GATEWAY

The Official Magazine of the Gippsland Gate Radio & Electronics Club Inc.

April 2017

Arduino DTMF generator

Antennapalooza in Pictures

Going Solar – worth it?

And More

President's report - page 3

Contents.

Event Queue

April:

21st AGM & Lecture on CNC milling technology.

May:

2nd Arduino night, 7pm – Note $4 hall contribution, **To be confirmed**
5th Prac Night – Club rooms
13th MDRC Hamfest - see page 8
16th Arduino night, 7pm – Note $4 hall contribution, **To be confirmed**
26th General Meeting – rescheduled to fourth Friday, to avoid a WIA event clash
30th Arduino night, 7pm – Note $4 hall contribution, **To be confirmed**

June:

2nd Prac Night – Club rooms
6th Arduino night, 7pm – Note $4 hall contribution, **To be confirmed**
16th General Meeting
20th Arduino night, 7pm – Note $4 hall contribution, **To be confirmed**

July:

22nd GGREC Hamfest

Presidents Report – April 2017

There's a whole bunch of things to chat about this month. First of all, the 2017 Antennapalooza event has been and gone. It was a great success, with good participation by the other Clubs. We got lots of feedback that people are loving the concept and we may well be regarded as one of the more popular Amateur Radio events to look out for each year. We had speakers on a variety of portable operations. Lectures are always nicer with beer and a folding chair.

Some of the campers at the 2017 Antennapalooza event

The weather on the Saturday was great, but we did cop showers on the Sunday. This was not much a problem with our Scout pavilion to protect us.
Our Editor Paul, VK3TGX was on-hand to capture some images of the event. These can be viewed at the GGREC Gallery at: http://ggrec.org.au/gallery/categories.php?cat_id=252
I had some drama with my van while we were there. It decided to stick permanently into third gear. I crawled underneath, drained the gearbox and removed its cover, where I tried to manually manipulate it out of gear, but it now seems there is a broken shaft. So I drove back home from Foster to Drouin with just third gear. Being a 4WD vehicle it did have a low and high range, so I was able to move off in third-low and double-clutch it into high range once I got going. I located another gearbox and transfer case in the L300 wreck I have here, untouched for around 20 years. After an inspection and fresh oil, it was fitted to the van and we are on the road again. I'm thinking the old gearbox got stressed during a recent 4WD journey into the Victorian Alps. Dianne and I had been field-testing a new software release I had written for the tyre inflation systems. (If you haven't seen it yet, I posted a cheesy video about the ordeal. https://www.youtube.com/watch?v=VZfWA597qC8&t=112s)

This Friday Night
This coming Friday night will be a big one. We have an exciting lecture on CNC milling technology and how it is changing the lives of people who require bone replacements. This is not a talk that you want to miss!

Our AGM
To save time, there will be no General Meeting in April, but we will have our brief scheduled AGM first. There are three confirmed nominations so far:

President	Ian Jackson VK3BUF
Secretary	Michael Van Den Acker, VK3GHM
Treasurer	Chris Chapman VK3QB

We need some Club members to fill the two general Committee Member positions. The committee don't meet each month, as often we can just work through issues by email, but we do try to meet in person every second month. It is not an arduous task, but it is important.

If you enjoy participating in our Club, you would by now realise that we need member input to keep it going. So even if you have had a term on the Committee in the past, you really need to seriously consider helping out this year. We have an Excellent Club with a good reputation and

good facilities, but success is not automatic. We need help and its only fair not to rely upon just a few people to put it all together. Please send an email to me asap and declare a nomination if you feel that the GGREC is a Club worth continuing.

The WIA

You will by now have read about the devastating state of the WIA over the past few years, with a board that has been performing badly, squandering members funds and compromising the WIA commitments for ACMA exams and licensing. This is not just my opinion. The facts are out there. Even a Senate hearing into the ACMA has queried the ability of the WIA to meet its license and exam commitments.

Well… finally, the members have spoken. At a General Election of Directors in March, all but one of the incumbent Directors have been turfed out of their roles when the membership sent in their postal votes in what was the largest Members return in many years. The transition to a fresh board will be in May at the WIA AGM in Hahndorf, South Australia. At this meeting there will be a presentation of financial records which may or may not meet with the approval of the membership on the day. As the old saying goes, there are limits to how much shine can be applied to excrement.

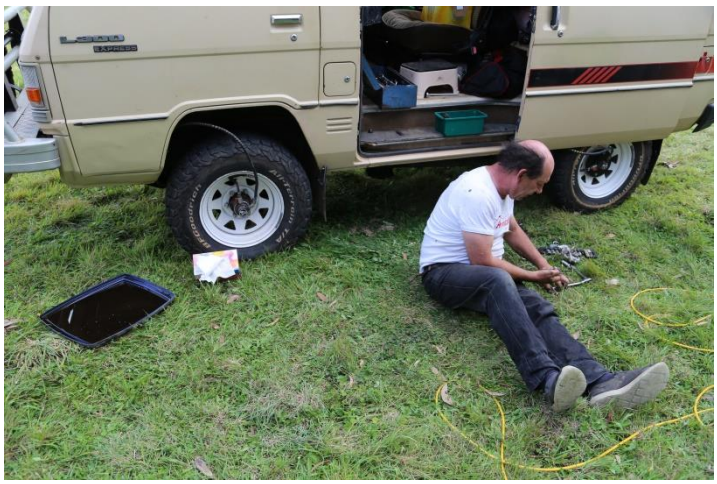
We congratulate the new, incoming board and understand the size of the task to restore fiscal responsibility to the organisation. I hope this will happen, but more is needed. The new board must find ways to better engage with the Amateur Radio **Club** fraternity around the country and to treat them like the asset that they are. This is the path to renewal of the hobby. Plus we need a good hard look at exam processes. Without diminishing standards and integrity, we need to make the hobby entry experience a lot more friendly than it is now.

Of course not everything can be done instantly, but like travelling down any wrong path, the longer you do the wrong thing, the harder it becomes to return to the right path.

Meeting change for May

The WIA Annual General Meeting will be held in Hahndorf South Australia on the 19th of May. A few GGREC members will be there, including myself. It is here that we will witness the changing of the WIA management team. This date clashes with the GGREC General Meeting in May, so there will be a change in our own meeting schedule. **We shall shift the May meeting from the 19th (the third Friday) to the 26th (the fourth Friday)**

That's enough for now. See you This Friday night!




VK5
National & Conservation
Parks Award
VKFF







More Antennapalooza pics at : http://ggrec.org.au/gallery/categories.php?cat_id=252

Notice Board

HAMFEST

The 2017 GGREC Hamfest Sale will happen this year on Saturday, July 22

If you are interested in setting up a table of your own it is recommended to book early as tables usually finish up in demand.

This year the bookings are being taken by Dianne VK3JDI. Tables must be booked and paid for in advance of the event. You can send an email to Dianne via hamfest@ggrec.org.au or call 5625 2545.

The GGREC Website carries all the latest information on table bookings

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Arduino Nights

February 21;
March 7
March 21
April 4
~~April 18 cancelled due to Easter~~
May 2
May 16
May 30
June 6
June 20

The last two Arduino nights have been awfully quiet, and as such were held in the club rooms

- Repeated from the last mag for your convenience.

Moorabbin and District Radio Club.

PO Box 58 Highett 3190

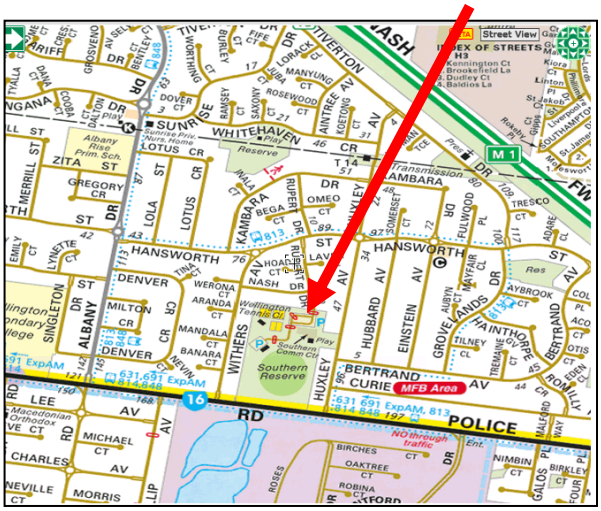
VK3APC

*** Saturday 13th May, 2017 ***

HAMFEST 2017

Location – Southern Community Centre - Rupert Drive, Mulgrave

Melways Reference **80 F4** (Enter via Huxley Ave off Police Rd.)



* GREAT VENUE
* PLENTY OF SPACE
* MELBOURNES BIGGEST
* MAJOR AND MINOR DOOR PRIZES

The Moorabbin & District Radio Club have much pleasure in inviting you to participate in
VK3's BIGGEST ANNUAL HAMFEST
Snacks and hot food will be available – FREE TEA & COFFEE!
Talk in via 439.900Mhz 70cm VK3RSE

PRIZE DRAWS: Every entry ticket goes into the draw & additional tickets on sale

SALES: NEW - Importers and suppliers of amateur equipment & accessories.

SALES: USED - Preloved ham gear & accessories, PC's & bits & pieces

All inside and undercover. Demonstrations of Radio equipment and accessories.

ENTRY ONLY $7.00
(Doors Open 10am – entry tickets on sale prior)
(INCLUDES **FREE** DRAW IN THE MAJOR DOOR PRIZE…..)

Tables available at $20 each, (1.8m long) includes lunch voucher. Please contact:

Lee Moyle, VK3GK. Tel: BH/AH (03) 9705 1051 or Mobile (0429) 810101
Email: vk3gk@aanet.com.au
Graeme Lewis, VK3GL. Tel AH: (03) 9702 1199 or Mobile (0418) 171601
Email: vk3gl@bigpond.com

Webpage - www.mdrc.org.au

From The Editor – overkill PC sound

In a previous article I mentioned a Marantz SR-14EX home theatre amp I 'scored' via my brother, it didn't work, it had gone into American Indian mode, issuing smoke signals.

This thing is a brute, it weighs a ton and is packed with electronics, unlike other home theatre amps that weigh almost nothing and are rather barren inside. A search on Google indicated that this model originally retailed for $4700!, maybe more in OZ.

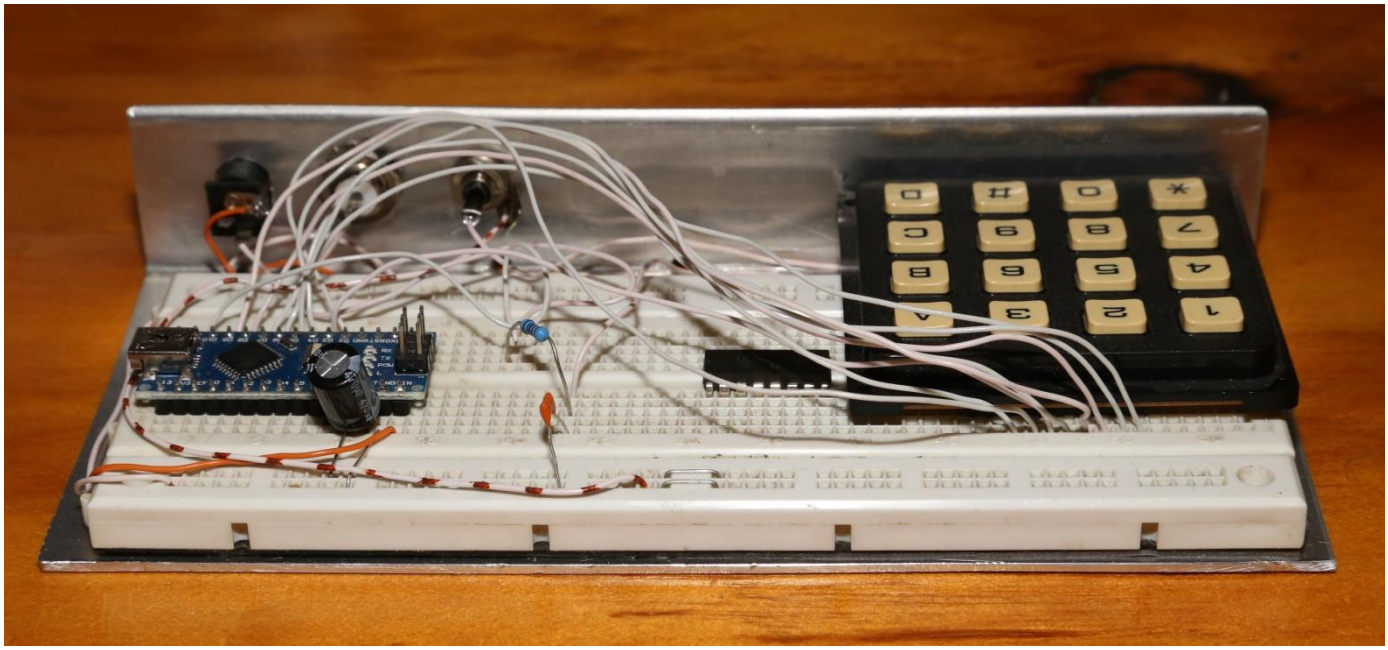
I have gradually built up a rather unfavourable view of all home theatre amps, they generally are great at reproducing sound effects from movies, but when it comes to music etc., a big letdown – usually their specs tell the story – bad distortion etc. A lot of them use cheap IC amplifiers, more at home in low end car stereos. The only things going for them is the 5.1/7.1 channel THX/Dolby/dts decoders, and the fact they can switch all the inputs to your TV/projector – Just don't expect anything decent from the actual 'amplifier' section.

However, Marantz seems to have spared not much when it came to building these. Having years of experience building top-line sound gear, they had all the audio expertise needed.

So what was wrong with this one, well it turns out the previous owner succeeded in blowing one of the power amp channels, that was now trying to put +70V DC out to the speakers. However the amp's speaker protector could see this fault and was doing its bit by not pulling in the speaker relays. The 5 x 140W amps are formed around a tunnel heatsink, with a fan pushing any excess heat out the grill on the side (hence me not being too concerned with stacking gear on top) Three amps on one board, two on another. The blown channel was on the three amp board, so I pulled the power lead for that board. The controller was no longer seeing the DC fault, so the relays pulled in and it was a goer. The only problem was I now only had two functional amps – but hang on – that's not a problem for me, I only need two! I have no desire for surround sound. The main thing I was looking for was a decent D/A converter to take digital audio (optical – toslink) from my PC and give me far better sound than can be had from the cheap'n nasty converters on my PC's motherboard. Being optically connected means I also lose all the digital noise present in the PC. – Not bad for a roadside zero dollar score!

Paul VK3TGX

Arduino Audio – pt. 2, DTMF generator



This is a follow on from the previous magazine article. I had a working tone generator, now all I needed was a way to control it. In the first part I simply had the desired tones hard coded into the software. If I wanted a different tone, I had to re-compile the code and upload it, not exactly the way to go. I could have easily controlled it via the USB connection to my computer, but that was not what I was after. So I plugged in a 'standard' keypad and wired it up to the Arduino board (Note the IC next to the keypad, is not connected, it's just parked there)

No resistors or diodes etc. are needed, all that is needed is in the Arduino. These keypads are formed as a matrix of 4 by 4 switches, amazingly simply as they are presented, 1,2,3,A on the first row etc. unlike a lot of other keyboards, like the computer keyboard in my previous USB keyboard article, that one was almost a mess, taking quite a while to figure out.

To read a keyboard/pad, you scan it, one row, or column at a time. In this case I have 4 Arduino pins used to scan the rows, and another 4 pins set as inputs with their pull up resistors enabled.

```
pinMode(Row4, OUTPUT);
digitalWrite(Row4,LOW);
if (!digitalRead(Col1)) keypad=13; // is it an '*'
if (!digitalRead(Col2)) keypad=14; // is it a '0'
if (!digitalRead(Col3)) keypad=15; // is it a '#'
if (!digitalRead(Col4)) keypad=16; // is it a 'D'
pinMode(Row4, INPUT);
```

To scan, you start with the 4 scan row pins set up as inputs, you then set the first one as an output and set it low, you then check the 4 input pins for any lows. If there is any, you've found a pushed button. If not then set the first scan pin back to an input, then set the second scan pin to output, & low. This process is continued till all the keys have been scanned. One of three things will emerge, No buttons pressed, (just scan again), one button pressed, (go generate a tone), or, lastly two or more down. In my case I went for the almost ultra-simple method of going with the last button detected – If you look at part of my code, you'll see how this occurs, as each key-down is detected, it is assigned to the variable 'keypad', as each new key-down occurrence is detected, it simply overwrites the previous, hence at the end of the scan all I have is the last key found.

In my case, that's fine, because I am generating the DTMF tones real time as the keys are pressed. If you just tap a key, you get just a short burst, if you hold a key down, the tone

continues until you let the key go. To me I see this as an advantage, as it allows me to implement long and short press functions at the receiving end of the DTMF system. This is traditionally how the dedicated DTMF chips have worked, so why confuse users by making it work differently.

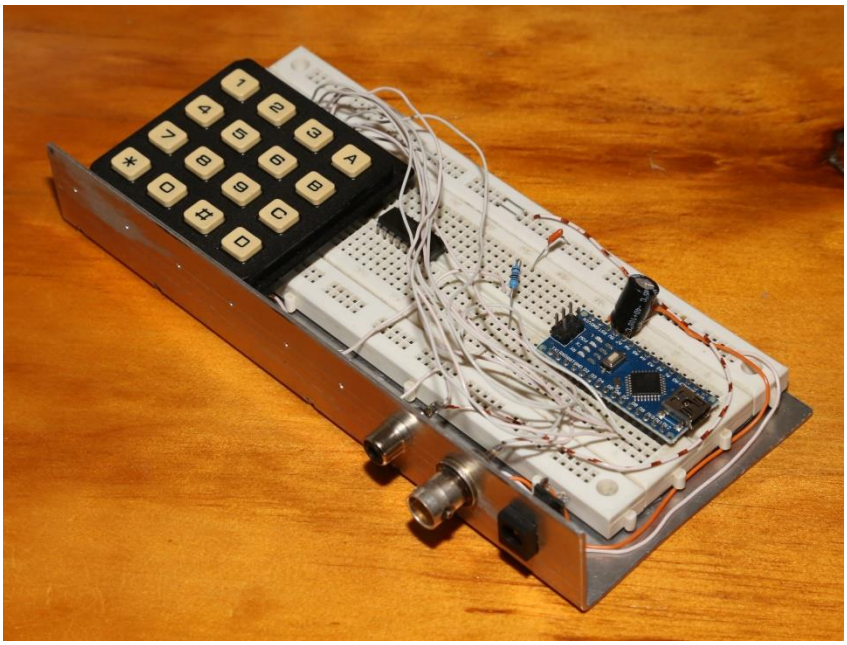
I have a few 'high tech' DTMF mic's that store rapidly struck key sequences, that then go to air at a fixed symbol rate – I find it a pain to use, they all sit in my junk box disused.

You may be wondering why I only have one scan row pin set as an output at a time, well that is do avoid damage to the Arduino, should two button's down at the same time effectively connect two scan rows together, in that case the low row pin would be shorted to a row pin set high. If only one pin is set to be an output at a time, no shorts are possible.

You may also be wondering why I have assigned a simple number to each key, rather than set the 'keypad' variable to the actual character that is on the key, i.e. " keypad='D'; // it is a 'D' " well the output from the scan routine is fed into a lookup table to determine the two tones necessary for that button, trying to index into an array with the actual characters is more complex, so why make my job harder. If the output was to go out a serial port as text, for example, then I would probably assign them their ASCII codes.

If you are scanning a full keyboard, then you'd probably also be better off also using key scan codes as I did for this simple keypad, because some keys don't directly generate a character, keys like the 'shift' 'Ctrl', 'alt', 'Caps lock' have to be scanned for, but they don't directly generate anything. In a simple case you could have two, or three 'keypad' type variable's, one to hold the actual 'alpha' keys, the others to capture the various 'shift' states, then use a lookup table to convert to ASCII.

In full blown keyboards, they implement what is known as 'n-key rollover' Any half decent high speed typist will start pressing the next key as they are, or about to release the previous key, your code has to allow for that, my DTMF scan routine would fail miserable in that scenario, However as keypads are generally 'typed' on with a single finger, it's usually not a problem.



To make working with proto boards easier, try mounting them on a small chassis, like this one, as it gives you somewhere to mount power sockets, and test lead connectors etc.

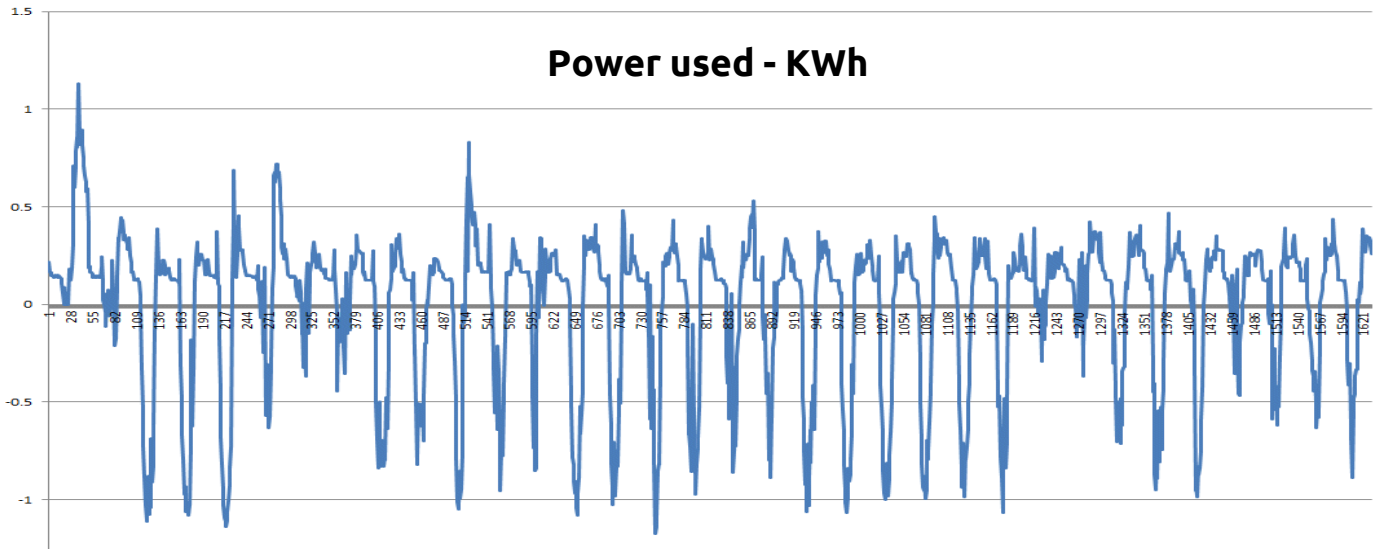
If you've ever tried to attach a BNC patch lead to your creation without having to continually hold it, lest it pull out some patch leads and fall away, now disconnected, You'll know the problem I'm talking about.

As you can also see, a row of centre punched marks ready to be drilled to accept the 'next' socket type required for my next creation.

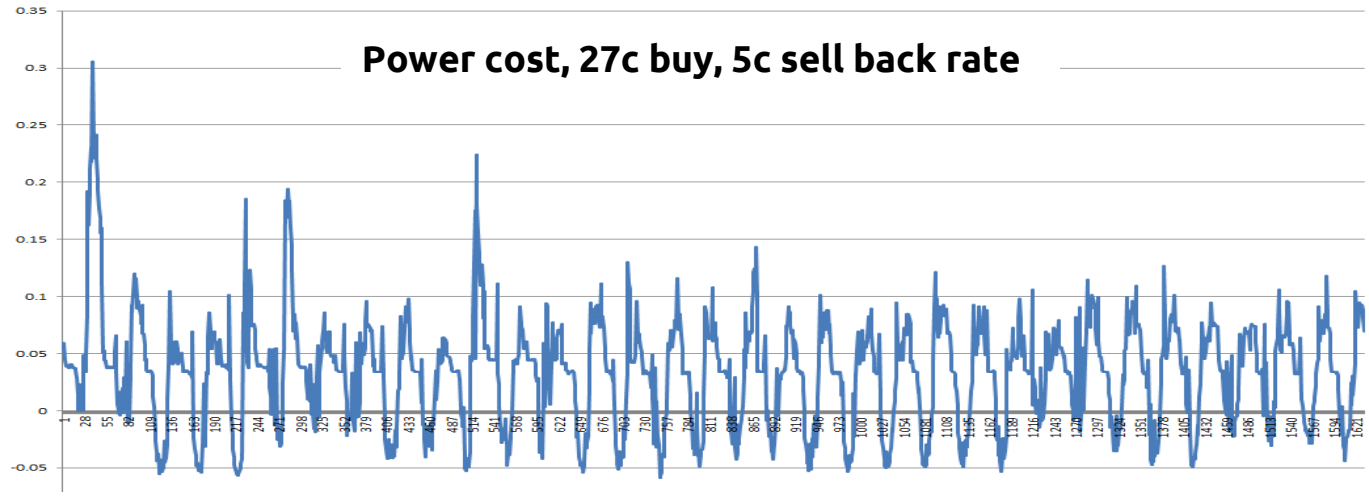
Going Solar pt. 2

An update on my Solar install, apart from a Barney with AGL, because the decided to redo their website with a dumbed down usage page, that was almost useless to me, not bad.

It looks like I may have been over optimistic in receiving a decent discount though.

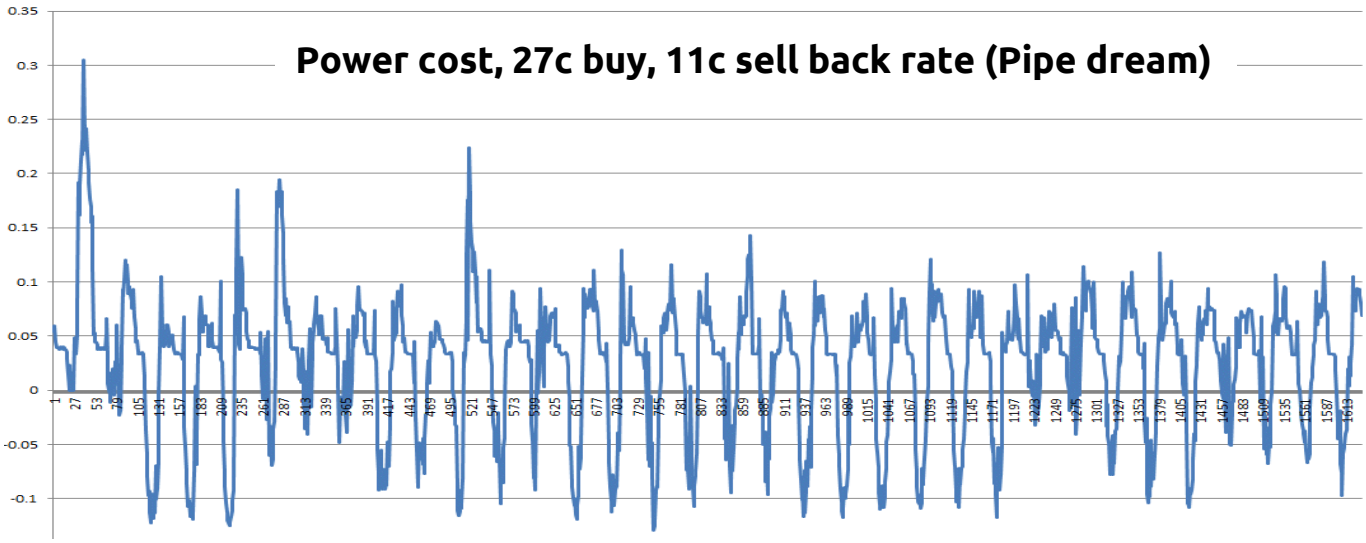


This is a graph of my power usage, negative being power returned to the grid. The first big usage blip is the day before it all kicked in. We drew 249.013KWh, and returned 258.467 KWh to the grid, in this sample period, so we are ahead in that way,



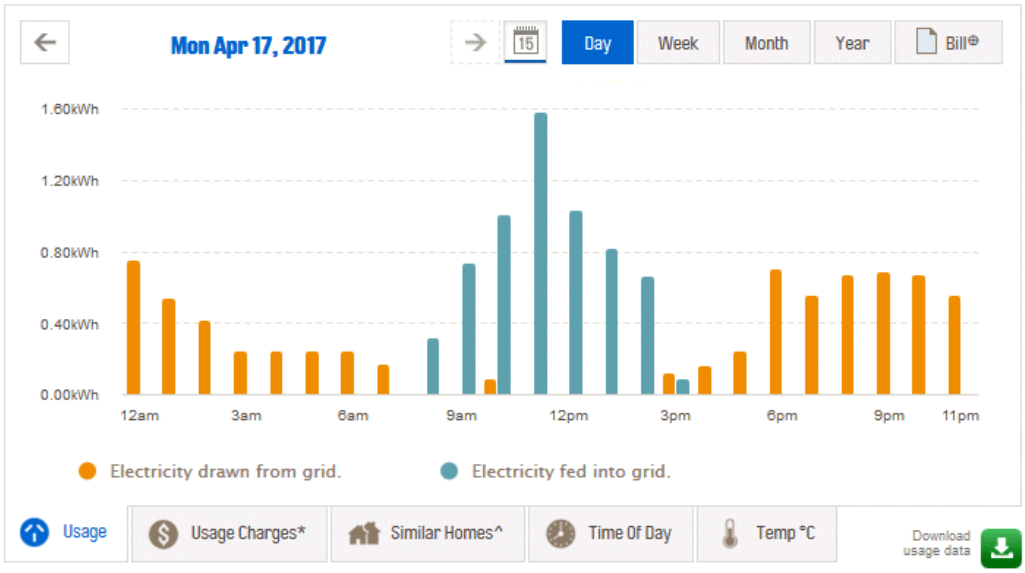
But as you can see here, with the great buy/sell price difference, we are still behind.

We bought $67.23 of electricity from the grid (assuming 27c/KWh), and earned $12.92 back. Meaning we owe them about $54 (plus their other customary charges) for the month.

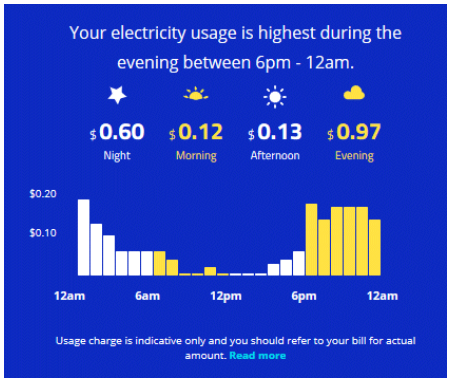


Even if they upped the price to that 11c feed-in rate that is probably just a dream, we are still behind by $29.06. So, getting back to reality our options are probably to try to make the most of the solar power during the day, and use less grid power at night.

Now if someone could explain the financials of a battery system, because at approximately $54 a month, it's going to take a very long time to pay off $10,000 – about 15 years, nah I'm definitely doing something wrong with the calculator, a financial wiz I am not.



Here is one of the graphs from the 'old' AGL website graphs showing power going both ways, and with the download button, that has now been buried out of sight. I eventually found it. No thanks to AGL help line staff, who's only suggestion was to 'reset' my account – Guess what, it didn't help



Part of the 'New' AGL usage page, no download button & no Solar info, as present in the now buried page.

Paul VK3TGX

Deep Space Communications

Inspired after a visit to the Canberra Deep Space Communication Complex at Tidbinbilla, ACT.

Ground Based Facilities

The Canberra facility has 4 primary dishes, 3x 34 metre and a 70 metre. There are also some smaller training, decommissioned and support dishes on site. Each can transmit and receive telemetry and data from distant spacecraft as well as perform some radio astronomy tasks. There are two other similar sites approximately equi-distant around the Earth in Madrid and Goldstone USA as part of the integrated network. NASA/ JPL handles the scheduling and control of this installation and pays the $20m per year to run. The 70m dish here is the largest steerable parabolic antenna in the Southern Hemisphere and is just 6m larger than the Parkes Dish.

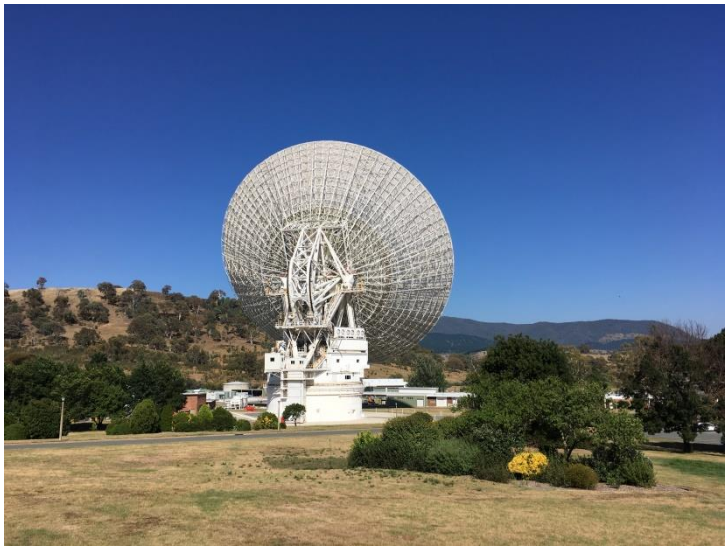


Image : Author – 70m Dish, DSS43

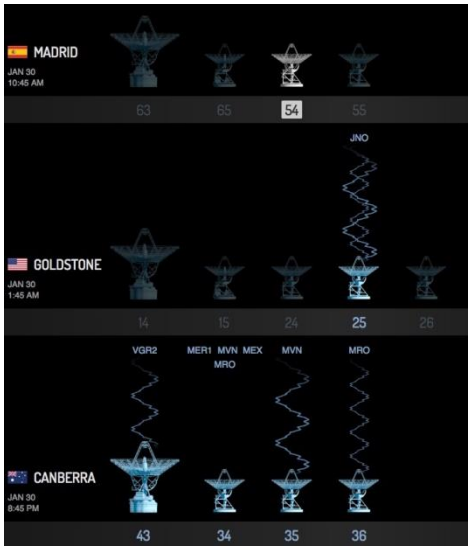
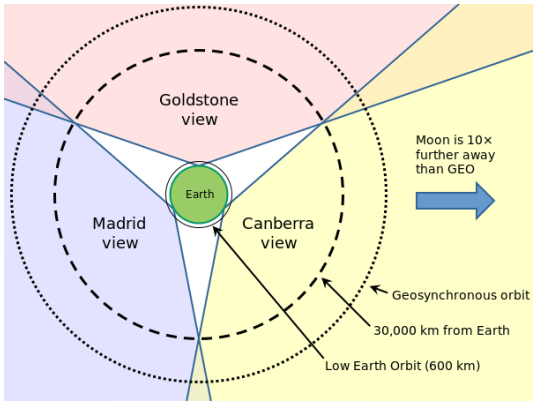


Image: www.eyes.nasa.gov/dsn/dsn.html

The system employed by the deep space network uses frequencies of 7.20 GHz Up-link (Send instructions) and 8.45 GHz downlink. The Power transmitted can be scaled up to 20kW (set so it does not overload distant receiver) and has a receive sensitivity of better than 4.5 x 10^{-22}kW (-153 dBm). When I observed it communicating with Voyager 2 at 17.08 billion km.



Network Reach

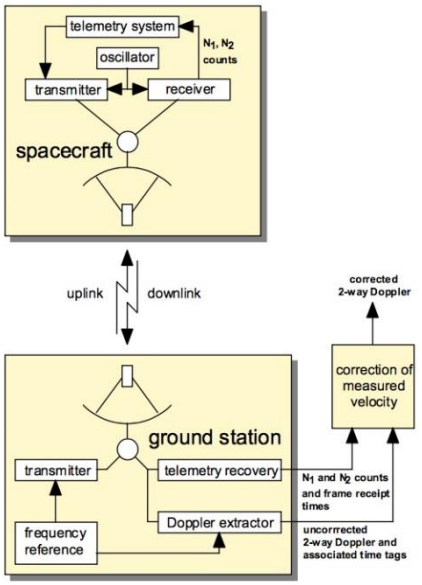
The deep space network itself will turn 50 years old next year as it was originally built for the Apollo program. Parkes is technically part of the network and can be added (or arrayed) at any time if needed; however it is a listening only dish (no transmitter). It should also be highlighted that Canberra seems to be the busiest and most crucial of the 3 sites as it is the only transceiver able to communicate with probes deep in the Southern Hemisphere (i.e. Voyager 2)

System Funding Issues

In January 2016, the NASA Cassini spacecraft was climbing from an orbit around Saturn's equator to a polar orbit, which would allow the spacecraft to cap its 13-year exploration. The mission, was to end with the craft running through the rings to perform a final dive into the atmosphere. The system was not able to communicate at a critical time, known later, as the 'The Cassini incident'. This was one of several recent glitches in the Deep Space Network. On 30 September 2016 at NASA headquarters officials briefed the scientists on the network's status. Many are still worried that budget cuts and age of the network will endanger the complex maneuvers that Cassini and Juno, a spacecraft now at Jupiter, will require over the next few years.

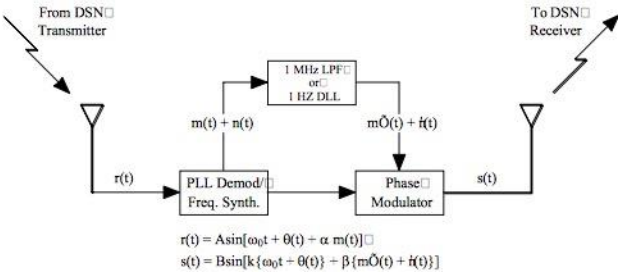
Navigation Support

The Deep Space Network is starting to use millisecond pulsars (better than 100nS period) for timing as the GPS network has potential issues of selective availability and a variable accuracy of up to 10nS. This is used for the best Time of Arrival (toa) and frequency accuracy that is needed for Doppler distance and velocity ranging (better than 0.1mm/s), as with the vast distances involved, slight errors will be greatly compounded.



Non-coherent Doppler Tracking

DLL = Delayed locked loop from Receiver



Regenerative Ranging

The system is based on a comparison of the spacecraft frequency reference with the uplink frequency received by the spacecraft. This comparison information is included in downlink telemetry. The ground stations measure the downlink Doppler to provide range information and can determine corrections that may need to be done to suit the Ultrastable Oscillator frequency (can be caused by varying spacecraft spin rates – see later on). Its also worth noting that the delay from transmit to receive can be over 9 hours and multiple sites are needed with earth rotation.

International Systems

The CCSDS (Consultative Committee for Space Data Systems) was established in 1982 to standardise practice between other space agencies to ensure their systems do not interfere with each other. This has been picked up by most agencies (Italian, Canadian, France, Japan, India, Russia) that have their own space tracking and communication networks. This has also created a foundation where standards in protocols and transmission types could allow inter-agency cross support.

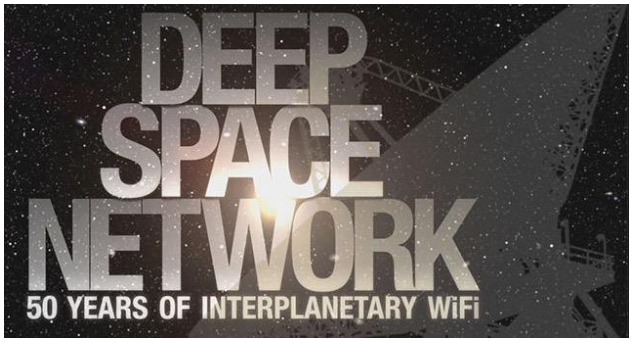
Did you know?

The first pictures from the Apollo moon landing actually came from Honeysuckle Creek tracking station in ACT (which has now merged into Tidbinbilla) and not Parkes.

Could the movie 'The Dish' been fundamentally wrong? [answer: yes]

Did Man even go to the moon? [answer: yes]

They certainly make that point known when visiting!



Space Based Equipment

Spaced based probes can have a great proportion of its weight and power requirements consumed in communication & power systems. These include backup and safe mode's as a probe in space with no telemetry is just a waste of time and money! Weight is also expensive to launch so any system needs to be as light and electrically efficient as possible.

Some probes not venturing too far from the sun use solar power (like Juno which I have focussed on), others like Voyager use Plutonium based Radioisotope Thermoelectric Generators that now (in 2016) generate about 250W of 30V electricity, steadily decline about 5% every 5 years. New Horizons that recently visited Pluto (plutonium powered) had just 255W available at launch. The Solar powered Juno on the other hand has solar cells that (when at earth distance from the sun) generate 14kW of energy while now at its Jupiter destination generates just 400W!

Juno's radio communication subsystems have been designed to use a maximum of 70W of power in the x-band and 116W in the X/Ka bands. Systems also need to operate in a vacuum, survive up to 25 krads of radiation and the magnetic field effects from Jupiter as well as endure close to absolute zero temperatures. To solve this a lot of this equipment is enclosed in a 200kg heated radiation vault that also helps to shield RF from the sensitive science experiment modules. Most other probes have a similar arrangement and share many proven designs. Juno's radio gear is an extension of systems already used in the previous Cassini mission.

The diagram below shows the radio block diagram as well as the radiation vault.

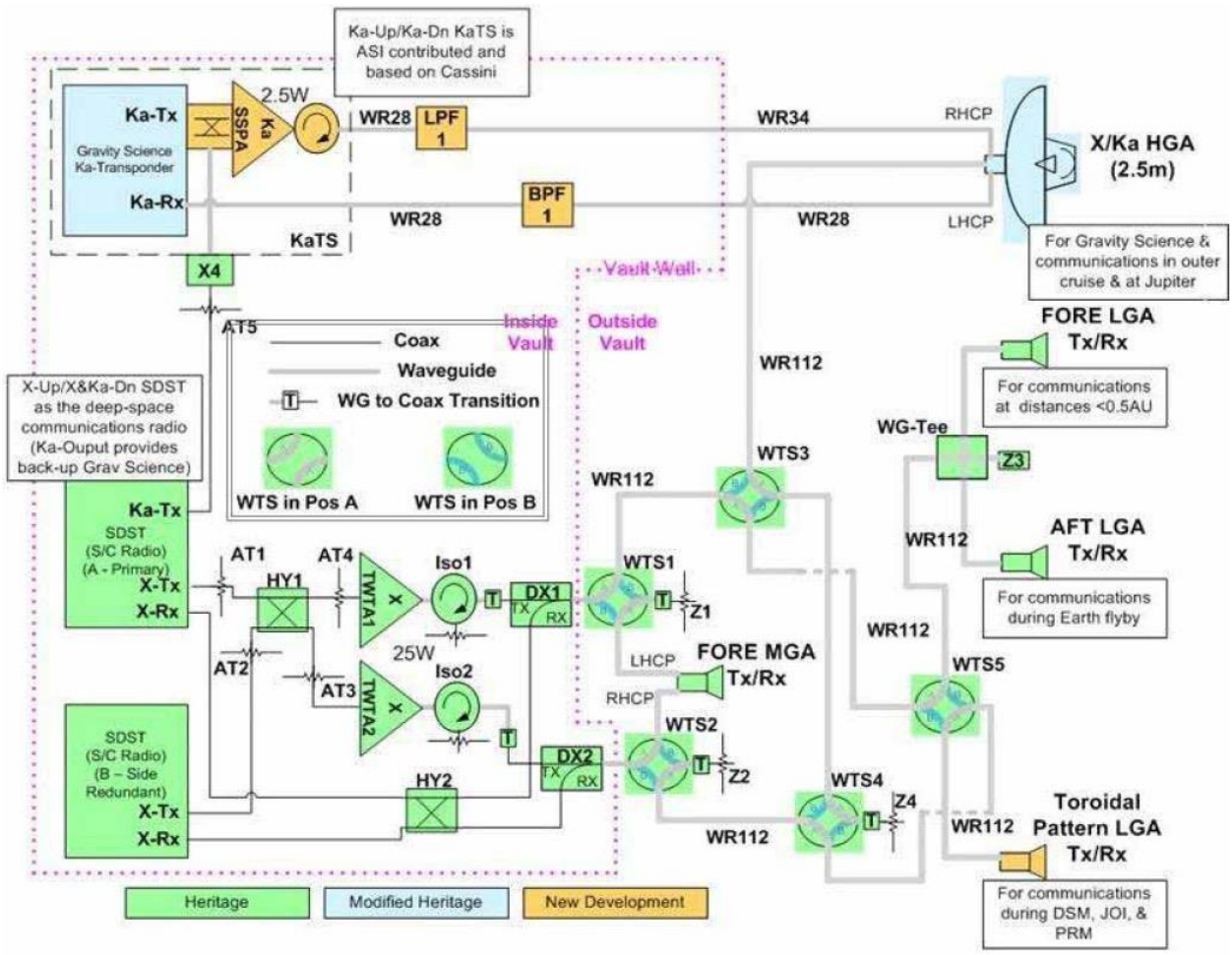
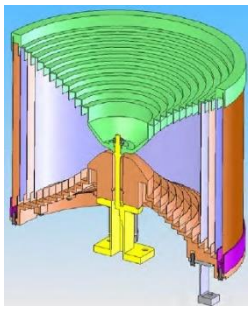


Diagram : JPL / NASA

Juno includes special communication hardware to allow the spacecraft to pick up a ground Ka-band signal, which is then processed by a special communication box called KaTS. This new signal is sent back the ground station on X-band radio. This allows the velocity of the spacecraft over time to be determined with a level of precision that allows the measurement of the gravity field of Jupiter.

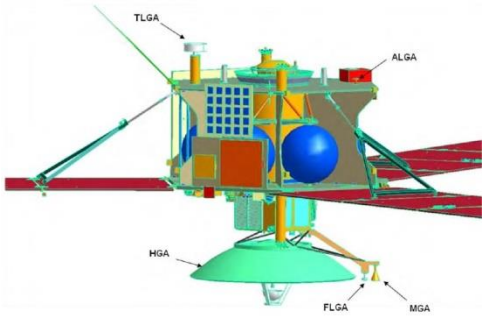
There are five antennas on Juno;

HGA: high-gain antenna *(Picture side on antenna array diagram)*
X Band : Right hand - Circular Polarized. Beamwidth +/- 0.25 deg RX/TX, 44dB Gain
Ka Band : Right hand - Circular Polarized (Down), Left Hand (Uplink). Beamwidth +/- 0.25 deg RX/TX, 47dB Gain
Weight : 23kg

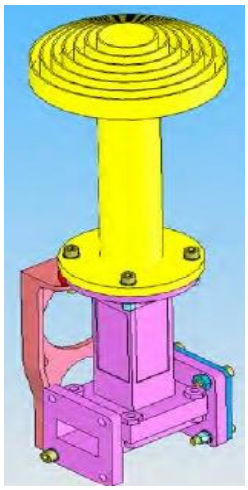


TLGA: Toroidal low-gain antenna
Right hand - Circular Polarized.
Beamwidth +/- 10 deg RX/TX, 6dB Gain.
Weight : 1.9kg

Used for some special events when HGA not pointing towards Earth.

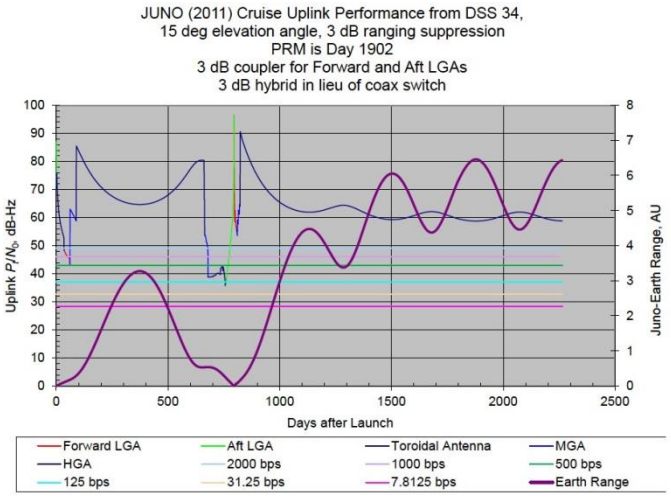


Juno Space Craft Antenna Array

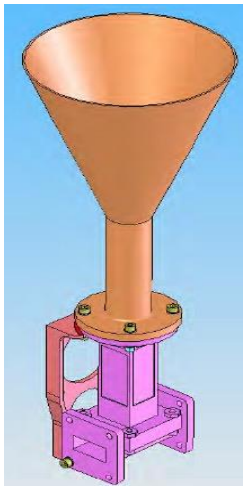


FLGA: Forward low-gain antenna & ALGA: Aft low-gain antenna
Right hand - Circular Polarized.
Beamwidth (3dB) +/- 40 deg RX/TX, 8dB Gain
Weight : 0.5kg

Chocked Horn Design.
Used Close to Earth and for backup MFSK Status Tones when spacecraft main High Gain Antenna not pointing Earthwood.



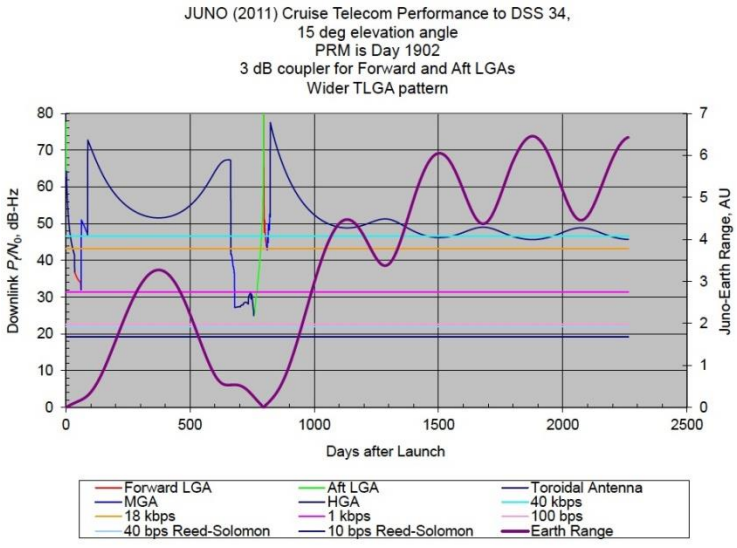
Uplink Performance Prediction



MGA: Medium-gain antenna
Right & Left hand - Circular Polarized.
Beamwidth (3dB) +/- 10 deg RX/TX, 18dB Gain
Weight : 0.5kg

RF Conical Horn Design.

Same design as on Mars Rovers.
Used for Safe Mode.



Downlink Performance Prediction

As you can see on the charts beside there is a need for all these antennas in the mission with forward predictions of all maneuvers and earth distances calculated.

All telemetry is digital. Horizontal lines on graphs are various data rates expected from 40kbps to 10 bps.

Ultrastable Oscillator

Most ground based microwave systems use GPS signals as a locked oscillator reference, but these signals are not available in deep space. In space they use a 30MHz ultrastable oscillator (USO) with an aging rate of better than $1x10^{-11}$ per day MHz per day and for best stability the 5MHz oscillator is in a temperature controlled enclosure. The 30MHz signal has the correction 100kHz added (includes correction from the Doppler calculations calculated before) to produce a 30.1 MHz carrier tracking reference.

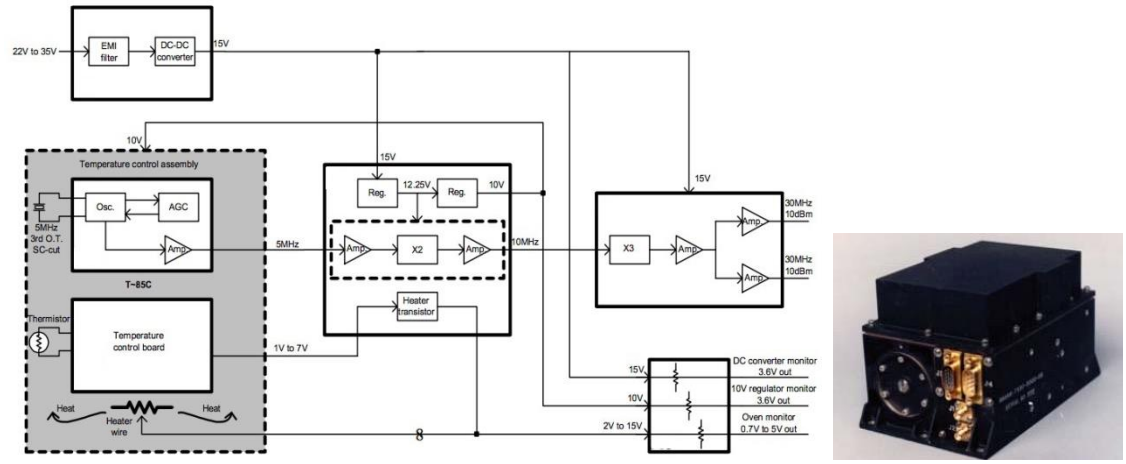


Diagram : USO block diagram and component picture

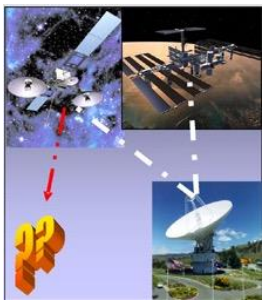
Communication Time & Distance

Radio travels at the speed of light, so with spacecraft like 'New Horizons' at Pluto distance, the signals take 4.5 hours to travel each way. This makes standard data correction (i.e. CRC data corrections) algorithms not viable, so new protocols and data redundancy were needed. This also includes data compression to minimize bandwidth. A lot of this technology has found its way into Public domain. An example is JPEG are too complex, images are sent using ICER format, which has a 10:1 compression ratio and is more robust.

Due to the inverse-square law in radio communications, the digital data rate (all signals are digital as no one volunteered to ride along) used in the downlinks from the crafts reduces as the distance increases. Voyager for example had a data rate from Jupiter at 115kbs. That was halved at the distance of Saturn, and it has gone down to about 300bps at the moment (best rate given the dB Signal). In 1985 the diameter of the DSN three largest dishes was increased from 64 m to 70 m, dramatically increasing their areas for gathering these weak microwave signals as these probes get further away.

Protocols

Well that's a secret! With the dollars at stake and the possibility of malicious attack it is on a need to know basis. I did see it asked on a forum and here was the reply.



'Reliable communication between ground and spacecraft is central to mission success, especially in the realms of digital communication (data and command links). Seen in the light of recent events, these communication links are vulnerable to malicious intrusion. If terrorists or hackers illegally listen to, or worse, modify communication content, disaster can occur. The consequences of a nuclear powered spacecraft under control of a hacker or terrorist could be devastating. Therefore, all communications to and between spacecraft must be extremely secure *and* reliable.' – JPL Forum

Inter-craft Beaconing

Spacecraft can use a CW tone to communicate with other craft in the network, once communications are established 16 CW tones (like DTMF) are sent between the compatible spacecraft. These simple tones will be added to all other receiving crafts downlink status to let ground control know that all is ok (or not) on the other craft in range.

Autonomous

The spacecraft do not have constant communications; there are a lot more spacecraft than dishes available. Science data & commands are stored in the CPU memory and only updated and read when scheduled. This means good planning and up-time is needed across the Deep Space Network. Other nations have a similar network (Russia, India, & Japan for examples) and there have been instances when facility sharing has been requested at critical times.

More Information

There is plenty of information on the Internet and at the 'Canberra Space Centre' visitor building.

73's for now.

de David Rolfe VK3JL

References: *NASA, Juno Telecommunications – Design and Performance Summary, Article 16, 2012*
http://www.cdscc.nasa.gov
https://www.nasa.gov/mission_pages/juno/
https://www.nasa.gov/mission_pages/voyager/index.html

General Meeting Minutes

Date :	17th March 2017
Start time :	20:10
Location :	Guide hall
Chairperson :	Ian Jackson vk3buf
Minute Taker :	Michael Van den Acker vk3ghm
Present :	As per attendance sheet
Apologies :	As per attendance sheet.
Visitors:	Nick
New Callsigns :	Nil
Correspondence received :	ACMA emails and info about WIA elections. Other club magazines.
Correspondence sent :	Other club magazines sent to members.
Treasurer's report :	As tabled **Moved :** Graeme 3bxg **Seconded :** Lee 3gk **Carried :** Yes
Previous Minutes :	As per Gateway magazine **Moved :** Michael 3ghm **Seconded :** 3flex **Carried :** Yes
Business arising from previous minutes :	Antennapalooza going well. Item in magazine more info to be distributed closer to the date. Move of 3rwd to the new site progressing well. Should be Installed this coming weekend. Hamfest progressing. Bookings happening and Dianne taking care of this. Arduino nights progressing - next session on Tuesday night. Anniversary dinner Dianne and Bruno working together on This. More info will be distributed as soon as known. Numbers are required.
New business :	Albert has been repeater officer for some time and will be standing down from this position. April talk by Chris Hart using CNC machines with dental work. GGREC annual general meeting to start at 20:00 hrs then the talk. Working Bee coming up on April 22. Members will be notified about what we will be doing and when.
Meeting closed :	20:32
Next Committee Meeting :	2nd Tuesday of the month
Next Prac Night :	1st Friday of the month
Next General Meeting :	3rd Friday of the month

Club Information

Meetings 2000hrs on third Friday of the month at the
Cranbourne Guide Grant Street Cranbourne
Prac nights first Friday in the Peter Pavey Clubrooms Cranbourne 1930hrs
Visitors are always welcome to attend

Office bearers

President	Ian Jackson	VK3BUF	Web Master	Mark Clohesy	VK3PKT
Admin Sec	Michael Van DenAcker	VK3GHM	Magazine Editor	Paul Stubbs	VK3TGX
Treasurer	Graeme Brown	VK3BXG	Property Officer	Bruno Tonizzo	VK3BFT
General 1	Rob Streater	VK3BRS	Secretary	Ian Jackson	VK3BUF
General 2	Max Hill	VK3TMK			

Call in Frequencies, Beacons and Repeaters

The Club Station VK3BJA operates from the Cranbourne Clubrooms.
6m Repeater VK3RDD – Currently de-commissioned until further notice - *sorry*
70cm Repeater Cranbourne VK3RLP In 434.475MHz Out 439.475MHz CTCSS 91.5Hz
VK3RLP Repeater supports Remote Internet access (IRLP), Node 6794.
70cm Repeater Drouin VK3RWD In 433.575MHz Out 438.575Mhz CTCSS 91.5Hz
Simplex VHF - 145.450MHz FM • Simplex UHF - 438.850MHz FM
VK3RLP Beacons 1296.532MHz & 2403.532MHz

Membership Fee Schedule

Pension Member rate $25.00 Extra Family Member $20.00
Standard Member rate $40.00 Junior Member rate$25.00
Fees can be paid by EFT to BSB 633000 - Account 146016746.
• Always identify your EFT payments.
• Membership Fee's Are Due at each April Annual General Meeting.

Magazine Articles to editor@ggrec.org.au or vk3tgx@gmail.com Cut off, 10th
All other Club correspondence to: secretary@ggrec.org.au
or via Snail Mail : GGREC, C/O Ian Jackson, 408 Old Sale Rd, Drouin West 3818
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