &= (10 * 1.11)^2 * R_w \end{aligned}$$

thus $R_w = 0.011$ ohms where R_w = effective resistance for Xfmr windings

$$\begin{aligned} Z_c &= 1/2 \text{ Pi } f \text{ C) } \\ &= 1/(6.28 * 100 * 0.145) \\ &= 0.011 \text{ ohm} \end{aligned}$$

$$\begin{aligned} Z_L &= 2 \text{ Pi } f \text{ L } \\ &= 6.28 * 100 * 1 \\ &= 628 \text{ ohm} \end{aligned}$$

With this disparity of Z_c and Z_L resonance is unlikely. (The resonant frequency of this combination is 0.42 Hz).

$$\begin{aligned} Z_{out} &= R_w + R_L || Z_c \\ &= 0.01552 \end{aligned}$$

$$\begin{aligned} \text{Total } Z(R_w, Z_c, R_L) &= (0.011^2 + 628^2) + 0.011 \\ &= 628 \text{ ohm} \end{aligned}$$

$$\begin{aligned} V_{\text{Ripple}}(\text{rms}) &= 0.0155 * 13.8 * 1.57 / 628 / 2 / \text{SQRT}(2) \\ &= 0.00019\text{v} \\ &= 190 \text{ microvolt (about .0014\%)} \end{aligned}$$

For a small (?) amount of extra copper and iron we have achieved a dramatic reduction in ripple (and hence in load regulation) compared to any C input filter.

In fact, such ripple and regulation is unnecessary for amateur applications and consequently smaller L and C could be used.

As a rule of thumb, Z_c should be no greater than one fifth R_L ie, 0.276 ohms, hence minimum C = 6000 uF

To achieve say 0.8% ripple, ie 150mV. $Z_L = 0.276 * 100 / 0.7 = 39.4$ ohms

$$L = 62 \text{ mH}$$

However, there is a limit to how small an inductor can be before it becomes ineffective. This is known as critical inductance:-

$L_{crit} = E_{out} / I_{load}$ Henries, which in our case = 1.38 Henries. Thus, 62mH will appear as a short circuit. With a 1.38H inductor, though, C can be reduced in size (increased in reactance) for the same ripple as previous (190 uV) to $1 / 1.38 * 0.145F = 0.105F$

If we are willing to put up with more ripple, say 0.7%

$$\begin{aligned} V_{ripple\ Peak} &= (0.7 / 100) * 13.8 * 2 * \sqrt{2} \\ &= 0.273\ V \end{aligned}$$

$$Z_C / Z_{total} = 0.273 / 13.8$$

$$\begin{aligned} Z_{total} &= \sqrt{R_W^2 + ((Z_L - Z_C) || R_L)^2} \\ &= \sqrt{0.11^2 + ((2 * \pi * f * L - Z_C) || R_L)^2} \\ &= 2 * \pi * f * L \text{ (approx)} \\ &= 2 * \pi * 100 * 1.38 \\ &= 867\ \text{Ohms.} \end{aligned}$$

$$\begin{aligned} \text{thus } Z_C &= (0.273 / 13.8) * 867 \\ &= 17.15\ \text{Ohms} \end{aligned}$$

$$\begin{aligned} \text{thus } C &= 1 / (2 * \pi * 100 * 17.15)F \\ &= 93\ \mu F \end{aligned}$$

$$\begin{aligned} \text{Finally, check the resonant frequency } f &= 1 / (2 * \pi * \sqrt{L * C}) \\ &= 14\ \text{Hz} \end{aligned}$$

For CW buffs the syllabic rate for full break-in at say 30 wpm is 30 / 2.4 cps = 12.5 Hz

Hence our choice of L & C is ok for mains ripple reduction and marginal for morse syllabic rate. RTTY, AMTOR, PACTOR and other digital modes will pose no problem at higher baud rates.

However, line regulation is as for all the previous designs - a 10% shift in mains voltage gives a 10% rise in E_{out} . Here endeth the non variable, non programmable designeth!

Regulators

With regulators, we can design in our load regulation and ripple levels, we can design out line regulation, and we can achieve continuously or remotely variable load management. However, to achieve these wonders we need to think 'system' and in particular closed-loop systems with high gain. To achieve RF and spike immunity when using high gain we need to be very careful however.

Regulators range from simple two-terminal devices using zeners through three terminal devices with fixed E_o and simple current limits to more complex multi-pin devices whose load envelope can be programmed.

All these devices have one thing in common - lower efficiency than our unregulated designs. This comes about through two main routes:-

- a) Line regulation management
- b) voltage drop across, or associated with, regulator design.

Let us pass over zener diode regulation to consider analogue (ie non switched or chopped mode) designs, and initially series pass designs.

Assume line regulation seldom exceeds + or - 10%, ie mains voltage 216 to 264 volts.

Assume regulator drop-out voltage, ie minimum voltage required across the series element of a series regulator is 2.5 v (1.5 is possible but risky)

Assume volt drop across diodes is from 0.5v at minimum load to 0.7v each at max load.

Assume transformer copper losses are 1% each in primary and secondary.

Assume full-wave bridge rectifier.

For 13.8v output, assume up to 50 amps load and for 28v output, 25 amps load (700w),

Allow 1mV to 100mV ripple

Allow C input and L-C filter designs.

Allow regulator ripple rejection from 50 to 70 dB.

13.8 v design - C input filter.

50 A output = 700 watt

$R_L = 13.8 / 50 = 0.28 \text{ ohm}$

$R_{wsec} = (700 / 100) * (1 / 50^2) = 0.0028 \text{ ohm}$

Primary R_w reflected to secondary

$= (13.8/240)^2 * (700 / 100) * (1 / 50)^2$
 $* (240/13.8)^2$

$= 0.0028 \text{ ohm}$

thus $R_{wtotal} = 0.0056 \text{ ohm}$.

Maximum diode voltage drop = 1.4v

Regulator series voltage drop = 2.5v

$V_{out \text{ max}} = 13.8v$

100 mV ripple = 0.283v peak at output

The regulator at worst applies 50db smoothing so input ripple to the regulator can be

$10^{50/20} * 283mV = 90 \text{ volts}$.

This is clearly unlikely as it exceeds the required input voltage, but it does tell what can happen to spikes within the frequency range of the regulator. What this also means is that 1 volt of input ripple should end up as 3mV of output ripple.

However, ripple at input to the regulator means we have to supply a higher average input voltage if we wish the regulator to keep regulating - and under the worst line regulation our input filter capacitor needs to stand a higher peak voltage and ripple current.

This can be demonstrated quite simply. Allow a range of input filters such that t/RC range from 0.1 (a good filter) to 0.5 (a not so good one).

t/RC	V_{min}	V_{peak}
0.1	0.905	3.35
0.2	0.819	6.40
0.3	0.741	9.16
0.4	0.670	11.67
0.5	0.607	13.90

Minimum DC input to the regulator, ignoring ripple for the moment =

$13.8 * 1.4 * 2.5 = 17.7v$

Taking ripple into account, even for the best case, we need to achieve a minimum input to the regulator of $17.7 / 0.905 = 19.6 \text{ volts peak}$.

Our design needs to allow for line regulation + or - 10%. ie minimum peak secondary voltage needs to be 19.6 peak or $19.6 / \text{SQRT}(2) = 13.8 \text{ rms}$

The maximum peak (for capacitor choice) will be $19.6 * 1.1 * 1.1 = 24 \text{ volt peak}$.

Transformer design voltage (at 240v input) would be $(240 / 216) * 13.8 = 15.4v$ and all this with a good quality C. But what size C (for input filter)?

$t = 10ms$

$R_L = 0.28 \text{ ohm}$

$C = t/0.1/R = 10/1000/0.1/0.28 = 0.36F$

Some of you will say you don't need to provide for 700 watts capability, ie CCS rating of 400w PEP. Lesser load currents equal smaller input C and smaller transformer. Having seen the ripple rejection of a worst case 50dB, some of you will be quite happy having a higher input ripple - and may have suitable transformers and C to match. The results are tabulated for convenience :-

$\frac{t}{RC}$	Cap (V)	Trans Sec RMS
0.1	24.0	15.5
0.2	26.5	17.0
0.3	29.3	18.8
0.4	32.4	20.8
0.5	35.8	23.0

Fig 6a - Voltage Rating

	Lead Current			
t/RC	10A	20A	40A	50A
0.1	.072	.144	.290	.360
0.2	.036	.072	.144	.180
0.3	.024	.048	.096	.120
0.4	.018	.036	.072	.090
0.5	.014	.029	.058	.072

Fig 7a Capacitor in Farads

Note that with capacitive input filter, what you gain in voltage, you lose in current - but $V_{Ain} = V_{Aout}$

Example 1.

So if you want 20 amp out at 13.8v DC and you have a 24v transformer, what capacitor do you use and what current rating of transformer?

For a 24v transformer, $t/RC = 0.5$ hence the peak voltage across C = 36 volts and the C required is 29,000 uF. The transformer will be delivering up to 28A RMS AC.

Example 2.

You want 10 amps out at 13.8v. The transformer you want to use has an output of 19 V RMS. What C do you need?

$$V_{peak} = 30 \text{ volts.}$$

$t/RC = 0.3$ which at 10A requires 24,000 uF. The transformer should be rated at 14 amp.

Example 3.

What do you do with a 150,000uF 28v capacitor?

at $t/RC = 0.1$, max $I_{out} = 20A +$ and $V_{peak} = 24v$ which is OK.

at $t/RC = 0.2$, max $I_{out} = 40A +$ and $V_{peak} = 26.5v$ which is OK.

at $t/RC = 0.3$, max $I_{out} = 60A +$ but $V_{peak} = 29.3v$ which is not ok.

Note that as the t/RC increases, so does the ripple % and hence the ripple current in input capacitor which implies heating. Also as the t/RC increases, power loss through dissipation in series pass transistors increases.

Example for $t/RC = 0.1$

$$I_i = 50A$$

$$V_{pass,max} = 10.2v$$

$$P_{pass,max} = 10.2 * 50 = 510 \text{ W (@ 58% eff)}$$

Example for $t/RC = 0.5$

$$I_i = 50A$$

$$V_{pass,max} = 35.8 - 13.8 = 22V$$

$$P_{pass,max} = 22 * 50 = 1100 \text{ W (@ 39% eff)}$$

So ripple reduction is not the only reason for having a low value of t/RC . Another major reason is power bills - and the cost of weight lifting workouts in the gym so you can built 'The Thing'

or carry it around. Also $1100 + 7 = 1800$ watts which occurs at peak line input hence $I_{\text{mains}} = 6.8$ amps.

You may care, as a worked example to see what happens when $t/RC = 0.05$ and $I_{\text{load}} = 60$ amps. What size of input C is needed, what spec transformer, and how efficient will it be?

NOTE:- These power loss calculations are extremely simplified. Detailed calculations will come later.

The L-C Input Filter

For the kind of currents we are talking about an inductor in excess of 1 henry is going to be big and heavy - and you probably won't find one at Cavigon's. However, as we saw earlier, we can economise on the capacitor required.

What was not mentioned earlier is that unless the load current is maintained for the critical inductor calculations, the inductor becomes transparent, and the voltage (with all its ripple) appears across the capacitor at $1.57 \times$ the level you thought it would. Thus our pass regulator needs to be able to withstand quite a high voltage at low current; the regulator will handle the ripple but will the capacitor?

To overcome this there are several solutions:-

- 1) Use a much larger inductor such that L_{crit} is ok for the lowest current to be drawn, or
- 2) use a bleed resistor to ensure minimum current keeps the inductor above critical level, or
- 3) use a shunt regulator.

1) Iron core inductors change their inductance as current changes, due to the saturation of the core. That is, inductance falls as current increases. So, we need to specify the inductance at full load current and at standby or receive current to maintain criticality. This was the function of the "Swinging choke" of valve designs.

2) Having a bleed resistor means the PSU needs to supply both the bleed power and the full load power. Hence, efficiency will never exceed 50%, even if the regulator can achieve 100%. But, as we saw earlier, even with $t/RC = 0.1$, efficiency was only 58% for a C input filter - and we still need to allow for line regulation and regulator drop outs. Overall efficiency may reach 35% with luck.

3) Shunt regulators, in effect, are a form of self switching bleed resistors; ie, when full load is on, the shunt passes enough to keep it regulating and when on standby or receive the shunt draws almost the full load. Thus, overall operating efficiency is low all the time, though not as low as with the bleed resistor.

In summary, the L-C filter with a swinging is the best design, followed by a shunt regulator. The L-C filters' best application is for high voltage moderate current eg valve amplifiers. An L-C followed by a series regulator has inherent problems of 1) current swing to low values - will the capacitor be able to handle high peak off-load voltages? and 2) if there is higher than the designed current eg an improperly tuned tank circuit or worse still, a short circuit, will the series

regulator be able to dissipate the power?

With shunt regulators, a short poses no problems to the regulator components - but will the rectifier withstand the added current load?

For the next instalment we will look at design of the regulator itself and finally design of the rectifier section but before that we should not leave our military equipment buffs in the lurch. So, let us look at the transformer and capacitor requirements for the capacitive input filter, series pass regulator design to get us started.

Next issue we will be looking at 28v considerations to keep the 'military mob' happy.

This article is written by our President Brian VK2KLH. Your comments are wanted on this subject - it is a club project being co-ordinated by Brian.

***** Mocom 70 *****

Ken, VK2KWG (him with the pink shorts) has taken the sketches that Brian (our President) made and will produce a 3 dimensional, multi colour scaled drawing so you can complete this project with a minimum of problems.

He will also be providing a leather bound, gold embossed 15 page instruction book written on hand made paper so you should have no problems when it comes to the final assembly.

Ken will be building it as well so you can copy his mistakes.

*** Field Weekend ***

Well, the field weekend was held and what magnificent weather we had. To those of you who never even made the trip up for the day, please accept my deepest commiserations - you missed a fantastic outing. Several good contacts were made. Ken VK2KWG topped the record count with 8 6m contacts. Nice going Ken. I certainly hope next year's committee organises this event again. We also had a couple of St George members although I forgot to write down their names and calls. Good to have you along fellows.

** Science Centre Roster **

I know Dale VK2DSH won't agree with me, but apathy has all but killed this project. There was a BBQ last Sunday to celebrate 12 months at the Science Centre, but since this is written before it, don't bother attending since you won't know about it. I can't tell you what will be discussed either since I haven't been there yet. I do know I'll have a great time though. How do I know? I'll make sure I have a great time.

Do you ever go somewhere and wish you'd never gone there? Why not turn your disappointment around. No matter what the situation, there is always something you can think to alter your outlook. How about visiting a sick person in hospital? I hate it, but have to do it sometimes so I think all the good things and forget about the bad. Life can be great if you 'turn the other cheek' so to speak.

***** Page 7 *****

***** Help!! *****

Our President Brian VK2KLH needs some info on a TRIO TS500. Circuit diagrams service manuals and mods would be greatly appreciated.

I think I had this comment in last month, but since I don't have a copy of last months Propagator, I can't check up!

How about looking through your library and see if you can help Brian out.

Available in our junk yard

1. Electronic bits and pieces (millions!)
2. Meters, gauges, instruments, cables, wires etc
3. Metal sections:- copper, brass, aluminium, s/steel
4. Motors, gearboxes, pumps, assorted machinery
5. Steel sections, sheet, planks, ladders, shelving, scales, safes, compressors
6. We buy all metals incl. platinum & gold
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*** Way Back Then ***

Episode 18.

Dapto Moonbounce Project - 1975.

Highlights of the Year.

(i) Completion of equipment rebuild after lightning in October 1974.

(ii) Replacement of power amp. by high effic. 650W output PA.

(iii) Major overhaul of dish.

(iv) Low noise preamp installed.

(v) First Aust.- Canada and Aust.- France 70cm contacts.

Equipment rebuild after lightning.

The rebuild of the receiving system was completed after receipt of a new "high power" coax relay from VE7BBG and low noise transistors from W1JAA - as "Christmas Presents". Another fine example of the assistance provided by the EME fraternity.

Noise figure checks at the CSIRO confirmed that the preamp was again "up to Spec."

The replacement coax relay allowed the transmit system to be completed and returned to operation at 350 watts output.

Several members of the club were involved in the rebuild, the cost of some items being covered by insurance held by the University.

Operation in Feb-March was severely affected by broad-band interference which was eventually traced to one of the local TV stations. Both of these stations were very co-operative in breaking their carriers to identify the source, which was then corrected.

Replacement of tx PA.

We were hearing EME stations but they were not hearing us - even though we were hearing our own echoes at up to 6dB above noise. It was decided that we should therefore increase xmit power output, but we were limited to 1kw DC input. The solution was a new design of 432MHz PA by K2RIW, which used the 4CX250 tubes which we had in our push-pull plate circuit, but in a high efficiency parallel tube arrangement (still popular in 1993).

The transmitter was taken out of service in April for the necessary PA mods. By July it was operational again, with output up from 350W to 650W - still with 1kw DC input!!

Operating results with increased transmitter output.

On 12th July we had our first contact with VE7BBG, this being the first Aust.- Canada 70cm contact. It was followed on 10th August by the first Aust.- France 70cm contact, with F9FT, whose signals were up to 10dB above noise!

We were now being heard by other weaker stations, but could not copy them well enough to make a contact, so, as soon as a new lower NF transistor and its preamp design became available, we were forwarded "the necessary" and proceeded to make up a new preamp. It was made up and, after optimisation was installed immediately. It gave a 0.3dB reduction in noise figure compared to the previous preamp - which may not seem much to the uninitiated, but was

a valuable improvement in 70cm EME communication capability back in 1975 (when we were still using bipolar transistors).

Major repairs to the dish.

The dish and its mounting and drive mechanism were beginning to show worrying signs of its age and lack of attention. Tubular steel supporting rings and radial supports of the dish itself were corroding through and the dish drive mechanism was becoming very "sloppy", which made it very difficult to keep the dish pointed on the moon, especially in gusting wind conditions.

Arrangements were then made for a local Contractor to cut out and replace 13 sections of the tubular steelwork, or weld patches over the less badly corroded areas. The teeth of the main drive gears, which were some 75cm in diameter, were built up and resurfaced and drive bearings replaced, to give much better meshing of the gears. After this was completed in September life was made much easier for the operators!

Results of all the above work.

On 11th November WA6LET was heard, at up to 15dB above noise and on 24th November we had our first contact with them, their signals being up to 18dB above noise! Our own echoes were peaking up to 12dB above noise.

We now had an EME station which was virtually second to none on 70cm - at our restricted DC input of 1kw DC - except that we had no means of measuring our transmit frequency with any great accuracy (digital

frequency counters for 400MHz and above being too hard to come by and too expensive for Amateurs in those days!!) So we began to figure out how we could use HF Standard Frequency stations for a reference. At the end of the year construction of the necessary equipment for this purpose was well under way.

Operating summary for 1975.

During the year, according to our logbook, we carried out a total of 52 tests (including echo tests) and had 11 contacts with overseas EME stations, including the two "VK firsts" to other countries.

Publicity for the club.

Early in the year the VK2AMW dish and equipment were covered, with photo, in the EIMAC publication - "Successful 432 EME Antennas".

In June the new ARRL book titled "Specialised Communication Techniques for the Radio Amateur" was published, showing a picture of the VK2AMW installation on its front cover.

During the year information on our EME activities was included in various amateur publications in Australia and overseas.

Cost to the club.

The club's Income and Expenditure Statement for year ending 25/2/76 indicated that the Moonbounce facility cost to the club was \$22.20 (not \$2220 - \$22.20!)

Lyle VK2ALU.

From : VK2YKQ

To : VK2FPN

Type/status : P\$

Date/time : 12-Apr 19:51

Bid : 8698_VK2XGJ

Message # : 8698

Title : Add for propagator

John,

Can I put an add in the Propagator? I want a particular connector and I would like to put a request in the Propagator asking any members if they have one spare to flog to me.... CU Tomorrow night at the meeting.

Dave.

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If we haven't got it
we'll be happy to get it in

***** Page 10 *****

*** Mexico Report *****

Greetings to all from the deep south and contrary to popular belief about the weather, I am still running around in shorts although I am advised it gets a little chilly around the knee caps during the winter months.

For those of you that have never been to Tasmania, let me say that you are missing some of the most spectacular scenery in the world (and I've travelled half of it). Someone once said "You can drive around Tassie in a day", well, I guess you probably could if you were a leadfoot but the only thing you would see is road! I got whisked around in a week and I reckon I only saw 1 percent of all there is to see. So if you're planning a holiday and don't know where to go, I can thoroughly recommend Tassie.

After reading the April edition of the Propagator, I find myself wondering why the same people are still struggling with the same problems year after year. I am beginning to think that it may just be a complete lack of interest in the club side of the hobby. The question arises that in recent years with the continual demand on the rf spectrum (and it's not going to lessen), what role will radio clubs along with the WIA play in preserving and enhancing our bands for the future development of our hobby, and, where will the support come from?

Recently I had to make up an 80 metre antenna to keep a sked with Harry, VK2JHW and the problem I had was

that I couldn't put one up in the back yard (postage stamp size and the landlord wouldn't allow it). Although I can work VHF & UHF on a rubber ducky from this location, HF posed a problem. As time was of the essence, I decided to throw a random piece of wire around the room with a 50 foot loop under the house and feed it with the matcher. Needless to say, it didn't work. So, I decided to wind an inductor to increase the electrical length of the first wire. Unfortunately the wire being only 10/0.64 mm hookup type made it very difficult to wind without using a former. As fortune would have it, an empty 750ml beer bottle was sitting on the table (that's another hobby of mine) and I decided that it would used as the former. After winding 20 turns around the flat part of the bottle and fixing them down with cello- tape, I hooked it in to the system. To my surprise signals shot up (including static) and I find I can work into Dapto at a good S9+ using only 15 watts PEP on most occasions. I also worked ZS6 on 15 metres with that wire (bottle shorted of course). SWR hovers around 2:1 @ 3.6Mhz and is probably somewhere around infinity on 15, but the matcher doesn't care.

I told you that story to ask what's happened to the 80 metre net on Sunday?

Till next time, 73's DE Peter, VK7KHE
@ VK7GL.TAS.AUS.OC

--- End of message # 8483 to VK2FPN
from VK7KHE ---

***** Misc *****

The following space fillers were all taken from John's BBS. Thanks to the contributors.

Insurance Report

An Insurance Agent, instead of making sales, spent the afternoon in one of those X-rated movie theatres. He went back to the office and wrote on his daily report: "Saw two people who weren't covered..."

Adolescence is that period when a boy refuses to believe that some day he'll be as dumb as his father.

The definition of a race horse is... An animal that can take several thousand people for a ride at the same time.

Father to son ... of course this country has faith in your generation ... just look at the size of the national debt we expect you to pay.

Said the egotistical actor to a friend...now let's talk about you...what did you think about my last picture.

A secretary was telling her office mates about her birthday party ... You should have seen the cake ... she boasted ... It was marvellous ... There were nineteen candles ... one for each year...Nineteen candles ... meowed a colleague ... What did you do, burn them at both ends?

Buying a house is easy All you need is a lawyer, a real estate agent and a winning lottery ticket.

There isn't much to see in a little town, but what you hear makes up for it

Eve ... You know, Adam, you should take more pride in your appearance... Adam ... Strange, you should say that Eve, because I've thinking about turning over a new leaf.

TRIVIA

* Mars has two moons...Deimos and Phobos....A day in Mars lasts 24 hours and 37 minutes.

* Tannic acid is found in the bark of trees, including oak. The acid is used in the leather industry to soften hides.

* The broad plateau that covers most of Spain, called the Meseta, has dry soil that's bad for most crops. In areas where more rain falls, farmers can raise Spain's famous olive trees.

* The most famous Faberge treasures ever produced were the Imperial Easter treasures ever produced were the Imperial Eastern Eggs. The Czar received two jewelled eggs each Easter, one to give to his wife, the Czarina, the other to his mother. No more than 57 such eggs were made, and only 10 are in the Soviet Union today.

From : VK2GID
To : VK2FPN
Type/status : PN
Date/time : 22-Apr 19:33
Bid : 9551_VK2XGJ
Message # : 9551
Title : The Packet tutes return!!

Greetings Mr Peter. OK, it has been a while since I wrote some tutes for you, so here is the latest column:

PACKET TECHNICAL COLUMN

Hello and welcome back to my extended ravings. Hopefully you are still finding them informative. Last month we looked at establishing a connection to a local station, talking for a while, and clearing down the call. This month we will look at what can go wrong in this process, then look at how to establish a connection to a station further away.

You may remember from the first tutorial that Packet radio has a built in error checking capability. This means that no matter how bad the radio link is, what is received will always exactly match what was sent, provided that packets can get through. This is the big "if" - provided that packets can get through. If the TNC doesn't get an acknowledgment for a packet after a short time, it will re-send the packet. If it doesn't get an answer after a few tries, it will give up and display "****RETRY COUNT EXCEEDED" on the computer screen.

This is a wonderful way to raise my blood pressure: I have just typed a nice long line (or two) of text and the

TNC throws it away with this message. What causes this to happen? Perhaps the channel has become fairly busy, so every time I try to transmit I "double" with someone. Maybe the path to the other station was a bit marginal anyway. The upshot is: not enough signal at the receiver.

What can I do about this? Firstly try to establish the connection again (same method as before) and try again. But if it keeps happening, what then? The first thought is to run more power or a higher gain antenna. (Be reasonable: 50 W to an omni or 10 W to a yagi is enough noise on the channel for your mates to compete with). Another idea is to use a digipeater to get a stronger signal through. The simplest (but most annoying) is to come back later when things are quieter.

This has brought us on to the use of digipeaters. But firstly I need to cover a bit of theory: the difference between "frames" and "packets". So far I have been very casual about my use of these two words, indeed most Packet operators would not know and do not need to know the difference. At first, I wasn't going to worry about it, but now I need to point out that they are not the same.

A "packet" carries information, a "frame" carries packets, the radio carries frames. Confused? You betcha! Let's try to think of something that might help. Consider a postal article (a letter). You have the paper inside the envelope which has the information written on it: that

is like a "packet" in radio which has the information in it. Then you have the envelope, which has the paper inside it and an address on the front: that is like a "frame" in radio which contains the information packet and the address for the packet. Then the envelopes go into a mail truck, that is like the radio channel which transmits frames across the countryside.

You are probably still confused here. I didn't want to cover this because it is so tricky to explain well. Obviously we need to send the paper, as it is the thing that tells your Grandma that the holidays were nice and so forth - without that there is no information. But you can't just put it in the mailbox to send without an addressed envelope - if you do then nobody knows where it has to go (or how to get it there). The same with radio - a frame contains a packet of information, the address for that information and an indicator of who last transmitted it.

Hopefully that is a little bit clear. If you can't figure it out, please ask me. Maybe it will become more obvious when I start explaining digipeaters.

Let's say that I want to talk to John VK2XGJ from my station at VK2GID. Unfortunately there is a big hill in the way and so we can't work direct because John's station can't hear mine. But Peter VK2FPN's station is well placed to hear us both, so I can use VK2FPN as a digi. How is this done? Instead of the usual "C VK2XGJ" command to my TNC, I would use "C VK2XGJ V VK2FPN", which means Connect to VK2XGJ Via

VK2FPN, or, use VK2FPN as a digi.

So, what actually happens? Every packet of information that I send to VK2XGJ, is sent from VK2GID to VK2FPN, and then VK2FPN sends it to VK2XGJ. Every packet from VK2XGJ gets sent to VK2FPN, then VK2FPN sends it to VK2GID.

This is where you need frames to understand what is going on. My station takes the packet of information to be sent and puts the packet into a frame addressed from VK2GID to VK2XGJ via VK2FPN, last transmitted by VK2GID. Peter's station takes the packet out of that frame, then into another frame addressed from VK2GID to VK2XGJ via VK2FPN, last transmitted by VK2FPN. Each station looks at the frame address to work out who is next to handle the message, which means that VK2XGJ will not pick up the packet until it is in a frame last transmitted by VK2FPN.

I am still not convinced that I have explained that properly. We shall see. If you can't follow what I am talking about, then I will have to have another go. Let me or Peter VK2FPN know if you want me to do it again.

73 until next month, de Graham VK2GID.

--- End of message # 9551 to VK2FPN from VK2GID ---

***** Page 14 *****

From : VK2XGJ

To : ALL @LOCAL

Type/status : BF

Date/time : 25-Apr 13:43

Bid : 9756_VK2XGJ

Message # : 9756

Title : STS + Kids + Help!

I have applied to NASA on behalf of Dapto High School to have some kids chat to the STS crew one of the STS flights and would like some volunteers to assist in extolling the virtues of Amateur radio etc to the kids plus their parents on the night(s) in question. I have no further info at this time other than to say that my request has been accepted and will be advised later. If anyone would like to assist please drop a msg or call on I/line.

73, John de VK2XGJ

*** ILLAWARRA PACKET ***

Having the latest in technology can be a frustrating, humbling and exciting experience. I spent four days in Hospital from 19/04/93 for a Gall bladder removal and the VK2XGJ PRBBS continued on, not putting a diode (foot) wrong anywhere, all without me being there. My guiding hand on the tiller, so to speak. Not only that but the general User knew no different until I made mention of the fact, where I had been and for how long. Comments like "The system worked perfectly with you not there!" "When are you going again?" Tsk, tsk, tsk!

Over the last few weeks I have managed to get operational on UO-22/KO-23 Packet satellites as you may well have heard. These satellite's use the latest high speed systems on 9600 BPS Full-duplex and have an access time of eight to twelve minutes on each pass. So with a little fiddling I've managed to get the computer system to track a Satellite, tune its Downlink frequency, download its File Directory for me, plus any marked Files that I require, on each pass with me just sitting there watching it, ain't technology terrific! Makes you wonder doesn't it?? To think that a cold hearted Silicon Based life form can replace a warm blooded Carbon Based life form is frightening! B-) Ah well it had to happen sometime.

I have some .GIF files, these are picture files viewable with VPIC or another .GIF/.PCX viewer, that have come off KO- 23 if anyone is interested. They are on the PRBBS for downloading or come for a wander over with a formatted disk if you haven't Packet access yet, or just feel like a chat. Give me a I/line first though. Some of the .GIF files are very interesting, one of them is the STS-56 Logo, another is a set of pictures showing the Ozone layer holes, plus some shack pix.

I have included some more info re the ARSENE satellite now due for launch the first week/fortnight of May 93. It is a Digipeater only and not a BBS, so if you have access to 2Mx and 70Cx FM radios and modest Yagi's you could Digi from your shack to.....

Have a read of them, I think you'll find it interesting. Almost as good as the Moon Digi Idea a year or so ago.

My effort at the last Meeting was a bit of a flop, I must apologise for that. Still, after the Meeting that was a flurry of activity on the Local Packet freq's. Do we want/need more Packet Chats? If so should they be within the Club Meeting or as a separate Meeting? Come on Packet is for your use as well as mine.

I have applied to AMSAT-AUST for a spot in the NASA STS program for Dapto High School. As yet I have had no reply but have been given to understand that it will be accepted. Now when the time comes, I would like some assistance from the IARS Club members. To simply be there and answer some of the questions and play a Public Relations part will help. This will be a good opportunity to have the hobby of Amateur Radio in the Public eye again as I intend to also invite WIN 4 to the party.

We have another Gateway now operational in the Illawarra. VK2BLR Mike has a two port gateway to/from 144.700 MHz/144.875 MHz. So you can connect to VK2BLR-1 on either of those freq's and use the NetRom Node to move to the other freq. This is something a little different and needs a little more testing done. Come on Lads, help with some of the tests, it is fun you know!

Well that is all that I can think of for now.

73, John de VK2XGJ

ARSENE Operations Planning

The ARSENE satellite due for launch in the spring of 1993 is the next planned OSCAR. ARSENE carries a conventional AX.25 digipeater using frequency modulated (FM) uplinks and downlinks. There are only three differences between the ARSENE digipeater and a conventional terrestrial digipeater. These differences are as follows.

1. The device is cross band. You uplink on 70 cm and receive on 2 m.
2. The device is moving, and will only be available for predictable but specific times of the day.
3. The link control parameters in YOUR TNC will have to be adjusted to cope with the time delay involved in the round trip from the ground to the spacecraft.

The digital transponder is a digipeater. There is no PBBS aboard (contrary to what the VK2 WIA B/cast says). All users will have to contact stations (in real-time) directly via the orbiting digipeater to send them messages. Packet radio Bulletin Board System (PBBS) stations will have to contact other PBBS stations for message forwarding, individuals will contact each other, and they will all be digipeating through the same ARSENE spacecraft. Working through ARSENE will be similar to working through AMSAT-OSCAR (AO) 13, namely minimal

Doppler, but some time delay on the signal. Received signal strengths however, are expected to be much stronger than those of AO-13.

Using ARSENE

ARSENE is going to be very easy to use especially for PBBS SYSOPs who are equipped for the 145 and 440 MHz bands. The ARSENE uplink is on 435.050, 435.100, 435.150 MHz, the downlink is on 145.975 MHz. You may use any of the uplink frequencies, they are all active in parallel. PBBS SYSOPS will be able to use conventional PBBS forwarding techniques for automatically passing messages over intercontinental distances. No software modifications will be required to an existing PBBS station to implement an ARSENE link. However, some software changes will make operations more efficient.

Hardware and software devices for pointing antennas at an OSCAR and following its motion are readily and inexpensively available. They can be operated in conjunction with, but separate from the PBBS software. The F6FBB PBBS software, for example, has OSCAR pass prediction software built in as a server.

This ease of access will probably encourage power VHF and UHF SYSOPs to add an ARSENE port to their stations. ARSENE will give them intercontinental forwarding capabilities without the licensing headaches of HF operation. Remember, unattended operation is legal on ARSENE's uplink and downlink frequencies.

The major problem from an operational aspect is that ARSENE is 10 years in the making and operates at 1200 bauds. If you look at the packet channels in your local area,

you will notice that certain ones are congested. If you live in densely populated areas you will certainly notice it. Have you copied a MIR packet pass lately? Look at all those disconnect replies from that spacecraft. Think of ARSENE's potential problem. It will be in range of not just your urban area, but of hundreds at a time. The potential for congestion could be worse than trying to get a packet through MIR.

Let's Plan to use ARSENE in an Optimal Manner

To get the maximum use of ARSENE we are going to have to use it in a planned or a controlled manner, not control access to the spacecraft itself. Access should be provided to the Roddy's of this world, namely, any suitable equipped individual who wants to send packets through it. PBBS message forwarding should be limited to designated PBBSs for intercontinental message forwarding. There is a precedent here in the closed HF nets which forward messages over long distances. If PBBS access to ARSENE can be limited in such a manner, the probability of the channel choking is lower than letting a free for all take place. This approach to message forwarding is an interesting alternative to the UoSAT low Earth orbit Gateway Store-and-Forward approach.

(Continued on the next page)

Individual Use of ARSENE

While some individual stations will leave their systems active via ARSENE all the time, the majority will not. Individuals will use ARSENE in two ways, non real-time message transfers and real-time keyboard to keyboard QSOs. They will probably come on-line on the frequency at local evenings and weekends. One way to optimise individual message transfers is for stations to use the beacon to signal the presence of a message, and to use software such as LAN-LINK [1] to scan the contents of packets appearing on the frequency. The LAN-LINK approach works in the same way either for terrestrial links, or for the ARSENE link.

The LAN-LINK approach works in the following manner. As an individual LAN-LINK user, leave a message on your system. To ensure that people know that you have left a message for them a 'MAIL for' list is loaded into your Packet Beacon and transmitted every 30 minutes (Refer to the BTEXT command in the TNC manual) as ':QTC:' followed by a list of calls.

Should a station that receives such a beacon message, recognise its callsign, it will issue a connect request to the callsign of the LAN-LINK station that originated the beacon transmission. If the connect is made, the other station will send the message automatically which LAN-LINK will "capture to disk". The connect will time out and terminate a few minutes later. The only change the individual LAN-LINK user will have to do is set the packet UNP parameter

to via ARSENE-1 (or whatever call sign the ARSENE digipeater uses).

Keyboard to keyboard contacts will proceed exactly as they do on terrestrial links, notwithstanding the QRM levels.

Upgrading PBBS Software for Using ARSENE

For PBBS message forwarding, a number of software changes comes to mind. These changes are modifications to the existing way of doing things, not a whole new approach. The changes are described below.

1. Modify the PBBS forwarding files to inhibit forwarding attempts with stations who do not have access to the satellite at that time.
2. Instead of having all stations try to transfer messages at the same time, as is done on HF, use a master-slave approach. This approach uses a master station that controls the transfer and will allow individual users time on the satellite. The Master station signals to each PBBS on the network when to start forwarding by sending it a token.

The PBBS that receives the token initiates a forwarding cycle to each PBBS on the network in turn, then returns the token to the Master. The PBBS software modification is to add the master/slave token scheme. If the slave PBBS cannot return the token to the Master, it takes over as the Master. This situation will arise when the satellite has passed beyond the range of the previous Master station.

ARSENE and PacketClusters

ARSENE will also have the capability to link PacketClusters [2] around the world. PacketClusters are growing around the world and extending feelers along terrestrial links. For example, there are linked PacketCluster Nodes along the East Coast of the U.S.A, Northern Europe is linked into one gigantic cluster, and there is at least one in Japan. I recently saw a packet message that had come from England through the London - New York wormhole asking about a way to get into the local NY PacketCluster. Looks like the U.S.A. East Coast Nodes will be linked into the European PacketCluster Nodes within the near future.

The compatibility of ARSENE to current 2 meter 1200 baud packet will make it possible to link all the PacketClusters in a hemisphere. It may be that the motivation to provide real-time connections between stations on different LANs will come from the DX community rather than the message forwarding community.

Think about the following scenario. A DXpedition sets up their hf equipment and a link to ARSENE. They connect to the PacketCluster system and the software starts working stations automatically on the active hf band by prompting via the ARSENE link. The ultimate in 11st operation. Fantastic? Yes, but almost within the state-of-the-art. Consider the changes needed to upgrade the current PacketCluster operation to the automated ARSENE link.

1. Modify the PacketCluster software to provide a broadcast link between Nodes. This could use the secondary header approach described for the PBBS above. If each Node uplinks a broadcast packet containing interlink information several times, until it copies its own packet on the downlink, there is a good probability that all Nodes copied the packet. The packets would be numbered so that fills may be requested.

2. Modify the PacketCluster to prompt each user when it is their turn.

3. Modify user programs that interface the user to the PacketCluster to hold a QSO when it is their turn. Using CW and any other digital mode such as RTTY, AMTOR or Packet, such modifications to software such as LAN-LINK is not difficult. The Kam with its dual link capability is an ideal terminal unit for this task. SSB QSOs with voice recognition capability would be more difficult to achieve with current technology.

All the modifications to the way things are currently done, are upward compatible with the current way of doing things. Each, on their own offer an improvement over the way things are currently done. Together, they have the potential to change packet radio radically.

Sharing the Satellite

Individual users, PacketClusters and PBBS will all be sharing the satellite at the same time. To even up the odds of getting packets through, perhaps we can allocate one uplink channel to

each class of user. This approach ensures that competition for the transponder in each class of user is limited to the particular class. The following spectrum allocation for the ARSENE Uplink is suggested.

PacketClusters 435.050 MHz

Individual Users 435.100 MHz

PBBS forwarding 435.150 MHz.

Summary

ARSENE can provide an interesting addition to packet radio if we don't choke it at birth. Think about ARSENE and plan for its optimal use. At the same time, you might care to speculate on how different packet radio would be today, if the RUDAK packet radio PBBS on AO-13 had worked. This article has made some suggestions for optimising the use of the ARSENE digipeater.

References

1. LAN-LINK is a Shareware software package with registered users in 50 countries. It is produced by G3ZCZ and distributed by Software For Amateur Radio, POB 3419, Silver Spring, MD., 20918.
2. PacketCluster is a software package produced by Pavilion Software. This article is copyright Joe Kasser 1992. Permission is hereby granted for publication in Amateur Radio Club Newsletters, providing a copy of the issue containing the material is sent to Joe Kasser, POB 3419, Silver Spring, MD, 20918, USA. Why not pass it on to the editor of your local club newsletter. 73 Joe

ARSENE LAUNCH DELAYED!

BID: \$ANS-114.01

ASTRA-1C Antenna Damaged Delays
ARSENE Launch Until Early May

The AMSAT News Service (ANS) has received information from F6BVP that the launch of the ARSENE-OSCAR satellite has been delayed until early May. Although the details are rather sketchy right now, it appears that an omni-direction antenna was damaged on the main payload, ASTRA-1C, during handling. At the present time, the ASTRA-1C satellite manufacturer, HUGHES, is making a determination how best to proceed with the repair and/or replacement. The first estimates of the repair and/or replacement of the ASTRA-1C antenna show it might be anywhere from 10 days to 3 weeks. The length of the delay depends on whether the antenna can be repaired or it has to be replaced. As soon as this information becomes available, F6BVP will make it known to the entire amateur radio community as quickly as possible. Please stay tuned to the AMSAT News Service (ANS) bulletins for any further updates on the launch of the ARSENE satellite.

If anyone is interested in following this Digi-In-the-sky through, leave me a msg on the VK2XGJ PRBBS and we can access the beast together. I'll keep you further informed as the data comes to hand.

73, John de VK2XGJ

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REPEATER REPORT

3/4/93 to 28/4/93

VK2RAW (146.850) - On the 11/4/93 (Easter Sunday), Ken & I went to Mt Murray to install the DTMF Remote Controller for the rptr. 6850 was taken off the air for about an hour for the installation which went well. The rptr was back on-air in time for the WIA Broadcast at 10am. The 5 DTMF controlled functions were listed in last month's Propagator. Ken also brought up an IFR to give the rptr a

check over while we were there. This showed the rptr to be in an excellent state of health. Also a 12V fluorescent light was installed in the cubicle which will make late arvo/early evening visits a bit more "pleasurable".

VK2RIL (438.725) - The rptr is working fine. The only work done was on the 10/4/93 when the sensitivity of the DTMF controller was increased with the addition of a 10K resistor.

VK2RIL (147.275) - The Pager interference continues as per last month's report. The rpttr is still operating on the folded dipole antenna. Of course it's not as good as the high-gain collinear, but it still surprising how well such a simple antenna can work. The busted collinear was taken back to my place where I had tried unsuccessfully to dismantle the base to make repairs. I'd almost given up, when John (ZLJ) offered on the 26/4/93 to come all the way down from Helensburgh to give me a hand. Within half an hour of his arrival we had the blessed thing apart. The base was very corroded which explains the antenna's reluctance to be dismantled. No damage could be found anywhere on the collinear elements & all solder joints were sound, so we're not sure on the problem, although we strongly suspect the N-socket. The antenna was re-assembled & tested, presenting a very nice 1.2 to 1 VSWR on 147.275MHz. The collinear will hopefully be installed back at Sublime Point by the time you read this.

Thank-you John for your assistance.

VK2RUW (438.225) - After installing the DTMF Controller at Mt Murray on the 11/4, Ken & I went over to Knights Hill to do the same to 8225. Installation again went well (Murphy must have been on holiday's. He was probably caught in the Easter traffic jam on the Kiama bends). The DTMF Control functions were also listed in last month's Propagator. We were able to connect the "talking clock" to

the controller. This function is presently the only "user" function which doesn't need the Security PIN number to be entered. If you have DTMF facilities, the number required to get the time announced is "9". Be warned, if this function is abused it will be removed. The "talking clock" does have novelty value, but many people have also told me how handy they have found it. The hourly announcements are still activated.

Also while on site we fixed the system's TXer time-out timer which had become intermittent. A dry solder joint was the culprit. Ken also checked the system with the IFR & found everything OK except the output power of the Goulburn Link TXer to be down to about 50mW. The TXer was still heard OK at the Goulburn end, even with such low power! Ken dissected the link transceiver & eventually found after much work, that the variable capacitor between the PA stage & the antenna changeover relay was intermittent. This was duly fixed.

We have spoken to the Canberra rpttr fellows & the two 1296MHz links, to link 8225 (& 8325 Goulburn) to 8525 Mt Ginini, are about half-built, so the linking to Canberra is getting closer.

Also work is progressing for the linking of the WIA Broadcast into 8225 from Mt Murray. This should be operational within the next month or so. A lot of Shoalhaven & Goulburn people are keen on this one.

(Continued next page)

***** Page 22 *****

VK2RUW(144.775) - The ROSE digipeater is apparently working very well. The UHF port has been regularly hearing other ports quite a distance away due to coastal ducting. Some work will be necessary soon due to a Primary user of the 440 - 450MHz part of 70cm setting-up a couple of "wind-sheer" detectors. It was previously thought these devices were some type of radar but we have been told otherwise now. Don't ask me how these things work, all I know is it puts out very strong pulses right across the 440.050MHz ROSE link. It has been decided, by the powers that be, to move the link down to 420.1MHz to avoid the interference. Of course, our UHF link radio won't be impressed by having to be re-aligned down 20MHz.

VK2RUW (29.520/29.620) - Work has commenced on the re-commissioning of the Club's 10m rpt, although there may be some changes to the way it was run from before, more next month.

Till next time - Rob VK2MT

**** Committee ****

Sorry there are no committee minutes this month but you can be assured that the committee have been working. Although I don't report them as written, our Secretary does a fantastic job in keeping me informed of the goings on with Our Club when I don't attend.

From:VK2KWG 04/22/93 20:48:53

Subject:mocomm

hi there peter.....

brian kh said that he has sent to you circuits etc on the conversion of the mocomms to a linear for 2 m .. in hand script .. perhaps that akin to the shearing maid .. (thumb nail dipped in tar) .. if thou so desirest I will for no fee draw them up on cad so that thou mayst publish the afore mentioned article in the next action packed publication of the propagator enough of my ramblings .. (oh by the way I got 8 contacts on 6m FM on the field weekend ... who said 6m was dead) .. if I can pick it up from you on the weekend perhaps for your deadline the weekend following??? of course if you have already redrawn the circuit fair enough ... forget about my ramblings..... hm sounds like a good name for a song .. rambling rose hmmm that may be a sensitive subject .. i better not cast my net too wide or i may get on the rom side of people. I'll stop now before you need a shovel to clean out your mail box ... cheers ken vk2kwg

{ED. Since I won't be doing The Propagator, you might like to consider nominating Ken VK2KWG (him mentioned above) for the job. Ken has a good writing style and may put back the spark into The Propagator. Personally, I don't like too many technical articles - there are enough commercial mags around to cover them. I think a club magazine should be more chatty, social and informative}

***** Page 23 *****

POST BOX "THE ILLAWARRA AMATEUR RADIO SOCIETY Inc"
PO Box 1838, Wollongong, 2500.

REPEATERS	VK2RUW	29.620	Voice	Mt Murray/Knights Hill (off air)
	VK2RUW	144.775	Packet (ROSE)	Knights Hill
	VK2RAW	146.850	Voice	Mt Murray
	VK2RIL	147.275	Voice/RTTY	Sublime Pt
	VK2RAW	147.575	Packet (NetRom)	Mt Murray (Off air)
	VK2RUW	438.225	Voice	Knights Hill
	VK2RIL	438.725	Voice/RTTY	Sublime Pt

BROADCASTS - The Wireless Institute of Australia, N.S.W Division broadcast is relayed to 29.620 MHz and 146.850 MHz at 10.45am and 7.15pm each Sunday. Callbacks after the broadcast. RTTY broadcast in the week before the Club meeting, Sunday evening, 6:45pm on 147.275 MHz, relayed onto 3.618 MHz +/- QRM and 29.620 MHz, with callbacks immediately after.

CLUB NET - There is a club net on 147.275 (VK2RIL) at 19:30, 7.30 pm and 09:30 UTC on Monday evenings. All amateurs are invited to join in and waffle.

NEWS LETTER - The "PROPAGATOR" is published each month to reach all financial members in the week preceding the Club meeting. Articles and letters are always welcome. Commercial advertising is \$60 per ad per year, member's classifieds are free. See Peter VK2FPN for details.

MEMBERSHIP - \$20.00 P.A, concessions \$15.00 P.A, expiring immediately after the Annual General Meeting in July.

LAWRENCE HARGRAVE AWARD - VK stations require 10 contacts with IARS members. Overseas stations require 5 contacts. One contact with the Club station VK2AMW is suitable. Details of contacts are to be sent to the Club secretary.

******* COMMITTEE *******

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