ANNEX 4
EXAMPLES OF HF ALE RADIO NETWORKS

A4-1   Introduction

This section contains examples of actual working, large-size networks to illustrate the variety of uses HF ALE radio serves each day. The examples are as follows:

1. The Air Force - *HF Global Communications System Air/Ground/Air Network*. This network was begun as a standardization project with the goal to develop standardized calling procedures throughout all DoD agencies. Later this network is scheduled to become a integral part of the Air Force's communication system.

2. A second example network is associated with the organization known as *Shares.* This organization is volunteer association of radio amateurs, private companies, and government agencies that have a common goal to developed a HF radio network that will serve as a backbone communication link in times of emergency. This network is a true test of the interoperability of equipment since all equipment is owned by the participants and varies greatly in brand and operation.

3. The U.S. Federal Emergency Management Agency (FEMA) has developed the *FEMA National Radio System (FNARS)* radio network. This network is another example of a emergency preparedness network that becomes significantly important in case of a national emergency.   This network uses, in addition to its own extensive equipment base, all possible residual communications capacity that may be available during emergencies, it is planned to accommodate the vast resources associated with radio amateurs, including RACES and the Military Affiliated Radio System (MARS). Again this FEMA network can be said to be a true test of interoperability standards for radio equipment, operation, and addressing.

4. A fourth example would be the U.S. Customs Service's *Customs Over-the-Horizon Network (COTHEN)*. The Customs Service with military and civilian law-enforcement agencies, and in concert with a number of federal governments in the American zone, have developed a communication system which has proven to be useful in the *war on drugs*. This network serves a number of fixed and mobile users as they attempt to communicate with fellow officers and base stations engaged in law enforcement duties.

The important attributes that make these networks good examples are:

1. Diversity – These networks use multivendor equipment (rather than building the entire network from equipment supplied by a single vendor).

2. Addressing - A significant item in building a large network is how the network accommodates addressing individual stations within the network. A good addressing scheme contributes to a smoothly functioning network. A poor scheme can lead to difficulties such as interference, missed and delayed calls, *etc*.

3. Mission—The network size, equipment, *etc*. fit the mission of the individual networks.

As we analyze each of these networks we should keep these items in mind.

A4-2   The HF global communications system air/ground/air network

The HF global communications system air/ground/air network is a network established by the Air Force Frequency Management Agency (AFFMA) for use by the National Command Authority (NCA), the DoD, Federal Departments, and Allied users equipped with HF ALE radio technology in support of Command and Control (C2) between aircraft/ships and associated ground stations.[HFALECoO, 1996]

The Federal Telecommunications Standards Committee (FTSC) tasked the AFFMA to develop a Federal HF ALE Concept of Operations (CONOPS) to be used in the development of a Federal Standard for HF ALE addressing. The purpose of the CONOPS document is to provide standardized operational instructions for DoD users of HF ALE networks and to provide interoperability between users. Standardized procedures for addressing protocols, ALE sounding rates, and management are all essential to ensure interoperability throughout DoD. [HFALECoO, 1996]

The AFFMA is tasked by HQ USAF to develop initial operating procedures to include addressing protocols, sounding rates, and all technical parameters that affect interoperability for USAF HF ALE Networks. The AFFMA, acting in concert with members of the working groups, is developing and using the Interim A/G/A network to do the following:
1. develop procedures that will ensure interoperability between DoD HF ALE users,
2. establish a training and testing environment for HF ALE users,
3. establish operational procedures that will ensure interoperability with other Federal agencies and connectivity to and from National Command Authority,
4. develop experience and generate an operational database for introducing HF ALE radio operations into the DoD.

HF ALE users of the HF Global Communications System Network must use the addressing protocol procedures developed in the CONOPS to communicate with Global HF stations. As a minimum, each agency must appoint an HF ALE network manager who will work with AFFMA to ensure that scan lists, ALE address elements, and equipment parameters are standardized. The HF ALE Network Manager shall build and maintain a database of all their HF ALE stations, their configurations, ALE addresses, frequency lists, and system parameters. The manager must build databases and disseminate this information to all agencies supporting mission operation. The manager must work closely with frequency managers and their agency's tasking offices in order to build HF ALE networks. [HFALECoO, 1996]

The interim network will be operated in a "live test" manner until the USAF declares the network as "operational". Once the USAF declares the network operational, only aircraft/ships of the United States, Allies, and authorized ground stations will be permitted to operate routinely in the network. When the network is declared to be in an "operational" status, the previous unofficial

Global HF A/G/A Network may then move to the **HF Global Communications System Point-To-Point US&P Network.** The US&P Network is designated as the "National Emergency/Contingency Network." A Federal entity or the Director of SHARES Network, acting upon proper authority and in response to a national emergency, contingency, or disaster, may declare this network to be for "official use only" and may exercise network control. All Federal departments and civil organizations participating in the situation should designate one or more of their HF ALE stations to represent their department or organization. [HFALECoO, 1996]

A4-3 SHARES.

The SHARES network, whose name stands for *Shared Resources*, was developed in a program sponsored by the National Communication System (NCS) to provide backup capability to the Federal government to pass/exchange emergency information. SHARES uses existing HF assets, including radio amateurs, to extend HF coverage for all Federal agencies. Purposes of SHARES include: 1. enduring backup to vulnerable leased systems, 2. providing for extended HF coverage for use by all agencies, 3. providing the flagword SHARES to identify critical message traffic, 4. standardizing framework for operational procedures and message formatting, and 5. providing for a "work around" for jamming by providing more frequency availability to circumvent a threat. Participation in SHARES is open to all Federal agencies, and the responsibilities include the maintenance of a SHARES Directory, and participation in readiness training exercises. [Goodman, 1992]

A4-4 FEMA National Radio System (FNARS)

The FNARS Radio system came into being under a U.S. Presidential mandate (*viz*., Executive Order 12742). FNARS is an Single Side Band (SSB) radio system that can transmit both voice and data, and that has the capability to operate in both secure and non-secure modes. The system must be interoperable with HF radio systems utilized by state and local public safety/health networks such as the FEMA Switched Network (FSN), and the Mobile Air Transportable Telecommunications System (MATTS). Also, in order to exploit all possible residual communications capacity which may be available during emergencies, it is planned to accommodate the vast resources associated with radio amateurs, including Radio Amateur Civil Emergency Services (RACES) and the Military Affiliated Radio System (MARS). [Goodman, 1992]

The FNARS network architecture is hierarchical in nature. FEMA manages, operates, and maintains the FNARS network, which consists of systems located in Washington, DC, (Headquarters); Sperryville, VA; 10 Federal/Regional Centers, and 59 State/Territory Emergency Operation Centers. During emergency and crisis situations, all of these specified sites will be interconnected. Additional connectivity will be achieved with the Armed Services, the Coast Guard, and local communication centers (*viz*., police, fire departments, hospitals, *etc*.). FNARS transmitter power ratings range from 1 kW to 10 kW.[Goodman, 1992]

Figure A4-1 shows all of the stations in the highest level of the network (*i.e*., from the special facility headquarters to each regional headquarters). Then, as an example of the second level of

networking, this figure shows an expansion of one of 10 FEMA Federal Regions. We have shown the nodes and branches associated with Region VIII. [FEMA, 1993] Other first-level nodes have a similar fan-out configuration, but to preserve simplicity on this diagram, they are not shown here.

FNARS radios will include both fixed site and mobile versions, and will have ALE capabilities incorporating LQA and preset scanning. Users of the system will be able to make selective calls (*i.e.*, individual or group) and broadcasts. [Goodman, 1992]

A4-5 Customs Over-the-Horizon Network (COTHEN)
The U.S. Customs Service, together with military and civilian law enforcement agencies, and in concert with a number of federal governments in the American zone, have developed a communication system which has proven to be useful in the *war on drugs*. The system includes the Over-The-Horizon Network or COTHEN. [Goodman, 1992] The communications capabilities of this network includes a network of HF SSB radios (*i.e.*, approximately 18 bases and 60 remote units) possessing ALE and Selective Calling (selcall) capability. The system also uses a gateway to enter a larger, mother network, the ATLAS Network. The network is a good example of the capabilities of HF ALE radio since many of the remote radio systems must be operated at the same time the operator is piloting a vehicle (boat, truck, auto, *etc*.), thus the radio must be capable of doing the procedural HF tuning allowing hands-free operation.
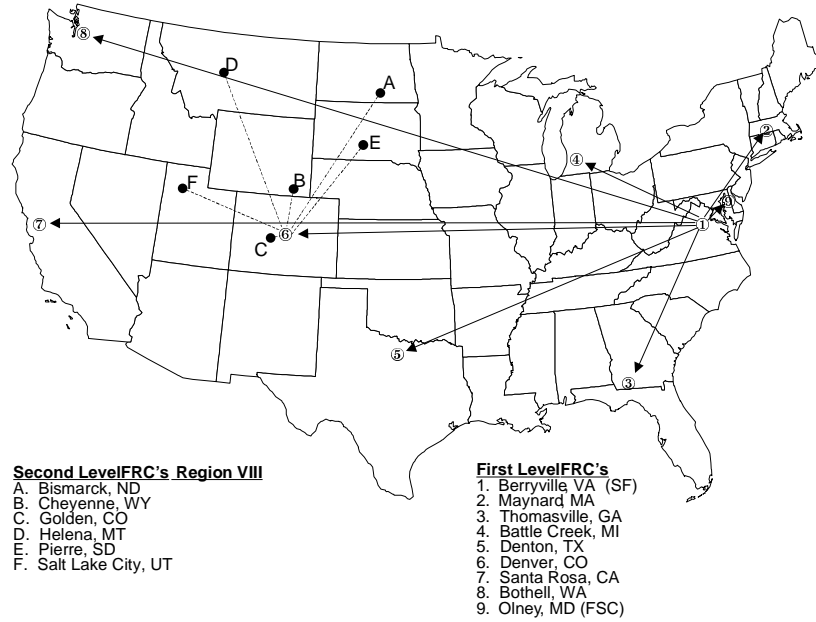
FIGURE A4-1
FNARS HF radio network with expansion for Region VIII

Second LevelFRC's Region VIII
A. Bismarck, ND
B. Cheyenne, WY
C. Golden, CO
D. Helena, MT
E. Pierre, SD
F. Salt Lake City, UT

First LevelFRC's
1. Berryville VA (SF)
2. Maynard MA
3. Thomasville, GA
4. Battle Creek, MI
5. Denton, TX
6. Denver, CO
7. Santa Rosa, CA
8. Bothell, WA
9. Olney, MD (FSC)