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NOVEMBER 2020

HAPPY NOVEMBER!

Annual Members Meeting and Election Results

The Annual Members Meeting was officially held on October 24th. The officers presented a sort of annual report of accomplishments during the last year. Of major note was that despite the influences of Covid-19, the organization is bigger and stronger than before the shutdown. Next was the election for 3 new directors to the Board. Voting started at the meeting and was expended online until Oct 30th. In the end, 25 members cast votes for the candidates. The new board members elected to two year terms are Eric Bradford, Lee Elliott, and Loren Montague. They will join Ryan Bibbey and Mark Pipes who are half way through their two year term. In the coming weeks, the Board will meet to select a Board Chair and appoint officers. We have some members who have expressed interest in several of the officer seats. If you are interested in doing your part to help run the organization please let a Board member know.

President's Corner

The coming year

Well we are all hoping that 2021 will be a better year for everyone. We have elected a new Board of Directors and they are looking for volunteer officers. Hopefully we can find volunteers who can put in some good hours of effort.

This could be a transformative period in Bridgewire's history. We have a good sized membership base and are financially secure. For the first time in our existence we have a solid foundation from which to build and expand the organization into a significant community organization. I'm not talking about just the maker community but rather the Reno/Sparks

community. We can become an organization that enriches the lives, knowledge, and capabilities of our society. If you can, please help us reach our potential.

Thank you,
Eric Bradford

Facilities Changes

Welding Shop Changes – Fees Implemented Starting in November there will now be a fee associated with any welding, plasma cutting, or oxy-acetylene use. Actually, there was always a fee, it was just poorly defined so no one seemed to pay. The fees are not arbitrary. They were derived from industry standard calculations for material costs. The fees will be $/ft. of weld bead you lay down. We expect this fee to pay for all materials used in the shop.

MIG Welder – New A few months ago the board approved a capital expense budget to upgrade the welding shop. In the last year we have had several pieces of equipment break which needed replacing. After studying several MIG welders, we determined that a midrange hobbyist machine was appropriate. Our new MIG welder is setup to operate with either Flux-Cored Arc Welding or Gas Metal Arc Welding. We also have a second tank of C25 gas to swap out when the primary tank runs out.

Plasma Cutter – New Plasma cutters are very expensive. We had been looking for months before we found a used plasma cutter at auction for a relatively low price. The Lotos plasma cutter is a hobbyist plasma cutter and should serve the community well. This brand seems to have a fair reputation, so we expect it to last for quite a while. There are electrodes and nozzles for purchase in the welding shop. Additionally, there are a few guides to help with straighter cuts.

Spot Welder - New We have a new spot welder which has been donated to us by member Tony Badzioch. None too soon. It is already being used to fabricate some sheet metal ducting for the laser cutter. This should be part of our welding shop demo nights. Additionally we will soon receive a quality box and pan brake for sheet metal. If you have a sheet metal idea in mind, these are significant additions to our growing sheet metal capabilities.

Grinders - Repaired You probably didn't know this, but we have 8 grinders/sanders dedicated to metals. They include 3 specialty tool grinders, 2 steel grinders, 2 all metal belt sanders, and 1 buffer/polisher. This last month we spent some time rebuilding a couple and improving the safety of all the grinders. They all now have attached signs to make it very clear what is permissible to grind on each machine. It is important to grind your material or tool on the appropriate grinder so that the wheels are not contaminated for function and safety reasons. It is important that no guards, tool rests, or shields are to be removed. If you need to remove anything to feed your work, then you need to find another tool to use.

WHO DUNNIT?

Inspector Policy is our house detective. He is always on duty looking for rules violations which disrupt the peace and fair maker environment. He lives by the maker credo "Be Excellent to each other". Each month he will ask for your help to identify a rules violator.

This month's case:

"Welding Spatter or Nodular life forms"

Last month the Inspector noticed a nodular deposit on the bench vise in the welding shop. What was it? He had recently read much about how the Mars rovers are looking for nodular deposits which could indicate life. He pondered if this could be evidence of a life form on the vise. Well, he was soon corrected by a wise welder and told that it was weld spatter that was not cleaned up.

This saddened the Inspector, because our Policy Manual clearly states in section 3.3.2 that we are all supposed to leave the place in the same or better condition after we use it. The inspector will grudgingly launch an investigation.

If you can provide any leads or know the culprit, please drop a note in the Who Dunnit / Scavenger Hunt box at the front desk.

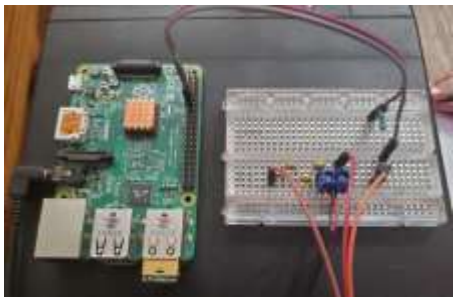
Inspector Policy

Jacob Smalser's Pager Project

I have a soft spot for tech that went out of style, especially tech I never had the privilege to use outside of work. POCSAG pagers, love them or hate them, can still be found used by medical and emergency responders. Cellphones may have made the use case of Pagers not as appealing to the general public however there is growing popularity with POCSAG Pagers in the Ham community.

DAPNET (Decentralized Amateur Paging Network) is a network operated by amateur radio nerds out of Germany. It consists of a decentralized server cluster feeding paging data to distributed transmitters (The thing we are building today). The most used frequency is 439.9875MHz however you can (legally) do this on other frequencies if you choose. It's preferred to keep this all on the same frequency because it benefits other DAPNET users so they don't need to reprogram their pagers when changing locations.

HOWEVER, it's more important to not walk on other transmitters so you'll need to see what frequencies are free first before blasting other people off the net. I first started using DAPNET with my Pi-Star (MMDVM) however being a 0.01w transmitter I wanted a little more range. DAPNET has a transmitter controller called UniPager which you can use with an RPi to control a 9k6 capable radio (Motorola GM300 for this write up). This application ties the RPi's GPIO with your target radio's PTT and you can pipe the data to the radio using



the RPi's audio jack. Below are the guides I used to complete this build however there were some differences when I tried this with the Motorola GM300.

Transmitter with 9600 Baud Data Transceiver

UniPager Installation

You'll need to register with DAPNET before you can use their service which requires an amateur license. To register you'll have to submit a ticket via their support page. More information about how to register can be found on their Wiki page which can be found in the link below.

DAPNET Wiki

UNIPAGER

The link above has a more complete guide on installing UniPager however here's what I did to install it on my RPi.

+----------+

$ sudo nano /etc/apt/sources.list.d/unipager.list

//Add these to unipager.list

deb http://db0sda.ampr.org/debian unipager main

deb-src http://db0sda.ampr.org/debian unipager main

$ wget -O - http://db0sda.ampr.org/debian/rwth-afu.key

sudo apt-key add -

$ sudo apt-get update

$ sudo apt-get install unipager

+----------+

After installing UniPager you'll need to configure the RPi's audio level so it's at 100%. You can use alsamixer via the terminal to accomplish this.

+----------+

$ alsamixer // Increase Audio Out to 100%, hit Esc key

// to exit

$ sudo alsactl store // Save Audio Settings +----------+

After installing UniPager it should automatically be running in the background as a service. It comes with a Web UI (RPi's port 8073) which you can use to configure your transmitter. Open up your favorite web browser

and enter in the RPI's IP address and port 8073 (Ex. 192.168.1.20:8073). Below are the settings I used for the Motorola GM300

-> Configuration

* Transmitter: Audio
* Master IP: dapnet.afu.rwth-aachen.de
* Port: 43434
* Callsign: (Your Callsign)
* Auth Key: (Your Auth Key)

-> Audio Config

* ALSA device: default
* Audio Level: 79
* Inverted: (Unselected)
* TX Delay (ms): 5

-> PTT Config

* PTT Method: GPIO
* GPIO Pin: 0
* Inverted: (Unselected)

IMG: UniPager Web UI Config

MOTOROLA GM300 CONFIG

I'm not going to lie, this next step is going to be a huge pain in the ass. Yes, the GM300 is a solid sub $100 25w UHF mobile radio however it was built during the 90's and the programming software requires MS-DOS.

To make matters more complicated the serial timing used to send and receive data from radio to computer is CPU based. In short, if your computer is too fast you're out of luck and you'll be out of sync with the radio. The good news is that you can use DOSBox to run the software and slow down the CPU's cycle rate to make it work. Below is the guide I used to make this work. Just a heads up it's still finicky and may not be consistent.

Motorola Radius GM300 Programming

Not all USB to serial cables are built the same and you may have limited success with what you have. I had to build my own programming cable using a FT232 and Cat5 Cable. Below is the schematic I used to accomplish this.

FT232 -> Motorola GM300 (RJ-45)

```
+-----------------------------------------------------------------+
|                                                                 |
|          FT232                                  RJ45            |
|          +---+  1N4148                        1 +-----+         |
|          |TXD|----|<---+       +-------- 2 |     |         |
|          +---+        |       |         3 |     |---+     |
|          +---+        |       |         4 |         |     |
|          |RXD|---------+-------+   +---- 5 |         |     |
|          +---+                    |     6 |     *---*     |
|          +---+                    |     7 |     |         |
|          |GND|---------------------+     8 +-----*         |
|          +---+                                              |
|                                                             |
+-----------------------------------------------------------------+
```

Nothing special is needed when you program your GM300, just create an analog channel for 25KHz FM at the desired frequency. The link below is a copy of the programming software I used. And again, this step is kind of a pain but with a little trial and error you should be fine.

Download: Motorola Radius GM300 V5

MOTOROLA GM300 PINOUT

Below is the pinout for the Motorola GM300 which is found in the back of the radio. The pins needed for this application will be the number 3 PTT, 5 Flat Audio TX, and 7 Ground.

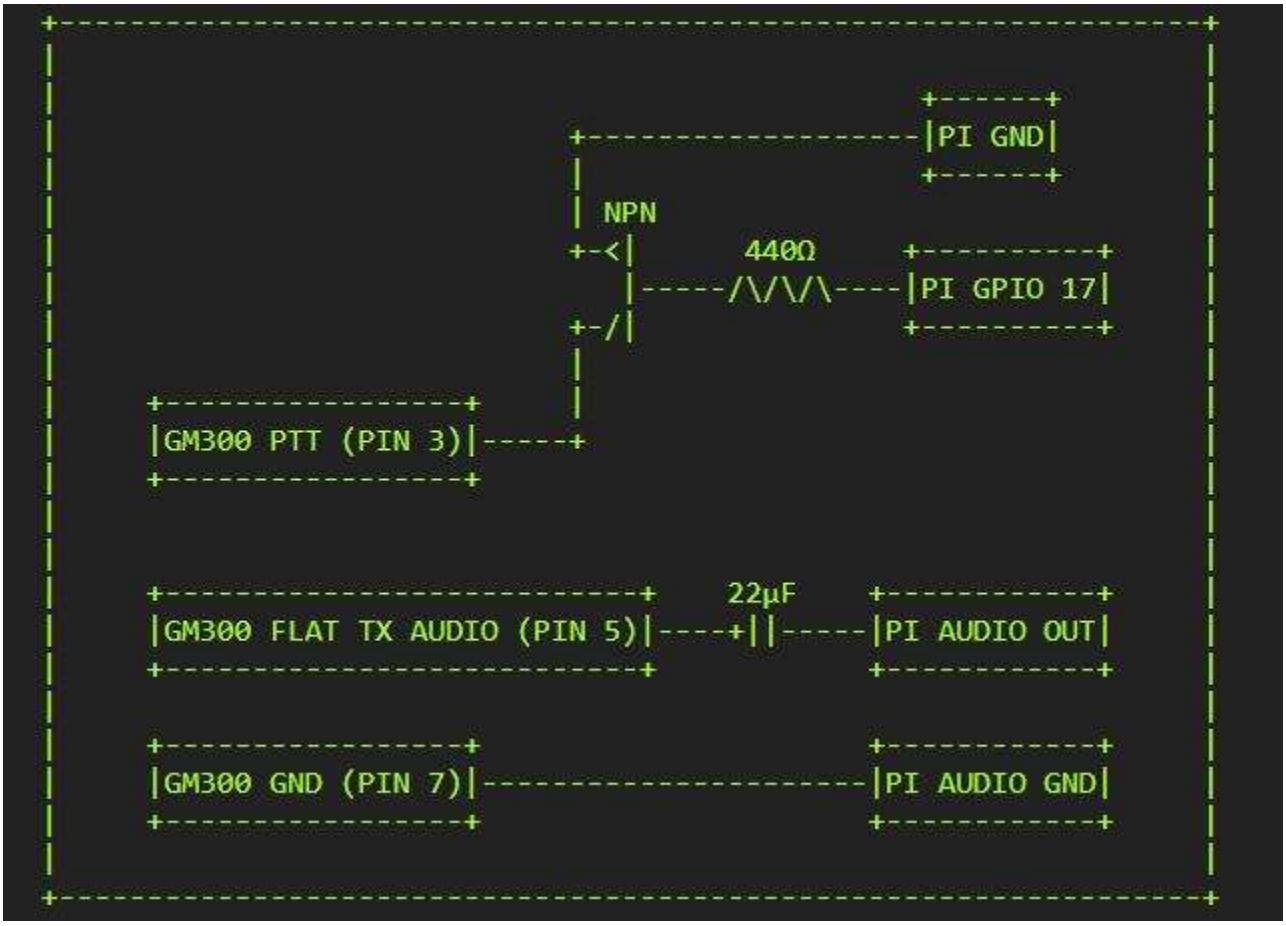
```
                    RADIO TOP
+---+---+---+---+---+---+---+---+
| 2 | 4 | 6 | 8 | 10| 12| 14| 16|
+---+---+---+---+---+---+---+---+
| 1 | 3 | 5 | 7 | 9 | 11| 13| 15|
+---+---+---+---+---+---+---+---+
                RADIO BOTTOM
              AS SEEN FROM BACK

    1 EXT SPKR            9 EMERGENCY ALARM
    2 MIC AUDIO IN       10 IGNITION CONTROL
--> 3 PTT                11 RX AUDIO OUT
    4 EXTERNAL ALARM     12 PROG I/O 12
--> 5 FLAT TX AUDIO      13 SW A+ SENSE
    6 PROG I/P 6         14 PROG I/O 14
--> 7 GROUND             15 INT SPKR +
    8 COS (PROG)         16 EXT SPKR +
```

RPi TO GM300 SCHEMATIC

With UniPager installed and your radio programmed it's time to connect everything together! Below is the schematic I used to make this work. Images of this can be found below the schematic.

RPi -> Motorola GM300



NEXTION TOUCH DISPLAY

There's also a Nextion touch display add-on built for the UniPager!

This is my first exposure to the Nextion display and I'm impressed by what they have to offer. These things work by sending and receiving UART messages to and from the RPi and gives you full control of your transmitter. Just a heads up, you'll have to flash the display with the software found in the UniPagerNextion repo to make this work. These displays have an ARM chip built in and are capable of running independently from the rest of the system. Below is a flow graph on how messages are sent to and from the UniPager application and Nextion display.

UniPager <-[WebSocket]-> **unipagernextion.py** <-[UART]-> **Nextion Display**

NEXTION HARDWARE

Below is the pinout needed to interface the Nextion display with the RPi's UART.

```
+-------------------------------------+
|      NEXTION      |       RPi       |
+-------------------------------------+
| VCC +5V (RED)    -->  PIN 02 VCC +5V |
| GND     (BLACK)  -->  PIN 06 GND     |
| UART_TX (GREEN)  -->  PIN 10 UART_RX |
| UART_RX (YELLOW) -->  PIN 08 UART_TX |
+-------------------------------------+
```

NEXTION SOFTWARE

+----------+

$ sudo apt install git python3 python3-websocket python3-serial

python-websocket python-serial

$ git clone https://github.com/rwth-afu/UniPagerNextion.git

$ cd UniPagerNextion/src

$ sudo bash ./install.sh

+----------+

The config file for UniPagerNextion can be found in etc/unipagernextionconfig.py. If you plan on controlling the display with the RPi's UART you'll need to update it so serialport = "/dev/ttyAMA0".

+----------+

$ sudo nano /etc/unipagernextionconfig.py // serialport = "/dev/ttyAMA0"|

// ctl-o to save

+----------+

You'll need to do some extra steps to configure the Rpi to make the display work. Below outlines what needs to be done.

+----------+

$ sudo -s // Do the following as root

$ echo "dtoverlay=pi3-disable-bt" >> /boot/config.txt // Disable BT

$ systemctl disable hciuart

$ nano /boot/cmdline.txt // Remove "console=serial0,115200"

$ echo "enable_uart=1" >> /boot/config.txt // Enable UART

$ exit // Exit root

+----------+

HACKS!!1

To get the unipagernextion.py application to work I need to change it from python3 to python2...

TL;DR serial.Serial didn't work for me in python3 so I compromised...

+----------+

$ nano /usr/local/bin/unipagernextion.py// Change #!/usr/bin/python3

// to #!/usr/bin/python

+----------+

FLASH NEXTION DISPLAY

+----------+

$ nano Nextion/nextion.py // Change PORT = "/dev/ttyUSB0"

// to PORT = "/dev/ttyAMA0"

$ sudo bash src/update_display.sh // Flash display firmware

+----------+

NEXTION SERVICE

To start the Nextion display service use the commands below.

+----------+

$ systemctl enable unipagernextion // Start at boot

$ systemctl status unipagernextion // Status check +----------+

More detailed instructions on how to install the software to control the Nextion display and the GitHub repo can be found here.

UniPagerNextion Wiki

UniPagerNextion GitHub

Trouble Shooting

If you're having any trouble sending messages you may have to adjust the volume from the Web UI to make this work with your setup. Inverting the signal may be needed as well.

PROJECT GALLERY

Phase 1: POC **Phase 2: Init Build & QA**

IMG: RPi Bread Board IMG: RPi Proto Board

IMG: GM300 Pinout IMG: Testing Before Installation

IMG: Test Page

Phase 3: Final Build **Phase 4: Added Touch Screen**

IMG: Outside 1 IMG: Nextion Touch Display

IMG: Outside 2

IMG: Back

IMG: Inside

CONCLUSION

OK! We just built ourselves a POCSAG transmitter and expanded the coverage of DAPNET! Go ahead and pat yourself on the back because you're doing God's work by making old tech fun again!

-- NotPike

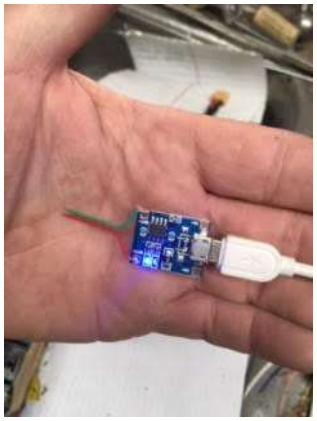
Here's a link to Jacobs website https://bad-radio.solutions/notes_unipager_gm300

Craig's LiIon Battery Tricks

Lithium Batteries
There are some lithium ion batteries in the electronics room and they are for Bridgewire members. These are mostly from old leaf blower and electric weed whacker packs that stopped working. This is usually because the BMS management board quits working and a set of two cells will gradually get under charged. Then the packs get thrown away. However it is not that hard to (carefully) disassemble the pack and rescue the other 18 good cells from the unit.
You can find the specs for the different types of batteries online, and these LGDs are rated at 1300 mAH.

These can be charged up to 4.2 V and discharged as low as 2.5 V. Their lifespan is probably rated at about 300 cycles, however you can greatly increase that number by not totally discharging the battery and not totally charging it to 4.2 V. Many people would charge to 4.1 V, and some sources say that the ideal charge is 3.9 V to get increased longevity.
While these are able to go as low as 2.5 V, I generally do not discharge them any lower than about 3 to 3.2 V.
Unlike NiCads, and NIMH cells these lithium ions do not have a memory, so you can leave them at any state of charge.
A whole world of information about batteries can be found online at batteryuniversity.com, and going through that stuff is like going back to school. Very interesting.
Be aware that lithium batteries are potentially dangerous and can catch fire if abused. They do not like being at a higher state of charge and get cranky. Also if you discharge them too low you can ruin the battery although with care they can sometimes be brought back to life. But they should never be trusted after that.

Also be aware that batteries do not like to be stored hot. Over 85°F they tend to lose capacity. And they probably don't like to get wet either just saying'…or rode hard.
Feel free to grab a couple of the cells to play with, and I also have some TP4095 lithium chargers, which you can plug into the end of your phone charger and they will bring your batteries up to about 4.2 V and then automatically turn off so that you do not overcharge them. If you are interested drop me an email and I will put one in your locker. The red light indicates charging and the blue or green indicates finished. When charged you should of course unplug the unit.

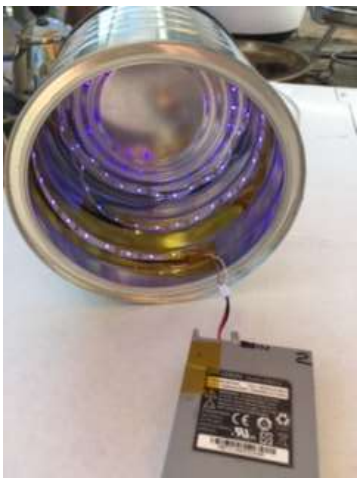


I also have some 4 cell battery holders that you can arrange in different configurations. If you put four in facing the same direction, then you have what is called a 1S4P grouping which is four batteries in parallel, which will give you 4 V at 5.2Amps, or about 20W in theory if fully discharged.
You can also hook them up in series which is called 4S1P, which will give about 16 volts fully charged.
The holders have eight tabs in the back which allow them to be soldered onto perf boards, and if you want to use them unsoldered, make certain that you push them onto a piece of thick cardboard or Coroplast so that you don't accidentally set down the pack on a piece of metal and short them out. That might get real exciting real fast!

Please note also that when you first put together a parallel pack of batteries the cells must be close to each other in voltage. Otherwise the higher cell will discharge into the lower and the cells may get very hot. I try to get them within 1/10 of a volt of each other. Then once in parallel they will automatically balance each other, and you may also gang charge a group of cells with your tp4095. It just takes a little bit longer is all?
I like to mark the positive ends of my batteries, so that it is easier to see the polarity is correct. Putting one in backwards is a serious rush.

If there is interest in this article I will post another one next month, and in the meantime here are pictures of some devices that I have built.

The easiest solution is to buy a battery bank box, which also will charge your phone and provides a flashlight. They are right around eight to $10 on eBay and they charge up from your wall wart.



This is a re-wired free flashlight from Harbor freight, and I have added two cells in parallel wired into the back. Pretty ugly but hey it's...ugly.

This is a coffee can with a strip of UV lights taped on the inside. It runs from a common modem back up battery pack and is a 3S system which is about 12 V. note you can also buy 5 V UV strips which will

run off a single cell. You can in theory disinfect currency, masks, credit cards etc. in this can.

Another 12 V modem pack which is running a cheapo harbor freight moto tool. This works great for deburring your batteries if you decide to pull the tabs off of them. Also good for cutting into your plastic battery holders to insert various things like voltage meters etc. A handy tool and it's totally portable.

This is a portable colloidal silver maker, using two .999 pure Silver dollar blanks along with distilled water and a modem pack. When the water turns very faintly light yellow then I consider it done. Colloidal silver is claimed to be a disinfectant, and some people use a few drops to cure sore throat, clean hands, etc.

Another modem pack built as a clip on flashlight with a board of 15 LEDs glued onto it. Pretty nice at night because it lets you be hands-free. Clips right onto your belt.

Here's a flashlight built into a four cell battery holder. This is a 1S3P system running a six piece LED board at about 4 V. This is a remarkably bright LED board for 4v, and I have a few extra of these if you want one. I used the Moto tool to cut out for an on/off switch which makes it fairly convenient to use.

This is a remarkably ugly and ill-designed tool using a piece of nichrome wire for cutting plastics and foam. It runs fine at 1S, but could probably run at 2S or 3S.

This is a portable battery capacity tester (ZB2L3) which I will talk about next month and it's hooked into a powerfully bright LED which draws about 0.9A when on and drains a single cell very quickly. And it gets hot hot hot fast fast fast, not something you want to keep on for a long time. It will almost blind you if you look at it it is so bright. Yes I have a couple extra of these too.

This is a Peltier junction. These are 12v devices used for electric portable coolers that plug into your car's cigarette lighter. They are grossly inefficient, produce a lot of heat, and will drain your car battery if you forget. You need to attach the hot side to a heat sink to keep the device from burning out. The good news is they also work on lower voltages. Here is photo of 4v running my red-beer cooler. They also work well as a hand-held muscle cooler/warmer and for sprains and owies. Just hold the leads onto a battery as shown and with your other hand place it on the sore muscle to either cool or heat it. Works quite well and is portable. Pay attention to your battery voltage level because this thing will suck up the juice and drain your battery.

Finally my very favorite. This is called an Anti-Masker Deterrent Device. A 12 V very powerful fan which also works nicely running off of a 2S 8 V pack. When someone without a mask invades my space I plug this thing in and point it at them. If they don't get the idea right away then I'll take a pinch or two of cayenne snuff and start sneezing. I think this will deter most anti-maskers, and the materials to make the cayenne snuff are still at Bridgewire in a plastic container in the kitchen as far as I know. Oh, yeah! Another LiIon use, portable grow light.

Thank you, stay safe

ARTICLES ALWAYS NEEDED!

The Newsletter

Things are looking up for the Bridgewire Newsletter, we're getting more and more interest in submitting articles, making the BWNL more interesting and relevant than ever. Thanks to Eric, Jacob and Craig, for contributing to this month's issue. If you have an article in mind or just a particular subject that you would like to see in the newsletter please email your entries to Lance, at lance@ipc-solar.com .

EDUCATION HAPPENINGS

Embedded Systems Group: Every Tuesday of the month with lessons in soldering, basic circuitry and electronics projects. We are restarting this group. We plan to have a meeting every week during the summer. This would be the place to learn electronics and upgrade your knowledge. Projects will be presented every meeting.

Bridgewire Classes and Workshops.

We offer a varying array of classes and workshops from month to month which can be viewed in our Calendar.

FINAL NOTES

Clean up for the cleaning crew?

We're back! And strict hygiene rules are in place. It's important that we pay attention to our workspace and be sure to consider the other members who come after us. Bridgewire's industrial cleaning service will again be doing a terrific job of keeping the shop tidy and dust free. We can all help them focus on the deep cleaning aspects of their job by keeping work areas organized and sanitized and cleaning up after ourselves. Let's not forget that Bridgewire is a co-operative facility that relies on member participation to maintain the facilities while keeping an affordable fee structure. This service frees us to spend more time on infrastructure issues. There's plenty of need for repair and maintenance of the tools and equipment.

New Members

Bridgewire is proud to welcome 3 new members and here they are:

Luke Davis

Sam Gerow

Zeb Stecker

BRIDGEWIRE CALENDAR

Bridgewire Calendar
November 2020

NOV

Mon	Tue	Wed	Thu	Fri	Sat	Sun
	27	28	29 6 pm - 9 pm Open House Night	30	31 Halloween	1 Daylight Saving (End
	3	4 6 pm - 7 pm BW Officers Meeting 7:15 pm - 8:15 pm BW Board Meeting	5 6 pm - 9 pm Open House Night 7 pm - 9 pm Metal Shop and Welding	6	7	8
	10	11 Veteran's Day	12 6 pm - 9 pm Open House Night 7:30 pm - 9 pm Laser Cutting & Etching	13	14	15
	17	18	19 6 pm - 9 pm Open House Night 6:05 pm - 8:05 pm Wood Shop	20	21	22
	24	25	26 Thanksgiving	27	28	29
	1	2 6 pm - 7 pm BW Officers Meeting 7:15 pm - 8:15 pm BW Board Meeting	3 6 pm - 9 pm Open House Night 7 pm - 9 pm Metal Shop and Welding	4	5	6

BELOW Click on “Calendar” to go to the Bridgewire calendar with interactive event details.

ALL MEMBERS, If you would like to add an event. Email us at info@bridgewire.org or click on the button below the calendar to schedule your event with details and contact info. The new event will be approved by an officer or director to make it show up. Your events can be any project you want to share or get help with. Add Event

Calendar