

EUROPE DATA BRIDGES

40 meters is a great band for region-wide communications. Long-range data links are perhaps best served by the more traditional DX bands, but 40m offers a good blend of range and ease-of-use as it is usually the lowest band of frequencies that most radio amateurs are capable of transmitting on regularly.

Weekly Every Saturday	
North America-Europe Data Bridge	1800-1900 UTC - JS8Call Net on 20m @ 14.107 MHz Use same Ghostnet groups and naming conventions as on previous page. 1900-2000 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list. Best for point-to-point comms between known users/callsigns.
Europe-Australia Data Bridge	2000-2100 UTC - JS8Call Net on 20m @ 14.107 MHz Use same Ghostnet groups and naming conventions as on previous page. 2100-2130 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list. 2130-2200 UTC - JS8Call Net on 80m @ 3.575 MHz Use same Ghostnet groups and naming conventions as on previous page.

Use this blank space for notes, such as converting comm windows into your local time.

GHOSTNET
VERSION 1.5

STOPGAP COMMS SOLUTIONS

S2 UNDERGROUND

PRINTING INSTRUCTIONS

This guide is intended to be printed by individual users using a wide variety of consumer grade printers. The original intent for this guide is to be printed "Actual Size", the dimensions of which are 4 x 6 inches. This pairs well with 4 x 6 laminating pouches, and a variety of hole-punches for incorporation into a field binder or bound together with ordinary zip ties.

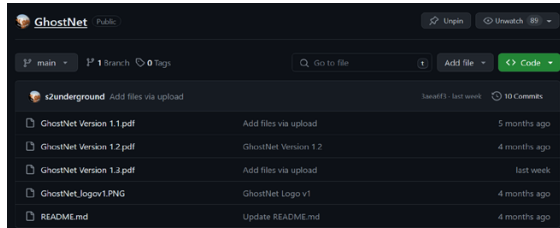
Larger versions can be printed as well. For those with restrictive eyesight, the smaller font sizes may be frustrating. By selecting "Fit to Page" in the print settings, this document will "stretch" appropriately to fill an entire page, with no loss of resolution. When combined with sheet protectors, this makes a great addition to any SOP binder.

Step 1: Verify and Download

Check to make sure you have the file of the latest version.

The most recent file will be uploaded to our GitHub page here:

<https://github.com/s2underground/GhostNet>

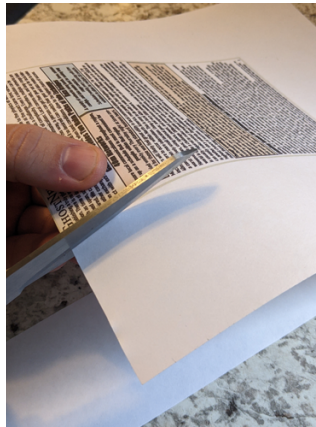


Step 2: Print

Print Actual Size, Duplex, Flip on Long Edge
If your printer has a High-Quality setting, use that. Higher quality paper is also recommended, but this document is optimized for low-grade copier paper as well.

Step 3: Cut and Laminate

Cut out each page, cutting on the outside of each bounding box. The colored frame on each page serves as a cutting guide, but also matches the color-coordination of our other products and publications. If you are printing Actual Size, you will have a decent amount of waste. However, in order to make each page line up perfectly using most printers (while also fitting laminating pouches) this is the option that will work for most people. However, if you want to experiment by printing multiple pages per sheet of paper, feel free to do so. Laminate each page using 4x6 laminating pouches if so desired. 5 mil thickness is preferred. Self-sealing laminating pouches can work for those who do not have a heat source or laminator.



Step 4: Hole Punch and Bind

Using a standard planner hole punch, punch each laminated page in the order so desired. If some pages are not needed, feel free to leave out of the binding process. Likewise, for full waterproofing users may wish to print out extra copies of important pages and leave intact, to prevent water ingress via the punched holes. Depending on your hole punch, you may want to include these in a field binder, or bind together with paracord, zip ties or metal rings. The choice is up to the end user.



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GHOSTNET EUROPE

Weekly HF radio communications network. For efficiency, this will largely be a data-only net, with voice comms only being used in an emergency to coordinate further link-ups.



Weekly Every Thursday Night

All Times GMT

Details

JS8Call (40m) NVIS 7.107 MHz

Use Offsets to find a clear space to transmit. All messages along the band will be decoded anyway, so pick any offset that's available.

NOTE: NOT STANDARD JS8 CONFIG, YOU MUST CHANGE THE FREQ! Offset chosen based on availability. For standard message traffic, check-ins and POSREPs. Heartbeats sent below offset of 1000 Hz. If many stations are present, JS8 can be used to allocate freqs for further comms. Groups shall be used to organize traffic and all stations shall monitor at minimum @GHOSTNET and @GSTFLASH. See below for complete list of Group Names.

@GHOSTNET - Generalized group for tagging routine messages. Also very useful for identifying callsigns not previously known.
@GN(Country Three Letter Code)(State Two-Letter Code) - For example: "@GNUSASC" is the GhostNet group for South Carolina, USA. For regional comms directed to a specific state. State-level organizations may choose to further divide into districts within a state or other geographic area.
@GSTFLASH - Emergency FLASH traffic: Any station in receipt of a GSTFLASH message shall transmit at once to highest level HQ within range via any means necessary.

Winlink P2P (Vara, USB) NVIS 7.107 MHz

Stations wishing to exchange emails may do so during this comm window. Use Vara HF Peer-to-Peer Connection with designated callsigns to avoid linking with formal Winlink nodes. Handshakes start at 1835Z, data burst as long as it takes. Use the JS8Call window to determine callsigns, and the order of stations sending emails. Emails should be posted to outbox BEFORE comm window to maximize efficiency.

RTTY 7.077 MHz 45.45 Baud

Use short RTTY bursts to transmit blindly to stations that missed check-in. Stations missing windows are to use RTTY presets on radio to communicate problem.
If contact is re-acquired, can re-send critical msg traffic that was missed earlier. If so desired, RTTY can also be used to send traffic to SWL-only stations during this window.

HF Voice Simplex LSB (40m) 7.190 MHz

ONLY FOR USE IN A DIRE EMERGENCY, NOT A STANDARD NET
HF voice freq shall be monitored for the last five minutes of all comm windows, no matter how the window flexes. If a station misses all prior check-ins, stations with highest likelihood of comm success will initiate voice calls for missing station as required. If station is expected to participate in the net, but is still not heard, proceed with Emergency PACE plan.

Though set up to be a weekly event, during contingent circumstances this plan can be used for battle tracking incidents as needed.

NORTH AMERICA DATA BRIDGES

40 meters is a great band for region-wide communications. Long-range data links are perhaps best served by the more traditional DX bands, but 40m offers a good blend of range and ease-of-use as it is usually the lowest band of frequencies that most radio amateurs are capable of transmitting on regularly.

Weekly Every Saturday

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1200-1300 UTC - JS8Call Net on 20m @ 14.107 MHz Use same Ghostnet groups and naming conventions as on previous page. 1300-1330 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list. 1330-1400 UTC - JS8Call Net on 80m @ 3.575 MHz Use same Ghostnet groups and naming conventions as on previous page.	

Use this blank space for notes, such as converting comm windows into your local time.

HOMEPLAN - BASIC

NOTE: When filled out, this is a sensitive document! Consider destruction procedures to prevent loss of PII.

Use this page to document various important details that lie outside the scope of radio communications, but are important communications tools nonetheless.

Family Password (A password that can be used by family members to verify authenticity of a message from someone else)	
Home Rally Point (A common location that all family members could evacuate to in the event of a fire in the home.)	
Family Recognition Symbol (A hand-drawn symbol that can be placed on signal panels, messages left at missing persons boards, or other meeting points. Can also serve as a challenge code if necessary.)	
Sketch your symbol in the space provided to the right	
Lost Contact Plan (General instructions for what to do in the event that a family/team member does not answer any communications after a predetermined period of time.)	

TRUSTED CONTACTS

NOTE: When filled out, this is a sensitive document!
Consider destruction procedures to prevent loss of PII.

Name	FCC Callsign	Alternate Callsign	Challenge/Response

The Need for Aliases In some very rare situations, the use of approved FCC callsigns may be above the level of acceptable risk. From open warfare, to adversarial ham radio operators interfering with communications during a time of unrest or disaster recovery, it is a good idea for all radio operators to maintain an alternate callsign to use if necessary. This callsign should NOT be used while FCC regulations are applicable, however, we must remember why the regulations exist in the first place...to allow operators to practice their radio skills in a peacetime environment. This allows radio operators to gain experience, and develop the habit of adhering to the best practices of radio, with the full intention of operating more clandestinely if needed during a crisis. In other words, following the rules in peacetime, but in a contingent situation being able to operate more privately. With this in mind, if a radio operator had to start operating clandestinely, it would be absolutely crucial to know what your network's alternative callsigns are. In short, if you and your buddy need to stop using your real name on the air, you need to know the callsign that each of you will go by. This is crucial for digital data modes like Winlink or JS8Call, where the software needs a callsign to be input before a message can be sent. As such, you need to know your buddy's alter ego before the crisis, if one day you both recognize the need to operate more covertly.

GHOSTNET NORTH AMERICA

Weekly HF radio communications network. For efficiency, this will largely be a data-only net, with voice comms only being used in an emergency to coordinate further link-ups.



Due to Time Zones, these times are technically the next day (Friday). Locally to North America, this comm window is Thursday Night.

Weekly Every Thursday Night	
All Times GMT	Details
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Though set up to be a weekly event, during contingent circumstances this plan can be used for battle tracking incidents as needed.

GHOSTNET SCHEDULE

Note that the time of day is listed in ZULU time (UTC). This means that the comm window can technically be across the International Date Line (and therefore the next day), depending on where you are in the world. For instance, the GhostNet for North America starts at 0000Z. This is technically the next day, on Friday morning ZULU time. Local to North America, this translates to Thursday night.

Thursday	0000Z	0100Z	0200Z	0300Z	0400Z	0500Z	0600Z	0700Z	0800Z	0900Z	1000Z	1100Z	1200Z	1300Z	1400Z	1500Z	1600Z	1700Z	1800Z	1900Z	2000Z	2100Z	2200Z	2300Z
GhostNet North America (40m)																								
GhostNet EUR (40m)																								
GhostNet AUS (40m)																								
Saturday	0000Z	0100Z	0200Z	0300Z	0400Z	0500Z	0600Z	0700Z	0800Z	0900Z	1000Z	1100Z	1200Z	1300Z	1400Z	1500Z	1600Z	1700Z	1800Z	1900Z	2000Z	2100Z	2200Z	2300Z
NA/EUR Data Bridge (20m)																								
EUR/AUS Data Bridge (20m, 80m)																								
AUS/PAC Data Bridge (20m, 40m)																								
NA/AUS Data Bridge (20m, 80m)																								

Ad Hoc Crisis Nets

In the event GhostNet communications are needed, GhostNets can be established at will. Chances are, if a major incident is underway of grave importance, someone will be talking about it on GhostNet. Hopping on JS8Call to check for message traffic, or firing up lon2g during a crisis is not only helpful for sharing information, but also great practice for when GhostNets might be needed for more substantial emergencies.

Persistent Comms Networks

For those who have the resources to spare, simply keeping an eye on the predetermined JS8Call freqs throughout the day can be quite helpful. Setting up a receive-only JS8Call arrangement and just leaving it running all day and night can be a great way to receive critical indications and warnings of world events in real time. Though this may be a bit resource intensive for some, running JS8Call around the clock requires very little CPU power, especially in receive-only mode. Though it would be great to see JS8Call being used to share information 24/7, right now JS8 is more of a hobby for hams than a tool for circumventing censorship/fairgating. However, in due time JS8Call's unique characteristics are great for group messages, and the heartbeat feature is a very resilient way to make sure comms networks are functional at any time of day.

GHOSTNET OVERVIEW

GhostNet is the overarching term for a collection of communications networks set up to allow users around the world to exchange information without relying on pre-established infrastructure. Far from being just an emergency plan, GhostNet is intended to ease the transition of radio technology into everyday life. Though radio networks cannot truly replace the internet, we hope that we can replace a substantial portion of a person's daily information requirements, and promote a culture of off-grid information sharing. Once per week (or more often, based on world events), users can gather on JS8Call for a brief chat in a casual atmosphere. JS8 is simple to use, easy to work with, and extremely common among radio hams. Users that are perhaps not as experienced in other HF data modes might find JS8Call to be an easy way to maintain contact. JS8 also serves as a great meeting point in the event of catastrophic communication loss, if a major societal event is occurring, simply hop on JS8 to find out what's going on and to coordinate other communications plans.

Data Bridges (on Multiple Bands)

In the world of HF radio, everything is a trade-off. The configurations, frequencies, and antennas needed to communicate over long distances are not best suited for local comms, and vice versa. Therefore, to allow users to have the best chance of success with extreme-long range comms, networks have been established to allow links between continents and regions, at the time and frequency that is most effective for each link. Understandably, one weekly net on only one or two bands is not robust enough to handle substantial message traffic. When we start to consider global partners, and the 24 hours in a day, we realize that a more substantial plan is needed to allow users around the world to communicate. Users in North America can usually only link up with Europeans during certain times of day. Similar situations appear with other long-range links, such as USA/Australia, Mediterranean/South America, Far East/Europe, etc. As such, various comms plans have been established to allow when there is the highest chance of success. In due time, we hope to incorporate major relay stations which can facilitate the movement of traffic 24/7. In this way, a person wishing to communicate with another continent can wait for the data bridge to open at a certain time of day, then use antenna configurations, power levels, frequencies, and data modes that are more suited to long-range communications instead of more local contacts.

Receive-Only Options (for Decoding RTTY, JS8)

To incorporate those who do not have the ability to transmit radio messages, various networks have been established to allow users to receive crucial information. Radio Teletype, despite being an ancient communication method, is a great tool for transmitting one-way communications, news updates, or other critical information to a wide audience. Those wishing to monitor various JS8Call networks or Data Bridges can also do so with a simple Software Defined Radio (SDR) receiver, a computer/phone, and an appropriate antenna. Understanding that radio communications are difficult, complex, and boring, special emphasis has been placed on creating networks for users who don't want/need to dedicate so much time to radios. In short, we have simple and easy-to-understand networks that users can monitor cheaply and without any technical knowledge at all. And since receiving messages does not require a license (in the US, at least), anyone can listen in. Various tutorials have been created (and are continuing to be made) guiding users step by step through the whole process. The goal for Receive-Only comms networks is to make the process as easy as possible, and incentivize many people to start treating radio as a viable information source, rather than a novelty.

lon2g ALE Networks ("Right Now" Comms)

A bit more advanced than JS8, several ALE networks are set up for persistent communication. Automatic Link Establishment protocols are the future of HF radio, and a gold standard for determining the best band/frequency to maintain a comm link. ALE removes the guesswork of which band to choose based on time of day, or other propagation factors. Simply fire up the program, and the software will determine the best frequency for you automatically. This makes comms plans obsolete, and allows for "right now" communication to be possible at any time of day.

Unencrypted analog comms - actions are not generally recommended for use in non-permissive environments. Even using brevity codes and other EMCON procedures, voice recognition, direction finding, and meta-data analysis make analog voice comms a risk on the modern battlefield. However, due to their low cost and extreme popularity, handheld VHF/UHF radios will always have a place in emergency preparedness or for local line of sight comms. The GhostNet is not meant to replace local VHF/UHF traffic, though these options are supported as a last-ditch measure for those that need it. Rather, GhostNet plans are best served as a more strategic, region-wide communications network using HF transceivers.

What About My Baofeng?

GHOSTNET CONCEPT

Establishing a truly global communications plan is difficult, simply due to the physics of ionospheric propagation. There is no one plan that will allow the globe to communicate at the exact same time; various factors such as time of day, frequency, and scheduling conflicts make this a challenge. Even if a solution can be agreed upon, scheduling conflicts would add in another layer of complexity. Therefore, multiple networks are required. We can get by with two main concepts for communication: Local comms nets, and long-range links with other continents or major population centers. This way, a person can get their gear set up for local information exchange during one comm window, and if so desired can switch their gear and data modes to make contact with extremely long range regions, when band conditions allow for the highest chance of success.

GhostNet Provides Two Main Paths of Info Exchange

40m Networks

For more local communications throughout a region, set up on a schedule that is most convenient for people within that region

Scheduled weekly every Thursday night at times convenient for those working standard business hours.

Data Bridges

A variety of networks using bands, times, antenna configs, and data modes best for making long range contacts.

Scheduled weekly, every Saturday with time windows to allow for multiple DX contacts.

Most users will likely find great utility in local communications throughout a region. For instance, if an incident were to occur within North America, most people in that region would likely tune in to JS8Call on 40m to obtain more information. This is easy to do with a wide variety of equipment, and can be done even in a comparatively small location. Using a local 40m network, comms can be reliably established even in the worst of times, using minimal gear, and very little power.

However, the gear, space, power, and experience needed to make that same network functional around the world is quite a challenge. Different antenna arrangements, and an extensive knowledge of band conditions is usually required to make reliable links with contacts at extremely long ranges. The average radio operator can easily make contact throughout Europe, but making a contact at any time of day from Sweden to Australia is another story entirely. Band conditions alone require very specific parameters to be met to ensure the highest chance of success. Therefore, we need to establish specific times of day, freqs, and antenna configs to make these long range comms reliable.

Though seemingly complex, the plan is quite simple. Need to check in to a local net, or see what's going on throughout your region? Pick up this guide and flip to the card for your local area. Fire up whatever HF transceiver you have (or even just a receiver) and tune in.

Need to send an email around the world? Flip the card over, find the link you want to make, wait until the appropriate Data Bridge comm window opens up, and give it your best shot. This also allows for more complicated relay stations to be set up in the future. For instance, a person in the US might be able to briefly make limited contact with Australia on 80m, but contact might be sketchy or difficult to maintain. To send a full email, they might have to relay longer messages through stations in Africa or the Mediterranean. This comm plan allows for the network to grow and eventually make that a reliable option.

Leaving Room for Automatic Link Establishment

Ideally, ALE technology would make the concept of Data Bridges irrelevant. Even with enough power, reliable contact can be made at will without waiting for a comm window. These Data Brides are made with the portable operator in mind who might have to rearrange his/her antenna to make long range contacts. With ALE, there is no guesswork to determine which band or time of day is most appropriate for a data link, as the software computes this automatically. This is why ALE is the gold standard for military communications links around the world. However, among radio amateurs, ALE is still in its infancy. Ion2G is the front-runner software package intended to encourage more ALE-based comms in the ham radio world, but the antenna and transceiver requirements make ALE cost prohibitive for most radio operators.

However, since ALE is the future, we can still allow for an ALE comm window. ALE is not magic, it simply chooses the best frequency to make a link between two points. At the moment, Ion2G in particular can only really be used for simple text messages, or voice calls. Sending emails must still be done using traditional Winlink P2P methods. This means that ALE can remove the guesswork when it comes to frequency choice, but the time of day must still be chosen by the operator*, and using different data modes (like RTTY) still requires manual decision making by the radio operator. One must remember that cutting-edge technology (in the ham world anyway), is perhaps not the most reliable in a serious emergency. Therefore, we can allow for the use of Ion2G by creating a specific time window for its use, but we also want to allow for other more manually selected networks to function using the equipment that most people already have.

*Ion2G is best used by leaving the software to run 24/7. However, this is not the best option for most radio operators as 1- it ties up resources, and 2- the clicking of relays in the radio 24/7 is not appealing to most people. Various work-arounds exist to make Ion2G a viable persistent system, but as this software is still in development trusting it with one's life is not advised unless a highly reliable backup solution is also in place...like a Data Bridge.

DATA BRIDGE OVERVIEW

North America-Europe Data Bridge

Established almost entirely on 20m, as this has the best chance of success over such a distance, while also being accessible to most people. Set up during the hours of 1800-2000 GMT so as to take advantage of afternoon DX potential.

Europe-Australia Data Bridge

Established on 20m, with an additional plan for 80m. Due to the long range, very short text-based options like JS8Call and VarAC will be most reliable. RTTY for blind transmissions or for maintaining comms when other modes are not ideal.

Australia-South Pacific Data Bridge

Established on 20m, with an additional plan for 40m. Due to the combination of low population density and long range, most comms will have to use the traditional DX bands for "semi-local" comms to be reliable. 40m can also be used more effectively due to open ocean eliminating vegetation/terrain restricting ground waves. However, ocean conditions can also hinder transmissions, so relying on the F2 layer of traditional DX bands can also help to ensure reliable comms.

North America-Australia Data Bridge

Established almost entirely on 80m, as this has the best chance of success over such a distance. This will limit users to those who have an 80m antenna system, but due to distance this is the best chance for reliable success. Set up during the hours of 1200-1400 GMT due to 80m being most useful when both continents are in darkness (mostly), while also considering the feasibility of operating hours for those on a tight schedule..

“WHAT’S THE POINT?”

Understandably, such a seemingly complicated plan/infrastructure is bound to result in the question “Why even bother with all this?” Though the answers should be fairly obvious, below are a few concepts that are perhaps not adequately explained in emergency communications:

- **He who owns the wires, owns the communication.** All internet communications are vulnerable to censorship, surveillance, manipulation, and information warfare. Granted, this can apply to all communications on Earth, but there is a reason that powerful entities have spent substantial portions of defense budgets on information warfare and censorship tools. You can jump from platform to platform, being banned from one social media site before moving to the next. But the inconvenient truth is that radio is exceptionally difficult to influence by anyone. Though this may change in the future, radio is the ONLY option for communicating over long distances, without using anyone else’s infrastructure.
- **Comms can’t be established after a disaster, only before.** No meaningful comms network has ever been set up after a natural disaster strikes, and certainly not after a man-made disaster (such as war) breaks out in a region. During a crisis, people tend to be rather busy as the time-saving conveniences that make our modern society function stop working. There are only so many hours in the day, and if a person has to spend a lot of time establishing even the most basic comms links (and assuming risk doing so), this is time lost that could have been better spent on other tasks. It’s better to create the plan, practice it, and integrate it into daily life NOW, so that when all other comms are shut down or censored, the transition to radio is as seamless as possible.
- **A couple of “prepper freqs” is not good enough.** Shouting into your radio handset on doomsday is hardly likely to be effective. In modern times, even during significant emergencies, traditional voice comms that hams are known for are extremely ineffective. If we factor in the sheer number of people who own radios (even HF radios), we can clearly see that more significant network planning is needed. If the HF bands are so busy that the average user has a hard time breaking through on the average sunny Saturday afternoon, during a time of emergency, comms won’t be possible at all. Thus the need for more substantial networks, modes, and methods that can handle higher volumes of varying kinds of traffic.
- **The average citizen is now playing for keeps.** No one lives forever, and in today’s world many people are finding out how true that adage really is. As such, resiliency in the face of an airstrike/raid is paramount. If a ham radio group cannot survive even a basic raid, they are of no help when the chips are down. This means that a “work-in-progress” plan is better than no plan at all. And more importantly, a non-hierarchical framework is essential for the networks survival in the event of kinetic targeting.

Typical Use Case Examples

Standard natural disaster preparedness: A great use of the GhostNet would be to serve as a common network that many people can use to share news regarding natural disasters which may have degraded cellular networks.

Decentralized, uncensorable, off-grid news network: The unique nature of HF radio makes censorship very very difficult. If someone wanted to stop a station from transmitting, they would have to either jam that station, or physically visit the actual location of the station, and physically stop the transmission. As the world discovered from the Cuban Jamming incident of 2021, even military grade jamming is not entirely effective enough to totally stop all communications. Where there is a will, there is a way, and JS8Call (and other tools) make alternative communications not just possible, but a reliable alternative for the average user. **Group Messaging:** JS8Call is a powerful group messaging tool. Due to the nature of using offsets, many people can send messages at the same exact time, only being limited by the time one is transmitting them—selves. A listen-only user can pull up JS8Call and automatically decode multiple messages simultaneously, receiving messages from many different regions. JS8’s store-and-forward capability allows users to send messages far beyond their own station’s range. This forms a very basic form of a mesh network, which although not a true mesh, still offers many of the capabilities of exchanging messages far beyond the line of sight of just one station.

ATAK Compatibility: Through the use of various plugins, the TAK suite of software can function within JS8Call. Obviously sending extremely high amounts of CoTs data is not best suited to HF radio, but this could be a useful feature for those who wish to integrate HF comms into their TAK network.

GhostNet is simply meant to help ensure communications. It’s not intended to replace anything, or override any pre-existing networks or plans. If you want to use it, Great! If not, that’s fine too. But it’s there for those that need a reliable plan, where nothing similar currently exists.

EMERGENCY C2 NODES

In the event of incidents occurring that require more active monitoring or response from average citizens, ad hoc Tactical Operations Centers may be required for monitoring the situation. Command and Control (C2) nodes may also be needed to coordinate the response of community members. In the event the situation becomes untenable, or if break/out operations are necessary, various considerations and equipment choices can ensure that communications can be maintained, even if on the run.

Communications are a Priority

No Command and Control is possible without communication with other units, groups, or communities. Among a prepared citizenry, which is not likely to be as organized, hierarchical, or disciplined as a formal military unit, communication will be difficult during the best of times. If there is any hope of maintaining even the most basic coordination during a time of crisis, extremely robust plans and standards must be in place. Constant training and practice must be routinely carried out, specifically with communications equipment, to ensure that at a moment’s notice, alternative communications plans can instantly put in place, without any loss of capability. Snap drills simulating a widespread cellular/internet outage are great for ensuring skills do not become rusty.

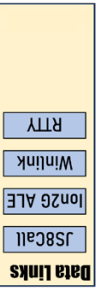
HF vs VHF/UHF Radios and the Fog of War

Though handheld VHF/UHF radios are far more common, if a C2 Node needs to relocate to ensure safety, or in the worst case, is on the run and being pursued by vastly superior forces, chances are the escapees will quickly be far out of range of Line of Sight communications. In that case, HF radio is really the only feasible option to maintain contact without using preestablished infrastructure. HF radio equipment must be as compact and lightweight as possible, in the event that evasion plans are enacted. Maintaining small QRP (low-power) HF transceivers may not be as powerful as larger 50-100 watt radios, but smaller rigs are easier to take with you when you break out of encirclement, break contact from an ambush, survive a drone strike, or any number of serious issues. QRP radios allow the possibility of establishing emergency C2 nodes upon rallying locals following an attack. Though usually discarded as being underpowered, a lot can be done with little power using digital modes such as JS8Call, VarAC, Winlink, or any other data modes.

Setting Expectations

If you are in the middle of a crisis that requires you to relocate for your personal safety, it is unrealistic to expect a professional TOC to be set up, with all the amenities and perfect communications. You may be cold, tired, hungry, and living out of a vehicle...yet still expected to provide critical communications for your community during a crisis. Obviously, the bare minimum communications and battle tracking capabilities are the only feasible options in situations of desperation. If you can get an HF radio up on JS8Call, that might be the best you can do.

Expectations must be tempered in the civilian environment; it is a hard to expect someone to establish stations. However, nothing worth having is free...and nothing worth doing comes easy. For a minimum investment, the average person can be vastly more prepared. And for a moderately capable in a changing world.



GHOSTNET SURVIVABILITY

We all live in strange and uncertain times. What is certain, however, is that accurate information is necessary for survival. Consequently, censorship has become a household term as most citizens around the world become victims of information warfare. This plainly obvious truth, while largely unspoken in the ham radio community, is a fact of life for most of the Earth.

Therefore, network survivability must be a priority, but not in the ways that we traditionally think of. Yes, we must prepare for power outages, systems going down, or any number of natural disasters. The ham radio world is well prepared for these contingencies. What tends to get ignored, are the more nefarious communications issues. Repeaters being kinetically targeted. Ham radio club members being arrested. Jamming. And of course, surveillance. These real world events are not fear-mongering, these events have already occurred and are fairly routine around the world. We mustn't dwell on this negativity, but we have to acknowledge that a substantial portion of the ham radio infrastructure is not entirely suited to operate in a contested or non-permissive environment. What good is a radio network if it reports directly to agencies that are targeting it in the first place?

And what does this mean for those of us who do wish to operate in a less-than-friendly environment?

Organization will be haphazard: No net control or "main" station means that a single airstrike cannot disrupt communications...taking out the leader won't work when there is no one leader. This makes for haphazard and disorganized communications, but it's the best that we can hope for in a situation of desperation.

Competing Interests Cloud Information Exchange: It's easy to create echo chambers, and only allow the free speech that a particular group of people agree on. However, if one has the very broad goal of simply allowing others to communicate with each other over long distances, when all other methods of communication are either surveilled or not available, ideology, politics, and personalities will become a problem over time. Everyone is different, and has different ideas of solutions to the world's problems. With no strong, top-down leadership, a system such as this has the potential to descend into cliques, political echo chambers, and general chaos. As HF radio is not super popular right now amongst the general public, these kinds of communications networks tend to attract the more dedicated and altruistic personalities, which is why this is not a large problem for now. Over time, as censorship becomes even more constricting, it becomes ever more important for every user to be the best person they can be, and reflect the goodness they wish to see in the world.

The Issue of Timing: One of the first questions we must ask ourselves when responding to any issue is: How much time do we have to work with? Though this idea is a concern with more formalized public-service incident and Rescue organizations, from a more "prepared citizenry" perspective, timing is more important. Unlike public services, which have strict "work the problem until it's solved, escalating assistance to higher levels as needed until mission complete" mindset, the average citizen might have to "break contact" while working an incident if it is determined that not enough time remains to be of any use.

Complications and the Fog of War. "No plan survives first contact". This phrase, a common utterance on the battlefield, also most certainly applies to the entire field of communications...especially the communications on the battlefield. Reliable communications in combat, while rarely given credit when things go well...is the most often cited complaint when people get killed. Communications is not alluring to most, but if you don't get it right, your chances of survival are remote. This is why understanding the unique nature of combat is necessary for success; if comms are good, clean, and efficient during peacetime, they might be barely successful during wartime. But if comms are nonexistent during the best of times, it will be impossible to establish comms during the worst of times. Communications in war is often times utter chaos; an adventure of utter madness, with no one knowing what's going on until the combat situation has reached a conclusion. Thus, we must often times choose the communications methods that are not the best, or even the most efficient...but rather the comms methods that are functional, rugged, reliable, repeatable, and accessible by the lowest common denominator. However, despite the assertions that "simple is best", a certain level of complexity is required in order to ensure that all the bases are covered, and as many situations as possible are planned for.

A Plan Comes Together All of this means that there is no one single communications method...each communications choice can compliment each other method. 20m HF transmissions can be used for extreme-long-range comms, with 40m filling regional comms requirements, and VHF/UHF comms can handle close range messaging needs. There are other options, such as Automatic Link Establishment programs, which are vastly more capable (and automated). Communications, much like training, defaults to the lowest common denominator. If you have a high speed HF ALE data-link setup, but the person you need to talk to has a Baofeng, your communications efforts will be in vain. Everything is a balance...a balance of what everyone on the net is capable of, all being influenced by the unpredictable and confusing nature of the Fog of War.

ARCHITECTURE OF PRIVACY

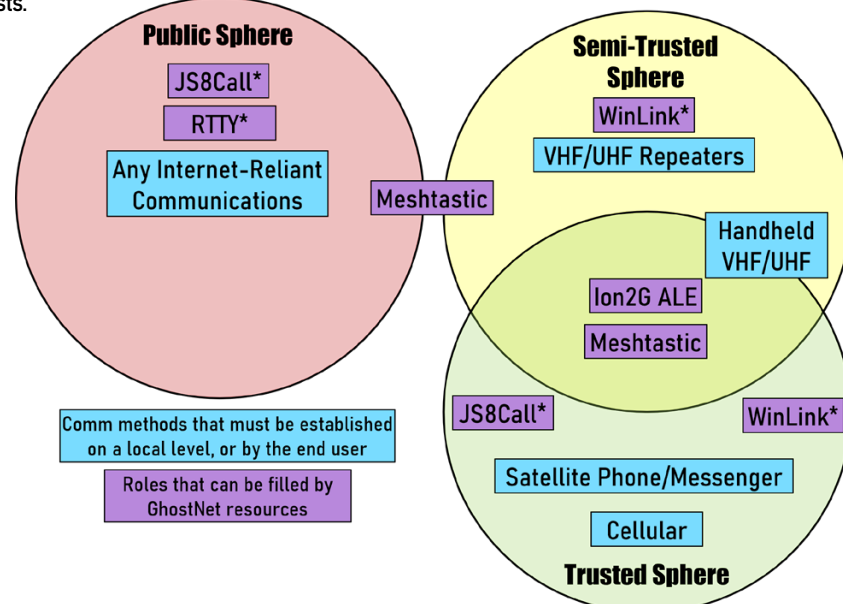
Operational Security (OPSEC) is of great concern to those wishing to establish communications networks in non-permissive environments. However, if maximum OPSEC procedures were to be followed 24/7, no one would ever communicate at all. Therefore a careful balance must be struck, allowing for some communications to be completely public (for the masses to consume), while other communications methods are only shared with trusted users, or those who have a vested interest in a local area (semi-trusted entities). Trust is a finite resource, and once it's gone, it's very difficult to obtain again. Why does this matter for communications?

- You need to exchange information and communicate with people, but powerful entities have invested significantly in making that difficult. You want to find like minded people, but you need to communicate to do that, and all internet based comms are surveilled. You need to organize, but the moment you get too popular, you meet Icarus's fate. Everything is a balance between keeping your head down, and flying too close to the sun (so to speak). GhostNet should enable everyone to participate at their own pace (and risk level), allowing people to assume an appropriate level of risk in order to make progress, but also not take on so much risk that safety is compromised. GhostNet should allow people to ride the line between doing nothing, and risking it all.

- You may have friends or family that know your cell phone number, but you wouldn't give out that cell phone number to just anyone. On the other hand, you may program in national calling freqs into your handheld radio, with the full intention of maybe having to talk to strangers during an emergency. There are many layers of communication between these two examples, and many ways of building networks on varying levels of trust.

Modular Privacy

With Operational Security (OPSEC) being a very important consideration, GhostNet comms can fit into any local or private communications plan. If you need to make contact with trusted contacts, or even people you don't know (but have a shared interest, such as for community defense), GhostNet hopes to enable this. On a more strategic level, GhostNet can fill a need for strategic communications, where no pre-organized solution is available. If an entity doesn't wish to use GhostNet, anyone can duplicate the idea fairly easily, and tailor a plan to their own needs. Communications cannot be established after a disaster, only before...but most people still will not plan for this. So even if a group of prepared citizens wants to create their own plan, GhostNet can temporarily serve as something, where nothing currently exists.



*Radio based communications can require a license, depending on the situation. For daily use in a questionably-permissive environment (such as the regular ham radio hobby), a license would be required. However, in an apocalyptic-level emergency where users are no longer concerned with regulations, many radio modes can technically be used regardless of callsign. This means that privacy, while non-existent under normal ham radio operating conditions, is extremely feasible in the event of an emergency.

LAST-DITCH RECEIVE-ONLY OPTIONS

Unfortunately, the sharp reality is that most people will simply not take the appropriate precautions to establish a comm plan before comms are lost. Most people will simply be caught unaware and unprepared in the event of an incident of some kind taking out internet servers, cellular networks, or satellite ground control stations. Nevertheless, how can we help these people at minimum receive some communications?

The tips below are a suggested standard for absolute last-ditch communications methods, to be used by those who have not taken measures to get on HF radio.

You Still Need a Radio!

Preferably, prepared citizen should own a small battery powered Shortwave radio. These radios can usually receive most radio transmissions on Earth. If you have a shortwave radio, here's worth monitoring:

The Gear You Have	What You Can Receive	Best Practices
Simple Shortwave Receiver	- Global news reports - Any voice comms transmitted by hams on amateur freqs - All commercial AM/FM signals - With a 3.5mm aux cable and a USB sound card, can be used as a primitive receiver for JSB/FT8/RTTY messages (which are decoded on a computer).	- Try scanning every hour for the first 24 hrs following an incident. Though this will burn through battery power, most shortwave receivers store the frequencies on which they received transmissions. In short, if you let your receiver scan for a while (or run the scan function throughout the day, as band conditions change), it will build a library of channels that you can quickly change between. Not all shortwave receivers do this efficiently, so check your specific model to determine if it's worth it. - At minimum, scan the airwaves with your receiver at sunrise and sunset. This conserves maximum battery power, and also creates a standard plan for those who may be blindly transmitting to others in their local area.
Software Defined Radio (with antenna and Linux PC)	- All digital HF data modes - Most digital voice modes - Almost every radio signal in existence (depending on the SDR) - Weather satellite imagery - Weather balloon data - Aircraft ACARS data - ADS-B/Mode S data	SDRs have infinite uses. Scanning utilities are useful for local traffic. Can also be used to decode modes like RTTY and JSBcall in listen-only modes. Requires a computer to process signals.
Analog VHF/UHF Transceiver (Such as a Baofeng)	- Unencrypted, analog local radio traffic - NOAA Weather Radio - Local amateur radio repeaters - Aviation and Marine traffic	VHF/UHF radios are very useful for scanning local freqs or monitoring local ham radio repeaters for information.
Handheld Scanner	- Trunked radio signals, such as public service traffic - All publicly available government agency frequencies - All common radio signals used for voice communications.	Scanning local radio traffic persistently is beneficial for local events. Be mindful of battery usage.

GHOSTNET AUSTRALIA

Weekly HF radio communications network. For efficiency, this will largely be a data-only net, with voice comms only being used in an emergency to coordinate further link-ups.



Weekly Every Thursday Night

Details	All Times GMT
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JS8Call (40m)
NVIS
7.107 MHz

Use Offsets to find a clear space to transmit. All messages along the band will be decoded anyway, so pick any offset that's available.

Winlink P2P (Vera, USB)
NVIS
7.107 MHz

Stations wishing to exchange emails may do so during this comm window. Use Vera HF Peer-to-Peer Connection with designated call signs to avoid linking with formal Winlink nodes. Handshakes start at 2035Z, data burst as long as it takes. Use the JS8Call window to determine call signs, and the order of stations sending emails. Emails should be posted to outbox BEFORE comm window to maximize efficiency.

RTTY
7.077 MHz
45.45 Baud

Use short RTTY bursts to transmit blindly to stations that missed check-in. Stations missing windows are to use RTTY presets on radio to communicate problem. If contact is re-acquired, can re-send critical msg traffic that was missed earlier. If so desired, RTTY can also be used to send traffic to SWL-only stations during this window.

HF Voice
Simplex LSB
(40m)
7.190 MHz

ONLY FOR USE IN A DIRE EMERGENCY, NOT A STANDARD NET
HF voice freq shall be monitored for the last five minutes of all comm windows, no matter how the window flexes. If a station misses all prior check-ins, stations with highest likelihood of comm success will initiate voice calls for missing station as required. If station is expected to participate in the net, but is still not heard, proceed with Emergency PACE plan.

0700-0730 UTC

0730-0800 UTC

0800-0830 UTC

0830-0900 UTC

Though set up to be a weekly event, during contingent circumstances this plan can be used for battle tracking incidents as needed.

AUSTRALIA DATA BRIDGES

40 meters is a great band for region-wide communications. Long-range data links are perhaps best served by the more traditional DX bands, but 40m offers a good blend of range and ease-of-use as it is usually the lowest band of frequencies that most radio amateurs are capable of transmitting on regularly.

Weekly Every Saturday

North America-Australia Data Bridge

1200-1300 UTC - JS8Call Net on 20m @ 14.107 MHz
Use same Ghostnet groups and naming conventions as on previous page.
1300-1330 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list.
1330-1400 UTC - JS8Call Net on 80m @ 3.575 MHz
Use same Ghostnet groups and naming conventions as on previous page.

Europe-Australia Data Bridge

2000-2100 UTC - JS8Call Net on 20m @ 14.107 MHz
Use same Ghostnet groups and naming conventions as on previous page.
2100-2130 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list.
2130-2200 UTC - JS8Call Net on 80m @ 3.575 MHz
Use same Ghostnet groups and naming conventions as on previous page.

Australia-South Pacific Data Bridge

0800-0900 UTC - JS8Call Net on 20m @ 14.107 MHz
Use same Ghostnet groups and naming conventions as on previous page.
0900-0930 UTC - JS8Call Net on 40m @ 7.107 MHz
Use same Ghostnet groups and naming conventions as on previous page.
0930-1000 UTC - Ion2G ALE Comm Window. Use provided config file for frequency list, or refer to Ion2G setup page for complete frequency list.

Use this blank space for notes, such as converting comm windows into your local time.

GHOSTNET RECEIVE-ONLY OPTIONS

Persons limited by a lack of license or transceiver, but still desiring to participate in GhostNets can set up a receive-only station to listen in on transmissions. Though there are many ways of doing this, a common setup requires the following:

Needed Hardware

- 1 - Software Defined Radio with a Windows (or Linux) PC to run it:** A simple SDR dongle can be configured to receive HF radio transmissions. Some SDRs are more efficient on HF frequencies, but with an appropriate antenna any SDR should be sufficient.
- 2 - HF Antenna:** Suitable for the frequencies you wish to receive. HF antennas for receiving can be built more easily than ones used for transmitting, and in a pinch a long, random length of wire will work (albeit, not very well).
- 3 - GPS Receiver:** A simple USB GPS dongle will function perfectly. You may need to install specific USB drivers to allow it to function on your particular operation system.

Needed Software

- 1 - A simple SDR software package:** A common option is SDR# (also known as SDRSharp). This will be used for a variety of tasks, but mostly to ensure that your HF antenna and audio settings are functional.
- 2 - Virtual Audio Cable:** A common option is VBAudio Cable. Radio signals are received by your SDR, where they are displayed as audio. That audio has to be input into the appropriate software in order to be decoded. If your radio isn't "piped in" to software that will hear it, no communications will be heard. Since our SDR is a device plugged in to a USB hub, we have to make this connection virtually, with software. VBAudio cable is a simple software package to allow the audio from the SDR, to be input into JS8Call, instead of coming out of your computer's speakers.
- 3 - JS8Call:** The main software package for decoding the bulk of our GhostNet signals, which use the JS8 protocol. This program will decode the audio that is fed into it (the audio that comes from your SDR) and decode those digital signals into plain text.
- 4 - FLRig and FLDigi:** Supplementary software that is similar to JS8 in that it decodes signals, but instead of decoding the JS8 protocol, FLDigi decodes a variety of other signals, such as Radio Teletype or RTTY. This software will be needed for GhostNet comm windows that require decoding RTTY.
- 5 - BKTTimeSync:** Software to set your computer's time to accurate GPS time. Necessary to decode JS8Call messages which rely on a very accurate clock.
- 6 - Zadig:** Software to install the proper driver for your SDR device.

Simplified Setup Checklist for Receive-Only JS8Call

- 1 - Install SDR# and Complete Setup:** Install SDR Software, install appropriate drivers for your SDR dongle.
- 2 - Open VBCable:** Download VBAudio Cable, open the .exe file, and install the driver.
- 3 - Insert SDR, launch Driver Replacement:** Plug in your antenna to the SDR, and insert your SDR into an open USB port, and use the Zadig software to install the proper driver for your SDR (the Windows operating system will automatically install the incorrect driver for most SDRs, so Zadig is needed to correct this mistake).
- 4 - Note Com Port:** With your SDR dongle inserted into your PC, open Device Manager and ensure that your SDR shows up under Ports. Note the Comm Port number.
- 5 - Open SDR#:** Confirm the SDR is working by clicking Settings -> Device, and from the drop down menu, select your SDR device. You should see signals coming in on the waterfall. This program is necessary to receive signals using your SDR (if you don't want to use FLRig/FLDigi). You can pipe the audio from SDR# directly into JS8Call using VBCable.
- 6 - Install and open BKTTimeSync.** This will sync your PC clock to the most accurate time. This is required for JS8Call to decode messages. This app will require an internet connection (not ideal) or a GPS dongle/internal GPS on your computer/tablet. Alternatively, you can use the Automatic Time Drift function in JS8.
- 7 - Install and Open JS8Call:** Follow the prompts for installation. When prompted to select a rig, choose "none". Open File -> Settings -> Audio, and under the Input drop down menu, make sure to select the VBAudio OUTPUT. Remember, your SDR (using the VBAudio cable software) is OUTPUTTING audio, which needs to be piped in to the INPUT of JS8Call. This "connects" the audio cable so that JS8Call can hear the audio signals that are being received by your SDR. You should now begin decoding JS8 signals.
- 8 - Install and open FLRig and FLDigi:** These software packages can be set up in a similar fashion as JS8Call. FLDigi can be used to send and receive RTTY messages (along with many other data modes). A receive-only arrangement can be established using FLDigi as well.

GHOSTNET ALE FREQUENCY LIST

WORKING DRAFT

Note: All of the frequencies are intended for data modes, not voice transmissions. This is for several reasons mostly pertaining to the efficiency of ALE, by its very nature, is not necessarily a low-power mode. Thus, smaller QRP transceivers will have trouble maintaining strong links with other ALE stations. By restricting ourselves to data-only modes during ALE nets, we can squeeze as much efficiency out of the system as possible. In other words, you will probably not be able to use Ion26 to make a voice phone call using a QRP radio. However, sending a text might be more feasible. Developments are being made in the world of ALE, and as technology improves more reliable links can be established by equipment that today is less than desirable.

Channel Name	Frequency (USB)
01GHOSTNET	3598.5 KHz
02GHOSTNET	7104.5 KHz
03GHOSTNET	7106.5 KHz
04GHOSTNET	7108.5 KHz
05GHOSTNET	10128.5 KHz
06GHOSTNET	14111.5 KHz
07GHOSTNET	14113.5 KHz
08GHOSTNET	14115.5 KHz
09GHOSTNET	18108.5 KHz
10GHOSTNET	28108.5 KHz

This is a work-in-progress, so some problems may be reported with these freqs. Expect future updates to address any concerns that may be present with this rather new communications tool. ALE has been around for a long time, but as more people begin to use it, more problems become exposed. Consider these freqs to be a sort of Early Alpha version as we begin to implement ALE more heavily.

Settings

Channels Setup

+

Name

Frequency

Mode

Scan

Tx

Traffic

01GHOSTNET	3598.5 KHz	USB	yes	yes	no
02GHOSTNET	7104.5 KHz	USB	yes	yes	no
03GHOSTNET	7106.5 KHz	USB	yes	yes	no
04GHOSTNET	7108.5 KHz	USB	yes	yes	no
05GHOSTNET	10128.5 KHz	USB	yes	yes	no
06GHOSTNET	14111.5 KHz	USB	yes	yes	no
07GHOSTNET	14113.5 KHz	USB	yes	yes	no
08GHOSTNET	14115.5 KHz	USB	yes	yes	no
09GHOSTNET	18108.5 KHz	USB	yes	yes	no
10GHOSTNET	28108.5 KHz	USB	yes	yes	no

If you would like to verify your codeplug, or make sure that you have input all channels correctly, below is a screenshot of the channels as they are set up in the codeplug file.

GHOSTNET BEST PRACTICES

Any decentralized, uncensorable platform is a double-edged sword. Offering on the one hand truly free speech, but on the other providing a network for malign actors to influence. On the radio waves, there is no "block" button, and users may hear opinions that they do not agree with. This is even more true of a network like the GhostNet, which has no Net Control, no single point of failure. To us, this is an acceptable compromise toward the goal of attaining real free speech. However, as the overall goal is information exchange that is helpful for the average person, below are some best practices that can help us all make the most of the platform. Users will get out of GhostNet what they put into it: garbage in, garbage out. Let's work toward providing quality content for all:

Check in Early for Testing

A major part of GhostNet is the ability to test gear, and check in with friends. However, with such a small comm window (and hundreds of users), the waterfall can get pretty busy. As such, if you are just beginning or testing out gear, feel free to hop on 30 minutes to an hour before the actual comm window starts. There is enough persistent traffic 24/7 to check your gear before the meeting time, so that we can save a bit of bandwidth for communication.

Try to limit CQs/MSG checks/SNR Reports during Comm Window

All of these features are excellent, and should certainly be used. However, with so many users active during the comm windows, it would be a good idea to do these checks before or after the window. Turning off Autoresponses during the comm window is encouraged. One user requesting an SNR report from the @ghostnet tag causes dozens of rigs to transmit simultaneously...and if a different person does this ever minute or two, most people's inboxes are filled with SNR reports instead of news reports, intel updates, etc. Likewise, if you want, feel free to share a brief news report or two during the comm window. Sharing information is what this is all about!

Be Mindful of QRP Stations

Always remember that one often transmits farther than their antenna can hear. It is quite common for more high powered stations to accidentally transmit over smaller stations. Remember the golden rule of radio: Only use enough power to complete the communication. Remember, we're trying to give the smaller stations a shot, as QRP rigs are extremely common transceivers for beginners. We don't want to alienate newer operators because they don't have a really powerful rig, or a super efficient antenna.

Understand the Cultural Barriers

Ham radio has a unique culture. Sometimes this culture is not great, and really discouraging towards new users. As much as we might not like to talk about it, it's the truth. Some operators don't like new things, and don't respect the effort we have undertaken to simply provide another communication option. Some other networks think that the GhostNet is hostile towards their own work (which it most certainly is not). Hams have been observed trying to intentionally jam the network, and generally cause trouble. No plan is perfect, but we are at least trying to improve communications in a time when humanity's freedoms are at risk. It is with this in mind that we move forward, helping people where we can, and learning a lot along the way. The unspeaken cultural issues within amateur radio are obvious to any newcomer, but let's remind ourselves that the culture is changing for the better...even if we have a long way to go.

Use Common Sense

Though perhaps a dying virtue throughout the general public these days, simply observing what's going on and making rational decisions is really helpful in the field of radio. Again, with radio there's very little content moderation. If it weren't for the FCC's regulations there would be no rules at all, and even so most radio etiquette is all but impossible to enforce. Radio is the last bastion of the technical ability to remain free to speak. With that comes great responsibility and the duty to ensure that the goodness we wish to see in the world is reflected in our actions. If someone is sharing a valuable information report, or is providing updates on a world even in real time, it might not be a super great idea to rag-chew right next to them. If the band is a bit busy, and you have a smaller group of friends you'd like to contact, feel free to move to a clear freq. The main freq is just a common gathering place; a tool for all of you to use. And remember, these Best Practices are just helpful tips. Not headline rules. It would be foolish for anyone to expect any type of enforcement of these recommendations, though many will certainly try. There's no need to shout someone down for the tiniest transgression of these helpful tips; we're all learning together and people sometimes make mistakes. The self-policing nature of radio is what turns off many new users, so let's encourage and guide each other, rather than cracking down on the smallest error. We're all in this together, for better or worse. We may all be strangers separated by distance, but we all want to make the world a better place. So let's build a team and work together toward the common goal of helping each other in these tough times.

MALIGN ACTORS

Despite our best efforts to create a wholesome project, various issues have become problematic since the launch of this Net. Below are some of the concerns to be aware of.

Cultural Problems

Though somewhat perplexing to new radio amateurs, cultural problems comprise nearly 100% of the issues on ham radio, and are by far the Number One reason new operators feel uncomfortable fitting in. The fact that this much text has been dedicated to addressing this problem (in a pocket-able field guide) should confirm the seriousness of the cultural problems within the world of radio. Though it is uncomfortable to discuss, these problems need to be addressed in the interest of moving forward and improving the GhostNet.

Poaching

The ham radio world is full of clubs and groups, and there tends to be a lot of overlap among users who may be members of multiple groups. However, the GhostNet was not intended to be a free advertising service for other networks. While we want to allow users to feel comfortable in creating their own GhostNets, we also want to remind everyone that the farther you get from the GhostNet's main freqs, TTPs, and operating schedule, the farther you get from the intended purpose of the GhostNet. Feel free to mimic our work on your own, but be mindful of mission-creep that might pull your attention from the main GhostNet plan. Be extremely wary of users that want you to change frequency to their own net, especially if that network belongs to a group that places radio communications behind a paywall. Multiple users have reported hams intentionally jamming GhostNet comm windows with SNR requests, then saying "hmm, this band sure is busy. Come join me on my own freq!"...which turns out to be a paid, members-only radio club.

Cliques, Bullying, and Deception

In the absence of a highly organized Net Control, power vacuums are inevitable. Be mindful of anyone who claims to be operating as Net Control. Most hams strive to improve efficiency, but sometimes these efforts are really just attempts to control other people. More often than not, this results in hams bullying users into following their arbitrary rules, or using their airwaves as their own fiefdom. GhostNet was created with the good intentions of working alongside preexisting groups, and have gone above and beyond to ensure our work has not interfered with any other network. Despite this, other groups have attempted to take over GhostNet comm windows, using their own software, reporting procedures, infrastructure, etc. Do not let other radio amateurs bully you into joining their own network if you don't want to. If you are a member of another ham radio group or club, that's great, but please keep your own procedures on your own network and respect the work that has been done here. Nothing will be officially supported by the S2 Underground beyond what is published in this guide. Also be mindful of people who want you to join a network, or use their reporting format. Someone might say to you "hey, try this report format, or this software, it's really efficient and cool!". That may be true, and we applaud attempts to grow and improve network efficiency. However, in many cases these claims of "efficiency" are less about improving a network, and more about getting users to use a common format, which is intercepted over the airwaves and published on a closed network behind a paywall. You may think you're using a neat tool which improves efficiency, but in reality you are jamming the airwaves with a proprietary tool/format that is nothing more than a way to generate paid content for other people. Don't end up the unwitting writer/content creator for another group that steals your work, and secretly charges other people money for it. Not everyone in the ham radio world has good intentions, which is a fact not often repeated aloud but is nonetheless true.

These Issues Are Real

Understandably, reading these somewhat harsh words might be discouraging to new users who are not aware of the cultural problems we face. Most radio hams are also highly likely to be offended by discussing these topics. More drama within the community is annoying, but we need to talk about these topics in the open, because they have caused real world problems: The user who is afraid to transmit in a life or death emergency because some Elmer chastises them for using "their" repeater. The user who wants to receive the news regarding serious world events, but can't because someone is describing their entire shack over the radio. Or the radio amateur that joins a club, and over time slowly begins to enjoy radio less and less, because of hams creating barriers to growth. The GhostNet is intended to refresh the world of radio, and really challenge users to think outside the box when it comes to preparedness, as well as the daily use of radio. So let's move forward despite the hate, and do the best we can to improve the world around us.

NICE NETWORK YOU'VE GOT THERE



WOULD BE A SHAME IF SOMEONE USED IT TO RECRUIT PEOPLE INTO A CLOSED, PAID RADIO CLUB

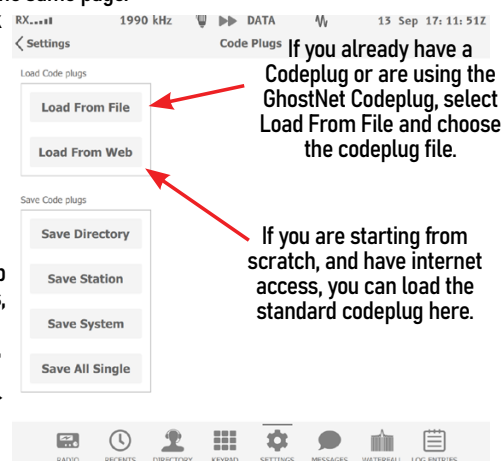
ION2G SETUP AND CONFIGURATION

Standard Config Works

As you install Ion2G ALE, the base configuration works fine to make contacts. However, you will need to check a few settings to make sure everyone is on the same page.

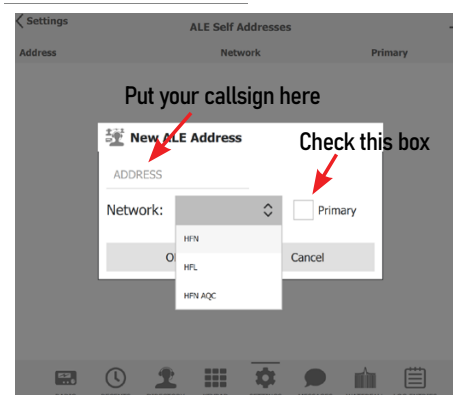
1 - Load Codeplug: Without a codeplug, you will talk to no one. You have three main options: You can load the standard codeplug using the "Load from Web" button (requires an internet connection). You can also load the GhostNet codeplug which can be downloaded via a variety of sources. Or you can manually create a list of channels, choosing frequencies by hand. If you wish to manually recreate the GhostNet freqs without access to the digital file, you can do so easily on the next page.

If you are setting this up without internet access, and without a pre-established codeplug file, you will need to go to Settings -> Channels -> Click the Plus symbol on the upper right, and add in each channel manually.



If you already have a Codeplug or are using the GhostNet Codeplug, select Load From File and choose the codeplug file.

If you are starting from scratch, and have internet access, you can load the standard codeplug here.



2 - Set Self Address: It's not super clear in the documentation, but you cannot transmit at all unless you set a self address for each of the networks you want to operate on. This setting is not cross-referenced with any database, so in the event of an apocalyptic emergency, or for MARS work, any callsign will be accepted by the software. To change this, click Settings -> ALE Self Addresses -> Click Plus symbol at upper right to add New ALE Address. Put your callsign in the Address box, select a network in the drop down menu, and check the box marked Primary. You will need to create a Self Address for each of the networks you operate on. This is just putting in your callsign for each of these networks. When using the standard code-plug, this means you will need 3 addresses, one for HFN, HLN, and HFN AQC. If using the GhostNet, you will need an additional address for that.

3 - Check Audio Source: This is not set automatically, you need to select your audio input and output manually. Go to Settings -> Audio and select the appropriate input and output audio sources from the drop down menus.

4 - Check Radio CAT Control: If you are familiar with setting up JS8Call or FT8, this should be familiar. This is found under Settings -> Radio Control. Make sure the appropriate radio is selected, along with the correct CI-V address, com port, and baud rate. If any of these settings do not match your radio, comms will not be successful.

5 - Disable Bands not compatible with your antenna: Using the standard codeplugs, BE CAREFUL! Most people do not have 160m, 80m, or 60m antennas, but these freqs are a part of the standard codeplugs. This means that your radio will try to transmit on these freqs, even if your antenna is not tuned for it. This can damage your transceiver.

JS8call

Primarily an HF-based platform that, when installed on a computer linked to an HF radio, provides the operator with keyboard-to-keyboard texting capabilities. JS8 excels at weak-signal interception, and is well known for its comparatively user friendly interface. JS8 can also be used to relay messages to stations BLOS, and is also capable of sending automated "heartbeat" messages to all stations, providing instantaneous confirmation of range. Groups can also be established, creating ad hoc nets as needed, with every station being notified of a group message, regardless of that station's call sign. As a result, JS8call can be used to easily create medium-to-long range communications networks as needed. And if a person knows which group to follow, it's not necessary for everyone to know each other's call sign. JS8 can also easily be used with custom, user-defined call signs, in the event of a catastrophic emergency. JS8 is ideal for monitoring 24/7 as it requires little power, and the automated Heartbeat messages periodically confirm that you are on the net. All the while, you can receive messages, including messages from all over the world via JS8 relays. By primarily staying on JS8, one's own station can be readily available to relay others' messages as well. Though far from perfect, JS8 is the closest to an all-in-one solution for medium-long range text-based comms.

Ion2G HF-ALE

One of the most effective Automatic Link Establishment platforms for civilian HF radios. This program, when installed on a computer linked to an HF radio (with compatible antenna), allows operators to remove the guesswork of which HF band will work best for their intended communications. In short, ALE software such as this simply "scans" all of the HF bands, and automatically selects the best one for a link to be established between two or more radios. This provides the advantages of being very hard to direction find, and very resistant to jamming, albeit with a much more complex system that is relatively new to civilian HF radio. ALE is tough to implement on the civilian side of radio comms, but with better SDR-based radios, and easier to use software coming to the market, ALE technology is a very valuable addition to any comm plan. However, the somewhat developmental nature of ALE software is still not reliable enough to forgo the usual contingency communication methods (such as JS8call), which are much more established, reliable, and easy for everyone to use with most hardware and antenna systems.

Winlink

The undisputed champion of HF data connections, Winlink is one of the only email clients for sending emails over HF radio. Comprising of a global network of gateways, Winlink is one of the most reliable methods of sending emails with zero local infrastructure. However, there are some significant disadvantages. Any connection whatsoever to internet servers presents very serious data privacy and censorship concerns. Additionally, Winlink developers routinely verify call signs on their platform, so using Winlink without an FCC-approved call sign, even during an emergency, will result in your account being deleted. We have verified this personally many times. Gatekeeping behavior such as this is normally a dealbreaker for reliable communications. However, Winlink can be used in Peer-to-Peer mode, completely bypassing Winlink gateways to send an email from one radio, to another. This eliminates the main benefit of using Winlink (the global network of internet gateways), but is censorship proof and hard to tamper with, either by authorities or by the developers themselves.

Meshastic

A relatively new addition to the world of communications, Meshastic has become the primary tool for communities centered around low-power mesh communications using DUV LoRa (Long Range) devices. The extremely low cost of equipment, and the compatibility of Meshastic with the TAP suite of software has resulted in Meshastic becoming an extremely popular platform for short-medium range text based communication, or CoT-style data exchange. Though this seems like a miracle that Meshastic as an enterprise solution has had trouble getting out of the developmental phase, Meshastic will be hard pressed to replace military-grade comms tools, and it is quite buggy at times. But Meshastic is a fantastic, low-cost addition to any comm plan, and is one of the most reliable ways to run ATAK effectively without using cellular data.

EMISSIONS CONTROL (EMCON)

EMCON		Guidelines
1	RADIO ROUTINE	Transmissions: RADIO ROUTINE. Any and all radio calls are authorized. ¹ Emitters: Any and all comm emitters are authorized. All non-comm emitters are authorized: PED, vehicles, generators, radars. Adversary: IMPROBABLE (45%) ES collections or EA, REMOTE (5%) threat of receiving fire (IDF). Scenario: Garrison or friendly country. Training, evaluations, and administrative movements. Note: Even during training, leaders should limit radio calls to mission-critical information. Standard for most amateur radio in a permissive environment.
2	RADIO ESSENTIAL	Transmissions: RADIO ESSENTIAL. Mission-critical and emergency radio calls ONLY. ² Emitters: Any and all comm emitters are authorized. All non-comm emitters are authorized. HF, and ANWZ) OR (standard Meshastic and Ion2G ALE) are restricted or OFF. Non-essential PED is OFF. Adversary: PROBABLE (80%) ES collections or EA, IMPROBABLE (45%) threat of effective IDF. ³ Scenario: Friendly, neutral, or hostile country. Contingency operations or pre-hostilities. Note: Emitters that are normally constant can be turned on for brief periods during scheduled comm windows, for data exchange. Unencrypted analog transmissions generally not recommended at this level.
3	RADIO SILENCE	Transmissions: RADIO SILENCE. NO voice radio calls. Text and burst data only. HF ideal. Wire. JBC-P, ALE / 3G ALE HF, and ANWZ) OR (standard Meshastic and Ion2G ALE) are OFF. Emitters: Selected bands are restricted, receive-only, or OFF. Constant emitters (BFT / Unencrypted UHF black gear is OFF. Non-comm emitters are restricted or OFF. Passive receivers—GPS, GBS—are restricted or OFF. Voice CFF / CAS are OFF. Adversary: HIGHLY PROBABLE (95%) ES collections or EA, PROBABLE (80%) threat of IDF. Scenario: Conflict. Enemy is collecting and targeting. Precision IDF weapons are in range. Note: Some units, executing fast-moving operations without key equipment, cannot rely on chat. Note: Constant-emitter features of JS8call are not recommended at this level. Turn OFF automated heartbeats and replies. Passive receiving is generally okay, but make sure to verify that automatic transmissions are OFF. SCHEDULE short comm windows. NVIS antennas for localized HF operations ideal for reducing DF potential.
4	BLACKOUT	Transmissions: BLACKOUT. NO radio calls—voice or data—are authorized. Emitters: ALL emitters are OFF. ALL radios, ALL PED are OFF. Batteries are OUT, generator power is off. ALL non-comm emitters are OFF. Vehicles are OFF. Lights are OFF. Adversary: NEARLY CERTAIN (99%) ES collections or EA, HIGHLY PROBABLE (95%) threat of IDF. Scenario: Conflict. Enemy is collecting and targeting. Precision IDF weapons are activated. Note: When missiles are inbound, units avoid being located, but cannot operate long at EMCON 4 Note: This level will be rarely used by prepared citizens, but is useful in the event of strategic homeland threats such as enemy reconnaissance flights over US soil or for operation within military occupation zones when active collection methods are regularly used.
Notes:		1. Specific EMCON actions taken under each option are defined by unit SOP. Restrictions on calls, nets, bands, and equipment are clearly defined by unit SOP. 2. Unit PACF plans specify alternate comms. 3. For emergency radio calls, leaders violate EMCON for safety, enemy engagement, or CASEVAC. 4. Adversary descriptions are ICD 203 language on the likelihood of enemy action. An actual attack or EA may not yet have occurred. Passive GPS Receivers are generally authorized at all EMCON levels, as long as all emissions from the device (Bluetooth, WiFi, etc) are turned OFF. Satellite communications are considered to be Constant Emitters as most commercial satellite messengers constantly ping satellite networks.

REDUCING EMISSIONS

USMC EP EMCON SOP

While not a concern for those operating radios in a friendly and civil environment, the use of radios as a tool sometimes precludes many of the operating habits currently used by the majority of the amateur community.

Below are the Ten Commandments of EMCON as described in the USMC Electromagnetic Protection Emissions Control Standard Operating Procedure. The **TEXT IN GREEN** describes recommended adaptations and interpretations for a prepared citizenry.

	Technique	Guidelines
1	TALK Less	TALK less . TRANSMIT only mission-critical information. TALK short . TALK correct . 'Ragchewing' not recommended. Think before transmitting.
2	SCHEDULE Less	MINIMIZE required reports . SCHEDULE comm windows . Do NOT send NSTR reports.
3	MOVE	MOVE units . MOVE radios . When in doubt, MOVE. Do not "yard-sale" comms gear. Keep all items in your pack until needed. Prioritize setups that maximize the ability to break down quickly. Be ready to move at a moments notice.
4	CHAT	CHAT. Do NOT Call . CHAT reports, requests, and brevity codes. Text-based data modes are preferred for efficiency.
5	SIGNAL	SIGNAL movement , tactical action, and convoys with one-arm hand and arm signals. Non-radio-based signals are also needed to round out a comms plan at the local level. Pre-established rally points are also helpful additions to this category.
6	WIRE	COMMUNICATE between stationary positions with comm wire and field phones.
7	MASK Antennas	PLACE CP, vehicle, and manpack antennas behind barriers, buildings, woods, or hills . Directional antennas are recommended for targeted comms.
8	REDUCE Power	SHUT it OFF when not in use. SET radio to low power .
9	PRIORITIZE LPD Nets	COMMUNICATE on radio nets that have LPD. KNOW which nets are more vulnerable . Data modes are less vulnerable and offer the opportunity for encryption, if the need arises in contingent situations.
10	PLAN Simple Flexible Ops	PLAN operations that require less radio calls . PLAN less nets . Simple is best. Be considerate of working hours, sleep schedules, technical knowledge gaps, and operational experience of the populace.

NOTE: The tactics described are provided verbatim from doctrine and therefore are more for reference. Obviously, many of the procedures from military doctrine do not perfectly translate into usage by citizens, thus the **TEXT IN GREEN** notes and additions. However, knowing the textbook answers (along with the adaptations) sometimes helps establish (and adapt) local procedures.

HELP! My JS8CALL Isn't Working!

Follow this checklist in the event your receive-only JS8Call setup is not working.

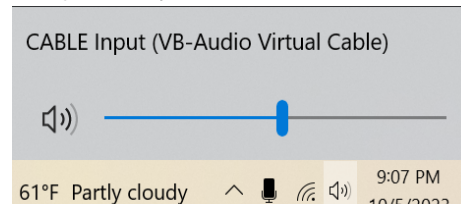
SDR Functioning?

- 1 - Check to see if your SDR is plugged in.
- 2 - If using a WebSDR, check that you have clicked the button to "start audio" within the web browser.

Check Audio Cables and Settings

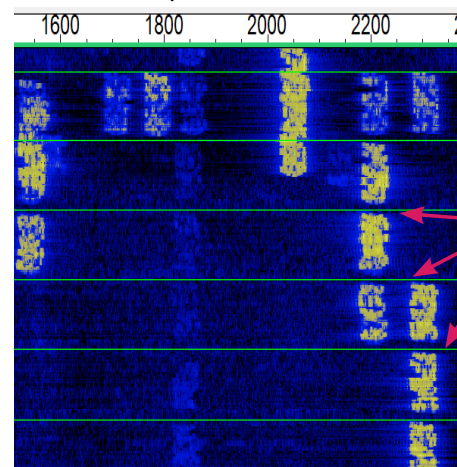
- 1 - If using Virtual Audio Cables, check to make sure that VBCable is selected as the output device.
- 2 - If using a physical USB SDR, check that your antenna connection has not become unscrewed, either at the SDR itself or the antenna.

If using VBCable, your sound bar should look like this



Check Time Sync

- 1 - Make sure you have run BKTTimeSync, and that a connection to an appropriate server/GPS has been made. Without super-accurate time, JS8Call will not decode messages as depicted below:

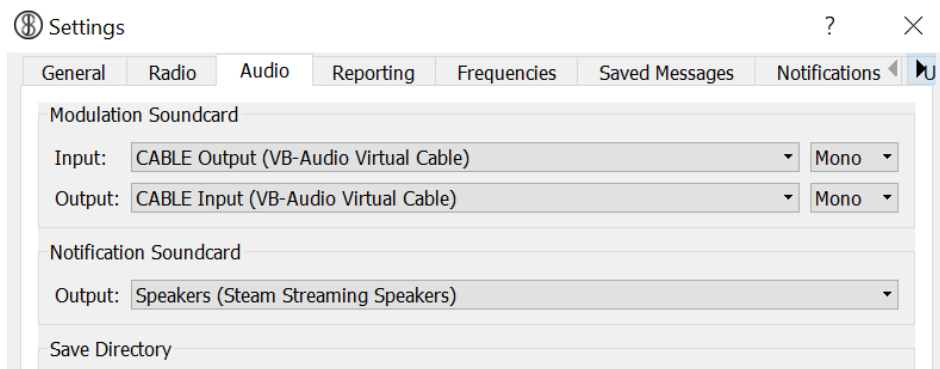


If messages are between the green lines on the waterfall, they will be decoded. If not, either your or the transmitting station's time sync is off and no messages will be decoded.

This is what a proper time sync should look like, all messages within the green.

Check Audio Sources within JS8

- 1 - Check to make sure your audio settings are appropriate for the SDR you are using. Depicted below is what your settings should look like if using VBCable with an online SDR:



INCIDENT RESPONSE MONITORING

Basic Monitoring Capabilities

The capabilities listed below are intended to help concerned citizens track events in real time, without forgetting a particular capability or tool. Not every item listed will be necessary for every event, but this checklist can be helpful for setting up an ad hoc monitoring station, listening post, or TOC as needed.

Signals Intelligence (SIGINT)

ADS-B receiver - Aircraft Monitoring
KrakenSDR Passive Radar - For limited Passive Radar capability, as well as Direction Finding capabilities.
SDR w/ Scanner feature - For identifying signals of interest in a local area.
Laptop, Tablet, or PC capable of running Windows or Linux OS - For processing signals with an SDR. Note: Several options exist for processing SDR signals on an Android smartphone, so this can be an option for limited work. However, for more substantial SIGINT processing tools, most smartphones do not have the processing (or CPU cooling capabilities) to get the job done, making a laptop or tablet the best overall choice.

Imagery Intelligence (IMINT)

Satellite Imagery - Helpful to download before internet connections are lost. Also, basic SRTM elevation data would be helpful to have on hand to make maps with if needed. If internet connection is not available, intercepting weather imagery from orbiting satellites would be useful as well.
Drone Imagery - For local imagery collection.
Magnified Optics - A good pair of binoculars of a spotting scope is very helpful for local observation.
Thermal Optics - Consumer grade thermal optics provide substantial force multiplication.
Night Vision Optics - Mandatory for observation of the local area at night.

Communications Intelligence (COMINT)

ACARS receiver (HF and VHF bands) - Configured to decode ACARS traffic from aircraft in the local area.
L-Band Antenna for SDR - For intercepting commercial aviation SATCOM ACARS messages.
General Purpose Scanner - Preferably with trunking capability. For monitoring unsecured local comms.
SDR w/ Scanner feature - Additional tool for monitoring unsecured comms in a local area.
HF Transceiver - Communication and information sharing/collecton tool.
Laptop, Tablet, or PC capable of running Windows or Linux OS - For interfacing with an SDR or Transceiver.
Handheld Analog VHF/UHF Transceiver - Can be used for unsecured local comms, but also can be used to monitor local ham radio repeater networks in a time of crisis. These info networks are historically unreliable for HUMINT purposes, but worth monitoring to determine how widespread an incident is.

Measurements and Signatures Intelligence (MASINT)

CBRN detection networks - Though reliant on internet connections, various CBRN detection networks allow users around the world to be aware of increases in baseline HAZMAT activity.
Weather Station/Westrel Meter - Establishing WX sensors early on during a crisis is helpful for determining weather patterns, which in turn aid weather forecasts.

Human Intelligence (HUMINT)

Local SneakerNet - Information shared by physical, face-to-face meetings with people in a local area.
Text-Based Word-of-Mouth Information Exchange - Simply texting local contacts (or trusted/high-confi- dence sources) directly can provide real-time intelligence of the situation on the ground. Even if cellular networks are overwhelmed, text-based services (either standard SMS messages or satellite-based communications) can be very effective.

Open Source Intelligence (OSINT)

Social Media Feeds - If internet access permits, social media can be a valuable source for determining what's going on around the world. Social media will be the only source of information that most people have, despite being heavily censored, surveilled, and increasingly unreliable. In a case of total devastation, internet access will be limited or nonexistent. Plan accordingly, and use OSINT tools as long as they are available, but always plan for that data link to be interrupted, censored, or subject to information Operations.

AUTHORIZED EMITTER MATRIX

USMC EP EMCON SOP

Below is a sample of the recommended emitters for each EMCON level. As always, there are more excep- tions to real-world usage than can be described in a manual, so experiences may vary. Just because the manual indicates a technology is safe to use, it may not be advisable for use in your specific situation. Also consider the constant use of emitters, versus the use during a comm window. For instance, at EMCON Level 3, Satellite messengers are not recommended for constant use. However, briefly turning one on to use during a short comm window may be authorized.

Tool	Mode	EMCON 1	EMCON 2	EMCON 3	EMCON 4
Analog VHF/UHF	VOICE, FM	YES	MAYBE	NO	NO
Digital VHF/UHF	VOICE, FM	YES	YES	NO	NO
Digital VHF/UHF	TEXT	YES	YES	MAYBE	NO
HF (Unencrypted)	SSB VOICE	YES	YES	NO	NO
HF (Unencrypted)	DATA² (TEXT)	YES	YES	MAYBE	NO
HF (Unencrypted)	DATA (ALE)	YES	YES	MAYBE	NO
HF (Encrypted w/ OTP)	DATA (TEXT or CHAT via ALE)	YES	YES	YES	NO
Satellite Messenger	TEXT	YES	YES	NO	NO
Satellite Phone	VOICE	YES	YES	NO	NO
Meshtastic (w/o OFF switch)	TEXT	YES	YES	NO	NO
Meshtastic (w/ OFF switch)	TEXT	YES	YES	YES	NO
Field Telephones¹	WIRE	YES	YES	YES	YES
Non-Radio Signals¹	Panels, hand signals, etc	YES	YES	YES	YES
UAS Platforms	-	YES	YES	NO	NO
PEDs	-	YES	YES	NO	NO
Receive-Only Equipment¹	ANY	YES	YES	YES³	YES³

Notes:

1 - Technically not emitters, but helpful to have on the chart as a reminder
2 - Though varying widely, most data modulation modes offer similar enough vulnerabilities to be classified together. Some modes are more efficient and faster than others, so understanding each modulation method is helpful.
3 - Some "receive-only" consumer electronics contain Bluetooth and WiFi emitters. This should be factored in and turned Off during periods of heightened EMCON levels. If a consumer electronic does not have the ability to be completely powered off (or signals mitigated) this must be considered as well.

READINESS CONDITIONS

FM 71-1

REDCON 1	Full Alert: Unit Ready to Move and Fight: WMD Alarms and hot loop equipment stowed. OPs pulled in. All personnel alert and mounted on weapons. Weapons manned. Engines started. Company team is ready to move immediately.
REDCON 2	Full Alert: Unit Ready to Fight: Equipment stowed (except hot loop and WMD alarms) Precombat checks complete All personnel alert and mounted in vehicles; weapons manned and charged, round in chamber, weapon on safe. (NOTE: Depending on tactical situation and orders from local commander, dismounted OPs may remain in place. All (100 percent) digital and FM communications links operational Status reports submitted IAW TF SOP Company team ready to move within 15 minutes of notification
REDCON 3	Reduced Alert: 50 percent of the unit executes work and rest plans Remainder of the unit executes security plan. Based on the commander's guidance and the enemy situation, some personnel executing the security plan may execute portions of the work plan Company team is ready to move within 30 minutes of notification.
REDCON 4	Minimum Alert: OPs manned; one soldier per platoon designated to monitor radio and man turret weapons. Digital and FM links with TF and other company teams maintained Company team is ready to move within one hour of notification.
STAND-TO	Stand-To encompasses all actions take to bring the company to a maximum state of preparedness. Times for Stand-To are derived from TF commander's OPORD. Unit SOP should specify Stand-To requirements, which will usually include procedures for sending and receiving reports, use of accountability checks for personnel and equipment, and criteria for assuming REDCON levels 1 and 2.

	MOPP READY	MOPP 0 (ZERO)	MOPP 1	MOPP 2	MOPP 3	MOPP 4	Command
Mask	Carried	Carried	Carried	Carried	Worn ¹	Worn	Worn
Overgarment	Ready ³	Available ⁴	Worn ¹	Worn ¹	Worn ¹	Worn	
Overboots	Ready ³	Available ⁴	Available ⁴	Worn	Worn	Worn	
Gloves	Ready ³	Available ⁴	Available ⁴	Available ⁴	Available ⁴	Worn	
Helmet Cover	Ready ³	Available ⁴	Available ⁴	Worn	Worn	Worn	
Protective Undergarment	Ready ³	Available ⁴	Worn ²	Worn ²	Worn ²	Worn ²	

1. In hot weather, coat or hood can be left open for ventilation.

2. The chemical protective undergarment is worn under the BDU (this primarily applies to armor vehicle crewmen and SOF).

3. These items must be available to the soldier within two hours, with a second set available within six hours.

4. These items must be positioned within arms reach of the soldier.

BASIC INCIDENT RESPONSE

IMMEDIATE CONCERNS

Step 1: Physical Security

Don't Panic. Establish personal security FIRST! All other comms and incident response actions can wait until you are secure. If security is not guaranteed, some level of tactical comms might be prioritized over personal safety, depending on the tactical situation and the nature of the emergency.

Step 2: Establish Comms, Determine Players, Send 5 W's

Once personal safety is established, the originator of the incident/distress call shall make every effort to establish a communications net and transmit a brief description of the incident. The 5 W's of Who, What, When, Where, and Why are a good format to stick to, if no other format exists. If a Troops-in-Contact report, or a SALUTE report is preferred, use that format instead. If the originator of the incident report is unable to establish an Incident Response Comms Net, other Net participants shall make every effort to coordinate a response as needed. As a prepared citizenry is often non-hierarchical, there are no Command requirements (beyond local group SOPs), so whomever is capable of maintaining the Nets and passing communications, is the primary party responsible for such action until no longer able.

In the more likely scenario of a person simply hearing of a national event, and wishing to obtain more information, tuning in to the appropriate radio communications net would be a good idea. Chances are, if something substantial is going on, people will be sharing information on the GhostNet.

BATTLE TRACKING

Step 3: Establish TOC, Staff Functions Begin

A Tactical Operations Center, appropriate to the incident, is to be established as needed. All staff functions begin to work the issue as their skillsets and capabilities allow. Intelligence and Operations maintain the primary responsibilities of Threat Assessments and Friendly Forces, respectively. Logistics, Weather, Medical, Administrative, and dedicated Communications experts also contribute as able. Amongst a prepared citizenry, most of the standard TOC functions (such as Battle Tracking) will fall to a single person. Do the best you can, and realize that perfection is not possible. Realistic expectations of operational capabilities are paramount to maintaining even the smallest measure of effectiveness.

Once a good Battle Rhythm is established, start working on improving effectiveness. Try to improve communications networks, and get some of the more advanced options (like Ion2G ALE or Winlink) up and running to make contact with personnel near the affected area. These more advanced actions take time, and will not be possible to create prior to the incident. Even though very basic comms are the bare minimum, highly efficient data exchange networks will need to be the eventual end goal if time, skill, and prior planning makes it possible.

Step 4: Reassess Situation and Response, Schedule 2-Minute Drills, Assess Logistical/Personnel Needs

As the incident progresses, people fall into the roles they have trained for. As a citizen-based response will not have a strong Command element like traditional Incident Command Structures, consideration must be given to logistical and personnel constraints that will affect operations. Ensure that clear schedules are communicated. For multi-day incidents be aware that personnel tracking incidents will be volunteers with other obligations which might dictate their retirement from the operation at a critical juncture. Create a template and a schedule for Two-Minute Drills, which allow each responding entity to convey a status update from their department quickly and efficiently. Be mindful of logistical needs, particularly energy requirements. Maintain flexibility as plans change.

FOLLOW-ON ACTIONS

Step 5: Hotwash, After Action Review, Logistical Recovery

As an incident comes to a close, or begins to settle in for the long haul, logistical capabilities must be considered. Personnel issues will be paramount as prepared citizens often are not capable of assisting with incident recovery 24/7. Conducting Hotwashes/AAR's will help increase efficiency, identify deficiencies, and improve response efforts for the next incident.

Australia/Pacific, use USA freqs
Africa, use EUR freqs

Band and Mode VHF DIGITAL DMR TIER II STANDARD	SPARROW Proword: THIS IS NOT A STANDARD NET, ONLY FOR USE IN A SCENARIO IN WHICH FCC AMATEUR RADIO REGULATIONS NO LONGER EXIST.
VHF ANALOG Proword: DENALI	ENCRYPTED VHF DMR TIER II STANDARD AES-256
SAHARA Proword:	

URBAN LINE-OF-SIGHT SOI

Band and Mode UHF DIGITAL DMR TIER II STANDARD	PROMWORD: BLUEJAY
UHF ANALOG PROMWORD: EVEREST	ENCRYPTED UHF DMR TIER II STANDARD AES-256
PROMWORD: ATACAMA THIS IS NOT A STANDARD NET, IN WHICH FCC AMATEUR RADIO REGULATIONS NO LONGER EXIST.	PROMWORD:

GHOSTMESH

MESHTASTIC
PROWORD:
SANDMAN

915 MHz for
USA (other
regions, use
permitted
ISM band)



Important! - Make sure you set up a personal Meshtastic channel BEFORE scanning this QR code. This will prevent this channel from importing in as your "Channel 0", which may result in your GPS location being shared with the net. ALWAYS SCAN THIS QR CODE FROM WITHIN MESHTASTIC APP, NOT A RANDOM QR SCANNER. Always ensure that for GhostNet Meshtastic nodes, your GPS location data is not shared with the net. Always remember, since this channel is available to the public, sensitive data should not be shared over this channel.

BE ADVISED - Scanning this QR code may override your existing Meshtastic settings. Make sure to save your pre-existing channel data BEFORE importing the GhostMesh channel.

Mode: LONG_FAST

Frequency Slot: 20

Channel Name: GhostMesh

Channel Key: u99Hy2GbFLPhP36QGT7V0F8iF6zQs+Lto7hI6itNv/I=

PERSONAL/TEAM MESHTASTIC
PROWORD:

Before laminating, print and paste your personal Meshtastic channel settings here in the space provided. This will ensure you always have a paper copy of your personal Meshtastic channels and encryption data.

GHOSTNET _____

BLOS VS LOS COMMS TOOLS

Creating a communications network that functions on a global scale is challenging, and usually precludes the options that most people have to hand, namely handheld VHF/UHF radios. As the GhostNet is largely a more strategic plan and resource, this is an acceptable trade-off.

In the past, the effectiveness of just picking a random frequency that can be used nationwide has not been completely effective. One or two "prepper freqs" that various communities can program into their radios may seem like a good idea, but in real-world use this doctrine's effectiveness is questionable due to the ways that these tools are used.

Different Tools for Different Needs

HF communications are **Beyond-Line-of-Sight (BLOS)** communications tools. Handheld VHF/UHF radios are **Line-of-Sight** communications tools. These two communications tools can complement each other, but generally not replace each other in most situations. Consequently, where the vulnerabilities of HF radio leave off, handheld radios can ease the burden of communications needs. HF radios are strategic tools meant for communication between long distances, at higher levels of concern. For instance, calling in a report of a robbery or an ambush over HF radio would not be the best use case since someone potentially thousands of miles away is not likely to be influenced by an event that only affects one neighborhood or street. Conversely, you wouldn't want to use a handheld radio to share details of an invasion taking place around the world, because that international incident is not likely to directly impact those within range of your handheld radio. Of course, there are exceptions to this mentally, but for the most part handheld radios are best for close-range, tactical communications where seconds count and maneuverability is paramount. Whereas HF radio networks are best for exchanging more strategic message traffic from more secure, fixed positions in order to keep tabs on events outside of a local area, maintain links with the outside world, etc. No potentially life-saving message traffic should be expected to reliably be sent over HF.



Understanding History and Culture

Most radio communications doctrine comes from military use. In fact, most of the radio doctrine currently in use within the ham radio hobby is the direct result of the impact of military radios becoming available to the public after WW2. As such, culture and history matter a LOT. Most of the companies or individuals creating prepared citizen doctrine regarding the use of radios primarily have experience at lower levels of warfare. This is very similar to other communities within the prepared-citizen space; There are infinite companies teaching small unit tactics, but very little emphasis on leading/organizing large groups of people at higher levels of operation...there are a lot of former service members training citizens to become platoon leaders, but not so many former field-grade officers teaching others how to become senior leaders. This isn't necessarily a bad thing, but from a comms perspective, this does mean that the prepared citizen community is skewed in favor of squad-level comms doctrine. Lots of doctrine and tactics are being developed for handheld voice comms, for when seconds count. Right now, less priority is placed on longer-range networks that are helpful for passing more routine, less-time-sensitive information. However, HF radio can fill a vitally needed role in connecting communities around the world, if expectations are managed with regards to what HF is beneficial for. HF radio is not simply a "bigger Baofeng", but a totally different technology intended for a different use case. This is important to consider for those who wish to scale-up comms networks beyond the squad/family level.

LINE-OF-SIGHT CONCERNS

Meshtastic Integration

While Meshtastic can be a helpful tool for many, it's best served when used by small groups that are within Line-of-Sight of each other. Using Meshtastic in this role does not make use of most of its benefits. However, there may be some use in establishing a dedicated Meshtastic channel for those who already use Meshtastic. Meshtastic itself makes use of what is essentially a national calling frequency (i.e. - the default "Long Fast" channel), so the implementation of such for GhostNet users may be of some benefit as well. At minimum, it doesn't take much effort to add to a user's channel list, so even if it's never used it won't be a burden. This integration also lays the groundwork for additional features and support as the Meshtastic project develops.

Expediency vs Security...and Risk Management

As with most ideas in the world of communications, the balance of security versus capability must be considered for each specific situation. It is very hard to create a communications plan with both ideas in mind. For the most part, many communications plans are either based on military doctrine, or emergency management doctrine, with very little crossover between the two communities on even the most basic features that are needed. Almost all military doctrine, for instance, assumes that most radio communications will be encrypted by default...non-encrypted comms are usually not even discussed at great length. On the other hand, encrypted comms are not only rare to see in the world of emergency management, but also illegal for non-professionals to use in many cases (such as in the world of amateur radio).

So, the conundrum becomes apparent...relying on emergency management comms doctrine in a warzone might summon an artillery strike within 60 seconds of transmitting, but on the other hand using encrypted comms during a widespread hurricane disaster response might also not be super effective.

Everything is a balance, and every risk that appears, has a mitigation technique. The use of radios in war relies on the Emissions Control (EMCON) doctrine to ensure that comms can occur, and be as safe as possible considering the overall risk. Disaster communications usually require more open communication techniques, but also may consider the need for increased security in some situations. Sometimes, even a disaster response is not entirely a permissive environment, and thus transmitting one's Personally Identifiable Information (PII) over the airwaves for anyone to see is probably not the best idea in all circumstances.

Though very challenging to incorporate into real-world practice and use, the entire GhostNet idea intends to bridge this unique gap: **To allow for a common standard to be adopted by those who need it during peace-time conditions, but also leave the door open for more security-conscious use if it's needed at some point.** The VHF/UHF options provided are intended to achieve this effect, albeit due to the nature of LoS comms, the practicality of such may be questionable over long distances.

Where this plan may be of some value is the expediency that comes with a predetermined plan. In short, a group of people can rapidly get together, and already have their radios speaking the same language. When seconds count, this will save precious time if/when it's needed. When you need to grab a rucksack and go at a moment's notice, having the ability to not worry about what frequencies to use will be helpful. Since this plan isn't too complicated, and backwards compatible with most radios that are in common use, it is also easy to incorporate comms with a variety of users. This allows for a rapid, ad hoc, comms hierarchy to stand up really quickly. For example, a team leader/radioman can have a digital radio to work with other teams, and individual team members can still use their Baofengs amongst themselves as needed.

Expectation Management: Even considering the widespread implementation of the GhostNet plan, it's astronomically unlikely for anyone to actually make contact with another human being via the use of these shared frequencies. Contact may be made in more populated areas, but the utility and usefulness of such link-ups is debatable.

Nevertheless, having a freq or two stored in a radio's codeplug may provide piece of mind for those who want to have some sort of last-ditch plan, even if it's very unlikely to be helpful. However, care must be taken to not rely on these specific procedures to the point of gaining a false sense of security. What would be extraordinarily ill-advised would be for someone to program in these freqs, and think they're all set with a solid plan that needs no additional work. This is the reasoning as to why these freqs are included in the GhostNet only hesitantly, and with much warning.

This LoS plan was created solely for those who only have a Baofeng or other low-cost handheld radio. These tools can provide a lot of capability for some people in certain situations, however the vulnerabilities and trade-offs should be known, planned for, and mitigated wherever and whenever possible. The digital portions of this plan serve to help users move towards these ends, and encourage the adoption of digital radio use on a more widespread scale.

RECOMMENDED HF GEAR LIST

Powering Your Radio

Once you get your first HF radio, you might take it out of the box and be rather dismayed to find bare wires sticking out of the back of it, instead of a power cable. Some radios might not come with a cable at all. Powering HF radios is by far the most neglected aspect of operating a radio, and the solutions vary widely depending on what kind of radio you have. Generally speaking, the power options for each class of radios are as follows:

Basestation Radios: Usually the easiest to power, because many come with a standard AC power cable for plugging in to a wall outlet of a dedicated power supply. These radios are not usually powered from a battery source, but this could be an option for many (with a bit of work).

Portable and Mobile Radios: Remember, this category of radio is designed to be installed in a vehicle, so almost all options for powering these radios revolve around the use of 12v batteries. Almost all solutions for such are homebrew, with very few commercial options readily available that don't require some knowledge of electronics. Some Portable radios can be powered by an internal battery pack, or a standard USB power bank (albeit usually at a lower transmit power).

Traditional Battery Assembly

For most people seeking to use a Mobile or Portable radio off-grid, most solutions are DIY in nature and require some knowledge of electrical circuitry. Here's what you will need to build your own radio power system:

Battery - Varies by cell chemistry, with the most common for radio use being LiFePo4 (also known as "LFP"). These batteries will usually come with two bare wires for connecting to a Solar Charge Controller

Solar Charge Controller - For charging the battery safely with a solar panel. Hooking up a solar panel straight to a battery is a recipe for disaster and could result in either killing your battery, or setting it on fire. Make sure you get a solar charge controller that is specific for the chemistry (and voltage) in your battery. One of the only brands that provides charge controllers safe for LFP batteries is Genasun.

Solar Panel(s) - The most popular means of charging radio batteries in the field, off-grid. You will probably need much more solar charging capability than you think.

Voltmeter/Multimeter - Optional, but handy to know your battery's state of charge.

Plugs, connectors, wire, etc: All needed for hooking everything up. The connectors needed will vary widely based on what battery you get.

AC Adapter - Optional, but useful in charging the battery from a wall outlet if you need to operate a radio and solar charging isn't available.

Commercial Options

Now that battery technology has improved significantly over the past few years, commercially-available batteries that require no DIY efforts are feasible. Portable Power Stations or "Solar Generators" are very popular options that work great for those who don't want to build their own battery solution. In the past, these self-contained power stations produced a lot of feedback unsuitable for radio use; radios need a relatively "clean" power source, free of interference that causes buzzing when transmitting or receiving. Now, most name-brand Portable Power Stations provide a 12v plug that is "clean" enough to use with radio without much interference. So for those that want the most pre-made system available, just buy the manufacturer's 12v cigarette lighter cable for your radio and plug it in to a Portable Power Station. Simple as that.

Disadvantages

Pre-made options are not without downsides. For instance, 12v cigarette lighter plugs are not known for being reliable, and can be frustrating to work with as the slightest bump might dislodge the plug, turning off your radio. For most people, this is negligible, but worth considering for field use in harsh conditions. 12v cigarette lighter plugs also can't carry that much amperage, so running 100w of power usually isn't possible. For smaller rigs less than 50w, most of the time it works fine without overheating. Additionally, the cheaper Chinese-made 12v plugs might cause interference (usually due to the poor solder work done on the inside)...90% of the interference caused by 12v plugs can simply be solved by getting a higher-quality plug.



Modern Portable Power Stations are now a feasible option for running radios in the field, if users are aware of their limitations and potential EMCON concerns.

RECOMMENDED HF GEAR LIST

Computers, Software, and Digital Interfaces

If you want to take part in the GhostNet, you will need to be familiar with working digital modes such as JS8Call. Unlike the old days of simply firing up a radio and keying the hand mic, these newer digital modes allow for text/chat-based software to work instead of just relying on voice comms. So instead of you controlling your radio by pressing the PTT on the hand mic, your computer plugs in to the radio and handles everything for you. For all of this to work, you need a few things:

The Computer: Any

PC or laptop will work, but most software for ham radio was developed for the Windows operating system. As such, you can get most of these software packages to work on Linux systems, but there's no guarantee. As distasteful as it may seem, Windows is for privacy and security, for most people it's begrudgingly still a more preferable option to get started.

Rig Control Software: If you want to hook up your computer to your radio, you need a way for that computer to control the radio. This is where Rig Control software comes in. Sometimes radio manufacturers will provide their own Rig Control software for use with their own radios. Other times, you need to provide your own more generic solution. The most popular options that work with most radios are **FLRig** or **Omnirig**. (FLRig is more user friendly).

For some modes, you need "CAT Control" or Computer-Aided Transmission Control. This is a feature that allows your computer to automatically change freq, operating mode, etc, without you having to touch the radio. Not all radios can do this, but most HF radios can. Check with the manufacturer of your radio to see what settings you need to put into FLRig, in order for CAT control to work. In FLRig, go to CONFIG -> Transceiver and put in the data for your radio. At minimum, you will need to put in the make and model, the baud rate, and the comm port that your radio is using (check under Device Manager in your PC settings).

Digital Interfaces: If you want to use digital modes like JS8Call, you will need a way for your radio to accept digital signals. Most HF radios on the market today are essentially using technology from the 1930's. As such, most HF radios are analog only. So we need a third-party piece of hardware to get everything to work. There are a few options, but by far the most popular is the Digirig. This is a small box that plugs in to your radio on one side, and your PC (via a USB port) on the other side. This small box is basically an interface between your radio and your computer, that converts audio from your computer into a digital signal to be transmitted by your radio. The Digirig box itself is standardized to work with pretty much any radio, but you will probably have to buy a cable for it specific to your radio. You may also need driver software to allow the Digirig to work with your computer. Some companies (such as ICOM) are producing radios (like the IC-705) that don't need this special third-party hardware, but for most radios on the market today, a Digirig is the best option for allowing your radio to use digital modes.

Specialty Software: There are lots of different kinds of software used to communicate over HF radio. JS8Call (what the GhostNet heavily relies on) is a common program to allow keyboard-to-keyboard messages to be sent over the airwaves. Winlink is a tool that allows sending rudimentary email-like messages. Ion2G is an advanced program to essentially create primitive 2G net-works over HF radio. The sky is the limit with regards to what programs you want to use for different purposes. JS8Call is a great platform to start with as it's the easiest to set up and is the bedrock of the GhostNet.

Time Sync Software: For almost all digital data modes, a very helpful tool is BkTimeSync. This software allows the use of GPS satellites (or an internet connection) to set the clock on your PC. This might not seem necessary, but for modes like JS8Call, your PC's clock must be within a few seconds of accuracy, otherwise messages won't decode. This is an often forgotten aspect of modes like JS8Call, so don't forget to run BkTimeSync whenever you start up JS8. There are Note: This is not necessarily required for JS8, there are workarounds that allow JS8 to work truly off-grid, without relying on satellites for accurate time. Much false information surrounds this topic; many people think JS8Call won't work without an internet or satellite connection, but **THIS IS FALSE**. JS8Call can sync to the appropriate time using the trans-missions of others, all completely, truly, and utterly off-grid. BkTimeSync is just more convenient to use if satellites are available to use for accurate time.

CRISISNET CONCEPT

Real World Lessons Learned

serious and dedicated response.

In the months that the GhostNet has been adopted, one important question has remained: At what point is it worth going through the effort to set up an HF radio to see what traffic the GhostNet can offer? In the (unlikely) event of a complete and simultaneous blackout of cellular and internet-based comms, the answer is clear...the GhostNet (or other HF comms) may be your only way of maintaining contact with the outside world. But what if an incident occurs that falls short of an Apocalyptic scenario, but still impacts routine communications platforms? At what point should the GhostNet take a higher priority, and what actions should citizens take (comms wise) if various incidents occur?

The Challenges of Decentralization

A highly decentralized (but still somewhat coordinated) communications plan such as the GhostNet is largely limited by the platforms and software that is available. These technological barriers, combined with a decentralized ecosystem, largely result in a lot of inefficiency and much disorganization. In the chaos of a dramatic world event, the fog of war results in even more complications. The GhostNet plan is already a system by which citizens will get out of it what they put into it. Dedicated and serious citizens will benefit greatly from taking a more deliberate approach to their communications preparedness. However, the Ghost-Net also appears to a wider audience of more casual users, who may only wish to check in during standard nets and likely are not interested in incident response. Additionally, the GhostNet was designed for the working man (or woman) in mind. Having a simple guide for knowing what is worth leaving work for, may be beneficial for those who have to remain at their workplace and carry on as usual during a cataclysmic national event. This enables small, decentralized groups and communities around the world to know when to link up via HF radio.

Personal Judgment

Due to the above factors, users will have to exercise best judgment when enacting any part of this entire plan.

You may wake up one day to find your internet is out, and your cellphone doesn't work. You may have a storm impact your area, which knocks out the power. A missile might strike your local TV station. Throughout any range of scenarios one can dream up, from the most benign and innocent, to the most nefarious, communications will be important in any case....but equally important will be exercising the personal judgment to know when to use certain communications tools. HF radio will not be the sole solution to everything, but you will need to have the understanding to discern when this tool might be most beneficial. When you have a hammer, not every problem is a nail.

This discernment will come as an operator gets more experience, but in the meantime the STRADCCON and CrisisNet concepts can help guide users in making better decisions regarding the timing and means of using radios in varying situations. Having a plan to communicate is important, but knowing when to use all of these procedures is paramount. This will largely be a judgment call on the part of citizens who are cut off from the outside world.

A CrisisNet is really simple Think of it as a standard weekly JS8Call net, but instead of on a schedule, it's stood up in an instant in response to a specific crisis event. As the GhostNet itself is a decentralized communication plan, a MAJOR part of a CrisisNet is simply knowing when to stand one up. This is not controlled from the top-down, any user can establish a CrisisNet for their own needs. However, on the following page, we can all generally be on the same standard for what to do if certain events occur. Nothing should change from the weekly nets, to establishing a CrisisNet, except for the topic. Now the plan should be a bit more clear...and the weekly JS8Call nets, RTTY, Winlink, and ALE procedures should all make more sense. The weekly nets should prepare us for standing up a CrisisNet at any time.

CRISISNET ACTIVATION CRITERIA

The CrisisNet concept is simple: If any of the events on the chart below occur, the Recommended Comms Posture is listed to the right. Keeping things as simply as possible, a "CrisisNet" is simply the name for the collective networking on JS8Call as a response to a current event. A volcano erupts? Locals on the next island over can hop on JS8Call and see if any information is being passed...this is a "CrisisNet". Locals in the affected area can provide information, others can check in with regional contacts, more complex and specific data transmission can get set up and take place, all by initially coordinating on JS8Call as per the instructions on pages 11-18. The "CrisisNet" concept is simply to have a word to describe the act of getting on JS8Call via the GhostNet procedures, and provide a way to link readiness (i.e. the STRADCON process) with real-world events (listed below).

Incident	Recommended Comms Posture
All-Hazard National Planning Scenarios, 1-15 As described and outlined by the U.S. Homeland Security Council to include: Nuclear Detonation, Biological Attack, Chemical Attack, Major Earthquake, Major Hurricane, Radiological Attack, IED Attack, Major Cyberattack. *Also can include similar incidents that take place around the world.	If inside affected area, consider security FIRST! If outside affected area, recommend STRADCON 1. Recommend distribution of tactical-level comms as required, pre-programmed with all necessary freqs and comms procedures. Use standard comms net procedures for each region to establish a CrisisNet (i.e. hop on JS8Call, 7.107mhz, and see if anyone is passing information).
Major Internet and/or Cellular Outage Multiple national/regional cellular and/or internet outages of unknown origin and/or scope affecting multiple companies and networks. Examples include: Multiple cyberattacks affecting multiple, totally separate systems.	If not affected by the comms outage, recommend STRADCON 3. If affected by the comms outage, and traditional internet-based/cellular comms are heavily impacted, shift to STRADCON 2 or 1 (depending on the severity of the outage).
Minor/Single-System Outage National/regional cellular and/or internet outage of unknown origin and/or scope affecting only one major network. Also includes IT outages that originate from only one source. Examples include: Nationwide or regional cellular outage affecting only one cellular carrier. *If outages spread to multiple networks, consider upgrading the severity of this crisis.	If not affected by the comms outage, recommend STRADCON 3. If affected by the comms outage, and traditional internet-based/cellular comms are heavily impacted, shift to STRADCON 2 or 1 (depending on the severity of the outage).

RECOMMENDED HF GEAR LIST

Antenna Options

Antenna choices usually fall into two categories: Resonant or Non-Resonant (AKA "Tuned"). Your choice of radio will dictate what type of antenna you need.

Resonant: Doctrinally speaking the "best" type of antenna, meaning the most efficient and the type that jives with your radio the best. The trade-off is size. You will need enough ground space to string up at least 70+ feet of wire in as straight of a line as possible. For small backyards, this is sometimes a no-go. However, for those with the space for them, Resonant antennas are always recommended over "tuned" antennas because they're more forgiving, easier to work with, and it's harder to fry your radio using one. These vary widely in construction, from the eBay special manufactured in someone's garage (and charged a premium for), to more professional multi-band antennas to allow for more options (at the cost of length and the frequent need to get these antennas really high off the ground, such as throwing up in a tree). Some resonant antennas use loading coils to cheat physics a bit, and shorten the overall length of the system (Buddipole in particular revolutionized this model of operating), however the trade-off is a higher "Q" factor (meaning that the bandwidth the antenna can hear is "thinner" so you may need to frequently adjust the antenna if you need to change freqs a lot. Also of note, if you use resonant antennas, you probably will need an Antenna Analyzer (SWR meter) to ensure your antenna is in fact resonant on the bands you want to transmit on. Some radios have this function built in themselves, but you may want to use a NanoVNA SWR meter (or another model) anyway.

Popular Brands and Models:
Chameleon: LEFS 8010, EMCOMM series
BuddiPole: BuddiPole system, BuddiStick System (definitely recommend an Antenna Analyzer for BuddiPole options, for ease of use)

Non-Resonant ("Tuned"): These antennas operate much differently than Resonant antennas and require the use of a tuner. Some radios have tuners built in, others require you to buy a separate tuner to hook up between the radio and the antenna. These antennas are often more compact, and able to access more bands/frequencies than resonant options. These antennas usually rely on a matching transformer to make the wire part of the antenna shorter, but safe to transmit on. This also allows you to use really any piece of metal or wire that you can find to transmit on. Fence wire, metal rooftops, and rain gutters, have all been used with some level of success by those who live in confined spaces and don't have room for a full blown resonant antenna. However, don't forget that with these kinds of antenna, there's always compromise. Tuners do NOT increase the capabilities of your antenna, a horrible antenna emplacement will yield horrible results. Tuners just trick your radio into being happy, and thinking that the wire antenna (or whatever the tuner is attached to) is safe to transmit on without blowing up the radio. Otherwise, if you hook up a bad antenna to your radio and key up the mic, all of that power is not going out through the antenna...it's getting reflected back into the radio which will probably fry it. This is why you may need a tuner. The benefits for tuned antennas are mostly felt in situations where space is limited. In that case you may have to get as much wire up in the air as possible, and slap on a tuner in order to make it work with your radio.

Popular Brands and Models:
Chameleon MPAS system (either the Lite or the standard versions).
 Antennas made by cottage vendors for the HOA market are usually tuned antennas as well, so the options are many. Chameleon is just the largest company making antenna systems that rely on a matching transformer and require a tuner to operate.

Antenna systems are usually the cause of most swearing and outbursts of rage when it comes to radios. Taking the time to do things right and follow the instructions of your antenna is super important. In the field of physics, there is no such thing as a free lunch, and there are trade-offs everywhere. Compact antennas can work, but generally suck to start with. Gigantic long-wire antennas are annoying to set up, but vastly better in every way as far as physics are concerned. If you live in an apartment or urbanized area, you may have to go the non-resonant route and hope for the best. This is why most low-power portable radios usually don't have tuners inside them, and you're expected to use a resonant antenna. The manufacturers know that the end user isn't going to waste that precious transmit power by using a tuner anyway, since resonant antennas are more efficient. Likewise, a lot of Mobile and Basestation radios will have internal tuners, due to largely being used in Homeowners Association territory (where most antenna theory regarding "Stealth antennas" is developed).

RECOMMENDED HF GEAR LIST

HF Transceivers

Generally speaking, HF transceivers (i.e. radios capable of transmitting and receiving) are broken up into three categories:

Basestation Radios: Huge, chunky rigs that are meant to sit on a desk. Usually capable of transmitting at 100W. Great for blasting out a lot of power without the radio overheating, and often found cheap on the secondary market. Not usually recommended for a first-buy, as modern mobile radios are usually more desirable by most prepared citizens. However, if you need to transmit on digital modes a lot, the superior heat dissipation basestations offer may be helpful for some. For most others, mobile radios are usually a better fit, even set up permanently in a location.

Popular Models: Icom 7100, Icom 7300

Mobile Radios: This category of radio is a bit of a misnomer. The "mobile" name refers to their intended use... for installing inside a vehicle. As such, these radios have less power than a Basestation model, but are also more compact and easier to power from a 12V source (the most common power source used by HF radios). Can easily be converted into a "manpack" style radio, to be carried inside a rucksack. These are a good compromise between weight and power, but if you need to operate off-grid for long periods of time, that weight (and the batteries/solar panel(s) gets really heavy, really quickly). These radios are best served for roles where comms have to closer to a zero-fail/highly-reliable operating environment, but also somewhat easily carried.

Popular Models: Yaesu FT-891, Xiegu G90

Portable Radios: Usually smaller, more compact, self-contained units that are only a few pounds in weight for maximum portability. This small size usually comes at a trade-off...lower power and/or the lack of an antenna tuner. Consequently, portable radios (sometimes called "QRP" radios in ham radio slang, meaning "low-power") usually are best paired with Resonant Antennas to squeeze the most potential out of the radio (and due to the lack of a tuner). Usually these radios offer better power consumption, and are a little easier to charge on the go (such as the IC-705, which has an internal battery). However, due to their low-power most users need to use good technique and experience in working with antennas. Consequently, portable radios can be just as reliable as mobile radios if utilized correctly.

Popular Models: Icom IC-705, Xiegu X6100, Lab599 Discovery TX-500, (tr)USDx.

Note: Right now, there aren't any "handheld" HF transceivers. A few companies are developing such, but this is cutting-edge at the moment, and not on the commercial market. This is mostly due to the antenna being the biggest burden...the radio can be very small, but trailing 60ft of wire is often counterproductive to any sort of tactical movement.

Cables, Connectors, and Adapters

As one might expect, various bits of kit are required to connect everything together.

Connectors and Adapters: There are a few commonly used connectors in the radio world. Most frequently used are BNC or PL-239/SO-239 connectors. Less common (but becoming more popular) are Type N connectors. You may get lucky and find that your antenna, your coax, and your radio all use the same type of connector, but most of the time you will probably need an assortment of adapters to make everything work. Again, don't go with the cheapest option available for adapters and connectors. Higher quality adapters make everything work more smoothly, and ease in troubleshooting later.

Austere Conditions

Amateur Radio is usually a fair-weather hobby. Consequently, most cables/connectors are not waterproofed for operating in the rain. Most of the time, DIY options are needed to keep connection points and antenna circuitry dry. Coax cable itself is mostly waterproof, so if you can keep your connection points dry, this will go a long way toward being able to use your radio system in wet-weather conditions.

STRATEGIC RADIO CONDITION (STRADCON) CONCEPT

"How concerned do I need to be?" - "Should I set up my radio?"

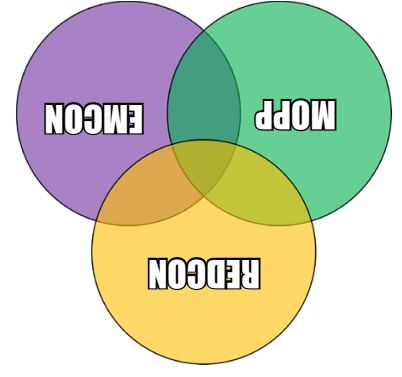
HF Radio is difficult. Not only because the concepts of shortwave radio signals are challenging to understand, but also because a lot of work is required to set up an HF radio. Instead of being able to simply sit on ones couch and push a PTT button, HF radio often requires setting up a large antenna outdoors, running coax cable, and setting up a computer to work with the radio. For someone who just got off of a long work shift, setting up an HF radio is the last thing they might want to do. Consequently, creating a system of readiness conditions (or Strategic Radio Conditions) may be worthwhile for setting a standard for establishing strategic HF radio networks like the GhostNet. This concept can be applied to any radio network, but primarily is geared toward HF data modes, or plans similar to the GhostNet. In short, the STRADCON concept is solely intended to create a standardized process for answering the questions of "How concerned do I need to be?" and "Should I set up my radio?". Admittedly separate questions with separate answers, however if the response is "We're going to STRADCON 1", anyone can know that this means a very serious incident has occurred, and that emergency communications plans should be enacted. Whereas a posture of STRADCON 3 might not warrant someone dropping what they are doing, to set up their HF radio. During a more routine disaster, significant time is often lost due to citizens not knowing that an incident has happened; for some people, several hours may pass before an internet and/or comms outage is noticed. Someone at work may only notice the outage because they didn't get a text from their spouse at the usual time, or that a few coworkers didn't come back from their lunch break. Once a comms outage is noticed, however, one must understand what to do and have a pre-established plan for what happens next.

Strategic Nature of HF Radio

Due to the unique nature of HF radio measures, the extreme long-range of shortwave radio is more of a strategic asset. As such, the STRADCON concept is really only best suited for HF radio and will be challenging to implement in a more tactical role...this plan/concept is simply not needed for handheld VHF/UHF radios as handheld radios are easy to set up and use quickly. Not so with most HF radios, which require several minutes to set up and are not usually able to be set up easily while on the move. The CrisisNet concept, when used with STRADCON levels, provides a quick and easy method for knowing how much to prioritize using HF radio. A team lead can tell a radio operator "take us to STRADCON 2, we're going to be halted here for a while", and the entire team will know what that means. This process is intended to reduce the downtime for regional comms, so that precious time is saved for communities in knowing what's happening outside their immediate area. If a serious incident occurs, saving time with comms is beneficial in reducing the workload of the citizen who will undoubtedly have much more to do than worry about radio.

Predicting Communications Outages

Most Amateur Radio networks operate under the assumption that a total communications blackout of cellular, land-based internet, submarine comms cables, and satellite networks could strike at any moment. While planning for the worst-case scenario is preferable, most of the time comms outages are localized and short-lived. As cyberattacks become part of everyday life over the next few years, outages of critical systems will likely become routine, possibly to the point that traditional "emergency" comms methods become a burden. With a communications disaster taking place every day, expecting someone to drop everything they are doing to go string up an HF antenna is not a realistic expectation. On the other hand, sometimes communications disasters (or at least the potential for such) can be predicted. While the day and hour of a comms outage can't be known beforehand, the increased potential for cyberattacks or other malign actions certainly can be. The weeks leading up to a major political election, major holiday seasons, at times of heightened international tensions...all of these situations would be great times to increase the priority of resilient communications.



Think of this system as a blend of the mentality behind MOPP, REDCON, and EMCON procedures: A gear-based plan of how prepared to be, that can scale based on the likelihood of needing specific radio tools at the strategic level (to monitor regional/national/global events).

STRADCON CRITERIA

STRADCON 1	Full Alert: All Radio Communications Tools Deployed and Net-working Personal security established in the local area. For small teams/groups, handheld radios distributed and turned ON. HF radio antennas emplaced and SWR verified to be within acceptable safety limits for the radio. HF radio (and computer) turned ON, tuned to GhostNet freq on JS8Call (and/or other freq specific to team SOP) and networking. Second HF radio (if available) turned ON, scanning ALE net.
STRADCON 2	Full Alert: All Radio Communications Tools Deployed and Ready to Transmit. Personal security established in the local area. For small teams/groups/elements, handheld radios distributed and turned OFF. HF radio antennas emplaced and SWR verified to be within acceptable safety limits for the radio. HF radio equipment DEPLOYED, but NOT turned on or transmitting.
STRADCON 3	Reduced Alert: HF radio equipment CARRIED, but NOT deployed. HF antennas ready to deploy. Batteries fully charged and packed for movement.
STRADCON 4	Minimum Alert: All radio equipment readily accessible within one hour. Batteries charging.

Important Note! - Don't Forget EMCON Concerns!

These Radio Conditions are irrespective of whatever EMCON level may be in place. Personal security always takes precedent over generalized procedures, so there may be times when it is not appropriate to transmit or follow the readiness levels indicated above. These STRADCON levels generally are best emplaced when EMCON levels are more permissive of networked communications. You may find yourself in a situation where you need to operate at STRADCON 1, but the tactical situation in your area makes radio transmissions ill-advised. **In all cases, EMCON takes priority to STRADCON.** As most people will find themselves operating at EMCON Level 1 conditions most of the time (even if a national event/crisis is unfolding), having some guidance for how to prioritize radio comms may be beneficial. Most importantly, having this guidance in place before a crisis, will allow prepared citizens to independently and simultaneously know what to do, and all be able to link up via HF radio, all without any top-down guidance whatsoever. Again, considering the strategic nature of HF radio, these STRADCON criteria are a very niche idea, but a concept that is most certainly needed in the event that national/regional communications outages become more routine and frequent. In wartime, this standard will likely not be of much use...the EMCON concerns of a combat zone make these procedures largely irrelevant, or require customizing to each user's needs that a common universal standard isn't really helpful. However, much like the rest of the GhostNet plan, these criteria are merely a stopgap solution to long-term strategic problems that currently do not have any satisfactory solution. User experiences may vary, along with the real-world usefulness of this standard.

RECOMMENDED HF GEAR LIST

Expectation Management

Almost all HF radios themselves are developed for the Amateur Radio community. As such, users must be aware of the history and culture that results in a heavily influenced commercial market. Virtually no one has designed a radio based on what is technically possible...all radios are based on what's possible within the bounds of the FCC's (frequently arbitrary and capricious) rules. Over the years, this has resulted in a very unique commercial market; HF radios use technology that is basically the same as that during the 1930's, but costs the price of a modern smartphone. Most new radio operators are shocked by this. Telling someone that they will need to shell out the cost of an iPhone to use a radio in much the same way that their great-grandparents did, is a hard pill to swallow sometimes. In the HF radio world, everything is very unjustifiably expensive. You'll frequently find used radios that were discontinued decades ago for sale at close to their original retail price. You may find someone on eBay selling antennas made from cheap wire and PVC pipe...and selling them for hundreds of dollars. And in general, you'll find that brand new "cutting edge" radios have features that should have been standard on radios decades ago. Consequently, you may spend thousands of dollars to only be completely underwhelmed by what HF radio can do when compared to modern comms infrastructure.

Unquantifiable Value

So what's the point? The entire reason for accepting these trade-offs is that HF radio is really the only option for long-range, point-to-point communication without using pre-established infrastructure. HF radio has plenty of faults, is not the most reliable due to varying solar weather, and it's expensive and frustrating to set up. This is why most people avoid it altogether. But for those that stick with it, and get a very basic plan together with others (such as the GhostNet), HF radio proves it's unquantifiable wealth during times of crisis. How much is a tourniquet worth to you, when you're bleeding out? Paying \$30+ for a brand new CAT tourniquet may seem to be a steep price at the time of purchase, but the value it has when it's saving your life is incalculable. Investing in HF radio requires a similar mindset; when cellular, internet, and satellite systems go down for any reason (and thus leaving HF radio as the only option), the value in being able to talk to someone outside your region is simply priceless. The side benefit to radio lies with being able to get more routine use out of it, instead of sitting it on a shelf and forgetting about it.

Gatekeeping

Due to the above factors, there's sometimes quite a bit of gatekeeping when it comes to learning about radios. Currently, there's no way to legally use the GhostNet HF radio plan without at least a General Class Amateur Radio license as designated by the FCC. Unlike GMRS and LMR for handheld radios, there's no way to circumvent the Amateur Radio community and legally use radios in a pay-to-play fashion (i.e. just buying a GMRS license). This detail, combined with the outrageous expenses of HF radio equipment has resulted in severe elitism over the years; so much so that very few people want to openly explain things. This is why many ham radio operators are not enthusiastic to teach concepts...they don't want to run the risk of someone realizing that self-restraint is really the only thing keeping unlicensed persons off the airwaves. Technically speaking, anyone can physically buy all of this gear, set everything up, and communicate on HF radio without a license (albeit illegally). Since there's no physical barrier stopping anyone from doing this, many hams gatekeep the knowledge side of things, protecting "their" hobby from unlicensed users. While it's not advisable to violate FCC regulations (and also not advisable to encourage others to do the same), most hams carry this to the extreme and refuse to acknowledge even a purely hypothetical war-gaming situation. Therefore, approaching the hobby from the perspective of what is technically possible often yields poor results; the entire ham radio community, from multi-billion-dollar corporations down to the individual user, is skewed in favor of what is technically possible *within the legal limits* of what the FCC imposes. Say that a user (purely hypothetically) doesn't care about the FCC regulations...that person would still be at the mercy of a radio marketplace that DOES care about FCC regulations. So even if a person is not concerned with regulations (like in a SHTF scenario where the FCC no longer exists), their radio would be handicapped to comply with federal code anyway. If HF radios could be built and operated with no baud limits, no bandwidth limitations, no power limits, and allow anonymity, theoretically the average person's communications needs could be met by the radio built without the rules in mind. As is, even in a disaster situation where the rules no longer matter, our radios were built to operate under these rules and regulations.



In radio, almost no one asks what *can* be done within the laws of physics...they only ask what can be done *within the current FCC regulations*. If it's against the rules, all innovation is shut down due to the cultural problems among hams. A can-do, push-the-limits mentality is very much discouraged within the ham radio community, thus the stagnation of innovation...and why we have to pay thousands for 1930's technology.

RURAL LINE-OF-SIGHT SOI

Band and Mode		TX Freq: RX Freq: Color Code: Timeslot/Repeater Slot: Groupcall ID Number TX Freq: RX Freq:			
VHF DIGITAL		DMR TIER II STANDARD PROWORD:			
VHF ANALOG		PROWORD:			
ENCRYPTED VHF		DMR TIER II STANDARD AES-256 THIS IS NOT A STANDARD NET, ONLY FOR USE IN A SCENARIO IN WHICH FCC AMATEUR RADIO REGULATIONS NO LONGER EXIST. PROWORD:			
Details		TX Freq: RX Freq: Color Code: Timeslot/Repeater Slot: Groupcall ID Number Key:			

URBAN LINE-OF-SIGHT SOI

Band and Mode		DMR TIER II STANDARD PROWORD:			
UHF DIGITAL		DMR TIER II STANDARD PROWORD:			
UHF ANALOG		PROWORD:			
ENCRYPTED VHF		DMR TIER II STANDARD AES-256 THIS IS NOT A STANDARD NET, ONLY FOR USE IN A SCENARIO IN WHICH FCC AMATEUR RADIO REGULATIONS NO LONGER EXIST. PROWORD:			
Details		TX Freq: RX Freq: Color Code: Timeslot/Repeater Slot: Groupcall ID Number Key:			

RURAL LINE-OF-SIGHT SOI

Band and Mode	Details	
VHF DIGITAL DMR TIER II STANDARD PROWORD:	TX Freq:	RX Freq:
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	Key:	

URBAN LINE-OF-SIGHT SOI

Band and Mode	Details	
UHF DIGITAL DMR TIER II STANDARD PROWORD:	TX Freq:	RX Freq:
	Color Code:	Timeslot/Repeater Slot:
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	Key:	

