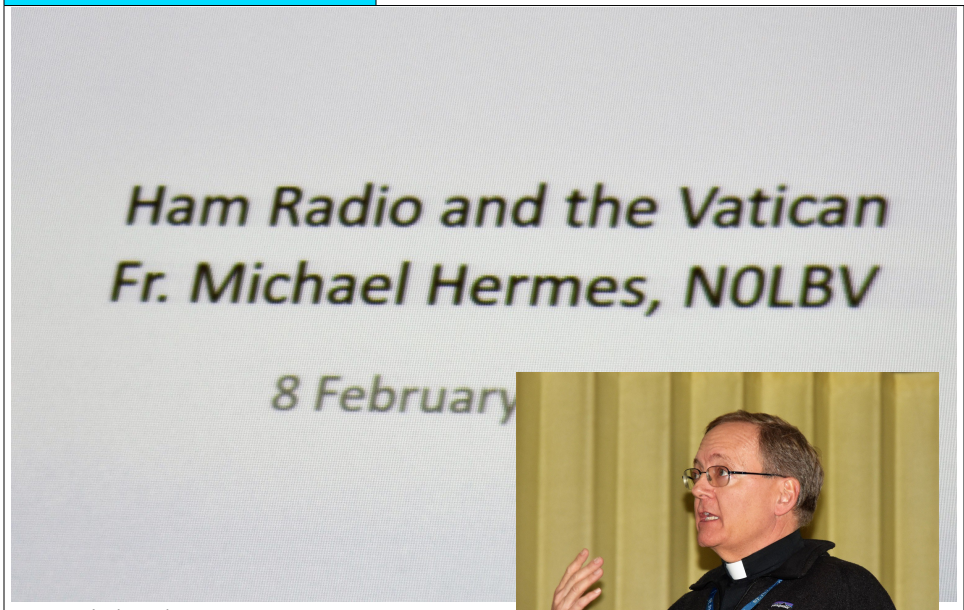
JOHNSON COUNTY RADIO AMATEURS CLUB, INC.
P.O. Box 93
Shawnee Mission, KS 66201

FEEDBACK

MARCH 2019



Fr. Michael Hermes, NØLBV now of St. Paul Catholic Church in Olathe, told the club about his experiences as a ham radio operator/seminarian at the Vatican.

"Van" Van Daveer, KØHCV told the club about changes to Yaesu's digital WIRES-X software capabilities.

MARCH MEETINGS

***March 8** -- Can You See RF? A visual observation of standing waves.*

***March 23** – Grounding and Bonding - Bill Brinker, WAØCBW*

The Johnson County Radio Amateurs Club normally meets on the 2nd and 4th Fridays of each month at 7:00 PM at the Overland Park Christian Church (north entrance), 7600 West 75th Street (75th and Conser), west of the Fire Station.

Much of the membership travels to the Pizza Shoppe at 8915 Santa Fe Drive for pizza buffet and an informal continuation/criticism/clarification of the topics raised at the meeting ... or anything else.

LEAVE THE CHURCH, TURN RIGHT (WEST) ON 75TH. TURN LEFT (SOUTH) ON ANTIOCH. TURN RIGHT (WEST) ON SANTA FE. THE PIZZA SHOPPE IS JUST PAST THE SONIC ON YOUR LEFT.

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-> FEEDBACK <-

A publication of the
Johnson County Radio Amateur Club, Inc.

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First Time Visitors During February

Tom Apalenek - WA2IVD

William Cunningham - KDØWEX

Richard Mullin - WAØTSH

Troy Wilson - KEØUDM

PRESIDENT'S CORNER

February has been a cold and snowy month. March looks no better. With the sun rising earlier each day and setting later in the evening we know we will be moving out of winter weather.

We're getting an early start with Field Day 2019. Jay Greenough, WJØX has contacted the park. It looks like we are a go with the same location again this year. One of our April meetings will be a planning session for that evening's program. As in past years we will start Field Day set up on Friday afternoon. As Jay would ask, "When is Field Day?" June 22-23. Mark your calendars.

We are looking into having several hands-on building programs this year. At the present the first may be a hand- held radio direction-finding kit.

– Bill Gery – WA2FNK

Johnson County Radio Amateurs Club - February 8, 2019

Meeting Date: Friday February 8, 2019. The meeting Started at 7:00PM.

Attendance: Self introduction with name and call sign. 30 signed the check in sheet. This was followed by the Pledge of Allegiance.

There were No Minutes from the last meeting to read as they were not available.

The Treasurer's report, as follows, was read and accepted unanimously.

Cash on Hand	$ 113.00	Repeater Operating Reserve	$ 1,210.83
Checking Account	$ 182.76	Memorial Fund	$ 310.00
Savings Account	$ 10,989.66	Active Members	140
PayPal Account	$ 0.00		
Total	$ 11,285.42		

Old Business:

- We welcomed all 1st time visitors to the meeting.
- Repeater Update – All are working well.
- Club Kit Building Project – Jaimie Charlton, AD0AB brought in to show a Direction Finder Kit as a possible assembly project.
- Field Day 2019 – Jay Greenough, WJ0X is checking with Shawnee Mission Park to see if last year's location, the Hutton Farm, is available. As a note, most of the buildings have been torn down.
- Ensor Auction in the Fall. Start saving items to donate.
- Hats with the Club's logo are available for $21.

New Business:

- None.

Reports:

- 6 m – NR.
- 10 m SSB Roundtable – NR.
- 40m SSB Roundtable – 3 or 4 participated on February 6.
- Fusion Digital 440 net – 20 Check-ins on February 6 and 20 Check-ins on January 30.
- 2m Wheat Shocker net – 25 Check-ins on February 7 and 20 Check-ins on January 31.
- HF Activity – None.

Announcements:

- JoCo ECS Protocols and Weather Spotter Training Saturday February 16.
- See Larry's List for upcoming Events.

Business meeting adjourned at 7:32 PM.

Program:

- The Program for this evening was a presentation on "Ham Radio at the Vatican" by Fr. Michael Hermes, N0LBV - St. Paul, Olathe, KS.

Submitted by Ted Knapp, N0TEK, Secretary.

Johnson County Radio Amateurs Club - February , 2019

Meeting Date: Friday February 22, 2019. The meeting Started at 7:00PM.

Attendance: Self introduction with name and call sign. 30 signed the check in sheet. This was followed by the Pledge of Allegiance.

The Minutes from the February 8, 2019 meeting were read and accepted unanimously.

The Treasurer's report, as follows, was read and accepted unanimously.

Cash on Hand	$ 103.00	Repeater Operating Reserve	$ 1,226.83
Checking Account	$ 595.31	Memorial Fund	$ 310.00
Savings Account	$ 10,990.96	Active Members	142
PayPal Account	$ 61.54		
Total	$ 11,750.81		

Old Business:

- We welcomed all 1st time visitors to the meeting.
- Repeater Update – All are working well.
- Club Kit Building Project – Still collecting information on potential kits.
- Field Day 2019 – We have permission to use the Hutton Farm at Shawnee Mission Park again this year once we present the Park with Proof of Insurance.

New Business:

- None.

Reports:

- 6 m – NR.
- 10 m SSB Roundtable – 4 or 5 participated on February 21.
- 40m SSB Roundtable – NR.
- Fusion Digital 440 net – 16 Check-ins on February 20 and 12 Check-ins on February 13.
- 2m Wheat Shocker net – 14 Check-ins on February 21 and 11 Check-ins on February 14.
- HF Activity – None.

Announcements:

- See Larry's List for upcoming Events.

Business meeting adjourned at 7:20 PM.

Program:

- The Program for this evening was a presentation on "Yaesu's New PDN (Portable Digital Node) Mode of Operation in Wires-X" by Harold "Van" VanDaveen, K0HCV.

Submitted by Ted Knapp, N0TEK, Secretary.

A Hambone Story - Jaimie Charlton, ADØAB

Hambone and Too Many Meters

Our story opens in the ham shack that is part of the frat house to which Hambone belongs. The boys, all techno-nerd friends of Hambone, are ogling the new software defined radio the fraternity bought with a generous gift they received. The blue glow of the transceiver's waterfall screen reflected in the boys' adoring eyes as they petted and praised their new toy as only nerds can. That is, until one of them connected an equally new SWR meter to the antenna coax, switched the radio to 30 meters and made an observation.

"Hambone, look here. I hooked this SWR meter up to our feedline and it is showing almost 2.1:1 SWR," observed Derek, one of several members who are also hams. Not all of them are.

"So," replied Hambone. "That's not too bad."

"Yeah, I know, but the SWR indicator on the transceiver shows a much lower SWR. It's kinda hard to read, but it looks like about 1.3:1. Isn't that a problem? Shouldn't both meters read the same?"

"Oh, that's because you have an impedance mismatch at the external meter," pronounced Greg, a ham with clearly more radio experience than the younger boys. "I had a problem with my 80 meter antenna giving an SWR of well over 2:1 and I fixed it by adding an extra length of coax. I added about twenty feet and the SWR dropped to nearly 1:1."

"Yeah, I read someplace that coax can actually act like a transformer and match impedances," added Hambone. "But I'm not sure what impedance should be matched to what."

"Let's try it!" said Greg. "There's some coax jumpers with connectors over there."

"I don't see how that will help," said Jim. "Isn't SWR caused by a mismatch between the coax and the antenna?"

Excited by the prospect of a quick fix for the not yet defined problem, the boys eagerly set to inserting a coax jumper between the SWR meter and the antenna feedline. Jim's comments went unnoticed.

"Well, that didn't make much difference. The SWR meter still reads about 2:1 but the transceiver output power dropped from 85 watts to about 70 watts."

Further tapping his sources of misinformation, Greg explained. "You see, the jumper helped, it's just not quite the right length. It fixed most of the antenna mismatch so the transceiver now shows the real power going to the…"

"Look!" Jim shouted, interrupting Greg. "I can change the SWR just by touching the jumper connector. I put my hand on it and the SWR goes down. I take my hand off, the SWR goes back up."

"That's amazing!" observed Hambone. "Jim has the magic touch. We just need him to keep his hand on the connector and our SWR will be fine. That's a lot easier than going out in the cold and messing with the antenna."

"I'm not sure I like that idea," muttered Jim. "Why do we care about SWR anyway, the radio works fine?"

"That's easy," said Greg. "The SWR indicates power that the antenna rejects so it doesn't become radio waves. It reduces our signal a lot."

"I always thought that a SWR over 2:1 damaged transceivers. That's why they fold back their output or even shut off when the SWR is high," said Hambone.

Although Derek had been quiet up until now, he suddenly spoke up. "These are all nice guesses, guys, but nobody has explained what's going on with the two readings."

"Hi boys," came a new voice from the doorway. "Is Hambone in here?"

"Hi Unck, I'm over here.

Hey guys, this is my Uncle Elmer. He can explain what's happening."

"I don't know about that," said Elmer. "But what's the problem."

Derek proceeded to explain and demonstrate the two SWR readings and summarize the discussion thus far. "So, Mr. Elmer, what do you think?"

"I think you guys are making a mountain out of a mole hill." Elmer replied and then continued without waiting for a response.

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from HAMBONE on page 5

"You've got this high-end transceiver here with very sophisticated circuitry to protect it from excessive reflected power. Its meter is not finely calibrated because it is not an antenna analysis tool, its purpose is just to show you how close you are to exceeding the safe limit for reflected power. Safe for the transceiver, that is."

"But what if the separate SWR meter is correct, doesn't an SWR of 2:1 mean we are throwing away a lot of power?" asked Greg.

"Not as much as you probably think. Here's how you calculate it."

"Oh no, here comes the math," moaned Hambone recognizing that his uncle was drifting into his professorial mode.

Pulling a pen from his pocket and grabbing a pizza box, Elmer began to write on the inside cover.

"You all know that SWR or Standing Wave Ratio is nothing more than an indication of how well the impedance of the antenna matches the characteristic resistance of the coaxial cable feeding it. Don't you?"

Heads nodded in agreement, some more than others.

"If you are using 50 ohm coax like RG-8X and the antenna has an impedance of 50 ohms, resistive, at your operating frequency, then your SWR will be 1:1. That means all the power that reaches the antenna goes into it. But, if the antenna's impedance is greater or less than 50 ohms, some of the power will be reflected back down the coax to the transmitter."

"That's what I mean," said Greg. "Our transmitter is putting out 100 watts. An SWR of 2:1 says that half the power is reflected back and that power is gone forever."

"Maybe not. Be still and learn," said Elmer as he continued to draw on the box cover. "SWR is really short for VSWR which stands for *Voltage Standing Wave Ratio*. If you have any reflected power, the voltage will vary along your transmission line. If you are using twinlead for transmission line, it's easy to measure this voltage variation. Just connect a voltmeter at various places along the line. With coax, it's harder because you have to get through the shield without shorting it to the center conductor.

Anyway, the VSWR is simply the highest voltage you read divided by the lowest voltage."

"I think I get it," said Jim. "Professor Flask said something like this in class, but I didn't really understand it. He said that a VSWR greater than 1:1 means that there is an impedance mismatch some place. What's impedance got to do with the voltages you're talking about?"

"We are really saying the same thing," said Elmer. "Voltage and current are related to resistance, or impedance, through Ohm's Law:

I = E/R where I is amps, E is volts and R is ohms."

"You mean that old formula from our DC classes applies to RF, too?" asked Jim.

"Yes, it does. It's one of the universal relationships in all of electronics. It's not just for batteries and resistors.

In fact, maybe I should suggest to the Professor that a good homework assignment for you guys would be to derive the relationships between voltages, currents and impedances in transmission lines."

"You don't need to do that," said Jim. "Your explanation is very clear."

"But what about power?" asked Greg, anxious to be vindicated.

"Okay, okay, let's calculate the amount of reflected power a VSWR of 2:1 represents. You've already covered this in your engineering classes, but we can go over it again," said Elmer.

"We start by defining a *reflection coefficient*, K.

K, in general, is the reflected voltage divided by the applied, or incident, voltage,

$K = V_{reflected}/V_{incident}$

But because of Ohm's Law, we could also write K as:

$K = (Z_1-R_0)/(Z_1+R_0)$

Where Z_1 is the antenna impedance and R_0 is the coax characteristic resistance.

Either way, that means K can be a complex quantity between -1 and +1 with K=0 indicating a VSWR=1:1.

But to keep things simple, I'm just using the magnitude of K which is written |K|.

This is a handy number because it turns out that:

(1) $VSWR = (1+|K|)/(1-|K|)$

see HAMBONE on page 7

from HAMBONE on page 6

And since power is proportional to voltage squared:

(2) $P_{reflected}/P_{incident} = |K|^2$

These two formulas are pretty slick because they allow us to find the reflected power for any VSWR," said Elmer.

"First we use formula (1) to find |K| for a VSWR of 2;

$2 = (1+|K|)/(1-|K|)$

Solving, that gives $|K|=0.33$

Then we plug that number, and the transmitter's 100 watts for the incident power, into formula (2) and solve for $P_{reflected}$;

$P_{reflected}/P_{incident} = |K|^2$

$P_{reflected}/100w = 0.33^2 = 0.109$

$P_{reflected} = 10.9$ watts

This means if our transceiver is putting out 100 watts into a VSWR of 2, the reflected power is only 10.9 watts.

In other words, our antenna is accepting 89.1 watts."

"Still," argued Greg. "I bet that lots of dB of loss."

"Let's see," said Elmer. Plugging the numbers into the formula for decibels:

dB = 10Log (89.1/100)

dB =-0.5 dB

Half a dB, not much loss."

"But doesn't the reflected power get absorbed by the transceiver and do some damage?" asked Derek.

"Not necessarily. I don't know about this transceiver, but the output impedance of many solid state transmitters is much lower than 50 ohms. So, the reflected power hits this low impedance and is reflected right back towards the antenna.

I've got to get going now. I hope that explains what's happening with your transceiver and SWR.

By the way, Hambone, I came over to tell you your mom is looking for you." With that, Elmer headed for the door.

"Just a second," said Jim. "Why did the SWR change when I touched the connector?"

"It appeared to change because you have common mode current flowing on the *outside* of the coax shield. It's kind of a weird effect, but happens when you connect an unbalanced cable like coax to a balanced antenna like a dipole. It's easily fixed with a common mode current choke or just coiling up your coax."

"One more thing," asked Jim. "Why did adding that long jumper reduce the transmitter's output?"

"I can't say for sure without some measurements, but because you have reflected power, the jumper acted like a transformer and changed the impedance seen by the transmitter to a value the transmitter can't match very well. The effect was reduced output power.

I've really gotta go, I'll see you guys later."

"Wait, Mr. Elmer! What should we do about the two different SWR readings?" Shouted Derek.

"Well, I would take the SWR meter to the next hamfest and sell it. There's an old saying, I think it's called Segal's Law, 'That the man with one watch always knows what time it is, but the man with two is never sure.' I Think that might apply to SWR meters, too."

Smiling to himself, Elmer left the building.

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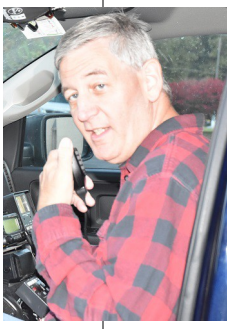
A Super-Powered Go Box -- Tom Wheeler, NØGSG

A Go Box is a great build project. In the last installation we talked about the logistics of building such a device. The criteria included portability, operability, and reliability. The Go Box you'll see here is an effort to improve operability on the HF bands given more challenging propagation conditions. This Go Box was used by the Alternative Energy (Solar) team during the 2018 JCRAC Field Day (turned down to 150 watts output, of course). It's more extreme than the usual portable ham station, but we wanted bragging rights to be able to operate 500-watts from solar-power.



The design parameters for this box are as follows:

1. Portability - The Go Box must be transportable by a single person and weigh less than 40 pounds if possible.

2. HF Operability - The station must be capable of 500 watts PEP (peak envelope power) on all HF bands. CW, RTTY, and SSB modes should be built in, along with spectrum scope capabilities. Antennas with up to a 5:1 VSWR should be useable on the ham bands.

3. VHF and UHF Operability - The station must be capable of FM and Fusion (C4FM) modes with 50 watts output and GPS/APRS capabilities on these bands.

4. Operability - The station must operate from 12-15 volts DC in the field or 120 volts AC from the grid and provide full HF, VHF, and UHF output power regardless of power source.

The equipment chosen for the Super-Powered Go Box is as follows:

- ICOM 7300 all-mode HF transceiver. This popular unit has stellar receiver performance, 100 watts PEP output out of the box, a live-view spectrum scope for monitoring band activity, and built-in ability for RTTY decode. (Sending RTTY requires a computer terminal). Weight: About 10 pounds. Receive current draw: 0.8 A (800 mA). Transmit current draw: 22 A maximum on signal peaks @ 100 w PEP output.

- YAESU FTM400 XDR VHF/UHF transceiver. This unit provides VHF and UHF capabilities, along with built-in APRS capability. It has an internal GPS that is both fast (< 2 minutes to satellite capture) and sensitive (can receive satellite signals even within a building). Weight: About 5 pounds. Receive current draw: 0.7 A (700 mA). Transmit current draw: 8 A maximum.

- Ameritron ALS-500 HF linear amplifier. This unit boosts the output of the HF transceiver by 10 dB to attain the 500 watt PEP level. The drive level required from the HF exciter (IC-7300) is around 50 watts to get full output from this unit. Weight: 7 pounds. Receive current draw: 0.05 A (50 mA). Transmit current draw: 75 A maximum on signal peaks @ 500 w PEP output.

- AC power supply. A power supply that can transfer enough energy to operate all the equipment (especially the HF transceiver and linear amplifier) and yet fit within the Go Box enclosure is not an off-the-shelf affair. MFJ Enterprises sells the MFJ-4275MV, which is a great supply, however, this supply won't fit into a Go Box - - it's way too big to fit into a reasonable-sized box (5.5" tall, 9.5" deep, 9.75" wide). It will not fit onto the same 19" shelf as the ALS-500 amplifier. A custom AC switch-mode power supply (SMPS) was constructed to meet the AC supply needs. The custom SMPS weights 8 pounds and measures 5 x 7 x 4.5" (H x W x D). It's built by strapping two Mega Watt S-400-12 supplies together in tandem and adding additional protection and filtering. As a bonus, it costs $100 less to build the custom power supply than purchasing the MFJ-4275MV. This power supply will be detailed in an upcoming article.

The total approximate weight of the equipment is 30 pounds. The heavy-duty wooden 19" rack enclosure chosen weighs 15 pounds, giving a total weight of 45 pounds for this particular Go Box--not light by any means, but still easily transported.

The Box

Portable rack enclosures are most commonly 19" wide inside and typically 14" to 30" in depth. The term "6U" refers to the height of the rack's mounting rails; a 1U component has a maximum height of 1.75", a 2U

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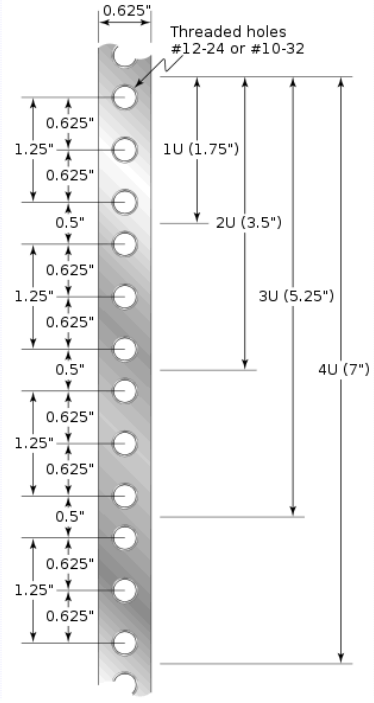
from GO BOX on page 8

component may be up to 3.50" high, and the chosen 6U rack has about 10.5" of vertical space to work with. The figure below shows how the this sizing system works.

Server Rack Rail Dimensions. (Retrieved from Wikipedia at https://en.wikipedia.org/wiki/File:Server_rack_rail_dimensions.svg).

The components were mounted using two 19" rack shelves within a 6U Road Runner Deluxe Effects Rack (Guitar Center SKU #12747419100 61103128). This is a heavy-duty wooden portable rack enclosure that is built like a tank (it weighs 15 pounds empty). Don't skimp on the enclosure--you'll regret it the first time your Go Box is dropped or bumped.



The electronics is divided into two 19" rack shelves. The top shelf holds all the communications gear, while the bottom shelf houses the ALS-500 and power supply. This allows the bottom shelf to be easily swapped out as a unit if so desired.

The components are bolted to the metal shelves using the mounting brackets provided by the equipment manufacturers. Metal rack shelves are supplied "blank." This means you will have to position the equipment on each shelf and careefully mark and drill the mounting holes for each piece of gear. Make a paper template first if this makes you nervous.

The custom power supply is within the two silver boxes on the lower-right. Attached to the front of the power supply is an inexpensive LED voltmeter that gives a positive indication of how the power is holding up. An AC line power switch is visible between the supply box and power amplifier. The DC voltage is deliberately set to 14.6 volts--Ameritron recommends the higher voltage for best performance of the ALS-500.

As you can see, the chosen equipment pretty much fills up this Go Box, and there is still plenty of room for ventilation and addition of external speakers for the two radios.

Power Supply and Linear Amplifier Tray

The power supply and amplifier tray is shown in the photo on the next page.

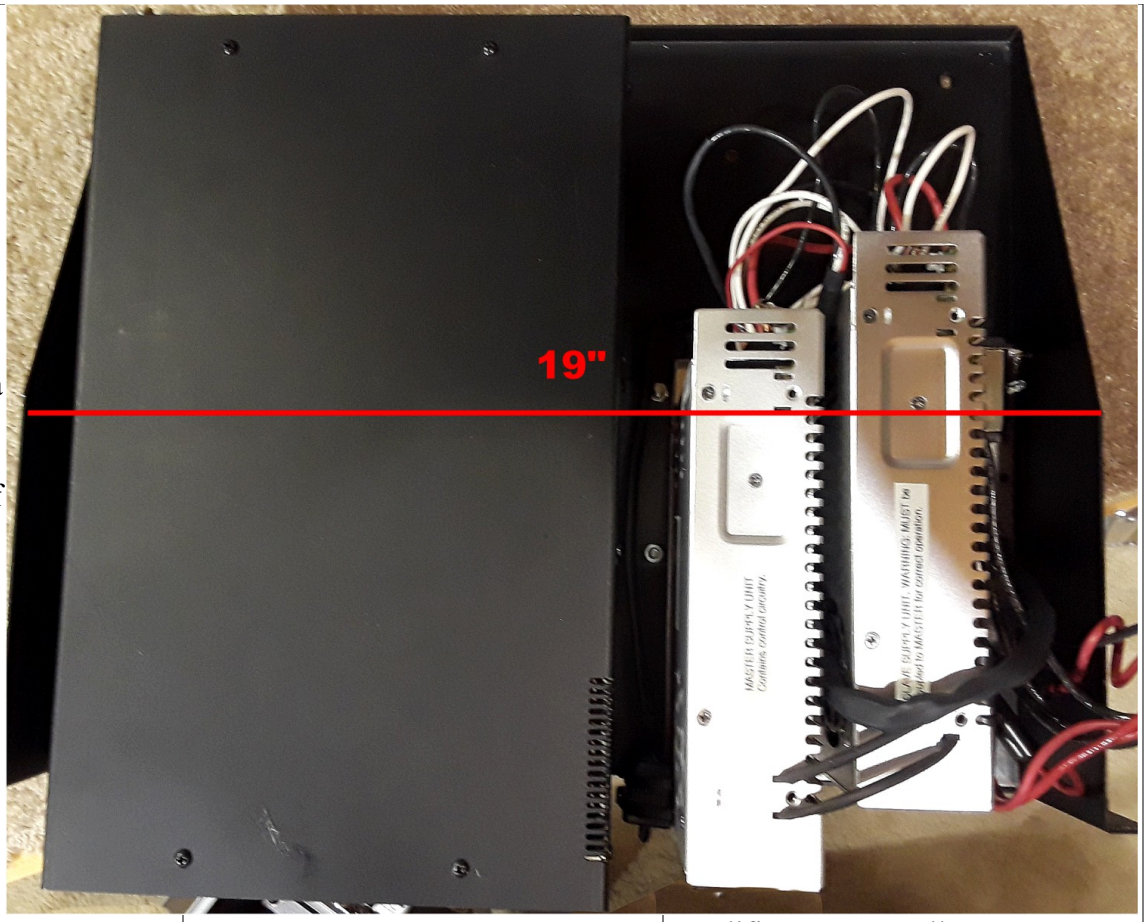
It's a tight fit on the bottom shelf. It took several tries to determine how to fit the parts in, and overall things worked out well. The only trouble is minor - - the warm air discharge of the left-hand power supply module lines up with the cool air intake of the ALS-500. A diverter on the warm air output will fix that for the immediate future. It would be better to rebuild it and simply

see GO BOX on page 10

from GO BOX on page 9

turn the supplies around so that warm air discharges to the right.

It's hard to see from the photo, but there is actually plenty of room on the shelf for a 600 watt antenna tuner. A tuner is absolutely necessary if the Go Box will be operated into anything but resonant antennas. The tuner has not yet been installed in the photo. A tuner such as the MFJ-994BRT automatic remote tuner, measuring 9x3x14", will fit above the linear amplifier with the fabrication of appropriate mounting brackets. You'll note that this arrangement will not block any ventilation openings on the amplifier (the vents are on the side).



Power Supply Connections

This Go Box uses Anderson PowerPole connectors for the DC connections Keith, KEØAEP, did for his own Go Box. However, no patch panel (such as a Rig Runner) has been provided--primarily to keep the space behind the radios as open as possible. Because KEØAEP and I both use ARES standard PowerPole connections, we can interchange equipment connections easily in the field in the event the need arises.

The power connections within the box consist of the following:

- Power for the IC-7300 HF transceiver (single 45A PowerPole)
- Power for the FTM-400 VHF/UHF transceiver (single 45A PowerPole)
- Power for the ALS-500 amplifier (two 45A PowerPoles)

To operate the Go Box from 120 volts, the radio and amplifier DC inputs (with PowerPoles) are simply connected directly to the four available PowerPole outputs on the power supply. The ALS-500 amplifier requires two 40A-capable connections (two 45A PowerPoles are used - the amplifier actually has two DC power cords), and each individual radio uses one 20A connection (45A PowerPoles are again used).

When operating from a battery or other external 13.8-volt source, the DC inputs to the ALS-500 linear amplifier are manually disconnected from the power supply and connected to the external 13.8-volt source. Either of the free power supply outputs is then connected directly to the 13.8-volt source to power the two radios.

The custom power supply is designed to safely operate this way--in this mode, it simply distributes the power to the HF and VHF/UHF radio and displays the bus DC voltage.

The figure on the next page shows how this is done. Inside the custom power supply, all of the DC bus connections are in parallel--so feeding DC into one of the supply outputs will allow that power to directly operate the HF and VHF/UHF radios.

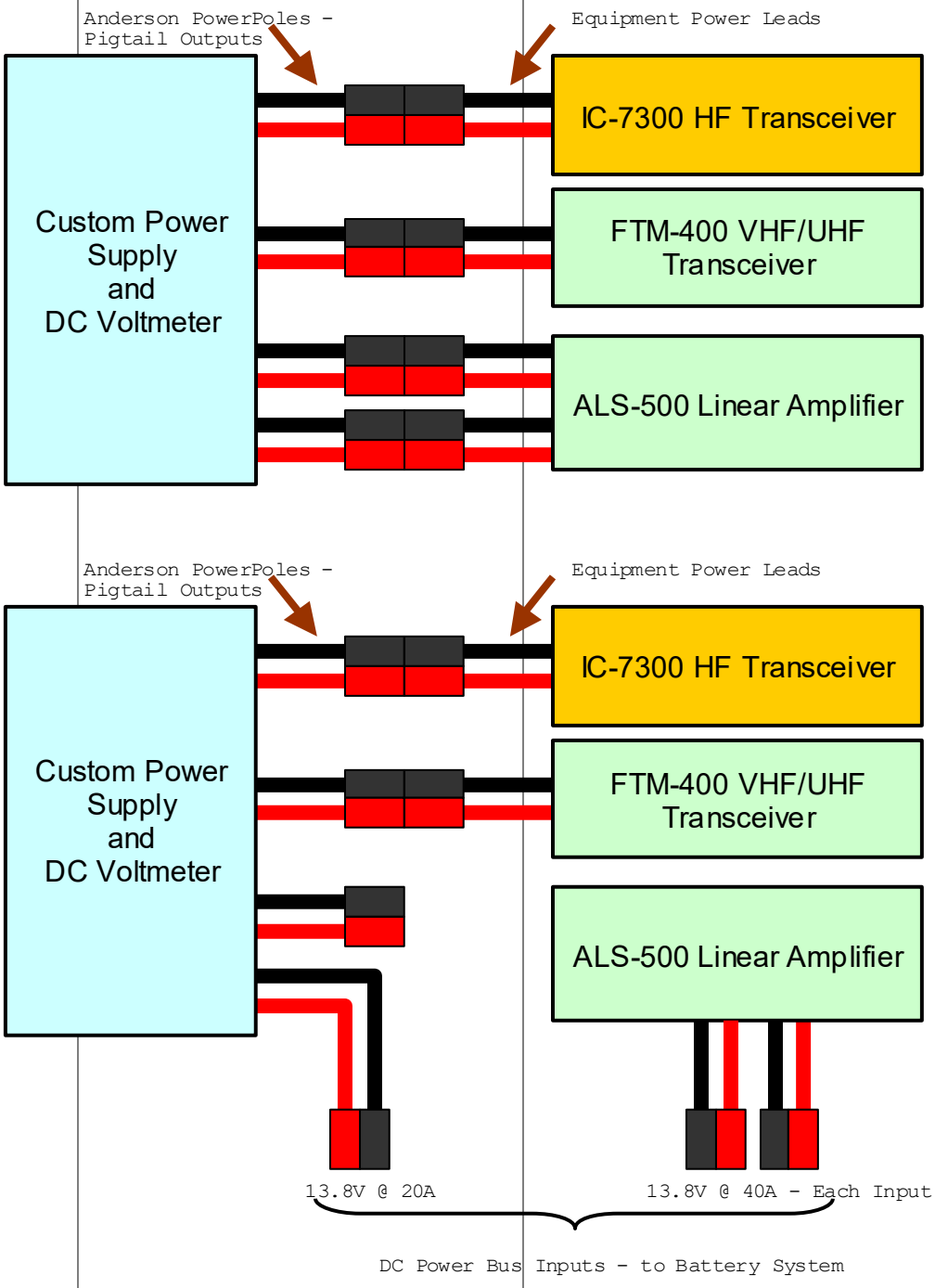
see GO BOX on page 11

from GO BOX on page 10

Conclusion

It's not hard to put together a high-output Go Box. In particular, if you are thinking of adding a 500 watt amplifier to your HF station, this approach might make good sense for you. The custom high-output power supply is not difficult to replicate (the individual Mega Watt S400-12 power supplies are readily available at http://www.megawattpowersupplies.com/ for about $60 each--and construction of this special supply will be covered next month). Of course you can also simply use an MFJ 4275MV (about $250) and place it nearby to run the unit.

This station runs efficiently on batteries. For low-power operation the amplifier may be left off and the power level of the IC-7300 can be turned down to just a few watts (though efficiency of the radio's transmitter suffers badly at low power levels). The ALS-500 amplifier is rated to deliver its 500 watt output power with a 14 volt supply. Below that, Ameritron claims a power reduction of about 85 watts per volt (so you'd be down to a bit less than 360 watts PEP at 12 volts).



With the 500+ watt solar array at the alternative energy station, this is not a problem; our setup with charge controller holds the DC bus at 13.8 to 14.4 volts, so there's no power sag, at least not in daylight.

Low sunspot numbers and poor band conditions? Still a problem, but with the Super-Powered Go Box and a decent antenna you'll almost always work anything you can hear.

In the next installation, we'll detail how to build the custom power supply.

>> JCRAC FEEDBACK <<<