GhostNet Overview

VERSION 1.0

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.

Weekly JS8Call Nets on 40m

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 occuring, 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. Understandibly, 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 comm plans have been established to allow communications to occur between major regions, at the times of day 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.

What About My Baofeng?

Unencrypted analog communications are not generally recommended for use in non-permissive environments. Even using brevity codes and other EMCOM proceedures, voice recognition, direction finding, and metadata 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, which warrants it's own comm plan. Rather, GhostNet plans are intended to serve as a more strategic, region-wide communications network using HF tranceivers.

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) reciever, 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 comm networks is to make the process as easy as possible, and incentivise many people to start treating radio as a viable information source, rather than a novelty.

Ion2G 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 comm plans obsolete, and allows for "right now" communications to be possible at any time of day.

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 tranceiver you have (or even just a reciever) 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 of 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 rearange 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 frontrunner 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 descision 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 he 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.

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 breakout 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, heirarchical, or disciplined as a formal miltiary unit, communications 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, extremly 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 communciations 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 lcompact and ligthweight 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.

Waking up in the middle of the night to the distant thumping of artillery rounds is never pleasant.

What do you do? Do you stay put and take cover, or do you enact your escape plan before you become encircled by enemy forces? Who do you need to talk to, or coordinate with? And how will you do this? And how will you communicate with those around the region to share the news, or determine where the front lines are?

All of this requires substantial communcations planning, equipment, expertise, and dedication even when you don't know what to do. When you are groggily standing in your living room, listening to the war inching closer, it would be preferable to be combat effective, instead of the only option being running for one's life. Having a plan to get comms up, rallying local contacts, beginning an incident response plan, and getting ready for the fight ahead makes you a valuable asset to your community, instead of a noncombatant.

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 civlilian environment; it is a hard to expect someone to establish communications in extreme circumstances. 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 moderate investment, can be infinitely capaple in a changing world.

Sensors

- ADS-B Receiver
- SDR
- Scanner
- HackRF One

Basic Equipment

Data Links

- JS8Call
- Ion2G ALE
- Winlink
- RTTY

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 assertations 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). But remember: 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.

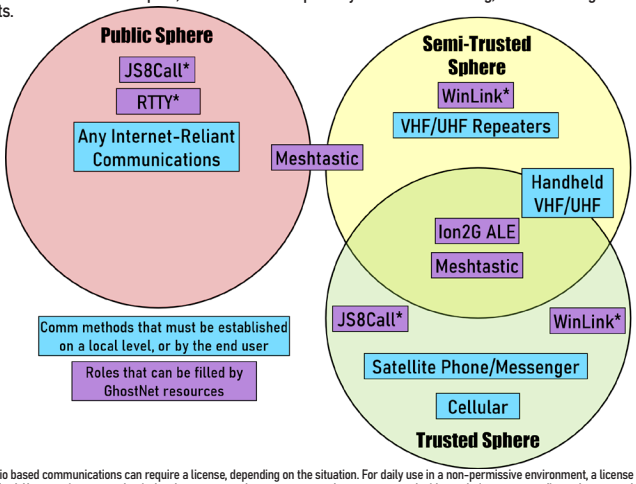
Architecture of Privacy

Operational Security (OPSEC) is of great concern to those wishing to establish communications networks in non-permissive environments. However, if maximum OPSEC proceedures 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' fate. Everything is a balance between keeping your head down, and flying to clsoe 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 entitiy 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 non-permissive environment, 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.

"What's the Point?"

Understandibly, 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 few concepts that are perhaps not adequately explained in the field of emergency communications:

- He who owns the wires, owns the communication. All internet communications are vulnerable to censorship, surveillance, entrapment, manipulation, and information warfare. Granted, this can apply to all communcations 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 taht 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 censores, 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 2023, 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-heirarchical framework is essential for the network's survival in the event of kinetic targeting.

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 in the worst of ionopsheric conditions.

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 vegitation/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).

GhostNet Schedule At-A-Glance

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 Ion2G 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 recieve-only JS8Call arragement 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/targeting. 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 a tany time of day.

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.

Weekly Every Thursday

All Times GMT	Details
0100-0130 UTC **JS8Call (40m)** **NVIS** **7.105 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 kHz. 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.
0130-0200 UTC **Winlink P2P (Vara, USB)** **NVIS** **7.105 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 0135Z, 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.
0200-0230 UTC **RTTY** **7.075 MHz**	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.
0230-0300 UTC **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	
North America-Europe Data Bridge	**1800-1900 UTC - JS8Call Net on 20m @ 14.105 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.
North America-Australia Data Bridge	**1200-1300 UTC - JS8Call Net on 20m @ 14.105 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 @ 3.105 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 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

All Times GMT	Details
1800-1830 UTC **JS8Call (40m) NVIS 7.105 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 kHz. 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.
1830-1900 UTC **Winlink P2P (Vara, USB) NVIS 7.105 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.
1900-1930 UTC **RTTY 7.075 MHz**	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.
1930-2000 UTC **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.

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 @ 14.105 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 @ 14.105 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 @ 3.105 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 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

All Times GMT	Details
2000-2030 UTC **JS8Call (40m)** **NVIS** **7.105 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 kHz. 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.
2030-2100 UTC **Winlink P2P (Vara, USB)** **NVIS** **7.105 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 0135Z, 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.
2100-2130 UTC **RTTY** **7.075 MHz**	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.
2130-2000 UTC **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.

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 @ 14.105 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 @ 3.105 mHz** Use same Ghostnet groups and naming conventions as on previous page.
Europe-Australia Data Bridge	**2000-2100 UTC - JS8Call Net on 20m @ 14.105 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 @ 3.105 mHz** Use same Ghostnet groups and naming conventions as on previous page.
Australia-South Pacific Data Bridge	**0800-0900 UTC - JS8Call Net on 20m @ 14.105 mHz** Use same Ghostnet groups and naming conventions as on previous page. **0900-0930 UTC - JS8Call Net on 40m @ 7.105 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.

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 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 4: 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.

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/collection 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/Kestrel Meter - Establishing WX sensors early on during a crisis is helpful for determining weather patterns, which in turn aid weather forecasts.

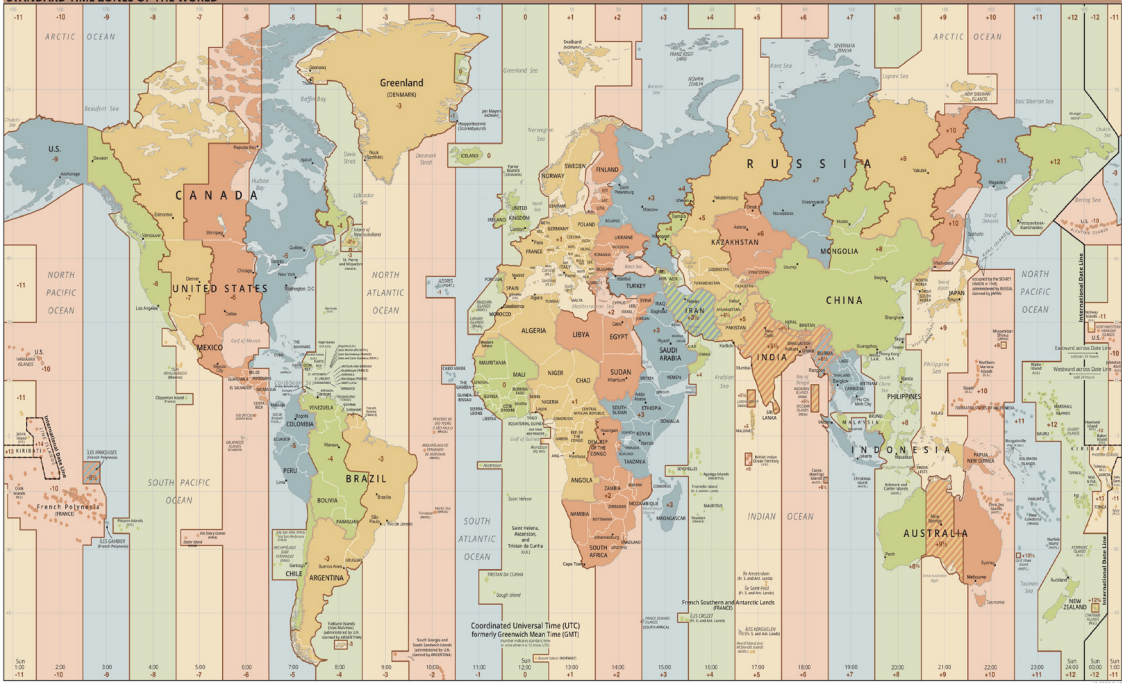
Human Intelligence (HUMINT)

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-confidence 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 interupted, censored, or subject to Information Operations.

STANDARD TIME ZONES OF THE WORLD



Platform Overview

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 it's 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 callsign. 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 callsign. JS8 can also easily be used with custom, user-defined callsigns, in the event of a cataclysmic 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 communication. 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 callsigns on their platform, so using WinLink without an FCC-approved callsign, 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.

Meshtastic

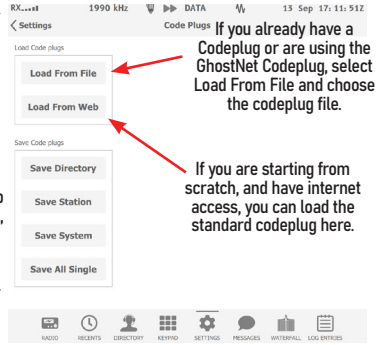
A relatively new addition to the world of communications, Meshtastic has become the primary tool for communities centered around low-power mesh communications using DIY LoRa (Long Range) devices. The extremely low cost of equipment, and the compatibility of Meshtastic with the TAK suite of software has resulted in Meshtastic becoming an extremely popular platform for short-medium range text based communication, or CoT-style data exchange. Though this seems like a miracle platform, the nature of open-source, grassroots development undertaken by volunteers means that Meshtastic as an enterprise solution has had trouble getting out of the developmental phase. Meshtastic will be hard pressed to replace military-grade comms tools, and it is quite buggy at times. But Meshtastic 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.

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 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.

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.

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 crossreferenced 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 codeplug, 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.

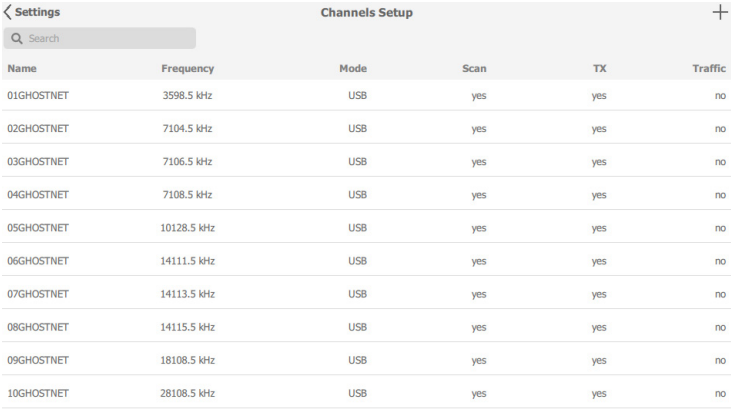
5 - Disable Bands not compatible with your antenna: Using the standard codeplugs, BE CAREFUL! Most people do not have 160m, 80m, or 60m antennas, but these freqs are a part of the standard codeplugs. This means that your radio will try to transmit on theses freqs, even if your antenna is not tuned for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

GhostNet ALE Frequency List

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

Note: All of the frequencies are intended for data modes, not voice transmissions. This is for several reasons mostly pertaining to the efficiency of data transmissions.
ALE, by its very nature, is not a low-power mode. Thus, smaller QRP tranceivers 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 Ion2G to make a voice phone call using a QRP radio. However, sending a text might be more feasible.

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 Receive-Only Options

Persons limited by a lack of license or transeiver, but still desiring to participate in GhostNets can set up a receive-only station to listen in on transmisions. 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 Reciever: 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 Ratio 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 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.
7 - 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.

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 uninformed in the event of an incident of some kind taking out internet servers, cellular networks, or satellite groudn control stations. Nevertheless, how can we help these people at minimum receive some communications?
The tips below are a suggested standard for absolute last-dtich 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 what's worth monitoring:

The Gear You Have	What You Can Receive	Best Practices
Simple Short-wave Reciever	- Global news reports - Any voice comms trasmitted by hams on amateur freqs - All commercial AM/FM signals	- 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 reciever 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 Windows/ Linux PC)	- All digital HF data modes - Most digital voice modes - Almost every radio signal in existance (depending on the SDR)	SDRs have infinite uses. Scanning utilites are useful for local traffic. Can also be used to decode modes like RTTY and JS8Call in listen-only modes. Requires a computer to process signals.
Analog VHF/UHF Transciever (Such as a Baofeng)	- Unencrypted, analog local radio traffic - NOAA Weather Radio - Local amateur radio repeaters	When not used for limited communications, analog 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 publi service traffic - All publicly available govern-mental 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.