President's Corner

HamCation, Feb. 11-13, 2022

First off, let me say that I am honored to be entrusted with the TAPR presidency, and I would like to thank Steve Bible, N7HPR, for his years of service in that role. As vice president, I have had a close-up view of and a chance to help with, Steve's handling of the organization. I hope that I can live up to the high bar that he has set for the job. So take a well-deserved rest, Mr. Past President, but don't get too restful, you are still vice president!

Kudos also goes out to John Koster, W9DDD for his many years of service on the TAPR board and to Laura Koster for her management of the TAPR store and office. John retired from the board this year after 27 years of service. It has been a real pleasure to work with both John and Laura over the years (or should I say decades?). A Thank You seems like hardly enough. But Thank You anyway!

The next event for TAPR is Hamcation, which returns to a live venue again on February 11-13, 2022, at the Central Florida Fairgrounds in Orlando, Florida. TAPR will have a booth in space 189 in North Hall. TAPR will be co-sponsoring a series of semi-technical talks alongside ORI in the forum rooms. We will be demonstrating the latest TangerineSDR hardware. Please come by and say hello if you are in the area!

73, Scotty, WA2DFI

###

TAPR Receives $97,000 Grant from ARDC

TAPR received a $97,000 grant from Amateur Radio Digital Communications (ARDC) for the purpose of providing support for the TangerineSDR test fixtures. (ARDC is a private foundation that exists to support amateur radio and digital communication science and technology.)

Efforts led by TAPR have produced a modular, direct-sampling HF Software Defined Radio (SDR) called the TangerineSDR. Education, experimentation, advancing the digital radio art, cloud-based networking, as well as heliospheric, ionospheric, magnetospheric and space weather research are all the target uses for the hardware.

Thanks to the July 8, 2020, ARDC grant to TAPR, complete parts kits for the CKM and RFM prototypes have been purchased. Due to worldwide shortages of silicon chips, the FPGA chips for the DE are back-ordered until May of 2022, precluding the completion the DE build until then. TAPR is ready to assemble the CKM and RFM, but without the DE, there is no way to test them.

To get the project moving forward before May 2022, with the new grant funds, TAPR can now build an RFM adapter board, a CKM carrier board and a set of DE loopback test boards. The RFM adapter will allow the existing TangerineSDR RFM boards to plug into an available off-the-shelf MAX10 FPGA development board without modification.

This will permit RFM design verification, DE FPGA firmware development and system software development before we have actual DE hardware. The CKM carrier will allow all the features of the CKM to be tested without a DE board. It will serve a second purpose – by transforming the CKM into a more general-purpose GPS-disciplined oscillator test instrument usable by scientists, academics and amateurs. This solution will allow TAPR to proceed with development despite the shortages and hopefully allow the shortages to be resolved before the project goes to production later in 2022.

###

Directors Election Results

Scotty Cowling, WA2DFI, George Byrkit, K9TRV, and Dan Babcock, N4XWE were elected as TAPR Directors for the next three years with 32.7%, 23.6% and 23.4% of the vote each, as follows:

Dan Babcock, N4XWE: 98 votes (23.4%)

George Byrkit, K9TRV: 99 votes (23.6%)

Scotty Cowling, WA2DFI: 137 votes (32.7%)

Mark Thompson, WB9QZB: 85 votes (20.3%)

###

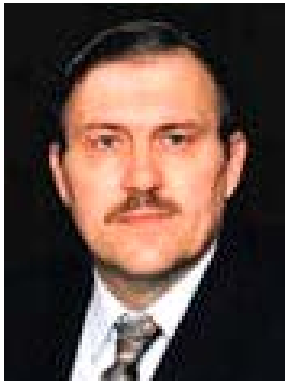
DCC Recap

Although virtual again due to the pandemic, the 40th ARRL/TAPR Digital Communications Conference (DCC) was a success with 185 and 205 attendees registered for the Friday and Saturday Zoom sessions, respectively, plus innumerable viewers on YouTube. The conference covered a wide range of digital amateur radio topics. A list of presentations is available in the previous issue of *PSR* (https://files.tapr.org/psr/psr149.pdf).

A printed copy of the DCC papers may be purchased from Lulu (https://tinyurl.com/4mw9xhp9). Videos are viewable on YouTube: the Friday session at https://tinyurl.com/4eavrwxs, the Saturday session at https://tinyurl.com/8m5et5ct

###

Joe Borovetz, WA5VMS, SK



Long-time keeper of the TAPR kit inventory, Joe Borovetz, WA5VMS, became a silent key in September after a short illness. Joe was the TAPR "parts guy" for many years and took care of an awful lot of the boring stuff that kept the kitting operation going.

Joe was also very active in the TexNet packet radio network and was an member of the Muskogee (Oklahoma) Amateur Radio Club. He was also the go-to guy when you had questions about Motorola radio equipment. WA5VMS will be missed.

###

Officers Selected

At the TAPR Board of Directors meeting preceding the DCC, the following individuals were selected to serve as TAPR officers for the next 12 months:

President Scotty Cowling, WA2DFI

Vice President Steve Bible, N7HPR

Secretary Stana Horzepa, WA1LOU

Treasurer Tom Holmes, N8ZM

###

Tom Clark, K3IO/W3IWI, TAPR Founder Deceased

Tom Clark, K3IO (formerly W3IWI), became a silent key on September 28. Tom was one of TAPR's founders and served as Executive Vice President (1987-1989) and Director (1983-1993) of our organization. Tom was also a former AMSAT-NA President and ham radio satellite and digital pioneer. He died after a short illness and hospital stay.

From *The ARRL Letter*:

An ARRL Life Member and ARRL Maxim Society and Diamond Club member, Clark's accomplishments are legendary, and he left a lasting footprint on the worlds of amateur radio satellites and digital techniques.

"His longtime technical achievements, mentoring to others, and technical leadership will be missed by his many peers and friends the world over," said Bob McGwier, N4HY.

To honor Clark, AMSAT has rebranded its upcoming annual gathering as The 2021 AMSAT Dr. Tom Clark, K3IO, Memorial Space Symposium and Annual General. It will take place on October 30 via Zoom. (AMSAT members may register to attend via AMSAT's Member Portal.) The event will be live-streamed on AMSAT's YouTube channel.

A founding member of Tucson Amateur Packet Radio (TAPR), Clark was a cofounder of the TAPR/AMSAT DSP Project, which led to software-defined radio. He was a leader in the development of the AX.25 packet radio protocol. Clark served as AMSAT's second president, from 1980 until 1987. He also served on the AMSAT and TAPR Boards.

In concert with McGwier, Clark developed the first amateur DSP hardware, including a number of modems. He developed the uplink receivers and the spacecraft LAN architecture used on all the Microsats (Oscars 16, 17, 18, 19, 26, 27, and 31). McGwier said it was Clark who convinced him in 1985 that the future lay in DSP.

"We started the TAPR/AMSAT DSP project, and it was announced in 1987," McGwier recounted. "We showed in our efforts that small stations with small antennas could bounce signals off the moon, and using the power of DSP, we could see the signals in our computer displays." This led to the software-defined transponder (SDX) for satellite work, including ARISSat and AMSAT's Phase 3E.

Clark received a doctorate in astro-geophysics from the University of Colorado. He went on to serve as Chief of the Astronomy Branch at NASA Marshall Space Flight Center and

was a Senior Scientist at NASA Goddard Space Flight Center, where he was principal investigator for the Very Long Baseline Interferometry (VLBI) activity.

In 2005, he became the first non-Russian to be awarded the Special Medal of the Russian Academy of Sciences for his contributions to the international VLBI network. He is a member of the 2001 class of CQ Magazine's Amateur Radio Hall of Fame.

In 2016, ARRL awarded Clark with its President's Award, to recognize his 60 years of advancing amateur radio technology. On that occasion, McGwier said, "There would be no AMSAT to inspire all of this work without Tom Clark. Tom…saved the organization and inspired all of us to look to the future and aim for the stars," McGwier said.

Clark was a Fellow of the American Geophysical Society and the International Association of Geodesy.

###

TAPR Wear Available

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 $39.85 plus shipping and sales tax where applicable. Processing time is 5-7 days.

###

Your TAPR Team

Scotty Cowling
WA2DFI
President & Director

Steve Bible
N7HPR
Vice President & Director

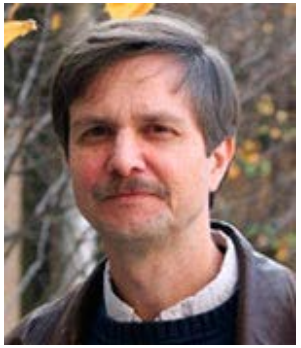
Stana Horzepa
WA1LOU
Secretary, Director, & PSR Editor

Tom Holmes
N8ZM
Treasurer

John Ackermann
N8UR
Director

Dan Babcock
N4XWE
Director

George Byrkit
K9TRV
Director



Dave Larsen
KV0S
Director

Bruce Raymond
ND8I
Director

Darryl Smith
VK2TDS
Director

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

The following paper was published in the papers of the 2021 ARRL/TAPR Digital Communications Conference. A printed copy of the DCC papers may be purchased from Lulu (https://tinyurl.com/4mw9xhp9)

Detecting Putative Sporadic E Propagation in WSPRNet Spot Records

By Jeanette Zhou, KN6DAD

The E layer affects radio broadcasting as well as other radio communications; as such, many researchers are attempting to predict sporadic E layer cloud formation. The Japanese Space Weather Forecast Center, for example, has reported preliminary results in predicting sporadic E clouds a few days ahead of its formation (1). However, while accurate forecasting of local sporadic E clouds is highly desirable, it is still elusive. For this study, I wanted to investigate whether the massive amount of amateur radio transmission data, such as the WSPRNet data sets, could be useful in building prediction models.

WSPRNet (2) is a centralized database that collects spot records from radio stations operating weak digital modes. Each of the millions of spot records on the WSPRNet provides SNR, transmitting power, and geographic information, which can be used to estimate transmission paths. For example, the December 2020 data set alone contains 74 million records, representing 22,552 senders from 19,588 grids. While WSPRNet provides a potential big data source for radio propagation study, it is not clear if the WSPRNet data are useful in studies of sporadic E propagation. The objective of this study is to investigate whether WSRPNet data are useful for characterizing sporadic E propagation.

WSPRNet propagation data were downloaded from (http://wsprnet.org/drupal/downloads) and solar indices were from the German Research Centre for Geosciences (GFZ) (gfz-potsdam.de) in February, 2021. WSPRNet spot records of 28, 50, and 144 mHz transmissions during 2020 were then used for the analysis, combining related spot records with the same timestamp and sender call sign to remove duplicates.

Putative sporadic E propagations were identified as when a transmission's distance was about 1200 km in the above identified bands; the total number of records used for the analysis was 1,118,989. Using python 3, data analysis was performed with pandas and maidenhead packages; geopandas, matplotlib, and seaborn were used for plotting (Jupyter notebooks and intermediate data used for this analysis are available upon request

from the author).

As the figures 1 and 2 show, putative sporadic E propagations seem to peak in the summer in the Northern Hemisphere; for 28 mHz and 50 mHz bands, the opening seems to start in April and mostly die down after September. The 144 mHz band has a later start around May or June and it seems to have a second peak around October. In the Southern Hemisphere, the putative sporadic E propagations are mostly shown during the winter up until March and they increase again in October for all three frequencies. It is known that the 28 mHz band supports F2 ionospheric propagation and some of the transmissions in the 50 mHz and 144 mHz bands may be through tropospheric ducting rather than sporadic E propagation. Further studies focusing on transmission paths and durations may further define the propagation modes in these putative sporadic E propagations. However, the seasonal changes of the putative sporadic E propagations seem to be consistent with what has been reported in the literature, suggesting that these records may reflect actual sporadic E propagation.

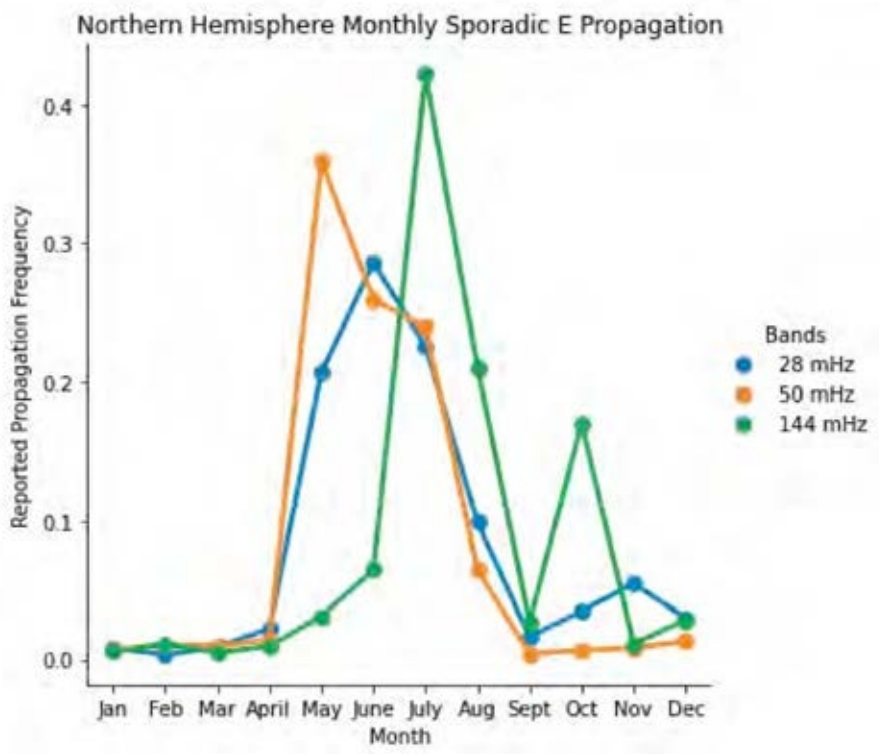


Figure 1. Northern Hemisphere Monthly Sporadic E Propagation

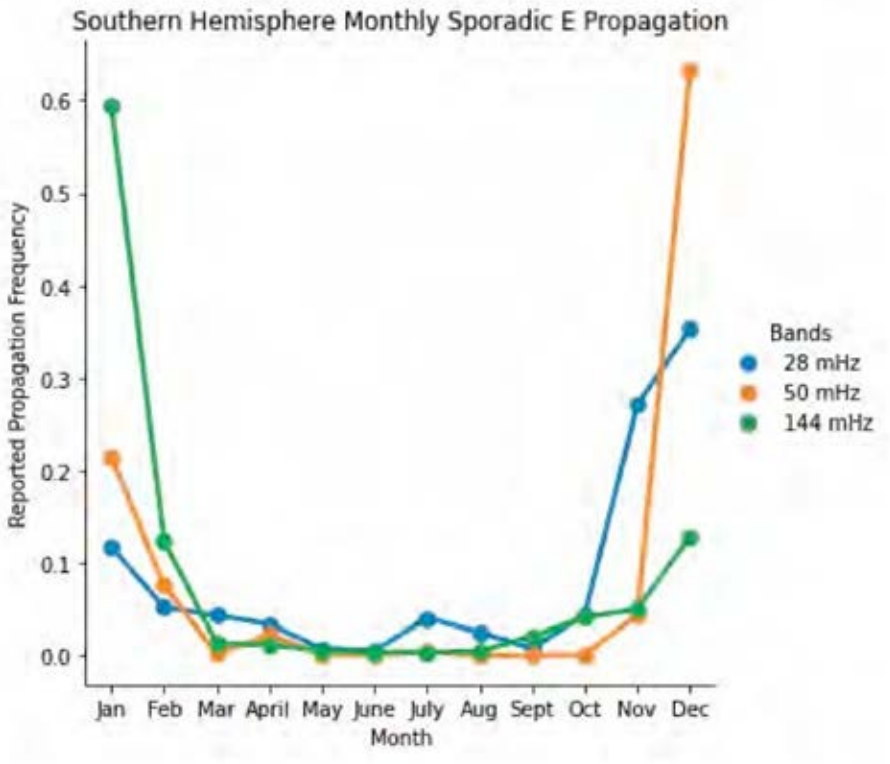


Figure 2. Southern Hemisphere Monthly Sporadic E Propagation

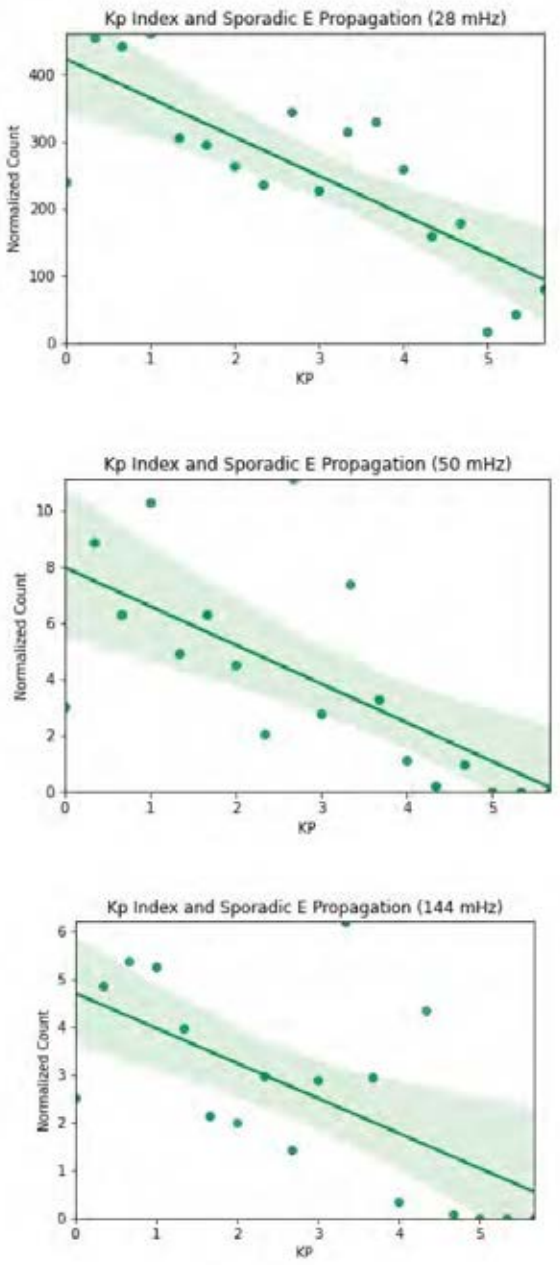


Figure 3. Kp index and Counts of Putative Sporadic E Propagation

In a final analysis of the relationship between Global Solar Indices and putative sporadic E propagation as seen in figure 3, there was not a strong relationship between F10.7 index and sporadic E propagation in the 2020 data set, which is also consistent with current literature. However, when I analyzed hourly Kp index and putative sporadic E propagation rate, there seems to be a negative correlation, with an R-Squared Value of 0.62 on 28 mHz, indicating a relatively strong effect, and an R-Squared Value of is 0.46 for Kp effect on 50 mHz and 0.40 for 144 mHz, which suggests a modest effect.

In conclusion, the putative sporadic E propagation in the WSPRNet spot records seems to be consistent with known seasonal variations of sporadic E propagation and corresponding geographic distribution, which suggests that these records provide a large number of observations that could be used to study sporadic E formation.

Exploratory data analysis also suggests that Kp index may be negatively correlated with recorded sporadic E propagation. However, further research is needed to determine whether the observed relationship between Kp index and sporadic E propagation is a simple correlation with seasonal changes or there is a causal relationship.

Note: An earlier version of this research was presented at the Hamsci WorkShop 2021.

References:

1.Shinagawa, H., Tao, C., Jin, H. et al. Numerical prediction of sporadic E layer occurrence using GAIA. Earth Planets Space 73, 28 (2021)

2.Taylor, J. (2010). WSPRing Around the World. *QST* November (2010), p. 30-32.

3.Whitehead JD (1989) Recent work on midlatitude and equatorial sporadic E. J Atmos Solar-Terr Phys 51:401

###

Donate to TAPR

TAPR is now participating in the AmazonSmile program!

When you shop using the AmazonSmile program, Amazon makes a donation to TAPR equal to 0.5% of the price of your eligible AmazonSmile purchases.

AmazonSmile is the same Amazon you know. Same products, same prices, same service.

Bookmark the TAPR AmazonSmile Program link:

https://smile.amazon.com/ch/86-0455870

That link takes you to a special login portal where you enter your normal Amazon credentials and get redirected at the same Amazon home page except there will now be a notice that you are supporting TAPR.

Other ways to donate to TAPR, email contact@tapr.org:

###

Four modern basic software and hardware tools for APRS

By Kenji Rikitake, JJ1BDX

I've checked out the article on PSR149 called "Back to the Basics of APRS" by David Dobbins, K7GPS. I would like to add four software and hardware tools I've been using for my recent APRS activities, which David did not mention in the article.

Direwolf https://github.com/wb2osz/direwolf

Direwolf is a versatile KISS TNC software modem for connecting audio and PTT devices to a transceiver, including digipeating and filtering messages, running on Linux, Raspberry Pi, and macOS. Direwolf is also capable of handling FX.25 error correction protocol and various modulation speeds for experimentation.

APRX https://github.com/PhirePhly/aprx

APRX is a routing software between APRS-IS and KISS TNCs, running on Linux, Raspberry Pi, and macOS. APRX is an excellent software for running stand-alone iGates with TNCs connected with serial/USB ports.

Mobilinkd TNC3

https://store.mobilinkd.com/products/mobilinkd-tnc3

Mobilinkd TNC3 is a small KISS TNC that can handle 1200bps AFSK and 9600bps GMSK modulation protocols and AFSK. TNC3 is configurable with dedicated apps on Android and iOS/iPadOS. TNC3 is accessible via the USB serial port wired connection and the Bluetooth serial port and has a build-in LiPo battery for portable operation. It nicely works with mobile transceivers with the 6-pin data ports and also with various hand-held transceivers.

PicoAPRS http://www.db1nto.de

PicoAPRS is a data-only battery-operational one-watt 2m FM transceiver for 1200bps AFSK AX.25 protocol and APRS, including a GPS receiver for time synchronization and positioning. You can operate the device as a stand-alone position reporter and an APRS message client, as well as a dedicated TNC-included transceiver with KISS protocol via the MicroUSB serial port. I've used the device in Osaka and Tokyo in Japan, and Stockholm in Sweden, making a lovely travel companion.

About the author

Kenji was first licensed in 1976 and started the packet radio activity in 1985. He was involved in the AX.25 networking with TCP/IP and Terakoya BBS system of Packet Radio User's Group (PRUG) until 1992 in Tokyo, Japan. During his life in Osaka from 1992 to 2020, his main interest shifted to internet networking in general and shortwave DXing. Since 2018 he has resumed activities of packet radio, and even after moving back to Tokyo in 2020, he occasionally experiments on APRS and other radio technologies. You can reach Kenji via email at jj1bdx@arrl.net *and on the website at* https://radio.jj1bdx.tokyo/ *as well.*

###

Power to go

By Bob Bruninga, WB4APR

While not a digital topic, everything we do needs power and hams should go nowhere without it. Over the last decade we have seen a drastic but mostly invisible transformation in our energy structure. Almost everything new runs on highly efficient universal power supplies. Large solar panels are 10% the cost of just a few years ago and the electrification of transportation places huge battery capacities at our disposal in our vehicles..

With modern LED lighting and EnergyStar rated appliances, the average grid-down power needs of a home in emergency conditions is well under 1 kW. Although a modern refrigerator might need a 1 kW inverter to start, the running current (not counting the defrost cycle) is on the order of 100 Watts or so. A well pump should be under 500W and operate on a very low duty cycle. As a result, the average emergency house power (250 W) can be on the order of about 6 kWh per day and simply provided from a cheap 12 V inverter from any hybrid or Electric Vehicle.

The battery capacity of the typical 250 mile EV (Chevy Bolt) is on the order of 64 kWh providing 6 kWh per day for ten days! On the other extreme, the typical hybrid (Prius) only has a battery capacity of about 1 kWh, but it has a 50 kW generator and gas tank capable of maintaining the battery charge for over a week without attention. Of course you should cut these estimates in half since the average EV or hybrid also has a typical

overhead drain on the order of 250 to 500 W which also has to be included in the load calculations.

This vehicle-to-home capability of EV's and hybrids does not apply to standard cars. Even with a 60 amp alternator, the actual current available at idle might only be 40 amps or about 400 W and without the automatic start/stop engine control the gas will be used very inefficiently. On the other hand, EVs and hybrids have 100 to 200 amp 12v converters that can run at full capacity maintaining the 12v battery at 13.8 volts as long as the system is ON.

So, put an inverter in your trunk and don't be left without power anywhere you go.

###

Write Here!

Your *PSR* editor is working on the next issue of *PSR* and hopes to find 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 wa1lou@tapr.org --- she can handle it!

The deadline for the next issue of *PSR* is January 15, so write early and write often.

###

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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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 (wa1lou@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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Secretary: Stana Horzepa, WA1LOU, wa1lou@tapr.org
Treasurer: Tom Holmes, N8ZM, n8zm@tapr.org

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