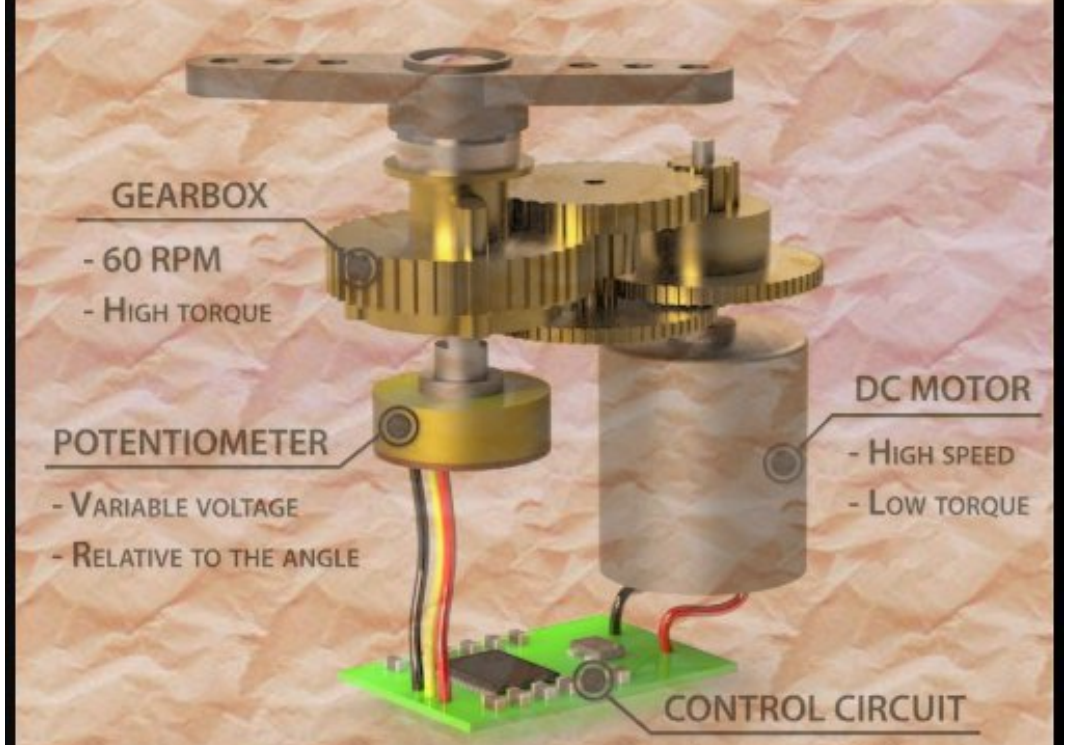
CQ-DATV

dotMOBI

Issue 89



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In this issue

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Jim, KH6HTV *Trevor Brown G8CJS*

The CQ-DATV editors gratefully acknowledge all those authors that have contributed articles for this free magazine.

Editorial

Welcome to CQ-DATV 89

Its been a strange kind of a month even the stories are getting weird.

A Welsh Village where the internet disappears at 7am every day and a major company's solution is to spend 18 months replacing cable runs, before somebody who could presumably use a spectrum analyser turned up. I will say no more - we have the full story and we would all like to see the TV set - was it a rogue switch-mode PSU or something even older. It would have made a good Halloween story.

Ken W6HHC has been adding to his DX records if you have been missed you know who to contact.

Trevor has released the GVG 16 software. It's a large file including a very short video of the GVG controlling a PTZ and the T-Bar, both are part of GVG16 (see Trevor in his Halloween mask - ed).

The diagrams for the panel from which Trevor worked out how the panel was controlled and how to add Vmix and PTZ are included in the download, along with the code he is now using. That may have already changed, but the words GVG 17 have not been heard in the editorial corridors of power - yet !!

I said a strange month, well we all know from the news its all happening in America, from Presidential elections to forest fires, Jim KH6HTV has actually captured pictures on the local ATV repeater from it's on site camera. (The fire not the President) I hope that's a long lens Jim, we have already lost one ATV repeater to fire.

Trevor in his column goes on to explain how the PTZ or should I say PT (Pan and Tilt) camera head is controlled. It's part of the I2C control and is connected to some of the as yet unassigned GVG controls. The PTZ addition has switched provision for four of the PTZ heads. The original mixer never had camera control. There is a short demo video's on our Facebook group.

Jim KH6HTV has been looking at the ARRL 10GHz & up contest, which has shown significant differences in propagation characteristics between 10GHz, single side-band (SSB) voice and digital amateur television (DATV) and in particular DVB-T. Jim investigates, starting with the usual suspect….. bandwidth.

One from the Vault, winds the clock back to the summer of 69 (is that where the song title came from). Neil Armstrong and Buzz Aldrin landed on the moon! Perhaps those of us that are old enough can remember where they were when we heard the immortal words "The Eagle has landed". It was watched by an estimated TV audience of over 600 million viewers. What you may not know is the TV pictures from the moon were 320 line, 10 frames per second, relayed back to earth via a 500KHz bandwidth link.

I will not spoil it for you, Trevor has the full story in this issue. What is not clear is how many cameras were on board Apollo 11 and where the camera switching took place. That's another story and the footage is on YouTube, unlike the 320 line 10 frames per second pictures which have disappeared leaving only the awful standard converted images, that really disappointed the camera designer.

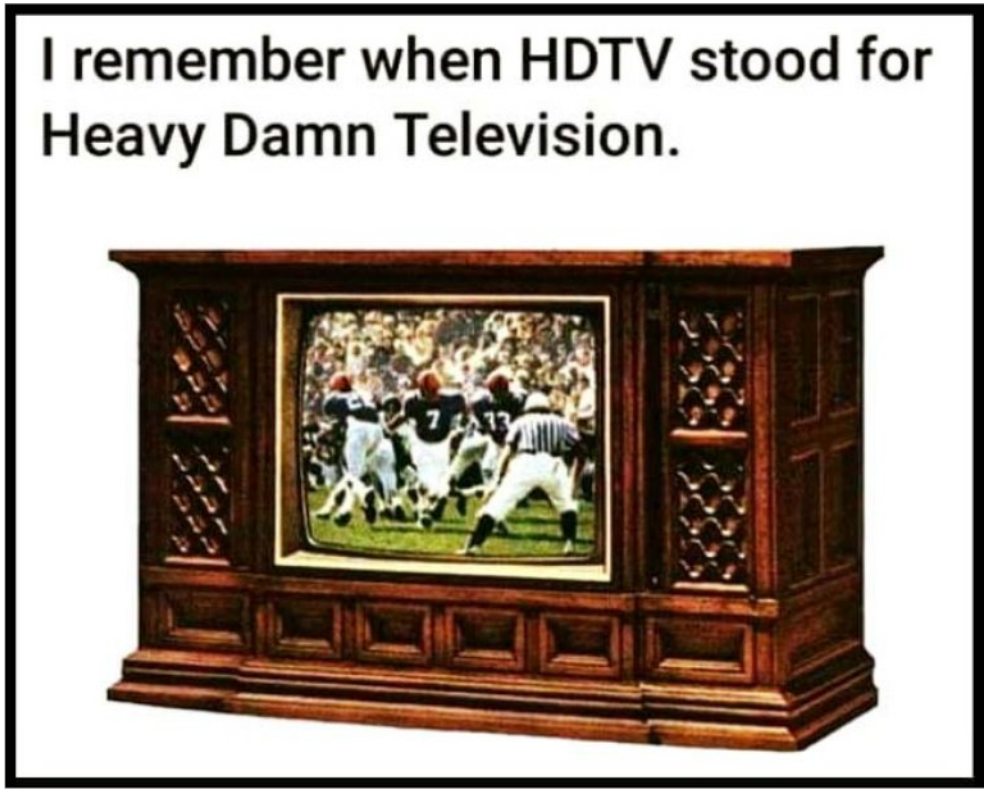
The lockdown has perhaps provided a little more than usual shack time, to put it lightly and the team has been using it to catch up on one or two background tasks. The Facebook group has had its "About" section revised, so you get a chance to meet the CQ-DATV team, well a little as there is a strict word limit.

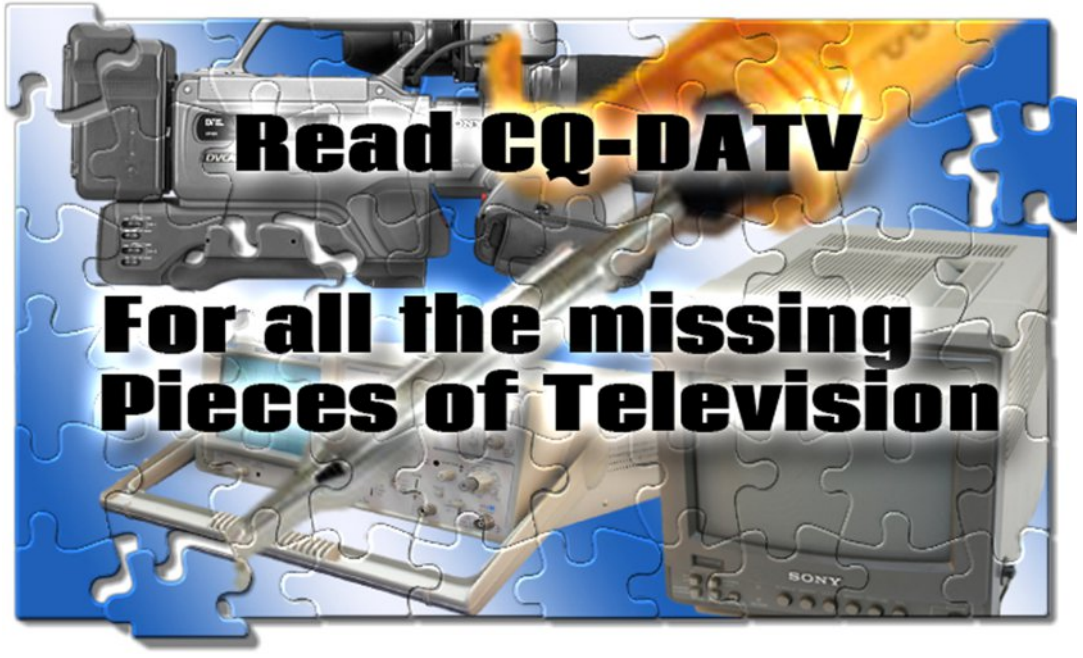
We have had a lot of new members from around the world. Sorry again if you are asked questions before you are let in, one of our team will look at your Facebook before we make a decision, the questions are a small part. The problem was some people with no interest in ATV or Video and were often members of some very strange groups. We have no idea what their end game was, they are not being approved. If you have fallen foul of this positive vetting please let the team know and apologies in advance.

We are also planning a Christmas CQ-DATV, so far its just a front cover, but we are on the lookout for anything seasonal, from circuits to pictures or just reminiscences of previous Christmas's when the word COVID 19 was something we had never heard of! I think our readers are not alone when we say we never want to hear the word again.

Please sit back and enjoy CQ-DATV 89 and then look back do you have any memories of Christmas Past or even ideas of Christmas Future to share (not the Ghosts we lost them when television went digital)

CQ-DATV Production Team





Mysterious 18-month broadband outage for entire village caused by an old TV

The village of Aberhosan. Pic: Google

The mysterious cause of an entire rural Welsh village's broadband being knocked out at 7am each morning has finally been uncovered - an old television set.

Frequent tests consistently showed that Aberhosan's network itself was working fine but even after local engineers replaced large sections of cable, the problems continued.

After 18 months of fruitless investigation, Openreach's Chief Engineer team - "the telecoms equivalent of the SAS" according to the company - were dispatched to the Powys village to look into the outages.

They hit their first obstacle when discovering there was no room for them to stay in Aberhosan itself.

"Accommodation was understandably hard to find due to the COVID-19 lockdown but we did eventually manage to find a guest house with a field near Llandrindod Wells," Openreach engineer Michael Jones said.

Based there, the team made the 55-mile journey early in the morning and "walked up and down the village in the torrential rain at 6am to see if we could find an 'electrical noise' to support our theory," Mr Jones explained.

The theory was that the fault was being caused by a phenomenon known as SHINE (Single High Impulse Noise Event), with electrical interference emitted by a local appliance affecting broadband connectivity.

A SHINE is a powerful radio wave emitted at the same frequency range as that of the broadband service, which effectively scrambles the signal in a similar manner to military-grade radio jammers.

"And at 7am, like clockwork, it happened!" said Mr Jones, who explained that the team's spectrum analyser picked up a large burst of electrical interference in the village.
"The source of the 'electrical noise' was traced to a property in the village," he added.

"It turns out that at 7am every morning the occupant would switch on their old tv which would in-turn knock out broadband for the entire village."

He said the resident was mortified to discover that their old second hand television was the cause of the entire village's broadband problems, and they agreed to switch it off and never use it again.

Source: *https://tinyurl.com/yct2mkh2*

ARLB028 FCC Orders Amateur Access to 3.5 GHz Band to "Sunset"

Despite vigorous and continuing opposition from ARRL and others, the FCC has ordered the "sunsetting" of the 3.3 - 3.5-GHz amateur radio secondary spectrum allocation.

The decision allows current amateur activity on the band to continue, "grandfathering" the amateur operations subject to a later decision. The FCC proposed two deadlines for amateur operations to cease on the band. The first would apply to the 3.4 - 3.5 GHz segment, the second to 3.3 - 3.4 GHz. The FCC will establish the dates once it reviews additional comments.

The Report and Order can be found online in PDF format at, *https://tinyurl.com/yy5zw9u9*

Source: the ARRL weekly e-mail newsletter

Update for Known DATV DX Records

After the update of KNOWN DATV DX on 2020-09-15, I received an e-mail from Dave G4FRE identifying more DATV efforts at DX for 50 MHz, 70 MHz, and 24 GHz. The PDF records sheet on the BATC wiki has been updated with five new DX records of note that I had not seen before.

See *https://tinyurl.com/y449vlml*

• 24 GHz DVB-S2 QSO by G8GTZ and G4FRE on 2019-06-09 138 KM
• 70 MHz DVB-S one-way by G4FRE (remotely controlled) to G4FRE/P on 2018-12-27 230 KM
• 70 MHz DVB-S QSO by G8GTZ and G4FRE on 2018-12-09 160 KM
• 50 MHz DVB-S one-way by G4FRE (remotely controlled) to G4FRE/P on 2018-12-26 228 KM
• 50 MHz DVB-S2 QSO of G4FRE and G8GTZ on 2019-04-06 140 KM
Please send me an e-mail if you know of a DATV QSO that should be added to this list (via W6HHC@ARRL.net)

73…de Ken W6HHC

Final GVG software

The final GVG software file is available from the CQ-DATV download site.
(*https://tinyurl.com/y64qboan*)
It has all the software some extensive notes/short version of the CQ-DATV articles.

The revised BASIC and the original Arduino file, the import file for Vmix and the diagrams from which Trevor figured it all out.

There is also a video clip showing Trevor working the mixer and camera rotator.

Forest Fire In Boulder County!

18th October 2020 - Jim Andrews, KH6HTV reports
Colorado, California and Oregon have been experiencing major forest fires for the past couple of months. We have had heavy smoke here in Boulder on occasions when the wind was right. It finally hit Boulder County yesterday, mid-day. The Cal-Wood Fire broke out in the mountains north-west of the City of Boulder, near the town of Jamestown. The fire moved quite rapidly during Saturday afternoon.
As of writing this (Sunday, 18 Oct, 8am), the fire has already consumed over 7,000 acres of forest, plus an outbreak on the prarie at US-36.

The Boulder ATV repeater, W0BTV, has been broadcasting views of the forest fire. The camera is located at the qth of KH6HTV, south-east of the city of Boulder, and 13-15 miles from the fire.

Using a long tele-photo lens, the KH6HTV TV camera has been able to view the fire along the Front Range as it approached the first ridge of the foothills of the Rocky Mountains. The TV images are being received at the Boulder County ARES (BCARES) command post in the Boulder County Emergency Operations Center (EOC). There they are then being displayed on a large screen video monitor for the EOC staff.

The W0BTV repeater video is being streamed live over the British Amateur TV Club's server in the UK. The URL for our video is: *https://tinyurl.com/y5d7cg5e*. The right audio channel on the BATC stream is carrying the live audio from the BCARES, 2 meter, FM repeater, 146.76 MHz with the emergency net traffic. Fortunately, now at 8:30am, there is nothing to be seen on the TV repeater's video image, as a cold front has just rolled in with light rain and fog. That is great news for helping suppress the fire.

Ofcom making communications work for everyone

Proposed measures to require compliance with international guidelines for limiting exposure to electromagnetic fields (EMF)

05 October 2020 Status: Open End: 16 November 2020
To ensure spectrum continues to be used in a way which is safe for people, in our February 2020 consultation we proposed formally incorporating the limits in the ICNIRP Guidelines for the protection of the general public into spectrum licences and into authorisations of licence-exempt spectrum. This statement sets out our decisions in relation to these proposals.

As a first step in implementing our decisions, we have also published a further consultation inviting stakeholders to provide feedback on the specific drafting changes we have made to the wording of the EMF licence condition and our 'Guidance on EMF Compliance and Enforcement'.
In addition, we are making available a trial version of our EMF calculator that will allow many licensees and other spectrum users to demonstrate their compliance in a straightforward way. We are also inviting feedback on our calculator.

Source: *https://tinyurl.com/srt4kw2*

BECG's ABC / Thames TV OB truck on the move!

Paul Marshall, Chairman of the Broadcast Engineering Conservation Group (BECG) reports that their next project has taken an important step.

ABC/Thames waits for attention to her gear box by specialist repairers

ABC Unit 5 / Thames Unit 2 – GNF 951E- was one of three units ordered by ABC around the time of the 1966 World Cup, then transferred to Thames TV and finally in 'active service' sold to Sony Broadcast for HDTV work. She was subsequently converted to a mobile living van and is now to be restored as the first ever example of an OB truck having a longitudinal layout – sideways arrangement - of all the engineering and production equipment.

Money is now available to start the rebuild, but the biggest problem during the current conditions has been to find people who are willing to start work on the mechanical and exterior restoration.

After much research we have found companies who are willing to undertake the work so the first step is a visit to a commercial vehicle company to have the gearbox attended to because she sometimes jumps out of gear. The gearbox was made by Clark Turner and the problem could be something simple such as the control linkage, or it could be more serious and may require a rebuild, so another specialist company is on standby. After that she will be going to specialist coach builders for the bodywork to be repaired and re-sprayed.

Once all this is done we can start on the TV side of things. She will carry transistorised mid 60s Image Orthicon cameras, late 60s colour cameras and early 80s Sony HD cameras. Vehicle restoration is just the first phase and this project will stretch out over the next few years.

For more information, see: *https://tinyurl.com/y2zy2pxo*

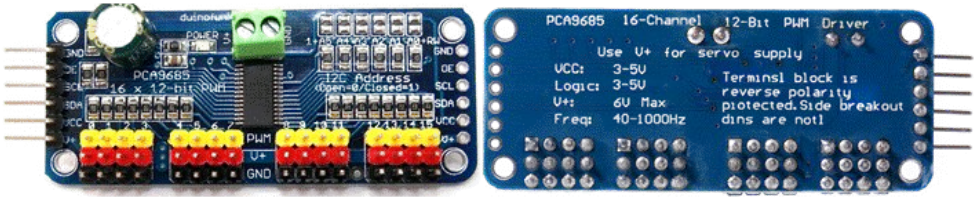
Grass Valley Mixer Conversions - Part 22

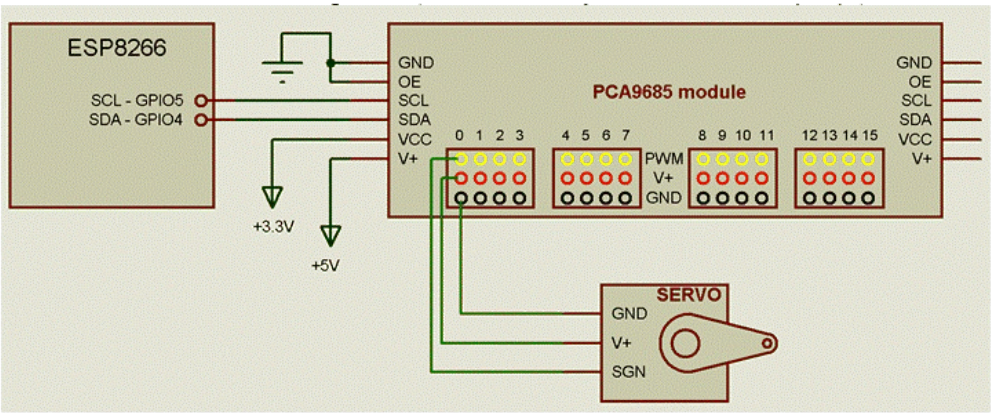
Written by Trevor Brown, G8CJS

At the time of closing of CQ-DATV 88 I said I would investigate using the GVG 100 panel Joystick to drive a pan and tilt head camera.

The PCA9685 module I had intended to use had not arrived at the deadline for the last issue so I could go no further. All I had was two SG90 servo motors and a rather inexpensive bracket which I mounted on a scuba weight. The PCA9685 board did arrive although long past the date promised and only after I complained to eBay of its non-arrival. The module appeared the very next day via first class postage, thanks eBay.

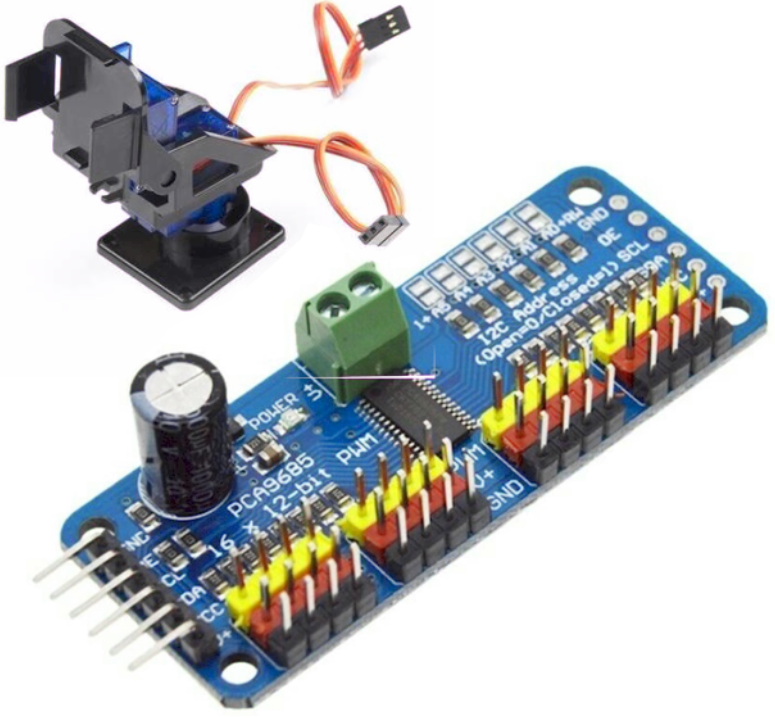
Let's start with a little recap on the PCA 9685 module.





The module has two power inputs Vcc shown as +3.3, this is actually +3.3 to +5. This is the power input to the module. I powered it up via the GVG +5 power supply and ground, extended the SDl SDA (i2c bus) from the GVG panel, grounded the output enable and ran the Annex i2c address scanner software. This revealed a new device at hex address 40 or decimal address 64. There are solder bridges to change this, but as it was an address not in use by any of the other devices on the i2c bus I went with it unchanged.

There is another connection V+, this is the power to the servo motors and again I used +5 from the GVG panel to drive both motors, by joining Vcc and V+ together. Plugged two SG90 servo motors into socket 0 and 1 being careful to get the plugs the correct way around. The PCB connector is colour coded yellow red and black. The SG 90 wires are orange red and brown. The orange end is the data and goes in the yellow end of the connector.



Then I loaded the demo program from the Annex help site.

```
PCA9685.SETUP  &H40, 55
PCA9685.SETFREQ 50
PCA9685.PWM 0, 150
PCA9685.PWM 1, 100

DX = 1
DY = 1
MINX = 100 : MAXX = 500
MINY = 150 : MAXY = 300
X = MINX : Y = MINY

WHILE 1
  PCA9685.PWM 0, Y
  PCA9685.PWM 1, X
  PAUSE 30
  PRINT Y, DY, MAXY
  X = X + DX
  Y = Y + DY
  IF (X  <  MINX) OR (X  >  MAXX) THEN DX = - DX
  IF (Y  <  MINY) OR (Y  >  MAXY) THEN DY = - DY
WEND
END
```

Save and run and the little camera bracket started panning left and right and tilting up and down. The pictures from my webcam mounted on the bracket with cable ties were a little jerky but proved the system I could start looking at the code and how to interface the device to the GVG panel.

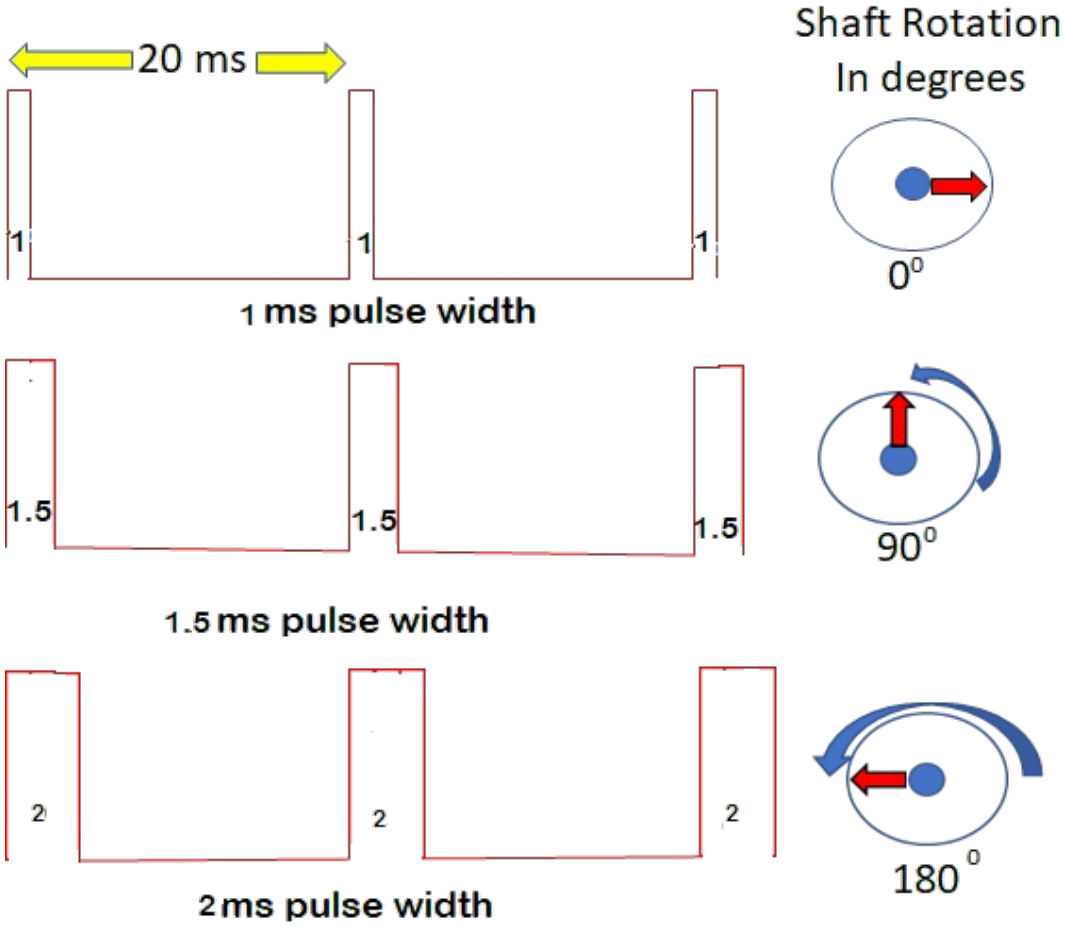
The Annex Demo program was set with the correct i2c address. The first line and the ,55 which is frequency.

It works so I have not tampered with it. I put the top two setup lines of code into the GVG 16 software, set up section and then started to play. You only need one further line of Annex Basic PCA9685.PWM pin, value.

Pin is the socket into which you plug the servo I settled for just the pan motor in Socket 0 and unplugged the tilt motor.

Value is a number between 0 and 512. The SG90 servo responds by changing position within 180° as defined by the number.

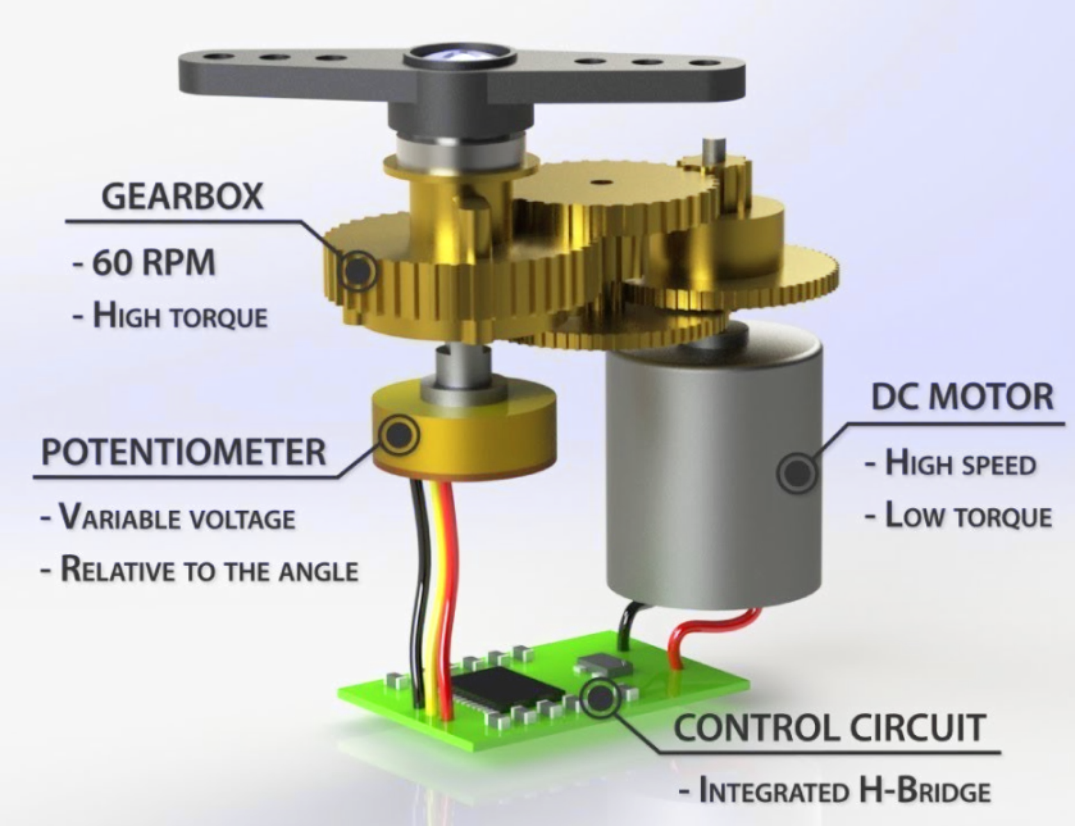
I was a little surprised as I did not expect the PWM to deliver position I just expected it to vary the rotation speed. The SG90 is more intelligent than I expected. Its uses PWM (Pulse Width Modulation.



This is a one-way communication; we just send out pulses and the width of the pulse sets the position of the servo. I have it connected by a short cable, but one way for the data means it can be driven by an impedance transformer (emitter follower) if long cable runs prove traumatic or even simple pulse regenerators inserted into the cable at specific points.

Unexpectedly I have something which delivers phase position as opposed to something that just has speed and direction control.

I had a rethink on using the spring-loaded joystick, which was never going to control a position servo and at best could only deliver 56 steps across the horizontal sweep. Leaving the camera parked, when I released the joystick would also need further thought.



I have other unused pots on the GVG panel, that I could allocate in place of the joystick I decided on Matt Box Chroma and using the old analogue sub routine (GVG 15 software) I scanned its range as delivered by the resident A to D on the GVG panel. It delivers 255 steps as I rotate to pot from end to end, more control than a spring-loaded joystick would deliver.

The pots seem to get the full range of the 8-bit A to D on the panel, (a known pinch point). I suspect the mechanical construction of the Joystick limits this further.

I put a simple program together to use the PCA9685.PWM pin, value, 0 being the socket and value the position of the chroma pot, delivering 0 to 255. Rotating the pot from end to end panned the camera 90°. The variable I used was Chromavalue, (just a variable in the old analogue routine) so I changed it to Chromavalue + Chromavalue and it would now rotate the camera through 180°. The pot is rotating 270° and the camera 180°. The action is smoother than the test program, the web camera has a short focal length, which always helps with camera work. I repeated the exercise for the tilt servo using socket 1 and lumvalue, again derived by putting the declared address of the lum pot into the analogue routine and I had tilt control.

Decision time I decided to stay with the pots to control the webcam, they have more steps than the spring loaded joystick and work better with a device delivering position control rather than speed control which would have meant more software for a lesser result.

I have rewritten the GVG15 software analogue subroutine in GVG16 to a more universal routine. The old routine required one subroutine per analogue device. GVG16 now has one routine called analog, where X equals the device address, (or declared name) call the subroutine and it delivers a value y which is the position of the pot between 0 and 255.

The PCA 9685 module has 16 sockets and they all work I have tested them by plugging the SG90 into each one in turn and changing the pin no in the software to correspond. Returning to the panel hardware, it is time to think how to use the GVG controls to drive the servo camera head to its full advantage.

I have used the push buttons under the OLED display called Normal, Boarder, Drop Shadow, Extrud, Outline. Normal (my panel is a GVG 1000 they may differ on GVG 100 and 110). The normal is the escape key (made sense) the other four can select a bank of three sockets or SD90 connectors so you can switch between four of these Pan and Tilt heads. I have also activated the Hue knob to the control a further SD 90 to control Zoom or Focus should this prove mechanically possible for your chosen camera.

When you select a camera the three pots are active so you can zoom or pan the camera head. When the micro is controlling the head the mixer controls are frozen. I could have put in a routine to periodically scan the other controls, but decided against it, it is easy enough to stop moving a camera and jump back into mixer mode should it prove necessary via the "normal" button.

The PCA module sockets are laid out in banks of four. Each bank could be a camera head, that leaves a spare socket in each bank, but you can link a GVG pot to any of them. The software subroutine is called pan, (never too imaginative with names).

The routine is included in GVG16 software, chromavalue is no more I have implemented the single analogue subroutine called analog and removed the old sub routines. T-Bar works with this new subroutine, so far, it's a win win.

Improvements since GVG 15 are:-

- *Key bank used for keying with Vmix*
- *T-Bar now active via VMIX effect selection*
- *OLED display will show DVE effect and PST source*
- *Four selectable pairs of SG90 servo motor control, (can be three or four per bank if required)*
- *Add this to what we had already in software 15 which was.*
- *Positioner and Reverse start and stop the hard disc recorder.*
- *Fade to Black will do exactly that to Vmix output*
- *The wipe buttons will select the DVE effect (and display on the OLED screen which one)*
- *Auto Trans will perform this operation and the PST and PGM banks will switch to keep sync*
- *Mix and Wipe will toggle the Auto Trans between Mix and DVD effect*
- *Key 9 will animate out any strapline keyed via the Key bank*
- *Cut will switch PST screen to PGM and put the previous PGM source on PST or Preview monitor.*
- *Camera cues for PGM and PST as two 4-bit words on port*

I am happy we have tamed this panel, still got some spare buttons pots and a joystick, along with a micro that for some strange reason is coping with 700 lines of Annex BASIC. If I can think of anything else to add I will and as soon as I am happy with the code, I will get it to the CQ-DATV download site.

PCB's for the hardware I will check with Mike G7GTN where we are.

Sub routine to control the camera :-

```
pan:
if (u and 2)    <>   0 then let xx = 0
if (u and 64)   <>   0 then let xx = 4       'shadow "
If (u and 16)   <>   0 then let xx = 8       'extrude "
if (u and 4)    <>   0 then let xx = 12      'outline "

do
let x=lum
gosub analog
PCA9685.PWM xx, y        'tilt routine

let x=chroma
gosub analog
PCA9685.PWM xx+1, 500 -y-y  'pan

let x=hue
gosub analog
PCA9685.PWM xx+2,y  'pan

i2c.begin PRT3                ' Address port
   i2c.write 5               ' Scan buttons BS2 low
   i2c.end

   i2c.begin PRT4            ' Control port
   i2c.write 255             ' needed to work
   i2c.end

   i2c.begin PRT1            ' Control port
   i2c.write buttons         ' Scan buttons
   i2c.end

   i2c.reqfrom PRT4,1
   e = i2c.read
   i2c.end
```

```
IF  e = 254 then return
Loop
```

The new pan subroutine will deliver control of up to four pan and tilt heads and include focus or zoom if you can figure out how to mechanically interface a third SG 90 to any your cameras.

To be continued in CQ-DATV 90……

This is your free ATV magazine.
Please consider contributing an article!

Comparisons of Microwave SSB vs DATV

Written by Jim Andrews, KH6HTV

Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER October, 2020

Recent experiences in the ARRL 10 GHz & Up contest have shown significant differences in propagation characteristics between 10GHz, single side-band (SSB) voice and digital amateur television (DATV) and in particular DVB-T. So what are the major differences and how do these impact our ability to make contacts ?

Bandwidth:

This is the biggest difference. SSB uses only 3 kHz of bandwidth. Conventional, live, TV uses 6 MHz of bandwidth. Even the more recent experiments with compressed video, etc. have pushed down the bandwidth requirements but they still require several 100s of kHz or 1 or 2 MHz of bandwidth. Bandwidth mainly impacts the weakest signal that can be detected. There is a fundamental noise floor set by the equation.

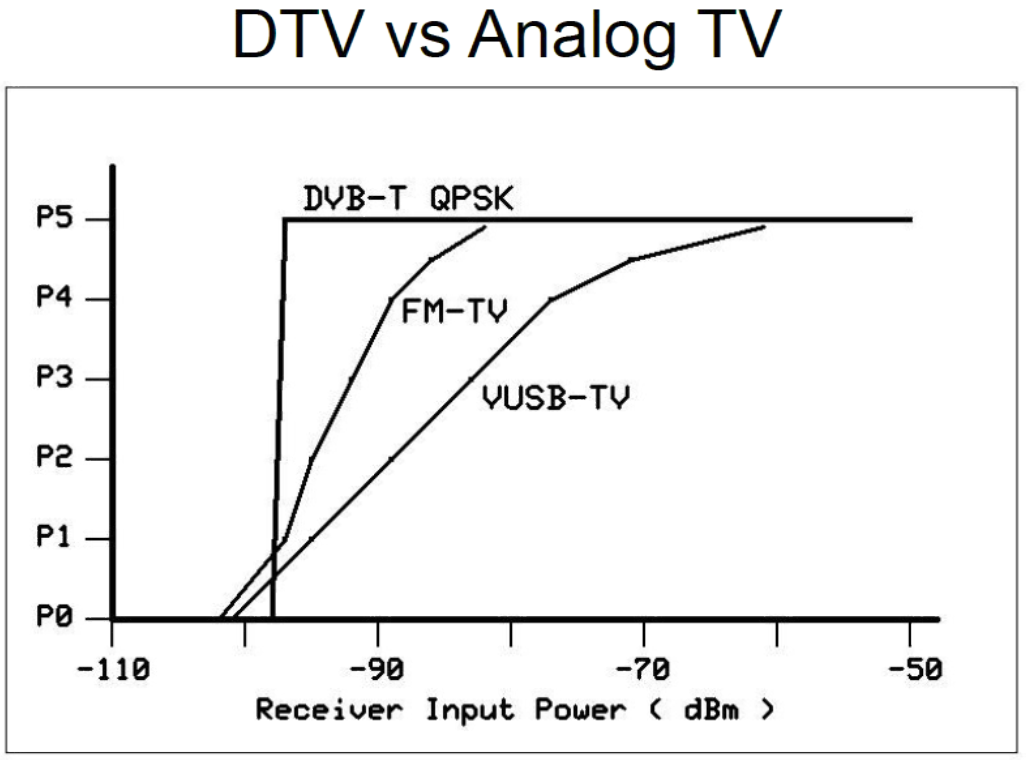
$P(noise) = kB * T * B$

where kB is the Boltzmann constant, T is the absolute temperature (^{o} K), and B is the bandwidth. T = 290^{o} K (20^{o} C) is normal room temperature.

Thus for a 3 kHz, SSB bandwidth, the thermal noise floor is -139.2 dBm. For our typical 6 MHz, TV bandwidth, it is -106.1 dBm. This is a really big difference of 33 dB ! Everything else being similar in transmitters, receivers and antennas, we should never expect TV to match SSB in distance, etc.

Required Signal to Noise Ratio: Most hams would agree that they need a minimum of 10 dB s/n for SSB signals to achieve reasonably accurate copy. Thus for a perfect receiver, this would mean the required SSB signal level needs to be at least -129dBm or stronger.

For analog ATV with either AM-TV or VUSB-TV modulation, a 40 dB s/n is required for a perfect, P5, picture. Lower s/n ratios result in increasing amounts of snow in the picture. An acceptable, P4 picture requires 24dB s/n. A very poor, P2, picture still requires 12dB s/n. For analog, FM-TV, the fm quieting effect improves things over AM. We know this from our experience with FM voice on 2 meters. FM requires 20dB s/n for perfect P5, 13dB for P4 and 7dB for P2. For digital TV, and in particular, for DVB-T, we have found that with normal digital parameters of QPSK modulation and 5/6 forward error correction, we can achieve perfect, P5 pictures down to an 8 dB s/n. With aggressive FEC encoding of 1/2, we can push this down to 5 dB s/n.



I have made some measurements on a Hi-Des model HV-110 receiver to demonstrate some typical numbers for 6 MHz bandwidth, DVB-T. These numbers are for "normal" parameters of 5/6 FEC, 1/16 guard interval, 8K FFT, 1080P resolution.

- *64QAM: The lower limit digital threshold is reached at -83dBm with 21dB s/n*
- *16QAM: The digital threshold is reached at -88dBm with 15dB s/n*
- *QPSK: The digital threshold is reached at -95dBm with 8dB s/n*

Then adding a low noise (0.5dB NF) pre-amp in front of the HV-110 receiver, the digital threshold is pushed down further to -99dBm, again with an 8dB s/n. If we are at 8 dB s/n, this then implies that the noise floor of this preamp enhanced receiver is about -107dBm. This is consistent within measurement accuracy of the calculated thermal noise floor of -106dBm

Transmitter Power:

A SSB transmitter is rated in terms of it's Peak-Envelope-Power (PEP). With proper drive adjustment, the voice peaks just barely reach up to the max. output power rating of the transmitter. For an AM-TV, or VUSB-TV transmitter, it is again rated in terms of PEP, measured on the sync tips. Again the sync reaches up to the max. output power rating of the transmitter. For an FM-TV transmitter, the output power is constant and is pushed to the max. output power of the transmitter. Thus all of these transmitters will essentially have the same output power rating.

For digital TV, the situation is different. The modulating signal appears like random noise with peaks and valleys. It can only be characterized by it's RMS power.

The transmitter must be able to handle peaks in the noise like waveform that are considerably stronger than the RMS value. We have found that for a QPSK, DVB-T transmitter, we need to provide at least 8 to 10dB of head-room to accommodate the peaks. If we clip off the peaks, we rapidly destroy the Bit Error Rate and the receiver can no longer decode the digital signal. Thus the power rating for a DVB-T transmitter will be at least -8dB below the max. output power rating of the transmitter.

35-40dB Difference:

For identical transmitter peak output power ratings, 6 MHz DATV compared to SSB, the difference in expected propagation results will be about 35 to 40dB worse. 30dB for receiver bandwidth threshold limits (-129dBm vs. -99dBm) and another 8 to 10dB for head-room allowance in transmitter power ratings. The result is about the same between DATV and FM-TV. This is because to have a P5 picture requires about an 8-10dB stronger received FM signal, but this is offset by the FM transmitter being 8-10dB stronger. The differences become even worse for analog AM-TV which requires a much stronger -60dBm received signal for a P5 picture.

LOs:

The requirements on Local Oscillators (LOs) are quite different for SSB vs. ATV. For SSB with it's very narrow bandwidth of only 3 kHz at an exceeding high rf frequency of 10GHz -- frequency accuracy is the most stringent requirement. For ATV, be it either analog or digital, this is not the case. For example, DVB-T can tolerate several hundred kHz of frequency inaccuracy and still work. What causes LO problems for DVB-T is phase noise. Excessive phase noise and the receiver will not demodulate the signal at all, or for weak rf signals, even moderate phase noise will degrade the receiver's digital threshold sensitivity.

Frequency West LO (left) & ADF-5355 synthesizer (right)

The photo shows two typical LOs used for radio amateur microwaves. The one on the left is the classical, Frequency West brick LO, that has been used for many years by microwave SSBers. The Freq. West brick consists of a free running, L band (1-2GHz), power oscillator phase locked to an oven controlled 100 MHz crystal oscillator. The L band oscillator then drives a step recovery diode (SRD) in a high Q, band-pass filter. The filter is tuned to the desired microwave output frequency. The Freq. West brick has very good phase noise, but it suffers from thermal drift. Thus for SSB service, they need to be turned on and warm up for at least 1/2 hour prior to use.

More recently frequency synthesizers from Analog Devices have now reached up to X band. The photo shows one such unit using the ADF-5355 device which covers from 54 MHz to 13.8GHz. It sells for about $160. I have found it to be extremely accurate and free from thermal drift. Mine is only off by 10 kHz at 10.3 GHz. I have found it very useful as a frequency marker to locate the SSB calling frequency of 10.368.1 GHz. However, it has a serious drawback of excessive phase noise which makes it unusable as an LO for DVB-T service. I thus was forced to use a Freq. West brick as my LO in my 5 & 10 GHz, DVB-T transverters. I suspect that the ADF-5355 would work ok as an LO in a SSB transverter.

Antenna Pointing:

Experience has shown that for "Local" SSB contacts, antenna pointing is not a major issue. Many times, we can have round-table QSOs on 10 GHz SSB without exactly pointing our dish antennas at any one particular ham. Granted the S meter readings are all over the place from S0 to S9+40dB, but we still carry on good QSOs. Not so with ATV on 10 GHz. Even for "local" contacts, we do need to have our dishes accurately pointed. That 35-40dB difference between modes makes all the difference in the world to antenna pointing requirements.

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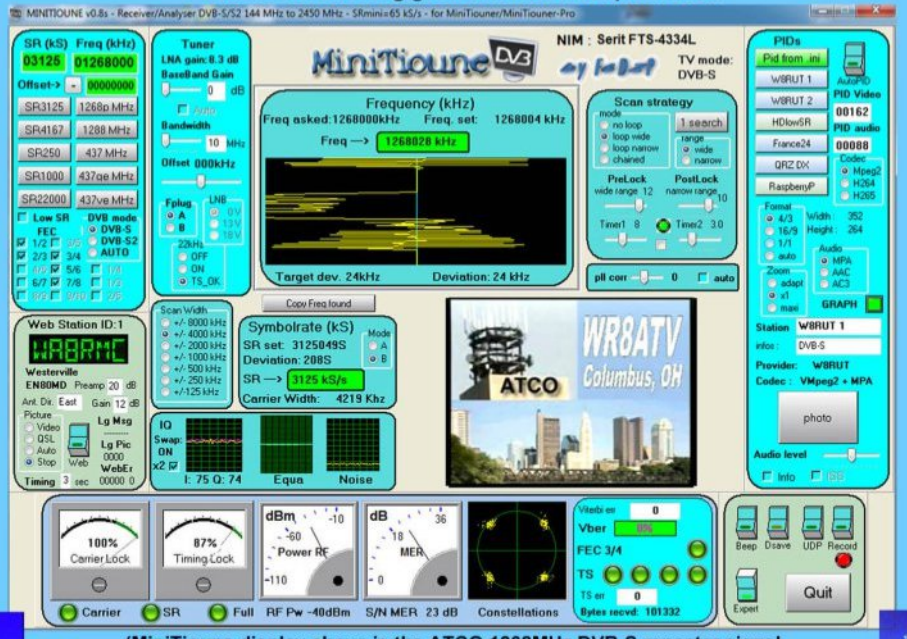
MiniTiouner-Express

Digital Amateur Television DVB-S/S2 Receiver / Analyzer

Available at DATV-Express.com

- Operates with Windows PC using free MiniTioune software from Jean-Pierre F6DZP
- Smaller than a stack of 2 decks of cards (picture above is full size)
- Two independent simultaneous RF inputs with internal preamps
- High sensitivity -100dBm @1288MHz – at 1/2 FEC
- Fully assembled/tested in aluminum enclosure
- Covers 144-2420MHz (ideal for Space Station DATV reception)
- Symbol rates from 75 KSymb/s to >20 MSymbols/sec
- Uses external 8-24VDC supply or +5V from USB-3 port (with small modification)
- Real time signal modulation constellation & dBm signal strength display
- Price: US $75 + shipping – order with PayPal

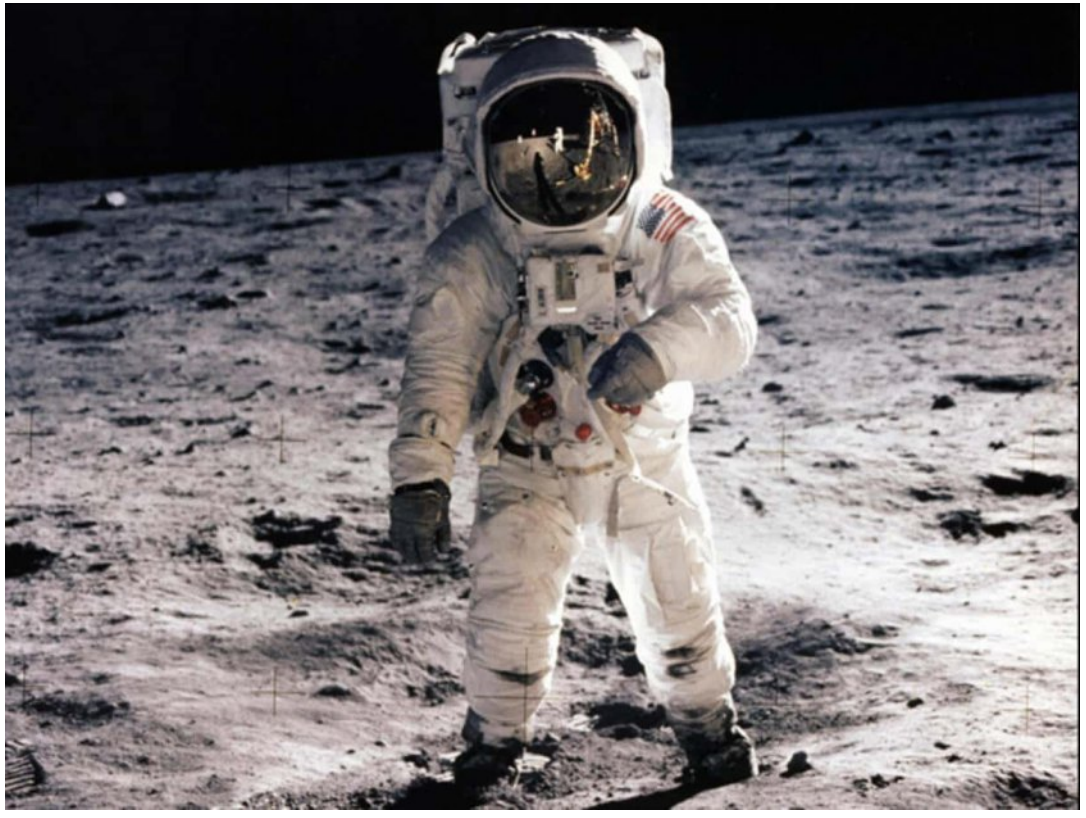
For details & ordering go to www.DATV-Express.com



(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).

One from the vault
Apollo 11 - 50 years ago

Written by Trevor Brown
First published in issue 74



We have just passed the 50th anniversary of Apollo 11, the mission to put a man on the moon.

For those of you old enough to remember One giant step for mankind or the immortal words of "the Eagle has landed" yes it really was 50 years ago and if that makes you feel old you are not alone. I know there are those who believe it all took place on a Hollywood set, but for those of us in the UK the talkback was monitored at Jodrell Bank where the world's third largest radio telescope monitored live the landing and

Stan Lebar, the project manager for Westinghouse's Apollo television cameras, shows the fieldsequential color camera on the left and the monochrome lunar surface camera on the right

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https://tinyurl.com/y6o3vzac

they assure us all the dish was definitely pointing at the moon. How does this link into a Television magazine well, they took with them a rather special TV camera to relay pictures back to earth.

This was developed by a team of engineers at Westinghouse lead by Stan Lebar, it was this camera that allowed us to see the Moon landings of the Apollo 11 mission in 1969.

Stan sadly passed away in December 2009 he was 84. The camera Stan's team developed and built ran at 10 fps using 320 lines. Rather a non-standard TV signal, but at the time nobody knew if live pictures from the moon would be possible, so the transmission path was via the telemetry channel and was shared with voice and biomedical data. The bandwidth available for a television signal was only 500kHz.

Remember this was analogue TV none of that digital nonsense. Stan's team had to engineer it from scratch the camera which had to withstand Lunar temperatures of -184 C to 101 C. This was rather a special camera the tube was supplied by the military and no pictures of the tube were permitted.

The Apollo 11 mission was tracked at three locations Goldstone, Honeysuckle Creek, and Parkes, the telemetry was recorded onto 1" tape by M22 recorders. NASA hired RCA to build a standards converter to process the images into a 525-line TV signal.

The tracking stations converted the signals and transmitted them by microwave links, Intelsat communications satellites, and AT&T analogue land lines to Mission Control in Houston. By the time the images appeared on television, they were substantially degraded.

Stan was delighted to see his camera working but was always disappointed with the quality; he knew it was capable of much better results. The problem was not the camera but the RCA standards converters and transmission path. "No one was unhappy," he said. "We were all in seventh heaven". America had pulled off the impossible. The Nation had landed a man on the moon and showed the world, via live television that it could be done.

The live pictures were viewed at tracking centres on monitors that worked on the 10 fps 320 line standard and reports

Photo attribute: NASA

confirm that these pictures were considerably better quality than what the rest of the world saw.

The original high quality was preserved via the M22 telemetry recordings. The engineers boxed the one-inch telemetry tapes wound onto 14-inch canister reels which served no other purpose than to provide backup if the live relay failed and shipped them to the Goddard Space Flight Centre.

From there, the tapes were sent to the Washington National Records Centre in Suitland, Md.

In 1997 a phone call from a British author, to Sarkissian who had been part of the Parkes team raised the issue of the location of the M22 tapes only one had ever surfaced in Australia which was a copy of one of the tapes sent to Goddard. Everyone assumed that NASA had the originals stored away safely.

This did however start a search in the states by Stan Lebar, Bill Wood and Richard Nafzger, for the original M22 recordings with a view to unlocking the true quality of the Apollo 11 camera and showing the world some improved quality recordings of this historic mission. This has been a long and exhausting search and in what one of the American papers headlined as "One Giant Blunder for Mankind" it would seem the Apollo 11 telemetry recording no longer exist and were presumed wiped.

Ampex VR 660 VTR

In 2004 a machine was located and the Australian tape was replayed and contained chatter and simulation data only, no pictures What the search did reveal was that NASA had hired the Applied Physics Laboratory (APL) near Baltimore to modify two Ampex VR-660C 2" helical VTR's to record the 320 line pictures. This machine only recorded the pictures received at Parkes. Sarkissian, found a letter and a photo showing two Ampex VR-660C recorders and a man who may have operated them. The letter, written by the former Parkes director, suggested the operator worked for APL.

They uncovered the identity of the man who had indeed modified the two Ampex VR-660C's. Now also in his 80s, the former APL employee confirmed he had modified the recorders and recorded the original moonwalk pictures, he packed the tapes and personally delivered them to APL. Nafzger found five two-inch videotapes only, but when a machine was located these tapes also turned out to be blank. It may seem the rest of us will never get to see the true quality pictures produced by the Apollo 11 mission.

Stan Lebars camera did prove that pictures were possible from the moon and although it was sent as a backup on the Apollo 12 and 13 missions it was never used again, Stan had proved what could be done and a higher definition colour camera was used on the following missions so presumably a greater bandwidth had been allocated.

Jim Andrews, KH6HTV comments:-

Here in our Boulder ATV group we have an "old-timer" from NASA. Joe Woods, AD0I, worked for NASA in Houston, Texas and was part of the NASA team that developed the TV gear for the moon landing. Joe was actually in mission control at the time of the moon landing as their technical consultant for the TV coverage. After working for NASA, Joe moved to Boulder, Colorado and started his own business, Video Aids of Colorado, building test instruments for the video industry. Joe eventually sold his company and retired.

Joe is still active in our ATV group here in Boulder. He was a key man helping build our first 70cm ATV repeater here in Boulder in the late 1970s. He was also active in our Boulder ARES (BCARES) for many years. Today, Joe refuses to join the digital revolution. He is stil transmitting analog, NTSC, vestigal side-band TV signals into our Boulder ATV repeater, W0BTV. Joe says it is in recognition of all the years he spent working with analog TV. His sole concession to DATV is to use a DVB-T set-top box to receive the pictures from our ATV repeater.

In addition to participating in our weekly Thursday afternoon net, Joe is a regular with the Boulder Friday morning, ham radio breakfast group. Joe is still active on HF, SSB, using a modern IC-7300 transceiver.

He has a very unique antenna tower. When he and his wife, Arlene, built their Boulder house many years ago, it was designed around having a 50ft tower planted in the middle of the basement. The house was then built around the tower. Thus the tower now sticks out of the center of the roof of their two story house. He has an HF Yagi, plus a 70cm Yagi on the top of his tower. Joe's basement ham shack is thus right at the base of the tower.

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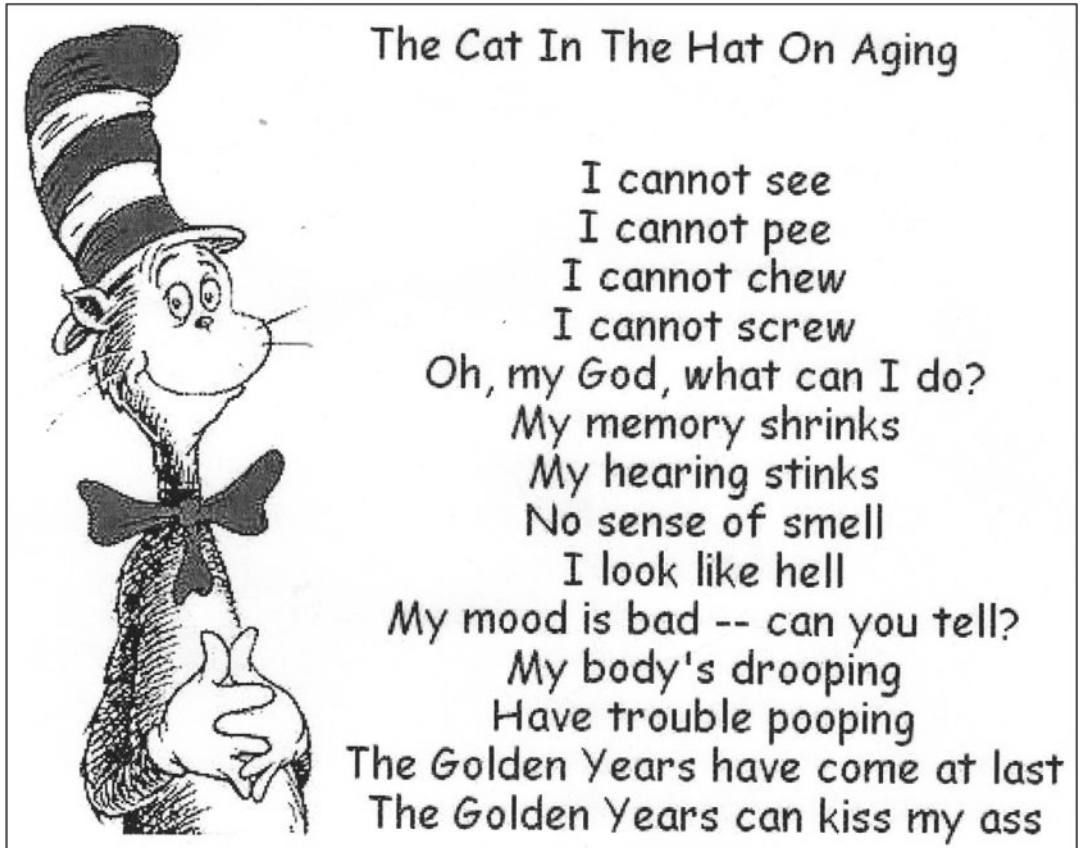

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