Community Emergency Radio Networks tells how to set up low-cost Family RadioService (FRS) radios and a radio relay station for emergencies. This type of network provides a backup connection to emergency services for neighborhoods and communities.

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Table of Contents

About the Author

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Hugh C. Maddocks, K3SS, was first licensed as a Novice, KN1IUS, in 1958, got his General in 1959, Extra in 1972, and has been K3SS since 1978. He has been a member of the American Radio Relay League (ARRL) for over forty years and is now a Life Member. He operates mostly low power (QRP) Morse Code (CW) and enjoys QRP contests, Field Day, and Sweepstakes.

After 9/11, he became interested in emergency communications and joined both the Amateur Radio Emergency Service (ARES) and the National Traffic System (NTS). In Fairfax County, Virginia ARES, he participated in several exercises and an actual emergency during Hurricane Isabel in September 2003. During Isabel, he acted as one of the net control stations (NCS) of the logistics net, high frequency (HF) liaison to the state emergency operations center (EOC) in Richmond, and one of the liaisons between the logistics net and the operations net. In NTS, he performed the following functions: regular NCS and Net Manager of the CW Virginia Net Late (VNL), regular liaison from the CW VNL to the single sideband (SSB) voice Virginia Late Net (VLN), regular NCS of the voice VLN, and occasional liaison from the CW Fourth Region Net (4RN) to the CW VNL

Professionally, he is a communications systems engineer and holds the B.S.E.E. *(summa cum laude)* and Ph.D. (E.E.) degrees from the University of Vermont. His professional engineering experience has been with non-profit centers performing studies and analyses of radio systems including national nuclear command and control communications to the strategic triad (bombers, missiles, and submarines). This experience involved several years of work on the Minimum Essential Emergency Communications Network (MEECN).

Hugh's Web site is www.k3ss.us. His email addresses are k3ss@arrl.net or hugh@k3ss.us.

Acknowledgements

The possibility of standardized community emergency radio networks (ERNs) across the country is the result of the tireless efforts of many organizations and individuals over a long time. The Amateur Radio Emergency Service (ARES) and the Radio Amateur Civil Emergency Service (RACES) have provided emergency radio communications across the country for decades. REACT International, Inc., which began by monitoring Citizens Band (CB) channel 9 for emergencies and traveler assistance (which is where I got the idea of using Family Radio Service (FRS) channel 9 for communications with the community relay station), now monitors General Mobile Radio Service (GMRS) frequencies and FRS channel 1 in addition to CB channel 9. The National Voluntary Organizations Active in Disaster (NVOAD), to numerous to list here, currently has 31 national member organizations, including the American Radio Relay League (ARRL), the American Red Cross, and The Salvation Army. The Salvation Army Team Emergency Radio Network (SATERN) is where I got "ERN."

Of course, this book would never have happened without my wife, Jane, KA4WJJ. I will always cherish her loving support.

Chapter 1

Introduction

In the post-Katrina, post-9/11 era, there is a national need for standard community emergency radio networks (ERNs). Katrina, even more than the terrorist attacks of 9/11, has shown the disastrous effects of having prolonged communications outages over extensive geographical areas. For national standard community ERNs to be realized, however, the networks must have two important characteristics:

1) They must use inexpensive radios that are widely available (or distributed) to citizens, and
2) They must be easy to use during an emergency.

The idea of family/neighborhood emergency communications using inexpensive, widely available Family Radio Service (FRS) radios is not new. About one hundred million FRS radios and combined FRS/General Mobile Radio Service (GMRS) radios have already been sold.

Guidelines have been published for networks using these radios by EMCOM, the National Emergency Alert Notification System. (More info on EMCOM is available at http://www.emcomus.org/commwp.html.) The EMCOM network architecture uses FRS communications for homes and businesses. It also uses community coordinators for FRS/GMRS communications between the FRS radios and an emergency amateur (ham) radio operator, who is a member of the Amateur Radio Emergency Service (ARES) and/or the Radio Amateur Civil Emergency Service (RACES). The ham operator then communicates with law enforcement, fire/rescue, and medical/relief agencies. A diagram of the EMCOM architecture is shown on the next page as Figure 1-1.

Recently, Eric Knight, KB1EHE, has started the National SOS radio network to capitalize on the use of small, inexpensive FRS radios. National SOS is entirely a volunteer operation, staffed by ham radio and GMRS radio operators nationwide.

A public emergency drill to test the network was held in Connecticut on June 10, 2006. It was "a remarkable success" in which thousands participated. Most importantly (and surprisingly) the public exercised great radio discipline, people waited their turn, and voice communications were effective. (More info on National SOS is available at http://www.nationalsos.com/.) Also,

articles about National SOS and the Connecticut drill are available online in the July-August 2006 issue of The REACTer magazine published by REACT International, Inc. (Go to http://www.reactintl.org/, click on The REACTer, then click on July-August 2006.)

This book builds on the ideas of EMCOM and National SOS by looking at a simple building block network that could be used across the country composed only of FRS radios or combined FRS/GMRS radios & a relay called a "community relay station," providing more details about the FRS radios & options for the community relay station, and providing coverage planning & channel reuse guidelines.

Chapter 2 describes a simple ERN for a suburban community using FRS radios and a community relay station. Chapter 3 provides more information about the FRS radios. Chapter 4 describes and discusses options for the community relay station including VHF/UHF ham options, a GMRS option, Citizens Band (CB) AM and SSB options, and a ham option employing Near Vertical Incidence Skywave (NVIS) on HF. Chapter 5 gives coverage planning guidelines for networks in terms of terrain type in suburban and rural areas as well as considerations for coverage in urban areas. The coverage planning guidelines include easy-to-use tables based on the coverage planning analysis included as Appendix E. Chapter 6 discusses channel reuse in groups of communities.

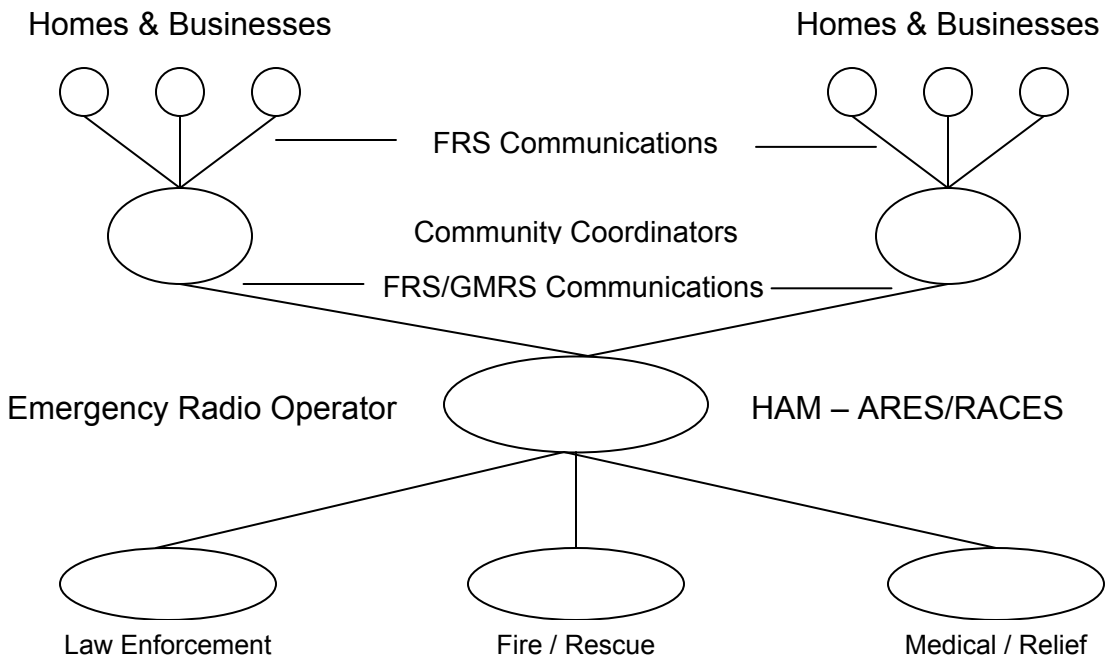

Figure 1-1. EMCOM Emergency Communications Architecture.

There are six appendices to the book. Appendices A, B, C, and D give detailed FCC FRS rules, amateur rules for emergencies (including RACES), GMRS rules, and CB rules, respectively. Appendix E presents the analysis used to get the values presented in the easy-to-use tables in Chapters 5 and 6. Appendix F presents an alphabetical list of Web sites and references cited in the book by subject.

The radio services needed to make national standard community ERNs a reality are already in place with well-defined FCC rules. The equipment needed is already widely available with very large numbers of FRS, GMRS, combined FRS/GMRS, CB, and ham radios already in the hands of citizens. All that is needed is proper use of the radio services that we already have and on-the-air discipline by the public. In a word, the only thing that needs to change is attitude.

I hope that this book will contribute to the many ongoing efforts to make national standard community ERNs a reality for all Americans.

Chapter 2

A Simple ERN for a Suburban Community

All of the community ERNs considered in this book have the following characteristics.

They are built from blocks of:

1) Community members using Family Radio Service (FRS) radios or combined FRS/General Mobile Radio Service (GMRS) radios, and
2) A community relay station operator who can be someone in the Amateur Radio Service, a GMRS licensee, or someone in the Citizens Band (CB) Radio Service.

They can use four radio services:

1) Family Radio Service (FRS),
2) General Mobile Radio Service (GMRS),
3) Amateur Radio Service, and
4) Citizens Band (CB) Radio Service.

A simple ERN for a suburban community is shown in Figure 2-1. This ERN includes:

1) Community members using FRS radios,
2) A community relay station operator who is a ham, GMRS licensee, or CBer, and
3) Two members of a Community Emergency Response Team (CERT) that has deployed near the community relay station.

Communications are currently taking place between:

1) A community member and the community relay station (on FRS Channel 9),
2) Two CERT members (on FRS Channel 11), and
3) Two other community members (on FRS Channel 10).

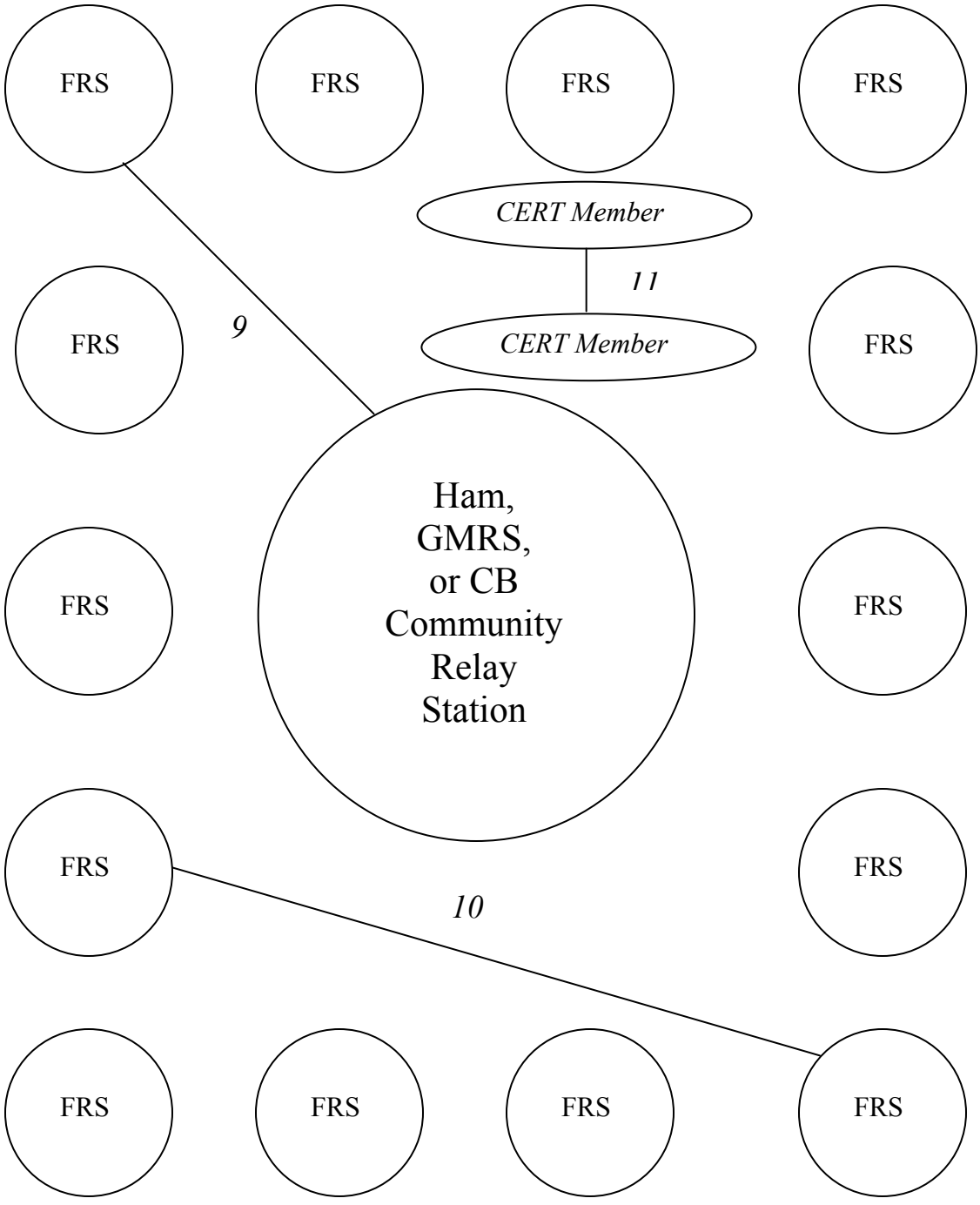

Figure 2-1. Typical ERN Operation in a Suburban Community.

Typically, in a suburban area, there are many communities adjacent to each other as shown by the honeycomb in Figure 2-2. (The dot at the center of each cell in the honeycomb represents a community relay station.)

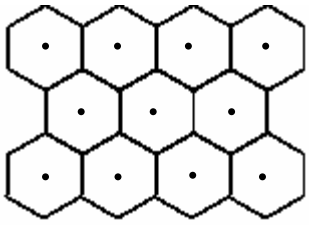

Figure 2-2. Adjacent Communities, Each With a Central Community Relay Station.

Looking at Figure 2-2, it is obvious that the following must be considered in planning a community ERN:

1) Coverage planning: how far apart two radios can be and still provide acceptable communications.
2) Channel reuse in groups of communities: how far apart two radios must be before the same channel can be reused, and
3) Possible interference with other radios tuned to other channels within a community or in adjacent communities (known as possible adjacent signal problems). Since the radios used by community members are all low-power FRS or combined FRS/GMRS radios, adjacent signal problems are minimal as long as the radios are separated by a reasonable distance (at least a few feet).

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