Advanced HF Radio System Features

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Modern HF radio systems leverage advanced features found in these radios to provide an outstanding user experience, high reliability and advanced capability to transmit digital information in addition to supporting voice conversations. These advanced features allow critical infrastructure entities to build a highly reliable, user-friendly contingency radio system to support emergency actions and restoration operations. This white paper provides an overview of these advanced features and how they contribute to building these contingency radio system.

No Operator Licensing

Commercial HF radio operations only requires the licensing of the station and not the operators. Amateur (Ham) radio licenses the operator and not the physical station. Any employee or volunteer may operate their entity's commercial HF radio stations which does not restrict who can actually use the HF radio equipment. With ham radio, since the radio operator has to be licensed with the necessary privileges for the frequencies being used, the pool of authorized operators may be significantly limited. This requirement can significantly limit the usability of amateur radio equipment during an emergency.

Advanced User Interface with Smartphone-Like Operation

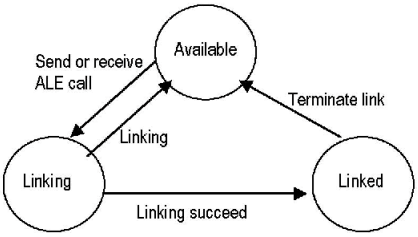
The target audience for advanced commercial HF radio equipment is the smart phone capable user. The radio's user interface is modeled after common smart phones with easy to follow menus and even the ability to customize the user interface. This customization capability allows the HF radio system owner to tailor the user interface to the system's users. This makes both learning and operating the HF radio equipment much easier. Modern systems also support multiple languages if needed by the system owner.

Software Defined Radio (SDR)

Conventional and digital radios capability are fundamentally limited by the hardware architecture. However, a Software Defined Radio (SDR) has capability substantially defined by its software and can transform to adopt new capability as future standards evolve. SDR provides you with access to the most advanced capabilities available today, and future-proofs your investment via firmware upgrades. These can include: new over-the-air waveforms; linking and data standards; interface protocols; and specific customer requirements. SDR offers customer protection of value of investment.

Automatic Link Establishment (ALE) Frequency Selection

Classical HF radio operation requires a trained and highly skilled operator and uses one frequency of operation at a time. The operator must select the frequency to be used. One single frequency cannot be effective at all times so that operator has to be very competent in the nuances of HF radio operations in order to select the appropriate frequency to use. In addition, all stations must be on the same channel in order to communicate. .Selection of the proper frequency is dependent on: knowledge of propagation, time of day/season, and luck.



ALE uses the "four S's:"

- **S**mart radio,
- **S**uite of frequencies to form a net,
- **S**ounding other stations in the net and
- **S**electing (automatically) the best frequency for transmitting to the desired station. This capability provides greatly improved operational capability without requiring an operator with specialized knowledge of propagation and HF operations.

HOW DOES ALE WORK?

The smart radios in the system continuously scan all frequencies in their net. All radios automatically and sequentially transmit (*sounds*) on all net frequencies and logs the responding stations on a preset schedule. Each radio receives and responds to soundings from other stations in the net. Each radio maintains a Link Quality Analysis (LQA) database of responding stations with the unique selfID of stations in the net; each net frequency and the corresponding link quality (signal strength) of each sounding connection. All this occurs in the background with no operator assistance required.

In order to contact a station in the net, the user simply selects the desired station from a cell-phone-like contact list and enters a call/connect command, usually a single button. The user's smart radio uses the data in its LQA database and initiates a call to the desired station. In very short order, the calling station and the called station connect on an acceptable frequency and both stations are alerted with a distinct signal tone and a display notice. The users on each station can now communicate!

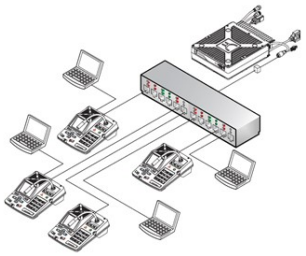
Digital Voice

Digital voice provides a voice quality experience similar to cellular phones and ensures continued operation in degraded and fading channels. With digital voice, the user no longer is subjected to listening to the "hiss" familiar to ham radios. Monitoring a channel using digital voice provides the user with the same experience as found with land mobile radio systems, no sound other than actual voice transmissions. Digital voice, by its very nature, will provide usable communications in conditions that traditional analog voice will fail.

Dual Antenna Capable

Ham radios as well as many commercial HF radios have only a single antenna connection. This limits the radio to using only one antenna without adding an external antenna switch that the user has to know when and how to switch between antennas. In a ALE network where a station needs to use two antennas to support station coverage, a single antenna connection and an external switch will not work. With dual antenna connections, two different (long and short range, for example) antennas may be connected and programmed to the proper channel. This allows for automatic connection to the proper antenna without user intervention or knowledge. This allows for programming of channels to a specific antenna for best coverage which supports optimized coverage through selection of the antenna with the best voice quality.

Multiple Control Points



Many contingency HF radio systems need to have multiple locations (control points or CP) from which their radio(s) may be operated. These locations may include EOCs, dispatch centers, system manager's office and remote support personnel/contractors. Instead of purchasing a radio for each location, modern HF radio systems support as many as four (4) simultaneous control points to operate a single RF unit (RFU). These control points can be connected to the RFU in various ways depending on the vendor. Control points can be connected directly with proprietary cables, using IP (Internet Protocol which is commonly used for data transfer) through LAN/WAN on either wireless or ethernet cabling and through the Internet.

Again, depending on the vendor, control point hardware options can include full control capability with desktop units, control heads, handheld units and virtual control points using a Windows program.

In addition, some vendors offer limited control features using an IOS or Android smartphone application. Depending on the vendor, individual control points attached to a single radio can have a unique Self Address (ID) supporting ALE calls. . A call can be made to a single CP and each CP can monitor the other if required. These features can be enabled or disabled by the user or system manager. Multiple control points provide extreme flexibility to support a multitude of different operational and maintenance configurations.

Text Messaging, Email-Like Services and File Transfer

Modern commercial HF radios can support various digital data modes when equipped with an optional internal or external modem. These features include text messaging (like SMS messaging done with cell phones), email-like services and file transfer. Most also support a very limited 72 character text messaging feature that displays on the receiving radio's display and does not require a data modem. Email-like services can be restricted to just the radio network or interconnected to an internal or external (Internet) email system allowing for email interoperability with non-radio system-based email addresses. File transfer, although at a very slow (1200 baud or so) rate, can support the transfer of pictures, complex documents and even software patches and radio programming profiles. With built-in error correction and automatic operations with ALE, even large files, that may take a considerable amount of time to transmit, can be transmitted across the network. Since these features are to be part of a contingency radio system, having even a slow system to transmit critical data, is better than having no system.

High security features including encryption

Contingency radio systems often are used to transmit sensitive information. Hospitals need to exchange HIPPA protected data. Government stations exchange critical sensitive operation and security data. Cyber security response teams exchange sensitive operational data as they work to overcome advisories and restore data networks and computer systems. Modern commercial HF radio systems offer commercial grade encryption and are capable of using add-on equipment (internal and external) to achieve military grade encryption. Ham radio operators are forbidden by FCC regulations to transmit encrypted messages so they cannot be used to support the transmission of sensitive information.

In Summary

By electing to acquire and deploy an HF radio system using modern HF radios with their advanced features, you will have a highly user friendly, resilient and dependable contingency radio system. Work with your value added system integrator to leverage these capabilities and build a system that will exceed your needs.

About NVIS Communications, LLC

NVIS Communications is a Systems Integrator and the Exclusive Partner/Distributor for Codan HF equipment in the US, Mexico and The Caribbean. NVIS works with Critical Infrastructure, i.e. Electricity, Gas, Oil, Water, Telecommunications and Cable TV Broadcasting, as well as Public Safety at the Federal, State, and Local Levels to help them design and implement resilient communications systems built on an HF-ALE core. NVIS also works closely with the Department of Homeland Security's SHARES program to further critical infrastructure entity access to nationwide HF radio backup, interoperability, and situational awareness. .

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