



President's Corner

By Steve Bible, N7HPR



WD5IVD SK

The TAPR Family was shocked by the recent passing of Greg Jones, WD5IVD. As past president, Greg became the face of TAPR and revitalized the organization after TAPR experienced some bumps in the road. Greg was the moving force behind many new projects that TAPR took on and he recruited new members, who are still active in the organization.

He was a colleague and a good friend. TAPR wishes to extend its condolences to Greg's family.

Hamvention with TAPR

Hamvention is nearly here and TAPR will be present in full-force! The biggest ham radio convention of the year runs from May 19 to May 21 at a new location: the Greene County Fairgrounds in Xenia, Ohio and TAPR has plans to fill your Hamvention weekend.

Booths

TAPR's booths will be in Building 5 (booths 5001 through 5003) where we will show what we have been up to lately. You can visit our booths 9 AM to 6 PM on Friday, 9 AM to 5 PM on Saturday and 9 AM to 1 PM on Sunday.

Board Meeting

An in-person TAPR Board of Directors meeting will occur Thursday evening at The Hilton Garden Inn Dayton South/Austin Landing, 12000 Innovation Drive, just off I-75 (exit 41) south of downtown Dayton. All TAPR members are invited to attend the meeting and speak their piece. The meeting starts at approximately 7 PM.

TAPR Forum

Friday at 9:15 AM, Scotty Cowling, WA2DFI, will moderate the TAPR Forum in Greene County Fairgrounds Forum Room 1. This years' speakers include:

- My "Introduction"
- Kai Siwiak KE4PT, *QEX* Editor, on "Write for *QST/QEX*"

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- Michael Ossman, AD0NR, and Dominic Spill, on “Low Cost, Open Source Spectrum Monitoring”
- Warren Pratt, NR0V, on “Advanced SDR Algorithms for Noise Blanking and Noise Reduction”
- Carl Laufer on “Introduction to RTL-SDR: Ultra Cheap Software Defined Radio”

For the full description of the forum, see “Hamvention TAPR Forum in Detail” on page 3.

Dinner

The 11th annual TAPR/AMSAT dinner takes place on Friday evening at the Kohler Presidential Banquet Center, 4572 Presidential Way, Kettering, OH 45429.

Attendees will digest a delicious dinner (menu below) and then listen to Carl Laufer discuss “The World of Low Cost Software Defined Radio” - a light non-technical talk on how the RTL-SDR and other low cost SDRs are changing the landscape of radio use. Carl is an electronics, software and radio enthusiast from New Zealand. After completing his PhD in machine learning he decided to pursue a new interest in the SDR world. He now runs the RTL-SDR blog and store <<http://www.rtl-sdr.com/>>, which specializes in news, projects and products related to ultra low cost SDR, and in particular the RTL-SDR dongle.

Carl will introduce you to some interesting applications, projects and stories that low cost SDR has brought to the world, and this will hopefully stimulate your imagination and ignite a passion for a new world of radio experimentation.

Doors open to a cash bar at 6:30 PM and dinner begins at 7 PM. Reservations are required and must be made by 6 PM by Tuesday, May 16 at 6 PM. Purchase tickets for \$35 online at the AMSAT Store

<<http://tinyurl.com/j378rn6>>.

One change this year: there will no printed tickets for the dinner. Rather there will be a list of ticket purchasers at the banquet to check-off as people arrive. So no tickets to dispense or to lose.

Here is the Menu:

- Hors d’oeuvres
- Fresh/grilled vegetables with dip
- Prime rib of beef with au ju
- Cranberry apple chicken
- Deep fried tempura shrimp with lemon tomato aioli
- Mashed potatoes with chicken gravy
- Sweet Potato Casserole
- Broccoli with lemon bleu cheese sauce
- Sweet potato casserole
- Salad and dressings
- Rolls
- Assorted layered cakes and cheesecakes
- Coffee, iced tea and water

The Crew

The folks behind the scenes at TAPR will be at Hamvention, so you will have an opportunity to say “Hello” and have an eyeball QSO with the TAPR crew.

I hope to see you in Dayton!

73,

Steve Bible, N7HPR, President TAPR

Hamvention TAPR Forum in Detail

By Scotty Cowling, WA2DFI

Friday, May 19, 2017

Moderator: Scotty Cowling, WA2DFI

Bio: Scotty was first licensed in 1967 and has been continuously active since that time. He is active while mobile on HF CW and on APRS. Scotty is an advisor for Explorer Post 599, a BSA affiliated ham club for teens in the Phoenix area. He has been involved in the openHPSDR project for the last 10 years, is a TAPR Director and past TAPR Vice President. Scotty is also active in the production of openHPSDR components and other SDR projects. He is a co-founder of iQuadLabs, LLC, a supplier of openHPSDR systems and other Software Defined Radio components. He currently works at Zephyr Engineering, Inc, a computer consulting company that specializes in FPGA design and SDR hardware.

9:15 – 9:20 AM: “Introduction” by Steve Bible, N7HPR, TAPR President

9:20 – 9:25AM: Write for QST/QEX by Kai Siwiak KE4PT, QEX Editor

9:25 – 9:50AM: “Low Cost, Open Source Spectrum Monitoring” by Michael Ossmann, AD0NR and Dominic Spill

Abstract: Over the past few months, we and other open source software developers have devised new tools allowing low cost Software Defined Radio platforms to rapidly sweep across radio frequencies in order to monitor the spectrum around us. Our base platform is HackRF One, and we are able to monitor 1 MHz to 6 GHz every 0.75 seconds, allowing us to build up a near real-time picture of radio usage around us. Now we are looking at new ways to visualize, analyze, and interpret this information. This will be a look at open source hardware and software tools that

enable us to monitor, analyze, and track down radio signals.

Bios: Michael Ossmann is a wireless security researcher who makes hardware for hackers. He founded Great Scott Gadgets in an effort to put exciting, new tools into the hands of innovative people.

Dominic Spill is senior security researcher for Great Scott Gadgets. The US government recently labeled him as “extraordinary”. This has gone to his head.

9:50 – 10:20 AM: “Advanced SDR Algorithms for Noise Blanking and Noise Reduction” by Warren Pratt, NR0V

Abstract: Wideband noise-blankers and LMS noise-reduction algorithms are commonplace in modern SDRs. With today’s CPU power, more advanced algorithms offering superior performance can be made available. In this presentation, Dr. Pratt focuses on two such algorithms implemented in 2015 in the WDSP signal processing library for the openHPSDR program.

* The Spectral Noise Blanker uses linear predictive coding and often removes impulse noise under conditions where wideband blankers are ineffective. Impulses are detected by comparing the observed waveform with a predicted waveform. Impulses are corrected by recreating an estimate of corrupt portions of the original waveform using spectral information.

* The Spectral Noise Reduction algorithm operates in the frequency domain and, based upon statistical models of speech and noise, reduces random noise much more effectively than LMS algorithms. The seminal work for this approach was published by Yariv Ephraim and David Malah in 1984. However, the state of the art has advanced substantially over the past thirty years.

To provide needed context, there is also a very limited introduction to wideband noise-blankers and LMS noise-reduction algorithms, both of which are also available in WDSP.

Bio: Dr Warren C. Pratt, NR0V Dr. Warren Pratt was first licensed in 1965 and was an avid operator and builder of ham radio equipment in his youth. He received a PhD in Electrical Engineering from the University of Illinois in 1977 and then entered the computer hardware and software industry, beginning as an engineer but then spending most of his career in executive management. He held engineering management positions at Hewlett-Packard, served as COO of Silicon Graphics, and as CEO of Alias, a 3D modeling and animation software company. Dr. Pratt is now retired and, in 2011, he joined the efforts of the openHPSDR program. He has written the WDSP digital signal processing library as well as other parts of the software that openHPSDR uses. He continues to enjoy exploring signal processing algorithms and supporting the openHPSDR program directions.

10:20 – 10:45 AM: “Introduction to RTL-SDR: Ultra cheap software defined radio” by Carl Laufer

Abstract: A brief overview of the RTL-SDR, an ultra low cost software defined radio that is opening the radio world up to new people. I will cover what the RTL-SDR is, what it can do, and how to set one up. The talk will also show some common applications and projects that it can be used for such as tracking aircraft and boats, receiving weather satellite images, decoding digital radio and more. The talk will also cover using SDRs together with portable computers such as the Raspberry Pi 3 for remote monitoring.

Bio: Carl Laufer is an electronics, software and radio enthusiast from

New Zealand. After completing his PhD in machine learning he decided to pursue a new interest in the software defined radio world. He now runs the RTL-SDR.com blog and web store, which specializes in news, projects and products related to ultra low cost software defined radio, and in particular the RTL-SDR dongle.

###

TAPR Changes

On March 31, Jeremy McDermond, NH6Z, resigned from the TAPR Board of Directors. Jeremy served as a Director from 2010 to 2017 and Vice President from 2012 to 2017.

In his place, the Board selected Bruce Raymond, ND8I, to serve the remainder of Jeremy's term, which ends in the fall of 2019.

###

Greg Jones, WD5IVD, SK

From www.arrl.org

Past TAPR President Greg Jones, WD5IVD, of Denton, Texas, died on March 30. He was 54.

Jones was a professor in the Department of Learning Technologies within the College of Information at the University of North Texas, where he received his bachelor's and master's degrees. He received his PhD in Curriculum and Instruction at the University of Texas, and was the author of numerous scholarly articles.



He served as TAPR's president from 1993 until 1999. "I am very proud of my time at TAPR," he once wrote. "I was able, with the help of so many, to take TAPR from the brink of going away into a strong, living organization that 10 years later is still doing important research and education in Amateur Radio digital communications."

Jones contributed to *QEX* in the early 1990s.

(Editor's Note: Follow this link to a more detailed obituary: <https://tinyurl.com/m4tyvbd>)

###

DCC in St. Louis, Sept. 15-17

The 2017 installment of the ARRL and TAPR Digital Communications Conference (DCC) will take place September 15-17 at the Holiday Inn Airport West in Earth City, Missouri, which is a suburb of St. Louis.

Further details will appear as they develop on the TAPR website and in the next issue of PSR.

###

DCC Call for Papers

Technical papers are solicited for presentation at the 36th Annual ARRL/TAPR Digital Communications Conference (DCC). Papers will also be published in the Conference Proceedings. Authors do not need to attend the conference to have their papers included in the Proceedings. The submission deadline is July 31, 2017. Submit papers via e-mail maty@arrl.org or via post to Maty Weinberg, KB1EIB, ARRL, 225 Main St., Newington, CT 06111. Papers will be published exactly as submitted, and authors will retain all rights.

###

DCC Video Online

Gary Pearce, KN4AQ, HamRadioNow's main man has posted on YouTube a slew of videos from the ARRL-TAPR Digital Communications Conference (DCC) held this past September in St. Petersburg. At <https://www.youtube.com/user/HamRadioNow/> look for HRN video numbered 271, which is the first in the series of 2016 DCC videos. They continue in ascending order to HRN 297.

###

TARPN: Old School Packet Network in North Carolina

By Tadd Torborg, KA2DEW

Hams in five counties around Raleigh, North Carolina are building a packet radio network based on Raspberry PIs, TNC-PIs and G8BPQ software. The connected part of the network runs at 1200 baud and has 12 network nodes across a 50 mile area in the North Carolina well-forested Piedmont (land is flat). There are a few other hams building nodes or sets of nodes, which are not connected to the main part of the network, yet.

The group describes the system as a Terrestrial Amateur Radio Packet Network, which is called TARPN for short.

The network is based in ham-controlled facilities (all houses at this point) and is only connected to the Internet for upgrades.

The catch phrase for the group is “Off the grid text messaging,” but the talk around the conference server is that they want to do much more than that. Several of the hams are working on new software and hardware, testing and integrating open source or free software into the system. TARPN already has several in-house hardware products including a Raspberry PI power manager with backup battery (TARPN PWRMAN), and a firmware based timed radio disable device to enable the local ham to do weak signal operation without having the packet system jam the band (TARPN INTERRUPTER).

The network is operating on the 50, 144, 222 and 440 MHz to permit collision free operation and to permit the use of inexpensive but powerful radios to plow through the trees here in the high precipitation flat forests. The range between node sites runs between 2 miles and 20 miles.

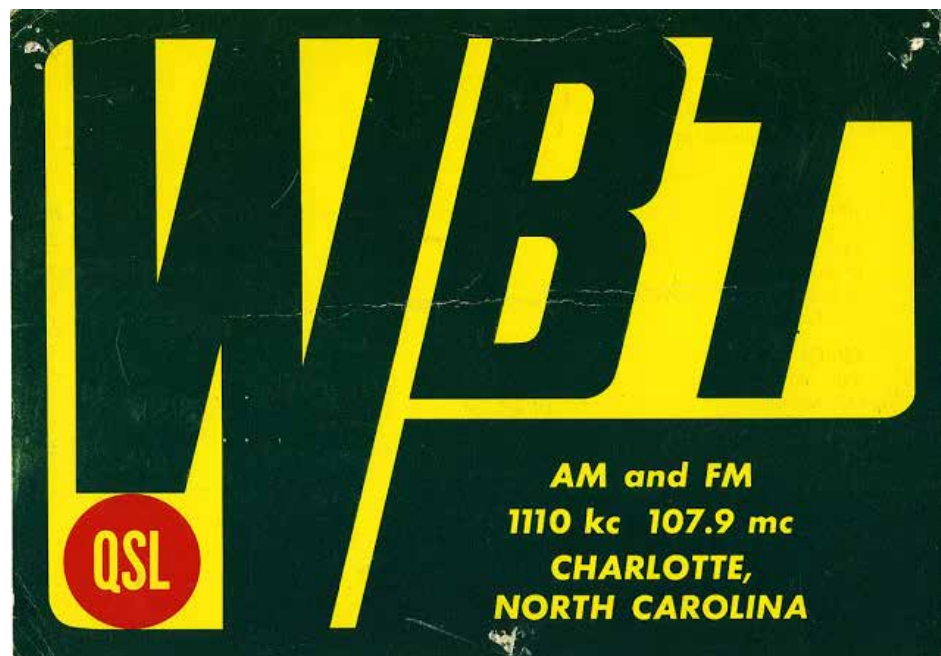
Creating a new node is cheap and easy. Cheap because the radios are surplus, the TNC-PIs are only \$43 and Raspberry PIs are amazing (and cheap). The scripting makes setting up a node under two hours, much of

which is watching downloads.

I manage the TARPN web page. We also have a Yahoo mailing list. And there are YouTube videos. See <<http://tarpn.net>> for more information or search for “TARPN” on Google or YouTube.

All are welcome.

###



Know Your Node

By Brian Rogers, N1URO for the EastNet Packet Network

A while back it came to me to dig into node aliasing. It made me ask the question to the ARRL if at the AX.25 level if aliasing is an acceptable way of establishing connectivity amongst:

users ↔ nodes

nodes ↔ nodes

When you consider that our FCC Part 97 states that all transmissions, regardless of mode -must- end with their proper call sign and also ID every 10 minutes in between how does this define the usage of aliases on packet? When I queried the ARRL, they even were unsure which made their Regulatory Department query the FCC for clarification. Their response was that the statute is not prejudice to -any- mode whatsoever, which includes packet operations. This had me thinking about doing some sniffs mainly on URONode and it's configurations but I took it a step further to study that of other node firmware/software. Now, of course not all firmware/software is developed within the U.S., nor is it designed to specifically follow our Part 97. That duty lays within the Node Sysop to maintain such. What I found was very fascinating to which I'll be sharing the results of my sniffs with you in this document.

Looking at the specifics of Part 97 and the FCC's recent reply to the ARRL on the issue, it's clear that since ax.25 is our proprietary protocol, then this ruling -must- remain true at this level. However, not all firmwares/software honor our FCC rulings in regards to Part 97 so SysOp beware! In my sniffs of packets I've found this to occur with almost all packet nodes available. Here's a sniff of what I'm trying to explain:

I'm using NET/ROM into N9LYA in Indiana who has a BPQ neighbor on his 220 interface. You'll see I made a specific request to connect to

N9UMJ-7 via 220, but I tried using his alias:

```
ax0: fm N1URO-2 to N9LYA-7 ctl I44^ pid=CF(NET/ROM) len 35
NET/ROM: N1URO-5->N9LYA-7 ttl 14
      info: ur ckt 01/A8 txseq 7 rxseq 20
0000 c ax3 lawnod-5.
```

...and my command ACK frame back:

```
ax0: fm N9LYA-7 to N1URO-2 ctl I54^ pid=CF(NET/ROM) len 64
NET/ROM: N9LYA-7->N1URO-5 ttl 15
      info ack: ur ckt 01/12 rxseq 8
```

You see N9LYA's URONode honoring my request:

```
ax3: fm N1URO to LAWNOD-5 ctl SABM+
```

N9LYA's URONode informs me that the link is being set up:

```
ax0: fm N9LYA-7 to N1URO-2 ctl I55^ pid=CF(NET/ROM) len 54
NET/ROM: N9LYA-7->N1URO-5 ttl 15
      info: ur ckt 01/12 txseq 20 rxseq 8
0000 IN105:N9LYA-7} link setup (ax3)...
```

My ACK back:

```
ax0: fm N1URO-2 to N9LYA-7 ctl I65^ pid=CF(NET/ROM) len 64
NET/ROM: N1URO-5->N9LYA-7 ttl 14
      info ack: ur ckt 01/A8 rxseq 21
```

A second retry:

```
ax3: fm N1URO to LAWNOD-5 ctl SABM+
```

...and finally a connect:

```
ax3: fm LAWNOD-5 to N1URO ctl UA-
```

N9LYA informing me I have link:

```
ax0: fm N9LYA-7 to N1URO-2 ctl I66^ pid=CF(NET/ROM) len 47
NET/ROM: N9LYA-7->N1URO-5 ttl 15
      info: ur ckt 01/12 txseq 21 rxseq 8
0000 .*** connected to LAWNOD-5.
```

MOTD header:

```
ax3: fm LAWNOD-5 to N1URO ctl I00+ pid=F0(Text) len 80
0000 LAWBPO:N9UMJ-7} BBS RMS CHAT CONNECT BYE INFO NODES
ROUTES PORTS
0040 USERS MHEARD ..
```

ACK of received header:

```
ax3: fm N1URO to LAWNOD-5 ctl RR1-
```

Right here, you do NOT see N9UMJ transmitting with his callsign. You can NOT look up LAWNOD in any FCC database of legitimate call signs. Any FCC Official Observer monitoring the frequency would then have to foxhunt to see where this broadcast is coming from and inform the Node Op of their illegal transmissions. This is why AX.25 is a plain text protocol for simple FCC monitoring of our activities on packet.

Granted, this is a BPQ node (and I'm not picking on BPQ's software by any means) however, there are -many- nodes which behave in this

manner and like with BPQ they're not developed in the U.S. I have tried to make an effort with those who are still in development and not one of them intends to run a fix/patch for their softwares. In an ongoing discussion with Kantronics, their TNCs also are vulnerable to this bug in regards to their MYALIAS function. Kantronics fails to recognize that while in NODE mode operations ("interface user" for example) that MYALIAS -will- indeed respond at the AX.25 layer with a non-call sign if the end user put in a human-readable alias into their configuration which most do as to simulate a KA-NODE as a NET/ROM node. Kantronics suggests that MYALIAS is for digipeat mode only and is not meant for node connectivity regardless of the fact it still allows users to connect to the KA-Node. For their failure to recognize this as a bug I will be including them in the "bad" list.

Before I list those I've tested and the results, I wish to further explain why NET/ROM aliasing works under the guidelines of our Part 97. Like with the internet and it's DNS (domain name services) that takes a human-readable string and converts it to a series of IP based numerics, NET/ROM does the exact same thing when a user makes a request to connect. As you see here, NET/ROM knows well enough to convert the human-readable string into a proper callsign(-ssid) as with my connect request to INNOS:N9LYA-5:

Node connect request and link setup confirmation:

```
n1uro-15@n1uro.ampr.org:/uronode$ c innos
Trying INNOS:N9LYA-5... hit <Enter> to abort
```

NET/ROM converting INNOS to N9LYA-5 and routing it via it's NET/ROM neighbor:


```
ax0: fm N1URO-5 to N1URO-2 ctl I16^ pid=CF(NET/ROM) len 64
NET/ROM: N1URO-5->N9LYA-5 ttl 15
      conn rqst: my ckt 01/3C wnd 1 N1URO-15@N1URO-5
      timeout 120
```

Connection established and ACKed:

```
ax0: fm N1URO-2 to N1URO-5 ctl I71^ pid=CF(NET/ROM) len 22
NET/ROM: N9LYA-5->N1URO-5 ttl 7
      conn ack: ur ckt 01/3C my ckt 01/02 wnd 1
```

Mailbox Header sent to me:

```
ax0: fm N1URO-2 to N1URO-5 ctl I72^ pid=CF(NET/ROM) len 44
NET/ROM: N9LYA-5->N1URO-5 ttl 7
      info: ur ckt 01/3C txseq 0 rxseq 0
0000 [JNOS-2.0j.7v-BFHIM$].>.
```

My ACK of frame:

```
ax0: fm N1URO-5 to N1URO-2 ctl I37^ pid=CF(NET/ROM) len 64
NET/ROM: N1URO-5->N9LYA-5 ttl 15
      info ack: ur ckt 01/02 rxseq 1
```

Node displaying to me my prompt and confirmation of connection:

```
Virtual circuit established to INNOS:N9LYA-5
[JNOS-2.0j.7v-BFHIM$]
>
```

As you see, NET/ROM converted my “INNOS” to N9LYA-5 for me thus keeping the frame within our Part 97... but here’s also where it gets trickier – NET/ROM is encapsulated under AX.25! This keeps it legal because the one(s) doing the actual transmissions are N1URO-5 and N1URO-2 if you look at the “ax0” lines. Each AX.25 neighbor does hop-to-hop acknowledgment of the NET/ROM frames as part of it’s error correction. There you see proper call signs(-ssids) along the way at the top protocol level keeping you and the link legal.

The listing of softwares is not 100% and I may have missed some but those I have tested are pretty conclusive. Those that do/can fall 100% under Part 97 rulings are:

- FlexNet*
- Xnet*
- URONode**
- FPAC**
- LinuxNode**

*Some of these may not even give you an option to configure any aliases as they don’t exist in the softwares while others use it strictly for NET/ROM only.

**Sysop has the duty to NOT configure aliasing in their ax25d.conf file

Those which failed the tests include:

- BPQ Node (all platforms)
- BPQ RMS
- BPQ BBS
- BPQ Chat

The Latest from TAPR...

TNS-BUF Isolation Amplifier

The TNS-BUF Isolation Amplifier is a very low noise, high isolation, buffer amplifier for use in time and frequency measurement applications where it is important to isolate signals without adding noise. The main purpose of the TNS-BUF is to look as much as possible like a one-way piece of wire at RF frequencies. For full technical details, visit <http://www.febo.com/pages/TNS-BUF> or download the manual from here:

http://www.tapr.org/~n8ur/TNS-BUF_Manual.pdf.

The price for the TNS-BUF is \$119 US plus shipping/handling if applicable. Note that the TNS-BUF is a one-time, limited run and there are only a few left in stock, so do not hesitate to order.

TICC Timestamping/Time Interval Counter

The TAPR TICC is a two-channel time-stamping counter with better than 60 picosecond resolution and less than 100 picosecond typical jitter. It has an Allan Deviation noise floor below 1×10^{-10} for a one second measurement. For full technical details, visit

http://tapr.org/kits_ticc.html

The price for the TICC with Arduino is \$190 US plus shipping/handling if applicable.

###

TheNet

X1J-4

JNOS

MFNOS

TNOS

Kantronics (if MYALIAS is configured with a non-call sign)

Other***

*** There may be others that were not tested due to lack of resources

So, know your node! You worked too hard for your license to have it violated! If you're using any of the node programs mentioned above you may wish to consider taking proper action so that you may insure you won't be making any illegal transmissions when a user or bbs script attempts to connect to you.



TAPR Wear Available

As seen on the cover of Lands' End Business catalog

Personalized Land's End clothing with the TAPR logo and your name and call sign are now available from the TAPR Store at <http://business.landsend.com/store/tapr/>

Select from the Men's or Women's catalog. (To make shopping easier, there are "TAPR Recommended Shirts" in the Men's catalog including two styles of polo shirts, each available with or without pockets.)

The logo is available in three colors -- red, blue, and white. The name/call sign monogram thread will match the logo color. (We recommend that you use the white logo with dark colored shirts.)

Prices are very reasonable, for example, after adding the logo and monogram, a mesh pocket shirt is \$36.95. Processing time is 5-7 days, plus shipping.

###

KD6OZH Mesh Network List

A mail list to discuss and further the mesh network technology work of John Stephensen, KD6OZH, is now up and running on the TAPR server. The list is open to all who are interested in John's work and subscriptions to the KD6OZH Mesh list may be had at:

https://www.tapr.org/mailman/listinfo/kd6ozh_mesh

All of software files related to John's work are located on Github here: <https://github.com/TAPR/DCP6>.

Write Here!

Your *PSR* editor is patiently waiting for a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to write about their activities and have them published here in *PSR*.

You don't have to be Hiram Percy Maxim to contribute to *PSR* and you don't have to use *Microsoft Word* to compose your thoughts.

Your *PSR* editor can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wallou@tapr.org, she can handle it!

The deadline for the next issue of *PSR* is August 1, so write early and write often.

If *PSR* publishes your contribution, you will receive an extension to your TAPR membership or if you are not a member, you will receive a TAPR membership.

###

On the Net

By Mark Thompson, WB9QZB

Facebook

As you may know, TAPR has a Facebook page, www.facebook.com/TAPRDigitalHam.

However, I also created a TAPR Facebook Group, www.facebook.com/groups/TAPRDigital/.

If you have a Facebook account, "Like" the TAPR Facebook page and join the TAPR Facebook Group.

If you join the group click on the Events link and indicate you're Going to the events.



On Twitter, Too

Access the TAPR Twitter account at www.twitter.com/taprdigital.



Also on YouTube

TAPR now has its own channel on YouTube: the TAPR Digital Videos Channel: www.youtube.com/user/TAPRDigitalVideo.

At this time, there are a slew of videos on our channel including many from the TAPR-ARRL Digital Communications Conference (DCC) that you may view at no cost, so have at it!



###

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Submission Guidelines

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you or someone you know is doing something that would interest TAPR, please contact the editor (wallou@tapr.org) so that your work can be shared with the Amateur Radio community. If you feel uncomfortable or otherwise unable to write an article yourself, please contact the editor for assistance. Preferred format for articles is plain ASCII text (OpenOffice or *Microsoft Word* is acceptable). Preferred graphic formats are PS/EPS/TIFF (diagrams, black and white photographs), or TIFF/JPEG/GIF (color photographs). Please submit graphics at a minimum of 300 DPI.

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PSR Advertising Rates

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Half Page Ad for 1 issue: \$75, 4 issues: \$250

Quarter Page Ad for 1 issue: \$50, 4 issues: \$175



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