PLANNING SECTION REPORT

Sections

Introduction: Planning

"Planning" is actually much more easily done AFTER the event or incident is completed. One can then reflect and conclude what might have worked better! However, it does little good. Effective Planning must make **actual decisions** *in advance of complete knowledge of the situation*. Without making some decisions, the "troops" do not know what to do or what to bring. Those planning decisions may require adjustments as the scenario unfolds, but lack of planning leads to having a restricted knowledge of constraints and possibilities that are uncovered in a proper planning sequence.

This Planning Section Report is therefore submitted, for discussion, amendment, and adoption, to the Gainesville Amateur Radio Society as a tentative set of decisions to guide the 2019 Field Day effort.

Sincerely,

Gordon L. Gibby KX4Z
Planning Section Chief

1. Trailer Unit Report

EXECUTIVE SUMMARY

GARS has between two and four trailers available depending on the number of people who can help fetch them (the major sticking point). Having discovered that only the solar power MPPT -storage battery system, and conventional gasoline (non-inverter non-voltage-regulator) generators can produce power without damaging radio frequency interference, a field layout of the living spaces similar to last year, but with the addition of a GOTA station, is proposed.

The GARS club is somewhat "short" on available air conditioned trailers suitable for emergency communications in a deployed situation. Based on information received to date we have the following available:

Owner	Description	Notes
Government	FEMORS Trailer approx 4000 lbs with integrated propane generator (unreliable) and 120 VAC wiring.	Long counter-top makes operations easy, but will need to have DC wiring fed through to provide DC power Wiring of the panel box for AC is found here: https://www.qsl.net/nf4rc/2018/FEMORSTrailerElectrical.pdf
Gordon Gibby	18 foot Travel Trailer approx 2500 lbs with integrated Group 24 Deep cycle Battery and wired with two fused power pole connectors.	Does not have integrated generator. 120VAC wiring is a TT-30 plug, using "line 2" as arbitrarily named locally. Need to create a better operating position with a small desk up front. Wiring of the system is found here: https://www.qsl.net/nf4rc/2018/TravelTrailerOperatingManual.pdf
Stewart Reissener	32foot extremely nice trailer – Stewart would want to stay with it overnight if utilized	No feed thru currently, no generator, and I think he is selling it to get one that is small enough to be acceptable to State/Federal campgrounds
Tom Gause	Small R-Pod (forest river?) 20 foot trailer, would need it to be moved for him as he has a wedding anniversary date in Canada. 2600 lbs	This could be a very usable trailer for a single station with plywood table apparatus on the sleeping bed in the rear. He would be interested in a bulkhead connector as long as we don't hit wiring.

		Photo to the left may not be like his unit, but gives the idea.

TENTATIVE POSITIONING

Based on the plans for the POWER UNITS below, I propose the following positioning:
(Each square is approximately 30 feet x 30 feet) approximately to scale. Factors suggesting this rough setup are:

1. GOTA as close to entrance and food tents as possible.-- could be a simple tent/tarp or a trailer as desired.
2. PortaPotty away from foot tents
3. Generator as far as AC power cords will allow, but near to GOTA + trailers; a 2nd generator is a possibility if there is a desire to move one of the Stations into a more isolated and more shady position.
4. Since solar appears to have no RFI, the solar panels no longer needs to be "away from antennas"
5. Batteries near trailers served
6. Inverters need to be in some sort of shade (beach cabana may work) and very near the batteries
7. Fire extinguisher somewhere 10 feet from generator
8. Fuel away from personnel, under trees, locked.
9. Room to space out the antennas by >250 feet if possible. (field is 330-390 feet; cross dimension is 510 feet)
10. Add additional trailers as appropriate

Possible Trailer Layout:

Trees – Trees – Trees-- Trees--Trees--Trees--Trees--Trees--Trees--Trees--Trees

Fuel		ANT		Food	Food			PortaP				
		GOTA										
				Genny								
		Trav Trailer	batt		Femor	batt				ANT		
												Brush
			Solar									Brush
												Brush
	Ant									ANT		Brush

Trees – Trees – Trees –Trees –Trees –Trees – Trees –Tress- Trees--Trees--Trees

ANT = Antenna

Note: farther apart the antennae are, the lower the coupling between them. ‘

If it becomes important to move the trailers farther apart, we can add a 2nd generator to handle the farther trailer.

2. POWER Unit Report

EXECUTIVE SUMMARY

Preventing radio frequency interference, and providing stable power for the radios and computers are the prime requirements of a power system. Extensive experimentation indicated that even the Xantrex pure sine wave inverter and voltage-regulator-controlled generators had some RFI, so the proposal is to utilize the ancient 10kw mechanically governed generator for AC units and voltage-insensitive computer supplies; to utilize solar / MPPT to charge double-Group 24 battery banks to run each transceiver (GOTA may operate solar or generator as desired) and to provide some sort of battery-backup for the network switch. A simple non-inverter 2-4 kw generator can be the backup for the solar system to charge batteries using analog (transformer) 12VDC battery chargers if necessary. The advantage of these plans is that nothing stops at all if a generator stops or has to be refueled.

REPORT ON NOISE TESTING / ALTERNATE POWER SYSTEMS

- Noise measurements were carried out with a standardized setup, over a period of several days
- Power source as close to the front of the travel trailer as possible.
- Off center fed Windom antenna from 20 foot mast running right overhead the front of the trailer.
- Windom tuned roughly to 40 meters.
- Comparison to ionospheric background noise with only BATTERIES – 80 meters in the S3-S5 range depending on time of day, 40 meters S0-S1.
- All measurements by ICOM – 725 transceiver. Find the worse noise from the noise source under test.

System	**Power Capability / Quality**	**HF NOISE MEASUREMENTS**
Champion 3400 Watt Inverter Generator	Perfect 60 cycle, 3400 watts, able to start travel trailer A/C	20dB over S9 80 meters 10 dB +/- over S9 40 meters Efforts to quell with filtering were mediocre and would require huge wiring filters to survive the A/C systems
Xantrex 2kw Sine Wave Inverter	Perfect 60 cycle, rated for 2kw but with only 1 storage battery could muster only 500 watts before low voltage trips. With	S5-S7 wavering 10 kHz wide oscillations were detected on at multiple spots in 80/40 meter bands

	concurrent solar charging, several hundred more watts. Plan would require 4 batteries	
Conventional 4kw Sportsman Generator	Believe this has an electronic voltage regulator. Able to run the travel trailer A/C	Re-testing suggested there are some birdies even from this type generator. Not totally clean.
30V 250Watt Solar Panels feeding Greeley MPPT charge controller feeding 12V storage batteries	Each Greeley MPPT controller is rated for up to 15A @ 12V charging. Unclear if this can be maintained without overheating. Sun protection a must. Expecting to have THREE units on site.	No discernible noise on HF discovered while running the HF transceiver
10KW conventional Generac Generator (mechanical governor voltage control)	Very poor voltage control as mechanical speed governor only.	Unable to get the generator into normal testing spot but no discernible noise discovered when 35 yards away.

DETAILED PROPOSED POWER PLAN

BASED ON THE ABOVE RESULTS a power plan as follows is proposed:

1. Air Conditioning Units – Run A/C systems for 2 trailers from 10 KW governor-controlled generator. As was done last year, use one "leg" for one trailer and the other "leg" for the other trailer as the generator is 240 (120-neutral-120) to keep the loads balanced.

- ☐The neutral of this generator appears to be grounded to the frame of the generator.
- ☐Recommend a grounding rod at the site of the generator, and explicitly tie the neutral to the ground lug and ground rod.
- ☐14-50 30-foot extension cord has been ordered, in order to allow the FEMORs trailer to extend its distance from the generator from 17 feet to 47 feet.
- ☐Travel Trailer can operate from a separate generator if needed to increase distance.

Efforts to run A/C currents through modestly priced commercial EMI filters were a failure – the filter rated at 20A burned out.

A common mode/differential mode filter could be constructed from three 240-31 toroids, two used for differential mode hot/neutral filtering and one used for common mode filtering with capacitors. The cost of each toroid is approximately $15.
See: https://www.murata.com/~/media/webrenewal/products/emc/emifil/knowhow/26to30.ashx

INFORMATION ON GROUNDING: https://www.rvtravel.com/how-generator-neutral-ground-bonding-for-an-rv-works/
You want only ONE point at which the neutral is connected to the ground wire.

> **SAFETY MEASUREMENT:** We should measure the neutral to ground voltage (should be 0) in every trailer before it is utilized. This measurement should be made and documented by the Safety Officer immediately after trailers are energized and before occupancy.

Heavy duty generator (10kw)

on the far side of trailers, away from antennas [goal is to reduce RFI]

- ❑ needs shield on spark plug wires added (to be done by G. Gibby)
- ❑ grounded (need ground rod; I don't have one)
- ❑ Fire Extinguisher setup 10-15 feet away. G. Gibby can provide a fire extinguisher, but does not have a stand
- ❑ Gasoline storage at a 3rd location, in shade
- ❑ Estimate of 30 gallons total usage, suggest 20 gallons onsite storage (4×5-gallon plastic containers) G. Gibby can provide 3 5-gallon plastic containers.
- ❑Previous experience is approx 1 gallon /hour = $3/hour x 30 hours = $90 in gasoline

Power Distribution System:
----------14-50 cord/extension cord to run AC of the Femors Trailer; a 30 foot extension has been purchased
----------30A TT cord/extension or 14gauge extension to run the AC of the travel trailer; up to 50 feet is available.

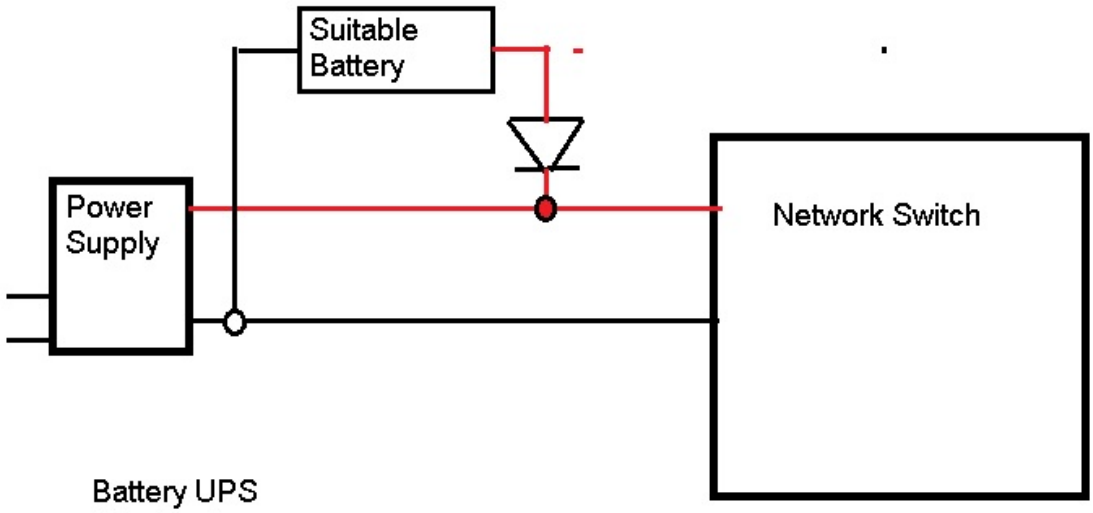
2. Logging Equipment (Computers, Network Switches)

Proposal is to power these from the raw generator AC from the 10 kw generator-- since usually these are powered by small power chargers that can work from 100-240 VAC without difficulty.

Most important requirement is that the batteries for the logging computers be in good shape, so that the computers can run for up to 30 minutes without AC power. For each computer, this should be tested prior to Field Day in enough time that replacement batteries can be obtained if needed. Larry Rovak indicated 2 computers had new batteries and agreed to test the remaining computer.

> **RFI Concerns:** ☐ The power supplies for the networking computers should ideally be tested for RFI by being operated directly underneath an 80/40 meter antenna and the change in background noise checked – and birdies searched for – but since these have been used in multiple GARS field days it is likely that they are fine.

The network switch (hub) employed has a 12 volt power supply and no battery backup to it – a simple diode-switched backup supply from a battery system might be used to give it the ability to bridge brief AC power interruptions. Alternatively, a UPS with a working battery could be used to power it, but the diode-switched backup will be infinitely faster.



Battery UPS
Circuitry for
Network Switch

3. Ham Radio Transceivers – Transmitters are expected to be operated in the range of 50-100 watts output and will require up to 250 watts AC or DC power. At 120VAC this is 2 Amps; at 13VDC this is 19 Amps and requires #12 wire at a minimum, #10 recommended (voltage drop estimated @ 19 amps to be (1 milliohm per foot, 2 wires) . .002 * 19 = 0.04 volts per foot of (2-wire) power cable @ #10.

The only AC systems capable of providing stable RADIO power are conventional generators with AVR (automatic voltage regulation) units. The 10KW Generac has only mechanical governor control and does not provide stable AC voltage. Both the Xantrex sine wave inverter and the Champion Inverter Generator produce varying amounts of HF interference when operated beneath a Windom antenna (test bed). A Honda Clone provided for similar testing by Leland Gallup produced modest interference on 20 meters and lesser to no interference on 80/40 meters.

Therefore, it is recommended to operate each transceivers from two DC STORAGE BATTERY (deep cycle 75-100 Ahr batteries) hooked in parallel. These Yaesu 480HX radios are sold with the required 2 DC cables, so hopefully their owners still have them – if not we need to order them or make them. The storage batteries can be charged primarily by solar power systems consisting of 250-watt solar panels, each connected to a Greeley MPPT charge controller (checked, and noise-free); and then for backup, charged by analog chargers coming from non-inverter generators.

- Batteries can be located just outside each trailer.
- Travel Trailer: The existing 12V wiring of the travel trailer, charged by an on-board converter, can be used to run the lights and water pump. The added fused power pole wiring can re rerouted to two storage batteries in parallel separate from the existing travel trailer wiring.
- FEMORS: Don't use any of the existing 12V wiring of the FEMORS trailer. Add additional wiring: Heavy duty DC wiring (#10 or better) will need to be run from outside the Femors trailer to the inside, with a 30A or greater fuse within 18 inches of the outside battery.
- MPPT controller can be placed at the batteries (Shield these from the sun or they will likely reduce their power output)
- Provide a battery and solar power setup for the GOTA station.
- 14 Gauge wiring (2 sets already existing) from each MPPT controller to a solar Panel
- Solar Panels re-oriented every 2 hours for maximum sun exposure.
- I have 3 deep cycle batteries and 1 used normal car battery. One member offered an additional deep storage battery. We need 2 for each transmitter. There should be a FUSE within a foot or two of each battery.
-

Calculation of Overnight Storage Required Not to require generator charging

Transmitter Power	**Duty Cycle**	**Dark Hours**	**Storage capacity (batteries not discharged beyond 50%)**
100 watts output / 250 watts input required	Estimate 30%	8 PM - 7 AM = 11 hours (Generator can be used to charge if necessary)	Required energy usage = 250 watts * 0.30 * 11 hours = 825 Watt Hours or @ 12V, 68 Ahr – Implies each transmitter requires 2 group 24 storage batteries starting at full charge at nightfall.

Solar Panels

(need 3, 250-300 watts each) again on the generator side of the trailers
Each panel 14gauge cable to MPPT controller – ground the green wire for EMI suppression, possibly at both ends (unclear if needed—testing important)
On a trailer or otherwise aim-able at the sun throughout the day
MPPT controllers [negligible RFI] have three 15A output controllers now, may be able to get more
3, 4 or 5 100A deep cycle batteries 12V banks, arrive charged.
❑Some sort of a tent / sun / rain protection for the MPPT controllers

The Digital/CW station may require some generator top-off. When the GOTA station ceases operation, move the solar charging system from it to the CW/Digital station (presuming it is the one using the most battery power)

4. GOTA STATION –

The GOTA station transceiver can be operated either from a 3rd solar power setup (panel, MPPT controller, battery – possibly a single battery) or from an extension cord from the (relatively unregulated) power from the 10 kw generator provided the GOTA power supply can handle relatively wide ranging voltages from 100-135 volts. Many switching power supplied handle that with ease.

If the GOTA station operates from an A/C equipped trailer, then it is likely that an additional generator would be needed to run that AC system – in which case it should be a non-inverting generator and placed as far away from the antennas of the stations as possible.

BACKGROUND INFORMATION

More information on the 2018 Solar Panel setup can be found here:
https://www.qsl.net/nf4rc/2018/SolarPowerSystemsManual.pdf

Information on the Femors Trailer wiring can be found here:
https://www.qsl.net/nf4rc/2018/FEMORSTrailerElectrical.pdf

Information on the Solar Panel system (2 panels, 2 MPPT controllers) from 2018 can be found here:
https://www.qsl.net/nf4rc/2018/SolarPowerSystemsManual.pdf

3. ANTENNA UNIT REPORT

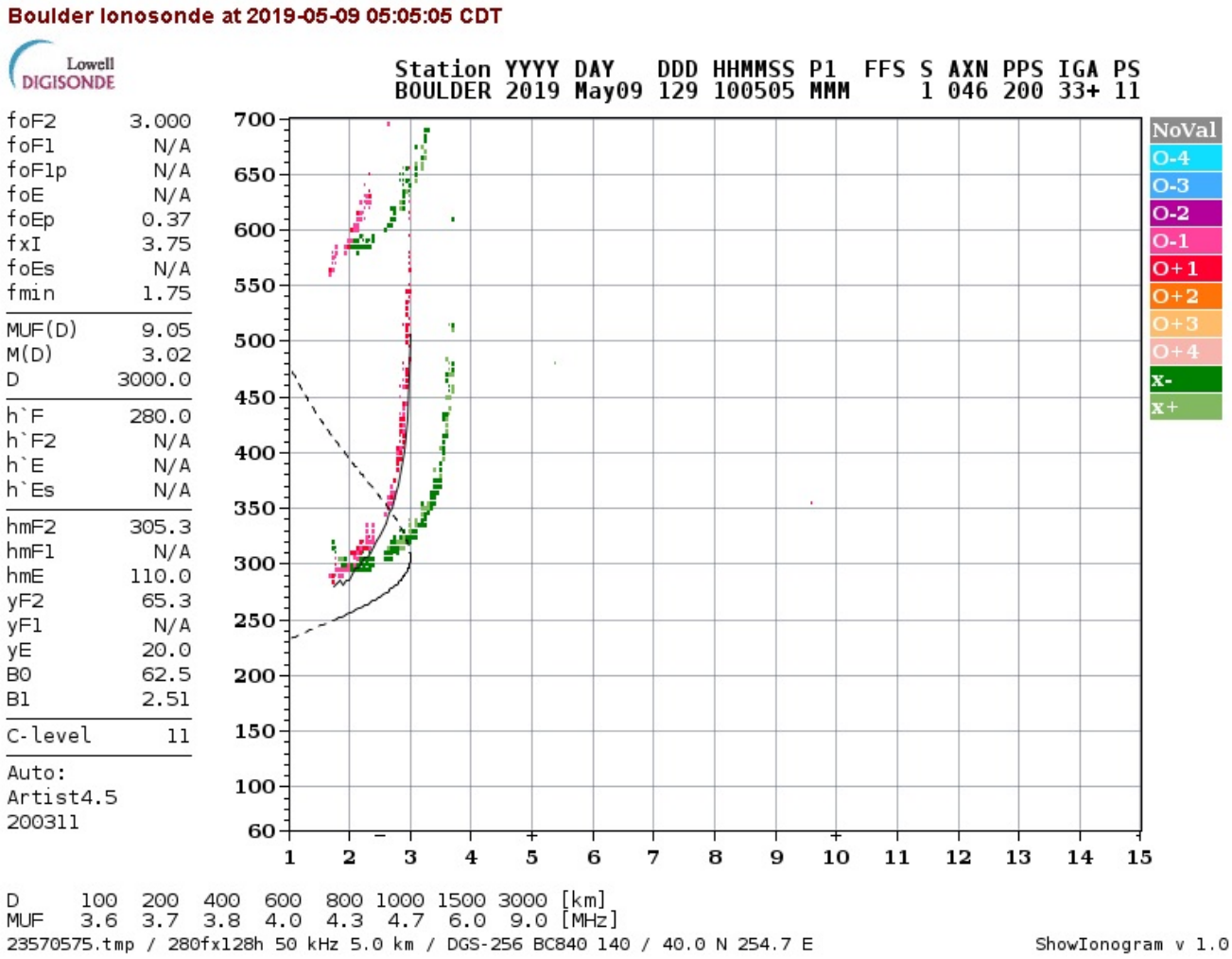
EXECUTIVE SUMMARY

The Antenna Plan is not finalized as the Antenna Unit leader reported that it would be dependent on the results of the Operations Section recruitment of operators. Nevertheless, suggestions for position of at least three sets of antennas were developed in an attempt to minimize interference between stations. Both Station 1 and Station 2 are suggested to have a combination of YAGI and some sort of dipole (whether center- or off-center fed is up to choice) for lower bands. It would be good to have antennas that extend all the way down to 160 meters. The GOTA station is suggested to have an antenna generally at right angles to those of Station 1 and 2. The antennas from 1 and 2 should be end-to-end and as far apart as possible to create the larges possible isolation (>50 dB is suggested) and this can be measured using a spectrum analyzer. The traditional 40 meter vertical can be positioned as desired, and then isolation between it and horizontal antennas (hoped to be > 20 dB) can be measured.

Critical Frequency Impacts of Solar Cycle

As we are near the solar minimum, the Critical Frequency may drop to the 80 meter band during the night. The Critical frequency is an easily measured quantity that gives significant information about the ionosphere – it is the HIGHEST frequency that can be reflected right back down to sending location. Signals from any frequency higher than the critical frequency must come from a farther distance – this is the concept of a SKIP ZONE for those higher frequencies.

There are formulae that estimate the extent of the SKIP ZONE. Here is a radio ionosonde report from Boulder Colorado just recently from 5AM which illustrates the problem:



For 40 meters, at that time, the small chart at the bottom of the page indicates that the skip zone is greater than 1500 km in radius! As a result, only signals from the West Coast will be workable in the early morning hours on 40 meters if the Critical Frequency drops to 3.0 MHz as shown in that example.

Because the bands allowed for usage in Field Day are limited:
"Bands: 160, 80, 40, 20,15 and 10 Meter HF bands, as well as all bands 50 MHz and above "

the result will be that during the nighttime the only workable bands will be 160m, 80m and 40m (only to a portion of the United States) – leading to the likely need for stations to operate both in the cw/digital and phone/image portions of a band simultaneously.

W0QE has done extensive work for his club's Field Day in order to make that possible:

> ARRL Field Day 2012 consisted of two Elecraft K3 transceivers with dipole antennas at special event callsign W0C in the mountains of Jefferson County Colorado. The above data shows that an antenna isolation of 49dB on 40m and 54dB on 20m is needed to be able to operate simultaneously on both CW and SSB in the same band without either phase noise or overload interference. The antennas consisted

of a band switchable flat top horizontal dipole 30' above the ground and a fan dipole 46' above the ground with the legs pointed downward at a 20 degree angle. The dipole centers were 265' apart and they were basically aligned end to end with about a 10' offset due to the trees and terrain. EZNEC modeling predicted antenna isolations of 47.5dB on 40m and 55.4dB on 20m. Both these isolations were very close to the isolations needed based on my tests but fit the Field Day site. Measurements on the erected antennas with a calibrated RF power meter showed isolations of 46.8dB on 40m and 54.3dB on 20m. **These numbers are VERY close to the values predicted by EZNEC using poor rocky mountainous ground (.002S/m, 13).** During Field Day we experienced no interference when operating simultaneously on 40m CW and SSB or simultaneously on 20m CW and SSB. Bottom line is that Field Day without interference is very enjoyable and EZNEC modeling produced an extremely good estimate of the antenna isolations.

See: http://www.w0qe.com/Technical_Topics/phase_noise_and_overload_testing.html

Although we don't' currently have Elecraft radios planned, it is likely that we will need isolations of greater than 50 dB in order to have simultaneous operators on different ends of these bands. The distance between the ends of horizontal dipoles then would be expected to require > 250 feet, to allow this.

Attempts at measuring the phase noise generation were unsuccessful, as the spectrum analyzer available had greater phase noise….then the transceivers under test. Operation of a typical ICOM transmitter on 40 meters, 100 kHz away from another ICOM transceiver, and separated by 55 dB of isolation (calibrated attenuator pad) illustrated that at the onset of CW transmission, the receiver was bothered – and then became OK with negligible signal.

It thus seems to be possible for us to operate simultaneously at ends of bands….if we have > 50 dB of antenna separation and potentially some filtering as well (it would have to be narrow). Note that the phase noise is NOT significantly reduced by going to lower transmitter power!

It is easy for us to measure antenna separation with a spectrum analyzer by feeding the tracking generator into one antenna….and reading the spectrum on the other.

Available Antenna Asset	Comments	
GARS trailer/multi-band YAGI	Hand-rope turning as the sun moves across America	
Mono-band 20 meter beam	Likely the beams will need to be more than 250 feet apart to achieve phase noise isolation	
30-foot Alumatower		
Off center fed dipole		

Vertical 40 meter with tuner	Unknown isolation to horizontal antennas on same band – will need to be measured	

ANTENNAS

A specific report from the Antenna Unit was not received, so this portion of the Planning Section Report will be somewhat less detailed.

Field day HF participation does not include the WARC bands. Due to the low sunspots, a smaller number of bands will be workable, particularly at night. The following table suggests roughly what bands may be preferable at different times of the day

Time of Day	Preferable Bands	Stations active
Bright Sunlight	40 meters – regional 20 meters – longer distance 15 / 10 sporadic openings	2 operating stations 1 GOTA station
Dark before midnight	80 meters southeast 40 meters nationwide 20 meters west coast	2 operating stations GOTA for a few hours
Dark wee hours	80 meters regional 40 meters distant	2 operation stations

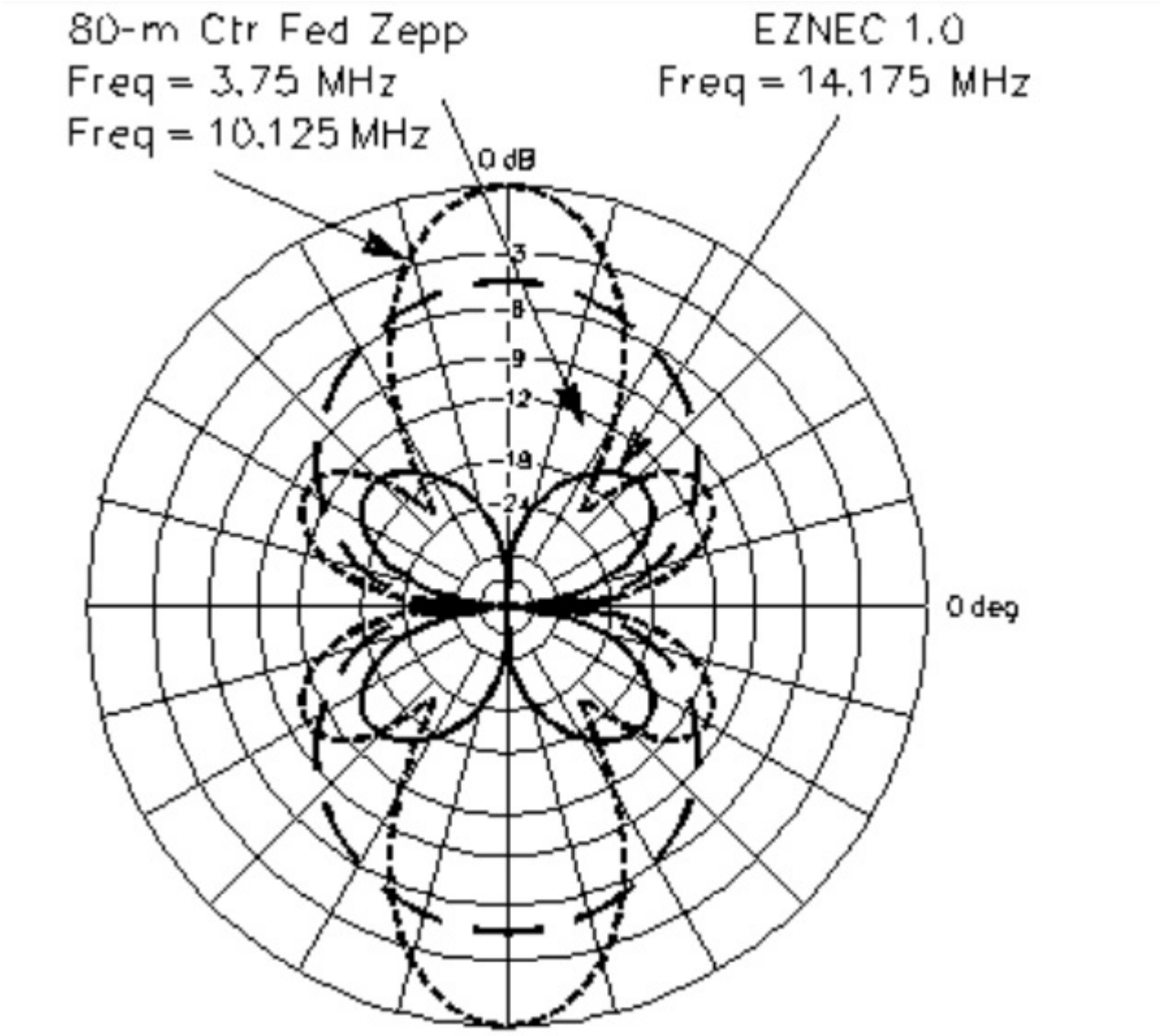
Based on the above table, band usage might work out as follows:

Time of Day	Station #1	Station #2	GOTA
Bright Sunlight	40 or 20	40 or 20	Use a mode or band that doesn't conflict with either Station 1 or Station 2 (will require coordination)
Dark before midnight	80/40/20	80/40/20	Use a mode or band that doesn't conflict with either Station 1 or Station 2 (will require coordination)
Dark After midnight	80/40	80/40	No operating

It is probably advisable to have antennas from Station 1 and Station 2 be "end to end" and as far apart as possible. Previous groups have found that a separation of 260 feet was necessary to allow one CW/ digital station and 1 SSB station to work the same band without interfering with each other.

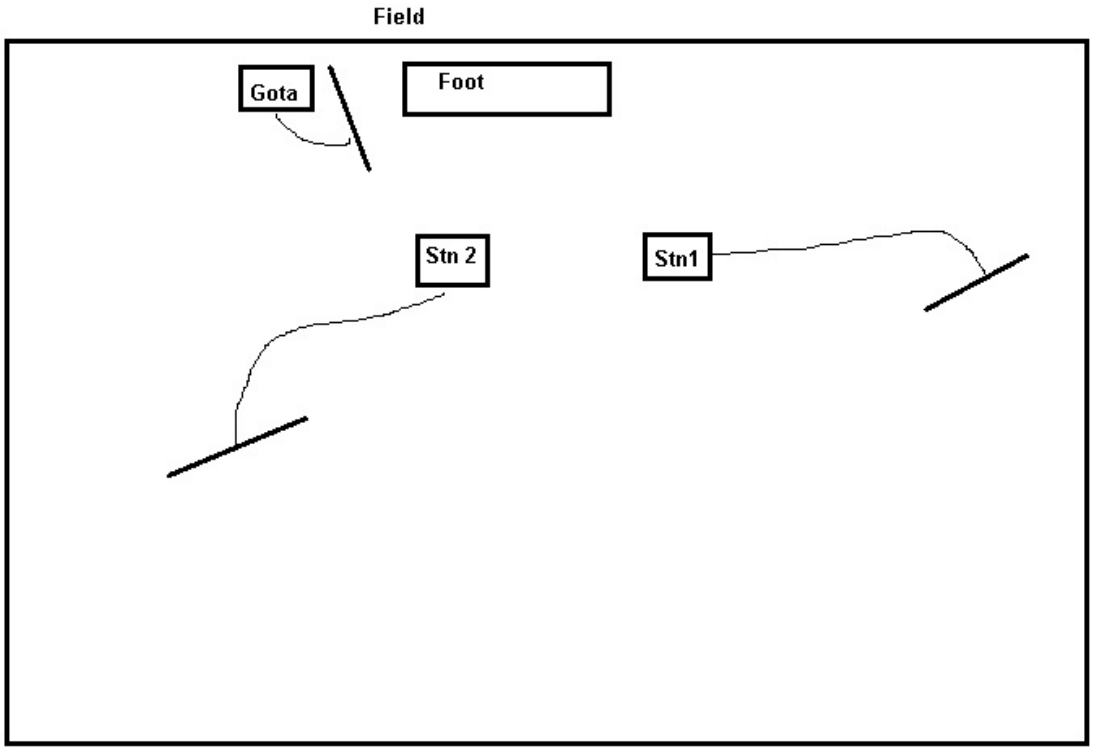
Realize however that a dipole operated above its first resonant frequency will have a different pattern:

(see for example: https://www.arrl.org/files/file/Technology/tis/info/pdf/9611073.pdf)



(taken from the article cited above)

So it isn't clear how to keep the GOTA station's transmissions from interfering with the other two stations, but one solution is to orient the GOTA station antenna at right angles to the antennas of the other two.



(Add in 40 meter vertical as far away as possible from the main antenna of the opposite station(s))

There are some limitations that make this difficult - generator lines from the generator are only so long – although a 30 foot extension for the FEMORS has already arrived, and the GOTA station can operate from a simple extension cord from unregulated power from the 10 kw generator or from a car battery intermittently charged by the solar system….

4. Operating & Bonus Points

Earning Points

Operating
Last year (2018 Field Day) K4GNV posted in the 3A category (I'm not sure why it wasn't 2A….) where the leader posted over 4,000 contacts in Georgia using the same power class as K4GNV (<= 150 watts); K4GNV posted 169 QSOs, and a total score of 1814. Not sure why in the 3-transmitter class, but even if only 2 transmitters running for 24 hours, this is an average of 3.5 contacts per transmitter per hour, or one contact every 17 minutes. Those figures are similar to what you would expect from a GOTA station. They are very discouraging numbers for operators and might contribute to people staying away from operating out of sheer frustration – when you have to go 17 minutes of work to make one contact….

While our club has excelled at getting Bonus Points, adding contacts (the 3A leader had 23.6 contacts for every 1 from K4GNV) is important. Ways to do might include

- using competitive power levels, so that our signal has a chance at being as strong as others in the X2 power multiplier class and
- good antennas (typically a strength of the GARS club)
- maximizing CW and Digital Contacts since those get double points – and this year even more digital participation is likely due to JSCall and other protocols, as well as CW
- avoiding interference from alternate power systems – checking systems for noise rises when switching from battery to alternate power will catch these, by spinning the dial up and down and hunting for birdies
- avoiding interference from co-located stations and maximizing frequency agility by having maximum isolation from antennas – Adding 8-10 dB of antenna isolation can make a lot of improvement, without any loss in transmitted signal at all; the same requirement achieved by reducing transmitter power would take a 100 watt output and reduce it to 1-2 watts….

Making it fun: In order to "hold" a frequency one must generally have enough signal strength not to be overwhelmed by others.

ADDITIONAL OPERATING POINTS:

GOTA STATION	There should be a LINE of GARS technician class operators lined up to operate the GOTA station with a COACH to get the fun of the Field day and add precious QSO's to our list, as the GOTA station does NOT increase our transmitter number

ONE FREE VHF/UHF STATION:	"4.1.2. Free VHF Station: All Class A entries may also operate one additional transmitter if it operates exclusively on any band or combination of bands above 50 MHz (VHF/UHF) without changing its basic entry classification. This station does not qualify for a 100-point bonus as an additional transmitter. This station may be operated for the clubs Field Day period and all contacts count for QSO credit. It is operated using the primary callsign and exchange of the main Field Day group and is separate and distinct from the GOTA station " So at any given time, we can be operating 6 meters, 2 meters or 70 cm (one at a time) without increasing our transmitter count out of the 2A group. If we have a 6 meter antenna up on the MARC unit we might catch some Es propagation.
2 meter FM contacts reverse-repeater frequency	Contacts cannot be made using a repeater, but if we have the MARC unit trailer, we could easily put a 2 meter antenna up at 60-100 feet, reverse the frequencies for the 146.82 repeater, down the repeater, and for several hours make legal field day contacts by notifying people in advance of this plan. They would contact us just as if they were using the repeater – but they would be reaching live operators in a limited time period for 2 meter Field Day exchanges. The 2 meter station DOES NOT COUNT for a transmitter.
70 cm contacts reverse-repeater frequency	The same trick could be then done on the 70 cm repeater frequency and all contacts on the 146.820 frequency could be asked to reach us on the 70 cm frequency ("different band") as well. This is also a great emergency communications practice. The effective range of a 60 foot tower is approximately 10 miles radius.

BONUS POINT OPERATIONS:

It is likely that of the 1814 points earned in 2018, with only 169 contacts, power multiplier 2 and maximum QSO multiplier (CW/Digital = 2X) the contact points were no more than 676 and thus 1200 points were obtained last year merely from BONUS POINTS. We should be able to repeat or improve on that this year based on the following bonus points:

BONUS POINTS	**Category**	**What we would have to do**
2 x 100	Emergency Power	Operate all transmitters (including GOTA) from generator or solar
100	Media Publicity	Copy of press release or newspaper article
100	Public Location	Operating in a church park probably qualifies

100	Public Information Table	Need handouts, visitors log, copy of club handouts
100	Message Origination / SM SEC	Have to send a formal message to SM or SEC (winlink radiogram would suffice) – must include copy of the message. Specific requirements for content.
Up to 100	Message Handling	Originate or receive/deliver up to 10 formal messages (can use winlink for this)
100 points	Satellite QSO	1 contact via satellite
100 points	Alternate power	At least 5 QSO from solar "A separate list of natural power QSOs should be submitted with your entry" We may need to make some QSO's with generator power to get both this and the alternate power??
100	W1AW bulletin	Last year MSFK was by far the best way to receive.
100	Educational activity	Have a talk given by one of us and documented.
100	Elected government Official	Get Sadie Darnell to visit.
100	Served agency representative	Get Torsell or Harding to visit
Up to 500 (more likely 20-60)	GOTA qso's bonus	Likely to get 60 points or so; 20 points when a gota operator gets to 20 qsos
Likely 20-60	GOTA COACH	Have a coach continuously present at the GOTA station
Likely extra points:		
1400 points		