Executive Summary
The Enduring Value of Volunteer Amateur Radio Operators in the Starlink Era

Starlink offers impressive high-speed internet for many routine and moderate emergency needs, providing tens of Mbps connectivity at reasonable cost. It has become a go-to solution for rural areas, RVs, and even some government backup during disasters where terrestrial networks fail or overload.

However, Starlink is not a complete or resilient substitute for all emergency communications, particularly in catastrophic events. Its system depends on vulnerable ground stations, public network interconnections, and unhardened user terminals/electronics. In a severe electromagnetic pulse (EMP) attack—or similar widespread disruption possibly by hacking or kinetic attack—many components could fail due to high-energy pulses destroying unprotected semiconductors, especially those connected to long wires/antennas or part of the ground infrastructure. While some terminals might survive if shielded or powered off, full end-to-end connectivity (including to public safety dispatch or inter-agency networks) is unlikely to remain reliable across a broad area. Further, it provides little support for mobile public service fire and police units.

Historical and recent examples show that even minor communications gaps cause major problems—such as the 2025 incident where a state trooper responding to a real bomb call was chased, spiked, and handcuffed by local police due to a single missing piece of shared information, despite fully functional systems. In true disasters like Hurricane Katrina, loss of command-and-control channels led to chaos. The Dec. 25, 2020 Nashville ATT vehicle bombing demonstrates how large scale communications dependent on the internet are quite vulnerable to traditional kinetic attack, with 911 and many other services were widely affected -- even air traffic control.

Volunteer amateur radio operators (hams) fill critical gaps that Starlink cannot:

- Provide **EMP-resilient, local voice communications** using simple, short-antenna radios (e.g., handhelds/walkie-talkies) that survive high fields simply because of their small intercept size.
- Offer **technical expertise** for rapid repair, reconfiguration, or extension of systems like Florida's Mutual Aid Radio Communications (MARC) units—portable VHF/UHF repeaters and radio caches that deliver ~10-mile public safety coverage but need relay for larger counties.
- Enable **relay and extension** to distant areas, patching systems, or bridging to state/federal networks (e.g., via SHARES HF/VHF data/voice channels, which many Florida groups like Alachua County ARES train on weekly).
- Deploy **pre-positioned, EMP-mitigated gear** (Faraday-protected equipment, backup antennas, duplexers) and bring networking know-how (e.g., extending Starlink over microwave links if partial function remains).
- Operate independently of commercial power/internet, with personal resources, self-sufficiency planning, and experience from exercises like Field Day.

Even after an EMP, it is now known that many vehicles will still operate (due to built-in electrostatic discharge protection). Technically-adept volunteers, who are already well-versed on many forms of communications disruption, are among the most likely to be still available and mobile and can additionally provide techniques for remote relays, connections and operations that can fill in and allow government professionals to maintain access to working communications systems, allowing coordination with state and other regional assistance.

In summary: Starlink enhances everyday and moderate-disaster connectivity, but volunteers provide unique redundancy, local resilience, repair capability, and long-distance reach in worst-case scenarios like EMP or targeted destruction of wired or fiber Internet systems by hacking or bombing—where professional resources may be overwhelmed, scarce, or unable to deploy. Integrating trained ham volunteers strengthens overall emergency communications posture at low cost, ensuring information flows when it matters most for public safety and command/control.

Full Discussion:

The Role of Volunteer Amateur Radio Operators in the Era of Starlink

Starlink satellite internet antennas and receivers are now widely available, providing high-speed internet access (in the tens of megabits per second) at a relatively low monthly cost. Many recreational vehicle (RV) enthusiasts and families in rural areas have embraced Starlink to ensure uninterrupted high-speed internet connectivity. It seems like an excellent solution for emergency internet access for governments and communities during disasters when regular communications are disrupted, severely overloaded, or degraded.

In this context, what is the significance of volunteer radio-trained communicators, such as amateur radio operators?

Moreover, if a catastrophic event, such as an electromagnetic pulse (EMP) attack or major internet outage due to hacking, bombing or other major system damage, were to occur, would these volunteers be able and willing to assist government officials?

These are crucial questions that demand a more thorough examination of the volunteer capabilities, existing emergency communication options, and the actual consequences of an EMP or other highly effective attack.

Highly experienced officials are well aware of the profound disarray and loss of command and control capabilities that result from disrupted communications, as demonstrated by the situation in New Orleans during Hurricane Katrina. In that instance, law enforcement was reduced to using only two simplex channels (without repeaters or trunking), leading to widespread chaos, including significant loss of life. The Nashville Dec 25 2020 vehicle bombing that destroyed a key ATT building resulted in widespread and lengthy loss of significant governmental command and control communications, including 911 and even air traffic control. These risks seem to only grow with increasing complexities of systems. Thus in 2025, during completely normal communications, communication errors between typically operating state and local communication groups resulted in a valid State Patrol bomb squad technician on a true emergency call being pursued by local police, stopped by spike trip, and held a gunpoint! This incident highlighted the significant damage that can be caused by even a single missing piece of information, even with perfectly functioning equipment and circuits. (See: https://www.wlbt.com/2026/03/20/state-trooper-responding-call-ends-up-handcuffs-after-police-mistake-him-criminal-deploy-stop-sticks/; https://www.wave3.com/2026/03/19/police-chase-ends-with-state-trooper-handcuffs-after-stop-sticks-deployed/)

Following a severe communications disaster, such as an electromagnetic pulse (EMP) or strategic bombing or effective hacking, it is highly likely that numerous normal communications systems, including public safety repeaters and trunking systems, as well as public switched telephone systems (including the internet), will be severely degraded or rendered inoperable, as has been demonstrated in real history. In the case of EMP, this is due to extremely high electromagnetic field strengths, reaching 25kV/meter for nanoseconds. Unprotected semiconductors exposed to substantial wiring may easily have their minuscule semiconductor junctions destroyed by this level of electromagnetic energy.

However, not all items are rendered inoperable. Items with short antennas, those that are turned off and not connected to significant lengths of charging wire, and those stored within conductive compartments are expected to continue functioning. Examples of items that are expected to remain operational include:

- Pocket calculators
- Walkie-talkies with short antennas, not connected to charging wires or external antennas
- Cell phones -- whose local games and calculators will still function, even though the phone no longer works due to destruction of cell tower communications
- Electronics stored within conductive (shielding) containers (“Faraday shields”)

Many believe that all vehicles will be disabled. *Testing shows this is false.* Automobiles have undergone extensive semiconductor Electrostatic Damage protection to mitigate the high voltage spark plugs (25kV) as well as high voltage static electricity and nearby lightning discharges. The effectiveness of these protections is demonstrated by the near elimination of damage to automobile computer controls today on a day to day basis. Industry standard testing is now performed on almost

all significant chips planned for automotive usage. Furthermore, the widespread use of metal car bodies provides some additional protection, as a semi-Faraday shield.

Testing has validated that these systems protect many vehicles. The 2008 Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack provides authoritative information on the effects of EMPs. (Reference: https://www.empcommission.org/docs/A2473-EMP_Commission-7MB.pdf) The transportation section of this very lengthy and detailed report presents the results of testing multiple automobiles and trucks in field strengths up to 50kV/meter (beyond typical EMP levels). Specifically, 37 cars manufactured between 1983 and 2002 were tested under both engine-on and engine-off conditions. While some reviewers have criticized the tests for stopping at the occurrence of anomalous results, they still offer valuable insights into the survivability of various vehicles.

The report concluded that for automobiles, the EMP threat is significant, but the extensive testing conducted has demonstrated that many vehicles can withstand the impact of EMPs.

> *Based on the test results, we anticipate minimal automobile damage at EMP field levels below 25 kV/m. However, approximately 10 percent or more of automobiles exposed to higher field levels may experience severe EMP effects, such as engine stalls, requiring driver intervention for correction. Additionally, we expect that at least two out of three automobiles on the road will exhibit some nuisance response at these higher field levels. These serious malfunctions could lead to car crashes on U.S. highways, while the nuisance malfunctions could exacerbate the situation. Consequently, the ultimate outcome of automobile EMP exposure could result in crashes that damage numerous vehicles beyond the initial EMP damage, leading to loss of life and multiple injuries.*

Therefore, both benevolent and malevolent actors are likely to continue having **significant access to motorized transport even after an EMP**, as long as they can access fuel. In the immediate aftermath, the primary concern will be blocked roads due to unexplained crashes throughout the region. Skilled volunteers and government officials will recognize the cause and initiate their response.

How can volunteers assist in a severely hindered response following a major communications disaster, such as an EMP?

Volunteers can provide assistance in

- deploying emergency radio systems,
- repairing emergency radio systems, transmission lines, and antennas,
- establishing relay capabilities to distant county towns and cities, and
- providing prior provision of immune radio gear and also
- facilitate emergency communications to other counties, states, and federal agencies.

In the event that normal communications, including repeater or trunked public service, and regular telephone and internet communications, are severely degraded or destroyed, emergency

communications capabilities will be urgently and critically needed. Volunteers can assist and extend limited professionals in the response.

EMP Testing of Current Communications Systems

MIL-STD-188-125-1 and MIL-STD-188-125-2 provide testing specifications for fixed and transportable equipment. However, as of March 2026, artificial intelligence queries suggest uncertainty about whether Motorola trunked systems are EMP-tested or immune to such attacks.

Starlink systems rely not only on low-Earth orbiting satellites but also on extensive ground stations and ground connections to the public switched network. It's highly unlikely that all these serial links will withstand a significant EMP attack. While specially designed TCP/IP communications might be maintained via uplink/downlink, the connections to essential telephone systems are unlikely to remain sufficiently functional, if at all.

Maintaining Local Public Service Communications

Providing public safety communications is of utmost importance, even when normal trunked systems fail. Even if specialized TCP/IP systems could remain operational, satellite systems are unlikely to provide communications to numerous moving public safety vehicles.

In Florida, MARC units are prepared to assist. They have large caches of handheld radios in the VHF/UHF spectrum and appropriate backup repeaters to continue providing some level of public safety communications within a roughly 10-mile radius. These units have been utilized multiple times and have the capability to patch together communications between various repeaters. Their repeaters and systems are quite similar to any basic VHF/UHF repeater.

In the event of a catastrophic communications failure, skilled IT professionals and radio equipment repair and configuration specialists will likely be severely short-staffed, even if they can access their usual work locations. If repair, maintenance, or configuration is required, the ranks of typical volunteer groups include individuals with substantial experience in tower operators, feedline repair, antenna repair, configuration of repeaters, and even re-tuning of duplexer systems essential for the operation of these repeaters. Some volunteers even possess the necessary equipment themselves to re-tune duplexers, enabling frequency adjustments in such repeaters. Additionally, volunteers are familiar with the characteristics of these programmable radios and can be valuable assistants to trained MARC unit personnel. In Florida, extensive efforts have been made to ensure that volunteers have a comprehensive understanding of MARC unit procedures.

MARC unit communications are generally limited by the height of their tower and the laws of physics, to approximately a 10-mile radius. My county, Alachua County, spans 30-35 miles in width and height, so a MARC unit will not be able to cover the entire county. Therefore, relay systems of some sort will be necessary to reach the towns located at the county's edges. Trained radio volunteers can play a crucial role in creating the necessary voice or data extensions to MARC unit emergency communications.

Emergency Operations Center (EOC) communications Starlink ground and satellite communication systems can still be utilized for emergency communications if they are operational. Volunteers, who are often familiar with these systems from their own use, can position Starlink terminals outside or on rooftops. Many volunteers also possess networking experience and assets that can be employed to manage these systems. Some groups, such as the Alachua County ARES(R) group, have even experienced projecting access to TCP/IP networks over extensive campuses using high-powered microwave communication systems, providing significantly broader access than anticipated. (This experience and equipment were developed as part of their annual Field Day emergency communications exercises.)

However, in a major communications disaster, such as an EMP, the serial connections to existing public switched networks are likely to fail. If Starlink communications are disrupted or degraded, many counties, states, and federal agencies maintain emergency direct voice or data radio communications through the SHARES program. This program is part of DHS/CISA, and information regarding frequencies and communications is not publicly disclosed. Nevertheless, many authorized volunteer radio groups, including the Columbia County and Alachua County amateur radio volunteers, are well-versed in these systems and use them regularly for training. Florida State EOC currently maintains 24/7/365 data systems on these radio frequencies. Additionally, as a result of our participation in annual national Field Day emergency communications exercises, our group has developed filter systems that enable us to simultaneously operate transmitters and receivers on multiple simultaneous radio connections, facilitating simultaneous communications with state, federal, and local authorities.

Many volunteer operators have home access to these emergency systems and even provide nodes of communication for some of these voice/data federal communications systems, utilizing their own authorized call signs.

EMP-Immune Communication Systems:

Some volunteer groups, such as the Alachua County ARES(R) team, have developed techniques that enable communication--both by our volunteers and also by government officials-- even after an EMP attack.

EOC Protected Equipment: Providing emergency communications equipment on-site at Emergency Operations Centers (EOCs) that is known to be immune to EMP attacks is crucial. Antenna systems can be designed to maintain functionality even against moderate EMP attacks or be easily repairable after extreme EMP attacks. Solutions are well known and not technically difficult. Volunteers can often provide communications equipment known to be impervious even to EMP. EOC's would be well advised to ask for MIL SPEC status of commercial equipment on which public safety depends to determine which other systems are likely to remain operable.

EOC-based pre-configured equipment can be left in pre-set states that would allow government officials to immediately establish communication with local volunteers on pre-assigned frequencies.

Volunteer Protected Equipment: Some volunteers have their own state/federal SHARES stations, and some even provide automated digital relay stations similar to those provided by the State EOC.

Volunteers are exceptionally aware of EMP risks and mitigation, and some are able to take steps to achieve lower levels (e.g., I, II) of DHS EMP protection. Refer to the following link for more information: https://qsl.net/nf4rc/2018/DHSEMPRec.pdf These levels are also within reach of ordinary county-level EOC backup communications systems.

Volunteer relay systems enable communication even when volunteers are unable to physically attend the government facility (due to damage, congestion, or safety issues). Communications from such facilities can be relayed to specific volunteers, who can then provide bidirectional information relay to other counties, states, and federal agencies. Information is crucial in command and control, even when resources are severely strained. A lack of information leads to the squandering of scarce resources due to misapplication.

Volunteer sustainability: In terms of independent longer-term sustainability, volunteer communicators are often unusually aware of the hazards of losing normal community infrastructure and have already made provisions for significant loss of power, water, food, and security.

Conclusion

In the event of a severe communications emergency, such as an electromagnetic pulse (EMP) attack, the absence of functional communications severely impedes any organized response. The ensuing chaos makes it extremely challenging for personnel, whether professional or volunteer, to reach their usual workstations and perform their regular duties. Public safety relies on intricate communications systems that have a significant potential for failure despite their redundancies. During times of immense need, the available technical resources for repair, reconfiguration, or replacement may be extremely scarce and limited. Volunteers with substantial personal radio resources and technical repair capabilities can be incredibly helpful, both for inter-county public safety and governmental communications, as well as for longer-distance communications. Their ability to deploy backup systems may extend the capabilities of mobile alert response (MARC) units to the county's outskirts. Their experience with SHARES and other long-distance communications systems can significantly assist in information sharing.

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